Moneda y Crédito

Segunda Época

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Ciccone and Papaioannou

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El presente número recoge las ponencias presentadas al XX Simposio de Moneda y Crédito aceptadas tras el proceso de evaluación. El XX Simposio de Moneda y Crédito, con el título *Globalization and the World Allocation of Production* se celebró en Madrid los días 19 y 20 de noviembre de 2007.

Financial Development and Intersectoral Investment: New Estimates and Evidence*

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Abstract

How do financial markets affect income growth? A prominent hypothesis has it that well working capital markets contribute to aggregate productivity growth by making sure that capital is allocated to the sectors where it is most productive (e.g. Bagehot,1873; Schumpeter, 1911). We examine this conjecture, building on an influential two-step empirical approach suggested by Wurgler (2000). The first step consists of the estimation of intersectoral investment responsiveness parameters for a wide sample of countries. Intuitively, the estimated country-level parameters measure to what extent sectoral investment growth is aligned with sectoral output growth. The second step examines whether intersectoral investment responsiveness is greater in countries with higher levels of financial development. Our main empirical finding is that there is a strong positive effect of financial development on the intersectoral investment responsiveness, and that this effect is robust to controlling for economic and institutional development.

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1. INTRODUCTION

Financial market reform is high up on the agenda. The Lisbon Agenda sees it as necessary for the European Union to close the productivity gap with the United States. But how are financial markets linked to income growth? An influential hypothesis has it that well-working capital markets contribute to aggregate productivity growth by making sure that capital is allocated to the sectors where it is most productive (e.g. Bagehot, 1873; Schumpeter, 1911). We examine this hypothesis, building on an influential empirical approach proposed by Wurgler (2000). The method proceeds in two steps. The first step consists of the estimation of intersectoral investment responsiveness parameters for a wide sample of countries. Intuitively, this country-level parameter measures to what extent sectoral investment growth is aligned with sectoral output growth. The second step examines whether intersectoral investment responsiveness is greater in countries with higher levels of financial development (conditional on some other characteristics).

To test whether financially developed economies allocate investment quickly to expanding sectors, it is important to have indicators that identify the responsiveness of sectoral investment to changes in the production pattern as cleanly as possible. Wurgler (2000) proposes a country-level measure of investment responsiveness, obtained by regressing sectoral growth of gross fixed capital formation on value added growth country by country. He then shows that this investment responsiveness measure is significantly higher in countries with larger capital markets. Our contribution is twofold. We first show that (overall) investment responsiveness is no longer significantly related to financial development once simple summary indicators of institutional quality are controlled for (and also that the effect weakens considerably when one focuses on high-income countries). Second, and more importantly, we show that there is a strikingly robust positive effect of financial development on the intersectoral component of investment responsiveness.

Our paper contributes to the literature that tries to understand how financial development affects productivity growth (see Levine (2005) for a recent review). Our work is most closely related to the approaches of Rajan and Zingales (1998), Wurgler (2000), and Fisman and Love (2007). Rajan and Zingales argue that if financial development fosters growth then it should matter most for sectors

that depend more on outside finance. To test this they construct sector-level measures of external finance dependence using financial statement data of U.S. firms and show that external-finance-dependent sectors grow faster in financially developed countries. This approach enables researchers to work around some of the limitations of the standard cross-country growth regressions, such as omitted variables and multi-collinearity. Building on Rajan and Zingales' approach, Fisman and Love (2007) show that financial development speeds the growth of sectors that face good growth opportunities, as proxied by sales growth in the US. The empirical approach taken here builds on the method first proposed by Wurgler (2000) (see also Almeida and Wolfenzon, 2005). The key difference between Wurgler's approach and that of Fisman and Love is that Wurgler focuses on country -sector growth opportunities –as proxied by value added growth in country-sectors –rather than relying on the US (or some other country) as a benchmark. This allows obtaining a country-specific measure of investment responsiveness and relate cross-country differences in this measure to cross-country differences in financial system characteristics. While the empirical approach is based on stringent theoretical assumptions (discussed in Wurgler, 2000), it has the advantage of illustrating how the sectoral allocation of capital in each country responds to country-specific shocks to the sectoral production pattern (rather than shocks to the production pattern in the US or some other benchmark country).

The remainder of the paper is structured as follows. In Section 2 we describe the data and present our estimates of investment responsiveness across countries. In Section 3 we show that there is a significant effect of capital markets size on the intersectoral component of investment responsiveness. In Section 4 we investigate the link between intersectoral investment responsiveness and some structural features of the financial system, such as government ownership of banks, corporate governance mechanisms, and legal efficiency. Section 5 summarizes.

2. Data and Methodology

Our data on sectoral investment and production comes from the Industrial Statistics Database of the United Nations Industrial

Development Organization (UNIDO). The database reports such data in US dollars for 28 manufacturing sectors at the 3-digit International Standard Industrial Classification level from 1963 to 2002. We deflate the investment and value added series using the US Capital Equipment and Finished Goods Producer Price Indices respectively. We drop observations where log investment or value added growth exceed one in absolute value and exclude sectors that represent less than 0.1% of total manufacturing in each country-year. We also eliminate the data for socialist economies and countries with less than 50 sector-year observations. This leaves us with sectoral data on 65 economies. Table 2 columns (1)-(3) report data coverage by country. Our sample is quite similar to Wurgler's, except that our data also cover the period 1996-2002 (Wurgler's data stops in 1995).

Wurgler estimates the general responsiveness of sectoral investment to shifts in the production structure by running the following regression country by country,

$$\ln \frac{I_{s,c,t}}{I_{s,c,t-1}} = \alpha_c + \eta_c \ln \frac{V_{s,c,t}}{V_{s,c,t-1}} + \varepsilon_{s,c,t}, \tag{1}$$

where I denotes gross fixed capital formation, V value added, and s, c, and t are subscripts for sectors, countries, and years respectively. The parameter of interest is the investment responsiveness parameter (η_c), which captures how quickly investment grows (falls) in expanding (declining) sectors in each country.

The country-specific parameter in (1) captures the intersectoral investment responsiveness as well as the responsiveness of aggregate manufacturing investment to aggregate value added in manufacturing. This is undesirable from our point of view, as it confounds the intersectoral responsiveness with the intertemporal response of investment to output shocks. Another drawback in (1) is that the investment responsiveness parameter will reflect global industry trends as long as countries differ in the sectors they specialize in. To see this, suppose that the responsiveness of investment to value added is the same in all sectors and countries. Suppose also that sectors are subject to different global trends that increase the optimal capital-output ratio faster in some sectors than others. These trends will translate into a higher estimated investment responsiveness parameter in those countries that are specialized in sectors with increasing capital-output ratios. Specialization will also affect the investment responsiveness parameter in (1), because some countries specialize in

capital-intensive sectors (Beck, 2003; Manova, 2008). To isolate the intersectoral component of the reaction of investment to output shocks, we therefore estimate the intersectoral investment responsiveness parameter η_c^* in our main estimating equation,

$$\ln \frac{I_{s,c,t}}{I_{s,c,t-1}} = \alpha_{c,t} + \alpha_{c,s} + \alpha_{s,t} + \eta_c^* \ln \frac{V_{s,c,t}}{V_{s,c,t-1}} + \varepsilon_{s,c}, \quad (2)$$

where $\alpha_{c,t}$ captures country-level links between investment and output and $\alpha_{c,s}$, $\alpha_{s,t}$ control for cross-country differences in the pattern of specialization.

In Table 2 we report the investment responsiveness parameters for all countries. The overall investment responsiveness is labelled *Elasticity 1* and the intersectoral investment responsiveness is labelled *Elasticity 2*. It is interesting to note that the average of the overall investment responsiveness parameter is 0.41, while the average intersectoral investment responsiveness parameter is 0.22. This suggests that the overall investment responsiveness parameter does in fact capture country-level co-movements between investment and output. It is also interesting to note that both elasticities are higher in industrialized countries. In fact, in some low income countries, such as Bolivia, Swaziland and Panama, the overall investment responsiveness is zero. In industrialized economies, on the other hand, the elasticity is in most countries greater than 0.5. Despite the high correlation between overall and intersectoral investment responsiveness (0.76), there are some notable differences. For example, while Germany scores the highest in the overall investment responsiveness measure, the United States has the highest intersectoral investment responsiveness. And Australia, South Korea, Hong Kong, and Japan are in the top-5 group when it comes to intersectoral investment responsiveness, but not in the overall investment responsiveness measure.

We examine whether investment responsiveness is greater in countries with large capital markets, by running cross-country regressions of the two elasticities on a broad measure of total finance, which equals the (log of) the sum of private credit by deposit money banks and other financial institutions and equity market capitalization, both expressed as a share of GDP. The data are retrieved from the World Bank's Financial Structure database (Beck, Demirgük-Kunt, and Levine, 2001). Our set of control variables includes real GDP per capita and a composite measure of

institutional quality. The institutional quality variable comes from the World Bank's Governance Matters database (Kaufmann, Kraay, and Mastruzzi, 2005 and Kaufmann, Kraay, and Zoido-Lobaton,1999) and is a composite index of bureaucratic efficiency, control of corruption, and rule of law. We will also use structural indicators of the workings of capital markets, such as the share of government ownership of the banking system, an index of legal inefficiency, and two proxies of corporate governance. Table 1 provides variable definitions and sources, while Appendix Table A reports the values of all variables.

3. MAIN RESULTS

Tables 3 and 4 report our estimates of the impact of financial development on the overall investment responsiveness (*Elasticity 1*) and the intersectoral investment responsiveness (*Elasticity 2*).

Overall Investment Responsiveness Table 3 column (1) replicates Wurgler's main result, while Figure 1a provides a graphical illustration. Financial market size is strongly positively correlated with the overall investment responsiveness. The coefficient estimate (0.51) is similar to that obtained by Wurgler (0.56) and statistically significant at the 99% confidence level. In columns (2) and (3) we show that the overall investment responsiveness is also higher in countries with higher levels of income per capita and better working institutions, respectively. This raises the question whether financial development affects the overall investment responsiveness once differences in income levels and institutional quality are accounted for. Columns (4) and (5) estimate the effect of financial development conditional on income and institutions. The coefficient on capital markets size drops considerably in these models (from 0.51 to 0.16 and 0.11) and loses significance when we control for institutions (see also Figure 2a which plots Elasticity 1 against financial development controlling for income and institutions). As the UNIDO data have poor coverage of low income countries, we exclude them from the estimation in models (7)-(9). The results are similar to those obtained in the large sample. The unconditional effect of financial development on the overall

investment responsiveness is positive and significant; yet the estimate becomes insignificant once we control for institutions and/or the level of economic development. In columns (10)-(12) we limit the sample to high income countries. The estimates continue to indicate a weak effect of financial development on overall investment responsiveness once income or institutions are taken into account.

Intersectoral Investment-Value Added Elasticity Our results in Table 3 show that the effect of financial development on investment responsiveness weakens when we account for differences in economic development or institutional quality. Does this continue to be the case when we focus on intersectoral investment responsiveness?

Table 4 re-estimates the specifications using intersectoral responsiveness of investment as a left-hand-side variable. In contrast to the analogous results in the previous table, we now obtain a significantly positive coefficient on financial development in all model permutations (Figure 1b provides a graphical illustration of the unconditional correlation). In particular, the estimate on capital markets size retains significance when we control for income level or/and institutional quality in the full sample of countries (columns (4),(5) and (6); see also Figure 2b) and when we drop low income countries (columns (7), (8) and (9)). The effect is also highly significant in the sub-sample of high income countries (columns (10), (11) and (12)). These results are especially striking in view of the strong positive correlation between financial development, on the one hand, and economic and institutional development on the other (the correlation of the log of financial markets size with the log of real per capita GDP is 0.71 and with the composite index of institutional quality 0.80). Despite this high correlation among (competing) explanatory factors, the results in Table 4 keep pointing strongly to financial development as a driver of the intersectoral investment responsiveness.

Our results in Table 4 therefore support the conjecture that financial development helps in moving capital quickly to expanding sectors (see also Fisman and Love, 2007; Ciccone and Papaioannou, 2006). When compared to the results in Table 3, they also illustrate why it is important to focus on the intersectoral responsiveness.

4. FINANCIAL SYSTEM CHARACTERISTICS, CAPITAL MARKET SIZE, AND INVESTMENT RESPONSIVENESS

Which are the drivers of cross-country differences in financial development? Some of the most important factors pointed to in the literature are state ownership of banks, investor protection, legal formalism, and insider trading legislation enforcement. We first examine whether these factors matter for cross-country differences in financial development in our sample and then analyze whether these characteristics have direct effects on the intersectoral investment responsiveness.

Financial System Characteristics and Capital Markets Size In Table 5 we examine whether state ownership of banks, investor protection, legal formalism, and insider trading legislation enforcement affect financial markets size. In columns (1), (2) and (3) we regress financial development on the share of commercial banks owned by the government in 1970 (close to the beginning of our sample). The state ownership of banks measure is taken from La Porta *et al.* (2002), who show that state ownership of banks is associated with poor performance of the banking system, illiquid capital markets, low levels of private credit, and slow productivity growth. Our results are consistent with their findings, as state ownership of banks significantly reduces the size of capital markets in our full sample (column (1)) as well as in our high-income and no-low-income samples (columns (2) and (3)). This result is robust to controlling for income or institutional quality (results not shown).

Starting with La Porta *et al.* (1997, 1998), the literature has also linked financial underdevelopment to poor corporate governance practices and inefficient legal systems. In columns (4), (5) and (6) we regress financial development on an index that measures de facto protection of shareholders and creditors to self-dealing transactions of managers. The 0-1 index comes from Djankov *et al.* (2008) and measures disclosure requirements, the ease of proving managerial wrong-doing, and approval requirements from disinterested shareholders. The results show that better functioning corporate governance mechanisms increase capital markets size.

Several studies have documented that the financial system is also affected by legal system efficiency (e.g. La Porta *et al.*, 1998; Acemoglu and Johnson, 2005; La Porta *et al.*, 2008). In columns (7), (8) and (9), we therefore investigate the impact of court efficiency on

financial markets size, using an index of legal formalism that measures the necessary time to enforce a simple dispute in courts (taken from Djankov *et al.*, 2003). In line with this work we also find a significant correlation between legal formalism and financial underdevelopment across all three samples.

In columns (10) (11), and (12), we examine the effects of insider trading legislation on financial development. The insider trading legislation measure comes from Bhattacharya and Daouk (2002), who trace the introduction and the first year of enforcement of insider trading legislation in 103 countries. In line with their empirical analysis, we find that the numbers of years since the execution of insider trading legislation has a strong positive effect on financial markets size.

In Table 6 we examine the joint effects of state ownership of banks, investor protection, legal formalism, and insider trading legislation enforcement on financial development. This allows us to examine which features of the financial and legal system are the most significant determinants of capital markets size. Multi-collinearity is a concern in these models, as, for example, countries with well functioning courts and high levels of investor protection tend to have fewer state owned banks. In addition, these countries tend to be economically successful, have well-functioning institutions, high productivity, etc. (Mankiw, 1995). Still, the results show that state ownership of banks continues to have a significantly negative impact on financial development. These specifications also continue to yield significant effects of the enforcement of insider trading legislation and legal formalism on capital markets size. The effect of the anti-self-dealing index, on the other hand, becomes insignificant once we control for the other institutional features (although it continues to be positive).

Financial System Characteristics and Intersectoral Capital Efficiency Tables 5 and 6 indicate that some key structural determinants of financial development have an effect on the size of capital markets. An open question is whether they also affect the intersectoral investment responsiveness. We address this question in Tables 7 and 8.

Table 7, model (1) reveals a statistically negative association between state ownership of banks and the intersectoral elasticity of investment to value added. Yet the coefficient on state ownership

of banks becomes insignificant once we control for income or institutional quality (results not shown). The estimate also weakens when we drop low income countries (in column (2)) or when we just examine high-income countries (column (3)). Specifications (4), (5) and (6) examine the effect of anti self-dealing legislation enforcement on capital markets size. The coefficient on the corporate governance proxy is positive and statistically significant at the 99% confidence level in the full sample and when we drop low income countries. The coefficient also retains significance when we control for income and institutional quality (results not shown). We continue to find a positive effect when we perform estimation in just 28 rich economies, although at a lower level of statistical significance (p-value of 11%). In columns (7), (8) and (9), we regress the intersectoral investment responsiveness on the index of legal formalism. The coefficient is negative and significant in the full sample of countries. The estimate retains significance when we exclude low income countries, although it becomes insignificant in the rich countries sample (p-value of 0.13). In models (10), (11) and (12), we examine the impact of insider trading legislation. The estimates show a significant impact of insider trading legislation enforcement on the intersectoral investment value added elasticity. This result prevails when we control for income or/and institutional differences (results not shown) and when we consider only the rich economies.

In Table 8 we control jointly for all financial legal system characteristics. The results show that while all variables enter with the theoretically predicted signs, in general none is statistically significant at standard confidence levels. State ownership of banks becomes insignificant once we control for legal system differences (or focus on high income countries). We also estimated models regressing the intersectoral investment responsiveness measure on the four structural characteristics and the size of capital markets (results not shown). In all models the size of the capital markets enters with a positive and significant coefficient, while the specific financial system characteristics enter with insignificant estimates. This indicates that state ownership of banks, sound corporate governance practices, and legal formalism affect the intersectoral investment efficiency through capital markets size.

5. Conclusion

We examine empirically whether greater levels of financial development are associated with capital flowing more rapidly to expanding sectors. To do so we build on the influential (two-step) approach developed by Wurgler (2000). In the first step, we estimate the country-specific responsiveness of sectoral investment to changes in the structure of production, using manufacturing data for a large number of countries and sectors over the last forty years. Our estimation method accounts for various sources of unobserved heterogeneity—at the country, the sector, the year, and the country-sector levels—and isolates the intersectoral component of investment responsiveness. In the second step, we relate the intersectoral investment responsiveness to financial development as well as measures of economic and institutional development.

Our main result is that there is a strong positive effect of financial development on the intersectoral investment responsiveness. To put it differently, in financially developed countries, capital appears to be flowing more rapidly to expanding sectors. This continues to be the case when we control for economic development (and/or focus on high-income or low-income economies) and for differences in institutional efficiency. This result contrasts with our findings regarding the overall investment responsiveness, which also reflects country-level co-movements between investment and income and confounding factors due to cross-country differences in patterns of specialization (in addition to the intersectoral investment responsiveness). We also investigate which (structural) features of the financial system affect the intersectoral allocation of capital. Our estimates indicate that better enforced insider trading legislation, stronger investor protection, faster resolution of pecuniary legal disputes in courts, and less state involvement in banking improve intersectoral investment responsiveness by increasing the depth and breadth of capital markets. Our results add to recent studies, which —employing alternative approaches and datasets— show that financial development fosters the rapid reallocation of capital to the sectors that need it most (e.g. Rajan and Zingales, 1998; Fisman and Love, 2004, 2007; Ciccone and Papaioannou, 2006; Bekaert *et al.* 2007). This strengthens the case for Bagehot's (1873) and Schumpeter's (1911) conjecture that financial development raises income levels by allocating capital quickly to where it is used most productively.

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Figure 1a.
General Investment Responsiveness and Capital Markets Size

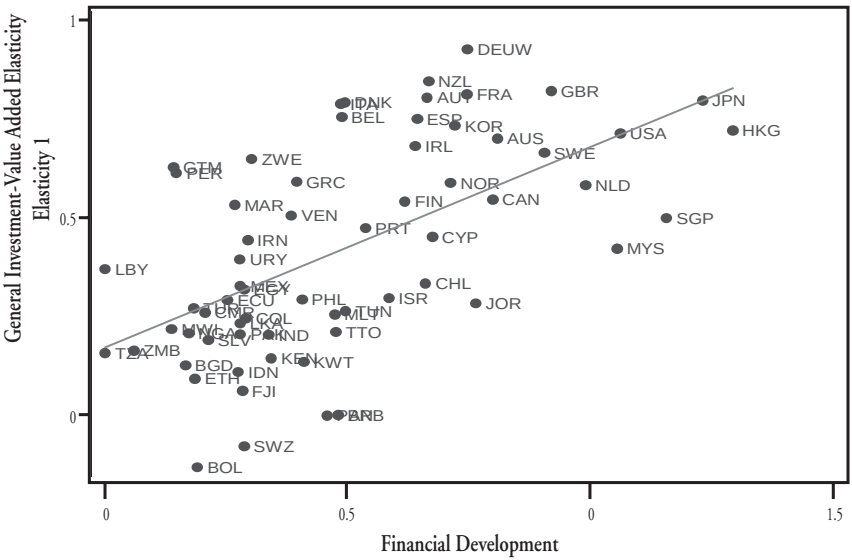

Figure 1b.
Intersectoral Investment Responsiveness and Capital Markets Size

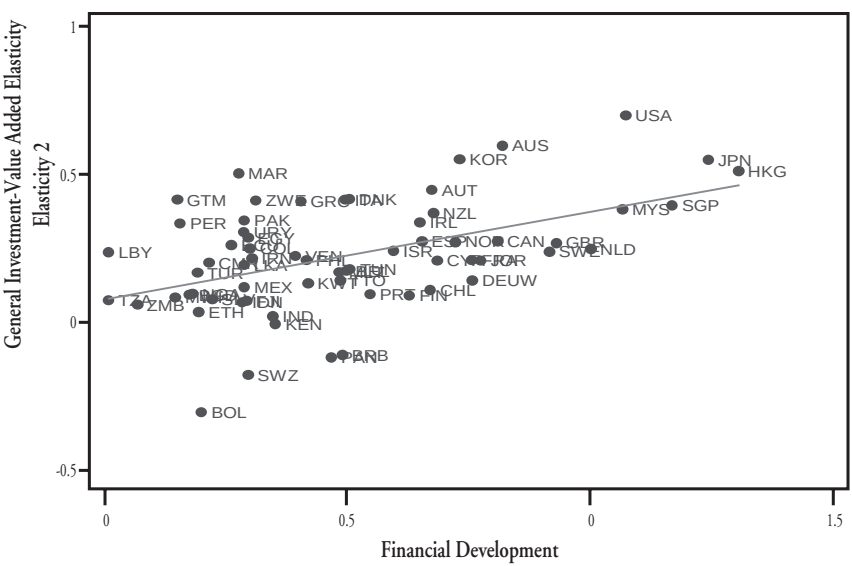

Figure 2a.
Orthogonal Components of the General Investment Responsiveness and Capital Markets Size

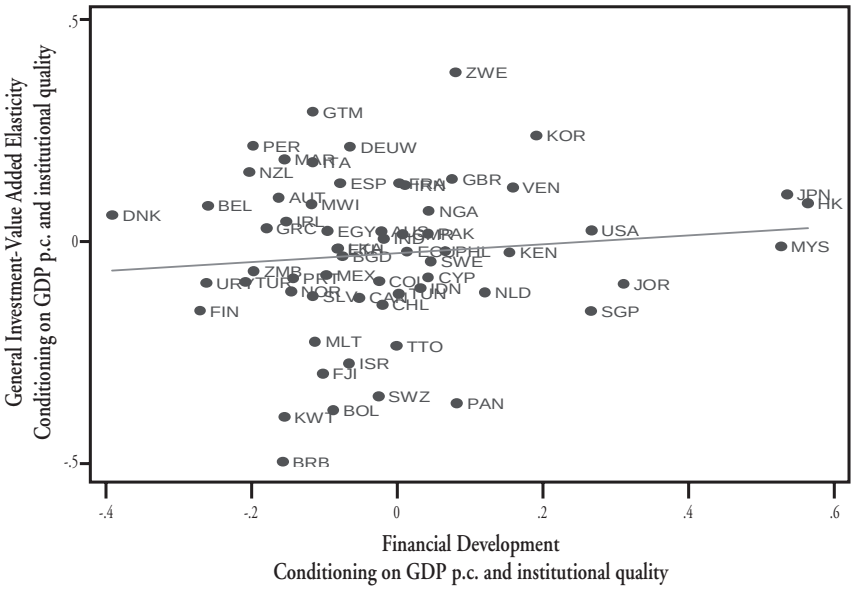

Figure 2b.
Orthogonal Components of the Intersectoral Investment Responsiveness and Capital Markets Size

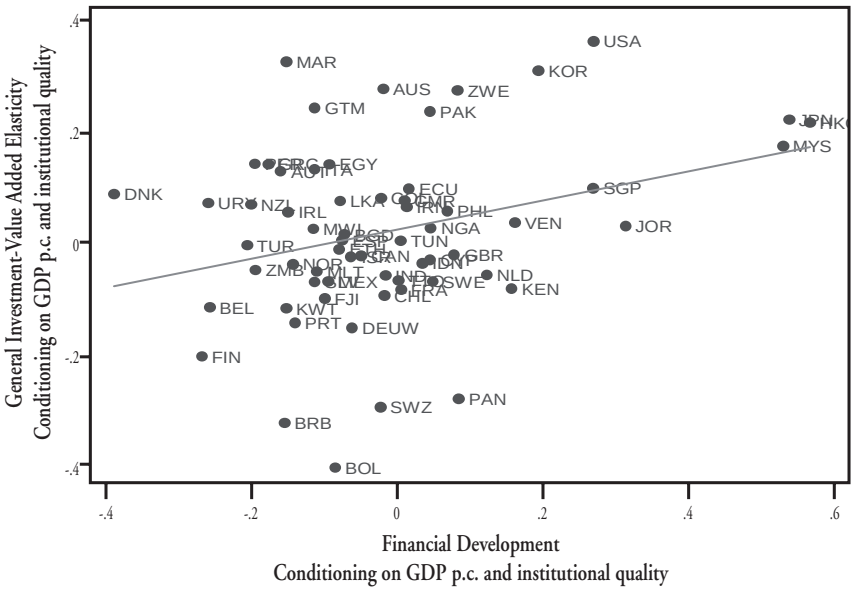

Table 1.
Variable Definitions and Sources

Variable	Definition
Financial Development (Capital Markets Size) [FD]	Sum of private credit by deposit money banks and other financial institutions as a share of GDP, and stock market capitalization as a share of GDP, averaged over the period 1980-1995. The variable is expressed in logs (as 1+ value). *Source: World Bank Financial Structure Database (Beck, Demirgük-Kunt, and Levine, 2001). Original source: International Monetary Fund IFS.*
Real GDP per capita [GDP]	Real per capita GDP in 1981 at constant 1995 international US dollars. The variable is expressed in logs. Source: World Bank World Development Indicators Database (2004).
Institutional Quality [IQL]	Composite index of institutional quality in the period 1996-2004, based on three sub-indicators of government effectiveness (which proxies mostly bureaucratic efficiency and functioning), rule of law (which proxies for contract enforcement, protection of intellectual property rights and judicial efficiency) and corruption (which proxies corruption among public officials, effectiveness of anticorruption initiatives, and mentality regarding corruption). *Source: World Bank Aggregate Governance Indicators Database (Kaufman, Kraay and Mastuzzi (2005) and Kaufman, Kraay and Zoido-Lobaton (1999)).*
Legal Formalism [LEXFORM]	The index measures substantive and procedural statutory intervention in judicial cases at lower-level civil trial courts, for completing a simple legal case, collecting a bounced check. The index ranges from 0 to 7, where higher values indicate greater control or intervention in the judicial process. *Source: Djankov, La Porta, Lopez-de-Silanes and Shleifer (2003).*
Investor Protection [ANTISELF]	Index that measures the de facto (ex-ante and ex-post) private control of self-dealing transactions. The ex-post components are the disclosure requirements in periodic filings and the ease of proving wrongdoing. The ex-ante components are approval requirements of disinterested shareholders and ex-ante disclosure. The index ranges from 0 to 1, with higher values indicating stricter-better protection against insiders' self-dealing activities (i.e. higher de facto investor protection). *Source: Djankov, La Porta, Lopez-de-Silanes and Shleifer (2008).*
Insider Trading Legislation [INSTR]	Years since 1995 that the country established and implemented legislation against insider trading. *Source: Bhattacharya and Daouk (2002).*
Government Ownership of Banks [BGOV]	Share of the assets of the ten largest banks in a country controlled or owned by the government of this country in 1970 (before bank privatization policies). The percentage of the assets owned by the government in a given bank is calculated by multiplying the share of each shareholder by the share that the government owns in that shareholder, and then summing the resulting shares. *Source: La Porta, Lopez-de-Silanes, and Shleifer (2002).*

Table 1 reports variable definitions and sources. The first column reports the variable name and the abbreviation; the second column reports definition and sources.

Table 2.
Estimates of Country-Specific Investment Responsiveness

	Sample Characteristics Observations			Country Fixed-Effects (FE)			Country-Industry FE; Industry-Year FE; Country-Year FE		
Country	**Obs.**	**Ind.**	**Years**	**Elasticity (1)**	**se (1)**	**rank (1)**	**Elasticity (2)**	**se (2)**	**rank (2)**
Australia	638	28	26	0.7011	(0.130)	*14*	0.5943	(0.1782)	*2*
Austria	774	28	29	0.8054	(0.070)	*5*	0.4459	(0.1211)	*7*
Bangladesh	177	26	11	0.1285	(0.121)	*57*	0.0944	(0.1215)	*50*
Barbados	211	17	25	0.0030	(0.114)	*62*	-0.1061	(0.1249)	*62*
Belgium	625	24	34	0.7561	(0.085)	*9*	0.1742	(0.1402)	*40*
Bolivia	223	26	18	-0.1294	(0.143)	*65*	-0.2991	(0.1463)	*65*
Cameroon	161	25	13	0.2620	(0.092)	*43*	0.2026	(0.1025)	*37*
Canada	704	28	27	0.5469	(0.113)	*23*	0.2743	(0.1384)	*22*
Chile	590	28	31	0.3359	(0.081)	*34*	0.1101	(0.1054)	*47*
Colombia	715	28	37	0.2476	(0.091)	*45*	0.2501	(0.1139)	*26*
Cyprus	614	26	31	0.4536	(0.105)	*29*	0.2088	(0.1624)	*35*
Denmark	647	28	28	0.7935	(0.115)	*7*	0.4143	(0.1854)	*8*
Ecuador	678	28	36	0.2937	(0.062)	*39*	0.2610	(0.0754)	*25*
Egypt, Arab Rep.	472	28	28	0.3194	(0.067)	*36*	0.2850	(0.0745)	*20*
El Salvador	147	26	12	0.1925	(0.120)	*52*	0.0781	(0.1455)	*53*
Ethiopia	152	21	12	0.0949	(0.154)	*59*	0.0365	(0.1770)	*58*
Fiji	24	018	24	0.0644	(0.125)	*61*	0.0742	(0.1344)	*55*
Finland	914	28	37	0.5427	(0.077)	*24*	0.0910	(0.0883)	*51*
France	678	25	37	0.8131	(0.061)	*4*	0.2095	(0.1248)	*34*
Germany, West	692	27	29	0.9272	(0.058)	*1*	0.1430	(0.1066)	*43*
Greece	771	28	32	0.5918	(0.089)	*20*	0.4070	(0.1165)	*12*
Guatemala	194	27	10	0.6298	(0.096)	*18*	0.4131	(0.1113)	*10*
Hong Kong, China	471	26	29	0.7221	(0.123)	*12*	0.5097	(0.1482)	*5*
India	607	28	24	0.2049	(0.082)	*51*	0.0228	(0.0866)	*59*
Indonesia	513	27	28	0.1107	(0.070)	*58*	0.0690	(0.0788)	*56*
Iran, Islamic Republic	539	28	29	0.4446	(0.058)	*30*	0.2159	(0.0862)	*32*
Ireland	601	26	28	0.6819	(0.111)	*15*	0.3369	(0.1566)	*17*
Israel	590	26	27	0.2982	(0.093)	*37*	0.2414	(0.1134)	*28*
Italy	816	28	33	0.7895	(0.054)	*8*	0.4138	(0.0842)	*9*
Japan	1008	28	37	0.7977	(0.059)	*6*	0.5463	(0.1317)	*4*
Jordan	422	27	27	0.2846	(0.079)	*40*	0.2083	(0.0791)	*36*
Kenya	141	25	13	0.1457	(0.319)	*55*	-0.0026	(0.3784)	*60*
Korea, Rep.	877	28	35	0.7342	(0.064)	*11*	0.5478	(0.0961)	*3*
Kuwait	403	25	33	0.1367	(0.081)	*56*	0.1336	(0.0989)	*45*
Libya	101	16	16	0.3719	(0.123)	*33*	0.2367	(0.2175)	*30*
Macao, China	211	23	22	0.0783	(0.137)	*60*	-0.0260	(0.1698)	*61*
Malawi	294	20	30	0.2192	(0.074)	*47*	0.0851	(0.0729)	*52*
Malaysia	432	28	20	0.4230	(0.097)	*31*	0.3815	(0.1219)	*14*
Malta	544	26	36	0.2572	(0.091)	*44*	0.1700	(0.1013)	*41*
Mexico	520	28	27	0.3293	(0.100)	*35*	0.1198	(0.1380)	*46*
Morocco	308	26	16	0.5345	(0.114)	*25*	0.5016	(0.1239)	*6*
Netherlands	712	27	30	0.5840	(0.069)	*22*	0.2479	(0.1027)	*27*
New Zealand	464	28	27	0.8465	(0.124)	*2*	0.3682	(0.1696)	*15*

Nigeria	493	24	16	0.2091	(0.104)	*49*	0.0985	(0.1208)	*48*
Norway	909	28	38	0.5895	(0.092)	*21*	0.2716	(0.1030)	*23*
Pakistan	151	27	8	0.2064	(0.150)	*50*	0.3431	(0.1677)	*16*
Panama	427	26	31	0.0021	(0.101)	*63*	-0.1145	(0.1204)	*63*
Peru	235	27	12	0.6148	(0.079)	*19*	0.3331	(0.1385)	*18*
Philippines	586	28	28	0.2940	(0.071)	*38*	0.2099	(0.0830)	*33*
Portugal	703	27	29	0.4752	(0.087)	*28*	0.0960	(0.1000)	*49*
Singapore	811	27	39	0.5006	(0.074)	*27*	0.3942	(0.0955)	*13*
Spain	799	28	34	0.7513	(0.076)	*10*	0.2745	(0.1371)	*21*
Sri Lanka	258	26	16	0.2346	(0.097)	*46*	0.1945	(0.1151)	*38*
Swaziland	811	62	1	-0.0767	(0.160)	*64*	-0.1744	(0.1905)	*64*
Sweden	610	26	24	0.6650	(0.118)	*16*	0.2383	(0.1646)	*29*
Tanzania	315	25	21	0.1594	(0.099)	*54*	0.0750	(0.1093)	*54*
Trinidad and Tobago	146	24	14	0.2119	(0.182)	*48*	0.1428	(0.2226)	*44*
Tunisia	594	27	31	0.2660	(0.095)	*42*	0.1798	(0.1128)	*39*
Turkey	751	28	34	0.2730	(0.063)	*41*	0.1680	(0.0731)	*42*
United Kingdom	754	28	28	0.8221	(0.085)	*3*	0.2685	(0.1375)	*24*
United States	1000	28	36	0.7149	(0.065)	*13*	0.6946	(0.0930)	*1*
Uruguay	214	27	11	0.3961	(0.125)	*32*	0.3040	(0.1461)	*19*
Venezuela, RB	418	28	20	0.5059	(0.077)	*26*	0.2251	(0.1103)	*31*
Zambia	135	22	12	0.1649	(0.150)	*53*	0.0611	(0.1766)	*57*
Zimbabwe	52	222	33	0.6494	(0.102)	*17*	0.4101	(0.1268)	*11*
Mean	500.05	25.86	25.69	0.4154			0.2213		
Median	522	27	28	0.3719			0.2099		
Standard Deviation	251.19	2.99	8.54	0.2667			0.1851		

The Table reports the country-specific elasticity of investment to value added. Estimation is based on a three dimensional unbalanced panel that covers 65 countries, 28 manufacturing industries in the period 1963-2002 (32,203 observations). The first three columns report panel descriptives. Elasticity 1 is based on regressing investment growth on value added growth, controlling for country (65) fixed-effects. Elasticity 2 is based on regressing investment growth on value added growth, controlling for country (65), industry (28), year (39), country-industry (1681), industry-year (1091) and country-industry (1670) fixed-effects. Standard errors for each elasticity are reported in parenthesess. Country ranks are given in italics.

Table 3.
Capital Markets Size and General Capital Allocation

Dependent variable:	**All countries**						**Non Low-Income**			**High-Income**		
Elasticity (1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Markets Size (FD)	0.5075			0.1663	0.11491	0.1116	0.4527	0.0772	0.0940	0.3194	0.1794	0.1729
stand.error	(0.0748)			(0.0939)	(0.1130)	(0.0990)	(0.0914)	(0.1211)	(0.0963)	(0.1640)	(0.1421)	(0.1234)
p-value	*0.00*			*0.08*	*0.31*	*0.26*	*0.00*	*0.50*	*0.33*	*0.06*	*0.22*	*0.17*
Real GDP per capita (GDP)		0.1213		0.0984		0.0797			0.1213			0.18269
stand.error		(0.0130)		(0.0192)		(0.0278)			(0.0444)			(0.1043)
p-value		*0.00*		*0.00*		*0.01*			*0.01*			*0.09*
Institutional Quality (IQL)			0.1636		0.13959	0.0434		0.1487	0.0276		0.1406	0.02415
stand.error			(0.0218)		(0.0357)	(0.0478)		(0.0404)	(0.0572)		(0.0828)	(0.1035)
p-value			*0.00*		*0.00*	*0.37*		*0.00*	*0.63*		*0.10*	*0.82*
Intercept	0.1737	-0.5606	0.3319	-0.4577	0.2944	-0.3023	0.2188	0.3102	-0.6520	0.3860	0.2695	-1.2888
stand.error	(0.0463)	(0.1074)	(0.0288)	(0.1206)	(0.0516)	(0.1888)	(0.0655)	(0.0650)	(0.3437)	(0.1459)	(0.0828)	(0.9095)
p-value	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*	*0.12*	*0.00*	*0.00*	*0.06*	*0.01*	*0.16*	*0.17*
Adjusted R-squared	0.343	0.483	0.425	0.500	0.354	0.505	0.265	0.394	0.475	0.122	0.209	0.313
Countries	64	62	65	62	64	64	52	52	51	28	28	28

The dependent variable is the general country-specific elasticity of investment to value added, where we control in the estimation for country fixed-effects (Elasticity 1). The set of explanatory variables includes a measure of financial markets size (FD), income level (GDP), and a composite index of institutional quality (IQL). The models in columns (1)-(6) are estimated in the widest sample of countries; the models in columns (7)-(9) exclude low income countries; the models in columns (10)-(12) are estimated only in high income countries. The income group classification follows the World Bank. Table 1 provides detailed variable definitions and sources. Table 2 reports the general investment-output elasticity for each country. Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. p-values are reported in italics below the standard errors.

Table 4.
Capital Markets Size and Intersectoral Capital Allocation

Dependent variable:	**All countries**						**Non Low-Income**			**High-Income**		
Elasticity (2)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital Markets Size (*FD*)	0.2935			0.2363	0.2840	0.2889	0.2779	0.2714	0.2837	0.3625	0.4113	0.4087
stand.error	(0.0597)			(0.0817)	(0.0939)	(0.0924)	(0.0778)	(0.9949)	(0.0959)	(0.1118)	(0.1204)	(0.1187)
p-value	*0.00*			*0.01*	*0.00*	*0.00*	*0.00*	*0.01*	*0.01*	*0.00*	*0.00*	*0.00*
Income-Real GDP p.c. (GDP)		0.0520		0.0195		0.0374			0.0385			0.0732
stand.error		(0.0124)		(0.0148)		(0.0197)			(0.0365)			(0.0709)
p-value		*0.00*		*0.19*		*0.06*			*0.30*			*0.31*
Institutional Quality (IQL)			0.0673		0.0034	-0.0417		0.00252	-0.0346		-0.0491	-0.0958
stand.error			(0.0190)		(0.0286)	(0.0385)		(0.0800)	(0.0476)		(0.0652)	(0.0657)
p-value			*0.01*		*0.91*	*0.28*		*0.94*	*0.47*		*0.46*	*0.16*
Intercept	0.0823	-0.1956	0.1870	-0.0494	0.0853	-0.1991	0.0951	0.09664	-0.2155	0.0444	0.0850	-0.5397
stand.error	(0.0379)	(0.1025)	(0.0235)	(0.1014)	(0.0431)	(0.1478)	(0.0547)	(0.0543)	(0.3078)	(0.0914)	(0.1136)	(0.6509)
p-value	*0.03*	*0.06*	*0.00*	*0.63*	*0.05*	*0.18*	*0.09*	*0.08*	*0.49*	*0.49*	*0.46*	*0.42*
Adjusted R-squared	0.239	0.184	0.149	0.255	0.2391	0.265	0.1979	0.198	0.224	0.252	0.269	0.296
Countries	64	62	65	62	64	62	52	52	51	28	28	28

The dependent variable is the intersectoral country-specific elasticity of investment to value added, where we control in the estimation for country FE, industry FE, time FE, country-industry FE, industry-year FE, and country-year FE (Elasticity 2). The set of explanatory variables includes a measure of financial markets size (FD), income level (GDP), and a composite index of institutional quality (IQL). The models in columns (1)-(6) are estimated in the widest sample of countries; the models in columns (7)-(9) exclude low income countries; the models in columns (10)-(12) are estimated only in high income countries. The income group classification follows the World Bank. Table 1 provides detailed variable definitions and sources. Table 2 reports the intersectoral investment-output elasticity for each country. Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. p-values are reported in italics below the standard errors.

Table 5.
Legal and Financial Structure Characteristics and the Size of Capital Markets

Dependent variable: Financial Markets Size (*FD*)	State Ownership of Banks			Investor Protection			Legal Formalism			Insider Trading Legislation		
	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gov. Ownership of Banks	-0.5350	-0.5443	-0.423									
stand.error	(0.0999)	(0.1051)	(0.1285)									
p-value	*0.00*	*0.00*	*0.00*									
Investor Protection				0.5561	0.5913	0.3862						
stand.error				(0.1433)	(0.1355)	(0.2021)						
p-value				*0.00*	*0.00*	*0.07*						
Legal Formalism							-0.1301	-0.1511	-0.1237			
stand.error							(0.0307)	(0.0275)	(0.0483)			
p-value							*0.00*	*0.00*	*0.02*			
Insider Trading Legisl.										0.0201	0.018	0.012
stand.error										(0.0029)	(0.0028)	(0.0023)
p-value										*0.00*	*0.00*	*0.00*
Adjusted R-squared	0.341	0.341	0.247	0.197	0.243	0.117	0.218	0.375	0.169	0.371	0.355	0.268
Countries	56	48	26	47	42	24	59	49	28	60	50	28

The dependent variable is financial markets size (FD). The set of explanatory variables includes: In models (1)-(3) government ownership of banks in the early 1970s (before privatization). In models (4)-(6) a measure of de facto protection of investors from directors´ anti-self-dealing activities. In models (7)-(9) an index of legal formalism based on the time needed to settle a simple legal dispute in courts. In models (10)-(12) an index based on the years since the first enforcement of insider trading legislation. Table 1 provides detailed variable definitions and sources. The models in columns (1), (4), (7) and (10) are estimated in the widest sample of countries; the models in columns (2), (5), (8), and (11) exclude low income countries; the models in columns (3), (6), (9), and (12) are estimated only in high income countries. The income group classification follows the World Bank. All models include a constant (not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. p-values are reported in italics below the standard errors.

Table 6.
Legal and Financial Structure Characteristics and the Size of Capital Markets (cont.)

Dependent variable: Financial Markets Size (*FD*)	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gov. Ownership of Banks	-0.4230	-0.4080	-0.3965	-0.3379	-0.2778	-0.2461	-0.3595	-0.3376	-0.3372
stand.error	(0.1043)	(0.1126)	(0.1548)	(0.0890)	(0.1019)	(0.1170)	(0.1008)	(0.1134)	(0.1482)
p-value	0.00	0.00	0.02	0.00	0.01	0.05	0.00	0.01	0.03
Investor Protection	0.1701	0.2125	0.0954				-0.0064	-0.0026	-0.0351
stand.error	(0.1370)	(0.1379)	(0.1835)				(0.1607)	(0.1700)	(0.1979)
p-value	0.22	0.13	0.61				0.97	0.99	0.86
Legal Formalism				-0.0662	-0.0875	-0.0815	-0.0753	-0.0880	-0.0637
stand.error				(0.0293)	(0.0310)	(0.0497)	(0.0388)	(0.0419)	(0.0561)
p-value				0.03	0.01	0.12	0.06	0.04	0.27
Insider Trading Legisl.	0.0123	0.0109	0.0062	0.0135	0.0109	0.0080	0.0110	0.0090	0.0064
stand.error	(0.0030)	(0.0030)	(0.0029)	(0.0029)	(0.0026)	(0.0025)	(0.0028)	(0.0026)	(0.0027)
p-value	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.03
Adjusted R-squared	0.556	0.553	0.403	0.582	0.592	0.434	0.587	0.601	0.402
Countries	47	42	24	54	46	26	47	42	24

The dependent variable is financial markets size (FD). The set of explanatory variables includes government ownership of banks in the early 1970s (before privatization), a measure of de facto protection of investors from directors' anti-self-dealing activities, an index of legal formalism based on the time needed to settle a simple legal dispute in courts and an index based on the years since the first enforcement of insider trading legislation. Table 1 provides detailed variable definitions and sources. The models in columns (1), (4), and (7) are estimated in the widest sample of countries; the models in columns (2), (5), and (8) exclude low income countries; the models in columns (3), (6), and (9) are estimated only in high income countries. The income group classification follows the World Bank. All models include a constant (not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. p-values are reported in italics below the standard errors.

Table 7.
Financial and Legal System Characteristics and the Intersectoral Investment Responsiveness

Dependent variable: Elasticity (2)	State Ownership of Banks			Investor Protection			Legal Formalism			Insider Trading Legislation		
	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Gov. Ownership of Banks	-0.1565	-0.1105	-0.1251									
stand.error	(0.0551)	(0.0607)	(0.1002)									
p-value	0.01	0.08	0.22									
Investor Protection				0.2886	0.3044	0.1618						
stand.error				(0.0956)	(0.0969)	(0.0974)						
p-value				0.00	0.00	0.11						
Legal Formalism							-0.0444	-0.0524	-0.0472			
stand.error							(0.0248)	(0.0248)	(0.0299)			
p-value							0.08	0.04	0.13			
Insider Trading Legisl.										0.0083	0.008	0.0063
stand.error										(0.0023)	(0.0024)	(0.0030)
p-value										0.00	0.00	0.05
Adjusted R-squared	0.076	0.025	0.017	0.137	0.171	0.021	0.054	0.091	0.020	0.155	0.157	0.120
Countries	56	48	26	47	42	24	59	49	28	60	50	28

The dependent variable is the intersectoral elasticity of investment to value added, where we control in the estimation for country FE, industry FE, time FE, country-industry FE, industry-year FE, and country-year FE (Elasticity 2). Table 2 reports the intersectoral investment-output elasticity. The set of explanatory variables includes: In models (1)-(3) government ownership of banks in the early 1970s. In models (4)-(6) a measure of de facto protection of investors from directors´ anti-self-dealing activities. In models (7)-(9) an index of legal formalism based on the time needed to settle a simple legal dispute in courts. In models (10)-(12) an index based on the years since the first enforcement of insider trading legislation. Table 1 provides variable definitions and sources. The models in columns (1), (4), (7) and (10) are estimated in the widest sample; the models in columns (2), (5), (8), and (11) exclude low income countries; the models in columns (3), (6), (9), and (12) are estimated only in high income countries. All models include a constant (not reported). The income group classification follows the World Bank. Heteroskedasticity-adjusted standard errors are reported in parentheses. p-values are reported in italics.

Table 8.
Financial and Legal System Characteristics and the Intersectoral Investment Responsiveness (cont.)

Dependent variable: Elasticity (2)	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income	All countries	Non Low-Income	High Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gov. Ownership of Banks	-0.0786	-0.0314	-0.127	-0.0917	-0.001	-0.0258	-0.0444	0.0113	-0.0943
stand.error	(0.0760)	(0.0784)	(0.1037)	(0.0669)	(0.0765)	(0.1012)	(0.0837)	(0.0836)	(0.1074)
p-value	0.31	0.69	0.23	0.18	0.99	0.80	0.60	0.89	0.39
Investor Protection	0.1803	0.2221	0.0688				0.0853	0.0917	-0.0029
stand.error	(0.1098)	(0.1110)	(0.1182)				(0.1162)	(0.1127)	(0.1410)
p-value	0.11	0.05	0.57				0.47	0.42	0.98
Legal Formalism				-0.0312	-0.0463	-0.0523	-0.0406	-0.0534	-0.035
stand.error				(0.0293)	(0.0295)	(0.0270)	(0.0348)	(0.0341)	(0.0311)
p-value				0.29	0.12	0.07	0.25	0.13	0.27
Insider Trading Legisl.	0.0046	0.0043	0.002	0.0048	0.0044	0.0034	0.0039	-0.0312	-0.0463
stand.error	(0.0027)	(0.0028)	(0.0036)	(0.0025)	(0.0028)	(0.0033)	(0.0029)	(0.0293)	(0.0295)
p-value	0.09	0.14	0.59	0.06	0.13	0.32	0.18	0.29	0.12
Adjusted R-squared	0.182	0.186	0.011	0.176	0.176	0.082	0.196	0.225	0.022
Countries	47	42	24	54	46	26	47	42	24

The dependent variable is the intersectoral elasticity of investment to value added, where we control in the estimation for country FE, industry FE, time FE, country-industry FE, industry-year FE, and country-year FE (Elasticity 2). Table 2 reports the intersectoral investment-output elasticity for each country. The set of explanatory variables includes government ownership of banks in the early 1970s (before privatization), a measure of de facto protection of investors from directors´ anti-self-dealing activities, an index of legal formalism based on the time needed to settle a simple legal dispute in courts and an index based on the years since the first enforcement of insider trading legislation. Table 1 provides detailed variable definitions and sources. The models in columns (1), (4), and (7) are estimated in the widest sample of countries; the models in columns (2), (5), and (8) exclude low income countries; the models in columns (3), (6), and (9) are estimated only in high income countries. The income group classification follows the World Bank. All models include a constant (not reported). Heteroskedasticity-adjusted standard errors are reported in parentheses below the coefficients. p-values are reported in italics below the standard errors.

Appendix

Table A: Data

Country	Country Code	Financial Development	Real GDP p.c.	Legal Formalism	Investor Protection	Insider Trading	Gov. Own. Banks	Institutional Quality
Australia	AUS	1.2433	16329.8	1.8026	0.790	1996	0.209	1.9327
Austria	AUT	0.9413	22184.1	3.5216	0.210	2005	0.708	1.8787
Belgium	BEL	0.6280	21212.7	2.7259	0.540	1994	0.399	1.4960
Bangladesh	BGD	0.1792	251.6	3.2412	.	1998	1.000	-0.6633
Bolivia	BOL	0.2095	996.1	5.7522	0.080	2005	0.531	-0.5580
Barbados	BRB	0.6146	6514.8	2.3706	.	2005	.	1.0433
Canada	CAN	1.2217	16842.7	2.0855	0.650	1976	0.110	2.0247
Chile	CHL	0.9349	2749.3	4.5658	0.630	1996	0.915	1.3153
Cameroon	CMR	0.2281	821.3	.	.	.	.	-0.9167
Colombia	COL	0.3361	1867.5	4.1118	0.580	2005	0.577	-0.4080
Cyprus	CYP	0.9625	6438.3	3.6754	.	2005	0.000	1.0447
Germany	DEU	1.1090	22593.3	3.5066	0.280	1995	0.519	1.8187
Denmark	DNK	0.6383	26753.2	2.5482	0.470	1996	0.098	2.1227
Ecuador	ECU	0.2860	1826.1	4.9232	0.080	2005	1.000	-0.7693
Egypt	EGY	0.3311	739.7	3.7939	0.490	2005	1.000	-0.0480
Spain	ESP	0.9010	10742.2	5.2478	0.370	1998	0.326	1.4273
Ethiopia	ETH	0.2031	114.4	.	.	.	.	-0.4927
Finland	FIN	0.8542	21023.1	3.1382	0.460	1993	0.321	2.1660
Fiji	FJI	0.3262	2475.6	.	.	.	.	-0.0990
France	FRA	1.1066	21558.3	3.2346	0.380	1975	0.744	1.5040
United Kingdom	GBR	1.5070	13976.3	2.5849	0.930	1981	0.000	2.0187
Greece	GRC	0.4830	10442.2	3.9912	0.230	1996	0.927	0.7147
Guatemala	GTM	0.1512	1568.2	5.6798	.	2005	0.321	-0.6887
Hong Kong	HKG	2.6404	12417.4	0.7303	0.960	1994	0.000	1.5367
Indonesia	IDN	0.3152	533.2	3.9013	0.680	1996	0.749	-0.6787
India	IND	0.4002	237.5	3.3421	0.550	1998	1.000	-0.1020
Ireland	IRL	0.8936	11119.5	2.6263	0.790	2005	0.038	1.7513
Iran	IRN	0.3415	1291.7	.	.	2005	0.894	-0.5333
Israel	ISR	0.7943	12201.0	3.3048	0.710	1989	0.676	1.0873
Italy	ITA	0.6238	14688.2	4.0414	0.390	1996	0.757	0.8347
Jordan	JOR	1.1463	1811.1	3.5219	0.160	2005	0.281	0.2940
Japan	JPN	2.4227	28806.8	2.9759	0.480	1990	0.069	1.3287
Kenya	KEN	0.4084	337.5	3.0877	0.220	2005	0.451	-0.8987
Korea, Rep.	KOR	1.0545	4098.7	3.3684	0.460	1988	0.566	0.5967
Kuwait	KWT	0.5053	12043.3	3.8772	.	2005	0.360	0.6647
Libya	LBY	0.0000	.	.	.	.	1.000	-0.9460
Sri Lanka	LKA	0.3208	474.6	3.7760	0.410	1996	1.000	-0.1300
Macao, China	MAC	.	.	.	.	.	.	0.9433
Morocco	MAR	0.3062	1059.2	4.7105	0.570	2005	0.591	0.1167
Mexico	MEX	0.3216	3486.3	4.7083	0.180	2005	0.827	-0.1573
Malta	MLT	0.6044	4813.5	2.4386	.	2005	.	0.8207
Malawi	MWI	0.1462	147.5	2.9539	.	2005	.	-0.5733
Malaysia	MYS	1.8685	2397.0	2.3421	0.950	1996	0.200	0.6600
Nigeria	NGA	0.1876	264.6	3.1930	0.520	2005	0.575	-1.1833

Netherlands	NLD	1.6889	20873.2	3.0658	0.210	1994	0.078	2.1220
Norway	NOR	1.0370	23384.8	2.9539	0.440	1990	0.546	2.0293
New Zealand	NZL	0.9464	14235.4	1.5789	0.950	2005	0.335	2.1060
Pakistan	PAK	0.3216	333.7	3.7610	0.410	2005	0.735	-0.6813
Panama	PAN	0.5790	2893.3	5.8377	0.150	2005	0.179	-0.1307
Peru	PER	0.1582	2685.5	5.6009	0.410	1994	0.874	-0.3067
Philippines	PHL	0.5003	1183.9	5.0000	0.240	2005	0.522	-0.2540
Portugal	PRT	0.7097	7382.2	3.9254	0.490	2005	1.000	1.2413
Singapore	SGP	2.1787	11601.7	2.4978	1.000	1978	0.129	2.2753
El Salvador	SLV	0.2360	1412.7	4.6009	0.570	2005	0.531	-0.3440
Sweden	SWE	1.4703	23250.7	2.9825	0.340	1990	0.208	2.0567
Swaziland	SWZ	0.3306	1103.6	3.6996	.	2005	.	-0.3955
Trinidad-Tobago	TTO	0.6087	4710.4	1.8048	.	2005	0.036	0.3160
Tunisia	TUN	0.6416	1686.2	4.0482	0.170	2005	0.529	0.4527
Turkey	TUR	0.1996	2002.8	2.5285	0.430	1996	0.818	-0.0733
Tanzania	TZA	0.0000	.	3.8221	.	2005	1.000	-0.6280
Uruguay	URY	0.3199	5525.1	4.0548	0.170	2005	0.423	0.5767
United States	USA	1.8892	21305.6	2.6206	0.650	1961	0.000	1.7853
Venezuela	VEN	0.4680	3865.8	6.0088	0.090	2005	0.829	-0.8527
Zambia	ZMB	0.0609	602.9	2.1306	.	2005	.	-0.6500
Zimbabwe	ZWE	0.3531	662.5	3.1053	.	2005	0.000	-0.7813

The Table reports the values of the main variables used in the empirical analysis. Table 1 provides detailed variable definitions and sources.

Consideraciones Empíricas de la Fuga de Cerebros*

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Resumen

Este artículo analiza la magnitud de la "fuga de cerebros" derivada de la emigración de Cabo Verde y si el retorno de emigrantes y las remesas pueden no sólo recuperar una parte importante de estos cerebros sino incrementar el nivel educativo del país de origen. Cabo Verde es un caso paradigmático al presentar una fuerte emigración de población a la par que un elevado crecimiento de su capital humano. Los autores realizaron una encuesta sobre emigración y calidad de las instituciones públicas. El primer objetivo del artículo es presentar esta nueva base de datos analizando la representatividad de la muestra. Con información añadida de censos de destino se

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llega a la conclusión de que la emigración de Cabo Verde drena individuos de la parte intermedia y alta del histograma educativo del país de origen, si bien no se obtiene una figura tan negativa como la que obtenían trabajos anteriores. Los resultados empíricos muestran que el retorno de emigrantes y las remesas internacionales no son mecanismos suficientes como para incrementar la educación del país de origen de tal manera que se compense la pérdida de cerebros derivadas de la emigración. Por tanto, para reconciliar emigración y crecimiento de capital humano habría que buscar otros mecanismos directos o indirectos por los que la emigración pudiera afectar a la distribución educativa del país de origen.

1. INTRODUCCIÓN

En los últimos años ha habido un creciente interés por los flujos migratorios internacionales[1]. En particular, los movimientos de individuos con elevada educación han sido un foco de preocupación tanto para los países donantes como para los países receptores de inmigrantes (World Bank (2006a, 2006b) y OECD (2007)). En este sentido no es nuevo, aunque sí cada vez más común, que los países desarrollados lleven a cabo políticas migratorias que seleccionen a inmigrantes de carácter permanente según su nivel educativo. Detrás de este sesgo podría existir la creencia de que los inmigrantes con mayor educación están más habilitados para asimilar con mayor rapidez la nueva forma de vida del país de acogida y poseen una mayor capacidad para conseguir unas condiciones laborales más estables. Asimismo, este tipo de políticas no son difíciles de vender a la opinión pública preocupada en gran medida por la seguridad nacional. Sin embargo, los países de origen se han quejado tradicionalmente de que estas iniciativas no sólo drenan su capacidad de acumular capital humano sino también incrementan el coste de la financiación pública de la educación ya que sus gobiernos se ven irremediablemente obligados a pagar una educación de la que posteriormente no se benefician.

En este sentido surge a partir de finales de los años 60 una literatura que habla de la "fuga de cerebros" y políticas que servirían para compensar a los países de origen por esta pérdida. Berry y Soligo (1969) son los primeros que con un modelo sencillo de equilibrio parcial indican los posibles efectos negativos de la emigración sobre la

1. Una perspectiva histórica de los flujos migratorios internacionales se puede encontrar en Chiswick y Hatton (2003).

renta per capita del país de origen[2]. El autor que con mayor número de trabajos ha defendido esta idea es Bhagwati, quien a principios de los años 70 presenta un modelo de equilibrio general incorporando consideraciones fiscales para financiar la educación de la población (Bhagwati y Hamada (1974)). A partir de este modelo, Bhagwati diseña mecanismos impositivos que compensarían a los países en vías de desarrollo a reducir los costes derivados de una emigración de individuos con elevada educación. A partir de estas ideas se discutieron a nivel internacional diferentes mecanismos para introducir este impuesto a nivel de Naciones Unidas, a nivel de país de llegada o a nivel de país de origen, e incluso en este último caso, se implementó alguna iniciativa gracias al gravamen por parte de los gobiernos nacionales de la renta global de sus ciudadanos independientemente de su residencia (paradigmático fue el caso de Filipinas[3]).

Se tiene que esperar hasta los años 90's con la creciente importancia del capital humano en los modelos de crecimiento endógeno, para ver una formalización en contra del efecto negativo de la emigración en el nivel educativo del país de origen. La idea primordial de esta nueva rama sería que la emigración también puede afectar positivamente a la acumulación de capital humano en el país de origen. En realidad, existen múltiples mecanismos por los que esto puede suceder, aunque la principal idea en estos primeros años de escritos fue el incentivo positivo a la educación que genera la probabilidad futura de emigrar[4]. Este incentivo genera un incremento del nivel educativo nacional antes de la emigración y como finalmente no todo el mundo que planea una emigración la realiza, el país de origen se acaba beneficiando. Vemos este argumento en Miyagiwa (1991), Mountford (1997) y Stark et al (1997,1998).

Recientemente, han sido sugeridos otros mecanismos por los que la emigración puede ser beneficiosa en el país de origen, seguramen-

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2. En un modelo de equilibrio parcial, si el factor trabajo es homogéneo, la emigración provoca una subida de las rentas de trabajo en el país de origen y una caída del rendimiento de capital. Berry y Soligo demuestran que en condiciones normales, si los no-emigrantes son los propietarios del capital físico de la economía, la renta per cápita (suma de salario y rendimientos de capital) de la población no-emigrante una vez ha partido una fracción no despreciable de la población es menor que la que tendrían de no haberse ido. Esto se exacerba si el factor trabajo es heterogéneo y parten los individuos más productivos.

3. Véase Bhagwati y Wilson (1988).

4. Esto sucede si los rendimientos a la educación son mayores en el exterior que en el país de origen o si se conjuga la existencia de restricciones a la emigración de los menos educados con un diferencial de renta positivo entre el país de acogida y el país de origen.

te influidos por la dificultad de contrastar empíricamente el anterior mecanismo. Se ha hablado del efecto positivo de las remesas internacionales que reducirían la posible existencia de restricciones crediticias (Edwards y Ureta (2003), Yang (2006), Mishra (2006)). Asimismo, como la emigración no es irreversible, el retorno de un número no despreciable de emigrantes que hayan podido acumular capital humano también sería beneficioso (Dustmann y Kirchkamp (2003) y Mesnard y Ravallion (2006)). Finalmente, aunque de manera más reciente, también se ha hablado del "efecto diáspora" o la importancia de las redes entre emigrantes y no-emigrantes para fomentar la inversión y los intercambios comerciales (Rauch y Trinidade (2002)).

Si bien la literatura teórica, como se ha visto, es bastante prolífica, la contrastación empírica de las diferentes hipótesis se ha quedado atrás. Esto ha sido motivado principalmente por la dificultad de conseguir buenos datos a nivel internacional en el tema de la emigración, el retorno o las remesas. Por tanto, el primer paso de la literatura empírica ha sido el de obtener datos sobre la "fuga de cerebros" por países. Recientemente, Docquier y Marfouk (2004) utilizan un conjunto de datos censales y de encuestas tanto de países de origen como de destino para obtener una medida de las características educativas de los emigrantes y de los no-emigrantes de cada país. Este tipo de datos, si bien es de gran utilidad para la contrastación empírica de las diferentes teorías, presenta problemas de difícil solución. La educación en el país de destino de los emigrantes no se puede interpretar como la educación que hubieran alcanzado en el país de origen, ya que por ejemplo un número importante de individuos llega al país de destino en edad escolar. Esto es analizado para casos particulares, como en Mishra (2006), pero es difícilmente tratable para el conjunto de todos los países, al no disponer de la información suficiente para ello.

En cualquier caso, los principales estudios empíricos a nivel macroeconómico sobre la "fuga de cerebros" han terminando trabajando con los anteriores datos o similares con técnicas de sección cruzada (Beine et al (2001, 2003)) y recientemente con técnicas de panel (Beine et al (2007)). Estos estudios analizan regresiones de la acumulación de capital humano sobre la probabilidad de que un individuo con estudios avanzados emigre, llegando a la conclusión de que la relación es positiva. Además, se desprende de estos estudios que el efecto positivo en la población es superior a la pérdida final de emi-

grantes educados. Sin embargo, estos estudios, al utilizar datos macro, no pueden tener en cuenta la heterogeneidad existente entre emigrantes y no-emigrantes, ni pueden en definitiva observar el mecanismo que subyace tras la relación estimada. Para poder ir más allá, como reconoce (Beine et al (2007)), es necesario obtener datos microeconómicos y estudiar la importancia relativa de cada mecanismo. Esto es lo que hacen Hanson y Woodruff (2002) y McKenzie y Rapoport (2006) para el efecto en la educación de los niños del hogar de la emigración de un familiar, o Edwards y Ureta (2003), Yang (2006), Mishra (2006) para las remesas.

Este artículo sigue la tradición micoreconómica para analizar el caso de Cabo Verde. Este país es de interés, como se verá más detalladamente en la sección segunda del artículo, puesto que habiendo incrementado enormemente en los últimos años su stock de capital humano, es según Docquier y Marfouk (2004) uno de los países con mayor número de emigrantes de África en relación a su población (casi el 20% de su fuerza laboral reside en el exterior) y es el país del África Sub-Sahariana que sufre la mayor fuga de cerebros con una huída del 67,5% de los individuos con más de 12 años de educación. En este sentido parece un candidato óptimo para analizar posibles mecanismos por los que la emigración pueda afectar positivamente a la acumulación de capital humano.

Para este fin los autores realizaron una encuesta sobre emigración y calidad de las instituciones públicas que se presenta en la sección 3. Al ser una base de datos nueva, se pone especial énfasis en la representatividad de la muestra y la comparación de sus principales agregados con información que se ha podido verificar de otras fuentes. Nuestra base de datos debe complementarse con los censos de los principales países de destino a raíz de los cuales se presenta un cálculo del número y la calidad de los emigrantes de Cabo Verde en el exterior.

En la sección cuarta, se usan los datos para calcular la pérdida de talentos de Cabo Verde. Como en otros estudios, se usan datos del país de origen y destino. Sin embargo, el artículo se distingue de los anteriores trabajos en la cautela con que trata la diferente codificación educativa que se observa en los cuestionarios de los diferentes censos. Como se verá en la sección cuarta, esta meticulosidad lleva a que el cálculo de la fuga de cerebros (probabilidad de emigrar teniendo un cierto nivel educativo) no sea igual que el de los anteriores artículos. Asimismo, como hay muchos inmigrantes que llegan al país de aco-

gida en edad escolar, su nivel educativo no tiene porqué reflejar el que hubieran tenido de haberse quedado en Cabo Verde. El artículo identifica la importancia de esta distorsión en la medición de la fuga de cerebros. Teniendo todos hechos en cuenta, nuestra estimación de la probabilidad de emigrar condicionada a la posesión de un cierto nivel educativo es elevada aunque inferior a los números de Docquier y Marfouk (2004).

Siguiendo las principales vías que la literatura ha defendido como posibles factores de ganancia de cerebros, la segunda parte de la sección cuarta analiza el retorno y las remesas como fuentes potenciales de ganancia de cerebros y mecanismos que pudieran compaginar la alta tasa de emigración de educados y el incremento de capital humano en Cabo Verde.

2. El caso de Cabo Verde

Cabo Verde es un archipiélago compuesto por nueve islas con 440.000 habitantes según el último censo 2000. Descubierto y colonizado por Portugal en el siglo XV, consiguió su independencia en el 1975, y desde 1991 es considerado una democracia estable. El país dispone de una renta media-baja (LIC)[5]. Sin embargo, el crecimiento de Cabo Verde en los últimos años (4,4% de media anual entre 1981 y 2000) ha excedido enormemente a la media del África Sub-Sahariana (crecimiento del 0,6% entre 1980 y 2004)[6]. En realidad, se ha convertido en el tercer país que durante este periodo creció a una mayor tasa en la región por detrás de Guinea Ecuatorial (11%) y Botswana (5%). Sin embargo, a diferencia de ellos, Cabo Verde no posee ni importantes recursos naturales, ni sus exportaciones representan un elevado porcentaje del PIB. Si en los anteriores países las exportaciones representan aproximadamente el 50% del PIB, en Cabo Verde estas sólo representan el 20%.

Durante la segunda mitad del siglo XX, la falta de lluvia provocó una desertización del país promocionando la emigración masiva que ha caracterizado el pasado reciente del país. Según nuestras estimaciones, que se comentarán más adelante, poco más de 100.000 indivi-

5. Según Heston et al (2006), dispone de un PIB pc de 5.900 ppp en 2003.

6. Esto no se debe simplemente a la estabilidad democrática ya que entre el 1980 y 1990 el país ya creció a un ritmo del 4.1%.

duos residen en el exterior del país (lo que supone un 19% de la población nacional). Los flujos de emigrantes del país representan en la actualidad un 3% de la población cada 5 años, con lo que se evidencia que la emigración es un fenómeno continuo y no un signo del pasado. Además, el Banco Mundial, basándose en las estimaciones de Docquier y Marfouk (2004), estima que el 67.5% de los individuos de Cabo Verde con educación terciaria reside en el exterior, situando a Cabo Verde como el país con la mayor fuga de cerebros de toda el África Sub-Sahariana.

Sin embargo, el factor fundamental del crecimiento reciente de Cabo Verde es un crecimiento continuo de la productividad basado en un enorme crecimiento del capital humano. Para comprobar este detalle se va a descomponer el PIB per capita (Y_t / N_t) en un término de productividad (Y_t / L_t) y en un término de utilización del factor trabajo que sería igual al número de personas empleadas per capita (L_t / N_t):

$$Y_t / N_t = (L_t / N_t) * (Y_t / L_t) \qquad (1)$$

Asimismo, siguiendo a Hall y Jones (1999) se asume que la productividad agregada es función del capital por unidad de output, del capital humano de la economía (donde S_t representa los años medios de educación y r el rendimiento a la educación) y de un factor que mide la productividad total de los factores – o PTF- (A_t).

$$Y_t / L_t = A_t . (K_t / Y_t)^{\alpha / 1-\alpha} . exp\ (r . S_t) \qquad (2)$$

En la ecuación anterior la constante α representa la participación de las rentas del capital en el PIB de la economía de Cabo Verde[7].

Para descomponer el crecimiento del PIB per capita hemos usado datos de población, y empleo del censo de Cabo Verde disponible en el Instituto Nacional de Estadística para los años 1990 y 2000 y de las Penn World Tables. Igualmente, se requiere de información censal para obtener el número de años de estudio de la población. El rendimiento de la educación proviene de

7. Esta expresión se deriva de una función de producción con rendimientos constantes a escala como la siguiente $Y_t = (K_t)^{\alpha} \ (A_t\ H_t L_t)^{1-\alpha}$, donde el capital humano sigue la siguiente forma funcional $H_t = exp\ (r . S_t)$.

Psacharopoulos y Patrinos (2004). Asimismo, las Cuentas Nacionales del país nos proveen de la participación del capital en la renta entre 1990 y el año 2000. La participación salarial media entre 1990 y 2000 fue de 45% a pesar de que en la mayoría de economías industrializadas se suele observar una participación salarial más cercana a los 2/3. Sin embargo, hay que tener en cuenta que el autoempleo es bastante extendido en Cabo Verde y la medida de participación salarial no está corregida por este factor[12]. Por este motivo la participación de las rentas del capital en el PIB de Cabo Verde se situaría en el 55%.

Para estimar la serie de capital se requieren datos de inversión y de empleo que provienen del World Bank (2006b). Para su cómputo se sigue un método de inventario perpetuo con una depreciación del 10%.

El cuadro 1 muestra que si bien en los últimos diez años ha habido variaciones en la tasa de empleo, el motor del crecimiento de la renta per capita en Cabo Verde ha sido la productividad.

Cuadro 1.
Promedio de la tasa de crecimiento anual para Cabo Verde, 1990-2005

Average Annual Growth Rates	Y/N	L/N	Y/L
1990-2005	4.1%	0.1%	4.0%
1990-1995	2.7%	-0.0%	2.7%
1995-2000	5.9%	1.9%	4.0%
2000-2005	3.4%	-1.8%	5.2%

Si descomponemos este crecimiento de la productividad entre sus componentes siguiendo la ecuación (2) se confirman que el capital humano ha tenido un papel preponderante en el crecimiento de la productividad de Cabo Verde (véase el cuadro 2). Este país ha experimentado un crecimiento muy importante en su nivel educativo en los últimos 15 años, en contraposición con la acumulación de capital físico. El sistema educativo ha experimentado un cambio muy importante recientemente. Siendo la educación primaria (6 años de educación formal) casi universal, muchos individuos tradicionalmente no avanzaban hasta la secundaria aún teniendo institutos accesibles en

8. Tener en cuenta este factor incrementaría no sólo la participación salarial sino también la importancia del capital en la descomposición, sin embargo los resultados no variarían sustancialmente.

las proximidades de sus lugares de residencia[9]. Sin embargo, el porcentaje de población que prosigue los estudios ha aumentado sustancialmente entre los jóvenes a lo que ha ayudado la construcción de una universidad y de un par de institutos de educación terciaria en la capital en el 1995.

Esto se observa de mejor manera si se analizan en grupos de cinco años los quince años anteriores. El primer periodo, que sigue a la democratización del país, es caracterizado por una entrada de flujos de capital y una caída de la PTF posiblemente fomentada en la existencia de cierta agitación social. Esto se revierte en los subsiguientes periodos. Sin embargo, la acumulación de capital humano es evidente a lo largo de todos los sub-periodos.

Cuadro 2.
Promedio de la tasa de crecimiento annual para la productividad en Cabo Verde, 1990-2005

Average Annual Growth Rates	Y/L	$(K_t/Y_t)^{\alpha/1-\alpha}$	A	H
1990-2005	4.0%	-0.2%	0.7%	3.5%
1990-1995	2.7%	0.5%	-0.6%	2.8%
1995-2000	4.0%	-1.1%	1.6%	3.5%
2000-2005	5.2%	-0.1%	1.0%	4.2%

Esta acumulación de capital humano se ha producido, como ya se ha dicho, en un entorno de fuerte emigración y con, según los datos de Docquier y Marfouk (2004), una elevada fuga de talentos. Las siguientes secciones van a analizar en qué medida la fuga de cerebros es tan elevada como se dice en la anterior referencia y en definitiva, comprobará si la emigración de retorno y las remesas pueden ayudar a explicar la convivencia de estos dos fenómenos.

3. DATOS

Para poder analizar cómo la emigración afecta a la acumulación de capital humano en el país de origen se necesita información tanto de los individuos que residen en el país de origen como de los individuos nacidos en Cabo Verde que residen en el extranjero. En esta sección se van a presentar los datos que se han utilizado para

9. En Cabo Verde existen instituciones secundarias en casi todos los municipios de las nueve islas.

el análisis, prestando especial interés en la representatividad de estos.

3.1 Datos de los residentes en Cabo Verde

Si bien el censo de población y vivienda de Cabo Verde presenta el nivel educativo de los residentes en el país, no detalla si estos reciben remesas del exterior, ni caracteriza el pasado migratorio individual o familiar. Es por esto que decidimos realizar nuestra propia base de datos que incorporase los anteriores aspectos y que se presenta a continuación.

La encuesta desarrollada se realizó mediante un conjunto de entrevistas directas realizadas por diferentes equipos locales y uno de los autores. Las entrevistas se realizaron entre Diciembre y Marzo 2006. Con anterioridad, se participó en el reclutamiento y del entrenamiento de los equipos locales. Concretamente, nos aseguramos de que cada entrevistador dispusiera de un total de 18 horas de entrenamiento en grupos de 2 a 3. El entrenamiento incluyó la lectura del contenido y discusión del objetivo del cuestionario; así como la determinación de algunas pautas sobre cómo debía responderse. Se realizaron entrevistas a 1066 hogares (997 entrevistas completas) en 30 – o un 5%- de las 561 áreas censales de Cabo Verde.

El cuestionario se compone de dos módulos: uno sobre características migratorias del hogar y otro sobre la percepción de la calidad/corrupción de los servicios públicos. El primer módulo tiene a su vez dos objetivos, en primer lugar pretende descifrar las características migratorias del hogar; si alguna persona ha emigrado alguna vez y si todavía está residiendo en el exterior, así como sus características socio-demográficas. Por otro lado, pretende averiguar si el hogar recibe remesas del exterior y en caso afirmativo, cómo las emplea. El segundo módulo permite conseguir información sobre la percepción de las instituciones públicas por parte de los residentes en Cabo Verde que va a ser de utilidad para identificar la relación causal entre remesas y educación[10].

El muestreo se realizó de forma aleatoria para las áreas censales una vez que éstas fueron ponderadas por el número de hogares den-

10. Si bien tiene una finalidad más ambiciosa en otros proyectos que tratan directamente el tema de la corrupción y la calidad de las instituciones.

tro del total del país. Dentro de cada área, los hogares se seleccionaron aleatoriamente con técnicas estándar. La condición para poder entrevistar a un hogar fue la residencia de la familia en Cabo Verde en cualquier momento dentro del intervalo 1985-2006. La condición para poder responder al cuestionario era la de tener al menos 30 años de edad. Existen dos imperfecciones en el muestreo aleatorio de hogares: el número de no-respuestas y el número de intentos a la hora de conseguir la realización de la entrevista y que puede variar por entrevistador. Hemos construido pesos que consiguen mantener la aleatoriedad de la muestra (usando las características de los que no respondieron: género, edad, educación y riqueza), aunque las diferencias entre los resultados usando o no los pesos son mínimas.

Para poder analizar la bondad de la base de datos a la hora de recoger información a nivel nacional, comparamos una serie de estadísticos descriptivos surgidos de la muestra con la misma información obtenida por otras fuentes.

Como se puede ver en las tablas 3 y 4, nuestra base de datos refleja adecuadamente la estructura demográfica de Cabo Verde en términos de género, edad y educación, una vez que se compara con el censo de población de Cabo Verde en el año 2000 o con los World Development Indicators del 2006.

Cuadro 3.
Datos demográficos básicos.

	Residentes en la base (2006)	WDI (2006)
Género		
Población masculina	47.95%	48%
Edad		
Población entre 15 y 64 años	58.13%	56.17%

Fuente: Base de datos propia y World Bank (2006c).

En la muestra se capta a un número ligeramente superior de gente mayor. Asimismo, en términos educativos, se capta a gente ligeramente más educada. Estas diferencias en parte pueden reflejar los 6 años de diferencia entre el censo y nuestra encuesta, aunque en ningún caso son diferencias muy elevadas.

En términos de actividad (activos por población en edad de trabajar), nuestra base de datos coincide significativamente con los datos proporcionados por el censo y los WDI si se usa una definición estric-

Cuadro 4.
Datos demográficos básicos y nivel educativo.

		Residentes en la base (2006)	Censo (2000)
Género			
	Población masculina	47.95%	48.42%
Edad			
	0-9 años	21.39%	27.45%
	10-19 años	28.63%	26.06%
	20-29 años	12.91%	15.18%
	30-39 años	13.05%	12.40%
	40-49 años	10.14%	7.34%
	50-59 años	4.44%	2.99%
	60-69 años	4.24%	4.41%
	70-79 años	3.80%	2.67%
	>79 años	1.21%	1.51%
Educación 15-64			
	No Educación	10.35%	13.9%
	Jardín de Infancia	1.34%	0.2%
	Primaria inacabada	11.15%	4.3%
	Primaria acabada	53.22%	52.6%
	Secundaria acabada	20.12%	26.4%
	Terciaria	3.82%	2.69%

Fuente: Base de datos propia y INE.

ta de actividad (65.93% en nuestra base por un 68.9% en el censo). Sin embargo, la tasa de desempleo que surge de nuestra base de datos (36%) es superior a la proporcionada por el INE en el año 2000, incluso cuando se usa una definición más laxa de desempleo (17.3%) o por el observatorio de desempleo para el año 2005 (24.4%). Esto puede tener que ver con el hecho de que mucha gente que está trabajando en el sector informal, cosa habitual en Cabo Verde, se declare desempleada en nuestra base de datos, mientras que no lo indique de la misma manera en las estadísticas oficiales. En este sentido hemos identificado menos auto-empleados en nuestra base de datos respecto al censo.

Otra información relevante es la composición sectorial de aquellas personas que dicen estar trabajando. En el cuadro 5, se observa que la distribución de las principales ocupaciones en la economía de Cabo Verde que surge de nuestra encuesta refleja de forma bastante fidedigna la descomposición que ofrece según una encuesta del INE de Cabo Verde y del Banco Mundial en el 2000 (INE (2001)).

Cuadro 5.
Descomposición sectorial de los trabajadores mayores de 15 años

		Residentes en la base (2006)	INE(2000)
Primary Sector		**14,39%**	**22,02%**
	Agriculture	13,59%	
	Fishing	1,41%	
Secondary Sector		**20,64%**	**17,97%**
	Industry	3,73%	7,09%
	Construction	15,99%	10,88%
Tertiary Sector		**64,97%**	**60,01%**
	Retail and Self-employment	12,75%	
	Transportation	5,00%	6,30%
	Public Service	11,06%	17,38%
	Education	6,41%	6,98%
	Health Care	1,97%	
	Other	28,10%	

Fuente: Base de datos propia e INE

3.2 Datos de los residentes en el extranjero

En nuestra base de datos se pregunta acerca de los ciudadanos pertenecientes a un hogar de Cabo Verde, en algún momento del pasado, y que habiendo partido al extranjero aún residen fuera del país. Sin embargo, este tipo de preguntas no recoge información alguna de aquellos emigrantes que han conseguido juntar sus hogares al completo en el exterior. Evidentemente, para estos ya no queda ningún miembro en Cabo Verde que pueda contestar nuestro cuestionario. Aunque la reunificación familiar no es inmediata ni permitida de la misma manera en todos los países receptores, la contribución de este factor en el total de entradas de muchos países receptores de inmigrantes supera el 50% (OECD (2006)).

Según nuestra base de datos un 11,64% de la población nacida en Cabo Verde – alrededor de 50.000 individuos- reside en el extranjero. Esto, supone una cota inferior a la cantidad real de inmigrantes de esta nacionalidad que debería encontrarse en los países de destino. Para obtener una cifra más aproximada del número de nacidos en Cabo Verde que residen en el exterior vamos a recurrir a diferentes censos de los países de destino. Para saber a dónde se dirigen los emigrantes de Cabo Verde volvemos a nuestra base de datos original ya que a partir de ahí se puede disponer de información sobre los desti-

nos preferidos de los emigrantes[11]. Los emigrantes de Cabo Verde se desplazan principalmente a Portugal (54%), siendo Estados Unidos (21%) y en menor medida Francia (12%) otros destinos con una afluencia importante. Los demás destinos no superan individualmente el 3%.

Se ha recopilado, por tanto, datos de los censos de Portugal, Estados Unidos, Francia, Holanda, Luxemburgo, Italia y España para enumerar a los residentes de Cabo Verde en el extranjero. Dando por válidos los porcentajes de el cuadro anterior para el total de la población emigrante que ha marchado alguna vez del país, esto supondría información sobre el 93% de los emigrantes de Cabo Verde. Por tanto, la suma de inmigrantes presentes en estos países en el 2001 (92.628) se divide por 0,93 para poder obtener la cifra total de individuos de Cabo Verde en el extranjero[12], que según nuestras estimaciones se situaría alrededor de 100.924, o lo que es lo mismo un 19% de la población. Esto supone que si sólo hubiéramos considerado a los residentes en el extranjero capturados en nuestra base de datos, nos habríamos olvidado de prácticamente la mitad de los emigrantes de Cabo Verde.

El cuadro 6 muestra el número de emigrantes por países de destino y sus características demográficas principales.

Como se puede observar, en las columnas sombreadas de la anterior tabla, si bien el porcentaje de hombres es prácticamente idéntico entre emigrantes y no-emigrantes, la población emigrante sobrerepresenta a los individuos con edades comprendidas entre los 30 y los 50 años. Estas diferencias en género y edad habrían sido igualmente distorsionadas si sólo hubiéramos considerado a los emigrantes que residen en el extranjero que son capturados por nuestra base de datos ya

11. Se analizan los destinos de los emigrantes más recientes (2000-2006) que en principio son los que menos afectados están por la reunificación familiar. Se coge un periodo reciente porque es esperable que la reunificación familiar sea distinta para diferentes países. Esta extrapolación tendría un problema si hubiera habido un cambio de preferencia entre países de destino, sin embargo nuestra información no parece mostrar un gran cambio en las preferencias de salida y coincide bastante bien con una información alternativa que nos ha proporcionado el INE de Cabo Verde para años anteriores.

12. Este cálculo supone que no existe infra-representación de los inmigrantes en el censo. Según el Accuracy and Coverage Evaluation (ACE) usado por el Census Bureau americano en el censo del 2000, la emigración temporal y la emigración ilegal son factores que influyen en la posibilidad de que la infra-representación de los inmigrantes pueda ser importante, pudiendo llegar a alcanzar en el censo una infrarepresentación de un 15% para los que residen en EEUU de forma ilegal. Para mejorar la estimación anterior deberíamos tener una idea del porcentaje de inmigrantes temporales y de ilegales por país de destino. Ante esta dificultad, hemos decidido presentar tan sólo el número bruto sin ningún tipo de corrección.

Cuadro 6 .
Características de los extranjeros que están en el extranjero.

	Censo de determinados países de destino								Censo Cabo Verde
	Portugal (2001)	United States (2001)	Francia (2001)	Holanda (2001)	Luxemburgo (2001)	Italia (2001)	España (2001)	Total estimado (2001)	Residentes en Cabo Verde (2000)
Total	44.060	27.059	12.140	1.404	2.420	3.263	2.282	100.924	431.989
Peso de cada país en el total	54,00%	21,00%	12,00%	1,85%	1,48%	1,11%	0,34%	100,00%	
Gender									
Male population	51,27%	51,31%	46,12%	49,17%	45,79%	18,79%	42,86%	49,08%	48,42%
Age									
0-10 years	7,85%	3,21%	14,02%	0,82%	2,23%	1,10%	10,20%	6,87%	27,45%
11-20 years	14,17%	16,58%	15,17%	8,10%	10,79%	3,37%	19,39%	14,57%	26,06%
21-30 years	20,06%	16,44%	14,28%	12,71%	16,65%	12,53%	26,53%	17,94%	15,18%
31-40 years	24,66%	21,14%	32,89%	28,64%	38,10%	28,23%	27,55%	25,32%	12,40%
41-50 years	20,33%	19,25%	14,80%	27,98%	17,19%	39,78%	14,29%	19,86%	7,34%
51-60 years	5,82%	8,96%	4,08%	13,08%	8,64%	11,37%	0,00%	6,74%	2,99%
61-70 years	4,73%	8,03%	3,33%	6,98%	4,71%	2,60%	0,00%	5,35%	4,41%
71-80 years	1,74%	3,80%	1,05%	1,32%	1,24%	0,77%	1,02%	2,18%	2,67%
81-90 years	0,58%	2,04%						0,97%	
>90	0,07	0,54%	0,38%	0,35%	0,45%	0,25%	0%	0,19%	

Fuente: Censos de población.
(*) El total estimado surge de dividir la suma de los países de destino disponibles por 0.93.

que tanto mujeres como niños menores de edad suelen juntarse con posterioridad a la primera emigración del cabeza de familia. Este sesgo incrementa la necesidad de tener en cuenta el censo de los países de destino.

Evidentemente, el usar datos de los censos de destino no está exento de problemas. En particular, como ya se ha comentado la infra-representación de inmigrantes puede ser importante y esta a su vez puede estar sesgada hacia determinadas características.
Concretamente, como ya se ha comentado, los colectivos que mayormente suelen estar infra-representados son los inmigrantes ilegales y los temporales y ambos grupos tienden a estar formados por hombres de poca calificación. Al no disponer de mejores datos en los países de destino, no podemos hacer un estudio pormenorizado de si este hecho afecta a los resultados empíricos[13]. Asimismo, el hecho de utilizar una base de datos alternativa incorpora una nueva manera de codificar determinadas características. Concretamente, la variable de interés en el artículo –la educación alcanzada- va a presentar ciertos problemas como se verá a continuación.

4. MECANISMOS DEL IMPACTO DE LA EMIGRACIÓN EN LA ACUMULACIÓN DE CAPITAL HUMANO

4.1 Pérdida de cerebros

Para poder valorar la pérdida de cerebros que supone la emigración es necesario disponer de la distribución educativa de los individuos que residen en el país de destino. La mayoría de institutos de estadística nacionales no ofrecen datos educativos de los inmigrantes por país de nacionalidad. Sin embargo, gracias al proyecto IPUMS (Ruggles (2004)) se han podido obtener microdatos del censo de Portugal y Estados Unidos para el 2001, que representan el 75% del total de emigrantes de Cabo Verde. Usar diferentes fuentes de datos para

13. Lacuesta (2006) muestra que para el caso mexicano en Estados Unidos, la importante infra-representación no está enormemente sesgada hacia determinadas características. Por otro lado, Hanson y Chiquiar (2005), teniendo en cuenta un cierto sesgo de la infra-representación hacia individuos menos educados y más jóvenes, no encuentran variaciones sustanciales en la selección total de los emigrantes mexicanos.

comparar el nivel educativo de la población es comprometido debido a que cada fuente suele disponer de una codificación alternativa, dependiendo sobretodo de su sistema educativo y de su propia realidad. Por ejemplo como en Portugal y en Estados Unidos la finalización de los cuatro primeros cursos de educación formal significa la consecución de la educación primaria elemental, es normal el preguntar por la cantidad de gente que llega a este grado, sin embargo en Cabo Verde esto carece de sentido ya que la educación básica finaliza con el 6º grado. Asimismo, gracias al peso de la educación avanzada en Portugal y Estados Unidos es normal el preguntar no sólo por la finalización de la carrera universitaria sino también por el hecho de haber realizado algunos cursos sin haberla finalizado, en Cabo Verde, donde el peso recae en la enseñanza básica, sólo se pregunta por la cantidad de gente que ha conseguido un título universitario. Los tres grupos que analizando la estructura educativa de cada país podemos construir de forma homogénea para los individuos de más de 25 años son: menos de 9 años de educación formal (primer ciclo de secundaria), más de 9 sin título universitario y universidad acabada.

Se observa en el cuadro 7 que los emigrantes están más concentrados en los grupos de educación intermedia y avanzada que los residentes en Cabo Verde. El grupo de emigrantes de Portugal y Estados

Cuadro 7.
Comparación educativa de los nacidos en Cabo Verde residentes en el extranjero y no emigrantes.

	Censos (2001)			Estimación (Resto como US (**))	Encuesta (2006)
	Residentes en el extranjero				
	Portugal	Estados Unidos	Total en Portugal y Estados Unidos	Total emigrantes	Residentes en Cabo Verde
Total	35760	19189	54949	73265	187203
	65%	35%			
Nivel educativo (*)					
Secundario intermedio completo o menos (<9)	84,45%	29,80%	65,37%	56,47%	77,58%
Entre 9 y universidad inacabada	9,34%	63,12%	28,12%	36,87%	19,02%
Universidad completa	6,21%	7,06%	6,51%	6,65%	3,40%

(*) Mayores de 25 años

(**) Se asume que el 25% del total de emigrantes poseen la misma distribución educativa que los residentes en EEUU.

Unidos que ha superado el primer ciclo de secundaria es del 28% por un 19% de la población no emigrante, mientras que el número de emigrantes con un título universitario asciende a un 6,51% ligeramente más elevado que el 3,40% de la población residente en Cabo Verde.

Esta desagregación muestra un comportamiento muy diferenciado de los emigrantes de Cabo Verde que se dirigen hacia Estados Unidos y hacia Portugal. Concretamente, los emigrantes que se dirigen a Estados Unidos presentan un nivel educativo mucho más elevado que el que presentan aquellos que se dirigen a Portugal. Esto podría ser debido a que para un emigrante de Cabo Verde es mucho más costoso ir a Estados Unidos que desplazarse a Portugal, ya no sólo geográficamente sino porque la lengua y la cultura del segundo destino están íntimamente relacionadas con el país de origen. Como el costo fijo de la emigración se incrementa con la distancia, el costo relativo de emigrar a un país lejano es menor para los individuos que más ganan, que serían los más educados. Si esta hipótesis es cierta, es complicado situar al 25% de emigrantes restantes ya que Francia, principalmente, aunque el razonamiento es válido para los demás países Europeos, se acercarían geográficamente a Portugal, alejándose en términos de lengua y cultura de ella. La mayor fuga de cerebros para Cabo Verde ocurrirá bajo el supuesto de que los emigrantes que van a destinos alternativos al Portugués y al Americano se pareciesen en términos educativos a los que se dirigen a Estados Unidos. Esta situación, a modo de ejemplo, es la que se presenta en la cuarta columna. Si esta fuera la situación, la selección intermedia de los emigrantes en términos educativos aún sería más acusada. Esta selección intermedia también se ha observado en otros casos como el mexicano (Hanson y Chiquiar (2005)) y ha sido justificada por costes de emigración elevados para los individuos menos educados.

Con estos datos, se puede obtener alguna medida de fuga de cerebros. La medida que se ha utilizado en Beine et al (2001, 2003, 2007) y que es tradicional en la mayoría de estudios empíricos es la probabilidad de emigrar dado un grado de educación superior, con lo que la fuga de cerebros de Cabo Verde tendría una cota superior en el 40% según nuestros datos. Doquier y Marfouk (2004) obtienen un 60% que es muy superior a nuestra cuota superior. La diferencia primordial entre las dos estimaciones proviene de la clasificación educativa utilizada ya que ellos elaboran una diferente partición educativa

para los residentes en el extranjero: menos de 9 años de educación formal, entre 9 y 12 y más de 13. La diferencia es aparente en los dos grupos más elevados de educación ya que incluyen en el grupo de educación superior a cualquier persona que haya realizado al menos un año de educación universitaria sin la necesidad de haberla acabado. Desgraciadamente, esta información no está disponible para los residentes en Cabo Verde y la comparación entre la distribución educativa de los residentes y de los no-residentes no es adecuada. Esta aparentemente pequeña divergencia tiene un gran impacto en la distribución educativa y en la medida de fuga de cerebros, ya que el peso de la educación universitaria en Cabo Verde es muy reducido. Para ilustrar este hecho y demostrar que las diferencias entre su estudio y el nuestro no proviene de diferencias en las bases de datos utilizadas realizamos con nuestros datos la misma partición que Docquier y Marofuk obteniendo resultados similares:

Cuadro 8.
Características de los emigrantes residentes en el extranjero.

	Docquier y Marfouk (2001)	Censos (2001)			Estimación (Resto como US (**))
		Residentes en el extranjero			
	Portugal	Estados Unidos	Total en	Total Portugal y Estados Unidos	Total emigrantes
	Total Emigrantes				
Total	53649	35760 65%	19189 35%	54949	73265
Nivel educativo (*)					
Secundario 1er ciclo completo o menos (<9)	55,50%	84,45%	29,80%	65,37%	56,47%
Entre 9 y 12	29,40%	8,77%	48,04%	22,48%	28,87%
Más de 12	15,20%	6,88%	22,14%	12,21%	14,69%

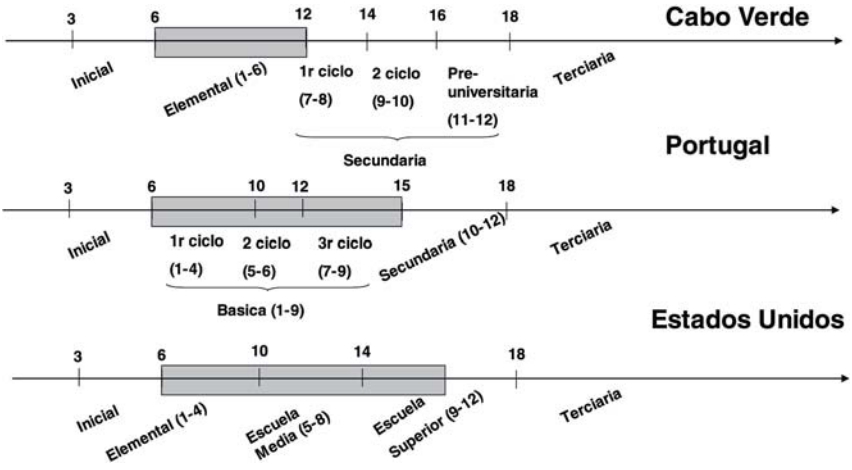
(*) Mayores de 25 años

(*) Se asume que los emigrantes de US y Portugal suman el 75% del total de emigrantes y el 25% restante presenta un nivel educativo idéntico al americano.

Bajo nuestro punto de vista, esto demuestra no sólo la cuidadosidad con la que se debe tratar la mezcla de diferentes bases de datos sino que sugiere una medida de fuga de cerebros basada en algún grupo educativo más representativo de la población de Cabo Verde. Por ejemplo, si la fuga de cerebros se midiera como el porcentaje de

emigrantes dentro de todos los nacidos en Cabo Verde que han superado el grado intermedio de educación secundaria, pequeñas variaciones en la forma de medir estos grados educativos no provocarían un sesgo tan grande.

En cualquier caso, cabe preguntarse si la distribución educativa de el cuadro 7 es la que se hubiera visto si los emigrantes no hubieran salido del país. Según nuestra base de datos, un 12% de los emigrantes de Cabo Verde realizan el movimiento para poder juntarse con otros miembros de la familia que ya habían emigrado con anterioridad, siendo una gran parte de ellos hijos en edad escolar. Evidentemente, los sistemas educativos y los incentivos a recibir esta educación no son los mismos en el país de destino y de origen. El gráfico siguiente muestra los sistemas educativos de Cabo Verde, Portugal y Estados Unidos. Los ejes muestran la edad del niño, y debajo de cada edad se indica el nivel que el niño debería estar cursando junto al número de años de educación formal que ha cumplido. En marrón se grafica la enseñanza obligatoria. Se puede observar que en cada país, no sólo los niveles acaban con un número diferente de cursos sino que la obligatoriedad también es distinta, por lo que si un emigrante, por ejemplo, llega a Estados Unidos antes de los 16 años es probable que consiga una educación superior a la que hubiera conseguido en Cabo Verde simplemente por el hecho de que se le obliga a estar más tiempo en la escuela. En este sentido, la distribución educativa de los emigrantes en el país de destino no refleja la educación contrafactual de estos si se hubieran quedado en su país.



Para comprobar la importancia relativa de este hecho se van a utilizar los microdatos de Estados Unidos[14]. Se va a comprobar como cambia la distribución educativa de los inmigrantes de Cabo Verde mayores de 25 años que residen en Estados Unidos si hubieran llegado con 16 años cumplidos o más. Para ello consideramos un modelo discreto multinomial donde la probabilidad de conseguir un grado determinado (*s*) depende del género de la persona, un polinomio de la edad y si entró con más o menos de 16 años:

$$P(s \mid Edad, Edad\text{^}2, 1(<16)) = F(\beta_0 + \beta_2 Edad + \beta_3 Edad\text{^}2 + \beta_3 1(\text{si entró con menos de } 16))$$

Se estima el modelo de forma separada para hombres y mujeres con dos logit multinomiales y se predice la distribución educativa restringiendo la variable ficticia sobre la edad de entrada a ser 0 (o sea a que todo el mundo entrara después de los 16 años). El cuadro 9[15] muestra que los individuos que entran a una edad más temprana tienen más posibilidades de concluir la educación secundaria y la universidad. Esta mejora educativa que estamos atribuyendo al sistema educativo de Estados Unidos podría en realidad deberse a factores inobservables del hogar o del individuo que no están captados por el modelo empírico y que también hubieran afectado a la educación de no haber emigrado. En primer lugar, podría ser que los individuos que entran a una edad más temprana hayan tenido la suerte de provenir de familias más educadas. Este hecho no sólo afecta a una más rápida reunificación familiar sino que también afecta de forma positiva a la educación del niño independientemente de su localización. Asimismo, como la edad actual está fija, al comparar inmigrantes que entran con diferentes edades se están comparando inmgirantes que entran en diferentes momentos del tiempo. Si la calidad de las cohortes de entrada ha descendido en Estados Unidos a lo largo del tiempo, como parece desprenderse de las tesis de Borjas (1985), el efecto que se está captando no debería atribuirse más que a ese cambio.

En cualquier caso, el efecto que se está captando gracias al el incremento educativo no consigue cambiar de forma considerable la dis-

14. En el censo portugués no se dispone de la edad de entrada de los inmigrantes por lo que sólo se puede realizar el análisis para el caso americano. En cualquier caso, una vez controlada la edad actual de los inmigrantes, las diferencias educativas entre inmigrantes en Portugal y residentes en Cabo Verde son mínimas o incluso negativas, por lo que no parece probable que el histograma se reduzca aún más.

15. Los resultados de la estimación se presentan en el Apéndice A.1.

tribución educativa de los inmigrantes de Cabo Verde en Estados Unidos. Esto es así porque sólo un 20% de los individuos mayores de 25 años entraron con menos de 16 años. Además, aunque el entrar pronto se ve compensado con una ganancia educativa, los que entran con posterioridad también tienen niveles educativos elevados.

Cuadro 9.
Características de los emigrantes residentes en el extranjero.

	Distribución contrafactual Estados Unidos	Distribución real Estados Unidos
Total	19189	19189
Nivel educativo (*)		
Secundario 1er ciclo completo o menos (<9)	32,90%	29,80%
Entre 9 y universidad inacabada	61,52%	63,12%
Universidad completa	5,58%	7,06%

(*) Mayores de 25 años

4.2 Ganancia de cerebros

Existen diferentes motivos por los que la emigración puede afectar de forma positiva tanto directa como indirectamente a la educación de la población en origen. En primer lugar y como ya se ha visto en la sección anterior, si una persona emigra, en el país de acogida, se le abren posibilidades educativas que no disponía en el país de salida. Por tanto, si existe emigración de retorno, la educación de la población residente en Cabo Verde debería estar sesgada al alza. En segundo lugar, aunque una persona no emigre, su educación puede verse afectada indirectamente por el hecho de que un pariente o conocido lo haya hecho y envíe remesas del extranjero que en parte se destinen a financiar la educación de los niños. En esta sección se van a evaluar de forma separada ambos mecanismos.

4.2.1Retorno de emigrantes

Usando nuestra base de datos podemos tener una idea de la emigración de retorno en Cabo Verde. Según nuestras estimaciones en Cabo Verde hay 14.000 individuos (3.3% de la población residente en Cabo verde y un 12% del total de emigrantes) que indican haber vivi-

do alguna vez en el extranjero. En nuestra muestra identificamos a 104 retornados que tienen más de 25 años y han vivido en Portugal o Estados Unidos, con lo que los resultados de esta sección deben considerarse con cautela.

Si bien en términos cuantitativos los retornados no representan un número excesivo, la importancia de la emigración de retorno a la hora de recuperar capital humano para el país de origen dependerá de la selección de estos retornados respecto a los emigrantes que se queden en el exterior y de donde se educaron. En el cuadro 10 se compara el nivel educativo de los emigrantes que residen en Portugal y Estados Unidos con el nivel educativo de los que han regresado habiendo ido a esos dos países. En términos agregados, las dos distribuciones son similares aunque se percibe una leve diferencia. Si los emigrantes que residían en el extranjero se concentraban en la parte intermedia de la distribución educativa respecto a los no-emigrantes, los retornados, aún y manteniendo este sesgo, incorporan peso en la parte alta y sobretodo en la baja de la distribución educativa respecto a los emigrantes que no residen en Cabo Verde. Este hecho es compatible con un modelo de ganancias heterogéneas de emigrar, en el que las personas que tienen menores ganancias (los más parecidos a los no-emigrantes) no están dispuestos a aguantar perturbaciones negativas en sus experiencias en el exterior (empíricamente sucede algo similar para el caso mexicano (Lacuesta (2006)). Esta evidencia es aún más clara cuando se observan las diferencias entre inmigrantes y retornados de Estados Unidos y de Portugal. Los retornados de Estados Unidos, aún y pareciéndose a los residentes en Estados Unidos, están seleccionados principalmente de la parte baja de la distribución educativa de éstos, que a su vez eran una selección positiva respecto a los no emigrantes. Contrariamente, los retornados de Portugal están seleccionados principalmente de la parte alta de la distribución de todos aquellos que deciden ir a Portugal, que a su vez estaban seleccionados de la parte baja de la distribución educativa de Cabo Verde.

El peso de los universitarios en la población de emigrantes de retorno es baja, y similar en orden de magnitud, al del grupo de no residentes en Cabo Verde, aunque lo supera en términos relativos[16].

16. Estos resultados se mantienen aún y controlando por las diferencias en edades de los dos grupos de emigrantes.

Cuadro 10.
Características de los emigrantes residentes en el extranjero.

	Censos (2001) Residentes en el extranjero			Encuesta (2006) Retornados que residieron en:		
	Portugal	Estados Unidos	Total en Portugal y Estados Unidos	Portugal	Estados Unidos	Total en Portugal y Estados Unidos
Total (*)	35760	19189	54949	63	27	90
	65%	35%		70%	30%	
Nivel educativo (**)						
Secundario intermedio completo o menos (<9)	84,45%	29,80%	65,37%	77,78%	51,85%	70,00%
Entre 9 y universidad inacabada	9,34%	63,12%	28,12%	14,29%	40,74%	22,22%
Universidad completa	6,21%	7,06%	6,51%	7,94%	7,41%	7,78%

(*) El total de retornos no está ponderado y corresponde a la muestra
(**) Mayores de 25 años

Si bien es cierto que se recuperan algunos emigrantes con educación elevada de la emigración, los emigrantes de retorno parecen mostrar menores niveles educativos que los emigrantes que se quedan en el extranjero en términos generales. En cualquier caso, al tener un nivel educativo mayor que los residentes en Cabo Verde, lo importante es saber si su emigración supuso un incremento educativo respecto a lo que habrían realizado de no haberse ido.

De un análisis preliminar de la base de datos no se desprende una respuesta muy positiva sobre este tema ya que sólo un 4% de todos los retornados indican los estudios como motivación principal de su viaje, aunque como pasaba con los emigrantes que residían en el exterior también hay algunos niños que se juntaron durante un tiempo con sus familias en el exterior pudiendo haberse beneficiado de un sistema educativo mejor. Para clarificar más este punto se realiza un ejercicio similar al de la anterior sección. Se va a comprobar como cambia la distribución educativa de los emigrantes que han retornado a Cabo Verde mayores de 25 años si hubieran salido de Cabo Verde una vez cumplidos los 16 años. Al tener pocas observaciones, para estimar el modelo discreto multinomial se juntan observaciones de los dos géneros y de emigrantes de retorno y de no-emigrantes[17].

17. Los resultados son similares si se hace el modelo sólo para emigrantes retornados aunque los coeficientes de la especificación no son significativos.

Se va a poner una variable ficiticia de retorno y otra interaccionada con una variable indicando si emigró con menos de 16 años. Se estima el modelo conjuntamente para hombers y mujeres con un logit multinomial y se predice la distribución educativa restringiendo la variable ficticia sobre la edad de entrada a ser 0 (o sea, se predice la educación si los emigrantes de retorno hubieran partido de Cabo Verde con una edad superior a los 16 años).

En los resultados econométrico presentados en el Apéndice A.2 se observa como los emigrantes de retorno tienen un diferencial positivo de educación respecto a los no emigrantes, tanto para el nivel intermedio como para el superior[18]. Sin embargo, entre ellos no hay diferencias estadísticamente significativas dependiendo de la edad de llegada. Por tanto, no es de esperar grandes cambios en la distribución contrafactual de educación si todos hubieran partido más tarde de los 16. El cuadro 11 confirma este hecho. Evidentemente, los problemas que se comentaron al final de la sección anterior también son extensibles a este grupo de individuos.

Este resultado confirma el hecho de que la emigración de retorno no parece una vía por la cual el país de origen se beneficie en términos educativos. Por un lado, los retornados no pesan mucho en la población residente total y además no parece que se eduquen en el extranjero mucho más de lo que lo hubieran hecho de no haberse ido.

Cuadro 11.
Ganancias educativas de lo emigrantes retornados.

	Distribución contrafactual Emigrantes retornados	Distribución real Emigrantes retornados
Total	150	150
Nivel educativo (*)		
Secundario 1r ciclo completo o menos (<9)	77,60%	76,76%
Entre 9 y universidad inacabada	16,44%	17,47%
Universidad completa	5,96%	5,77%

(*) Mayores de 25 años

En cualquier caso, este resultado no impide que la emigración de retorno pueda tener muchos otros beneficios para el país de origen. En primer lugar, los retornados pueden haber aprendido habilidades que se aplicarían en el mercado laboral local y que no son captadas por la educación formal. En segundo lugar, pueden traer capital con

18. Los resultados econométricos están a disposición del lector bajo petición

el que formar negocios que den empleo a otros trabajadores nacionales. Estos mecanismos deberán ser estudiados en un futuro.

4.2.2 Remesas de emigrantes

Según los *World Development Indicators* (World Bank (2006c)), la magnitud de remesas recibidas en Cabo Verde representa alrededor de un 10% del PIB en el 2003. Este número probablemente sea una cota inferior del verdadero valor de las transferencias entre emigrantes y residentes en Cabo Verde ya que una gran cantidad de remesas se perciben por vía informal[19]. Este porcentaje es el mayor de toda África y son muy superiores a los flujos de capital que entran en el país como inversión directa extranjera y de igual magnitud a los flujos de ayuda internacional.

Según nuestra base de datos el 29% de hogares ha recibido algún tipo de dinero o bienes del extranjero en los últimos 12 meses. La remesa mediana anual para el hogar fue de 15.000 escudos de Cabo Verde[20] aunque el histograma del total de remesas recibidas está muy sesgada hacia la derecha haciendo que la remesa media sea de 50.000 escudos. La importancia de las remesas se puede observar en nuestra base de datos donde el 50% de los hogares que reciben remesas las define como extremadamente importantes comparativamente con la renta del hogar. Nuestra información salarial o de renta del hogar es vaga por lo que no podemos conseguir una medida numérica de la importancia de las remesas en relación a los ingresos. Sin embargo, según una encuesta del INE de Cabo Verde y del Banco Mundial en el 2000 (INE (2001)), las remesas internacionales suponían un 15% del salario mediano en Cabo Verde[21].

Al ser de tal magnitud, las remesas podrían afectar a la decisión de educación del hogar sobretodo pensando en que algunos de los hogares sufren restricciones de crédito y las remesas podrían solventarlas al menos momentáneamente. Sin embargo, al preguntar por el principal destino de las remesas se observa que la mayor preocupación del hogar es asegurarse un nivel apropiado de consumo[22]. Sólo cuando se

19. De nuestro cuestionario se desprende que la mitad de individuos que reciben remesas las reciben en persona aprovechando un viaje de regreso del emigrante.

20. El tipo de cambio en 2006 del Escudo es de 110,33 CV Escudos/ Euro. En este caso la remesa mediana es de 136 euros.

21. La remesa media incluso superaba el 20% del salario medio.

22. El 84% de los hogares indica como principal destino de las remesas el consumo de bienes. Sólo un 3% destina las remesas a educación.

pregunta al hogar por múltiples destinos de las remesas, un 20% de los hogares indican que su segundo destino sería la educación de los niños, aunque este porcentaje está incluso por detrás de la preocupación por la salud de los miembros del hogar como segundo destino[23].

Aunque las remesas no se destinen íntegramente a la educación de los niños, puede ser que los recursos conseguidos por esta vía solventen la necesidad del hogar de impedir la continuidad de los estudios del niño. Para ver si esto es así, nos centramos en niños de 14 a 18 años y analizamos la posibilidad de que finalicen el primer ciclo de educación secundaria intermedia (9-10 grados) dado un nivel de remesas recibido por el hogar[24]. Pensemos en un modelo empírico donde la decisión de seguir educando a un niño del hogar se toma en función de una variable latente (S^*_i) que depende de las características del hogar (X_i), el hecho de recibir remesas (R_i), y variables inobservables para el econometra (ε_{si}), como se expresa en la siguiente ecuación:

$$S_i^* = \alpha_0 + \alpha_1 R_i + \alpha_2' X_i + \varepsilon_{si} \tag{3}$$

Concretamente, si la variable latente toma valores positivos, el individuo sigue estudiando mientras que para sus estudios si esta variable es negativa:

$$S_i = 1\,(S_i^* \geq 0) \tag{4}$$

Se ha estimado la ecuación anterior con un probit, incluyendo tres tipos de variables para las remesas. En primer lugar, se incluye una variable que indica el cobro de remesas por parte del hogar, en segundo lugar se incluye una variable indicando el valor de las remesas que se han recibido y su cuadrado y en tercero, cuatro variables discretas que recogen la pertenencia a uno de los cinco quintiles del total de remesas recibidas para captar posibles no-linearidades (el primir quintil estaría omitido). En cuanto a otras variables que influyen en la decisión de escolarizar al niño y son independientes a las remesas recibidas se considera tres tipos de variables: características individua-

23. El 24% de los hogares que indican más de un destino, aseguran que el segundo destino de las remesas es la educación, un 38% la salud y un 22% el consumo de bienes.

24. En Cabo Verde la repetición de curso es bastante frecuente, por este motivo y con el objetivo de incrementar al máximo la muestra de niños, alargamos la edad de consecución de grado hasta los 18.

les (género y edad), características del hogar (número de hijos, ausencia de alguno de los padres, propiedad de activos, restricciones de crédito, máxima educación en el hogar y calidad percibida del sistema educativo), características de la región (ratio de educados por no educados, desempleo y gasto anual por capita).

En el cuadro 12 se observa que las variables de control tienen los signos esperados a priori, con especial relevancia de la edad del niño (+), el número de hijos del hogar (-), la ausencia del padre (-), la educación de los miembros del hogar (+), la calidad percibida del sistema educativo (+) y el desempleo local (-). En la primera columna se observa que el hecho de recibir remesas no incrementa significativamente, una vez que se tienen en cuenta otras características del hogar, la probabilidad de finalizar la secundaria intermedia. Esto en principio no nos debería sorprender sabiendo la gran heterogeneidad que existe en las cantidades remitidas. Por este motivo, parece apropiado el controlar por el valor de las remesas que se reciben como se hace en la columna (2). En este caso, sí que el efecto de las remesas se incrementa con su valor. Para ver de forma más evidente este patrón se impone un efecto no lineal a lo largo de diferentes quintiles de la distribución. En la columna (3) el efecto se descompone a lo largo de los cinco quintiles. Se observa que si bien es cierto que no existe efecto en aquellos hogares que reciben cantidades de remesas pequeñas, parece haber una correlación entre educación y remesas en aquellos hogares que reciben una cantidad grande de éstas (pertenecientes al 5º quintil). Esto no sería de extrañar dada la manera en qué contestaban los hogares de la muestra a la pregunta sobre el destino de las remesas ya que la mayoría no ponía la educación como prioridad. En este caso, sólo en el caso de tener otras necesidades cubiertas se vería un efecto de las remesas en la educación.

Un problema que puede sesgar los coeficientes de la variable remesas y de la cantidad recibida en las anteriores especificaciones es que puede haber características inobservables del hogar que lo hagan más proclive a recibir remesas a la vez que beneficien la educación del niño. En este sentido, puede ser que la voluntad de que el niño siga con su educación haga que el hogar no sólo mantenga una persona en el exterior para poder financiar los estudios, sino que incremente el esfuerzo para conseguir una remesa mayor. En este sentido, la causalidad de la relación anteriormente descrita no estaría clara. Cuando esto ocurre se dice que existe un problema de endogeneidad, por lo que la especificación empírica debería tener en cuenta los factores que

Cuadro 12.
Probabilidad de pasar a educación secundaria avanzada (s>=9)

	(1)	(2)	(3)	(4)
Remesas>0	0.0387	-0.0098	-0.0537	0.0196
	(0.0380)	(0.0489)	(0.0828)	(0.0408)
Valor remesas		0.0024		
		(0.0014)*		
Valor remesas^2		-0.0000		
		(0.0000)		
2º quintil de remesas			0.0591	
			(0.0846)	
3r quintil de remesas			0.0968	
			(0.0689)	
4º quintil de remesas			0.0944	
			(0.0763)	
5º quintil de remesas			0.1723	0.1488
			(0.0333)***	(0.0405)***
Hombre	-0.0460	-0.0427	-0.0438	-0.0455
	(0.0332)	(0.0329)	(0.0330)	(0.0329)
Edad	0.6246	0.6075	0.6025	0.5949
	(0.3037)**	(0.3032)**	(0.3037)**	(0.3029)**
Edad^2	-0.0192	-0.0186	-0.0185	-0.0182
	(0.0095)**	(0.0094)**	(0.0095)*	(0.0094)*
Número de hijos	-0.0209	-0.0208	-0.0205	-0.0206
	(0.0095)**	(0.0095)**	(0.0095)**	(0.0095)**
Madre ausente	-0.0299	-0.0301	-0.0330	-0.0311
	(0.0590)	(0.0585)	(0.0594)	(0.0592)
Padre ausente	-0.1116	-0.1102	-0.1095	-0.1083
	(0.0355)***	(0.0356)***	(0.0354)***	(0.0354)***
Propiedad activos (tierra, casa, coche)	0.0013	-0.0013	-0.0013	-0.0009
	(0.0450)	(0.0444)	(0.0446)	(0.0446)
No restricción crediticia	0.0251	0.0251	0.0269	0.0231
	(0.0765)	(0.0770)	(0.0755)	(0.0777)
Máxima educación del hogar	0.0613	0.0613	0.0619	0.0617
	(0.0073)***	(0.0073)***	(0.0074)***	(0.0073)***
Calidad educativa percibidad	0.0286	0.0280	0.0276	0.0278
	(0.0137)**	(0.0137)**	(0.0137)**	(0.0136)**
Ratio de educados/no-educados	0.1960	0.1971	0.1893	0.1885
	(0.1794)	(0.1771)	(0.1779)	(0.1788)
Desempleo local	-0.9347	-0.9287	-0.9117	-0.9153
	(0.4838)*	(0.4793)*	(0.4784)*	(0.4819)*
Gasto anual por capita local	-0.9194	-0.8658	-0.8514	-0.8549
	(0.7078)	(0.7084)	(0.7219)	(0.7147)
Control de isla, zona rural y constante	Sí	Sí	Sí	Sí
Observaciones	677	677	677	677

Fuente: Base de datos propia. Restringido a niños entre 14 y 18 años dependientes.
Los coeficientes muestran efectos marginales en la media de las demás características.
En paréntesis desviación estándar (cluster por hogar).
* significativo al 10%; ** significativo al 5%; *** significativo al 1%

están detrás del recibo de remesas y de su cantidad. En particular se puede modelizar el cobro de remesas en función de una variable latente (R^*_i) que depende de las características del hogar (Z_i) dentro de las cuales pueden estar englobadas todas las variables que afectaban a la decisión de educarse, y finalmente variables inobservables (ε_{ri}), como se expresa en la siguiente ecuación:

$$R_i^* = \beta_0 + \beta_2' Z_i + \varepsilon_{ri} \tag{3}$$

$$R_i = 1(R_i^* \geq 0) \tag{4}$$

Lo mismo sucede con la cantidad o la pertenencia al quinto quintil[25]. El problema mencionado en el párrafo anterior se podría expresar analíticamente como que las variables inobservables de la decisión de educarse y del recibo de remesas estén relacionadas entre sí (cov (ε_{si}, ε_{mi}) $\neq$ 0). En ese caso, el coeficiente de la anterior estimación estaría sesgado y no nos estaría informando de la verdadera relación causal. Lo mismo sucede con el coeficiente del valor de las remesas o del quinto quintil. Por este motivo se debe realizar una estimación conjunta de remesas y educación.

Para poder identificar el efecto causal de las remesas en la decisión de educarse se requiere de al menos una restricción de exclusión en *Z,* o sea alguna variable que entre en la decisión de remitir *(Z)* pero que no entre en la decisión de recibir escolarización *(X)*. Si tenemos en cuenta más de una variable endógena (remesas y cantidad, o remesas y pertenencia al quinto quintil) se necesitarían al menos dos, uno para cada variable.

Tenemos algunos candidatos como instrumento a la recepción de una cantidad positiva de remesas. El instrumento que en principio pensamos puede considerarse de forma menos controvertida como exógeno a la decisión de educarse del individuo es la proporción de emigrantes en la región. Esta variable está relacionada con la decisión de emigrar de una persona y debería ser exógena a la educación del niño. Podría suceder que sólo individuos de un cierto nivel educativo decidieran emigrar con lo que la emigración llevaría a efectos de equilibrio general cambiando el ratio de personas educadas y no edu-

25. No se va a realizar la estimación por variables instrumentales de todos los quintiles ya que esto significaría estimar un modelo con seis ecuaciones simultáneas que no sólo incrementaría la dificultad sino que demandaría un número mayor de instrumentos.

cadas en la región. Sin embargo, esto es un dato que conocemos por lo que podemos controlar por esto en la regresión inicial.

Asimismo, tenemos otras variables de índole subjetiva que podrían a priori considerarse exógenas a la decisión de educarse y que sin embargo, afectarían a la decisión de emigrar y en definitiva a la capacidad del hogar de recibir remesas del exterior como son la confianza en un futuro mejor para Cabo Verde y la poca corrupción política del país. Puede suceder que aquellas personas críticas con su país, también piensen que el sistema educativo no funcione, por lo que es necesario controlar por la calidad percibida de la educación en la regresión inicial.

Por otro lado, los candidatos a instrumentar la cantidad de remesas cobradas se relacionarían con variables que afecten la capacidad de éxito o fracaso de la emigración de un miembro del hogar antes de la edad de 12 años del niño (justo antes de decidir si proseguir los estudios o no). En ese sentido, pensamos en el género, la edad y sobretodo el destino del emigrante. Nótese que el nivel educativo del emigrante tiene un efecto directo en la probabilidad de seguir educándose por lo que no sería un instrumento adecuado.

Aunque se piense que los anteriores instrumentos son válidos, puede ser que su poder explicativo, una vez que se tienen en cuenta todos los demás regresores no sea muy elevado en los datos finalmente utilizados. Para comprobar la relevancia de estos instrumentos se realiza una regresión de las variables endógenas a instrumentar sobre todos los regresores que entran en la decisión de educarse. Posteriormente, se realiza una regresión del residuo de la anterior regresión sobre todos los instrumentos candidatos. El cuadro 13 muestra los resultados de la regresión del residuo de las tres variables endógenas a instrumentar sobre los potenciales instrumentos. Se observa que dentro de las características de los emigrantes del hogar, el hecho de haber retornado y la edad presentan un cierto poder explicativo. El destino del emigrante es importante sobretodo para la cantidad pero también lo es para el hecho de recibir cuantía alguna. La proporción de emigrantes en la región está débilmente relacionada con el hecho de recibir o no remesas. Finalmente, la percepción subjetiva del cabeza de familia de la situación futura y política de Cabo Verde están relacionadas de forma relevante con la cuantía percibida. Los diferentes F-tests rechazan la hipótesis de que los instrumentos no tengan poder explicativo.

Ninguno de los instrumentos presenta unos T mayores de 4 con lo que no pueden ser considerados muy fuertes. Sin embargo,

al usar diferentes especificaciones para la variable educativa (probit con variables instrumentales y un modelo de probabilidad lineal estimado por mínimos cuadrados en dos etapas que se presenta en el apéndice), así como utilizando subgrupos de instrumentos para las variables endógenas, parece que los resultados a los que se llega no varían ni cualitativa ni cuantitativamente. Al tener varias variables que instrumentar es importante que al menos dos de los instrumentos no estén muy correlacionados. Los únicos instrumentos que están sensiblemente correlacionados son el retorno y la edad del emigrante que sólo tenían poder explicativo para la recepción de remesas y no para la cantidad, por lo que disponemos de suficiente información como para identificar el coeficiente.

Cuadro 13.
Primera etapa de instrumentos (1)

	Remesas	Remesas >0	
		Valor de las Remesas	5º quintil
Emigración familiar antes de la edad de 12 años			
Emigrante	0.0859	-167.531	-0.1879
	(0.83)	(0.58)	(1.42)
Retronado	-0.1412	95.312	-0.0524
	(2.08)**	(0.41)	(0.49)
Edad al momento de irse	0.0064	-0.2757	0.0058
	(2.03)**	(0.33)	(1.52)
Género	-0.0615	37.483	-0.0117
Destino del primer emigrante	(0.91)	(0.23)	(0.16)
Destino Portugal	0.1726	356.857	0.1738
	(2.21)**	(1.58)	(1.68)*
Destino EEUU	0.0860	877.546	0.3256
	(0.80)	(3.19)***	(2.58)**
Otros:			
Proporción de emigrantes en la región	0.4535	-756.683	-0.3819
	(1.83)*	(1.07)	(1.18)
Optimismo en el futuro	-0.0148	-85.099	-0.0214
	(1.30)	(1.90)*	(1.04)
Calidad de las instituciones políticas	-0.0113	77.349	0.0333
	(1.61)	(3.14)***	(2.95)***
Constante	-0.0405	-24.683	-0.0385
	(0.73)	(0.14)	(0.48)
Observaciones	655	177	177
R-20.09	0.15	0,12	

Valor absoluto de los estadísticos T en paréntesis

(1) La regresión es del residuo de las variables una vez que se controla por todos los regresores de el cuadro 12

* significativo al 10%; ** significativo al 5%; *** significativo al 1%

Cuadro 14.
Probabilidad de completar educación secundaria 1r ciclo
(variables endógenas instrumentadas)

	(1)	(2)	(3)
Remesas>0	0.1556	-0.7510	0.0544
	(0.4199)	(0.8500)	(0.5168)
Valor remesas		0.0392	
		(0.0339)	
Valor remesas^2		-0.0001	
		(0.0001)	
2º quintil de remesas			
3r quintil de remesas			
4º quintil de remesas			
5º quintil de remesas		0.9639	0.9025
		(1.9710)	(1.8881)
Hombre	-0.1499	-0.1058	-0.1437
	(0.1296)	(0.1485)	(0.1312)
Edad	2.5203	2.1534	2.4115
	(1.1574)**	(1.2406)*	(1.1983)**
Edad^2	-0.0775	-0.0663	-0.0742
	(0.0362)**	(0.0387)*	(0.0374)**
Número de hijos	-0.0832	-0.0789	-0.0822
	(0.0220)***	(0.0235)***	(0.0222)***
Madre ausente	-0.1111	-0.1231	-0.1108
	(0.1974)	(0.2091)	(0.1982)
Padre ausente	-0.4097	-0.4297	-0.4037
	(0.1390)***	(0.1485)***	(0.1429)***
Propiedad activos (tierra, casa, coche)	0.0423	-0.0352	0.0349
	(0.1758)	(0.1927)	(0.1775)
No restricción crediticia	0.0532	0.0070	0.0457
	(0.2500)	(0.2633)	(0.2522)
Máxima educación del hogar	0.2132	0.2224	0.2171
	(0.0269)***	(0.0289)***	(0.0279)***
Calidad educativa percibidad	0.0899	0.0764	0.0859
	(0.0520)*	(0.0556)	(0.0525)
Ratio de educados/no-educados	0.7384	0.8209	0.6893
	(0.7095)	(0.8033)	(0.7333)
Desempleo local	-3.3115	-3.1011	-3.2934
	(1.9112)*	(2.0135)	(1.9213)*
Gasto anual por capita local	-3.7171	-2.5961	-3.3735
	(2.8032)	(3.2095)	(2.9581)
Control de isla, zona rural y constante	Sí	Sí	Sí
Observaciones	677	677	677

Fuente: Base de datos propia. Restringido a niños entre 14 y 18 años dependientes.
En paréntesis desviación estándar (Cluster por hogar)
* significativo al 10%; ** significativo al 5%; *** significativo al 1%

El cuadro 14 presenta la estimación del sistema (2)-(4) y del sistema extendido a dos (remesas positivas y quinto quintil) y tres variables endógenas (remesas positivas, valor de las remesas y remesas al cuadrado). Seguimos a Newey (1987) usando su estimador para el modelo probit bi-variante[26]. En el cuadro se observa que los coeficientes de las variables de control son robustos a la especificación. De la columna (4) se desprende que las remesas, a pesar de tener un signo positivo no ganan en significatividad estadísticas. Asimismo, en la columna (5) se observa que el sexto quintil pierde significancia.

Esto debería generar ciertas dudas sobre el hecho de que las remesas estén realmente causando una ganancia educativa en los hogares que las reciben una vez que tenemos en cuenta todas sus carácterísticas observables y la posible correlación con otras características inobservables. Incluso en aquellos hogares donde se recibe más, la relación, de existir es muy débil y no parece robusta. En cualquier caso, y a pesar de que los resultados de esta sección no atribuyan a las remesas ningún efecto en la decisión de educarse, las remesas pueden tener otros efectos muy positivos para el país de origen vía consumo, inversión o relación real de intercambio.

5. CONCLUSIONES

Este artículo analiza empíricamente la fuga de cerebros de Cabo Verde. Este país es de interés, ya que como se desarrolla en el artículo, gran parte de su crecimiento del PIB per cápita se debe a la acumulación de capital humano, a pesar de ser uno de los países con mayor número de emigrantes de África en relación a su población (casi el 20% de su fuerza laboral reside en el exterior) y de tener, según Docquier y Marfouk (2004) una enorme fuga de cerebros.

Para analizar la fuga de cerebros y las posibles vías de ganancia de cerebros, los autores realizaron una encuesta sobre calidad de las instituciones públicas y emigración. El cuestionario se distribuyó a 1066 hogares (997 entrevistas completas) en 30 – o un 5%- de las 561 áreas censales de Cabo Verde. Se muestra que la encuesta es represen-

26. Al ser un modelo no lineal no se puede utilizar una estimación estándar en dos etapas. Se ha realizado la estimación de un modelo de probabilidad lineal en dos etapas que puede pedirse a los autores.

tativa de la realidad de Cabo Verde y que recoge de forma apropiada características demográficas y socio-económicas. Sin embargo, esta base de datos no es útil para describir a los emigrantes que residen en el exterior con lo que la anterior información debe de ser ampliada con datos de los censos de los países de destino.

Con estos elementos, se presenta una estimación de los emigrantes de Cabo Verde en el exterior que se acerca a los 100.000 (19% de la población). Para calcular la fuga de talentos se necesita una distribución educativa de los emigrantes y de los no-emigrantes. El artículo describe la dificultad de emparejar información educativa proveniente de diferentes fuentes ya que cada país codifica el nivel educativo dependiendo de su sistema educativo y de su realidad. Para el caso de los emigrantes de Cabo Verde se observa que Estados Unidos, por ejemplo, ofrece información acerca de aquellos individuos que han realizado algún curso universitario sin haber acabado el grado, cosa que no se ofrece en otros censos y en particular en el de Cabo Verde. Estas diferencias, que no deberían ser significantes, son importantes a la hora de valorar la "fuga de cerebros" ya que ésta se suele definir como la probabilidad de emigrar de la población con estudios universitarios y éstos representan un porcentaje muy reducido de la población total de Cabo Verde. En este sentido, cualquier discrepancia en la definición de educación superior entre las fuentes del país de origen y destino tiene grandes consecuencias. En este sentido, sería importante buscar medidas alternativas de fuga de cerebros menos sensibles a este problema. En cualquier caso se observa que la pérdida principal de población ha alcanzado el nivel secundario intermedio.

Asimismo, se muestra en el artículo que la distribución educativa de los emigrantes que residen en el exterior no representa la educación que estos individuos hubieran alcanzado de no haber emigrado ya que hay muchos que llegan en edad escolar y los sistemas educativos del país de origen y destino son distintos. Sin embargo, este factor no es capaz de explicar las diferencias educativas existentes entre emigrantes y no-emigrantes.

Siguiendo las principales vías que la literatura ha defendido como posibles factores de ganancia de cerebros, se analiza el retorno y las remesas como fuentes potenciales de ganancia de cerebros. Usando nuestra base de datos se estima que en Cabo Verde hay 14.000 individuos (3.3% de la población residente en Cabo verde y un 12% del total de emigrantes) que indican haber vivido alguna vez en el extran-

jero, cosa que limita la capacidad del retorno como factor que incremente la distribución educativa del país de origen. Además de presentar una selección más negativa en líneas generales que los emigrantes que residen en el extranjero, estos emigrantes de retorno no muestran incrementos educativos significativos respecto a lo que hubieran realizado de haberse quedado en su país, por lo que este factor no parece explicar la contradicción existente entre fuga de cerebros y acumulación de capital humano.

En segundo lugar, las remesas de emigrantes alcanzan el 10% del PIB en el 2003 según los *World Development Indicators*, con lo que son una importante fuente de ingresos que puede afectar de forma positiva a la educación de los que no han emigrado. Nuestras estimaciones no muestran una correlación positiva entre remesas y educación una vez que se tienen en cuenta otras características diferenciales entre hogares que cobran remesas y los que no. La correlación positiva sólo es evidente en aquellos hogares que cobran unas remesas bastante cuantiosas – aquellas que pertenecen al quinto quintil de remesas-, pero incluso en ese caso, la relación no parece causal una vez que se tienen en cuenta posibles características inobservables de los hogares.

En este sentido, para poder compaginar el crecimiento educativo de Cabo Verde con la fuerte emigración se debería ir o bien a los argumentos iniciales de la literatura de "ganancia de cerebros" de Stark y otros, donde la posibilidad de una futura emigración es el factor que incrementa el incentivo a educarse o bien a la literatura de redes de Rauch y Trinidade. Estas dos vías abren líneas futuras de investigación.

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7. Apéndice

A.1.
Logit multinomial con educación secundaria 1er ciclo completa como base

	(1)	(2)	(3)	(4)
	Hombres		Mujeres	
	<9 grados	Universitaria	<9 grados	Universitaria
Edad	0.1473	0.1239	0.0612	0.1978
	(0.0120)***	(0.0291)***	(0.0100)***	(0.0216)***
Edad^2	-0.0008	-0.0017	-0.0002	-0.0017
	(0.0001)***	(0.0003)***	(0.0001)*	(0.0002)***
Entrada antes de los 16	-1.3826	0.5570	-1.4000	1.0633
	(0.1022)***	(0.0883)***	(0.0941)***	(0.0970)***
Constante	-5.7522	-4.2365	-3.0152	-7.6900
	(0.3253)***	(0.6249)***	(0.2631)***	(0.5344)***
Observaciones	9267	9267	10455	10455

Desviaciones estándar en paréntesis
* significativo al 10%; ** significativo al 5%; *** significativo al 1%

A.2.
Logit multinomial con educación secundaria 1er ciclo como base

	(1)	(2)
	Educación secundaria 1er ciclo completa	Universitaria
Mujer	-0.5086	-0.6200
	(0.1238)***	(0.2531)**
Edad	-0.0833	-0.0451
	(0.0076)***	(0.0631)
Edad^2	0.0001	-0.0002
	(0.0000)*	(0.0007)
Retorno	0.5099	1.1029
	(0.2880)*	(0.4443)**
Salida antes de los 16	0.5148	-0.0028
	(0.7042)	(1.1767)
Constante	2.1499	-0.5544
	(0.2622)***	(1.3825)
Observaciones	2009	2009

Desviaciones estándar en paréntesis
* significativo al 10%; ** significativo al 5%; *** significativo al 1%

Comment

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Robert Lucas, Profesor de Economía en la Universidad de Boston, en el prólogo de libro *Internacional Migration and Economic Development* señala que cuando en 1990 John Williamson[1] planteó por vez primera el término "Washington Consensus" para resumir las prioridades políticas de las instituciones internacionales con sede en el Distrito Federal en relación con los países subdesarrollados, para nada se refirió a los problemas migratorios. Las políticas de liberalización comercial, los problemas de formación de precios, o los sistemas de ayudas y subvenciones a los sectores productivos dominaban la "agenda". Quince años después, el comercio sigue siendo prioritario, pero los efectos de las migraciones están recibiendo una importante atención. No es para menos, estudios rigurosos subrayan que las modificaciones productivas asociadas a los cambios migratorios podrían estar causando efectos tan significativos en las pautas de especialización mundial, que superarían ya a los estimados para las repercusiones del desarme arancelario[2]. En el mismo sentido, en muchas de las ocasiones los países subdesarrollados perciben a través de las transferencias de emigrantes, recursos financieros que exceden sobradamente a la suma de las percepcio-

1. Williamson J. (1990) .

2. Walmsey T. y A. Winters (2003) .

nes vinculadas a las ayudas internacionales más las inversiones directas procedentes del exterior[3].

La literatura teórica sobre las consecuencias económicas de las migraciones, y más específicamente sobre los efectos en el crecimiento económico de los países afectados, tanto por la emigración como por la inmigración, no es muy profusa y gravita exclusivamente sobre los efectos demográficos y el capital humano. Las consecuencias de la inmigración sobre el ritmo de crecimiento en el equilibrio de largo plazo se vinculan esencialmente a la capacidad y nivel de formación relativa de las poblaciones involucradas. En el caso de los países de origen respecto al resto de la población no emigrada, y en el caso de los países de acogida respecto a la población nativa. Esta conclusión básica, está condicionada a las mejoras de la capacidad y la formación de los inmigrantes en los países de destino, así como a los procesos de integración educativa de sus descendientes, que son factores decisivos para el país de acogida y, en el caso de retorno, en sus países de origen.

Más abundante y preciso es el análisis de corto plazo, donde igualmente las migraciones repercuten en la demografía y la productividad, resonando directamente sobre la evolución del mercado de trabajo afectando a los salarios y al nivel de empleo, pero también sobre la evolución de la demanda agregada influyendo sobre el comportamiento y la composición del consumo y la inversión. La naturaleza y composición de las migraciones, tanto como el capital humano y personal de los inmigrantes, determinan la magnitud y la amplitud de los efectos previsibles. Pero las huellas de las migraciones se aprecian igualmente en los balances de las cuentas públicas y externas que son parte sustantiva de la demanda agregada. La repercusión de las migraciones sobre los ingresos y los gastos públicos, y en los saldos de la balanza corriente (que reflejan conjuntamente el resultado a través del saldo comercial neto externo y sobre las rentas y transferencias netas externas) forman parte del complejo cálculo de las resultas de los procesos migratorios.

La totalidad de estos fenómenos están asociados o vinculados directa o indirectamente con el grado de formación, la capacidad y la productividad de los flujos migratorios, y en un sentido genérico podría ser considerada como el cómputo del "brain drain" o del "brain gain". No me parece, sin embargo, esta una decisión razona-

3. Ratha D. (2003) .

ble. Como no me parece razonable tampoco, aunque haya hecho fortuna en los últimos años, que la actividad productiva y la capacidad de crecimiento de un país gravite exclusivamente sobre el balance de generación de ideas del mismo. Aunque, sin duda, el volumen de remesas de la emigración pueda estar relacionado con los niveles del capital humano de los emigrantes, nada indica el signo de esta relación[4], y tal vez deberíamos sondear la influencia de otros factores determinantes, tales como la voluntad de retorno (el carácter temporal o permanente de la migración), las posibilidades de reunificación familiar, la mejora de los niveles de formación y capacidad productiva de las migraciones en el país de destino, y desde luego el nivel de desarrollo del mismo. En mi opinión deberíamos considerar los efectos del drenaje (o ganancia) de capital humano como un fenómeno vinculado esencialmente con el mercado de trabajo y la actividad productiva, y no tanto con la magnitud de los flujos de transferencias de renta que impliquen. Establecer regularidades sobre el comportamiento de las remesas de los emigrantes implica suponer la homogeneidad de un fenómeno que, contrasta con las enormes diferencias en la composición, motivaciones y comportamientos de los emigrantes según sus orígenes.

Más sentido tiene evaluar los aumentos de formación de los emigrantes en sus países de destino como parte del "brain drain", como lo sería incluir en los mismos los efectos de la formación e integración económica de los descendientes o como consecuencia de los retornos posteriores. La utilización de información directa de origen familiar a partir de encuestas directas, como la realizada por Batista, Lacuesta y Vicente (BLV), enriquece los análisis de caso y mejora los procedimientos efectuados en trabajos anteriores sobre los procesos de retorno. Por lo mismo me parece constructivo y viable el establecimiento de estudios de caso, como el que proponen estos autores, que iluminen una realidad estructural, pero en ningún caso con la pretensión de generalización que se esconde siempre tras los contrastes empíricos.

El artículo que comentamos está en línea con una tradición de la literatura donde la distribución de la renta en los países de origen

4. Si en lugar de tomar como referente a Cabo Verde con una emigración de altos niveles relativos de formación, se hubiese seleccionado el caso de la emigración a España de los países latinoamericanos, la relación entre el volumen de remesas y el capital humano de los emigrantes seguramente sería el inverso al sugerido en el artículo que comentamos. Pero la experiencia española de las décadas del desarrollismo permiten sostener un argumento estrictamente antagónico al presentado por Batista, Lacuesta y Vicente.

y de destino son al mismo tiempo factores determinantes de la probabilidad de emigrar y determinantes de la formación media de la población emigrante[5]. La dispersión de la renta respecto a la media del país generador disminuye la cualificación media de los emigrantes; como la dispersión de la renta respecto a la media del país receptor eleva la cualificación de los emigrantes. El grado de correlación entre los niveles de dispersión de la renta de los países tiene igualmente una influencia aunque más compleja.

Un problema más espinoso es el que se refiere a la relación existente entre la renta de los emigrantes en sus países de origen y la renta obtenida en los países de acogida por tales emigrantes. En otros términos si las condiciones de capacidad o formación técnica estuviesen representadas por la renta de los emigrantes, se trataría de saber si los niveles de renta en los países de destino se confirman, disminuyen o aumentan. Bajo tales circunstancias podrían testarse las hipótesis establecidas sobre la dispersión de la renta, el grado de cualificación y los efectos económicos de las migraciones[6]. En todo caso, todas estas regularidades pueden estar condicionadas por el hecho de que las decisiones de emigración son, en general, decisiones familiares. Por lo mismo, las migraciones derivadas o las reunificaciones familiares, tanto como los movimientos migratorios de las mujeres, pueden estar condicionadas por motivaciones diferentes de las estudiadas para el cabeza de familia.

Pero Batista, Lacuesta y Vicente van más lejos. En realidad, el artículo que comentamos en su introducción plantea de una forma secuencial directa o indirectamente siete hipótesis diferentes aunque relacionadas, algunas de las cuales distan de ser evidentes o de estar convenientemente fundadas en la literatura teórica existente, y para las cuales el estudio que nos ocupa no siempre proporciona una justificación suficiente:

- La primera y más importante de las hipótesis sugeridas por BLV sostiene que, al menos en su análisis de caso, *la intención de emigrar supone un incentivo y estímulo para mejorar el capital humano de los emigrantes en el país de origen antes del desplazamiento.*

5. Roy A.D. (1951), pp.138.

6. Bratsberg B. (1995).

La literatura sobre migraciones siempre ha distinguido entre las causas y las consecuencias de las migraciones. En el caso de Cabo Verde, con una originalidad notable, no sólo se integran ambos procesos sino que es la probabilidad de emigrar lo que determina las decisiones igualmente probabilísticas de formación en el país de origen. Así las familias con mayores niveles de educación no sólo tendrían mayores niveles de formación tras los procesos migratorios (evidencia que no se aprecia en los datos de "survey" para Cabo Verde) sino que, contrariamente a lo descrito en la literatura, tales niveles sería inducidos por la intención de emigrar y causa del propio proceso migratorio. Los contrastes realizados parecen confirmar esta sugerencia y suponen que los caboverdianos conocen y aprovechan por anticipado la existencia de rendimientos diferenciales positivos de la educación en el país de destino[7], y mayores niveles de escolarización determinan mayor actitud migratoria.

La descripción de los procedimientos de contraste no es demasiado explícita. El contraste realizado de la hipótesis sobre la relación entre la probabilidad de emigrar y la probabilidad de ampliar el grado educativo comprende diversas variables que no son significativas (incluyendo uno de los regresores esenciales: la probabilidad de emigrar sin el nivel de formación secundaria). Más riguroso sería eliminar del contraste las variables que no son significativas, lo que inevitablemente implicaría una modificación de los coeficientes de las variables significativas y de la significación de las mismas. Así se desconoce si la elasticidad de los individuos que se implican en la graduación de enseñanza secundaria respecto a la probabilidad de emigrar es la definida por BLV, como se desconoce igualmente su grado de significación.

- Dos hipótesis adicionales (segunda y tercera) se suscitan directamente relacionadas con la primera. Por un lado, se sostiene que c*uanto mayor sea el capital humano del colectivo emigrado más intenso será el flujo de remesas de emigrantes hacia el país de origen*. Y, por otro, que *las remesas de emigrantes, esté previsto o no el retorno, son asignadas principalmente en la mejora de la educación de la familia del país de origen*.

7. Lo que implicaría también una expectativa, no siempre cierta, de reconocimiento de los grados o títulos de los países de origen en los países de destino.

La evidencia presentada por BLV no soporta fehacientemente ninguna de ambas hipótesis. Es cierto que las familias caboverdianas donde se ha producido una emigración previa están más escolarizadas que aquellas otras donde no se ha producido emigración. Conforme con la primera de las hipótesis ello podría ser interpretado como un propósito educativo orientado a preparar el futuro proceso migratorio, y no una consecuencia del envío de transferencias por los miembros de la familia ya emigrados. Sin embargo, el contraste empírico de la influencia escolarizadora de las remesas de emigrantes no son en este caso significativas.

Contrasta este resultado con los resultados obtenidos en otros estudios de caso. Existe una abundante literatura en relación con el destino y el reparto de las remesas efectuadas al país de origen entre gastos de consumo y/o gastos de inversión[8]. Los resultados de los estudios empíricos disponibles permiten confirmar el incremento de la actividad inversora en las zonas de origen de la población inmigrante. La inversión en capital productivo y la sustitución de mano de obra por pequeña maquinaria y otros "inputs" derivó en incrementos de la productividad. Pero sobre todo el incremento en inversiones en capital humano y formación, por un lado, y en salud, por el otro, determinó mejoras sensibles del nivel de vida de las poblaciones origen de las migraciones internacionales[9].

- A lo largo del texto, BLV suscitan una hipótesis adicional sobre la influencia del retorno y un corolario sobre los efectos de la emigración sobre el capital humano del país de origen. Aparentemente, se señala, *el retorno de los emigrantes a sus países de origen tras el proceso migratorio contribuye aún más a elevar el capital humano de los países de origen*. Y por ello, la formación previa a la emigración, las remesa derivadas utilizadas en inversión educativa, y la formación adquirida por aquellos que retornan, suponen

8. Este tema ha sido estudiado desde diferentes perspectivas y para distintos países. Vid.: Lucas R. (1987) ; McCormick B. y Wahba J. (2003); Cox-Edwards A.y Ureta M. (2003); León-Ledesma M. y .Piracha M. (2004).

9. Adams R.H. (2006) en Özden Ç y Schiff M. (Ed.) *International Migration, Remittances & the Brain Drain*. Palgrave Macmillan y World Bank. Washington D.C. (2005), estudia los efectos de las remesas de emigrantes sobre el consumo y la inversión, confirmando los resultados de estudios precedentes en el sentido de que las remesas generan efectos sustancialmente mayores sobre la inversión que sobre el consumo de las familias afectadas. Sus conclusiones permiten destacar que los efectos de las remesas se concentran básicamente en el incremento de las inversiones en vivienda y en educación.

que *el balance de los efectos de la emigración es un incremento sustantivo del capital humano del país origen de las migraciones.*

Los datos aportados en el estudio de Cabo Verde apuntan una tasa de retorno del 12%, superior a la presentada en los estudios de caso de otros países del África sub-sahariana no insular. Ciertamente se plantea de forma inmediata si los niveles de formación de la población que retorna son equivalentes a los del conjunto de la emigración, o si los ciudadanos que regresan tienen la misma formación que el colectivo emigrado. Curiosa y un poco contradictoriamente, el trabajo de BLV subraya que el análisis de encuesta confirma que la tasa de escolarización de las familias de emigrantes retornados no es sensiblemente diferente del apreciado en las familias sin emigrantes.

Parece sensato poner de manifiesto en este punto que la capacidad y la formación del trabajo no se asocia sólo a dominio de lo "visible" u observable en términos de titulaciones o grados de formación. Es obvio subrayar que una parte de conocimiento es "no visible" y se deriva de la experiencia laboral y del hábito en la utilización instrumental. Las dificultades asociadas a la información impiden evaluar la incidencia de la inmigración sobre la formación no observable. En ausencia de datos relativos a los salarios previos y posteriores a la emigración, la capacidad no asociada con formación "reglada" se realiza a partir del contraste de las consecuencias de la emigración retornada sobre las rentas brutas semanales. La evidencia presentada por BLV sugiere ausencia de repercusión de la formación no escolar de los emigrantes retornados sobre sus niveles de renta, ni en el caso masculino ni en el femenino.

En cualquiera de los casos, la conclusión provisional del artículo subraya un efecto neto "positivo" de la emigración sobre el capital humano, asociado esencialmente a los incentivos que la propia expectativa migratoria tiene sobre el nivel de escolarización. Se subraya además que la relación entre la probabilidad de emigrar y la probabilidad de aumentar el nivel de formación es sensiblemente elevada. Curiosamente este resultado evaluado a la luz de la información proporcionada por Özden y Schiff[10], que presentan una base de datos exhaustiva sobre ganancia y pérdida de capital humano en el conjunto de la economía mundial con una atención específica al balance de la inmigración en los países de la OCDE, per-

10. Özden Ç y M. Schiff (Ed.) Op.Cit. Cap.5

mite afirmar que el comportamiento de Cabo Verde está más próximo a los países del Caribe que a los países africanos. En efecto, el panel como cabía esperar es notablemente diferente cuando se analiza el capital humano y los niveles de titulación por áreas de procedencia. En el caso de América latina y el Caribe una buena parte de su población con mayores niveles de titulación se encuentra trabajando fuera de los países de origen, si bien su destino son los Estados Unidos. Los casos del África sub-sahariana y magrebí presentan tasas de emigración con porcentajes de formación y titulación sensiblemente más bajas. Y aún inferior es el porcentaje de población emigrante procedente de Asía. Las migraciones procedentes del centro y el este de Europa son, con diferencia, el colectivo con niveles de formación más acusados[11].

Los epígrafes introductorios del artículo incorporan dos afirmaciones adicionales, una no contrastada y otra simplemente estimada. La primera, por lo demás razonable habida cuenta del nivel de formación de la población emigrada, sostiene que *la salida de los emigrantes con elevados niveles de capital humano determinan un desequilibrio presupuestario como resultado de la pérdida de ingresos*. Y la segunda, apenas apuntada en el texto pero incorporada en el Anexo, subraya que *las mejoras del capital humano, en unión de las complementariedades observadas con el capital físico y la productividad total de los factores, las remesas y los retornos, podrían haber implicado una elevación del ritmo de crecimiento económico del país origen de la emigración*.

Consideremos ambas hipótesis por separado. En relación con la primera de las hipótesis, que reseña una pérdida de ingresos impositivos, un planteamiento más completo debería considerar los saldos netos presupuestarios derivados de los procesos migratorios. Además de los ingresos perdidos por el efecto de la emigración sería necesario computar los gastos evitados. El estudio de BLV no aporta elementos de juicio en relación con este tema. El elevado nivel del capital humano que caracteriza la población emigrada caboverdiana permite suponer un desequilibrio presupuestario negativo como resultado de la pérdida de la exacción fiscal de las rentas de dicha población, pero no se aporta información concluyente. Tampoco se toma en consideración el efecto de las remesas de emigrantes sobre el curso del tipo de

11. Estos resultados son muy parejos en el caso de la emigración hacia España. En relación con los niveles de formación de los inmigrantes en la economía española, vid.: Jiménez-Ridruejo Z. (2005)

interés y las repercusiones de este dato sobre los intereses de la deuda, que son un componente sustantivo de los gastos corrientes[12].Los datos del 25% de la población retornada, a juzgar por los datos de encuesta, no permiten suponer la existencia de compensaciones posteriores derivadas de los incrementos de renta, que se asociarían a las mejoras de formación adquiridas en los países de destino.

Resta el análisis de los efectos de la emigración sobre el crecimiento económico del país, que BLV apuntan como plausible a la luz de los datos disponibles y las estimaciones realizadas. Sin menoscabo de los datos del crecimiento del PIB de Cabo Verde en el período considerado, conviene analizar si dicho crecimiento puede asociarse esencialmente al proceso migratorio en sus efectos sobre el capital humano, las remesas, y los retornos. La primera y nada desdeñable cuestión, con independencia de los efectos ya reseñados sobre el aumento pre-migratorio del capital humano, es el análisis de la repercusión de la pérdida de población en edad laboral sobre los salarios y el nivel de empleo de Cabo Verde. Sin duda este es el núcleo de la teoría y la evidencia de los procesos migratorios. Lo que apuntan los fundamentos no va precisamente a favor de la hipótesis del trabajo que comentamos.

Como se ha puesto de manifiesto en el ámbito del estudio del equilibrio parcial del mercado de trabajo[13], el análisis de los beneficios y las pérdidas de los diferentes grupos de población (emigrantes y no emigrantes) en términos salariales, depende crucialmente de la participación del trabajo en la renta nacional, de las elasticidades de oferta y demanda de trabajo a los cambios del salario y de la participación de la población emigrante respecto al total de la fuerza laboral. De otra forma, los efectos del descenso de la oferta de trabajo asociado a los procesos migratorios, debe tomar en consideración si la oferta de trabajo es elástica o inelástica y si la productividad de la mano de obra no emigrante es inferior a la mano de obra emigrada. En un modelo de un solo producto, si la oferta de trabajo es total-

12. Ello sin tener en cuenta además de los efectos de las remesas de emigrantes sobre el valor de la moneda caboverdiana y su influencia posterior sobre la actividad económica y presupuestaria. Sobre este punto insisten Yang D. y Martinez C. (2005) al estudiar los efectos de las crisis monetarias de principio de los años noventa y las devaluaciones del peso filipino para estudiar las repercusiones de las remesas sobre las economías familiares de los inmigrantes y de las familias relacionadas, demostrando el desbordamiento de los efectos de las depreciaciones.

13. Borjas G.J. (1994) Friedberg and Hunt (1995) y, especialmente, Borjas B.J. (1999). Un "survey" reciente resume los efectos de las migraciones sobre los salarios y el empleo, vid: Dustmann and Glitz (2005).

mente inelástica (lo cual no es probablemente el caso de Cabo Verde) la emigración altera la composición de la cualificación de la mano de obra, eleva los salarios de los trabajadores con mayor capital humano y reduce la de aquellos con menor formación, todo ello tiende adicionalmente a desplazar negativamente la productividad del trabajo en el conjunto del mercado laboral. Las consecuencias sobre el salario y el empleo serían, en función de los elementos descritos, seguramente negativas tanto en el caso de los salarios y como en el empleo.

Sin embargo, diferentes planteamientos teóricos y una extensa literatura empírica[14] han puesto de manifiesto que los planteamientos de un solo producto y tres factores (capital, trabajo capacitado y trabajo sin capacitar) están lejos de dar una respuesta unívoca a los efectos de las migraciones. Sin duda, uno los factores relevantes es la relación existente entre los niveles del capital humano del trabajo emigrado y del trabajo en la población no emigrada. Pero esto no es todo, además los efectos de la emigración gravitan y dependen de la estructura y la incidencia sectorial del país afectado por el proceso migratorio, tanto como de las relaciones de complementariedad o sustituibilidad del trabajo emigrado respecto al trabajo no emigrado. En el corto y medio plazo los cambios en la estructura y composición del nivel formativo de la economía que genera o recibe el proceso migratorio han sido objeto de análisis detallados en modelos de determinación salarial, pero los avances han sido limitados por el momento.

No podemos, por lo tanto, hablar de un solo bien. Cuando ampliamos el análisis al caso de varios bienes surge inmediatamente el problema de la homogeneidad o heterogeneidad productiva de los mismos, es decir si emplean las mismas o diferentes proporciones de trabajo cualificado y no cualificado. La clave en este caso, si la oferta de trabajo es inelástica, estriba en que si la emigración implica un cambio en la proporción ofertada de trabajadores cualificados y no cualificados, cuando los bienes son homogéneos ello implicaría una sensible modificación de los salarios (elevándose los salarios del trabajo capacitado y reduciéndose el del trabajo sin cualificar), y cuando son heterogéneos se alterarían no sólo los salarios sino también las producciones relativas. En el

14. Sobre la repercusión de las migraciones en los mercados de trabajo de diferentes economías, distintos trabajos relevantes han puesto de manifiesto la complejidad de la cuestión: Card (1990; 2001), LaLonde and Topel (1991), Altonji and Card (1991), Butcher and Card (1991), Hunt (1992), Carrington and de Lima (1996), Winter-Ebmer and Zweimuller (1996 y 1999), Pischke and Velling (1997), Friedberg (2001), Borjas (2003), Carrasco R. y Jimeno J.F. (2004), Cohen-Goldner and Paserman (2004),), y Dustman C., F. Fabri e I. Preston (2005) son una muestra representativa.

más probable caso de oferta de trabajo elástica, la emigración podría modificar en el mismo sentido los salarios relativos, pero el descenso de la retribución del trabajo sin cualificar podría generar rentas adicionales y aumentos relativos de producción, que finalmente elevaran la demanda de dicha mano de obra compensando los descensos salariales iniciales. Un resultado en línea con el teorema de Rybczinski, que ha dado en denominarse "factor price insensitivity".

En una perspectiva multisectorial los efectos, incluso en el largo plazo, de la emigración sobre la producción, el empleo y los salarios están estrechamente relacionados, por una parte, con el número de bienes producidos y la flexibilidad de la economía para adaptarse a los cambios productivos que la emigración impone y, por otra, con el grado de apertura de las diferentes actividades a los mercados internacionales y de la capacidad de ajuste de sus precios. Cuanto menor sea la capacidad de adaptación productiva y más reducido el grado de apertura internacional mayores los efectos sobre el empleo y los salarios[15].

En síntesis, si distribuyésemos la población del país de origen entre población formada y no formada, y la población emigrante presentase una proporción diferente (como es el caso de Cabo Verde), el efecto sobre los salarios dependería sustancialmente de la comparación entre ambas proporciones. Con toda probabilidad, como los emigrantes caboverdianos parecen tener un nivel de formación relativamente más elevado en relación con la de los no emigrantes, una vez que tenga lugar la emigración los salarios de los trabajadores sin formación tenderían a elevarse menos y los salarios de los trabajadores formados más, dependiendo de la proporción de emigrantes y de las diferencias de formación relativa, de la concentración en la estructura productiva, y de la elasticidad de oferta de trabajo.

Por otra parte, adicionalmente puede afirmarse que la pérdida de población de elevado nivel educativo, si la oferta de trabajo es elástica, puede tener consecuencias desfavorables respecto a la tasa de empleo. En el Anexo 1 se presenta a modo de síntoma una estimación simple de la eventual repercusión de la educación relativa sobre el empleo relativo[16]. Es probable cuanto mayor sea la proporción de

15. La necesidad de analizar el problema con modelos que incluyan múltiples bienes, ha sido resaltada por Gaston, y Nelson (2000) y Scheve y Slaughter (2001) entre otros.

16. La imposibilidad de contar con datos de la economía caboverdiana impide realizar el ejemplo en relación con las relaciones de la titulación relativa y el empleo relativo de los trabajadores con elevados y bajos niveles de graduación. En su lugar se ha realizado con la formación relativa y el empleo relativo de los emigrantes en España por zonas de procedencia.

emigrantes con elevada cualificación en relación con los trabajadores no emigrantes de menor cualificación, mayores los efectos negativos del proceso migratorio sobre el empleo y la producción. También puede producirse que la pérdida de los trabajadores de elevado capital humano eleve la tasa de actividad, aunque este resultado no puede afirmarse con el mismo énfasis.

Los datos de Cabo Verde espigados a partir de la evidencia presentada por BLV son contundentes al respecto. El cuadro 1, que explicita y ordena algunas de las cifras y tasas de la economía caboverdiana, subraya que la población emigrada se sitúa en torno al 47% de la población activa y al 66% de la población empleada. Y que la población emigrada con empleo, que sería al menos el 70% de la población emigrada total (y probablemente superior dado su mayor nivel de cualificación), constituiría al menos el 46,7% de la población con empleo total de Cabo Verde. Esta enorme sangría de mano de obra, que según los autores alcanza el 67,5% de la "fuerza de trabajo educada", puede haber sido impelida a superiores niveles de formación ante la expectativa migratoria, incluso cabe, contradictoriamente, que haya coincidido con un período de sólido crecimiento simultáneo del PIB del país, pero no parece razonable que sea la causa de tan activo crecimiento. Lamentablemente carecemos de datos sobre evolución de los salarios por niveles educativos, y especialmente sobre evolución de la productividad diferencial entre población educada y no educada en el país de origen.

Cuadro 1.
Datos de población, actividad y empleo de Cabo Verde 2005.

		%Total	%Pob. 15-65	%Pob. Act.	%Pob. Emp.	%Pob. Emig.
Población	469.261	100				
Población 15-65	301.124	64,17	100			
Población Activa	180.674	38,5	60	100		
Población Empleada	126.472	26,9	42	70	100	
Población Emigrada	84.467	18	28	46,7	66,79	100
Población Emig. Empl.*	59.122	12,6	19,63	32,72	**46,74**	70

Fuente: Estimación propia apartir de datos de Batista, lacuesta y Vicente (2007).

A la vista de los datos del apéndice sobre descomposición del crecimiento el factor clave debe inequívocamente ser el capital humano H_t , que depende de L_t, el número de trabajadores lastrado por la emigración, de S_t el número de años promedios de escolarización

(que aumenta por la incidencia de las expectativas de emigración, pero disminuye con esta), y de r la rentabilidad media de cada año de escolarización (que es constante). Sólo nos resta asociar el crecimiento del PIB al intenso flujo de remesas de emigrantes, que se cifran en promedio en el 15% del PIB, pero el trabajo de BLV no aporta ninguna evidencia al respecto.

Pero existen algunos problemas adicionales: En relación con el capital humano H_t conviene señalar que está compuesto del capital humano de quienes trabajan pero también debe considerarse el capital humano de quienes (activos o no) acumulan un cierto grado de formación. Hay personas que emigran desde el trabajo L_t y otras que emigran sin haber trabajado. Existe un capital humano que no se computa en el crecimiento interno, pero que cuenta en las estadísticas de cualificación de los emigrados. Igualmente hay problemas en relación con St que se define como el promedio de escolaridad de la población en edad de trabajar, que podría no coincidir con el promedio de escolaridad de los empleados. Tampoco disponemos de datos sobre evolución del empleo por niveles de formación o capital humano acumulado. Sólo se dispone de evidencias sobre el efecto de la emigración en el descenso de la proporción de población empleada de elevada cualificación respecto a la población empleada de baja cualificación. De hecho el país pierde una buena parte de su población de elevada cualificación. Ello no anula en modo alguno el carácter cualitativo de los datos relativos al "growth accounting" de BLV, pero revela la extremada dificultad que se asocia con los contrastes empíricos de los modelos migratorios.

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ANEXO 1

Una buena parte de los estudios sobre efectos de los inmigrantes sobre el mercado de trabajo han enfocado la relación existente entre la formación y las retribuciones relativas. Sin embargo, en la perspectiva del efecto sobre la producción y el crecimiento económico es relevante la estimación de la correlación de la formación y el empleo relativos. Algunos de los contrastes realizados se han centrado en la evaluación de las consecuencias de la formación inmigrante sobre la tasa de desempleo[17], pero la presencia de rigideces en la formación de los salarios trasladaría una buena parte de los efectos de la llegada de inmigrantes a las proporciones de participación en la fuerza de trabajo[18]. Los resultados generales de estas estimaciones apuntan a la existencia de una limitada influencia de los inmigrantes sobre el empleo de los nativos. No obstante, esta influencia podría estar determinada por el género de los inmigrantes llegados (hombres o mujeres), y sobre todo por los niveles de formación relativa de los mismos. La capacidad de la inmigración para aprovechar las oportunidades de empleo, tomando en cuenta sus zonas de procedencia y sus niveles de formación.

Con el fin de analizar la relación que existe entre el nivel de ocupación relativo y la formación relativa de los inmigrantes según las distintas procedencias, se ha planteado un panel de datos que recoge información de dichas variables a lo largo de una serie temporal trimestral, para el periodo 2000:I-2004:IV y para un determinado nivel de formación que, en términos generales, se estructura en analfabetos (AN), educación primaria (EP), educación secundaria primera etapa (ES1), educación secundaria segunda etapa (ES2), educación superior sin doctorado(ESP) y doctorado (DC), no se ha utilizado nunca la formación profesional por ser la muestra muy poco relevante y los analfabetos y el doctorado solamente en aquellos casos en que lo eran. La fuente estadística utilizada ha sido la Encuesta de Población Activa, EPA.

El nivel de ocupación relativo se ha construido dividiendo el número de ocupados nativos por el de extranjeros para los distintos niveles de formación, mientras que la formación relativa de los inmi-

17. Vid.: Muller T., Espenshade T.J., and Manson D.M. (1985) pp.23 y Simon J. , Moore S., and Sullivan R. (1993) pp. 299.

18. Tal es el caso de Borjas G.J. (1991) pp.92 y. Atonji J.G y Card D. (1991) pp 220.

grantes se ha construido como el cociente entre el porcentaje de nativos para cada nivel de formación respecto a los nativos totales entre el mismo porcentaje para cada uno de los inmigrantes extranjeros según su procedencia. A su vez, los niveles de procedencia que se estudian son en conjunto la población Extranjera Total (EX). Una población que se desglosa en los ciudadanos extranjeros procedentes de la Unión Europea (UE), los del Resto de Europa (RE), los de América Latina (AL) y los del Resto del Mundo (RM). Dicha desagregación se enriquece con su descomposición en tres clasificaciones, varones, mujeres y ambos sexos.

De esta forma, las series de corte transversal que componen el panel se refieren a los distintos niveles de formación para cada zona de procedencia y para cada clasificación. En concreto, para los extranjeros totales y el resto del mundo se trabaja con cinco secciones de corte transversal (AN,EP,ES1,ES2,ESP), para la Unión Europea las secciones son también cinco aunque no las mismas ya que no hay analfabetos pero si doctores (EP,ES1,ES2,ESP,DC) y para resto de Europa y América Latina son cuatro (EP,ES1,ES2,ESP).

Para cada panel de datos se han estimado tres modelos alternativos:

Modelo con *efectos fijos constantes*:

$$OCURJ_{it} = \beta_o + \beta_1 FRJ_{it} + u_{it}$$

donde OCUR es la ocupación relativa, J es la procedencia (J=EX, UE, RE, AL y RM), i=1….6 denota las secciones cruzadas y t=1….T denota el subíndice de las series de tiempo y FR es la formación relativa. En estos modelos se supone que el efecto de la formación relativa en la ocupación relativa es constante sea cual sea el nivel de formación.

Modelo con *efectos fijos deterministas:*

$$OCURJ_{it} = \beta_{oi} + \beta_1 FRJ_{it} + u_{it}$$

siendo $u_{it} = \alpha_i + \phi_t + \varepsilon_{it}$ tal que $\alpha_i = \sum_{i=1}^{N-1} \alpha_i d_i$ y $\phi_t = \sum_{t=1}^{T-1} \phi_t t_t$ son deterministas y en los que se intenta captar con α_i los efectos "cross-section" es decir, la variación existente en la muestra debido a la pre-

sencia de distintos niveles de formación por lo que d_i es una variable ficticia que toma el valor 1 para un determinado nivel de formación y 0 para el resto y con ϕ_t los efectos de series de tiempo es decir, las diferencias que puedan existir a través del tiempo por lo que t_t es una variable ficticia que toma el valor 1 para un periodo de tiempo y 0 en el resto. En todos ellos se supone que esta diferencia no es aleatoria. Por otro lado ε_{it} es una variable aleatoria

Modelo de *efectos aleatorios:*

$$OCURJ_{it} = \beta_o + \beta_1 FRJ_{it}$$

siendo $u_{it} = \eta_i + \varepsilon_{it}$ tal que en los que se asume que la variación a través de los distintos niveles de formación (y/o a través del tiempo) es el azar y por lo tanto se especifica en el término de error de la ecuación, por lo que tanto η_i como ε_{it} son aleatorios.

Realizadas las estimaciones de los tres modelos para cada nivel de procedencia tanto para ambos sexos, como para varones y mujeres, un análisis general de dichas estimaciones revela las siguientes características:

- El contraste de la razón de verosimilitud RV que permite contrastar la hipótesis nula de redundancia de los efectos fijos no rechaza, en ningún caso, que los efectos fijos de tiempo sean iguales por lo que se prescinde de ellos en dichos modelos, sin embargo, por otra parte, los efectos fijos de los distintos niveles de formación son claramente diferentes a excepción de la estimación referente a las mujeres en el resto de Europa que es el único que presenta un p-valor de un 24,4% por lo que, salvo en este caso, rechazamos la hipótesis nula de igualdad de efectos fijos, por tanto las estimaciones con efectos fijos constantes no son válidas. De hecho, los valores bajos del R^2 así como los bajos coeficientes de Durbin Watson detectan claramente errores en la especificación de estos modelos, que en muchos casos se solventan al incluir los efectos fijos. En definitiva, asumimos que existen otros factores no observables determinantes para explicar el nivel de ocupación relativo además de la formación relativa que son invariantes a lo largo del tiempo pero distintos según los diferentes niveles de formación.

- En segundo lugar, al analizar los coeficientes, podemos destacar que la elasticidad apenas cambia independientemente de que el modelo sea de efectos fijos o efectos aleatorios. Por otro lado, el efecto de la formación relativa de los inmigrantes sobre el empleo relativo es mayor en los varones que en las mujeres a excepción de los procedentes de la Unión Europea que claramente es al contrario y del resto del mundo que es muy similar. Además, mientras que cuando los datos se refieren a ambos sexos, el efecto de la formación relativa sobre el empleo relativo es muy similar sea cual sea la procedencia (a excepción del total de extranjeros), en el caso de los varones y las no ocurre lo mismo. Así, en los varones del resto de Europa es claramente, llegando a ser el doble al de los varones procedentes de la Unión Europea. De forma similar, aunque no tan rotundo, ocurre con las mujeres donde el peso de las mujeres procedentes de Europa es mayor que las que proceden de América Latina o el resto del mundo.

- En tercer lugar, el test de Hausman permite dilucidar si el modelo de efectos aleatorios es o no adecuado al contrastar la hipótesis nula de incorrelación entre el regresor y los efectos aleatorios, tal que, si rechazamos la hipótesis nula implicaría que el modelo de efectos aleatorios no es el adecuado, mientras que si no la rechazamos implicaría que si lo es. Así, mientras que para el total de extranjeros y para América Latina no se rechaza la hipótesis nula, tanto para ambos sexos como varones y mujeres, por lo que el modelo sería adecuado, para el resto de procedencias el contraste es más dispar puesto que mientras que para los varones de la Unión Europea como del Resto de Europa y del resto del mundo el modelo sería adecuado, no ocurre lo mismo para las mujeres (a excepción de las que provienen del resto del mundo) ni cuando se consideran ambos sexos.

Los cuadros que se presentan a continuación recogen los modelos seleccionados para los extranjeros de distintas procedencias según las categorías de ambos sexos, varones y mujeres lo que nos permite diferenciar claramente, para cada uno de ellos, cual tiene una mayor o menor elasticidad. La selección de los modelos se ha efectuado en base a los siguientes criterios:

1) Se ha contrastado la presencia de efectos fijos deterministas con el test de la razón de verosimilitud que contrasta la redundancia de

efectos fijos (RV) rechazando la hipótesis nula en todos ellos a excepción de las mujeres provenientes del resto de Europa, por lo que desestimamos los modelos de efectos constantes salvo en ese caso.

2) Con el fin de seleccionar entre modelos de efectos fijos o efectos aleatorios se ha utilizado en primer lugar el test de Hausman para rechazar la hipótesis de efectos aleatorios en aquellos modelos donde el test rechaza la hipótesis nula. En términos generales, cuando trabajamos con la muestra relativa a ambos sexos el modelo de efectos aleatorios es rechazado (salvo con los extranjeros totales claramente donde el p-valor es igual al 98% y menos claro con América Latina donde el p-valor es del 9%), sin embargo no se rechaza en ningún caso cuando la muestra es de varones, todos los p-valor superan ampliamente el 10%. Por lo que respecta a las mujeres, la selección es menos homogénea ya que mientras que América Latina, el resto del mundo y los extranjeros totales superan un p-valor del 18%, en el resto de las muestras no llegan al 5%.

3) En aquellos modelos en los que se podría utilizar los efectos fijos o los efectos aleatorios se ha seleccionado el modelo de efectos aleatorios ya que los estimadores no solo son consistentes sino también eficientes.

4) En aquellos modelos en los que se ha aplicado los efectos fijos se han analizado otras características como la heteroscedasticidad "cross-section" por medio del contraste de Barlett que contrasta la hipótesis nula de igualdad de varianzas entre las secciones cruzadas, así como la autocorrelación seleccionando aquel modelo sin problemas de heteroscedasticidad y autocorrelación si es posible.

5) En el supuesto de que en los modelos perdurase la heteroscedasticidad y/o la autocorrelación se ha utilizado la matriz de White cross-section robusta a la heteroscedasticidas y autocorrelación para secciones cruzadas.

El cuadro 2 recoge los distintos modelos estimados seleccionados en base a los criterios anteriores según las distintas procedencias de los inmigrantes de ambos sexos. En aquellos que se han estimado con efectos fijos no rechazamos la hipótesis nula de homoscedasticidad puesto que el p-valor asociado al estadístico de Barlett es superior al

5%. Sin embargo, en los modelos estimados con efectos aleatorios (para América Latina y el total de extranjeros) se rechaza la hipótesis de varianzas constantes por lo que se ha estimado utilizando la matriz de White cross-section . En todos ellos la formación relativa es significativa siendo la elasticidad superior en aquellos modelos cuyos inmigrantes provienen de Europa (tanto del resto de Europa como de la Unión Europea). Por otro lado el contraste de la razón de verosimilitud rechaza la hipótesis de igualdad de efectos fijos cross-section por lo que los factores no observables son distintos como consecuencia de las características particulares derivadas según el diferente nivel de procedencia (ver cuadro 3).

Cuadro 2.
Modelos estimados con datos de panel para extranjeros de distintas procedencias. Ambos sexos

Procedencia	Modelos Estimados	$\hat{\beta}_o$ (estad. t)	$\hat{\beta}_1$ (estad. t)	R^2	RV (P-valor)	Hausman (P-valor)	Barlett (P-valor)
Unión Europea	Efectos Fijos deterministas	-0,250 (-1,09)	1,394 (6,54)	0,79	30,0 (0,000)		5,22 (0,07)
Resto Europa	Efectos Fijos deterministas	-0,562 (-4,64)	1,452 (15,97)	0,92	132,2 (0,000)		6,29 (0,098)
América Latina	Efectos Aleatorios	-0,109 (-0,49)	1,144 (18,3)	0,81		2,85 (0,09)	6,68 (0,035)
Resto Mundo	Efectos Fijos deterministas	-0,099 (-1,61)	1,175 (8,01)	0,97	104,94 (0,000)		0,23 (0,998)

RV: valor muestral del estadístico de la razón de verosimilitud que contrasta la redundancia de los efectos fijos deterministas.

Test Hausman: contrasta la hipótesis nula de incorrelación entre los regresores y el término de error que recoge los efectos aleatorios.

Barlett: contrasta la hipótesis nula de igualdad de varianzas cross-section

El cuadro 3 refleja los valores que toman los distintos efectos de corte transversal (según los modelos estimados y especificados en el cuadro 6) para los diferentes niveles de formación, cuando se estiman

Cuadro 3.
Valores obtenidos para los efectos fijos y aleatorios cross-section. Ambos sexos

	UE Efectos fijos	RE Efectos fijos	AL Efectos Aleatorios	RM Efectos Fijos
	AN	—-	—-	—--0,167
EP	-1,04	-1,349	-0,776	-0,426
ES1	0,18	0,333	0,231	0,076
ES2	0,20	0,404	0,104	0,116
ESP	0,179	0,612	0,442	0,40
DOC	0,482	—-	—-	—-

los modelos con inmigrantes de ambos sexos. Claramente se detecta que cuanto mayor es el nivel de formación mayor es el efecto que tienen todos aquellos otros factores característicos no observables sobre el nivel de ocupación relativo.

En el cuadro 4 se recogen los distintos modelos estimados según las distintas procedencias de los inmigrantes varones. En ninguno de ellos el test de Hausman rechaza la hipótesis nula de incorrelación entre el regresor y el término de error dado que el p-valor supera siempre claramente el 5%, por lo que se han estimado por mínimos cuadrados generalizados al considerar los efectos aleatorios, donde el término constante no es más que el valor medio del componente de error aleatorio. En aquellos modelos en los que se detecta heteroscedasticidad (Unión Europes, Resto de Europa y Total extranjeros) se ha utilizado la matriz de White cross-section para calcular varianzas robustas. Por otro lado, en todos ellos la formación relativa es significativa siendo la elasticidad superior en aquellos modelos cuyos inmigrantes provienen del resto de Europa.

Cuadro 4.
Modelos estimados con datos de panel para extranjeros de distintas procedencias. Varones

Procedencia	Modelos Estimados	$\hat{\beta}_o$ (estad. t)	$\hat{\beta}_1$ (estad. t)	R^2	Hausman (P-valor)	Barlett (P-valor)
Unión Europea	Efectos Aleatorios	0,245 (2,67)	0,866 (7,23)	0,68	0,203 (0,654)	20,15 (0,005)
Resto Europa	Efectos Aleatorios	-0,713 (-2,129	1,65 (18,6)	0,81	2,49 (0,115)	10,21 (0,017)
América Latina	Efectos Aleatorios	0,053 (0,34)	0,964 (22,96)	0,87	1,42 (0,232)	5,49 (0,359)
Resto Mundo	Efectos Aleatorios	0,372 (0,89)	1,195 (11,6)	0,58	2,28 (0,131)	0,157 (0,984)

Test Hausman: contrasta la hipótesis nula de incorrelación entre los regresores y el término de error que recoge los efectos aleatorios.
Barlett: contrasta la hipótesis nula de igualdad de varianzas cross-section

El cuadro 5 presenta los efectos aleatorios de corte transversal, obtenidos en los diferentes modelos estimados especificados en el cuadro anterior para los distintos niveles de formación, cuando se estiman los modelos con la muestra referenciada a los inmigrantes varones. En este caso, el comportamiento de los efectos es más heterogéneo puesto que no siempre a mayor nivel de formación, el efecto sobre el nivel de ocupación es mayor, de hecho solo ocurre cuando los inmigrantes provienen del resto de Europa o del Resto del Mundo.

Cuadro 5.
Valores obtenidos para los efectos aleatorios cross-section. Varones

	UE Efectos Aleatorios	RE Efectos Aleatorios	AL Efectos Aleatorios	RM Efectos Aleatorios
AN	—-	—-	—-	1,815
EP	-0,08	-0,984	-0,441	-0,756
ES1	0,32	0,047	0,209	-0,354
ES2	-0,017	0,401	-0,0004	-0,411
ESP	-0,117	0,535	0,232	-0,292
DOC	-0,111	—-	—-	—-

Completando la presentación de los resultados del contraste, el cuadro 6 recoge los distintos modelos estimados según las distintas procedencias de los inmigrantes mujeres. Es quizá está clasificación la más heterogénea en cuanto a los modelos estimados, ya que el único modelo donde no se detectan factores no observables distintos para los diferentes niveles de formación es en el relativos a las mujeres inmigrantes procedentes del resto de Europa, a pesar el bajo coeficiente de determinación, lo que indica que a pesar de que la formación relativa es una variable significativa, se están omitiendo otras variables relevantes para explicar el nivel de ocupación de las mujeres que provienen del resto de Europa.

Por otro lado en el caso de las mujeres procedentes de la UE se ha estimado un modelo con efectos fijos en el que no rechazamos la hipótesis nula de homoscedasticidad puesto que el p-valor asociado

Cuadro 6.
Modelos estimados con datos de panel para extranjeros de distintas procedencias. Mujeres

Procedencia	Modelos Estimados	$\hat{\beta}_o$ (estad. t)	$\hat{\beta}_1$ (estad. t)	R^2	RV (P-valor)	Hausman (P-valor)	Barlett (P-valor)
Unión Europea	Efectos Fijos deterministas	-0,341 (-3,96)	1,414 (19,04)	0,90	34,0 (0,000)		5,30 (0,257)
Resto Europa	Efectos Fijos Constantes	-0,502 (-0,58)	1,697 (2,09)	0,32			12,16 (0,007)
América Latina	Efectos Aleatorios	0,232 (1,95)	0,836 (12,44)	0,43		1,76 (0,184)	35,45 (0,000)
Resto Mundo	Efectos Aleatorios	-0,357 (-1,32)	1,384 (4,12)	0,30		0,342 (0,559)	14,93 (0,005)

RV: valor muestral del estadístico de la razón de verosimilitud que contrasta la redundancia de los efectos fijos deterministas.

Test Hausman: contrasta la hipótesis nula de incorrelación entre los regresores y el término de error que recoge los efectos aleatorios.

Barlett: contrasta la hipótesis nula de igualdad de varianzas cross-section

al estadístico de Barlett es superior al 5%. Respecto a las mujeres que proceden tanto de América Latina como del resto del mundo el modelo seleccionado ha sido el de efectos aleatorios, todos presentan problemas de heteroscedasticidad por lo que se han estimado utilizando la matriz de White cross-section para calcular las varianzas. En todos ellos la formación relativa es significativa siendo la elasticidad superior en aquellos modelos cuyos inmigrantes provienen de Europa (tanto del resto de Europa como de la Unión Europea).

Por último, en el cuadro 7 se presentan los efectos aleatorios de corte transversal obtenidos en los distintos modelos estimados especificados en el cuadro 10 para los distintos niveles de formación cuando se estiman los distintos modelos con inmigrantes mujeres (no se incluye el resto de Europa por ser constantes los efectos). Cuando la muestra solo recoge las mujeres inmigrantes, en general a mayor nivel de formación el efecto sobre el nivel de ocupación es mayor, salvo cuando los inmigrantes provienen de la Unión Europa cuyo efecto es mayor en el caso de la educación superior.

Cuadro 7.
Valores obtenidos para los efectos fijos y aleatorios cross-section. Mujeres

	UE Efectos fijos	AL Efectos Aleatorios	RM Efectos Aleatorios
AN	—	—	0,168
EP	-1,161	-0,859	-0,534
ES1	0,370	0,214	-0,121
ES2	0,332	-0,045	0,087
ESP	0,381	0,690	0,400
DOC	0,224	—	—

El conjunto de los resultados obtenidos confirman con carácter general, la hipótesis establecida en el sentido de que la aportación al empleo relativo de los inmigrantes está estrechamente relacionada con los niveles de formación relativa. El contraste de datos de panel permite sostener que la capacidad para conseguir empleo es notablemente más elevada en los datos de ambos sexos en las migraciones procedentes de Europa, que en aquellas con origen en Latinoamérica o en resto del Mundo (África y Asia). Este resultado se confirma cabalmente en el caso de la población inmigrante femenina, donde resaltan los bajos niveles de la elasticidad de las migraciones latinoamericanas. Por el contrario, en el caso masculino resalta la elevada

elasticidad de los inmigrantes procedentes de Europa del Este, siendo en el resto de los casos menos patente la relación entre la evolución del empleo y los niveles de formación relativos.

Discussion

Jaume Ventura (Universitat Pompeu Fabra and CREI)

I think it is a very interesting paper. There are two points I would like to talk about. One is the subject of measuring the value of migration, and what migrants learn. I imagine that immigrants must take with them know how and linkages with companies. You have not measured this, you are missing part of this immigration's value. Perhaps you should look at wages or differences in wages between immigrants with a certain education who go back and those who have never left that have the same education and use this difference in wages to partially measure the value of this human capital.

The second question is about the question of investing in the education of people who leave the country and later live abroad and never return. Is this bad for the country? How do we measure the country's welfare? I think that education has more value when these people can use it and achieve more with it if they have the opportunity to migrate. The question is our evaluation, whether we should take into consideration only those people who are living in the country or all those who are citizens of the country.

Juanjo Dolado (Universidad Carlos III)

I believe that in a developing country where at least part of the education is financed by residents, by natives. In that case, I believe that the aspect of whether they are going to achieve a direct rate of return, especially in higher education levels, is a genuine concern.

Antonio Ciccone (CREI)

The thing you want to emphasize is if the possibility of migrating lends an additional incentive to being educated in Cape Verde. I believe that there is a clear effect that works the other way around. That the education you obtain in Cape Verde is not profitable. There are many waves of immigration that are less educated. You find that your father being away has a negative effect on your education in Cape Verde. I wonder, there are two possible factors here. The first is not having your father, I see that this may have an effect, but it can

have another effect, which is that your father is in a place where you are going to emigrate, you may get less education for yourself.

The Effect of Foreign Service on Trade Volumes and Trade Partners*

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Abstract

It has been emphasized that international promotion activities such as state visits or the presence of embassies, consulates and export promotion agencies help foster trade when there are search costs and/or uncertainty. In this paper we try to disentangle the differential effect that foreign service (embassies and consulates) has on both the establishment of trade links with countries, and the effect on trade volumes with already existing trading partners (the extensive and intensive margins at the country level). Using the estimation procedure suggested by Helpman, Melitz and Rubinstein (2007) and a cross-section of 21 exporters and 162 importers as in Rose (2005), we find that the presence of a foreign service office in a given country increases the probability of trading with that partner between 11% and 18%, but that it has no effect on the volume of trade with already existing trading partners. We then proceed to evaluate the importance of the extensive margin at the sectoral level, finding that these probabilities are substantially larger for more differentiated sectors.

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1. INTRODUCTION

Do international promotion activities foster trade? Do they help create new trade links among previously non-trading countries (the extensive margin at the country level) and/or do they help intensify those links (the intensive margin at the country level). This paper tries to answer these questions.

Of course we are not the first ones to address some of these issues. Export promotion agencies, foreign missions and foreign service (henceforth, international promotion activities or IPA) have been widely used to promote export activities of countries, with the goal of increasing export volumes, the number of firms that engage in exporting activities, the number of countries reached by domestic firms, and the diversifacation of those exporting activities in markets and goods. As these promotion activities became more and more important, an empirical literature emerged which tries to analyze both their importance and their efficiency (among others, see, for instance, Kessing and Singer, 1991a, 1991b, Lederman *et al*, 2006, Volpe *et al*, 2007, and Rose, 2005), with different results depending on the type of activity, the countries in the sample, the time frame, and the outcome being analyzed.[1]

In general, most of these studies have focused their analysis on the effect on either total bilateral trade volumes or on whether they helped increasing the number of products exported to a given country. However, to the best of our knowledge, nobody has tried to quantify the potentially differential effect of these activities on the extensive (whether they help to find new trading partners at the country level) and the intensive margin (the effect on trade volumes with already existing trading partners). This is the aim of this paper.

The motivation for it stems from the same reasoning that is typically used to justify the need for international promotion activities: uncertainty. In a world without frictions, international promotion activities should play no role; they would not have any effect on exporting activities since there is nothing stopping firms from engaging in exporting activities whenever it is profitable to do so. The most repeated justification for the role of international promotion activities is that of imperfect information. For instance, firms may not know which exporting markets are profitable with certainty, the

1. See below for a review of their results.

contracting procedures in a foreign country or the enforcement of those contracts may be uncertain, or consumers in the foreign country may not be well informed about the characteristics of the domestic products. In this case, promotion activities may help eliminate or, at least, reduce these uncertainties that abound in both sides of the market. More importantly, if uncertainty is the driving force, are we sure that the effects of these promotion activities go beyond those of establishing new links? The answer to this question may have important policy implications. For instance, if international promotion activities only have an effect on the establishment of new links, it may be hard to justify the increasing number of export promotion agencies and their enlarging expenditures. Furthermore, as Rauch (1996, 1999) has argued, the lack of information may lead to the formation of informal networks. Whether these informal networks leave no role for government sponsored international promotion activities is an empirical issue.

Several theoretical contributions suggest that the effect on both margins may not be the same. Among them, in a recent paper, Segura-Cayuela and Vilarrubia (2007), we have argued that informational externalities generated through other firms´ actions may be an alternative way of obtaining information about a given market. In particular, by observing how other firms are performing in a given foreign market, producers trying to decide whether to enter that given market can make inference about its expected profitability. The problem is that this same information providing device simultaneously generates incentives to free-ride on information, which may make firms more reluctant to enter new markets.

In this context, international promotion activities should have a large effect as they help establish new trade links, but not necessarily explain their trade volumes once those links have been formed. Informational externalities may be enough to disseminate information. On the other hand, Rauch (1999) argues that establishing a link is not enough since uncertainty may be product specific and product life cycles are limited, giving a rationale for why ongoing international promotion activities may have an effect on trade volumes even with existing partners.

To quantify the relative importance of the two margins we use the procedure in Helpman, Melitz and Rubinstein (2007) (henceforth HMR). Due to data availability, we only analyze the role of foreign missions (embassies and consulates, as in Rose, 2005) helping

establish new links and increasing volumes with those trade links already formed. This framework also allows us to correct for selection bias of trade link formation and the heterogeneity of exporters (see the empirical implementation and HMR for the details on this).

We perform a two-stage procedure that allows us to ascertain the relative importance of foreign service on the intensive and extensive margins using cross-sectional bilateral trade data. The first stage allows us to generate controls for the formation of new trade links and for the effects of firm heterogeneity on bilateral trade volumes which we include in our second stage, where we perform a gravity-type estimation of bilateral trade flows.

We find that foreign service agencies play a crucial role in the formation of trade links (extensive margin) and this is the only channel through which it has an effect on aggregate bilateral trade volumes. More concretely, we find that the presence of a foreign service office increases the probability of trade by between 11% and 18%, depending on the specification. These results are robust to the potential endogeneity arising from the fact that countries might endogenously setup international offices in those markets which present the largest potential for their exports. We also apply this procedure to the estimation of sectoral bilateral trade links and volumes. We find very similar effects on the trade link formation properties of foreign service offices with the effect being larger for those sectors producing more differentiated goods, which might be subject to larger uncertainties when accessing foreign markets.

The empirical literature on the impact of international promotion activities is large so we only mention those papers most related to our work. Kessing and Singer (1991, 1991b) evaluated the efficiency of export promotion offices (EPO) finding very negative results. Lederman *et al* (2006), using several measures of EPOs activities, find that for each dollar of export promotion there is a corresponding $300 increase in the volume of exports. Nitsch (2005) finds that a typical external visit by a government official increases bilateral exports by 10%. Volpe *et al* (2007) find a strong effect of EPO on the number of products exported to a given country, while embassies and consulates (foreign service) seem to have no effect. The paper that is more related to ours is Rose (2005) which estimates the effect of foreign service on total trade volumes finding that bilateral exports increase around 6-10% for each additional consulate. However, as mentioned before, none of these papers try to disentangle the diffe-

rential effect of international promotion activities on the extensive and intensive margins at the country level, nor they try to correct for selection bias of trade link formation and the heterogeneity of exporters that access a given market. To the best of our knowledge, our paper is the first to do so.

The paper proceeds as follows: section 2 describes the data used in the estimation whose procedure is described in detail in section 3. Section 4 provides a description of the results we obtain both for aggregate and sectoral bilateral trade flows, along with some robustness checks. Finally, section 5 concludes and presents some policy implications.

2 DATA DESCRIPTION

2.1 Dataset construction

We are interested in estimating the determinants of the existence of bilateral trade flows among countries and, therefore, we need to take into account all possible trade flows, not only those that take positive values. To this effect, we construct the most comprehensive dataset possible considering every possible bilateral trade flow between any two trading partners in any two-digit SITC sector. Into this *empty* dataset we merge data on bilateral trade flows, on individual country characteristics, and on characteristics of each bilateral relationship.

The data on bilateral trade flows at the sectoral level has been obtained from Feenstra *et al.* (2005). These data contain information about bilateral trade flows between 1962 and 2000 at the sectoral level up to the 4-digit SITC disaggregation level. We only use the data for year 1999 which is the most recent year for which more reliable data is available. Furthermore, for computational purposes, we collapse these data into its corresponding 66 two-digit SITC categories and we drop observations corresponding to the one-digit category 9 in the SITC which corresponds to "Commodities and transactions not classified elsewhere in the SITC". This leaves us with data for 62 two-digit SITC categories as listed in Table 1 in the Data Appendix. The aggregate bilateral trade flows among countries were

obtained by adding across the sectoral data for every country pair.

Data on individual country's characteristics as well as data on each bilateral relationship were obtained from the dataset used in Ruiz and Vilarrubia (2007) which provides a thorough description of the data construction process. These data include a large number of controls used in the standard gravity equation estimation of bilateral trade flows such as distance (measured as the distance between each country's capital cities), the presence of a land border, the presence of a common language, of a common colonizer, membership in the same trade agreement and currency union. As for individual country characteristics, the dataset contains information about GDP, GDP per capita, area and maritime access (i.e. it has information about the island and landlocked status of each country as well as the number of miles of coast it has).

Finally, we merge data on the number of embassies, consulates, and trade promotion offices from any given origin country in any other host country. These data were obtained from Rose (2005) and they contain, not only the number of these offices but also the number of workers they employ. We associate the origin country with the exporter country and the host country as the importer and we proceed to investigate the role that these embassies have played on each margin. This interesting dataset has two unfortunate drawbacks. Firstly, it is only available for 21 exporting countries which report their presence (in terms of embassies and consulates) vis-à-vis around 163 countries and territories. The list of exporters and importers can be found on table 3 in the Data Appendix where the subset of exporters is identified in bold font within the (more comprehensive) list of importers. Secondly, these data are only available for years 2002 and 2003 and, even then, with a very reduced amount of intertemporal variation which naturally leads our analysis to focus on cross-sectional results instead of the potentially richer panel effects that we might observe.

2.2. Description of the Data

After combining data from all these sources we are left with data on just over 210,000 observations which correspond to all potential bilateral trade flows corresponding to all possible links between 21 exporters and 163 importers in 62 sectors.

As reported by Helpman et al. (2007), there is a significant por-

tion of non-existing observations in international trade flows. If we were to restrict our analysis only to aggregate trade flows among countries, our data shows that almost 8% of all potential trade flows between countries are, in fact, zeros and that, therefore, we obviously have data on over 92% of all possible aggregate bilateral trade flows.[2] The share of positive trade flows in our data is significantly larger than the one reported by Helpman *et al.* (2007). This could largely be attributable to our sample containing a reduced set of exporters which actually correspond to some of the most active exporters in the world. Nevertheless, and as one would expect, the share of non-existing trade flows increases substantially if we consider sectoral data: over 60% of flows in the average sector correspond to non-existing flows. Table 4 reports the share of existing (positive) and non-existing (zero or non-reported) trade flows among all potential trade flows in every sector. As expected, the share of zeros varies greatly from one sector to the next, from 98.3% of zeros in sector 35 ("Electric current") to just over 33% in sector 77 ("Electrical machinery and appliances"), just to cite the two bounds.

Table 5 provides a summary of all variables used in the estimation grouped into three separate categories. The first set of variables correspond to the standard variables used in country-level standard gravity estimations of bilateral trade flows. It includes data on the value of bilateral sectoral trade flows, on its existence, on the value of aggregate bilateral trade flows and its existence as well as information on some of its most commonly considered determinants such as distance, presence of a common border, language, colonizer or an index of religious similarity and membership in the same free trade area and currency union. In the second category, we include information about the number and presence of official agencies between the source (exporter) and host (importer) country as well as information on the attractiveness and geopolitical importance of each country that we use in the instrumentation of the decision to set up an embassy. The third set of variables correspond to variables describing the state of information technology in each country: availability and density of internet, bandwidth and computers. We use these variables to construct the variable "information technology" that we use in one of the robustness checks of our results. These data correspond to 1999

2. An analysis of flows using the largest possible dataset with 168 exporters and 168 importers reveals these figures to be close to 58% and 42% respectively.

and were obtained from the World Development Indicators (WDI) database put together by the World Bank.

3. ESTIMATION PROCEDURE

3.1. Econometric Procedure

In order to investigate the relative importance of the extensive and intensive margin in international trade, we employ a two-stage procedure very similar to the one developed by Helpman, Melitz, and Rubinstein (2007). This procedure aims to correct for two effects: (1) the relative importance of the extensive and an intensive margin in adjusting the total volume of trade, and (2) the effect on trade volumes of non-observable firm heterogeneity. The procedure constitutes an extension of the classic Heckman (1979) sample selection correction procedure augmented in order to take into account the heterogeneous nature of the agents determining aggregate bilateral trade flows among countries.[3]

In this setup, parameter identification requires the existence of a variable that affects the probability of observing a non-zero flow between two countries (the intensive margin) but not the volume (the extensive margin). In other words and thinking in terms of firm's decissions, we need a variable that affects the decission to enter a given market (that is, it affects the fixed costs), but it does not affect the decission of how much to sell in that country (it does not affect variable costs). Alternatively, a variable which affects both decisions in opposite directions, as does the land border dummy variable, would also work.[4]

More formally, in a first stage, we estimate a probit equation of the type:

$$\rho_{ijs}^{T} = \Pr\left[1(T_{ijs}) = 1\right] = \Phi(X_{ijs}, Z_{ijs}, \varepsilon_{ijs}^{T}), \qquad (1)$$

where $1(T_{ijs})$ is an indicator function that takes a value of 1

3. HMR show that the second form of correction is even more important than the first, biases in the results are larger when failing to correct for heterogeneity.

4. For details on how to go from firm level decissions to aggregate flows, see Helpman *et al.* (2007).

when there is a non-zero trade flow from country *i* to country *j* in sector *s,* and zero otherwise; Φ is the cdf of the standardized normal distribution, X_{ijs} corresponds to variables which affect both the probability and the volume of trade, and Z_{ijs} are variables that are used for our exclusion restriction i.e. those that affect the probability of observing a positive volume of trade without actually affecting the trade volume if this was to be positive. In this paper, we consider the role that trade promotion institutions play in promoting the creation of new trade links via a reduction in the existing uncertainty faced by domestic firms when pondering access to foreign markets. More precisely, we focus on the role that the presence of even a single agency has and thus, in our benchmark, we define Z_{ijs} as an indicator variable for the presence of at least one trade promotion agency of the exporting country in the importing country.

We include in X_{ijs} variables such as (the log of) bilateral distance (between capital cities) as well as indicator variables for the presence of a land border, of a common language, and common membership in a regional free trade area or a currency union. Given our assumption on the fixed effect nature of the error structure, we can not use among X_{ijs} any variable which are either exporter or importer specific such as GDP, population, sea access, or land area.

Following this regression, we construct the inverse Mills ratio as $\widehat{\eta}_{ijs}$ which is included as a regressor in the next step. Also with the results from the first stage, we are able to construct a polynomial approximation to the function $h(\omega_{ijs})$ that accounts for the correction for firm size heterogeneity as suggested by Helpman *et al.*(2007).

In this study, none of the control variables (X_{ijs}) we consider varies at the sectoral-bilateral level which implies that the sector-by-sector estimation of equation (1) would be equivalent to the estimation of a pooled regression with all sectoral data where we included sectoral fixed effects, and we allowed the coefficients of all controls and interest variables to vary by sector. The error term, ε^T_{ijs}, is assumed to contain an exporter fixed effect for each sector with the following structure $\varepsilon^T_{ijs} = \delta^T_{is} + \nu^T_{ijs}$ where ν^T_{ijs} is assumed to be a well-behaved error term.[5]

5. We do not include importer fixed effects in this stage since, when we control for endogeneity concerns on the setup of foreign service offices, we would not have enough variability in our data.

The estimation of equation (1) using non-linear methods, such as a probit, together with the use of exporter dummies to perform the fixed effects estimation might be subject to the incidental parameter problem and introduce a bias in the coefficients of the rest of variables (X_{ijs}, Z_{ijs}). However, as pointed out by Fernández-Val (2007), this bias does not affect the estimated marginal effects and, therefore, the predicted values obtained for the dependent variable. As a robustness check, we also estimate equation (1) using a linear probability method where we can safely use a full set of exporter dummies to account for the fixed effects nature of the error term.

After constructing η_{ijs} and the polynomial approximation to $h(\omega_{ijs})$, we include these two terms in the gravity estimation of trade volumes:

$$T_{ijs} = f(X_{ijs}, \widehat{\eta}_{ijs}, h(\widehat{\omega}_{ijs}), \varepsilon^G_{ijs}), \tag{2}$$

where ε^G_{ijs} is an error term which contains a exporter and importer fixed effect as $\varepsilon^G_{ijs} = \delta^G_{is} + \delta^G_{js} + \nu^G_{ijs}$, where ν^G_{ijs} is a well-behaved error term.

For the purposes of our paper, we apply the previous estimation procedure to both aggregate bilateral trade flows as well as to sectoral flows.

3.2 International promotion activities and the extensive margin

The role that IPA may have in the creation of new trade links and not in volumes of existing trade links deserves some discussion. For this to be true (and for our estimation procedure to allow proper identification) it has to be the case that their existence only affects the decision of firms to enter a new market while it does not have an effect on their decisions once they have entered that market.[6] In other words, IPA should only have an effect on fixed costs but not on variable costs, as emphasized by HMR.

As noted in the introduction, IPA may play a role on export decisions if there is some market failure, and in particular, the most emphasized failure is the lack of information. As Rose (2005) points out, one of the objectives that the US State Department establishes

6. In particular, it should not affect their production decissions after entrance.

for itself is that of *"creating jobs at home by opening markets abroad."*[7] Furthermore, as Lederman et al. (2006) describe, the role of IPA is

> *"to help (potential) exporters find markets for their products, as well as provide them with a better understanding of products demanded in different export markets. One can divide the services offered by EPAs into four broad categories: 1) country image building (advertising, promotional events, but also advocacy); 2) export support services (exporter training, technical assistance, capacity building, including regulatory compliance, information on trade finance, logistics, customs, packaging, pricing); 3) marketing (trade fairs, exporter and importer missions, follow-up services offered by representatives abroad); and 4) market research and publications (general, sector, and firm level information, such as market surveys, on-line information on export markets, publications encouraging firms to export, importer and exporter contact databases)."*

From all this, it is clear that IPA activities may affect the decision of firms to enter a given market. On the other hand, it is hard to make a strong case on whether those activities also help reduce variable costs and thus increase the intensive margin in those countries given their expressed objectives. Whether this is the case remains an empirical matter. Thus, it seems reasonable to use the presence of foreign missions as our exclusion restriction to identify the extensive and the intensive margins.

Having said that, we want to establish whether it is actually the case that IPA and uncertainty play a role mainly through the extensive margin at the country level. This is particularly important if we want to compare our results with those of Rose (2005), that shows (without distinguishing between margins) that the effect of foreign service is of a 6-10% increase in bilateral exports for each additional consulate. For this reason, we use alternative measures to identify the role of the extensive (relative to the intensive) margin. See below for the discussion on this.

It is important to note the possible drawbacks of our analysis. First of all, we have endogeneity concerns, which are addressed as in Rose (2005), and discussed at further length in the next sub-section. Second, we are using the cross-sectional variance to analyze the impact of IPA on the extensive and intensive margins at the country level, which is an

7. See Rose (2005) for similar quotes about other countries' foreign missions objectives.

intrinsically dynamic matter. We do this because of data restrictions since our sample does not contain sufficient variation on the presence or number of foreign missions over time to identify the dynamic effect. This may be a concern if, first, given that we already address reverse causality, there remain omitted variables that determine both the existence of a trade link between two countries and the presence of embassies, consulates, and trade promotion offices between them. Nevertheless, as long as the standard gravity controls such as common border, colonial links and others are capturing this possibility, this should not be a concern. Secondly, the same reasoning applies if we still had omitted variables at the importer or exporter level that affect the relative importance of the two margins, which again are likely to be controlled for by the importer and exporter fixed effects we include.

Finally, it could be argued that the use of aggregate flows does not allow us to identify the effect on the extensive margin at the firm level. That is, IPA may be important for the establishment of new trade links with new countries and, also, after the link is formed, for the entrance of new firms and products in those same countries. However, if this was the case, we should see this reflected on total volumes, something that we do not observe in our results below. A reason for this, as discussed earlier, may be that as we have emphasized in Segura-Cayuela and Vilarrubia (2007), informational externalities generated through other firms' actions may be an alternative way of obtaining information about a given market. In particular, by observing how other firms are performing in a given foreign market, producers trying to decide whether to enter that given market can make inference about its expected profitability and, ultimately, have an impact on the intensive margin at the country level. So, as long as our estimation strategy is convincing enough, we do not seem to identify an effect of IPA on the extensive margin at the firm level after a link between any two countries has already been formed.

3.3 Endogeneity concerns

When using the presence of embassies and consulates of the exporting country in the importing country, and as Rose (2005) rightfully points out, a potential endogeneity problem emerges. The source of this lies on the fact that the decision to set up an embassy or a foreign trade promotion office might itself be endogenous: the decision of country i to set

up an office in country *j* might be related to the potential that market *j* offers to firms in country *i*. If this is the case, our identification procedure for the extensive vis-à-vis the intensive margin would not be correct. We recognize this possibility and attempt to correct for it by introducing another stage in our procedure, where we proxy the probability of setting up a foreign mission on a set of variables that attempt to capture the general (tourist) attractiveness of a country, as well as its geopolitical importance. A first set of instruments includes the number of Zagat's guides, the number of Condé-Nast Top 100 destinations in the country, the number of Lonely Planet guides, the number of Economist city guides as well as the volume of oil reserves held by the country. Also, as in Rose (2005), as a robustness check, we extend our instrument set to include information about other guides (Michelin and Baedeker) as well as information about natural gas reserves. Given that our variable of interest is the indicator for the presence of an official trade promotion agency, we estimate a probit model on the probability that country *i* has set up a foreign mission in country *j* and thus, we run the regression:

$$\rho_{ij}^{Z} = \Pr[1(Z_{ij} = 1) = \Phi(X_{ij}, T_{ij}, \varepsilon_{ij}^{Z}), \tag{3}$$

where we also include the bilateral characteristics of country *i* and *j* as well as the aforementioned set(s) of instruments (T_{ij}), and an error term which we assume to be well-behaved.

We estimate this equation and include its predicted value $\widehat{\rho}_{ij}^{Z}$ as a regressor in equation (1) instead of Z_{ij}. It is important to keep in mind that in this additional stage both the dependent and independent variables are the same across all sectors. Thus, when doing the estimation at the sector level the instrument for the presence of a trade promotion agency is going to be exactly the same for all sectors as well as for the estimation of aggregate bilateral trade flows.

4. RESULTS

4.1 Aggregate results

We first estimate the role that the presence of trade promoting agencies plays in promoting increases in international trade via the inten-

sive margin, that is, by fostering the formation of trade links at the aggregate level. It is important to keep in mind that in our aggregate data, only 8% of all potential trade flows correspond to zero trade flows. Table 6 shows the results of estimating our first stage, to which we also refer as the selection equation.

The coefficient on the presence of a foreign service office is shown to have a positive and significant effect on the formation of trade links among countries. Our findings suggest that the presence of a foreign service office from an exporter in an importer country increases the probability of the existence of a trade link by over 11%. The effect of distance in this selection equation has the expected sign and it is strongly significant. The rest of the coefficients are not significantly different from zero which could be attributed to one of two factors: (i) the reduced variation in the dependent variables or (ii) the reduced and non-random sample of exporters in our data.

As described in the econometric section, using this estimation we construct η_{ij} to control for the sample selection effect and a polynomial approximation to $h(\omega_{ij})$ which allows us to control for the effects of firm heterogeneity on aggregate trade flows. These constructs are then included as regressors in the next stage where we estimate a gravity-type regression of aggregate bilateral trade flows on these variables as well as on the standard variables considered in the literature. The results of this exercise are presented in table 7 next to the results of estimating a gravity equation without taking into account the intensive-margin effects of trade promotion agencies. Recall that this estimation also includes exporter and importer fixed effects which allow us to control for the potential biases that might arise from the non-inclusion of the multilateral resistance terms (given by the ideal price indices).[8] As it can be seen in the first column of table 7, all the variables in this estimation have the expected sign and are highly significant: while distance reduces the expected trade volume, sharing a border, a language, a colonizer, or a belief system all promote bilateral trade albeit at different intensities. If we compare these results with those of a standard gravity equation, we find that taking into

8. See Anderson and van Wincoop (2003) for a discussion on the importance of multilateral resistance and the biases arising from its omission and Feenstra (2002) for a discussion on a fixed effect correction of the omitted variable bias.

account the intensive-margin effect causes the coefficient on distance to fall significatively while the (positive) effect of borders is amplified. The effect on the rest of the coefficients is of an attenuation but the difference is smaller. These results suggest the importance of understanding the determinants not only of the extensive margin (trade links) but also of the intensive margin (trade volumes) for the understanding of international trade and its determinants.

So far we have established that the presence of foreign service offices increases the probability of exporting to that country. This does not mean that foreign service does not have an effect on the intensive margin between two countries as we do not control for this on the gravity equation. Unfortunately, our identification strategy does not allow us to include the same variable in both the selection equation and the gravity equation.

For this reason, and to disentangle the differential effect on the intensive and extensive margins, we do two different exercises. In a first test, we repeat the previous two steps and include in the gravity regression the number of embassies, consulates, or trade promotion offices beyond the first one in that given bilateral relationship. The results are displayed in the first column of table. We find the coefficient on this variable in the second stage to be statistically not different from zero. This reinforces our prior that the presence of any such agency is really important for the formation of trade links but that its effect on the extensive margin (once we control for the effect on the intensive margin) is not important.

The second exercise we perform involves the use of an additional variable to identify the model, variable also aimed at capturing the role of informational asymmetries on the extensive margin.[9] It has been suggested that the emergence of information technology has helped reduce the cost of acquiring and transmitting information. We define this variable as the interaction between the density of internet servers in the importing country interacted with the density of internet connections in the exporting country. This measure aims to capture the potential amount of information available about an importing country (server density) that could be available to the average firm in the exporting country (internet

9. Alternatively, we could use religious similarity to identify our empirical model as in HMR. Given our emphasis on uncertainty, we prefer our information technology variable.

connections density).[10] We include this variable in our selection equation instead of the variable on the presence of a foreign service office. In the second stage, we include the number of embassies and consulates over and above the first one and as it can be seen in the second column of table 8 we do not find this variable to be different from zero at standard significance levels. We take this result as further evidence of the importance of the *first* international agency on the extensive margin of international trade but its negligible effect on the intensive margin after controlling for the previous effect.

How does this finding compare to Rose (2005) who finds that the effect of foreign service is of a 6-10% increase in bilateral exports for each additional consulate? It is, first of all, important to point out that they are not incompatible given that Rose (2005) uses bilateral flows between countries without correcting neither for the selection effect nor for exporter heterogeneity. Thus, the effect he reports could be driven by this two biases and simply be capturing the fact that foreign missions do indeed increase the probability of trading with a given country.

As we mentioned in the econometric section, one of the main concerns in Rose (2005), as well as in the present work, is the potential endogeneity arising from the decision to set up embassies, consulates, and trade promotion offices according to the importing country's market attractiveness. This problem could be especially pervasive for us given our focus on the extensive and intensive margins: the presence of a foreign service office is likely to be correlated with both margins and, thus, not a valid instrument for the selection equation. To this effect, we instrument the presence of an embassy in the host (importing) country by its tourist attractiveness and geopolitical importance. We use the set of variables described in the econometric section to proxy these two concepts in an additional stage to our procedure, where we estimate a probit for the presence of an embassy on those variables. The results of this estimation are presented in table 9 in the Appendix for two possible sets of instruments. These estimates are, then, used to construct the instrument which is, essentially, the probability that the exporting country has, indeed, an internatio-

10. The variable is defined as the interaction between the number of internet servers per one million people in the importing country and the number of internet users per 1000 people in the exporting country. The results subsequently described are robust to the use of similar measures for each variable such as overall counts and existing bandwidth.

nal agency in the importing country (i.e. the predicted value from this regression). The coefficient on all variables are quite consistent across both specifications. Using the predicted probabilities from these estimations, we re-estimate our selection and gravity equations with the two instruments we construct, one for the restricted and one for the expanded instrument sets.

The results of the estimation of the selection equation are presented in table 10. While the results across the two instrumentations are quite similar, two main facts are quite striking. The first one is the increased importance of the presence of an embassy or consulate in the formation of trade links: the coefficient in this specification is around 0.185 relative to 0.113 in the standard selection equation, both of them quite precisely estimated. The second and first surprising result is the estimated coefficient on most of the controls used in this regression which have the opposite signs as one would expect and as we obtained earlier. This apparent contradiction is attributable to the inclusion of this same set of controls in the instrumenting regression where, for instance, distance has a large and significative negative coefficient. The composite effect of distance (and most other controls) has the expected sign once we take into account its effect on the predicted probability of the presence of a trade promotion agency.

Table 11 shows the estimation results of the gravity estimation. The first two columns correspond to the two possible instruments we defined for the presence of a foreign service office which, in turn, generated different (albeit very close) prediction for the existence of trade links and which, subsequently generate the correction for the sample selection (η_{ij}) and for the firm heterogeneity correction $(h(\omega_{ij}))$. The gravity results are very similar across the two instrumentation strategies considered and, in turn, very close to the ones we obtained without performing any instrumentation. We report the same standard gravity controls as we did in the table with the earlier results and the same comparison still applies. The coefficient on distance is sensibly reduced from an estimated -1.215 to just -1.037 for the most complete set of instruments. A similar pattern can be observed on the estimation of the common colonizer effect whose magnitude drops from 0.73 to around 0.58. Other coefficients see their effects amplified, such as the one on the presence of a common land border whose estimated effect jumps from an estimated 0.54 in the standard gravity model to around 0.95 in the estimation where we

control for trade link formation.[11] The coefficients on sharing a common language and on religious similarity do not seem to be altered by this correction.

4.2 Sectoral results

Having established the importance of foreign service offices only for the extensive margin we now turn to a sector-by-sector estimation of the importance of this margin. We first perform the simple two-stage procedure, and then correct for the potential endogeneity and employ the instrumentation of the presence of an embassy or consulate.

We estimate equation (1) for all 62 sectors with the only exception of that for sector 35 ("Electric current") since the large number of non-existing values (over 98% of all possible values) prevents the estimation from being carried out. Table 12 displays the estimated marginal effect of the presence of an official agency on the existence of a given bilateral trade link. The estimated coefficient is positive and significant at over the 1% level for all sectors; the corresponding marginal effect is somewhat larger in magnitude to the one we estimated for the aggregate trade flows. This effect is a direct consequence of the significantly larger proportion of zero flows in the sectoral data relative to the aggregate data. There are also some interesting differences when examining the magnitude of the coefficient across sectors: the impact is significantly larger for sectors producing more differentiated goods, such as 1-digit SITC sectors 6 ("Manufactured goods") and 7 ("Machinery and transport equipment"), than for sectors where homogenous goods play a more significant role, such as sectors 2 ("Crude materials"), 3 ("Mineral fuels"), and 4 ("Animal and vegetable oils").

The tables containing the full regression results are not presented, due to space constraints, but are available from the authors. Instead, table 13 shows the complete regression results for a few selected sectors:

4 *Cereals and cereal preparations*

25 *Pulp and waste paper*

11. These coefficients imply a border effect of around 71% in the standard gravity estimation and of close to 150% for the corrected model.

58 *Plastics in non-primary forms*

65 *Textile yarn, fabrics, made-up articles, and related products*

77 *Electrical machinery, apparatus and appliances*

78 *Road vehicles (including air-cushion vehicles)*

The first two sectors could be defined as homogeneous goods sectors, while the last two ones fall squarely in the category of heterogonous/differentiated goods. As emphasized by Rauch (1999) that argues that search barriers are larger for more differentiated goods, we would expect our selection variable related to information asymmetries among countries to have a stronger effect on the later than on the former. This intuition is confirmed by the results: the marginal effect on the probability of the existence of a trade link increases substantially more with the presence of an official agency in sectors 77 and 78 (with marginal effects of 51.8% and 43.3%) than in sectors 4 and 25 (with marginal effects of 38.9% and 18%).

Next, we estimate the gravity equation for every sector including among the regressors the standard determinants as well as the terms constructed in the first stage. We find these correction terms to be significant in all but 11 of the 61 sectors at standard significance levels.[12] Regarding the coefficients on the rest of variables, we observe the same qualitative effects as we do in the aggregate results. We present the results of the gravity estimation for selected sectors in table 14. Sectors 4 and 25 appear to be among the 11 sectors for which the selection and heterogeneity correction do not appear to be jointly significant in the gravity estimation.

In this sectoral estimation, we correct for the potential endogeneity in the same fashion as we did in the estimation of aggregate bilateral trade flows. Given that neither the dependent variable nor the independent variables in the instrumentation stage vary according to sector, we simply use as instruments the two variables we generated earlier using two different instrumentation sets.

Table 15 reports the marginal effect of the instrument constructed using the expanded instrument set in the probit regression for the existence of a sectoral bilateral trade flow. We find the effect to be

12 Recall that we are unable to perform the estimation for sector 35.

positive and significantly different from zero at the 1% in all sectors. We find the same pattern as we did before correcting for the endogeneity in the decision to set up an official agency. However, the estimated marginal effects of the instrumented presence of an embassy or consulate on the probability of observing a positive trade flow are now significantly larger than those estimated without instrumentation. We attribute this difference in magnitude to the fact that the new dependent variable is actually the *probability* that there is an embassy of the exporting country in the importing country for every country pair instead of the given *actual* presence of this embassy, which we considered earlier. In other words, the dependent variable used to predict the existence of a trade flow, which was an indicator variable in table 12, is now a continuous variable, which forces us to change the interpretation of the coefficient. When interpreting these coefficients, it is useful to keep in mind that the average of the indicator variable for the presence of a trade promotion agency is around 0.666. In any case, we still find that the estimated marginal effects are significantly larger for sectors producing more differentiated goods relative to sectors more associated with the production of homogenous goods. Table 16 reports the full regression results for a few selected sectors. We find similar results as we did for the aggregate results: most of the coefficients on the standard gravity controls do not have the expected signs. We are not concerned about this since these variables only constitute controls and, again, attribute this result to the inclusion of these same set of controls in the instrumenting equation for the presence of an international agency of the exporting country in the importing country.

Finally, we estimate a gravity equation including the same set of controls as well as our constructs from the previous estimation that allow us to control for sample selection (the intensive margin) and firm heterogeneity in the determination of trade volumes (the extensive margin). We report the results of this estimation in table 17 for selected sectors.[13] We find the same qualitative results as we did in the previous (non-instrumented) estimation with the coefficients on the selection and firm heterogeneity controls being jointly significant in 54 out of the 61 for which we perform the estimation.

13. As usual, the complete tables are available from the author's upon request.

5. Conclusions and policy implications

In this paper we analyze the importance of international promotion activities in determining trade flows. In doing so we disentangle the differential effect that these activities may have both at creating new potential partners and at increasing the volume of trade with existing partners. Using cross-sectional data and following HMR and Rose (2005), our results indicate that having a foreign service agency in a country increases the probability of exporting to that country in between 11 and 18% at the aggregate level, while it does not appear to have an additional effect on the volume of exports. At the sectoral level the results are qualitatively similar, with foreign services mattering more at the extensive margin in more differentiated goods sectors, a result that is consistent with what the literature has previously emphasized.

These results suggest that uncertainty may be an important barrier for trade as long as two countries do not trade with each other. However, once they are already exchanging goods, either information flows between them (perhaps through informational externalities as emphasized in Segura-Cayuela and Vilarrubia, 2007, or through the creation of informal networks as emphasized by Rauch, 1996), or the remaining uncertainty is something international promotion agencies can not help overcome. Whatever the answer is, it is hard to find an economic justification for the increasing proliferation of export promotion offices among trade partners, based on uncertainty as their justification.

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6. DATA APPENDIX

Table 1.
List of sectors

Code	Description
0	Food and live animals
01	Meat and meat preparations
02	Dairy products and birds´eggs
03	Fish (not marine mammals), crustaceans, molluscs and aquatic invertebrates
04	Cereals and cereal preparations
05	Vegetables and fruit
06	Sugars, sugar preparations and honey
07	Coffee, tea, cocoa, spices, and manufactures thereof
08	Feeding stufffor animals (not including unmilled cereals)
09	Miscellaneous edible products and preparations
1	Beverages and tobacco
11	Beverages
12	Tobacco and tobacco manufactures
2	Crude materials, inedible, except fuels
21	Hides, skins and furskins, raw
22	Oil-seeds and oleaginous fruits
23	Crude rubber (including synthetic and reclaimed)
24	Cork and wood
25	Pulp and waste paper
26	Textile fibres (other than wool tops and other combed wool) and their wastes (not manufactured into yarn or fabric)
27	Crude fertilizers, other than those of division 56, and crude minerals (excluding coal, petroleum and precious stones)
28	Metalliferous ores and metal scrap
29	Crude animal and vegetable materials
3	Mineral fuels, lubricants and related materials
32	Coal, coke and briquettes
33	Petroleum, petroleum products and related materials
34	Gas, natural and manufactured
35	Electric current
4	Animal and vegetable oils, fats and waxes
42	Animal oils and fats
43	Fixed vegetable fats and oils, crude, re.ned or fractionated
44	Animal or vegetable fats and oils, processed; waxes of animal or vegetable origin; inedible mixtures or preparations of animal or vegetable fats or oils
5	Chemicals and related products
52	Organic chemicals
53	Inorganic chemicals
53	Dyeing, tanning and colouring materials
54	Medicinal and pharmaceutical products
55	Essential oils and resinoids and perfume materials; toilet, polishing and cleansing preparations
56	Fertilizers (other than those of group 272)
57	Plastics in primary forms
58	Plastics in non-primary forms
59	Chemical materials and products

Table 2.
List of sectors (cont´d)

Code	Description
6	Manufactured goods classified chiefly by material
61	Leather, leather manufactures, and dressed furskins
62	Rubber manufactures
63	Cork and wood manufactures (excluding furniture)
64	Paper, paperboard and articles of paper pulp, of paper or of paperboard
65	Textile yarn, fabrics, made-up articles, and related products
66	Non-metallic mineral manufactures,
67	Iron and steel
68	Non-ferrous metals
69	Manufactures of metals
7	Machinery and transport equipment
71	Power-generating machinery and equipment
72	Machinery specialized for particular industries
73	Metalworking machinery
74	General industrial machinery and equipment, and machine parts
75	Office machines and automatic data-processing machines
76	Telecommunications and sound-recording and reproducing apparatus and equipment
77	Electrical machinery, apparatus and appliances and electrical parts thereof (including non-electrical counterparts)
78	Road vehicles (including air-cushion vehicles)
79	Other transport equipment
8	Miscellaneous manufactured articles
81	Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings
82	Furniture, and parts thereof
83	Travel goods, handbags and similar containers
84	Articles of apparel and clothing accessories
85	Footwear
87	Professional, scientific and controlling instruments and apparatus
88	Photographic apparatus, equipment and supplies and optical goods; watches and clocks
89	Miscellaneous manufactured articles
9	Commodities and transactions not classified elsewhere in the SITC
91	Postal packages not classified according to kind
93	Special transactions and commodities not classified according to kind
96	Coin (other than gold coin), not being legal tender
97	Gold, non-monetary (excluding gold ores and concentrates)

Table 3.
List of exporters and importers

Afghanistan	Dominican Rep.	Korea (North)	Romania
Albania	Ecuador	**Korea (South)**	**Russian Federation**
Algeria	Egypt	Kuwait	Rwanda
Angola	El Salvador	Lao P.Dem.R	Samoa
Argentina	Eq.Guinea	Latvia	Saudi Arabia
Armenia	Estonia	Lebanon	Senegal
Australia	Ethiopia	Liberia	Seychelles
Austria	Falkland Islands	Libya	Sierra Leone
Bahamas	Fiji	Lithuania	Singapore
Bahrain	Finland	Madagascar	Slovakia
Bangladesh	French Ind. Or.	Malawi	Slovenia
Barbados	French Guiana	Malaysia	Somalia
Belarus	**France**	Mali	South Africa
Belgium (Lux.)	Gabon	Malta	**Spain**
Belize	Gambia	Mauritania	Sri Lanka
Benin	Georgia	Mauritius	St.Kitt and Nevis
Bermuda	**Germany**	**Mexico**	Sudan
Bolivia	Ghana	Mongolia	Suriname
Brazil	Greece	Morocco	**Sweden**
Bulgaria	Greenland	Mozambique	**Switzerland**
Burkina Faso	Guadeloupe	Myanmar	Syria
Burundi	Guatemala	Nepal	TFYR Macedonia
Cambodia	Guinea	Aruba	Tanzania
Cameroon	Guinea-Bissau	**Netherlands**	Thailand
Canada	Guyana	New Calednia	Togo
Cent. Afr. Rep	Haiti	New Zealand	Trinidad Tobago
Chad	Honduras	Nicaragua	Tunisia
Chile	Hungary	Niger	**Turkey**
China	Iceland	Nigeria	**United Kingdom**
Hong Kong	**India**	Norway	**United States**
Macao	**Indonesia**	Oman	Uganda
Colombia	Iran	Pakistan	Ukraine
Congo	Iraq	Panama	United Arab Emirates
Costa Rica	Ireland	Papua New Guinea	Uruguay
Cote d´Ivoire	Israel	Paraguay	Uzbekistan
Cuba	**Italy**	Peru	Venezuela
Cyprus	Jamaica	Philippines	Vietnam
Czech Rep	**Japan**	**Poland**	Yemen
Dem. Rep. of Congo	Jordan	Portugal	Zambia
Denmark	Kazakhstan	Qatar	Zimbabwe
Djibouti	Kenya	Rep Moldova	

Table 4.
Share of zeros per sector

Sector	Share of 1´s	Share of 0´s	Sector	Share of 1´s	Share of 0´s
1	25.87%	74.13%	55	48.79%	51.21%
2	31.13%	68.87%	56	21.11%	78.89%
3	26.81%	73.19%	57	11.58%	88.42%
4	44.56%	55.44%	58	51.26%	48.74%
5	42.56%	57.44%	59	51.44%	48.56%
6	34.60%	65.40%	61	27.75%	72.25%
7	36.48%	63.52%	62	51.97%	48.03%
8	28.37%	71.63%	63	36.04%	63.96%
9	39.62%	60.38%	64	52.79%	47.21%
11	34.57%	65.43%	65	58.70%	41.30%
12	28.57%	71.43%	66	55.47%	44.53%
21	12.40%	87.60%	67	57.00%	43.00%
22	16.55%	83.45%	68	43.77%	56.23%
23	24.37%	75.63%	69	60.79%	39.21%
24	23.90%	76.10%	71	55.91%	44.09%
25	16.87%	83.13%	72	63.70%	36.30%
26	36.45%	63.55%	73	38.71%	61.29%
27	32.16%	67.84%	74	65.17%	34.83%
28	23.40%	76.60%	75	46.36%	53.64%
29	32.63%	67.37%	76	56.44%	43.56%
32	12.64%	87.36%	77	66.61%	33.39%
33	38.12%	61.88%	78	66.14%	33.86%
34	8.94%	91.06%	79	38.36%	61.64%
35	1.70%	98.30%	81	36.16%	63.84%
41	9.26%	90.74%	82	45.86%	54.14%
42	26.16%	73.84%	83	26.01%	73.99%
43	17.64%	82.36%	84	42.36%	57.64%
51	48.00%	52.00%	85	35.57%	64.43%
52	40.80%	59.20%	87	53.82%	46.18%
53	45.15%	54.85%	88	39.21%	60.79%
54	57.44%	42.56%	89	62.76%	37.24%

1 corresponds to an existing flow; 0 to a zero or to non-existing values

Table 5.
Descriptive statistics of the variables

Variable	Obs.	Mean	Std. dev.	Minimum	Maximum
Value (1000 US$)	210924	18741	267216	0	56700000
1(Value >0)	210924	0.381	0.486	0	1
Value (log)	80467	7.953	2.193	0	17.853
Aggregate value	210924	1196859	7040360	0	202000000
1(Agg. Value >0)	210924	0.920	0.27	0	1.000
Distance (log)	205716	8.727	0.771	5.277463	9.894
Common border	209994	0.027	0.163	0	1
Common language	209994	0.130	0.336	0	1
Common colonizer	209994	0.015	0.121	0	1
Religious similarity	188790	33.238	30.711	0	99.800
FTA	210924	0.053	0.225	0	1
CU	210924	0.013	0.113	0	1
Number of embasies & consulates	206522	1.136	1.900	0	43.000
Presence of an embasy or consulate	210924	0.666	0.472	0	1
Zagat´s guides	206522	0.404	3.127	0	40
Baedeker guides	206522	0.275	0.804	0	6
Condé-Nast top 100	206522	0.312	1.103	0	10
Lonely Planet guides	206522	0.213	0.848	0	10
Michelin guides	206522	0.242	1.202	0	13
Economist city guides	206522	0.128	0.540	0	6
Oil reserves	206522	6.30E+10	2.64E+11	0	2.62E+12
Gas reserves	206522	9.57E+12	4.48E+13	0	4.79E+14
Bandwidth per person	165354	484.95	1518.23	0.0151	10791.04
Bandwidth per 1000	161448	6.975	20.762	0	164.845
Broadband subscribers	162750	269261.3	1365534.0	0	12800000
Computersper 1000	178374	115.131	160.431	0.4920776	683.282
International bandwidth	166656	11333.0	42132.6	0.064	273770
Internet servers	154938	965.1	7005.1	1	78126.0
Internet servers per million	153636	34.714	73.584	0.00761	497.181
Internet users	199206	2989451	12600000	0	143000000
Internet users per 1000	199206	101.95	145.29	0	603.51
Personal computers	178374	3595783	15800000	1100	178000000
Information technology	153636	6.286154	2.921118	-2.964339	12.45739

Table 6.
First stage: Probit regression for the existence of a trade flow

Dependent variable: Indicator for the existence of a trade flow	
Presence of a foreign service office	0.113***
	(0.015)
Distance (log)	-0.019***
	(0.005)
Common border	-0.127*
	(0.074)
Common colonizer	0.004
	(0.016)
Common language	-0.007
	(0.009)
Religious similarity	0.000
	(0.000)
Observations	2453

Marginal effects reported. Robust standard errors in parentheses
Included, but not reported, are exporter fixed effects
* significant at the 10%; ** significant at the 5%; *** significant at the 1%

Table 7.
Second stage: Gravity regression

Dependent variable:Value of aggregate bilateral trade

	Correcting for selection and heterogeneity	Regular Gravity
Distance (log)	-1.062***	-1.215***
	(0.060)	(0.044)
Common border	0.831***	0.544***
	(0.200)	(0.189)
Common colonizer	0.662***	0.734***
	(0.232)	(0.233)
Common language	0.428***	0.497***
	(0.075)	(0.077)
Religious similarity	0.004***	0.005***
	(0.001)	(0.001)
Observations	2277	2277
R-squared	0.99	0.99
F-test (significance of 1st stage instruments)	25.13	n/a
Prob(F >0)	0.00	n/a

Included, but not reported, are exporter and importer fixed effects
Robust standard errors in parentheses
* significant at10%; ** significant at 5%; *** significant at 1%

Table 8.
The importance of the extensive and intensive margins

Dependent variable: Value of aggregate bilateral trade

	(1)	(2)
Distance (log)	-0.936***	-1.049***
	(0.05)	(0.04)
Common border	0.788***	0.509***
	(0.163)	(0.143)
Common colonizer	0.937***	1.066***
	(0.219)	(0.228)
Common language	0.561***	0.526***
	(0.067)	(0.066)
Religious similarity	0.004***	0.004***
	(0.001)	(0.001)
Number of embassies	0.023	0.018
and consulates over one	(0.014)	(0.012)
Observations	2138	2138
R-squared	1.00	1.00

Included, but not reported, are exporter and importer fixed effects

Table 9.
Instrumenting the presence of a foreign service office

Dependent variable: Indicator for the presence of an embassy or consulate.		
Zagat´s surveys	0.163***	0.147***
	(0.019)	(0.018)
Condé-Nast top destinations	-0.001	-0.004
	(0.005)	(0.007)
Lonely Planet guides	0.181***	0.196***
	(0.031)	(0.034)
Economist city guides	0.069*	0.068
	(0.040)	(0.042)
Oil Reserves	0.000***	0.000***
	(0.000)	(0.000)
Michelin guides		0.016
		(0.026)
Baedeker guides		0.025
		(0.020)
Gas Reserves		0.000
		(0.000)
Distance (log)	-0.065***	-0.072***
	(0.017)	(0.019)
Common border	0.022	0.025
	(0.024)	(0.028)
Common colonizer	0.032**	0.036**
	(0.014)	(0.016)
Common language	0.031***	0.035***
	(0.010)	(0.011)
Religious similarity	0.000	0.000
	(0.000)	(0.000)
Observations	3033	3033

Marginal effects reported. Robust standard errors in parentheses
* significant at the 10%; ** significant at the 5%; *** significant at the 1%

Table 10.
First stage: Probit regression for the existence of a trade flow

Dependent variable: Indicator for the existence of a trade flow

	(1)	(2)
Presence of a foreign service office	0.184***	0.183***
(instrumented)	(0.025)	(0.025)
Distance (log)	0.009*	0.011**
	(0.005)	(0.005)
Common border	-0.045	-0.042
	(0.040)	(0.039)
Common colonizer	-0.013	-0.014
	(0.032)	(0.031)
Common language	-0.037**	-0.039**
	(0.017)	(0.017)
Religious similarity	0.000	0.000
	(0.000)	(0.000)
Observations	2453	2453

Marginal effects reported. Robust standard errors in parentheses
Included, but not reported, are exporter fixed effects
* significant at the 10%; ** significant at the 5%; *** significant at the 1%

Table 11.
Second stage: Gravity regression

Dependent variable: Value of aggregate bilateral trade

	(1)	(2)	Regular Gravity
Distance (log)	-1.022***	-1.037***	-1.215***
	(0.044)	(0.043)	(0.044)
Common border	0.952***	0.948***	0.544***
	(0.186)	(0.184)	(0.189)
Common colonizer	0.577**	0.579**	0.734***
	(0.232)	(0.232)	(0.233)
Common language	0.513***	0.520***	0.497***
	(0.075)	(0.075)	(0.077)
Religious similarity	0.004***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)
Observations	2277	2277	2277
R-squared	0.99	0.99	0.99
F-test (significance of 1st stage instruments)	10.60	17.25	n/a
Prob(F >0)	0.00	0.00	n/a

Included, but not reported, are exporter and importer fixed effects.

Table 12.
First stage: Estimated marginal effect of the presence of a foreign service office on the existence of a bilateral trade flow by sector

Sector	Marginal effect	Sector	Marginal effect
1	0.223***	55	0.479***
2	0.240***	56	0.192***
3	0.291***	57	0.085***
4	0.389***	58	0.606***
5	0.434***	59	0.557***
6	0.359***	61	0.334***
7	0.383***	62	0.541***
8	0.324***	63	0.390***
9	0.398***	64	0.521***
11	0.301***	65	0.527***
12	0.266***	66	0.544***
21	0.130***	67	0.455***
22	0.157***	68	0.548***
23	0.309***	69	0.533***
24	0.262***	71	0.547***
25	0.180***	72	0.499***
26	0.396***	73	0.460***
27	0.404***	74	0.540***
28	0.293***	75	0.522***
29	0.401***	76	0.534***
32	0.106***	77	0.518***
33	0.407***	78	0.433***
34	0.043***	79	0.319***
35	–	81	0.413***
41	0.062***	82	0.480***
42	0.245***	83	0.256***
43	0.180***	84	0.409***
51	0.550***	85	0.341***
52	0.476***	87	0.565***
53	0.524***	88	0.448***
54	0.555***	89	0.521***

All regressions include as controls distance (log), common border, common language, and religious similarity, as well as fixed exporter effects.

Table13.
First stage: Probit regression for the existence of a trade flow for selected sectors

Dependent variable: Indicator for the presence of a sectoral trade flow

	Sector 4	Sector 25	Sector 58	Sector 65	Sector 77	Sector 78
Presence of a foreign	0.389***	0.180***	0.606***	0.527***	0.518***	0.433***
service office	(0.021)	(0.011)	(0.018)	(0.022)	(0.022)	(0.022)
Distance (log)	-0.256***	-0.060***	-0.202***	-0.158***	-0.140***	-0.144***
	(0.020)	(0.010)	(0.020)	(0.017)	(0.016)	(0.016)
Common border	0.071	0.247***	0.102	0.092	0.059	0.074
	(0.084)	(0.076)	(0.085)	(0.086)	(0.077)	(0.065)
Common colonizer	0.045	-0.076***	-0.060	-0.068	0.107**	0.018
	(0.089)	(0.018)	(0.091)	(0.126)	(0.054)	(0.070)
Common language	0.099***	-0.011	0.068**	-0.013	-0.020	0.048*
	(0.035)	(0.017)	(0.035)	(0.033)	(0.029)	(0.025)
Religious similarity	0.000	-0.001***	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2991	2890	2991	2991	2991	2991

Marginal effects reported. Robust standard errors in parentheses
Included, but not reported, are exporter fixed effects
* significant at the 10%; ** significant at the 5%; *** significant at the 1%

Table 14.
Second stage: Gravity regression for selected sectors

Dependent variable:Value of sectoral bilateral trade

	Sector 4	Sector 25	Sector 58	Sector 65	Sector 77	Sector 78
Distance (log)	-0.961***	-0.885***	-1.367***	-1.253***	-1.149***	-1.023***
	(0.137)	(0.210)	(0.079)	(0.079)	(0.069)	(0.083)
Common border	0.941***	0.021	0.773***	0.694***	0.630***	0.587**
	(0.231)	(0.442)	(0.208)	(0.193)	(0.208)	(0.234)
Common colonizer	0.420	0.800	0.888**	0.384	0.974***	0.884**
	(0.390)	(0.909)	(0.349)	(0.287)	(0.304)	(0.373)
Common language	0.590***	0.440*	0.468***	0.305***	0.708***	0.379***
	(0.138)	(0.237)	(0.094)	(0.097)	(0.087)	(0.108)
Religious similarity	0.004*	0.00	0.003*	0.005***	0.003**	-0.000
	(0.002)	(0.005)	(0.002)	(0.001)	(0.001)	(0.002)
Observations	1385	551	1613	1832	2076	2067
R-squared	0.98	0.98	0.99	0.98	0.99	0.98
F-test (significance of 1st stage instruments)	1.88	1.97	4.36	3.64	3.13	6.78
Prob (F>0)	0.08	0.06	0.00	0.00	0.00	0.00

Included, but not reported, are exporter and importer fixed effects
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 15.
First stage: Coefficient of the instrument for presence of a foreign service office on the existence of a bilateral trade flow by sector

Sector	Coefficient	Sector	Coefficient
1	0.739***	55	1.454***
2	0.890***	56	0.552***
3	1.122***	57	0.259***
4	1.218***	58	1.714***
5	1.630***	59	1.744***
6	1.375***	61	1.288***
7	1.363***	62	1.534***
8	1.180***	63	1.567***
9	1.386***	64	1.362***
11	1.147***	65	1.455***
12	0.802***	66	1.579***
21	0.376***	67	1.415***
22	0.496***	68	1.803***
23	1.087***	69	1.298***
24	0.960***	71	1.591***
25	0.580***	72	1.122***
26	1.210***	73	1.719***
27	1.482***	74	1.353***
28	1.096***	75	1.765***
29	1.515***	76	1.441***
32	0.354***	77	1.332***
33	1.388***	78	0.980***
34	0.136***	79	1.322***
35	–	81	1.459***
41	0.175***	82	1.583***
42	0.845***	83	1.021***
43	0.588***	84	1.476***
51	1.761***	85	1.271***
52	1.575***	87	1.666***
53	1.628***	88	1.678***
54	1.445***	89	1.493***

All regressions include as controls distance (log), common border, common language, and religious similarity, as well as fixed exporter effects.

Table 16.
First stage: Probit regression for the existence of a trade flow for selected sectors

Dependent variable: Indicator for the presence of a sectoral trade flow

	Sector 4	Sector 25	Sector 58	Sector 65	Sector 77	Sector 78
Presence of a foreign	1.218***	0.580***	1.714***	1.455***	1.332***	0.980***
service office	(0.062)	(0.034)	(0.069) (0.067)	(0.065)	(0.055)	
Distance (log)	-0.129***	-0.006	0.010	0.027	0.058***	-0.019
	(0.022)	(0.008)	(0.022)	(0.019)	(0.019)	(0.017)
Common border	0.079	0.245***	0.123	0.153**	0.104*	0.105**
	(0.085)	(0.072)	(0.078)	(0.069)	(0.053)	(0.052)
Common colonizer	0.013	-0.065***	-0.110	-0.192*	0.028	-0.052
	(0.088)	(0.012)	(0.086)	(0.114)	(0.062)	(0.077)
Common language	0.018	-0.037***	-0.063*	-0.129***	-0.164***	-0.024
	(0.036)	(0.011)	(0.036)	(0.036)	(0.035)	(0.030)
Religious similarity	0.001**	-0.001***	0.001***	0.001*	0.001***	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2990	2889	2990	2990	2990	2990

Included, but not reported, are exporter and importer fixed effects
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 17.
Second stage: Gravity regression for selected sectors

Dependent variable: Value of sectoral bilateral trade

	Sector 4	Sector 25	Sector 58	Sector 65	Sector 77	Sector 78
Distance (log)	-0.975***	-0.975***	-1.219***	-1.087***	-1.043***	-0.974***
	(0.155)	(0.174)	(0.068)	(0.072)	(0.056)	(0.090)
Common border	0.905***	-0.269	0.550***	0.484**	0.302	0.516**
	(0.228)	(0.404)	(0.196)	(0.214)	(0.199)	(0.234)
Common colonizer	0.384	0.981	0.806**	0.364	0.896***	0.942***
	(0.389)	(0.894)	(0.340)	(0.296)	(0.282)	(0.364)
Common language	0.597***	0.483**	0.425***	0.317***	0.787***	0.361***
	(0.137)	(0.238)	(0.090)	(0.096)	(0.084)	(0.110)
Religious similarity	0.003	0.00	0.000	0.004***	0.00	-0.002
(0.002)	(0.005)	(0.002)	(0.001)	(0.001)	(0.002)	
Observations	1385	551	1613	1832	2076	2067
R-squared	0.98	0.98	0.99	0.98	0.99	0.98
F-test (significance of	4.23	2.37	13.87	8.85	13.34	3.84
1st stage instruments)						
Prob(F>0)	0.00	0.02	0.00	0.00	0.00	0.00

Included, but not reported, are exporter and importer fixed effects
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Comment

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The paper by Segura-Cayuela and Vilarrubia tackles a relevant and difficult issue in international trade, namely the importance of uncertainty for trade flows, from a rather original perspective. The authors profit from a particularly interesting feature of the data, the presence of embassies and consulates in export markets, to ascertain the effect of these 'producers of information' on the export performance of the country of origin.

Their methodology, based on state-of-the-art econometrics, enables them to estimate the effect of these international promotion activities on both the extensive margin (the formation of new trade links) and the intensive margin (the increase of the volume of trade with already existing trading partners). For this purpose, they use aggregate export data as well as disaggregate trade data by industry.

The results they obtain are very interesting, and are crudely summarized in the following points:

1. The presence of foreign missions in a destination country raises the probability of trading with it by a sizable amount (between 11% and 18%).

2. The volume of trade with already existing partners is not affected by the presence of foreign missions.

3. The importance of the extensive margin is larger for more differentiated sectors, where uncertainty is supposed to be more

important, as quality comparisons here are more relevant than for homogeneous goods.

The relevance of these results is twofold. First, the immediate policy implications of the Segura-Vilarrubia estimates are rather striking, and cast serious doubts about the current practices of many governments: international promotion activities might be a waste of taxpayers' money if trade with the destination country is already taking place. Secondly, these empirical results characterize the stylized facts we want our theoretical models of uncertainty and trade to replicate: once information has reached a certain threshold and trade takes place, more information seems to be ineffectual.

My main (but minor) concern about the paper is the interpretation of the presence of foreign missions in potential/actual export markets as a source of information. In fairness to the authors, I should add that they have done their best to address this problem by instrumenting for the presence of foreign missions with the tourist attractiveness and geopolitical importance of the host country, as well as distance, colonial ties and common language.

However, one can still think of reasons why trade flows, tourist attractiveness, and the presence of foreign missions might be driven by the same 'omitted variable'. I will use an admittedly extreme example to illustrate my point: the fact that the United States has no foreign mission in Teheran probably does not explain why American exports to Iran are nil.

All in all, I think this is a very interesting, thought-provoking piece of research. After reading it, one cannot stop thinking about the importance of information for trade. With this paper the authors have opened a number of research lines (both theoretical and empirical) that constitute a very promising work agenda.

Geographic Neutrality: Measuring International Trade Integration*

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Abstract

Measuring the advances of International Trade Integration (ITI) requires standards. Under conditions of geographic neutrality, we define a benchmark (standard) of perfect international trade integration (SPITI), and present indicators for degree of openness, connectedness and integration for two opposite scenarios: when distance matters, and when it doesn't (geographic neutrality). We apply our indicators to data on trade flows for 59 countries –accounting for 96.7% of world output– for the 1967–2005 period, computing the indicators for each specific economy and also for the world economy. Results differ for each country but, in general, they show that the level of ITI is crucially determined by the degree of connectedness, yet its progress is more influenced by the degree of openness. In addition, several economies achieve high levels of ITI, but the relatively low degree of openness in some of the largest and wealthier economies jeopardizes the progress of complete world trade integration. However, for many of them, the level of trade integration is higher when controlling for distance. In either case (when distance matters, or when it does not), the world is still far from achieving the SPITI.

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1. INTRODUCTION

According to a recent state-of-the-art revision of economic globalization indicators (OECD, 2005), the current indicators do not reflect the new economic reality appropriately. There is no correspondence between the importance that international economic integration has acquired and the improvements in the available indicators, which are inordinately based on the old concept of market openness. However, measuring international integration is not only a question of increasing the openness of countries but also of developing a network of relations between countries which represents a progressive abolition of every possibility of remoteness.

McLuhan and Fiore (1968) proposed an early image of this process of globalization in the sixties, referring to the birth of a global village. From this perspective, and according to Scholte (2002), globalization is not a particularly intense form of internationalization, since it refers to a shift in the nature of social space involving a removal of barriers to transworld contacts, and it promotes transplanetary connectivity and supraterritorial links.

In order to judge whether we are approaching this state in the economic arena, and at what speed, we need standards for characterizing a world where frontiers and distance do not matter, and geographical dimensions are irrelevant. Following a suggestion by Frankel (2000), this study proposes a Standard of Perfect International Trade Integration (SPITI) describing the conditions under which the world trade would operate as a global village. This standard does not have a normative value; it represents a benchmark which not only requires countries to be more open, but also to obtain a full and geographically unbiased development of the network of connections linking economies. In this scenario, the maximum value of trade integration must be characterized so that it is possible to assess the gap between the current level of international trade integration (ITI) and its theoretical full potential.

From the wide range of literature on international economic integration indicators, two issues emerge as most relevant to our objective: the foundations of the indicators of integration –particularly, the rationale of the geographic orientation of bilateral trade flows– and the analysis of connections from a network perspective.

Traditionally, international economic integration indicators are classified into two broad categories, namely, price-based and quan-

tity-based indicators. Measures of integration based on prices are preferred by many scholars when considering an axiomatic criterion, i.e., the compliance with the law of one price (LOOP), in different geographical markets. However, empirically the LOOP does not seem to offer a very promising solution, since a unique price would only exist for homogeneous goods, yet not for others which could be differentiated. The most commonly used integration measure based on quantities is the degree of openness defined as exports plus imports divided by GDP (*(X+M)/GDP*). While this provides a straightforward approach, its principal disadvantage is that it completely disregards the architecture of trade connections that each country has with the rest of the world.

In order to develop a more general and theoretically founded indicator of ITI based on quantities, we will consider the literature on gravity equations, which represents the most empirically used approach to explain the rationale for bilateral trade flows. Basic gravity models state that economic interactions between two geographically defined entities, which in our case would be trade flows between countries, are proportional to the sizes (GDP) of these entities and inversely related to the distance between them (Combes, 2008). As indicated by Henderson and Millimet (2008), the reliance on the gravity model is not surprising, given its solid theoretical foundation and empirical success. Some authors such as Hummels and Levinsohn (1995) even consider that the gravity model yields "some of the clearest and most robust empirical findings in economics". The success of the gravity model explaining data increases the interest into giving the gravity equation a structural interpretation, in different ways. According to Harrigan (2003), the theoretically derived gravity model differs from the simple gravity equation because the first recognizes the role of relative distance effect, which results from applying the iceberg assumptions to bilateral distance between country pairs. Controlling for country size and bilateral distance, trade will be higher between country pairs that are far from the rest of the world than between country pairs that are close to the rest of the world (remoteness).

Many researchers use variants of the gravity equation as a benchmark for the volume of bilateral trade. From this perspective, the gap between observed trade flows and those predicted by the effects of GDP's and distances can be explained by a variety of reasons such as relative prices, comparative advantage and other barriers (Eaton and Kortum, 2002), borders, currency unions, WTO membership, insecu-

rity, institutions, etc. If geographic barriers are lifted –because transportation costs fall and economic frontiers reduce their relevance due to enhanced free trade, despite increasing political disintegration (Alesina and Spolaore, 1997)–, the effect of relative distance fades away and the shares of different countries in the imports/exports of a country ought to be closer to the GDP's shares. In the limiting scenario of abolition of every possibility of remoteness (Scholte, 2002), only the economic dimension of partners would matter.

The concept of geographic neutrality may be defined as the absence of preferential directions in trade flows: the geographic distribution of a country's trade is said to be neutral if the weight of every partner in the country's trade is equal to its weight in world trade (Kunimoto, 1977; Iapadre, 2006). The literature on regionalism has been using this concept to analyze its effects on the intensity of intra-regional and extra-regional trade, and the relevance of prioritizing some trade connections over others (see Krugman, 1996). The geographic neutrality scenario would be equivalent to what some gravity studies define as "zero gravity models" (see, for instance Eaton and Kortum, 2002), because distance does not matter and/or remoteness does not exist, but in general these ideas are at odds with the theses maintained by the advocates of gravity models, according to whom actual economies are still far from that scenario, and location does matter. Since output is still mostly physical stuff, its transportation entails costs which are not negligible as of today. However, as indicated by Quah (1996), location and physical geography are irrelevances in the economies constructed by Coyle (1997), since "all economically valuable things –database information, gene sequences, computer software, encryption and code-cracking algorithms– retain value independently of their physical manifestation". These extreme views hold strong similarities with maintainers of the geographic neutrality idea, which the media has been systematically referring to as the "global village".[1]

Analyzing the network relationships between economies in the age of globalization must take into account the complexity of connections. To uncover the structure of the trade network that economies forge, we can contemplate the relations, or flows, between them as the vectors of

1. These terms refer to the scenario in which every possibility of remoteness is progressively abolished. We consider interesting to use them interchangeably, since they represent the same idea treated by different stems of the literature; however, in order to keep the exposition as simplest as possible, we will mostly use the term "geographic neutrality" hereafter.

a graph in which the nodes represent countries, and then analyze the degree of connectedness in the network. Although these techniques are somewhat underused by economists, at least in comparison with other social sciences, this approach is not new in international economics, and has attracted recent interest (see, for instance Rauch, 1999, 2001; Rauch and Trindade, 2002; Rauch and Casella, 2003; Greaney, 2003; Pandey and Whalley, 2004; Combes *et al.*, 2005).

Our analysis of trade integration shares a characteristic with the network analysis approach: while the number of connections an economy has is important, the way in which they are distributed is also highly relevant. However, while the network analysis considers a set of useful statistics to uncover the topology of the World Trade Web (WTW), our integration index is specifically defined to measure how far/close the world economy is to a SPITI. Hence, our description of the economy as a network is aimed at studying which properties related to the advance of integration are verified, and at analyzing the evolution of some economic features.

Taking these issues into account, our paper proposes trade integration indicators aimed at filling some gaps in the literature. The core of the contribution is constituted by the SPITI concept, and a treatment of its components (degree of trade openness and degree of trade connection) that enables us to measure their importance and contribution in the advance of trade integration. This approach differs from the existing literature because it allows different and relevant dimensions of ITI to be combined in one single analysis.

The rest of the article is structured as follows. Section 2 presents the methodological contents of our approach to measure international economic integration. Sections 3 and 4 present the data set and empirical application, respectively, by considering data on exports of goods for a wide set of countries that account for most of world output and trade, and for a relatively long sample period (1967–2005). Section 5 concludes.

2. Integration trade indicators: definitions and properties

The international trade integration process starts with the openness of economies, but its effects and scope also depend on the structu-

re of current relations between them. Relevant aspects of this structure include the number of economies each one is in contact with, the proportionality of these flows to their sizes,[2] and the role of barriers –particulary distance. In order to characterize a benchmark of trade integration, we will define the Standard of Perfect International Trade Integration (SPITI) as an extension of concept of geographic neutrality (Kunimoto, 1977; Krugman, 1996; Iapadre, 2006), which covers the notion of a single space world. To analyze the evolution of trade integration from this perspective, we consider a set of properties that must be verified by a trade integration index.

Contrary to some common international trade integration indices, in our approach higher trade openness does not necessarily entail higher trade integration. An economy whose trade flows with the rest of the world are below those corresponding to its size is as far from being integrated as another economy whose trading flows are above that proportion. Both economies show an unbalanced situation between the intranational flows (i.e., the share of their GDP internally consumed) and the international flows (i.e., the exported share of their GDP) that is not in accordance with the geographic neutrality criterion. Under the neutrality assumption, there exists an optimal value for the international flows, and the following property must be verified:

- **Property 1. Domestic (home) neutrality:** An economy whose domestic demand is proportional to its share of the world GDP (Wolf, 2005; Alesina and Spolaore, 1997) will have a higher level of trade integration.

  Not only it is important the global trade flow an economy has, but also its distribution. Under geographic neutrality, when there are no regional preferences, the distribution of the flow of an economy between the destination economies should be characterized by their relative sizes. In this scenario, an economy has no preferences of any kind (social, political, geographical, etc.) for the direction of its flows, and they are only determined by the size of the recipient economies, as stated by the following property (P2),

2. This approach has several links with the literature on social networks. See, for instance, Annen (2003), Hanneman and Riddle (2005), Karlin and Taylor (1975), Wasserman and Faust (1992), or Wellman and Berkovitz (1988).

- **Property 2. Balanced relationships:** An economy that balances its relationships with other individual economies in proportion to their size will have a higher level of trade integration.

  An economy can deviate from perfect trade integration due to some of the factors mentioned above. The impact of this deviation on the trade integration of the world will depend on the size of every economy. When a large economy deviates from perfect trade integration, it reduces global integration to a larger extent than a small economy does. For example, the influence of the USA on global integration is necessarily higher than, for instance, that of Albania. Thus, the trade integration index should also be weighted by the size of the economies.
- **Property 3. Size:** The larger the economy is, the more relevant its trade integration will be for the world trade integration.

  We say that a world meets the SPITI if properties P1 to P3 are verified, constituting an extension of the concept of geographic neutrality. Given its wider coverage, we name it geographic *super-neutrality*.

  To determine the degree of trade integration we proceed in four stages, each one defining different indicators:

1. In the first stage we characterize the degree of trade openness. We start with the usual definition of openness found in the literature[3] but corrected for home bias to take into account the different sizes of the economies being compared.
2. In the second stage we analyze whether the connection of one economy with others is proportional to their size in terms of GDP, or whether this connection shows geographical bias, creating a gap with respect to the scenario of perfect world trade integration. Thus, we define the degree of balanced trade connection to measure the discrepancy between trade volumes in the real world and trade volumes corresponding to a perfectly integrated world.
3. From the above concepts, we define the degree of trade integration . This combines degrees of trade openness and balanced trade connection, provided that both set limits to the trade integration level achievable. We show that the degree of trade integration verifies the three properties listed above.

3. Namely, *(X+M)/GDP*, yet in our case only one flow direction (either exports or imports) is considered.

The analysis of the three indicators is conducted on two levels, namely, the individual level, which focuses on each economy, and the global level, which corresponds to the analysis of all economies, for which the weight of each economy enters the aggregated analysis.

2.1 Notation

Let $N = \{1,.... ,g\}$ be the set of economies and let i and j be typical members of this set. Let g be the number of elements in N, i.e., the number of economies in the analysis. Even when the following definitions should be indexed by the year, to clarify notation we will omit that index. Let Y_i be the size of economy $i \in N$, for example its GDP and let d_{ij} be the geographic distance between the economies i and j, where d_{ii} is the economy i's internal distance.

In order to compare economies that are not physically contiguous, we follow Samuelson´s (1954) standard iceberg assumption considering that if an economy j of size Y_j is carried as close to economy i as possible, then its size will reduce to Y_j/d_{ij}^{θ} (i.e., as stated by Samuelson´s (1954), "only a fraction of ice exported reaches its destination as unmelted ice"), where θ is a non-negative parameter measuring the impact of distance (the farther the economies are, the greater the reduction is, with an intensity that depends on the θ parameter). In the extreme case in which $\theta = 0$ the iceberg effect disappears.

We define a_i as the economy i's relative weight with respect to the world economy i.e., $a_i = Y_i / \sum_{j \in N} Y_j$ and r_i as the economy i's relative weight with respect to a world economy where the correction through distance has been done (distance corrected world) i.e., $r_i = (Y_i/d_{ii}^{\theta}) / \sum_{j \in N} (Y_j/d_{ij}^{\theta})$. . Notice that:

a. We also consider that there exists an iceberg effect on the home economy (due to countries' differing geographic sizes) or, equivalently, that transportation costs exist both for inter- and intranational trade.
b. The above definition does not depend on the units of measurement for the distance between economies, given that r_i can be written as $r_i = Y_i / \sum_{j \in N} (Y_j/(d_{ij}/d_{ii})^{\theta})$. This expression enables reinterpreting the effect of geographical distance as the one given by a normalized distance matrix between economies where every

internal distance of the economies is 1 and the distance from economy i to economy j is d_{ij}/d_{ii}, the times the geographical distance between these economies is bigger than the economy i's internal distance.

c. The impact of the distance depends on the θ parameter. In a world where distance is irrelevant, $\theta=0$ (geographic neutrality).

Given a measurable relationship between economies, we define the flow X_{ij} as the intensity of this relationship from economy i to economy j. The flow between economies can be evaluated through either the imports or the exports of goods, capital, or any other magnitude measured in the same units as Y_i. Moreover, in general the flow will be asymmetric, so that X_{ij} will not necessarily be equal to X_{ji}, for all $i,j \in N$. We also assume that $X_{ii}=0$ for all economy $i \in N$. All definitions in this study depend on the flow considered to measure the international trade integration.

2.2 Degree of trade openness

In the first stage we characterize the *degree of trade openness*. We start with the usual definition found in the literature but corrected for home bias in the distance-corrected world to take into account the differing sizes of the economies being compared.

If the orientation of output towards domestic demand is not biased, then its volume will not be the same for each economy since it depends on the relative sizes of the economies after considering the iceberg effect. In order to control for the magnitude of the home bias we define $\widehat{Y}_i$ as the trade flow from economy i to the rest of the world taking into account the share (in the distance-corrected world economy) of the economy under analysis, namely, $\widehat{Y}_i = Y_i - r_i Y_i$. Then, we define the relative flow or **degree of trade openness** between economies i and j as $DTO_{ij} = X_{ij}/\widehat{Y}_i$. Given that $X_{ii} = 0$, it follows that $DO_{ii} = 0$ for all $i \in N$.

Definition 1 Given an economy $i \in N$, we define its ***degree of trade openness***, DTO_i, as

$$DTO_i = \sum_{j \in N} DTO_{ij} = \frac{\sum_{j \in N} X_{ij}}{\widehat{Y}_i}. \tag{1}$$

By definition, the degree of trade openness is 1 if and only if the domestic neutrality property (P1) is verified. The degree of openness yields nonnegative results, where a value lower that 1 indicates that the economy is "under-open" to the world (its exports to the world are lower than those it should have according to its share of the world GDP); and a value higher that 1 indicates an "over-openness" to the world (economy *i*'s exports to the world are higher than those corresponding to its share of the world economy).

Differences in *DTO* across economies can be attributed to a variety of obstacles to integration (trade barriers, borders and political factors, etc.), as well as to cultural or political elements that promote integration (free trade agreements, common language, etc.), but differences cannot be due to the bias in the measure of openness, since we have corrected for home bias and the effect of geographical distance.[4]

2.2.1. Degree of balanced trade connection

In the second stage we analyze whether the connection of one economy with others is proportional to their relative sizes in terms of GDP,[5] (geographic superneutrality) or not, widening the gap from that scenario corresponding to a perfectly integrated world according to the balanced relationships property (P2). Thus, we define the *degree of balanced trade connection* to measure the discrepancy between the trade volumes in the real world and those trade volumes corresponding to the SPITI. Note that the SPITI varies according to the θ parameter; therefore, the economies will be closer of farther away depending on our assumption on how important distance is, which is measured by θ.

In the economic network, the relative flow from economy *i* to economy *j* in terms of the total flow of economy *i*, α_{ij}, is given by

$$\alpha_{ij} = \frac{X_{ij}}{\sum_{j \in N} X_{ij}} \tag{2}$$

4. We write *DTO* instead of DTO_i when general statements on the degree of openness are being made, or references to the variable itself, which do not hang on any specific economy. The same rule will be applied to the other indicators.

5. The dependence of both the number and magnitude of exchanges on economy size is the focus of international trade analyses based on gravity models and widely used in the literature (Hummels and Levinsohn, 1995; Feenstra *et al.*, 1998, 2001; Rauch, 1999).

(recall that we are assuming $X_{ii} = 0$). Let $A = (a_{ij})$ be the square matrix of relative flows: the component ij of matrix A is a_{ij}.

We consider that the world economy is perfectly connected if the flow between two economies is proportional to their relative sizes. Thus, if the world economy is perfectly connected, then the flow from economy i to economy j should be equal to $\beta_{ij}\widehat{Y}_{i\cdot}$, where

$$\beta_{ij} = \frac{Y_j/d_{ij}^{\theta}}{\sum_{k\in N\setminus i}(Y_k/d_{ik}^{\theta})} \tag{3}$$

is the relative weight of economy j in a distance-corrected world where economy i is not considered.

Note that $\sum_{j\in N\setminus i}\beta_{ij} = 1$ and that β_{ij} is the degree of openness between economies i and j in the perfectly connected world, with $\beta_{ii} = 0$. Let $B = (\beta_{ij})$ be the square matrix of degrees of openness in the perfectly connected world.

Considering the previously defined matrices, we can define an indicator that measures the distance between the real distribution of flows and that corresponding to a perfectly connected world, for which we use the cosine of the angle of the vector of relative flows with the vector of the flows in a perfectly connected world.

Definition 2 *Given an economy $i \in N$ we define the* ***degree of balanced trade connection*** *of i, $DBTC_i$, as*

$$DBTC_i = \frac{\sum_{j\in N}\alpha_{ij}\beta_{ij}}{\sqrt{\sum_{j\in N}(\alpha_{ij})^2}\sqrt{\sum_{j\in N}(\beta_{ij})^2}}. \tag{4}$$

Although the cosine of two vectors ranges between -1 and 1, the degree of balanced trade connection always takes nonnegative values given that both vectors have only nonnegative components. *DBTC* measures whether economies meet property P2, yielding a single value that equals 1 if and only if an economy meets the property of direct balanced relationships, and approaches zero for an economy whose flows are directed towards the smallest economies in the world.

2.3 Degree of trade integration

From the concepts introduced above, we define the *degree of trade integration*, which combines degrees of trade openness and balanced

trade connection, and for both of them we set limits to the integration level achievable:

Definition 3 *Given an economy $i \in N$ we define its* ***degree of trade integration****, DTI_i, as*

$$DTI_i = \sqrt{\min\{DTO_i, 1/DTO_i\} \cdot DBTC_i} \tag{5}$$

The degree of trade integration of an economy is the geometric average of its deviation from the unbiased degree of trade openness and balanced trade connection, thus *DTI* depends on both the openness of the economy and the balance in its trade flows.

To characterize the trade integration of the world economy as a whole, we should consider the share of each economy in the world (property P3) to define the global indicator as follows,

Definition 4 *We define the* ***degree of world trade integration*** *as*

$$DWTI = \sum_{i \in N} a_i DTI_i. \tag{6}$$

where $a_i = Y_i / \sum_{j \in N} Y_j$.

The *DWTI* indicator is the most general quantitative approximation to the international integration of economies, as it considers not only the degree of openness but also the distribution and size of the flows between economies. In light of the different concepts included in this definition, the indicator will be considered as a Integration Index for the world economy, according to properties P1 to P3. The degree of global integration measures how close the world is to the SPITI, and it should be equal to 1 when all economies are perfectly integrated and achieve their theoretical full potential of integration, i.e., they have neutral degrees of openness (taking into account domestic and foreign demand) and the flows between economies are proportional to the share of each economy in the world.

2.4. Other global indicators

In the previous subsections we have defined several indicators that characterize the components of trade integration for each individual

economy which, likewise the degree of trade integration, can also be summarized for the whole economy:

Degree of world trade openness:

$$DWTO = \sum_{i \in N} a_i DTO_i. \tag{7}$$

Degree of world balanced trade connection:

$$DWBTC = \sum_{i \in N} a_i DBTC_i. \tag{8}$$

3. DATA

To apply our indicators we require information on the volume of trade flows and the volume of activity and distance. Our indicators consider the two main regressors included in any gravity equation, i.e., the size of the trading economies and the distance between them. One of their advantages is that, instead of providing us with information as to whether these variables are important for trade flows, it will be possible to measure the gap from the scenario of complete trade integration in goods under different hypotheses on the impact of distance. The measure of trade flows used in this paper is the volume of bilateral exports and the measure of activity is GDP. The international trade integration indicators may well be used to study the evolution of other international flows such as financial assets, immigration or tourism.

We use data on bilateral trade flows from the `CHELEM` data set[6] corresponding to 59 countries accounting for 96.7% of world output and 86.5% of international trade.[7]

The available information covers a relatively long period of time, from 1967 to 2005, uncovering entirely what some authors have termed the second wave of globalization (O´Rourke and Williamson.,

6. Information on `CHELEM` (*Comptes Harmonisés sur les Echanges et l'Economie Mondiale*), or Harmonised Accounts on Trade and The World Economy) database is available at `URL` `http://www.cepii.fr/anglaisgraph/bdd/chelem.htm.` Data compiled by CEPII, Paris.

7. The computations for indicators based on imports do not alter the general results, although they may differ for some specific countries. These results are not reported due to space limitations, but are available from the authors upon request.

1999, 2002; Maddison, 2001). The data set also contained information for other countries, yet it was not available for all sample years, thus we disregarded it.

As stated above, two types of distances are considered. The distance from country i to country j (d_{ij}) is measured by the distance between the main city of the country which, in most cases, is the capital of the country. The CHELEM data set also provides data for internal distances (d_{ii}). See Head and Mayer (2002) for details.[8]

4. RESULTS

Table 1 reports information on the relative weight of each country in terms of world GDP (a_i) for 1967, 1986 and 2005, and its distance-corrected counterpart (r_i). This indicator represents the share corresponding to domestic demand in each country when the economic dimension of the rest of the world is corrected for relative distances. That correction implies a general and substantial increase in the weight of domestic demand. Consequently, although the U.S. share of world GDP (a_i) almost triples that of Japan as of 2005, the home and distance bias (r_i) is larger for Japan, because of Japan's relative remoteness and shorter internal distances. Indeed, the r_i top-ten is constituted by Japan, Singapore, Hong Kong, U.S., South Korea, Taiwan, Italy, U.K., Germany, and Spain, i.e., these are countries that will trade less not only because of the intranational home bias effect but also because of their bilateral and internal distances. Should this effect be removed, some countries would fall sharply in the ranking (Hong Kong, Singapore, Taiwan), whereas some others would join this top-ten group (China, Canada, the Former USSR), basically big countries in which internal distances are relevant. Although both indicators are designed to measure countries' importance in GDP terms, we have that $\sum_{i=1}^{N} a_i = 1$, whereas $\sum_{i=1}^{N} r_i \neq 1$, due to the effect of distance, both internal and bilateral.

Thus we control for two effects captured by a_i and r_i. The a_i parameter controls for the home bias effect, in order to account for the fact that large countries trade less because of the size of markets

8. See also www.cepii.fr/anglaisgraph/bdd/distances.htm.

(Alesina and Spolaore, 2003); this fact is related to the effect of intranational trade (see Wolf, 2000).[9] Correcting for home bias yields a degree of openness in which the denominator is the home bias-corrected GDP, i.e., $\widehat{Y}_i = Y_i - a_i Y_i$. However, not only the home bias but also distances will affect trade openness, as suggested by the vast literature on gravity models (see Anderson and van Wincoop, 2003, 2004; Leamer and Levinsohn,1995, and Section 1).

Correlation between a_i and r_i is 0.7331, i.e., the magnitude of the bias is slightly different when only size is taken into account (large countries trade less because of the size of markets effect) than when both size and distance (both international and intranational) enter the analysis (distant countries trade less with other countries, as the literature on gravity predicts).

4.1. Degree of trade openness, degree of balanced trade connection and degree of trade integration

Results for the degree of trade openness are shown in Table 2, for individual countries and selected years, and Figure 1, which reports the evolution of some summary statistics. We provide results on both $\theta = 0$ and $\theta = 1$, i.e., the scenarios of geographic neutrality,[10] and non zero-gravity. This indicator reflects some of the findings achieved when examining r_i. There are countries such as Hong Kong, Japan, Singapore or Taiwan for which the effect of distance, both internal and bilateral, causes a deep impact on the degree of trade openness in 2005. These countries share several characteristics, but those which cause them to move up in the ranking relate to their remoteness (high) and their internal distances (low, either because of the country size or their density).

On average, the degree of trade openness has more than doubled (for $\theta = 0$) and almost tripled (for $\theta = 1$) from 1967 to 2005.

9. Some authors such as McCallum (1995) or Helliwell and McCallum (1995) have documented the magnitude of this effect, finding that Canadian provinces trade approximately ten times more with other Canadian provinces than with equidistant and equisized U.S. states. This type of effects have also been referred to by the literature as the "border effect" (see Evans, 2003; Parsley and Wei,2001; Chen, 2004). As indicated by Wolf (2000), trade barriers, both formal and informal, might provide reasonable reasons for these findings. However, they are not the only explanations since, as shown by Aviat and Coeurdacier (2007), even for bilateral asset holdings –for which some trade barriers are obviously lifted– the border effect also matters.

10. To which we can refer interchangeably as zero-gravity, or distance irrelevance.

Comparing $DTO_i^{\theta=0}$ to $DTO_i^{\theta=1}$, accounting for distance makes the degree of trade openness increase from 32.09% to 40.71% (year 2005). The upper panels in Figure 1 show the evolution of $DTO^{\theta=0}$ and $DTO^{\theta=1}$ summary statistics (mean, weighted mean, and median). In all cases there is a sharp increase, although the effect is dimmed for the larger countries, especially under geographic neutrality. Additional statistics would provide the reader with more painstaking details on the distributions; however, the violin plots[11] displayed in the lower panels summarize virtually all information a given distribution can convey. They show that not only has the openness of economies increased substantially over the last forty years but also that the shape of the distribution is changing, becoming flatter due to the variety of behaviors. Although there is still an important number of countries whose degrees of openness are low (below 20%), most of them have moved to higher degrees. By 1967, probability mass was overwhelmingly located below 20%, whereas the result is reversed by 2005.

Results for the degree of world trade openness (*DWTO*) correspond to the evolution of the weighted mean in both upper panels. They are also reported in Table 3, given our special interest in finding integration indicators. It would suggest *how open* the world economy is (in terms of trade volumes), and it is apparent that if we recognize that distance matters, the level of trade openness is higher. In both instances, however, the degree of trade openness advances at a similar pace: in the economy where distance is irrelevant ($\theta = 0$), the increase is from 8.03% to 20.84%, and in case location mattered ($\theta = 1$), the increase is higher (from 12.13% to 32.27%). However, the analysis by subperiods discloses additional results: under $\theta = 0$, the highest increase took place after 1986, whereas for $\theta = 1$ it occurred before. This finding may be explained by the role of countries such as Japan, which is big in GDP terms (therefore its behavior affects the evolution of *DWTO*), which is distant, and whose $DTO_i^{\theta=1}$ increased sharply before 1986.

Table 4 displays results for the degree of balanced trade connection ($DBTC_i^{\theta=0,1}$). The most apparent feature is that they are much

11. Violin plots are a mix between box plots and density functions estimated nonparametrically via kernel smoothing, to reveal structure found within the data. Box plots show four main features of a variable: center, spread, asymmetry and outliers. The density trace, which in the case of violin plots is duplicated for illustrating purposes, supplements this information by graphically showing the distributional characteristics of batches of data such as multi-modality. See Hintze and Nelson (1998).

closer to the economies' theoretical full potential (100%) than the *DTO*, particularly when distance matters ($\theta = 1$). However, on average the increases have been more modest than in the degree of trade openness case, yet initial levels were already high. These tendencies are common under geographic neutrality and $\theta = 1$, although the increase has been even more modest in this last case.

Figure 2 shows the evolution of basic summary statistics over the 1967–2005 period. The values corresponding to the degree of world balanced trade connection (DWBTC) are also reported in Table 5. In contrast to the result obtained for the degree of trade openness, the wealthier countries are those with highest degrees of balanced trade connection. These values peaked before the 1990s. The most interesting results, however, emerge when dropping the physical irrelevance assumption and distance enters the analysis. It is especially noticeable how the violin plots' shape varies: whereas by 1967 the range of behaviors in *DBTC* terms was quite wide, by 2005 it had shrunk dramatically, and all countries lie above *DBTC=70%*. Therefore, once the downward impact of distance on the volume of trade is controlled for, countries export more "proportionally" to the size of their trading partners. In other words, if as found and predicted by gravity models distance matters, and its importance does not seem to diminish strongly over time despite the decline in transportation costs, the current level of balanced connections would already be high. However, the balance would be lessened from the geographic neutrality perspective, for which distance becomes irrelevant.

The degree of trade integration results from combining the effects of the *DTO* and the *DBTC*. Their values for individual countries in 1967, 1986 and 2005 are displayed in Table 6. The relevant message is not only that it indicates the level of international trade integration achieved by each country but, more importantly, that it indicates how far each country is from its theoretical full potential for trade integration. Many countries are more integrated when controlling for distance, but there are notable exceptions to this rule, whose degrees of trade integration decrease. The interpretation for these particular cases is straightforward: these are countries whose export flows suffer from a "distance bias", the major trading partners for these countries are remotely located– i.e., in the case of distance being relevant, they should export more to their geographic neighbors. Therefore, it is obvious that this type of result only arises for countries sharing several characteristics, among which we might consider the fact of being

surrounded by developing countries (e.g., Algeria, Gabon, Nigeria, Pakistan and, to a lesser extent, Chile) or being highly exporting countries whose trading partners are physically distant (China, Malaysia and Singapore). On the other hand, some of the countries for which distance matters (i.e., for which results differ widely depending on the assumption on θ) are Austria, Belgium, Denmark, Finland, Italy, Spain, or the U.S., i.e., advanced economies which are members of regional trade agreements, and whose trading partners are physically close. Therefore, although the literature has documented that the impact of distance is strong and not diminishing over time, we should add that according to our integration measures, its impact *depends* on the country under analysis.

The evolution of the summary statistics is depicted in Figure 3. The specific values for the degree of world trade integration (*DWTI*) are reported in Table 7. The general assessment of the level of world trade integration (*DWTI*) as of 2005 is that, in the case of distance still being relevant, we are already halfway to the theoretical full potential for world trade integration. However, from the geographic neutrality perspective in which distance becomes an irrelevancy, the process is still in a previous stage, since the degree of world integration decreases sharply (from 50.96% to 35.48%). However, as suggested by both the dispersion statistics in Table 6 and the violin plots in Figure 3, the variety of behaviors is wide: the standard deviation has increased sharply (although the coefficient of variation has declined due to the growing average), and probability mass becomes increasingly spread, suggesting that some countries are quite close to the SPITI, yet many others are still far– although the prevailing picture is that trade integration is advancing.

The relative contributions of the *DTO* and the *DBTC* to the *DTI* are reported in Table 8, for the three selected years, and for both θ values under consideration. It is based on the decomposition of $1 = (DTO_i/DTI_i)^{1/2} \times (DBTC_i/DTI_i)^{1/2}$, where the first component in the right hand side is the relative contribution of *DTO* to the integration, whereas the second term refers to the relative contribution of *DBTC*. Although the magnitude of the *DBTC* contribution clearly surpasses that of the *DTO*, the gap has been shrinking, as shown by declining means (see the bottom of the Table). This finding is more apparent through Figure 4, which visually confirms the results in Table 8, for either geographic neutrality or $\theta = 1$. Therefore, both *DTO* and *DBTC* components are relevant for trade integration and,

although the contribution of *DBTC* is much higher, the increasing openness of economies could eventually reverse this result.

All calculations have been performed for two different scenarios, that of geographic neutrality ($\theta = 0$) and that of gravity ($\theta = 1$). The effect of θ is not negligible, although the magnitude of the divergences varies both depending on the different indicators, and also over time. Figure 5 provides us with this type of information. Each row shows the effect of distance ($\theta = 0$ vs. $\theta = 1$) for each indicator (*DTO*, *DBTC*, and *DTI*), and within each row we have the comparison for the initial year (1967), final year (2005), and all years. In general, the indices decrease if the standards correspond to a world where distance is irrelevant. For the *DTO*, the effect of distance is only relevant for some countries, and it also increases over time, as observations tend to abandon the 45-degree line. In the case of *DBTC*, the effect is stronger, and time also contributes to these differing results. The combined effect of *DTO* and *DBTC* results into Figure 5.a, 5.b, and 5.c: the effect of distance is remarkable, especially for the most internationally integrated countries.

4.2. The relations between the different indicators

Table 9 presents Spearman correlation matrices between different indicators for the three selected years. Notable among these results is the low (and negative) correlation between *DTO* and *DBTC*, which shows their independence from each other, and the irrelevance of the differences in correlations associated with the different θ values.

In addition, Table 9 shows that the correlations between *DTO* and *DTI* are also high, indicating that the degree of trade openness is quite relevant in explaining the degree of trade integration distribution. The correlation between *DTO* and the most widely used indicator of openness, namely, *(X+M)/GDP*, is also high, as we might expect. Correlation between *DTO* and trade balance (*(X-M)/GDP*), or comparative advantage (*(X-M)/(X+M)*) is high as well, yet far less important than in the case mentioned above but increase substantially during the analyzed period.

The degree of balanced trade connection (*DBTC*) presents low correlations with the degree of trade integration, and is negative with *(X+M)/GDP*. In turn, its correlations both with the trade balance and the comparative advantage are positive and higher, particularly in the

last period and for $\theta = 0$ indicators.

The degree of trade integration shows similar relatively high correlations with *(X+M)/GDP*, (*(X-M)/GDP*), and the comparative advantage (*(X-M)/(X+M)*), particularly in the recent years and for $\theta = 0$. The latter two indicators are also strongly correlated with each other, but not with the traditional degree of trade openness (*(X+M)/GDP*).

4.3. Country groupings: GDP, per capita GDP, and geography

Apart from the relations between our basic indicators of interest, we can also analyze how they relate to different country groupings. In particular, we find that it is difficult to identify any sort of clear association between the average values of the two dimensions of integration according to geographical areas (Table 10), according to economy size (GDP) (Table 11), or according to per capita GDP (Table 12), although this classification reveals distinctive features for some of the indicators. In particular, we may observe that the Eastern European economies stand out for their high levels of openness, but low levels of connectedness, whereas those in South and Southeast Asia excel in both regards. We can also point to low trade openness in North America, Australasia, and South America, although for this case *DTC* is the highest indicator. The highest *DTI* levels are found in Asia (South and Southeast), whereas North America ranks lowest.

Another trend worthwhile pointing out is the diverse effect of distance on the different country groupings. Accordingly, for clusters based on geography, the differences derived from considering either $\theta = 0$ or $\theta = 1$ are important in Europe, North America and Australasia, yet much more unimportant in South America, Africa and South and Eastern Asia. These data allow us to consider the hypothesis that in those regions of the world where developing countries prevail, trade integration is more strongly linked to the "global village" idea, whereas distance becomes more relevant for advanced economies. Although this hypothesis requires formal testing, the idea is confirmed through tables 11 and 12, according to which those countries with the lowest levels of GDP (both in absolute terms and per capita) are barely affected by reducing the θ parameter from 1 to 0 (geographic neutrality), in contrast to what occurs for the wealthier countries.

5. Conclusions

The aim of this article was to provide a Standard of Perfect International Trade Integration (SPITI), following the early proposals by Frankel (2000). According to our standard, the level of international trade integration for each particular economy and for the world economy as a whole advances because of two main effects. First, we consider it important to be more open, as recognized by the international economics literature. However, we also consider that it is highly relevant for trade integration to account for both the number of trade partners and their relative size, i.e., that economies should export in proportion to the size of the recipient economies. These ideas have also been developed by the network approach to the world trade web, which considers world trade as a network in which countries represent the nodes, and exports and imports represent the flows between them.

According to this rationale, our degree of trade integration indicator is made by the degree of openness, and by the degree of balanced trade connection. Our indicators take into account some additional issues. First, the degree of trade openness considers the ideas by Alesina and Spolaore (1997), amongst others, who find that the benefits of trade openness and economic integration become larger for small countries and, consequently, there exists a home bias effect–-large countries trade less because of the size of their markets. Second, both the degree of trade openness and the degree of balanced trade connection have been designed to accommodate the effect of distance among countries. Therefore, we can contemplate a variety of scenarios, from geographic neutrality (Kunimoto, 1977; Kurgman, 1996; Iapadre, 2006) or zero-gravity (Eaton and Kortum, 2002), according to which distance becomes irrelevant, to other possible cases where the importance of distance still holds.

We apply our indicators to a sample of 59 countries accounting for 96.7% of world output and 86.5% of world trade for the 1967–2005 period. We find that both the degree of trade openness and the degree of balanced trade connection have been advancing rapidly, yet substantial differences exist between them. On the one hand, the degree of trade openness is much lower than the degree of balanced trade connection, both at the beginning and the end of the sample period. However, its increase has been much faster, especially when distance matters. On the other hand, the degree of balanced

trade connection has increased much more slowly, yet this result is partly expectable due to their already high levels as of 1967, for both scenarios of distance's relevancy.

The degree of trade integration results from combining *DTO* and *DBTC*. We find that, in the case of distance being important, the world is still halfway to its theoretical full potential of trade integration, as indicated by a degree of world trade integration of 50.96%. Under geographic neutrality, for which distance becomes irrelevant, the indicator declines to 35.48%. However, although the gap is remarkable, the effect of distance is highly non-linear, as it affects different countries in different ways: whereas developed countries used to be more affected by distance, developing countries show an inverse pattern. Of special note is the case of some countries (highly open, small, or surrounded by poor countries) whose exports are distance-biased– i.e., distance causes and adverse effect, since they export more to distant countries rather than to their neighbors.

Another potentially relevant result stems from from the growing correlation between the degree of connection and integration indicators with those corresponding to trade balance and comparative advantage. This increasing correlation could suggest that, in today's world, each country's international competitiveness depends increasingly not only on its degree of openness but also on the balance of its trade network. This is an interesting hypothesis which deserves further investigation.

The observed heterogeneity of the degrees of trade openness and balanced trade connection for economies of differing sizes causes the integration indicator to be affected by the lower degree of trade integration of some of the largest and wealthier economies. These results may lead us to question further issues. First, we may investigate the likely causes for the differences between countries in terms of their degrees of trade integration, trade openness and balanced trade connection. The literature on international economic integration has explored many factors, but mostly under the assumption that openness and integration are one and the same thing. Once the role of the degree of connection has been introduced, we may reconsider the relevance of economy size, language, colonial or political relationships, currency, trade or tariff agreements, etc., and also other factors such as economic and technological development, specialization, or human capital endowments, reexamining their importance in rela-

tion to the degree of openness or connection, and their eventual impact on trade integration.

Our future research agenda comprises some additional related questions which have not been formally examined in this article. Specifically, the results may naturally arise some questions such as whether those countries for which distance is more relevant are members of Free Trade Agreements (FTA) and, therefore, there could be two forces pushing in opposite directions: whereas FTA membership creates a bias to trade regionally, declining transportation costs encourage trade with distant countries. If the opposite effects offset mutually, then we might be facing likely explanations for the "missing globalization puzzle" (Coe *et al.*, 2002), i.e., the failure of declining trade-related costs to be reflected in estimates of the standard gravity model of bilateral trade.

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Table 1.
GDP shares of world GDP (*a* and *r*) (%)

	a_i			r_i		
	1967	**1986**	**2005**	**1967**	**1986**	**2005**
Albania	0.03	0.02	0.02	1.41	0.65	0.81
Algeria	0.15	0.46	0.24	0.80	2.36	1.20
Argentina	1.09	0.79	0.42	14.25	11.00	6.09
Australia	1.44	1.32	1.69	16.32	14.19	17.39
Austria	0.52	0.70	0.70	9.11	12.11	12.14
BLEU	0.94	0.89	0.94	12.93	11.94	12.08
Brazil	1.38	1.92	1.83	10.00	14.25	13.90
Brunei Darussalam	0.01	0.02	0.01	2.01	4.59	3.85
Bulgaria	0.21	0.15	0.07	4.33	3.27	1.46
Canada	2.91	2.63	2.61	3.12	3.21	3.42
Chile	0.31	0.13	0.26	7.98	3.54	7.40
China, PR	3.25	2.10	5.15	17.04	9.34	20.51
Colombia	0.26	0.25	0.28	3.67	3.80	4.35
Denmark	0.57	0.61	0.58	13.22	14.31	13.52
Ecuador	0.07	0.07	0.08	2.09	2.43	2.87
Egypt	0.25	0.26	0.21	3.02	3.22	2.54
Finland	0.42	0.52	0.44	4.84	6.49	5.83
Former Czechoslovakia	0.62	0.38	0.40	10.16	6.53	6.73
Former USSR	7.92	4.38	2.28	18.06	10.63	5.63
Former Yugoslavia	0.47	0.38	0.27	8.92	7.57	5.34
France	5.30	5.44	4.94	25.15	25.78	22.65
Gabon	0.01	0.02	0.02	0.45	0.93	0.67
Germany	5.02	6.19	6.43	27.29	32.40	32.50
Greece	0.46	0.45	0.66	10.16	10.29	14.47
Hong Kong	0.12	0.29	0.42	41.80	59.76	66.48
Hungary	0.21	0.17	0.25	3.88	3.27	4.76
Iceland	0.03	0.03	0.04	0.84	0.88	1.16
India	2.20	1.75	1.94	19.13	15.61	16.62
Indonesia	0.27	0.57	0.66	5.16	9.57	10.43
Ireland	0.15	0.20	0.46	3.13	4.20	8.99
Israel	0.18	0.21	0.29	12.94	15.44	20.26
Italy	3.66	4.42	4.14	33.93	38.90	36.95
Japan	5.54	14.23	10.67	68.08	85.46	78.04
Malaysia	0.16	0.20	0.30	6.39	7.16	9.49
Mexico	1.23	0.98	1.77	11.57	10.06	17.36
Morocco	0.14	0.12	0.12	1.58	1.43	1.36
Netherlands	1.13	1.29	1.46	14.64	15.97	17.15
New Zealand	0.28	0.21	0.25	16.18	12.27	14.31
Nigeria	0.23	0.14	0.23	4.24	2.67	4.24
Norway	0.43	0.54	0.69	4.70	6.15	7.71
Pakistan	0.33	0.23	0.26	5.10	3.69	4.09
Peru	0.27	0.13	0.18	4.71	2.41	3.45
Philippines	0.33	0.22	0.24	12.14	6.87	7.13
Poland	0.79	0.55	0.70	8.20	6.12	7.83
Portugal	0.26	0.27	0.43	6.88	7.11	10.49
Romania	0.43	0.25	0.23	6.19	3.85	3.58
Singapore	0.05	0.14	0.30	34.16	54.76	70.58
South Korea	0.21	0.80	1.89	8.92	21.96	39.69
Southafrican Union	0.61	0.54	0.61	13.68	12.60	13.79
Spain	1.42	1.76	2.61	13.92	16.74	23.00
Sweden	1.22	1.00	0.82	11.26	9.73	8.15
Switzerland	0.78	1.00	0.84	14.95	18.25	15.55
Taiwan	0.17	0.55	0.85	14.13	30.89	39.43
Thailand	0.25	0.31	0.43	7.41	8.14	10.36
Tunisia	0.05	0.06	0.07	0.94	1.21	1.23
Turkey	0.74	0.54	0.83	6.98	5.46	8.28
United Kingdom	4.99	3.98	5.19	32.99	27.34	33.05
United States	37.11	31.82	29.01	69.92	66.77	63.99
Venezuela	0.43	0.41	0.27	5.99	6.18	4.31
Mean	1.69	1.69	1.69	12.76	13.79	15.26
Standard deviation	4.97	4.55	4.09	13.94	16.85	17.74
Coefficient of variation	2.93	2.69	2.41	1.09	1.22	1.16

Table 2.
Degree of trade openness (*DTO*), individual countries (%)

	$DTO_i^{\theta=0}$			$DTO_i^{\theta=1}$		
	1967	**1986**	**2005**	**1967**	**1986**	**2005**
Albania	1.01	9.14	7.02	1.02	11.28	7.07
Algeria	19.46	13.99	39.49	19.49	14.84	39.88
Argentina	5.40	5.57	19.15	6.19	5.82	20.31
Australia	9.46	9.70	13.51	11.14	11.03	16.09
Austria	14.40	22.35	35.83	15.61	24.97	40.51
BLEU	32.10	53.09	81.85	36.46	59.85	92.25
Brazil	5.90	7.67	13.11	6.40	8.22	14.95
Brunei Darussalam	53.88	75.61	91.59	54.99	84.46	95.25
Bulgaria	4.43	4.55	35.90	4.63	9.50	36.41
Canada	16.44	22.81	32.47	16.48	23.73	32.70
Chile	11.11	22.01	31.48	12.04	21.70	33.91
China, PR	1.54	7.21	36.25	1.80	8.89	43.26
Colombia	7.84	13.54	16.44	7.97	13.35	17.14
Denmark	18.44	22.06	29.32	21.01	25.43	33.72
Ecuador	13.72	23.81	30.41	13.99	24.44	31.28
Egypt	9.95	9.53	11.64	9.75	8.35	11.92
Finland	15.36	21.72	31.60	15.93	23.05	33.43
Former Czechoslovakia	4.76	6.99	47.68	5.27	30.91	50.92
Former USSR	1.47	3.85	25.40	1.65	6.86	26.30
Former Yugoslavia	11.29	18.89	19.90	11.94	21.74	20.97
France	8.82	15.00	20.25	11.12	19.13	24.89
Gabon	31.89	33.76	57.82	32.01	34.08	58.20
Germany	19.45	29.59	35.25	24.91	38.51	48.86
Greece	4.54	8.02	5.24	4.92	8.86	6.09
Hong Kong	40.05	46.59	10.87	68.73	115.36	32.28
Hungary	8.76	13.90	49.83	9.10	34.62	52.20
Iceland	18.07	33.60	19.54	18.15	31.87	19.76
India	2.62	3.46	9.10	3.10	3.89	10.71
Indonesia	14.67	18.08	31.47	15.42	20.19	34.91
Ireland	21.72	43.92	54.05	22.38	45.96	59.16
Israel	12.75	20.57	31.52	14.61	24.27	39.40
Italy	10.05	15.10	19.89	14.62	23.63	30.24
Japan	7.46	11.23	13.63	22.07	66.27	55.41
Malaysia	32.76	48.30	107.92	34.94	50.23	118.88
Mexico	4.20	17.00	27.71	4.69	18.68	33.02
Morocco	12.25	15.22	21.47	12.33	14.57	21.74
Netherlands	24.90	48.91	49.34	28.72	45.14	58.69
New Zealand	16.51	17.21	17.11	19.64	19.90	19.92
Nigeria	13.89	38.02	43.56	14.47	40.79	45.40
Norway	15.86	24.73	33.36	16.52	22.36	35.93
Pakistan	5.63	7.02	8.39	5.90	7.02	8.73
Peru	10.92	13.31	18.74	11.30	13.25	19.38
Philippines	10.12	16.22	50.53	11.48	16.84	54.28
Poland	4.76	6.29	23.18	5.14	14.14	24.98
Portugal	8.83	18.09	18.34	9.45	19.30	20.41
Romania	4.60	12.64	25.87	4.88	16.67	26.77
Singapore	38.75	70.66	89.19	58.80	157.64	302.25
South Korea	6.42	27.88	32.15	7.04	35.43	52.27
Southafrican Union	9.11	13.45	18.01	10.49	15.22	20.76
Spain	4.07	10.19	16.23	4.65	12.00	20.53
Sweden	15.55	25.96	35.32	17.11	28.47	38.12
Switzerland	19.47	25.64	33.60	22.60	30.97	39.42
Taiwan	16.63	49.22	49.01	19.34	70.76	80.25
Thailand	8.83	17.13	52.99	9.51	17.85	58.87
Tunisia	9.77	18.59	32.66	9.80	18.35	33.04
Turkey	3.05	7.21	16.77	3.20	7.28	18.13
United Kingdom	11.27	19.10	16.91	15.95	23.80	23.95
United States	5.31	6.62	8.40	11.09	12.24	16.56
Venezuela	15.31	13.49	37.97	16.21	14.66	39.54
Mean	13.35	21.27	32.09	15.60	27.94	40.71
Standard deviation	10.37	15.89	21.22	13.30	26.64	40.99
Coefficient of variation	0.78	0.75	0.66	0.85	0.95	1.01

Table 3.
Degree of world trade openness (*DWTO*), 1967–2005 (%)

	$DWTO^{\theta=0}$	$DWTO^{\theta=1}$
1967	8.03	12.13
1968	8.44	12.91
1969	8.90	13.67
1970	9.53	14.65
1971	9.53	14.70
1972	9.80	15.31
1973	11.04	17.34
1974	13.27	20.87
1975	12.25	18.94
1976	12.76	20.02
1977	12.81	20.59
1978	12.87	21.79
1979	14.18	22.81
1980	15.11	24.20
1981	14.63	24.75
1982	14.07	23.33
1983	13.84	23.58
1984	14.63	25.73
1985	14.25	24.92
1986	13.53	25.66
1987	13.99	26.69
1988	14.18	28.25
1989	14.62	28.33
1990	14.81	27.42
1991	14.52	27.84
1992	14.54	28.20
1993	14.38	29.61
1994	15.25	31.12
1995	16.38	32.42
1996	16.61	30.60
1997	17.51	31.63
1998	17.47	30.59
1999	17.41	31.24
2000	18.85	34.37
2001	18.28	31.44
2002	18.24	30.35
2003	18.78	30.38
2004	20.12	32.01
2005	20.84	32.27

Table 4.
Degree of balanced trade connection (*DBTC*), individual countries, 1967–2005 (\%)

	$DBC_i^{\theta=0}$			$DBC_i^{\theta=1}$		
	1967	**1986**	**2005**	**1967**	**1986**	**2005**
Albania	14.86	16.51	22.18	65.24	40.77	72.89
Algeria	20.38	65.99	82.25	55.63	90.93	78.28
Argentina	54.70	75.84	55.74	55.68	82.29	70.02
Australia	59.68	67.47	57.85	68.96	85.80	77.21
Austria	34.98	33.45	42.66	80.82	84.67	88.52
BLEU	40.68	40.00	48.25	86.00	93.82	92.77
Brazil	91.33	97.07	89.48	91.52	99.08	91.37
Brunei Darussalam	0.40	43.21	49.72	3.29	81.91	80.99
Bulgaria	25.03	44.58	40.21	66.89	31.75	86.47
Canada	95.73	89.74	88.38	98.44	99.91	99.97
Chile	62.71	88.17	88.02	57.90	90.36	81.43
China, PR	15.02	85.31	97.77	34.61	80.83	79.14
Colombia	92.34	89.42	87.30	94.33	93.00	95.59
Denmark	40.69	53.59	51.30	74.15	88.82	87.58
Ecuador	86.54	88.68	88.77	83.97	96.81	97.35
Egypt	38.09	40.18	79.81	67.26	68.90	89.15
Finland	44.78	39.03	48.86	77.92	85.90	86.11
Former Czechoslovakia	29.29	28.63	35.18	72.63	27.57	90.61
Former USSR	34.09	39.75	65.45	58.49	40.68	87.50
Former Yugoslavia	44.98	34.68	38.64	89.08	72.67	90.17
France	40.81	50.40	56.64	80.33	91.27	84.87
Gabon	27.70	51.11	89.28	36.48	58.72	83.58
Germany	54.35	59.18	63.24	85.83	92.53	87.28
Greece	65.41	44.25	50.70	88.43	83.37	88.63
Hong Kong	92.43	90.95	67.10	73.84	57.36	72.50
Hungary	23.72	40.57	39.54	71.88	50.32	83.44
Iceland	66.21	76.87	52.02	76.55	80.15	70.91
India	71.10	89.85	92.88	80.74	90.61	89.47
Indonesia	44.17	72.57	69.24	60.14	91.59	91.66
Ireland	26.95	40.07	76.27	75.09	87.43	85.64
Israel	77.59	93.37	90.73	76.26	81.27	73.82
Italy	57.72	59.69	63.77	90.82	97.13	97.08
Japan	94.76	96.37	83.70	89.61	95.02	95.22
Malaysia	64.75	72.69	85.93	76.71	90.02	91.23
Mexico	95.07	89.84	87.74	99.29	99.23	98.69
Morocco	28.36	34.60	34.96	58.02	63.70	71.38
Netherlands	32.64	36.64	43.24	93.70	93.00	86.39
New Zealand	44.82	75.90	66.95	43.94	86.56	83.81
Nigeria	37.72	87.66	89.79	48.42	94.41	85.46
Norway	43.47	37.72	47.42	77.51	75.62	85.19
Pakistan	70.58	83.29	95.11	65.68	81.08	73.81
Peru	89.96	97.91	90.61	87.79	96.73	92.73
Philippines	76.16	96.24	75.86	86.44	83.39	88.61
Poland	51.92	39.48	35.82	73.75	62.46	86.24
Portugal	53.90	48.53	41.11	72.27	83.05	88.58
Romania	27.73	70.77	42.49	61.86	80.75	89.27
Singapore	22.44	82.31	54.50	44.37	80.04	77.60
South Korea	84.27	96.67	69.48	80.30	58.18	75.96
Southafrican Union	60.05	83.10	77.62	61.83	86.72	80.38
Spain	73.95	57.45	44.24	94.15	94.61	87.25
Sweden	46.60	60.33	69.03	70.06	84.48	91.69
Switzerland	64.46	57.22	64.87	91.61	92.91	91.98
Taiwan	95.09	95.40	63.34	79.86	59.91	77.09
Thailand	52.10	89.44	85.87	65.27	90.50	94.59
Tunisia	27.61	28.34	30.88	80.75	78.26	77.43
Turkey	79.97	55.19	58.65	87.37	82.59	91.60
United Kingdom	76.15	75.24	77.24	61.89	80.91	82.33
United States	56.79	59.59	57.59	93.49	96.54	90.51
Venezuela	92.43	90.83	88.07	95.70	99.34	98.51
Mean	54.55	64.90	64.94	73.23	80.82	85.86
Standard deviation	25.04	23.15	20.16	18.04	17.09	7.64
Coefficient of variation	0.46	0.36	0.31	0.25	0.21	0.09

Table 5.
Degree of world balanced trade connection (*DWBTC*) (%),1967–2005

	$DWBTC^{\theta=0}$	$DWBTC^{\theta=1}$
1967	57.66	82.42
1968	58.96	83.90
1969	58.26	84.22
1970	60.38	83.21
1971	59.46	84.60
1972	61.12	86.20
1973	63.97	86.67
1974	64.29	87.24
1975	62.56	88.11
1976	63.04	89.04
1977	62.74	89.52
1978	65.23	90.72
1979	65.55	90.69
1980	66.32	89.38
1981	66.93	89.05
1982	67.57	88.69
1983	66.90	89.65
1984	67.75	90.66
1985	67.33	89.78
1986	67.13	89.66
1987	68.02	90.07
1988	69.47	91.44
1989	70.38	91.28
1990	70.27	90.67
1991	69.63	90.82
1992	68.84	90.66
1993	67.11	90.16
1994	67.03	90.15
1995	67.16	89.76
1996	67.47	89.42
1997	66.90	89.08
1998	66.99	89.45
1999	67.20	89.29
2000	67.70	88.78
2001	67.66	89.54
2002	66.87	89.56
2003	65.89	89.48
2004	65.22	89.08
2005	67.10	88.80

Table 6.
Degree of trade integration (*DTI*), individual countries (%), 1967–2005

	$DTI_i^{\theta=0}$			$DTI_i^{\theta=1}$		
	1967	**1986**	**2005**	**1967**	**1986**	**2005**
Albania	3.87	12.29	12.48	8.17	21.45	22.70
Algeria	19.91	30.39	56.99	32.93	36.73	55.87
Argentina	17.18	20.56	32.67	18.57	21.88	37.71
Australia	23.76	25.59	27.96	27.71	30.76	35.24
Austria	22.44	27.34	39.10	35.52	45.98	59.88
BLEU	36.13	46.08	62.85	56.00	74.93	92.51
Brazil	23.21	27.29	34.26	24.20	28.54	36.96
Brunei Darussalam	4.65	57.16	67.48	13.45	83.18	87.83
Bulgaria	10.54	14.24	38.00	17.59	17.37	56.11
Canada	39.67	45.25	53.57	40.27	48.69	57.17
Chile	26.40	44.05	52.64	26.40	44.28	52.54
China, PR	4.81	24.79	59.53	7.89	26.81	58.51
Colombia	26.91	34.80	37.89	27.42	35.24	40.48
Denmark	27.39	34.38	38.79	39.47	47.53	54.34
Ecuador	34.46	45.95	51.95	34.28	48.64	55.18
Egypt	19.47	19.57	30.48	25.61	23.99	32.60
Finland	26.22	29.12	39.29	35.23	44.50	53.65
Former Czechoslovakia	11.81	14.14	40.96	19.56	29.19	67.93
Former USSR	7.08	12.37	40.78	9.84	16.70	47.97
Former Yugoslavia	22.53	25.60	27.73	32.61	39.75	43.48
France	18.97	27.50	33.87	29.89	41.79	45.96
Gabon	29.72	41.54	71.85	34.17	44.73	69.74
Germany	32.51	41.85	47.21	46.24	59.69	65.30
Greece	17.23	18.84	16.31	20.87	27.18	23.24
Hong Kong	60.84	65.09	27.00	71.24	70.52	48.38
Hungary	14.41	23.75	44.39	25.57	41.74	66.00
Iceland	34.59	50.82	31.88	37.27	50.54	37.43
India	13.64	17.62	29.07	15.81	18.77	30.95
Indonesia	25.45	36.22	46.68	30.45	43.01	56.57
Ireland	24.19	41.95	64.21	41.00	63.39	71.18
Israel	31.45	43.82	53.48	33.38	44.41	53.93
Italy	24.09	30.02	35.61	36.44	47.91	54.18
Japan	26.59	32.90	33.78	44.47	79.35	72.64
Malaysia	46.06	59.25	96.30	51.77	67.25	87.60
Mexico	19.99	39.08	49.31	21.58	43.05	57.08
Morocco	18.64	22.94	27.40	26.75	30.47	39.39
Netherlands	28.51	42.33	46.19	51.88	64.79	71.21
New Zealand	27.20	36.14	33.85	29.38	41.51	40.86
Nigeria	22.89	57.73	62.54	26.47	62.06	62.29
Norway	26.25	30.54	39.77	35.78	41.12	55.33
Pakistan	19.94	24.19	28.25	19.68	23.86	25.38
Peru	31.34	36.10	41.21	31.50	35.80	42.39
Philippines	27.76	39.51	61.91	31.50	37.47	69.35
Poland	15.72	15.75	28.82	19.47	29.72	46.41
Portugal	21.82	29.63	27.46	26.13	40.04	42.51
Romania	11.29	29.91	33.16	17.37	36.69	48.89
Singapore	29.48	76.27	69.72	51.08	71.26	50.67
South Korea	23.27	51.91	47.26	23.77	45.40	63.01
Southafrican Union	23.39	33.43	37.38	25.47	36.33	40.85
Spain	17.36	24.20	26.79	20.92	33.70	42.32
Sweden	26.92	39.58	49.38	34.62	49.04	59.12
Switzerland	35.43	38.31	46.68	45.50	53.64	60.21
Taiwan	39.77	68.53	55.72	39.30	65.11	78.66
Thailand	21.45	39.14	67.46	24.91	40.19	74.63
Tunisia	16.42	22.96	31.76	28.13	37.89	50.58
Turkey	15.62	19.95	31.36	16.72	24.51	40.75
United Kingdom	29.30	37.90	36.14	31.41	43.89	44.40
United States	17.36	19.86	21.99	32.20	34.38	38.71
Venezuela	37.62	35.00	57.83	39.39	38.16	62.41
Mean	23.95	34.46	42.99	30.55	42.82	53.21
Standard deviation	10.20	14.17	15.57	12.10	15.69	15.50
Coefficient of variation	0.43	0.41	0.36	0.40	0.37	0.29

Table 7.
Degree of world trade integration (*DWTI*) (%), 1967–2005

	$DWTI^{\theta=0}$	$DWTI^{\theta=1}$
1967	20.30	30.41
1968	21.02	31.53
1969	21.32	32.45
1970	22.34	33.30
1971	22.22	33.47
1972	22.78	34.37
1973	24.76	36.83
1974	27.37	40.49
1975	26.00	38.97
1976	26.58	40.13
1977	26.62	40.66
1978	27.26	42.13
1979	28.73	43.38
1980	30.04	44.40
1981	29.63	44.59
1982	29.02	43.27
1983	28.55	43.51
1984	29.69	45.53
1985	29.10	44.48
1986	28.24	44.66
1987	28.92	45.82
1988	29.53	47.56
1989	30.13	47.85
1990	30.43	47.21
1991	30.14	47.58
1992	30.14	47.97
1993	29.55	48.81
1994	30.32	50.11
1995	31.37	51.13
1996	31.73	49.90
1997	32.47	50.67
1998	32.39	50.09
1999	32.40	50.61
2000	33.74	52.80
2001	33.12	51.08
2002	32.98	50.13
2003	33.19	49.91
2004	34.16	50.93
2005	35.48	50.96

Table 8.

Degree of trade integration for individual countries (*DTI*) and its decomposition into degree of trade openness (*DTO*) and degree of balanced trade connection (*DBTC*)[a] (%), 1967–2005

	$\sqrt{DBTC_i^{\theta=0}/DTI_i^{\theta=0}}$			$\sqrt{DBTC_i^{\theta=1}/DTI_i^{\theta=1}}$		
	1967	**1986**	**2005**	**1967**	**1986**	**2005**
Albania	195.87	115.92	133.34	282.52	137.88	179.17
Algeria	101.17	147.37	120.13	129.98	157.33	118.37
Argentina	178.43	192.05	130.61	173.17	193.95	136.27
Australia	158.50	162.38	143.84	157.75	167.01	148.02
Austria	124.85	110.61	104.46	150.85	135.70	121.58
BLEU	106.11	93.17	87.63	123.93	111.89	100.14
Brazil	198.36	188.61	161.62	194.47	186.33	157.23
Brunei Darussalam	29.39	86.95	85.84	49.46	99.24	96.03
Bulgaria	154.14	176.97	102.87	195.00	135.20	124.14
Canada	155.34	140.83	128.44	156.34	143.25	132.23
Chile	154.13	141.47	129.31	148.10	142.85	124.49
China, PR	176.64	185.50	128.15	209.41	173.64	116.30
Colombia	185.24	160.30	151.80	185.46	162.45	153.67
Denmark	121.88	124.85	115.01	137.06	136.70	126.95
Ecuador	158.48	138.92	130.71	156.52	141.08	132.82
Egypt	139.87	143.29	161.82	162.05	169.46	165.38
Finland	130.68	115.79	111.50	148.71	138.94	126.69
Former Czechoslovakia	157.47	142.28	92.68	192.68	97.18	115.50
Former USSR	219.37	179.28	126.69	243.85	156.06	135.05
Former Yugoslavia	141.28	116.40	118.04	165.28	135.22	144.00
France	146.65	135.39	129.32	163.94	147.78	135.89
Gabon	96.54	110.93	111.47	103.32	114.57	109.47
Germany	129.30	118.92	115.74	136.24	124.50	115.61
Greece	194.86	153.26	176.33	205.86	175.14	195.30
Hong Kong	123.25	118.21	157.63	101.81	90.19	122.41
Hungary	128.27	130.70	94.38	167.67	109.80	112.44
Iceland	138.34	122.98	127.75	143.32	125.93	137.64
India	228.34	225.80	178.73	225.98	219.68	170.02
Indonesia	131.74	141.54	121.79	140.54	145.93	127.29
Ireland	105.54	97.73	108.99	135.33	117.44	109.69
Israel	157.07	145.97	130.26	151.15	135.27	117.00
Italy	154.80	141.00	133.82	157.86	142.38	133.86
Japan	188.76	171.16	157.42	141.96	109.43	114.49
Malaysia	118.57	110.76	94.46	121.73	115.70	102.05
Mexico	218.07	151.62	133.40	214.52	151.82	131.49
Morocco	123.35	122.80	112.96	147.28	144.59	134.61
Netherlands	107.00	93.03	96.75	134.39	119.81	110.15
New Zealand	128.37	144.91	140.64	122.30	144.42	143.22
Nigeria	128.38	123.23	119.82	135.26	123.34	117.13
Norway	128.67	111.13	109.19	147.19	135.61	124.09
Pakistan	188.15	185.57	183.49	182.68	184.36	170.54
Peru	169.43	164.68	148.28	166.94	164.36	147.90
Philippines	165.63	156.08	110.69	165.66	149.19	113.04
Poland	181.76	158.30	111.49	194.62	144.97	136.31
Portugal	157.19	127.98	122.35	166.29	144.03	144.35
Romania	156.73	153.83	113.20	188.71	148.36	135.13
Singapore	87.23	103.89	88.41	93.20	105.98	123.75
South Korea	190.30	136.46	121.25	183.78	113.20	109.79
Southafrican Union	160.22	157.66	144.10	155.80	154.49	140.28
Spain	206.42	154.09	128.49	212.16	167.56	143.58
Sweden	131.57	123.47	118.24	142.25	131.25	124.53
Switzerland	134.89	122.22	117.88	141.90	131.61	123.59
Taiwan	154.63	117.99	106.62	142.55	95.92	99.00
Thailand	155.86	151.16	112.83	161.85	150.06	112.59
Tunisia	129.67	111.12	98.61	169.42	143.71	123.73
Turkey	226.23	166.34	136.76	228.57	183.55	149.93
United Kingdom	161.21	140.89	146.18	140.36	135.78	136.17
United States	180.86	173.21	161.81	170.41	167.57	152.90
Venezuela	156.76	161.09	123.41	155.87	161.35	125.64
Mean	151.83	140.68	125.58	161.41	142.24	131.03
Standard deviation	36.94	28.06	22.87	37.95	25.92	20.01
Coefficient of variation	0.24	0.20	0.18	0.24	0.18	0.15

a Expression $\sqrt{DBTC_i/DTI_i}$ is derived from the decomposition $1 = \sqrt{\frac{DTO_i}{DTI_i}}\sqrt{\frac{DBTC_i}{DTI_i}}$. Therefore, $\sqrt{DTO_i/DTI_i}$ is obtained straightforarwardly.

Table 9.

Spearman correlation matrices among the different indicators, 1967, 1986 and 2005

	$DTO^{\theta=0}$	$DTO^{\theta=1}$	$DBTC^{\theta=0}$	$DBTC^{\theta=1}$	$DTI^{\theta=0}$	$DTI^{\theta=1}$	$(X+M)/GDP$	$(X-M)/GDP$	$(X-M)/(X+M)$
Year 1967									
$DTO^{\theta=0}$	1.0000	0.9579	-0.0942	-0.0784	0.7298	0.8056	0.9614	0.1009	0.3379
$DTO^{\theta=1}$		1.0000	-0.0256	-0.0140	0.7494	0.8628	0.8991	0.1539	0.3918
$DBTC^{\theta=0}$			1.0000	0.6009	0.4925	0.1856	-0.1159	0.0602	0.0664
$DBTC^{\theta=1}$				1.0000	0.2943	0.3411	-0.0456	-0.1002	-0.0746
$DTI^{\theta=0}$					1.0000	0.8543	0.6781	0.1290	0.2996
$DTI^{\theta=1}$						1.0000	0.7704	0.0050	0.2351
$(X+M)/GDP$							1.0000	-0.1071	0.1168
$(X-M)/GDP$								1.0000	0.9299
$(X-M)/(X+M)$									1.0000
Year 1986									
$DTO^{\theta=0}$	1.0000	0.8671	0.0195	0.0764	0.8708	0.9009	0.9689	0.3288	0.3615
$DTO^{\theta=1}$		1.0000	0.0056	0.0015	0.7648	0.9380	0.8140	0.3600	0.4092
$DBTC^{\theta=0}$			1.0000	0.3944	0.4663	0.1400	-0.0560	0.2414	0.2553
$DBTC^{\theta=1}$				1.0000	0.2693	0.2561	-0.0258	0.3009	0.2740
$DTI^{\theta=0}$					1.0000	0.8548	0.7989	0.4609	0.4832
$DTI^{\theta=1}$						1.0000	0.8300	0.3958	0.4408
$(X+M)/GDP$							1.0000	0.1451	0.1732
$(X-M)/GDP$								1.0000	0.9448
$(X-M)/(X+M)$									1.0000
Year 2005									
$DTO^{\theta=0}$	1.0000	0.9127	-0.0347	0.0300	0.8645	0.8636	0.8766	0.5974	0.5749
$DTO^{\theta=1}$		1.0000	0.0164	0.0254	0.8207	0.9477	0.8236	0.5942	0.5802
$DBTC^{\theta=0}$			1.0000	0.2158	0.4167	0.0666	-0.2489	0.5437	0.5155
$DBTC^{\theta=1}$				1.0000	0.1611	0.2291 &	-0.0665	0.1587	0.1641
$DTI^{\theta=0}$					1.0000	0.7998	0.6378	0.8208	0.7872
$DTI^{\theta=1}$						1.0000	0.7537	0.6263	0.6063
$(X+M)/GDP$							1.0000	0.2386	0.2133
$(X-M)/GDP$								1.0000	0.9663
$(X-M)/(X+M)$									1.0000

Table 10.
Degree of trade openness, degree of balanced trade connection and degree of trade integration, weighted means, country groups according to geography, 2005

Region	*DTO*		*DBTC*		*DTI*	
	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$
Western Europe[a]	27.46	35.23	60.20	87.71	39.21	54.36
Eastern Europe[b]	26.75	28.46	55.60	87.40	37.51	49.15
North America[c]	11.31	18.69	61.60	91.68	25.91	41.13
South America[d]	18.40	19.99	84.88	89.08	38.59	41.44
Africa[e]	25.91	27.46	75.09	81.21	42.78	46.07
Asia (South and Southeastern)[f]	32.68	50.97	84.11	88.54	45.56	47.08
Asia (Eastern)[g]	23.13	52.40	84.83	87.63	42.94	67.58
Australasia[h]	13.98	16.58	59.03	78.07	28.73	35.97

a France, BLEU, Germany, Italy, Netherlands, U.K., Ireland, Denmark, Finland, Norway, Sweden, Iceland, Austria, Switzerland, Spain, Greece, Portugal.
b F. Yugoslavia, F. USSR, Bulgaria, Former Czechoslovakia, Hungary, Poland, Romania, Albania, Turkey, Israel.
c United States, Canada, Mexico.
d Venezuela, Ecuador, Brazil, Argentina, Chile, Colombia, Peru.
e Southafrican Union, Algeria, Morocco, Tunisia, Egypt,Nigeria, Gabon.
f Indonesia, Singapore, Malaysia, Philippines, Thailand, Brunei D., India, Pakistan.
g Japan, South Korea, Hong Kong, Taiwan, China PR.
h Australia, New Zealand.

Table 11.
Degree of trade openness, degree of balanced trade connection and degree of trade integration, weighted means, country groups according to GDP, 2005

Region	*DTO*		*DBTC*		*DTI*	
	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$
Group 1[a]	17.38	29.91	67.98	89.31	33.30	50.08
Group 2[b]	32.52	38.90	63.92	88.56	42.63	56.20
Group 3[c]	27.33	31.61	59.90	84.81	38.71	49.96
Group 4[d]	42.44	64.98	70.81	86.06	50.83	53.82
Group 5[e]	27.50	28.30	71.45	85.47	42.25	47.44

a United States, Japan, Germany, United Kingdom, France, Italy, China PR, Canada, Spain, F. USSR, South Korea, India.
b Mexico, Australia, Netherlands, Brazil, BLEU, Switzerland, Sweden, Turkey, Taiwan, Austria, Norway, Denmark.
c Poland, Indonesia, Greece, Southafrican Union, Finland, Ireland, Thailand, Hong Kong, Portugal, Argentina, F.Czechoslovakia, Israel.
d Malaysia, Venezuela, Singapore, F.Yugoslavia, Hungary, New Zealand, Colombia, Chile, Philippines, Algeria, Pakistan, Romania.
e Peru, Egypt, Nigeria, Morocco, Ecuador, Tunisia, Bulgaria, Iceland, Albania, Gabon, Brunei Darussalam.

Table 12.
Degree of trade openness, degree of balanced trade connection and degree of trade integration, weighted means, country groups according to per capita GDP, 2005

Region	*DTO*		*DBTC*		*DTI*	
	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$	$\theta = 0$	$\theta = 1$
Group 1[a]	15.06	29.83	64.47	90.44	29.19	49.89
Group 2[b]	25.06	35.00	62.02	88.54	38.72	52.09
Group 3[c]	34.19	44.94	65.69	86.43	45.91	59.32
Group 4[d]	23.60	25.24	73.37	87.59	40.29	46.11
Group 5[e]	28.46	33.16	92.03	83.25	49.51	50.49

a Norway, Switzerland, Ireland, Denmark, Iceland, United States, Sweden, Japan, United Kingdom, Austria, Netherlands, BLEU.

b Finland, France, Germany, Australia, Canada, Italy, Hong Kong, Spain, Singapore, New Zealand, Greece, Israel.

c Portugal, Brunei Darussalam, South Korea, Taiwan, Hungary, F.Czechoslovakia, Mexico, Poland, Chile, Malaysia, Gabon, Turkey.

d F.Yugoslavia, Venezuela, Argentina, Southafrican Union, Romania, Bulgaria, Brazil, Tunisia, F.USSR, Thailand, Algeria, Peru.

e Albania, Ecuador, Colombia, Morocco, China PR, Philippines, Indonesia, Egypt, India, Nigeria, Pakistan.

Figure 1.
Degree of trade opennes (*DTO*), 1967-2005

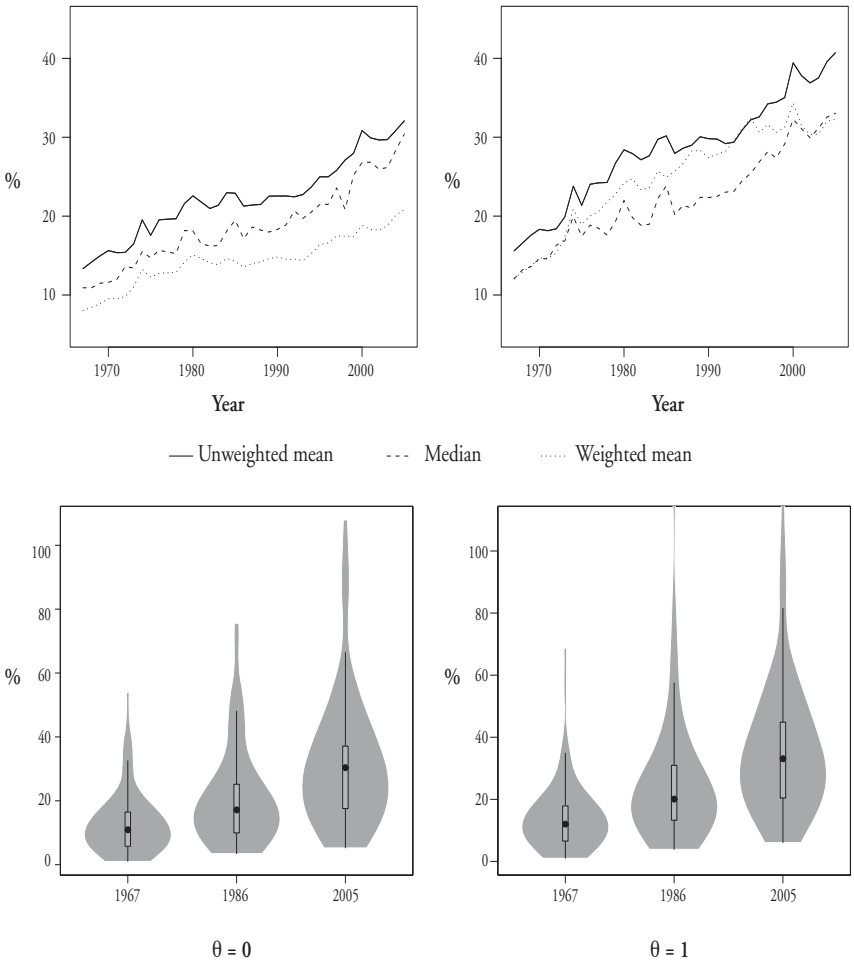


Figure 2.
Degree of balanced trade connection (*DBTC*), 1967-2005

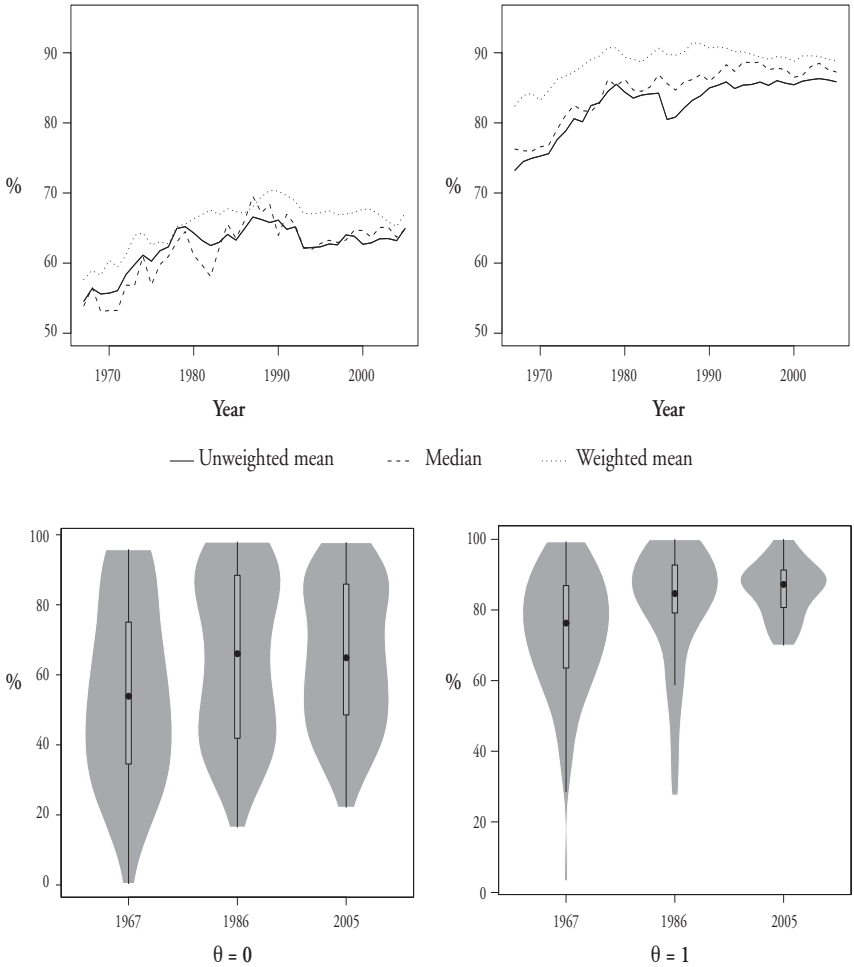


Figure 3.
Degree of trade integration (*DTI*), 1967-2005

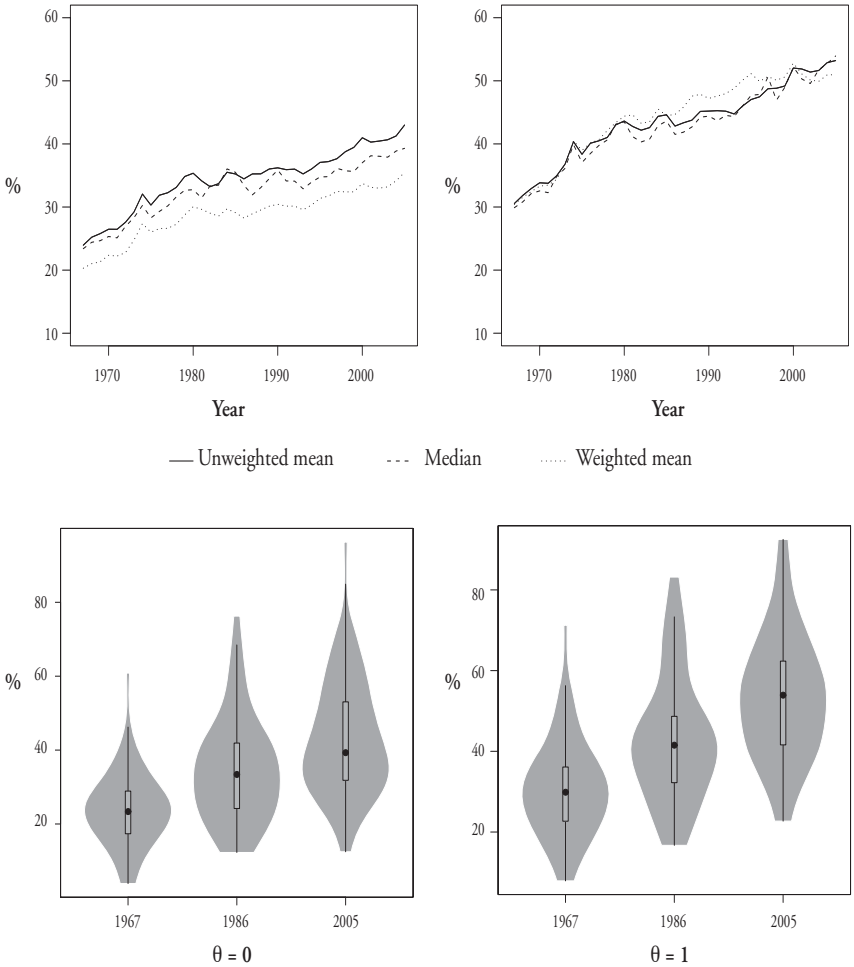


Figure 4.
Evolution of $\sqrt{DTO_i/DTI_i}$ vs $\sqrt{DBTC_i/DTI_i}$ (means), 1967-2005

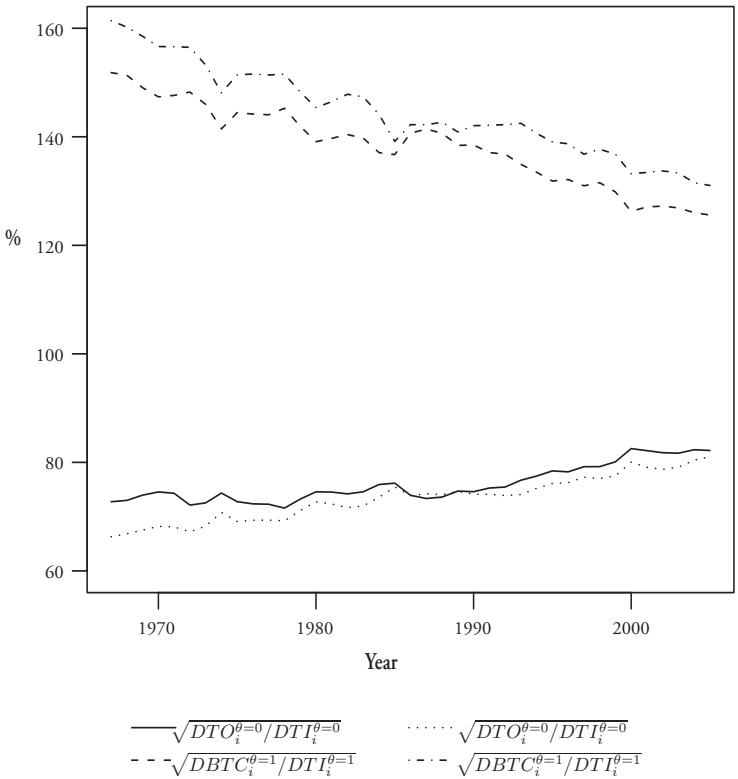
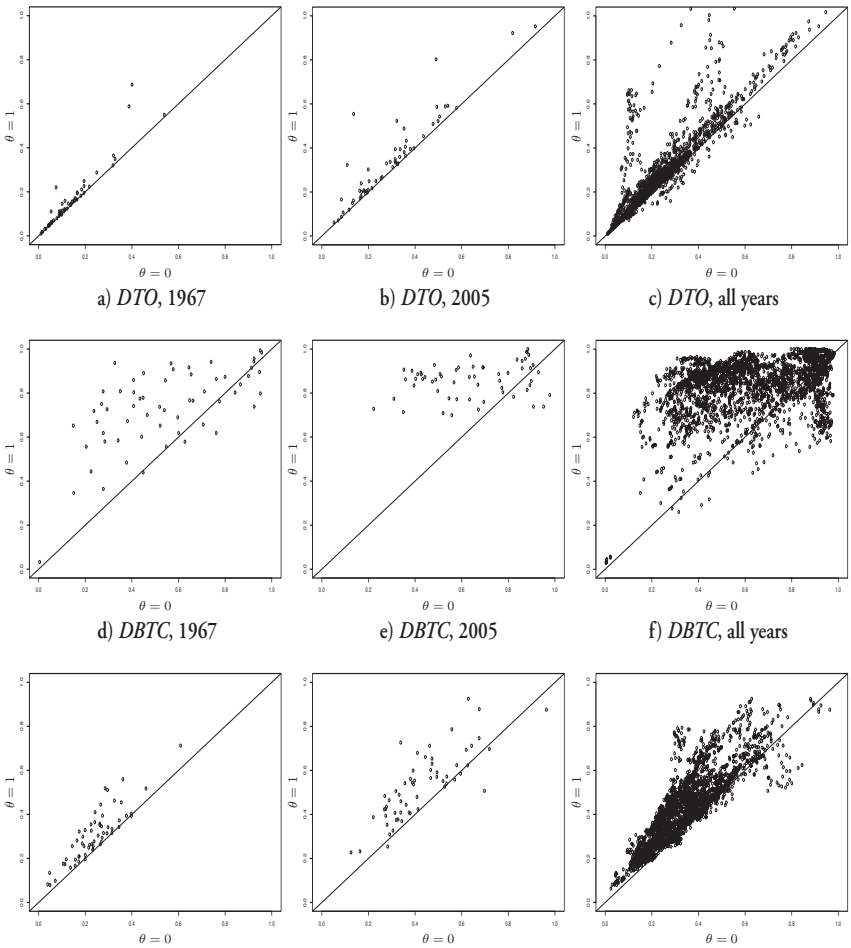


Figure 5.
Relative positions for *DTO*, *DBTC* and *DTI*, θ = 0 vs. θ = 1



a) *DTO*, 1967 b) *DTO*, 2005 c) *DTO*, all years

d) *DBTC*, 1967 e) *DBTC*, 2005 f) *DBTC*, all years

g) *DTI*, 1967 h) *DTI*, 2005 i) *DTI*, all years

Comment

Enrique López-Bazo
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The paper of Arribas, Pérez and Tortosa-Ausina aims to provide a new indicator for quantifying the degree of economic globalization, which includes more information than the one traditionally considered in the *old concept of market openness*. In doing so, the authors follow Frankel's (2000) suggestion of defining a benchmark of a standard perfect international trade integration (SPITI) with two dimensions, namely: i) openness, and ii) network connections. These two dimensions are combined to produce an indicator of trade integration (ITI) which is compared with its theoretical full potential. The ITI thus measures the distance between the situations of the real world and the SPITI world. The authors base their definition of SPITI on three properties, P1.- Domestic neutrality, P2.- Balanced trade relationships, and P3.- Size, which in addition allow them to define the partial and global indicators of integration. The partial indicators define a measure of the degree of trade openness (DTO), and a measure of the degree of balanced trade connection (DBTC), based respectively on P1 and P2. Finally, the global indicator is defined as a measure of the degree of trade integration (DTI) obtained by geometrically combining the two partial indicators. Partial and global indicators can be obtained for each economy and then added up by using P3 to provide the indicators for the world economy as a whole.

It should be stressed that the paper takes into account only economic globalization, in spite of the fact that this process also has a social, political, and cultural dimension. Additionally, the authors associate economic globalization with international economic inte-

gration, which, following Rodrik (2000), can be defined as *the process of increasing the connectivity and interdependence of the world's markets and businesses. Results in convergence of prices, products, wages, interest rates and profits*. This process can be favoured by the reduction in transportation and communication costs in the private sector and by a reduction in policy barriers in the public sector. In other words, international economic integration means increasing cross-border transactions in goods and services, that is, increasing international trade, but also in financial assets, direct capital investments, labour services, and technology. The indicators proposed and, particularly, the reasoning in the paper are related to the first type of transaction, but it would be interesting to investigate the possibility of applying them to measure integration in other dimensions. In the case of financial assets and foreign direct investment flows the procedure could be quite straightforward, while my feeling is that suitable indicators for the labour force and technology would demand further developments.

In the final version of the paper the authors have incorporated ideas from the literature regarding the gravity equation for the bilateral trade flows, controlling by the distance in their indicators. In this way, they define a benchmark SPITI world of *geographic superneutrality*, in the sense that distance does not matter and/or remoteness does not exist. Actually, all the indicators are obtained by comparing the situation in the real world with a benchmark in which distance matters and another one in which it does not. The comparison of the two sets of results allows the authors to offer insights into the effect of distance on the degree of trade integration. Undoubtedly this is an important point as it is advisable to adjust outcome-based measures of international economic integration based on quantities for the potential influence of country size and geographical isolation. It could also be thought that factor endowments and the stage of development might have a role, although their inclusion in the indicators would be more problematic. In any case, the raw measure of distance used by the authors might be questioned as in some cases geographic distance may not be a good proxy for economic distance. Using the example by Conley and Ligon (2002), *the United States may be farther from Mexico than it is from Canada in economic sense, while Hong Kong and Britain may be rather close*. Conley and Ligon suggest alternative measures of distance which help to determine the degree to which countries share common markets, based on the cost of trans-

porting physical and human capital between each pair of countries. The use of these alternative measures of economic distance in future developments and applications of indicators of economic integration should provide additional, and probably more reliable, information on the degree of economic globalization.

The empirical application uses bilateral exports for 59 countries from 1967 to 2005. As this period covers what is known as the *second wave of globalization*, the evolution of the partial and global indicators would be expected to reveal a clear trend towards further trade integration. Results for the DTI indicate that the world is still far from the theoretical full potential of trade integration, in spite of the increase observed until the end of the eighties. For their part, the results for the partial indicators reveal that the degree of balanced trade connection is much higher than that of trade openness, which is particularly low in some of the larger, wealthier economies. Actually, the low value for the DTO indicator in those countries has a strong effect on the world-wide indicator of trade integration. Finally, the results obtained under the assumption of geographic neutrality point to a lower degree of openness, balanced connection and, thus, integration, when compared to those in the case in which distance is still important. However, the effect of distance on (the indicators of) trade integration is not homogeneous, being stronger in the case of the developed countries. In connection with these interesting results I would like to raise the following comments:

- The DTI may be lower than the SPITI if the real degree of integration is far from perfect. But this may also be the case when some of the properties on which the partial and global indicators are based are not fulfilled in the real world. In this regard, I would like to note again the role of the measures of distance implicit in P1 and P2, and their absence in P3. In other words, the results in the paper are conditional on the *pure* geographic measure of distance that is used when computing the partial and global indicators. This is likely to be particularly important for the results obtained for specific countries, and might help to explain the high non-linear effect of distance. Furthermore, doubts might be raised about the use of weights that rule out the effect of distance when combining the country indicators to compute the world-wide aggregate measures. This means that, *ceteris paribus*, the aggregate indicator of

integration will vary in value if the relative weights of countries with respect to the world economy change, regardless of their locations. In my opinion this is at odds with the distance-corrected world that is used in one of the scenarios in the paper.

- One of the major contributions in the paper is the inclusion, following P2, of the degree of balanced trade connection in the measure of trade integration. As the authors state, this is closely connected with the network analysis approach, since what matters for trade integration is the number of connections an economy has, and the way in which they are distributed. However, as stated in a previous version of the paper, the DBTC only considers *direct* flows between economies, whereas it is well known that part of the flow moving from one economy to another may pass through other economies. Despite the complexity of including this induced effect in the empirical analyses, my feeling is that it would be worth assessing whether or not the indicator of the degree of balanced trade connection should incorporate the indirect flows between economies. In any case, when reading the results in the paper we should bear in mind that only the direct channel is considered.

- Values of the partial and global indicators for a large number of the EU-12 countries are below or around the countries' mean. And in some cases, interestingly for Spain, Greece and Portugal which joined the EU in the eighties, there is a decrease in the indicators from 1986. This is particularly the case for the degree of balanced trade connection. Actually, as in some other countries, the values for the DBTC evolve rather differently to those for the DTO, and the correlation across countries in each of the years for both indicators is negative. This evidence suggests that an increase in trade openness may be at the cost of balanced connections, and highlights the effect of the processes of regional trade integration on the measure of the DTI. Removing borders between some countries promotes internal trade, but simultaneously maintaining the barriers with the rest of the world may reduce trade in general. This issue deserves further exploration.

- A point that has not been addressed in the paper is the contribution of production and trade of services to international integration and the indicators proposed to measure it. A priori this aspect appears significant since it is well known that services tend to be less internationally tradable, whereas they represent a larger share of output and consumption in advanced countries and their contribution to the economy has been steadily growing. As far as I am able to appreciate from reading the paper, only trade (exports) in goods have been considered in the empirical analysis, while GDP as the measure of economic activity includes all the sectors of the economy. Consequently, the differences between countries in the weight of the services may be contaminating the indicators of trade integration.

All in all, the paper makes interesting methodological and empirical contributions to the measurement of the degree of international trade integration, one of the constituents of economic integration, and at the same time raises issues that should guide further research.

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DISCUSSION

José Manuel Campa (IESE)

I would like to address four points. First, the Perfect International Integration standard is an extremely demanding standard. If this occurred, we would say that globalization has gone too far. It is important to avoid normative aspects about standards in the paper. Second, why don't you use a gravity model in which you have distance in addition to GDP. Third, it seems to me that indirect relations should be zero. In fact, we can view indirect relations as deviations from the international integration. Fourth, what you would like to capture with indirect barriers is the degree of specialization.

Jaume Ventura (Universitat Pompeu Fabra and CREI)

I would basically like to say that this paper perplexes me. We are talking about a very concrete topic: moving goods from one place to another. The question of globalization may be that the costs of moving those goods have fallen. One way to measure the costs is volume; that is first thing you measure; but then I do not understand the relation between connectivity and globalization. When the cost of transporting goods from one place to another may fall symmetrically and it is much easier to export than before, but you estimate that globalization has decreased, that we are less integrated. I believe that the only way to resolve these paradoxes is to have a formal apparatus, a theory that predicts exports and imports among countries. I was going to make the same suggestion as José Campa, which is to use a gravity model. These paradoxes are not going to arise in the gravity model. If there are low transport costs for goods to one series of countries but not to others, it will be reflected there, and transport costs are always going to be lower and integration in any metric that you adopt will increase. I don't understand very well things such as the fact that entry into the European Union reduces the degree of economic integration with the rest of the world, I don't understand it.

Francisco Pérez (Universidad de Valencia and IVIE)

In the first place, thank you very much for the comments. What we are trying to do is to propose a measure of integration. In fact, we

agree with many of the things that have been said, and we would like to do address them later on. For instance, why do the indicators show what they show. Another question is the idea of transforming the concept of the perfect integration standard to something operative. As José Manuel Campa said: indirect relations wouldn't play a role if truly perfect integration existed. Quique López Bazo spoke of the optimum. No, we aren't thinking about an optimum; I would leave that work for later. In fact, we would like to propose a type of approximation through quantities rather than price-based indicators. At times, price indicators display several paradoxes. This suggests examining quantities. Enrique has commented on the applicability of the concept to other fields. This requires data, which is not trivial, because we need trade matrices on flows between countries. This also explains why the exercise is conducted with goods and not services. It is true that services have an increasing weight in international trade, but despite their increased weight but they do not represent more than 20%.

Do Trade and Financial Links Foster Business Cycle Synchronization in a Small Economy?*

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Abstract

We estimate a system of equations to analyze whether bilateral trade and financial linkages influence business cycle synchronization directly and/or indirectly. Our paper builds upon the existing literature by using bilateral trade and financial flows for a small, open economy (Spain) as benchmark for the results, instead of the US as generally done in the literature. We find that both the similarity of productive structure and trade links promote the synchronization of cycles. However, bilateral financial links are inversely related to the co-movement of output. This might point to financial integration allowing an easier transfer of resources between two economies, which could enable their decoupling, as predicted by a standard model of international business cycles. Both the effects of trade and financial links on output synchronization are statistically significant and economically relevant.

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1. INTRODUCTION

The last few years have witnessed increasing economic globalization stemming from very rapid growth in trade and financial linkages, among other factors. At first sight, one would be tempted to think that tighter trade and financial linkages contribute to the synchronization of business cycles. However, theoretical models do not have a clear prediction regarding the relationship between these variables. In fact, the theoretical literature proposes both positive and negative effects of trade and financial links on the synchronization of cycles, which may, in principle, counteract each other. The question is therefore an empirical one, but the empirical literature also reflects these unclear theoretical predictions, as there are a number of diverging results when testing for the influence of trade and financial integration on business cycle co-movements, which could be due, in part, to the lack of data on bilateral financial flows. This paper estimates the effect of bilateral trade and financial links on output co-movement for a small, open economy such as Spain. We assess whether these two types of linkages exert a positive or negative influence over the synchronization of output and whether the influence is not only statistically but also economically significant.

Assessing whether there is more or less output synchronization is important for a number of reasons. First, more synchronized business cycles would presumably mean a stronger and faster transmission of shocks across countries, which could provide an important reason in favor of international policy coordination. Second, business-cycle synchronization has profound implications for the design and functioning of common currency areas. Third, if business cycles in a country are mostly driven by external factors, domestic policy aimed at economic stabilization will probably have a smaller impact.

Besides knowing whether outputs are more or less synchronized, it is also interesting to know the source of such synchronization. For example, it is important to disentangle whether outputs are synchronized due to the effects of common exogenous shocks (e.g. an oil shock) or due to spillovers stemming from greater integration. In the same vein, if trade linkages lead to business cycle synchronization, external demand will not dampen economic fluctuations, but quite the opposite. This implies that exchange rate policy will be unlikely

to play an important role in boosting demand at times of low economic activity. Another interesting application concerns policy reform: knowing whether trade or financial links determine stronger output synchronization might condition the sequence and pace of opening of the current and financial account.

This paper contributes to the empirical literature mainly in two ways. First, most of the existing studies analyze the issue estimating a reduced-form equation. However, there are a number of effects between trade linkages, financial integration and business cycle synchronization –some of them bidirectional–, which need to be taken into account for meaningful results. Although, in principle, instrumental variables can solve these endogeneity problems, the possibility of conflicting indirect effects between these variables might lead to low net effects, even when partial effects are strong. We, therefore, use a system of equations to disentangle direct and indirect effects on the synchronization of business cycles.

Second, many studies suffer from the lack of bilateral data to measure financial linkages and use aggregate financial stocks or flows as a rough proxy. However, aggregate financial flows, which measure financial integration with the rest of the world, are clearly inadequate to explain business cycle co-movements between two countries. The few studies with bilateral data generally use US bilateral financial flows against the rest of the world (or those of the largest economies). There is an important caveat in using these data: such a large economy, or area, influences other countries through many channels other than trade and financial linkages, something that biases the estimated effect on synchronization of activity. To minimize this problem, we take a relatively small and open economy (Spain), as a benchmark and use a new dataset on bilateral financial flows between Spain and a large number of countries, from the Spanish Balance of Payments.

From our empirical exercise, we obtain several conclusions: as in Imbs (2004, 2006) we find that, both the similarity of productive structure and trade links enhance the synchronization of business cycles. However, our use of bilateral financial flows (as opposed to Imbs, 2004), including many emerging economies in the sample (contrary to Imbs 2006), gives us very different results. Contrary to him, we find that bilateral financial links are *inversely* related to the degree of output comovement, as would be predicted by a standard model of international business cycles (e.g. Backus, Kehoe and

Kydland, 1992).[1] As highlighted also by Heathcote and Perry (2004), this negative relationship might point to financial integration allowing an easier transfer of resources between two economies, something that could enable their decoupling. Both the effects of trade and financial links on output synchronization are statistically and economically significant. In particular, in our benchmark regression we find that increasing trade links by one standard deviation starting from its sample mean raises the bilateral cross-country correlation of GDP from its sample mean of 0.160 to 0.311. In turn, increasing financial links by one standard deviation from its mean lowers the correlation of output from 0.160 to 0.005. In both cases, this represents moving the correlation of output by around 40% of one standard deviation, an economically significant effect. We also find a positive indirect effect of financial linkages on output synchronization: more financially integrated countries induce an increased similarity of productive structures, which in turn increases the correlation of output. This indirect effect of financial links on output co-movement, which has the opposite sign of the direct effect, turns out to be of a lower magnitude than the latter.

The rest of the paper is organized as follows: the next section reviews recent literature on the relationship between trade and financial integration and business cycle synchronization; section 3 outlines the main theoretical predictions and the estimation strategy; section 4 presents the empirical results and section 5 concludes.

2. RELATED LITERATURE AND THEORETICAL PREDICTIONS

Although the synchronization of business cycles has been extensively analyzed in the literature, its determinants have not been unequivocally assessed.

Neither the theoretical nor the empirical literature offer a definitive answer on the direction or sign of potential channels by which trade or financial links may affect business cycle synchronization.

1. For example, in a model with two countries with perfectly integrated financial markets and where output fluctuations are driven by technology shocks, resources will flow towards the country receiving a positive productivity shock from the other country. This will reduce further the degree of output correlation between the two countries, beyond what would be explained by the different exogenous shock alone.

Regarding real links, Kose and Yi (2001) suggest that higher trade integration might lead to more or less synchronization of cycles, depending on the nature of trade and the type of shocks affecting both economies. Countries will become more synchronized if there is an increase of intra-industry trade and industry-specific shocks are the main drivers of business cycles. However, if there were more inter-industry trade (i.e. higher specialization), then industry-specific shocks would reduce the co-movement of output in both countries. Empirical studies have found that higher trade integration increases cross-country output correlations, especially among advanced economies (Frankel and Rose, 1998; Clark and van Wincoop, 2001; Imbs, 2004 and 2006), possibly reflecting the prevalence and increase of intra-industry trade rather than inter-industry trade.

There might also be some indirect effects of trade links on output synchronization, through the similarity of productive structure or through financial links. Thus, for example, stronger trade links might increase financial linkages because they promote FDI in export-oriented sectors, or because they foster international loans (Rose and Spiegel, 2004). In turn, stronger trade links might induce more or less similarity of economic structure —depending on whether it is mostly inter-industries or intra-industries— which, in turn, influences the co-movement of output.

As for financial linkages, some studies have pointed out a positive relationship between financial integration and business cycle co-movements both in output and consumption in the case of advanced economies (Imbs 2004, 2006). This empirical result, which runs against the predictions of a standard international business cycle model (Backus et. al, 1992) does not seem to extend to developing economies (Kose, Prasad and Terrones (2003)), something that might explain the difference between our results in section 4 and those of Imbs (2004, 2006). In addition, Heathcote and Perri (2004) propose that higher financial integration may arise because of less correlated real shocks, since the diversification gains from asset trade are bigger. By fostering financial flows, financial integration, in turn, would dampen GDP correlations more than the reduction implied by the lower correlation of shocks, in effect decoupling both economies.

As it is the case of trade linkages, there might also be some indirect effects of financial links on output synchronization, through

trade links or the similarity of productive structure. In the first case, stronger financial links might allow the relocation of capital by comparative advantage, thus increasing opportunities for trade. In the second case, more financial integration between two economies might increase the similarity of economic structures between the two countries, if FDI flows are concentrated on those sectors where the source country has a comparative advantage, thus replicating the productive structure at home. However, stronger financial links also allow the unhinging of production and consumption, and therefore make it less costly to achieve greater specialization in production and so differing economic structures (Kalemli-Ozcan et al, 2003 and Helpman and Razin, 1978).

The methodology generally used in the literature to test for the relevance of trade and financial channels is the estimation of a single equation. The fact that there may be indirect effects going in opposite directions might account for the generally small impact found in studies using single equation regressions. In fact, Kose, Prasad and Terrones (2003), using a single-equation regression, find a positive effect of trade on business cycle synchronization, but a non-significant effect of financial links on output (and consumption) comovement. To address the possibility of conflicting indirect effects, Imbs (2004, 2006) estimates a system of simultaneous equations to take into account direct and indirect effects on the synchronization of output but there are a number of differences between his analysis and ours. First, he does not consider the possible two-way relationship between financial and trade linkages (Aizenman and Noy, 2001) or the incentives for financial linkages that might stem from a low correlation of business cycles (Heathcote and Perri, 2004). Second, Imbs (2004, 2006) works with a limited set of countries –41 in Imbs 2006 and 24 in Imbs 2004–, with a very high proportion of rich economies in the sample. Having mostly developed countries in the sample might induce a selection bias in the results, as developing countries are also likely to have weak links, especially financial ones. More importantly, as highlighted by Kose, Prasad and Terrones (2003), the positive association between financial links and output synchronization disappears for developing economies. Third, measures of financial integration in Imbs (2004) consider global financial flows for each country, instead of bilateral financial flows between a country-pair. Imbs (2006) uses a cross section of bilateral investment positions with data from the CPIS, although the quality of the data

is questionable.[2] Fourth, his estimated coefficients in Imbs (2004) might be picking up some other channels through which big economies affect other countries' business cycles. Finally, Imbs (2004) includes output correlations from the 80s and 90s. However, the existence of a number of global common shocks in the 80s (although less prevalent than in the 70s) makes it difficult to identify the source of output co-movements.

3. DATA AND ESTIMATION

We assess empirically whether bilateral trade and financial linkages foster or hinder output co-movement, while taking into account other potentially relevant determinants of business cycle synchronization.

As described in the previous section, both in the case of trade and financial linkages, there are arguments for and against their fostering synchronization. Such different arguments are based on multi-directional channels of influence. This implies potential endogeneity problems in naïve OLS estimations. Moreover, the different directions of indirect effects might offset each other and lead to very small *net* effects if we just try to correct the endogeneity problem using instrumental variables in a reduced-form estimation as in Kose, Prasad and Terrones (2003). Thus, we shall use a system of equations to deal with this problem. We also control for other possible sources of synchronization, such as the convergence of economic policies –which we approximate with the volatility of exchange rates and the differences in inflation rates– or a similar exposure to global shocks, such as oil shocks.

As already mentioned, we use bilateral data to account for trade and financial linkages. While data on bilateral trade flows is readily available from the IMF's Direction of Trade Statistics, bilateral financial flows are particularly difficult to find except for the US[3]. This paper uses a newly processed dataset for bilateral financial flows

2. The CPIS matrix on bilateral financial flows compiled by the IMF provides data for a limited number of years, which is by surveys and therefore is prone to underreporting.

3. Apart from the aforementioned CPIS matrix on bilateral investment positions compiled by the IMF, the OECD publishes data on bilateral FDI flows, although we are more interested in financial integration involving *total* flows.

(including FDI, but also portfolio flows, including equity transactions other than those considered as FDI), obtained from the Spanish Balance of Payments. Choosing Spain as a benchmark country also has the advantage of using a small open economy whose financial markets are unlikely to have other channels of influence on other countries, limiting the problem of omitted variables in previous studies.

We thus estimate a system of four equations, in which we test for the determinants of output co-movement (eq. 1), those of trade and financial linkages (eqs. 2 and 3, respectively) and those of the similarity in productive structure (eq. 4). As previously explained, there are theoretical reasons to support the idea that the latter could be a key variable governing the indirect effects of trade and financial links on cycle comovements, as already found by Imbs (2004, 2006):

(Eq. 1): $\log(\rho_{i,t}) = \alpha_0 + \alpha_1 \log(T_{i,t}) + \alpha_2 \log(S_{i,t}) + \alpha_3 \log(F_{i,t}) + \text{Controls}(\rho) + \varepsilon_\rho$

(Eq. 2): $\log(T_{i,t}) = \beta_0 + \beta_1 \log(S_{i,t}) + \beta_2 \log(F_{i,t}) + \text{Controls}(T) + \varepsilon_T$

(Eq. 3): $\log(F_{i,t}) = \delta_0 + \delta_1 \log(\rho_{i,t}) + \delta_2 \log(T_{i,t}) + \text{Controls}(F) + \varepsilon_F$

(Eq. 4): $\log(S_{i,t}) = \gamma_0 + \gamma_1 \log(T_{i,t}) + \gamma_2 \log(F_{i,t}) + \text{Controls}(S) + \varepsilon_S$

where:

$\rho_{i,t}$ is the correlation between Spain's output and country *i* at time *t*.

$T_{i,t}$ is bilateral trade integration between Spain and country *i* at time *t*.

$S_{i,t}$ is an index of the similarity of economic structure between Spain and country *i*.

$F_{i,t}$ is bilateral financial integration with country *i*.

As described in section 2, the expected sign of the direct effect of trade links on output co-movement (α_1 in Eq. 1) is ambiguous, depending on the nature of trade (intra- vs inter-industry) and of shocks (global versus industry specific). In the same vein, the coefficient of $F_{i,t}$ in the same equation (α_3) also has an ambiguous sign. The expected sign of the coefficient of $S_{i,t}$ in equation 1 (α_2) should

in principle be positive as the more similar their economic structure the closer output co-movement between two countries.[4]

Although optimally one should conduct a panel data regression with the structure outlined above, the poor quality of the geographical allocation of financial data prior to 1997 (especially portfolio transactions), leaves us with few observations to construct our measure of business cycle synchronization (ρ_i), namely the period 1997-2004. We, therefore, use the whole sample period to construct ρ_i and use period-averages for the rest of endogenous variables –as explained later–. We thus drop the time subindex for all variables considered in the system of equations and turn it, effectively, into a cross section.

There are large differences in how synchronization (ρ_i) is measured in the literature. Kose et al (2003) use correlations of output and consumption of countries with respect to the same aggregates in G-7 countries. They complement it with dynamic factor models to look for common components and assess whether their importance has increased over time, something that would signal a stronger synchronization. Heathcote and Perri (2004) measure cross-regional correlations of the log-difference of US GDP with that of an aggregate of Europe, Japan and Canada. They also propose and use a measure of correlation that corrects for the existence of high conditional volatility, based on Loretan and English (2000). Helbling and Bayoumi (2003) employ various indicators of synchronization, including a binary indicator of expansions and recessions, correlation coefficients and detrended series.[5] They finally use dynamic factor models to assess what is the role of common components on output synchronization. Finally, Imbs (2004) measures synchronization using cross-country correlations of band-pass series of quarterly GDP over the last 20 years. In this paper, we choose to measure business cycle synchronization (ρ_i) as the correlation between detrended annual GDP in Spain and each partner country. Detrending is done using Baxter and King's (1999) band-pass filter.[6]

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4. Note that Imbs (2006) estimates a similar system of equation imposing (β_1=0 and γ_1=0). Imbs (2004) imposes (β_2=0, δ_1=0 and δ_2=0).

5. Detrending is done using Baxter and King (1999) band-pass filter to eliminate low- and high-frequency components to keep business cycle components defined as those between 6 and 32 quarters. An alternative method used is log first differences (i.e. growth rates).

6. GDP is measured at purchasing power parity and was obtained from the IMF's World Economic Outlook database. We also conducted the same exercise using the correlation of GDP growth rates or the correlation of HP-filtered annual GDP series. The qualitative results remain unchanged in both cases.

Measures of trade linkages also differ across studies. Some of the earlier studies used aggregate measures of trade openness (i.e., global trade integration instead of bilateral trade links between two countries). This is obviously less appropriate to investigate the determinants of business cycle synchronization between two countries. As for bilateral trade relations, some authors have used *de jure* measures, namely restrictions to trade, such as import duties (IMF 2002). Another alternative, non-standard measure is the dispersion between two countries' goods prices (IMF 2002). By far the most common *de facto* measure is the sum of bilateral exports and imports between two countries, divided by the sum of their GDPs (IMF, 2002; Frankel and Rose, 1998; Imbs, 2004), which is the one we use in this paper for trade linkages (T_i) between Spain (in the subindex as *ESP*) and country *i*. Denoting this measure by $T^1_{ESP,i}$, we have:

$$T^1_{ESP,i} = \frac{1}{T}\sum_t \frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{ESP,t} + GDP_{i,t}}$$

where $X_{ESP,i,t}$ are exports from Spain to country *i* at time *t*, $M_{ESP,i,t}$ are imports to Spain from country *i* at time *t*, and $GDP_{i,t}$ is country *i*'s GDP at time *t*.[7] Note that we are taking a time average (over the period under study) of this measure.

An alternative measure, proposed by Clark and van Wincoop (2001), which is independent of country size (and dependent only on trade barriers) includes also world GDP:[8]

$$T^2_{ESP,i} = \frac{\frac{1}{T}\sum_t \left(\frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{ESP,t} \times GDP_{i,t}} \right) GDP_{World,t}}{2}$$

The measures of financial linkages also differ in the literature.[9] As in the case of trade linkages, earlier studies used measures of

7. Data for exports and imports is obtained from the IMF's Direction of Trade Statistics. Data for GDP (at purchasing power parity) is obtained from the IMF's World Economic Outlook database. All data are annual.

8. Note that if we use $T^2_{ESP,i}$ in the regressions, we can drop $GDP_{World,t}$ from the computation of the index, as it will be included into the constant term. All the results presented here are robust to measuring trade linkages in this alternative way.

9. Edison et al (2002) and Prasad et al (2004) provide surveys of different measures of financial integration.

global financial integration rather than measures of bilateral links. In fact, the use of measures of global integration is even more pronounced for financial links than for trade links, because of the difficulties in finding bilateral data of financial transactions. Among the aggregate measures, several authors have employed aggregate *de jure* indicators, namely a global index of capital account restrictions from the IMF Annual Report on Exchange Arrangements and Exchange Restrictions (Prasad et al., 2004; IMF, 2001b and 2002). Imbs (2004) uses the sum of these indices in two countries as a bilateral *de jure* measure of their financial linkages. Another *de jure* measure of aggregate financial integration is an index of stock market liberalization (Prasad et al (2004)). Among *de facto* measures, there are quantity and price measures, most of which are aggregate and not bilateral. The most comprehensive aggregate quantity measure is the sum of stocks of external assets and liabilities of foreign direct investment and portfolio investment, constructed by Lane and Milesi-Ferretti (2001) from the accumulation of financial flows, with some valuation adjustments. (IMF, 2001b and 2002; Prasad et al., 2004[10] and Heathcote and Perri, 2004[11]). Other aggregate measures are total capital flows as a share of GDP, though they suffer from large volatility (Prasad et al (2004)). Others are proxies of risk sharing obtained regressing GDP on disposable income (Kalemli-Ozcan et al, 2003).[12] A bilateral quantity measure (i.e., of financial linkages) is the sum of gross asset positions between two countries, but this is only readily available for the US against the rest of the world (Imbs, 2004). Alternative sources of bilateral data are equity transaction flows (Portes and Rey, 2005) although it is only available for a few countries, and equity holdings from the Coordinated Portfolio Investment Survey conducted by the IMF in 1997 and 2001, which also has geographical limitations, as well as some problems of underreporting (Lane and Milesi-Ferretti, 2004). There are also bilateral price measures, such

10. Prasad et al (2004) also separate financial flows into its main constituents: FDI, bank loans and portfolio flows.

11. Heathcote and Perri (2004) use, for assets, the sum of FDI plus the equity part of portfolio investment. They also test for separate measures (FDI on one side and equity holdings on the other).

12. The idea is that with perfect risk sharing, disposable income should be unrelated to GDP, whereas in the absence of risk sharing, they should be closely related. Kalemli-Ozcan et al (2003) also use measures of consumption risk sharing. Imbs (2004) uses pair wise sums of this estimate of risk sharing as measure of bilateral financial integration

as differences from covered interest rate parity, but with very limited data availability (Frankel, 1992), and asset price arbitrage based on rolling correlations of stock and bond prices (IMF, 2001a) which, however, suffers from potential reverse causality.

In order to measure financial integration through a bilateral *de facto* measure, we use total bilateral financial flows (portfolio and FDI flows) from the Spanish Balance of Payments. Although data on international financial positions (stocks) would have been a better indicator, it was not available for Spain on a bilateral basis. We measure financial integration by taking the sum of the absolute values of inward and outward financial flows and computing a time average over the period of study, dividing it over the sum of GDPs, to scale their importance relative to the size of economic activity. Note that, by taking average flows over a period of time we diminish the volatility of this measure, one of the problems of using financial flows instead of investment positions.

$$F^{1}_{ESP,i} = \frac{1}{T}\sum_{t}\frac{I_{ESP,i,t} + I_{i,ESP,t}}{GDP_{ESP,t} + GDP_{i,t}}$$

where I_{ijt} represents financial flows from country i to country j (*ESP* denotes Spain) at time t. In our benchmark regressions, we will use the sum of FDI and portfolio flows, but we also conduct robustness checks using only FDI flows and using total equity flows. Additional robustness checks are conducted using a level definition of financial linkages, as in Imbs (2006):

$$F^{2}_{ESP,i} = \frac{1}{T}\sum_{t} I_{ESP,i,t} + I_{i,ESP,t}$$

The similarity in productive structure can be measured in several alternative ways. All of them are based on data of shares of each productive sector, and differ in the depth of disaggregation of economic activities and whether or not they concentrate on manufactures –at greater disaggregation[13]– or on all sectors –at lower disaggregation[14]–. Let $s_{n,i,t}$ be the share of industry n in country i at time t. Then the first measure of economic similarity can be expressed as

13. Typically, 2- or 3-digit ISIC classification groups.

14. Generally, 1-digit ISIC classification groups.

$$S^1_{ESP,i} = -\frac{1}{T}\sum_t \sum_{n=1}^{N} \left| s_{n,ESP,t} - s_{n,i,t} \right|$$

where N is the number of sectors. Note that $S^1_{ESP,\,i}$ represents the time average of discrepancies in economic structures, as in Imbs (2004).[15] $S^1_{ESP,\,i}$ might take values between 0 for identical structures and –2 for disjoint productive structures. Therefore *higher* values for $S^1_{ESP,\,i}$ imply *more* similarity between the structure of Spanish production and that of country i. Clark and van Wincoop (2001) use a similar concept but taking time averages of structures before computing distances in shares.[16]

$$S^2_{ESP,i} = -\sum_{n=1}^{N} \frac{1}{T} \left| \sum_t s_{n,ESP,t} - \sum_t s_{n,i,t} \right|$$

Industry shares $s_{n,i,t}$ can be measured using a number of different indicators. The three main indicators are shares in total employment, shares of production or shares of value added. All the results presented in the next section use the definition $S^1_{ESP,\,i}$ described above applied to shares of value added, although the results are robust to using other definitions or data on employment or production, as they are highly correlated. We use data for the industrial sector at the two-digit ISIC level from UNIDO.[17]

We also use a number of controls in the regressions as suggested by existing literature. One potential source of business cycle synchronization is the similarity of macroeconomic policies and of exposure to global shocks such as movements in the price of oil. For the former we use a number of proxies: the volatility of the bilateral exchange rate, the average inflation differential and a dummy variable to account for use of the euro as official currency (in effect, a dummy for the use of the same currency). For the lat-

15. This is similar to Imbs (2004) but we prefer to use a minus sign in front of the definition of similarity of productive structure so that a higher value of S implies higher similarity between the productive structures in both countries. This of course only changes the sign of its associated estimated parameter, but neither its size nor its significance.

16. In this paper we present the empirical results using the first measure of similarity of productive structure. Both measures outlined here are highly correlated, thus using the second definition does not affect the results significantly.

17. We could in principle use data at the three-digit ISIC level and increase the disaggregation of activities. However, some countries in the sample do not report data at that level of disaggregation, and therefore we opted for a lower level of disaggregation in order to increase the sample size.

ter, we concentrate on oil shocks by introducing an index of similarity of oil dependency. More specifically, we take each country's net oil imports as a percentage of GDP and average that percentage for the period 1990-2002. We then multiply that measure with the equivalent one for Spain, which is positive[18]. In principle, countries that are more dependent of oil should have a high and positive dependency ratio, whereas oil-exporting countries have a highly negative indicator. A high and positive product of both indicators indicates countries that are affected negatively by an oil shock, as Spain.

In the case of trade linkages, a number of studies have suggested that gravity variables play an important role in explaining trade links between two countries. We therefore include (the log of) distance between countries, land areas, and dummy variables to account for access to the sea, a common main language and membership in the European Union.[19]

Recent studies (e.g. Portes and Rey, 2005) have suggested that gravity variables might also explain bilateral financial linkages. Thus, we include (the log of) distance, the time difference between main financial centers, a dummy for common language and the partner's per capita GDPs. This last variable tries to capture the idea that richer countries tend to generate more financial flows (both inward and outward).

Surely the most difficult variable to explain is the similarity of productive structure. Following on Imbs and Wacziarg (2003) we use the pair-wise difference of per capita GDPs, based on the idea that rich countries tend to have a more diversified productive structure, but in a similar way among themselves, whereas poorer countries tend to be more specialized in production.

Taking all these variables into account, we end up with a sample of 109 countries (counterparts to Spain), of which 21 are developed countries and 88 are emerging or developing countries (see table 13).

18. Details of the construction and sources used for this oil dependency index can be found in Appendix B.

19. Some studies include, instead of common language, a dummy variable capturing past colonial relationship. In the case of Spain both variables coincide.

4. ESTIMATION RESULTS

As a preliminary step we show some stylized facts of the main variables of interest in this study: business cycle synchronization, trade and FDI linkages.

The degree of bilateral business cycle synchronization between Spain and EU countries has increased substantially from 1960 to 1995 (figure 1). Since then, it has fallen somewhat and now hovers at 0.6 (in terms of Pearson correlation coefficient of annual growth rates). Bilateral synchronization between Spain and G7 countries also rose fast from 1970 to 1976 but then fell again. Since Spain's entry in EU in 1986, it has risen at a slower pace than synchronization with EU countries. Business cycles in Spain and in Latin American countries move in opposite directions since the late 1980s. Overall, the period of closer synchronization between Spain and other countries was from 1975 to 1985.

Trade linkages between Spain and EU countries started to rise already ten years before Spain's entry into EU but since then the increase has been exponential (Figure 2). Trade linkages with G7 countries began to grow later, in the mid 1980s and at a much lower pace, while trade linkages with Latin American countries haven remained relatively small throughout the period.

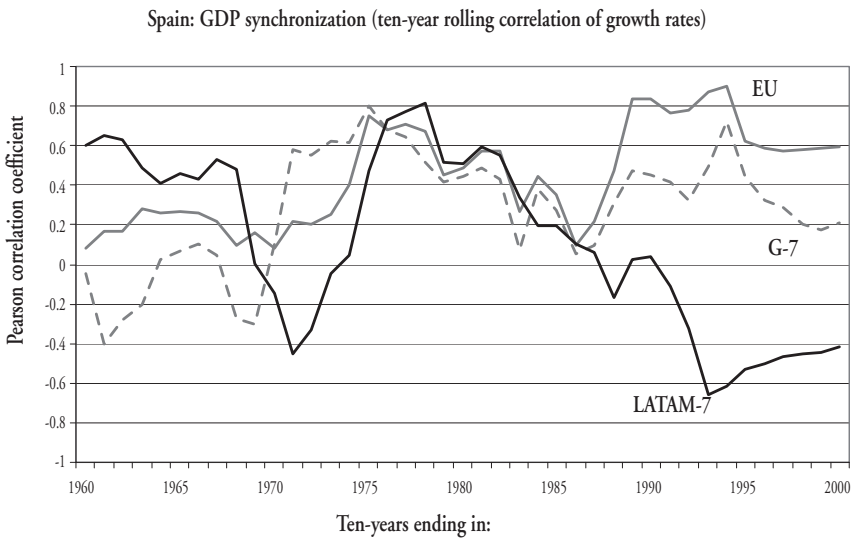
Before the mid-1908s, Spain's FDI linkages with the rest of the world were basically nonexistent. Since then, FDI with the EU and, to a lesser extent, G7 countries rose substantially (Figure 3). FDI linkages with Latin American countries also rose but at a lower pace. In 2000, there was a sharp fall of FDI linkages with all countries but it has recovered again in the last few years. As for total financial flows, they have risen substantially in the last six years (reliable bilateral data is only available from 1997). The surge concentrates on the euro area and, to a lesser extent, the United Kingdom (figure 4).[20] The importance of Latin America is much smaller than for FDI flows.

Turning to the estimation of our system of four equations, we first report the results of the estimation of equation 1 in section 3, our equation of interest, using OLS. Table 1 reports parameter estimates for different specifications. A salient feature of these estimations is the negligible role of financial integration or the similarity of produc-

20. The United Kingdom accounts for almost 95 percent of total financial flows to EU countries outside the euro area.

tive structure in promoting a closer comovement of output between Spain and other countries. Only trade links seem to promote stronger output synchronization, and even that effect disappears once we control for membership of the euro area, which in turn might be increasing trade and financial flows.

Figure 1.
Evolution of GDP synchronization between Spain and selected regions



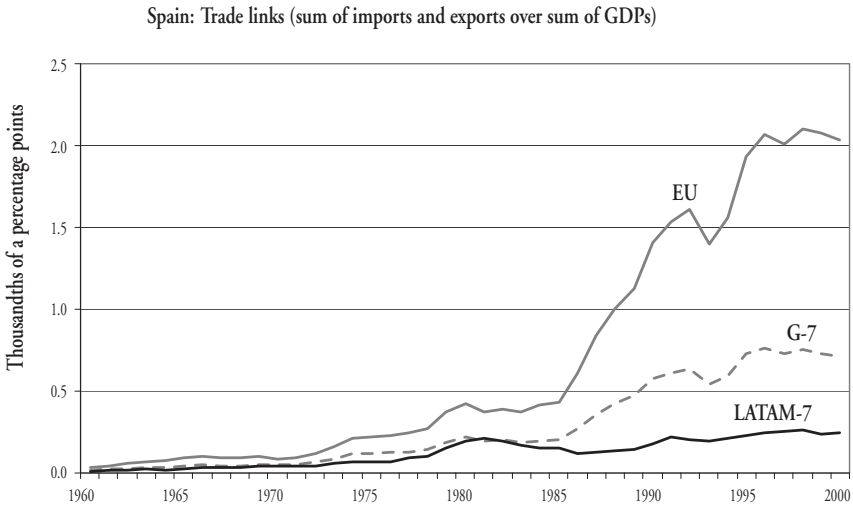
Source: Penn World Tables 6.1 and author´s calculations.

EU (14 countries) and G-7 exclude Germany before 1970.
LATAM-7: Argentina, Brazil, Mexico, Chile, Colombia, Peru and Venezuela.

There are good reasons to suspect endogeneity problems and thus biased estimates in table 1. Thus, we complement the estimation of equation 1 –the equation of interest to us– with the use of suitable instruments for the other three endogenous variables (trade and financial linkages –*T* and *F*– and the similarity of economic structure *S*).[21] Table 2 presents instrumental variable (IV) estimates for the same specifications as table 1, and a quick comparison hints that the endogeneity of regressors is indeed a severe problem. First, coefficient estimates differ significantly from those in table 1. In particular, financial integration and the similarity of productive structure are

21. Instruments used in the IV estimation are the same as those used for three stage least squares, described next.

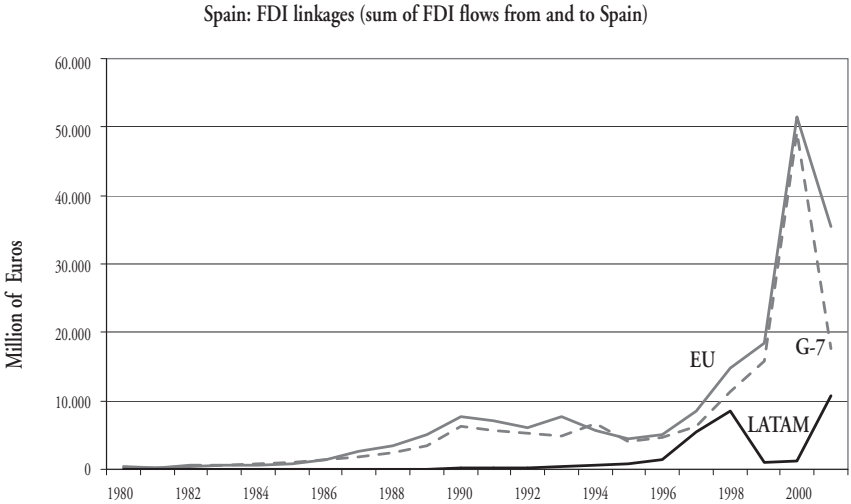
Figure 2.
Evolution of trade linkages between Spain and selected regions.



Source: IMF Direction of Trade Statistics. Penn World Tables 6.1 and author´s calculations.

EU (14 countries) and G-7 exclude Germany before 1970.
LATAM-7: Argentina, Brazil, Mexico, Chile, Colombia, Peru and Venezuela.

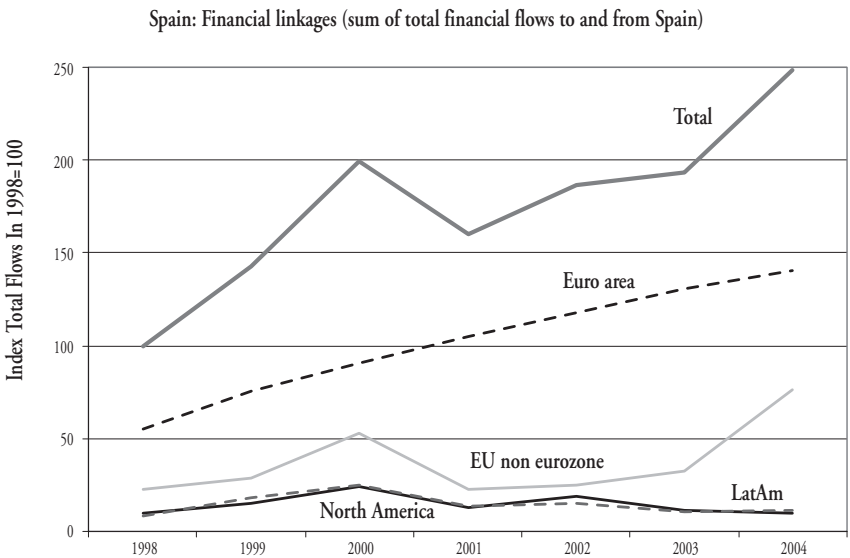
Figure 3.
Evolution of FDI linkages between Spain and selected regions.



Source: OECD and author´s calculations.

LATAM: Includes Caribbean countries.

Figure 4.
Evolution of total financial linkages between Spain and selected regions.



now statistically significant to explain output comovement, and the similarity of macro policies, as captured by inflation differentials also seem to play a role. Exchange rate differentials do not seem to play a role, but membership in the euro area is already used as instrument for trade and financial links. Second, the Anderson-Rubin test of significance of endogenous regressors also point to the importance of *T*, *F* and *S* as explanatory variables.

Estimation of equation 1 by instrumental variables, however, still pools together the direct and indirect effects of trade and financial linkages over business cycle synchronization, for example through their effect over the convergence of productive structures between Spain and the other countries in the sample. If indirect effects through different channels go in opposite directions, the net effect might become small, contributing to its statistical insignificance. We thus go a step further than the IV estimation in table 2 and try to disentangle the direct and indirect effects of trade and financial linkages on business cycle synchronization, as described in the previous section. Thus, we conduct a three-stage least-squares regression (3SLS) on the complete system of four equations.

The estimated parameters of equation 1 using 3SLS on the system of four equations (table 3) differ significantly (see e.g. estimation 7 in

table 2, which is comparable), although signs are unchanged. Both trade links and the similarity of productive structures directly foster business cycle synchronization, possibly through external demand channels in the first case, and through similar exposure to external shocks (even is they are predominantly sector-specific) in the second. The negative influence of financial links on business cycle synchronization might reflect that an easier transfer of resources across countries allows a decoupling of business cycles, as highlighted by Heathcote and Perri (2004). Xing and Abbott (2007) obtain similar results for the effects of trade and financial links (using FDI flows only) and the similarity of productive structure for a different country sample.

As discussed above, one key difference with Imbs (2006) is the importance of developing countries in the sample. In his paper he considers 41 countries, out of which 26 are emerging economies. In the estimations in this paper, we consider a sample of 109 countries, out of which 88 are emerging economies. The results in Kose, Prasad and Terrones (2003) that trade and financial links seem to increase output synchronization mostly in industrial countries might explain in part why Imbs (2006) finds a stronger effect of financial links on output synchronization, given the bigger weight of industrial countries in his sample. Indeed, we find some evidence of a different effect of developed and emerging economies when we estimate an alternative version of the system of equations described in table 3. In particular, we include a dummy variable for emerging economies, interacted with our measure of financial linkages as explanatory variables for equations 1, 2 and 4. With this inclusion we find that, for developed countries, the effect of financial integration on output synchronization is positive (as in Imbs, 2004, 2006), but statistically not significant. However, the effect of financial links on output synchronization is negative (and statistically significant) in the case of emerging economies. This gives support to our claim that the higher prevalence of emerging economies in our sample might account for the difference in the sign of α_3, between our paper and Imbs (2006). The same negative sign appears if we only introduce a separate effect for emerging economies in equation 1.[22]

22. We thank an anonymous referee for suggesting the inclusion of a dummy for emerging economies to test the difference with Imbs (2006). The results of these estimations are available from the authors upon request.

As for the control variables, our measure of similar fuel dependency is not statistically significant in explaining output correlations in this exercise, which might point to oil shocks not being an important factor driving global economic fluctuations in the period of study (1990-2003), as they probably were in the 70s or, to a lesser extent, in the 80s. The same is true for the inflation differential and the exchange volatility. However, being member of the euro area does seem to foster business cycle synchronization.

Table 3 also shows, in its second column, that trade linkages (Eq 2) do not seem to be significantly affected by financial linkages (i.e. we cannot reject that β_2=0), beyond what is predicted by standard gravity variables. These gravity variables, related to the cost of bilateral trade (e.g. distance, access to the seacoast and land area), are statistically significant and have the expected signs.

Financial linkages, estimated in column 3 of table 3, seem to be determined also by gravity variables, such as distance, a common language and a common currency –with the expected sign– in line with Portes and Rey (2005). Beyond these effects and those captured by the partner's GDP per capita (which significantly promotes financial links) trade linkages do not seem to be statistically significant in promoting financial linkages, as opposed to Aizenman and Noy (2004). Finally, a stronger correlation of business cycles is associated with lower financial flows as percentage of GDP. This reflects that risk-hedging opportunities are reduced –and thus gains from asset trade are lower– as economies become more synchronized, a point highlighted by Heathcote and Perri (2004).

Finally, the last column in table 3 tries to identify the determinants of the similarity in productive structure (Eq. 4). As in Imbs and Wacziarg (2003) the absolute difference in per capita GDPs is a good explanatory variable, together with financial flows.

Beyond the direct effects on GDP correlation of our main variables of interest (equation 1), there are also possible indirect effects of trade and financial linkages on business cycle synchronization, both through their influence on each other and though their effect on the similarity of productive structures. As described before, in table 3, our benchmark regression, we find no statistically significant effect from (to) trade links to (from) financial links, and only a significantly positive effect of financial links on the similarity of productive structure, which might point to the importance of FDI flows and its influence on production in the recipient country.

Considering all –direct and indirect– effects of financial links on business cycle synchronization, the net impact is negative, as summarized by $\alpha_3 + \alpha_2 \gamma_2 + \alpha_1 \beta_2 = -0.0083$[23]. As expected by the non-significance of the indirect effects of trade, including them does not significantly change the estimate of its total effect on business cycle synchronization, given by $\alpha_1 + \alpha_2 \gamma_1 + \alpha_3 \delta_2 = 0.113$.[24]

The positive influence of a similar economic structure and trade links on business cycle synchronization is in line with Imbs (2004), though the effect of financial linkages is negative in our case and positive in his. This difference might be related both to the fact that we use a small open economy as a benchmark, a wider set of partner countries (including more emerging countries than in his sample), and bilateral financial links, instead of a broad proxy derived from aggregate financial integration in both partners as in his case. Another reason, as regard financial linkages, might be that our data includes FDI and portfolio flows which are only a part of all possible financial linkages, albeit possibly the most important ones that might influence the synchronization of economic activity.

There are few other findings worth highlighting from the system of equations we estimate. First, we do find a reverse causality from business cycle synchronization to financial linkages (i.e. δ_1 is significantly different from zero), as argued by Heathcote and Perri (2004). Second, the estimation does not find a double causality between trade and financial linkages (i.e. δ_1 and β_2 are not statistically significant from zero).

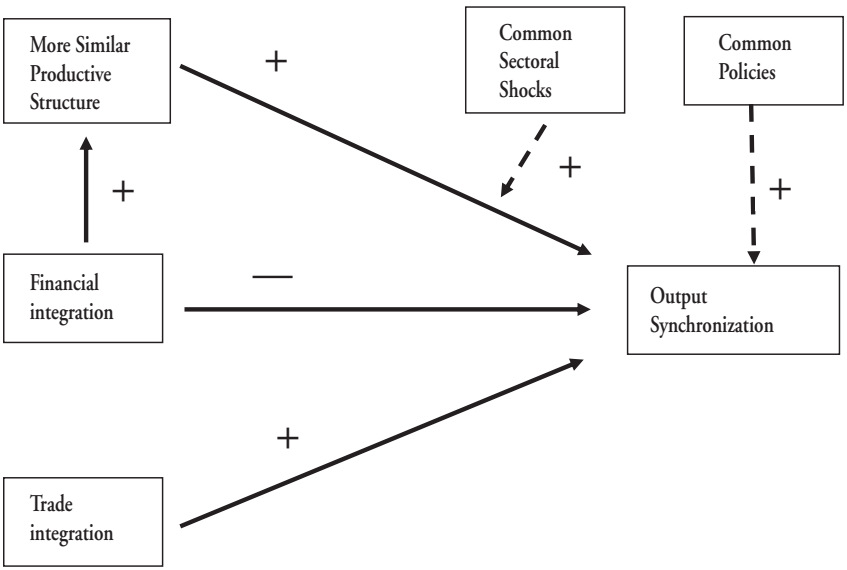
Figure 5 summarizes the statistically significant relations out of our four-equation system. They are all positive except for the direct impact of financial integration on output co-movement.

Another important question concerns the economic relevance of the statistically significant effects found in the previous exercise. As described before, the total effect of trade and that of financial links on the synchronization of business cycles is given through their direct and indirect effects. Specifically, for our benchmark 3SLS regression in table 3, the effect of trade links on our measure of comovement of output is $\alpha_1 + \alpha_2 \gamma_1 + \alpha_3 \delta_2 = 0.113$ whereas the effect of financial links is $\alpha_3 + \alpha_2 \gamma_2 + \alpha_1 \beta_2 = -0.0083$. In order to gauge whether this effect on output synchronization is big or small, we can check

23. Using the delta method, a test of significance of this estimate gives a t-statistic of –2.72, with a p-value of 0.007.

24. Again using the delta method, this estimate has a t-statistic of 2.11, with a p-value of 0.036.

Figure 5.
Statistically significant channels leading to business cycle synchronization found in the empirical exercise, and their associated signs.



the effect of increasing trade or financial links by one standard deviation, as described in table 11. Increasing trade links by one standard deviation starting from its mean raises bilateral cross-country correlation of GDP from 0.160 to 0.311. In turn, increasing financial links by one standard deviation lowers the correlation of output from 0.160 to 0.005. In both cases, this represents moving the correlation of output by around 40% of one standard deviation, an economically significant effect (table 10).

We conduct a number of additional tests to confirm the robustness of our results. Since the most interesting result probably is the negative impact of financial linkages on output co-movement, we explore alternative measures of financial links. First, we include total financial flows in levels (instead of measured as percentage of GDP, as described earlier), an indicator also used in the literature. The results of this regression are shown in table 4, where we can see that parameter estimates do not differ strongly from previous estimates, and the total effects from trade or financial links to business cycle synchronization are very similar in magnitude.

We turn next to decompose total financial flows in two groups. First, we take all flows related to investment in productive capacity

abroad, which might influence GDP and/or trade more directly than fixed-income instruments like bond purchases. In particular, in table 5 we describe the results of the 3SLS estimation taking as financial links the aggregate of equity purchases and FDI flows over GDP. As expected, this narrower definition of financial integration now significantly influences trade links, although in table 6, where we use just FDI flows, the effect is wiped out. In both cases, however, the total effects over the synchronization of business cycles are not very different from those obtained from table 2. More specifically, according to regression results in tables 5 and 6, an increase of trade links by one standard deviation from its mean would increase output correlation from 0.16 to 0.29 and 0.31, respectively. Equivalently, an increase in financial links by one standard deviation would reduce output correlation from 0.16 to 0.03 and 0.01, respectively. That is, when we use total equity flows as measure of financial integration, an increase of trade links or reduction of financial links by one standard deviation results approximately in an increase in output correlation equivalent to around one third of its standard deviation. When we use only FDI flows this ratio increases to around 40%, the same effect as in the benchmark regression (Table 10).

The other dimension in which we check for the robustness of our results is the normalization of trade and financial links as proportion of GDP. Since we are interested in measuring the effect of trade and financial links on the synchronization of output, it is perhaps more relevant to normalize the size of those links by the smaller of the two GDPs in the country pair under scrutiny. The idea is that, for the same size of trade flows, two countries might be more synchronized the more unequal they are in size, since then the bigger country can "pull" the other more strongly through external demand or financial links. Thus, we conduct the same estimations displayed in tables 3, 5 and 6 but with trade and financial links defined as percentage of the minimum of the two GDPs involved. The corresponding estimation results are presented in tables 7, 8 and 9. For the most part, the qualitative results are unchanged, except that now we do observe a bidirectional effect between trade and financial linkages mentioned in the literature (i.e. δ_1 and β_2 are statistically significant from zero). Both the signs and statistical significance of the effect of trade and financial links on output correlation are unchanged from the previous exercise, and the magnitude increases up to 60% of a standard deviation of GDP correlation, as summarized by table 10.

5. CONCLUSIONS

This paper assesses the role of trade and financial linkages in the output co-movement between two countries, while considering a large number of interrelations between relevant variables through a system of equations. This allows us to identify direct and indirect effects of trade and financial linkages on output co-movements. While there are number of possible endogeneity problems associated with trade and financial linkages as explanatory variables for output synchronization, in theory one could eliminate those biases by using suitable and readily available instruments. However, the reduced form IV estimates might appear small or not significant because, in theory, direct and indirect effects might run in opposite directions, partially offsetting each other. When we conduct the estimation of a system of equations in order to separate direct and indirect effects of trade and financial linkages on output synchronization, we actually find conflicting direct and indirect effects of financial links, though, in the end, they do not reverse the sign of the negative direct effect on synchronization.

In line with Imbs (2004, 2006) we find that, both the similarity of productive structure and trade links promote the synchronization of cycles. However, the main contribution of the paper is the use of bilateral financial flows to measure bilateral financial integration in a small, open economy. When we do this, we find that, contrary to Imbs (2004, 2006), bilateral financial links are inversely related to the comovement of output, which might point to financial integration allowing an easier transfer of resources between two economies, which could enable their decoupling. This is in line with what a standard international real business cycle model (e.g. Backus et al, 1992) would predict and with results by Heathcote and Perry (2004), that point to financial integration fostering financial flows, and thus dampening GDP correlations as domestic investors seek out to diversify to less correlated economies abroad. It is important to point out that the *direct* negative effect of financial integration on business cycle synchronization we find in this paper is an alternative to Kalemli-Ozcan et. al. (2003) where financial integration reduces output synchronization *indirectly*, because financial links reduce the cost of an economy specializing according to its comparative advantage.

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APPENDIX A: TABLES

Table 1.
OLS regressions Dependent variable: GDP correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade Integration (T)	0.090***	0.096**	0.093**	0.083**	0.015	0.026	0.027	0.019
	(0.033)	(0.037)	(0.037)	(0.034)	(0.034)	(0.037)	(0.038)	(0.033)
Financial Integration: all Flows (F)		-0.001	-0.002			-0.002	-0.002	
		(0.002)	(0.002)			(0.002)	(0.002)	
Similary of Prod. Structure (S)			0.105	0.058			0.035	-0.013
			(0.094)	(0.074)			(0.080)	(0.067)
Member of Euro Area					0.579***	0.603***	0.594***	0.575***
					(0.084)	(0.088)	(0.093)	(0.089)
Inflation differential					-0.063*	-0.059*	-0.061*	-0.064**
					(0.032)	(0.033)	(0.034)	(0.031)
Exchange Rate Volability					0.018	0.016	0.019	0.022
					(0.052)	(0.052)	(0.053)	(0.050)
Similiar Fuel Dependency					-0.001	-0.001	-0.001	
					(0.002)	(0.002)	(0.002)	
Constant	1.364***	1.429***	1.315***	1.238***	0.448	0.568	0.554	0.528
	(0.444)	(0.477)	(0.478)	(0.460)	(0.488)	(0.517)	(0.521)	(0.469)
Observations	109	109	109	109	109	109	109	109
R-Squared	0.10	0.10	0.11	0.10	0.34	0.35	0.35	0.34

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 2.
IV regressions Dependent variable: GDP correlation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Trade Integration (T)	0.127***	0.172***	0.180***	0.116***	0.108***	0.150***	0.169***	0.100***
	(0.034)	(0.044)	(0.047)	(0.040)	(0.036)	(0.046)	(0.049)	(0.042)
Financial Integration: all Flows (F)		-0.004*	-0.011*			-0.004	-0.010***	
		(0.002)	(0.003)			(0.002)	(0.003)	
Similary of Prod. Structure (S)			0.345**	0.064			0.315**	0.050
			(0.139	(0.095)			(0.131)	(0.089)
Inflation differential					-0.074**	-0.069**	-0.081	-0.077**
					(0.032)	(0.035)	(0.049)	(0.034)
Exchange Rate Volability					0.001	0.000	0.032	0.006
					(0.053)	(0.055)	(0.064)	(0.052)
Similiar Fuel Dependency					0.000	0.001	0.002	0.000
					(0.002)	(0.002)	(0.002)	(0.002)
Constant	1.862***	2.406***	2.220***	1.669***	1.753***	2.257***	2.312***	1.626***
	(0.458)	(0.563)	(0.621)	(0.563)	(0.518)	(0.637)	(0.656)	(0.618)
Observations	109	109	109	109	109	109	109	109
R-Squared	0.08	0.04	-0.05	0.09	0.18	0.14	0.05	0.19
Anderson (1984) LR-test of identification	108.85	62.46	45.76	80.52	106.78	62.05	41.61	88.23
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cragg-Donald Chi-sq test of identification	186.88	84.33	56.87	119.16	181.33	83.59	50.67	135.89
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Anderson-Rubin test of significance of endog. Regressors	436.13	436.13	436.13	436.13	206.64	206.64	206.64	206.64
p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 3.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: Total flows over GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-23.707* (12.939)	
Trade Integration (T)	0.110** (0.049)		-0.698 (2.916)	-0.023 (0.046)
Financial integration: all flows (F)	-0.012*** (0.004)	0.017 (0.017)		0.011*** (0.004)
Similarity of Prod. Structure (S)	0.203* (0.123)	0.043 (0.582)		
Member of Euro Area	0.561*** (0.137)	0.190 (0.549)	17.934*** (8.632)	
Inflation Differential	-0.040 (0.035)			
Exchange Rate Volability	0.003 (0.053)			
Similar Fuel Dependency	-0.000 (0.002)			
Distance		-0.856*** (0.155)	-10.080*** (3.747)	
EU-15		0.504 (0.527)		
Common Language		0.742 (0.526)	20.312*** (5.448)	
Access to sea		0.792*** (0.214)		
Partner´s Land area		-0.103** (0.044)		
Absolut difference of GDP per capita				-0.213*** (0.051)
Absolute time difference			0.304 (0.229)	
Partner´s GDP per capita			8.799*** (1.556)	
Constant	1-337** (0.649)	-5.524*** (1.187)	-16.876 (36.245)	0.730 (0.576)
Observations	109	109	109	109
R-Squared	0.20	0.59	0.44	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 4.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: Flows in Levels)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-7.620 (11.850)	
Trade Integration (T)	0.095** (0.046)		-1.328 (2.553)	-0.086** (0.004)
Financial integration: all flows (F)	-0.011*** (0.003)	0.035** (0.015)		0.011*** (0.004)
Similarity of Prod. Structure (S)	0.335*** (0.124)	-1.121** (0.524)		
Member of Euro Area	0.539*** (0.136)	0.073 (0.551)	6.889 (7.873)	
Inflation Differential	-0.066* (0.037)			
Exchange Rate Volability	0.035 (0.057)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.793*** (0.154)	-10.665*** (3.333)	
EU-15		0.604 (0.517)		
Common Language		0.433 (0.484)	21.629*** (4.954)	
Access to sea		0.804*** (0.210)		
Common Border		0.394 (0.659)		
Partner´s Land area		-0.082* (0.042)		
Absolut difference of GDP per capita				-0.126** (0.050)
Absolute time difference			0.125 (0.215)	
Partner´s GDP			5.121*** (0.688)	
Partner´s GDP per capita			6.776*** (1.553)	
Constant	1.213* (0.619)	-5.382*** (1.184)	-93.813*** (33.553)	-0.173 (0.553)
Observations	109	109	109	109
R-Squared	0.18	0.47	0.67	0.37

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 5.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: Equity Flows [stocks + FDI] over partner´s GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-10.026 (12.648)	
Trade Integration (T)	0.101** (0.049)		0.348 (2.844)	-0.016 (0.045)
Financial integration: Equity+FDI (F)	-0.011*** (0.004)	0.029* (0.017)		0.009*** (0.004)
Similarity of Prod. Structure (S)	0.188 (0.121)	-0.316 (0.555)		
Member of Euro Area	0.558*** (0.136)	0.116 (0.555)	10.124 (8.386)	
Inflation Differential	-0.049 (0.036)			
Exchange Rate Volability	0.012 (0.056)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.818*** (0.152)	-7.069* (3.676)	
EU-15		0.504 (0.536)		
Common Language		0.411 (0.517)	23.041*** (5.347)	
Access to sea		0.798*** (0.215)		
Partner´s Land area		-0.087** (0.044)		
Absolut difference of GDP per capita				-0.225*** (0.049)
Absolute time difference			0.251 (0.230)	
Partner´s GDP per capita			8.501*** (1.522)	
Constant	1.266* (0.654)	-5.542*** (1.197)	-28.193 (35.541)	0.820 (0.568)
Observations	109	109	109	109
R-Squared	0.24	0.57	0.54	0.46

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 6.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: FDI flows over partner´s GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-23.313* (12.722)	
Trade Integration (T)	0.109** (0.049)		-0.763 (2.870)	-0.019 (0.046)
Financial integration: FDI (F)	-0.012*** (0.004)	0.017 (0.018)		0.010*** (0.004)
Similarity of Prod. Structure (S)	0.191 (0.121)	0.054 (0.584)		
Member of Euro Area	0.555*** (0.137)	0.192 (0.549)	17.025** (8.488)	
Inflation Differential	-0.039 (0.035)			
Exchange Rate Volability	0.002 (0.053)			
Similar Fuel Dependency	-0.000 (0.002)			
Distance		-0.856*** (0.157)	-10.070*** (3.685)	
EU-15		0.515 (0.525)		
Common Language		0.733 (0.538)	20.682*** (5.363)	
Access to sea		0.793*** (0.214)		
Partner´s Land area		-0.103** (0.044)		
Absolut difference of GDP per capita				-0.218*** (0.050)
Absolute time difference			0.304 (0.225)	
Partner´s GDP per capita			8.594*** (1.531)	
Constant	1.322* (0.647)	-5.527*** (1.186)	-16.494 (35.665)	0.793 (0.573)
Observations	109	109	109	109
R-Squared	0.21	0.59	0.44	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 7.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: Total flows over minimum of Spain´s and partner´s GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-8.737 (11.957)	
Trade Integration: trade over min (GDP_i, GDP_{Spain}) (T)	0.131** (0.055)		6.565*** (2.520)	0.021 (0.049)
Financial integration: all flows over min (GDP_i, GDP_{Spain}) (F)	-0.013*** (0.004)	0.057*** (0.017)		0.008** (0.004)
Similarity of Prod. Structure (S)	0.134 (0.122)	-0.828 (0.582)		
Member of Euro Area	0.538*** (0.138)	0.138 (0.550)	5.184 (8.038)	
Inflation Differential	-0.039 (0.036)			
Exchange Rate Volability	0.001 (0.054)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.622*** (0.159)	-1.406 (3.218)	
EU-15		0.433 (0.513)		
Common Language		-0.471 (0.518)	17.309*** (4.817)	
Access to sea		0.678*** (0.220)		
Partner´s Land area		0.012 (0.043)		
Absolut difference of GDP per capita				-0.210*** (0.050)
Constant	1.636** (0.709)	-7.299*** (1.219)	27.278 (34.514)	1-267** (0.609)
Absolute time difference			0.174 (0.204)	
Partner´s GDP per capita			6.286*** (1.540)	
Observations	109	109	109	109
R-Squared	0.18	0.45	0.49	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 8.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: Equity flows [stocks + FDI] over minimum of Spain´s and partner´s GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			1.288 (11.746)	
Trade Integration: trade over min (GDP_i, GDP_{Spain}) (T)	0.112** (0.055)		6.836*** (2.513)	0.032 (0.049)
Financial integration: Equity + FDI flows over min (GDP_i, GDP_{Spain}) (F)	-0.011*** (0.004)	0.065*** (0.016)		0.007** (0.004)
Similarity of Prod. Structure (S)	0.130 (0.121)	-0.961* (0.549)		
Member of Euro Area	0.545*** (0.137)	0.176 (0.537)	-0.028 (7.872)	
Inflation Differential	-0.048 (0.037)			
Exchange Rate Volability	0.009 (0.056)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.622*** (0.156)	0.458 (4.820)	
EU-15		0.284 (0.490)		
Common Language		-0.700 (0.500)	20.215*** (4.820)	
Access to sea		0.666*** (0.221)		
Partner´s Land area		0.016 (0.042)		
Absolut difference of GDP per capita				-0.221*** (0.049)
Absolute time difference			0.114 (0.197)	
Partner´s GDP per capita			6.055*** (1.553)	
Constant	1.428** (0.715)	-7.054*** (1.226)	14.916 (34.673)	1.416** (0.601)
Observations	109	109	109	109
R-Squared	0.24	0.42	0.50	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 9.
Three-stage least squares regression: System of four equations (1)-(4)
(Financial Linkages: FDI flows over minimum of Spain´s and partner´s GDP)

Equation Number Dependent variable	(1) Outpt Correlation (ρ)	(2) Trade Linkages (T)	(3) Financial Linkages (F)	(4) Similarity of Prod. Struct. (S)
GDP Correlation (ρ)			-8.582 (11.727)	
Trade Integration: trade over min (GDP_i, GDP_{Spain}) (T)	0.130** (0.055)		6.337** (2.473)	0.026 (0.049)
Financial integration: FDI flows over min (GDP_i, GDP_{Spain}) (F)	-0.012*** (0.004)	0.058*** (0.017)		0.008** (0.004)
Similarity of Prod. Structure (S)	0.123 (0.121)	-0.820 (0.587)		
Member of Euro Area	0.531*** (0.138)	0.160 (0.552)	4.517 (7.884)	
Inflation Differential	-0.038 (0.036)			
Exchange Rate Volability	0.002 (0.054)			
Similar Fuel Dependency	-0.001 (0.002)			
Distance		-0.617*** (0.161)	-1.571 (3.157)	
EU-15		0.449 (0.515)		
Common Language		-0.512 (0.532)	17.759*** (4.727)	
Access to sea		0.686*** (0.221)		
Partner´s Land area		0.011 (0.043)		
Absolut difference of GDP per capita				-0.214*** (0.050)
Absolute time difference			0.175 (0.200)	
Partner´s GDP per capita			6.146*** (1.513)	
Constant	1.619** (0.706)	-7.305*** (1.223)	26.425 (33.869)	1.342** (0.603)
Observations	109	109	109	109
R-Squared	0.19	0.45	0.49	0.45

Standard errors in parentheses
* significant at 10%; ** significant at 5%; ***significant at 1%
All varaibles measured in logs except dummy variables.

Table 10.
Effect on GDP correlation from increase by 1 standard deviation in trade or financial links

Specification as in:	Table 3	Table 5	Table 6	Table 7	Table 8	Table 9
Absolute variation of GDP correlation						
Trade Integration (T)	0.1509	0.1254	0.1527	0.1750	0.1496	0.1737
Financial Integration (F)	-0.1550	-0.1222	-0.1538	-0.2439	-02037	-0.2207
Percentage of standard deviation of GDP correlation						
Trade Integration (T)	39.3%	32.7%	39,7%	45.6%	38.9%	45.2%
Financial integration (F)	-40.4%	-31.8%	-40.0%	-63.5%	-53.0%	-57.5%

Memo:

Mean GDP correlation in sample:	0.160
Standard deviation of GDP correlation:	0.384

Table 11.
Summary Statistics

Variable	No. Observ.	Mean	Std. Dev.	Min	Max	Coeff. of Variation	Percentiles 5%	50%	95%
Output correlation with Spain, 1990-2004 (ρ)	109	0.160	0.384	-0.846	0.898	2.401	-0.528	0.173	0.838
Trade Linkages over partner´s GDP 1997-2003[1] (T)	109	-13.379	1.336	-17.188	-10.143	-0.100	-15.711	-13.256	-11.584
Trade Linkages over min (GDP_i, GDP_{Spain}) 1997-2003[1] (T)	109	-13.274	1.355	-17.188	-10.143	-0.102	-15.665	-13.184	-11.184
Total Financial Linkages over partner´s GDP 1998-2003[2] (F)	109	-16.350	18.676	-36.841	6.554	-1.142	-36.841	-2.503	3.242
Total Financial Linkages over min (GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.350	18.760	-36.841	6.554	-1.154	-36.841	-2.362	3.650
Equity Financial Linkages over partner´s GDP 1998-2003[2] (F)	109	-16.894	18.515	-36.841	6.139	-1.096	-36.841	-2.846	2759
Equity Financial Linkages over min (GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.894	18.515	-36.841	6.139	-1.096	-36.841	-2.846	2759
FDI Financial Linkages over partner´s GDP 1998-2003[2] (F)	109	-16.751	18.312	-36.841	5.635	-1.093	-36.841	-3.136	2.536
FDI Financial Linkages over min (GDP_i, GDP_{Spain}) 1998-2003[2] (F)	109	-16.655	18.394	-36.841	5.635	-1.104	-36.841	-3.136	2.536
Similarity in productive Structure 1980-2003[2] (S)	109	0.594	0.489	-0.281	1.666	0.824	-0.158	0.497	1.401
Member of Euro area (1=yes)	109	0.101	0.303	0.000	1.000	2.999	0.000	0.000	1.000
Average Inflation differencial 1990-2003	109	1.994	1.530	-0.630	7.298	0.767	0.446	1.713	5.053
Exchange Rate Volability 1990-2003[4]	109	-1.415	0.998	-3.302	1.668	-0.706	-2.697	-1.612	0.779
Similar Fuel Dependency 1990-2002	109	-0.621	14.837	-73.795	13.445	-23.884	28.360	3.481	11.020
Distance to main city (km)	109	8.424	0.785	6.217	9.883	0.093	7.140	8.672	9.365
Spanish spoken (1=yes)	109	0.156	0.364	0	1	2.337	0	0	1
Access to seacost (1=yes)	109	0.807	0.396	0	1	0.491	0	1	1
Sharing a land border	109	0.018	0.135	0	1	7.348	0	0	0
Partner´s Land area	109	12.032	2.154	5.756	16.653	0.179	7.621	12.378	15.855
Absolute time difference to main financial cente	109	-2.786	6.557	-13.816	2.398	-2.354	-13.816	0.000	2.079
Average GDP 1990-2003	109	17.877	1.928	12.594	22.877	0.108	15.206	17.622	20.978
Average per capita GDP 1990-2003	109	8.610	1.104	6.133	10.615	0.128	6.729	8.642	10.149
Absolute difference of percapita GDPs 1990-2003	109	1.271	0.946	0.043	3.616	0.745	0.150	1.106	3.019

1 Average over the period of the sum of bilateral exports plus imports over the sum od GDPs
2 Average over the period of total bilateral inflows and outflous to and from Spain.
3 Computed from value added from the industrial sector only. Higher values imply more similarity.
4 Coefficient of variation of the bilateral exchange rate with Spain (monthly average).

Table 12.
Table of Cross Correlations

(Based on common 109 observations. Star: correlations significantly different from zero at 95% confidence level)

	Output correlation with Spain, 1990-2004 (r)	Trade Linkages over partner's GDP 1997-20031 (T)	Trade Linkages over min(GDP$_i$, GDP Spain) 1997-20031 (T)	Total Financial Linkages over partner's GDP 1998-20032 (F)	Total Financial Linkages over min(GDP$_i$, GDP Spain) 1998-20032	Equity Financial Linkages over partner's GDP 1998-20032 (F)	Equity Financial Linkages over min(GDP$_i$, GDP Spain) 1998-20032	FDI Financial Linkages over partner's GDP 1998-20032 (F)	FDI Financial Linkages over min(GDP$_i$, GDP Spain) 1998-20032 (F)	Similarity in Productive Structure 1980-20003 (S)	Member of Euro Area (1=yes)	Member of the EU	Average Inflation differencial 1990-2003	Exchange rate volatility 1990-20034	Similar fuel dependency 1990-2002	Distance to main city (km)	Spanish spoken (1=yes)	Access to seacoast (1=yes)	Sharing a land border	Partner's Land area	Absolute time difference to main financial centre	Average GDP 1990-2003	Average per capita GDP 1990-2003	Absolute difference of percapita GDPs 1990-2003
Output correlation with Spain, 1990-2004 (ρ)	1.0000																							
Trade Linkages over partner's GDP 1997-2003[1] (T)	0.3130*	1.0000																						
Trade Linkages over min(GDP$_i$, GDP$_{Spain}$) 1997-2003[1] (T)	0.3065*	0.9615*	1.0000																					
Total Financial Linkages over partner's GDP 1998-2003[2] (F)	0.1094	0.4711*	0.5299*	1.0000																				
Total Financial Linkages over min(GDP$_i$, GDP$_{Spain}$) 1998-2003[2] (F)	0.1088	0.4674*	0.5312*	0.9998*	1.0000																			
Equity Financial Linkages over partner's GDP 1998-2003[2] (F)	0.1026	0.4692*	0.5288*	0.9833*	0.9832*	1.0000																		
Equity Financial Linkages over min(GDP$_i$, GDP$_{Spain}$) 1998-2003[2] (F)	0.1026	0.4692*	0.5288*	0.9833*	0.9832*	1.0000*	1.0000																	
FDI Financial Linkages over partner's GDP 1998-2003[2] (F)	0.0990	0.4676*	0.5245*	0.9997*	0.9994*	0.9832*	0.9832*	1.0000																
FDI Financial Linkages over min(GDP$_i$, GDP$_{Spain}$) 1998-2003[2] (F)	0.0984	0.4639*	0.5260*	0.9996*	0.9997*	0.9833*	0.9833*	0.9998*	1.0000															
Similarity in Productive Structure 1980-2000[3] (S)	0.1675	0.3243*	0.3992*	0.5765*	0.5792*	0.5823*	0.5823*	0.5714*	0.5742*	1.0000														
Member of Euro Area (1=yes)	0.5396*	0.4803*	0.4977*	0.3491*	0.3493*	0.3462*	0.3462*	0.3379*	0.3382*	0.3506*	1.0000													
Member of the EU	0.5415*	0.5260*	0.5468*	0.3974*	0.3977*	0.3945*	0.3945*	0.3847*	0.3851*	0.4020*	0.8727*	1.0000												
Average Inflation differencial 1990-2003	-0.3608*	-0.1796	-0.2133*	-0.0294	-0.0321	-0.0428	-0.0428	-0.0208	-0.0236	-0.0442	-0.1332*	-0.3573*	1.0000											
Exchange rate volatility 1990-2003[4]	-0.3272*	-0.2167*	-0.2284*	-0.0903	-0.0913	-0.0781	-0.0781	-0.0822	-0.0832	-0.1321	-0.3501*	-0.3892*	0.8362*	1.0000										
Similar fuel dependency 1990-2002	-0.0264	-0.1379	-0.1302	0.0606	0.0609	0.0486	0.0486	0.0598	0.0601	-0.0086	0.0653	0.0646	-0.0450	-0.1174	1.0000									
Distance to main city (km)	-0.5098*	-0.5828*	-0.5669*	-0.2913*	-0.2896*	-0.2732*	-0.2732*	-0.2853*	-0.2836*	-0.3396*	-0.4993*	-0.5420*	0.1624	0.2564*	0.0326	1.0000								
Spanish spoken (1=yes)	-0.3669*	0.0830	0.0511	0.3455*	0.3419*	0.3592*	0.3592*	0.3572*	0.3534*	-0.1353	-0.1440	-0.1650	0.3252*	0.2391*	0.0189	0.3568*	1.0000							
Access to seacoast (1=yes)	-0.1792	0.2897*	0.3233*	0.1593	0.1611	0.1494	0.1494	0.1567	0.1585	0.1624	0.0092	0.0485	-0.0019	0.0062	-0.1670	0.0690	0.0818	1.0000						
Sharing a land border	0.2604*	0.2897*	0.3076*	0.1437	0.1446	0.1443	0.1443	0.1411	0.1420	0.1683	0.4081*	0.3561*	-0.1254	-0.1593	0.0318	-0.3215*	-0.0588	0.0668	1.0000					
Partner's Land area	-0.1366	-0.1403	-0.0432	0.1980*	0.2034*	0.2070*	0.2070*	0.2002*	0.2057*	0.2638*	-0.0919	-0.0827	0.2355*	0.2984*	-0.2674*	0.1477	0.1106	0.0657	0.0186	1.0000				
Absolute time difference to main financial centre	-0.3595*	-0.3881*	-0.3659*	-0.1070	-0.1055	-0.1093	-0.1093	-0.1024	-0.1010	-0.2768*	-0.3083*	-0.3585*	0.1068	0.2557*	0.2668*	0.6481*	0.2984*	0.1633	-0.0863	0.0636	1.0000			
Average GDP 1990-2003	0.0432	0.1432	0.2977*	0.5698*	0.5777*	0.5788*	0.5788*	0.5658*	0.5740*	0.7358*	0.2496*	0.2986*	-0.0639	-0.0464	-0.0985	-0.1104	-0.0172	0.2448*	0.1442	0.5999*	-0.0394	1.0000		
Average per capita GDP 1990-2003	0.2126*	0.4840*	0.5340*	0.6007*	0.6018*	0.5902*	0.5902*	0.5932*	0.5945*	0.6243*	0.4208*	0.4866*	-0.3277*	-0.4053*	0.0120	-0.2851*	-0.0378	0.2369*	0.1475	-0.1603	-0.2194*	0.4433*	1.0000	
Absolute difference of percapita GDPs 1990-2003	-0.1353	-0.4583*	-0.4883*	-0.5616*	-0.5615*	-0.5493*	-0.5493*	-0.5563*	-0.5563*	-0.6089*	-0.3440*	-0.3943*	0.2526*	0.3682*	-0.0128	0.2418*	-0.0164	-0.2841*	-0.1584	0.1784	0.1653	-0.4047*	-0.9665*	1.0000

[1] Average over the period of the sum of bilateral exports plus imports over the sum of GDPs

[2] Average over the period of total bilateral inflows and outflows to and from Spain

[3] Computed from value added from the industrial sector only. Higher values imply more similarity.

[4] Coefficient of variation of the bilateral exchange rate with Spain (monthly average).

Table 13.
Countries included in the regressions (total=109)

ISO code	Country Name	ISO code	Country Name	ISO code	Country Name	ISO code	Country Name
ALB	Albania	**ECU**	**Ecuador**	KEN	Kenya	**POL**	**Poland**
ARG	**Argentina**	**EGY**	**Egypt**	**KOR**	**Korea**	**PRT**	**Portugal**
AUS	**Australia**	ETH	Ethiopia	LCA	St. Lucia	**PRY**	**Paraguay**
AUT	**Austria**	**FIN**	**Finland**	LKA	Sri Lanka	**ROU**	**Romania**
BDI	Burundi	FJI	Fiji Is.	**LUX**	**Luxemburg**	**RUS**	**Russia**
BEL	**Belgium**	**FRA**	**France**	**LVA**	**Latvia**	RWA	Rwanda
BEN	Benin	GAB	Gabon	**MAR**	**Morocco**	SEN	Senegal
BFA	Burkina Faso	**GBR**	**UK**	MDG	Madagascar	**SLV**	**El Salvador**
BGD	Bangladesh	**GER**	**Germany**	**MEX**	**Mexico**	**SVK**	**Slovakia**
BGR	**Bulgaria**	GHA	Ghana	MKD	Macedonia	**SVN**	**Slovenia**
BLZ	Belize	GMB	Gambia	**MLT**	**Malta**	**SWE**	**Sweden**
BOL	**Bolivia**	**GRC**	**Greece**	MUS	Mauritius	SWZ	Swaziland
BRA	**Brazil**	**GTM**	**Guatemala**	MWI	Malawi	SYC	Seychelles
BRB	Barbados	**HGK**	**Hong Kong**	**MYS**	**Malaysia**	SYR	Syria
BWA	Bostwana	**HND**	**Honduras**	NAM	Namibia	TGO	Togo
CAN	**Canada**	HRV	Croacia	NER	Niger	THA	Thailand
CHE	**Switzerland**	**HUN**	**Hungary**	NGA	Nigeria	TTO	Trinidad and Tobago
CHL	**Chile**	**IDN**	**Indonesia**	**NIC**	**Nicaragua**	**TUN**	**Tunisia**
CHN	**China**	**IND**	**India**	**NLD**	**Netherlands**	**TUR**	**Turkey**
CIV	Cote d´Ivoire	**IRL**	**Ireland**	**NOR**	**Norway**	TZA	Tanzania
CMR	Cameroon	IRN	Iran	NPL	Nepal	UGA	Uganda
COG	Congo Brazzaville	**ISL**	**Iceland**	NZL	New Zealand	**URY**	**Uruguay**
COL	**Colombia**	ISR	Israel	PAK	Pakistan	**USA**	**USA**
CRI	**Costa Rica**	**ITA**	**Italy**	**PAN**	**Panama**	**VEN**	**Venezuela**
CZE	**Czech Rep.**	JAM	Jamaica	**PER**	**Peru**	ZAF	South Africa
DNK	**Denmark**	JOR	Jordan	**PHL**	**Phillipines**	ZMB	Zambia
DOM	Dominicab Republic	**JPN**	**Japan**	PNG	Papua New Guinea	ZWE	Zimbabwe
DZA	**Algeria**						

In boldface: countries with total financial flows greater than zero.

APPENDIX B: DEFINITION OF VARIABLES AND SOURCES.

Output Synchronization (ρ): Measured as the Pearson correlation between the filtered series of GDP for Spain and for the partner country. GDP data was filtered using Baxter and King's band-pass filter. Alternative specifications use H-P filtered data or the log difference (growth rates) of annual GDPs. Data for annual GDP at purchasing power parity was taken from the IMF's World Economic Outlook database.

Trade Linkages (T): Measured as the sum of imports and exports between Spain and a given country, over the partner's GDPs. This measure is then averaged over the denoted period. That is,

$$T_{ESP,i} = \frac{1}{T}\sum_{t}\frac{X_{ESP,i,t} + M_{ESP,i,t}}{GDP_{i,t}}$$

Data for exports and imports was obtained from the IMF's Direction of Trade Statistics. GDP data was taken from the Penn World Tables version 6.1.

Financial Linkages (F): Measured as the sum of inflows and outflows of FDI and portfolio flows between Spain and a given country, divided over the partner's GDP. Alternative specifications use just the level of inflows plus outflows, or divide them over the minimum of Spain's and the partner's GDP. This measure is then averaged over the duration of the period. This measure can also be constructed for Equity flows (Stock + FDI) or for FDI flows. Data obtained from the Spanish Balance of Payments.

Similarity in productive structure (S): Measured as the time average of discrepancies in economic structures. In particular, we take the shares $s_{n,i,t}$ of value added for industrial sector n in country i at time t and construct the following indicator of distance:

$$S^{1}{}_{ESP,i} = -\frac{1}{T}\sum_{t}\sum_{n=1}^{N}\left|s_{n,ESP,t} - s_{n,i,t}\right|$$

For value added, we take industrial sectors at 2-digit ISIC level. Data was obtained from the United Nations Industrial Development Organization (UNIDO).

Distance to main city: Computed at the great circle distance (in km) between Madrid (Spain), and the main city of a given country. In general, we take the capital city as the main city, except for the US (New York), Pakistan (Karachi), Brazil (Sao Paulo), China (Shanghai), Canada (Toronto), Switzerland (Zurich), Germany (Frankfurt), Turkey (Istambul), Israel (Tel Aviv), India (Mumbay), Australia (Sydney), Cote d'Ivoire (Abidjan), Kazakhstan (Almaty), Morocco (Casablanca), New Zealand (Auckland), Nigeria (Lagos), South Africa (Johannesburg) and Yemen (Aden). Data was obtained from http://www.indo.com/distance/index.html.

Spanish spoken: dummy variable that takes value 1 if a given country has Spanish as the main language. Data was elaborated by the authors.

Access to seacoast: dummy variable that takes value 1 if a country has sovereign access to the seacoast. Data elaborated by the authors.

Absolute time difference to main financial center: Absolute value of the standard time zone difference between the main city used for "distance" and mainland Spain. Source: http://www.timeanddate.com/worldclock/

Member of Euro Area: dummy variable that takes value 1 if a given country has joined the Euro. Data elaborated by the authors.

Member of European Union: dummy variable that takes value 1 if a given country has joined the European Union (before 2004). Data elaborated by the authors.

Average Inflation Differential: Computed as the time average over the period referred of the absolute difference of quarterly inflation rates between Spain and a given country. Annual inflation data was obtained from the IMF's International Financial Statistics.

Exchange Rate Volatility: Computed as the standard deviation (over the period referred) of the bilateral nominal exchange rate (monthly average) between Spain and a given country. Monthly exchange rate data was obtained from the IMF's International Financial Statistics using bilateral exchange rates for both countries vis-à-vis the US dollar.

Land area: Partner's land area (in square km). Data for land areas was obtained from http://www.infoplease.com/ipa/A0004379.html and the CIA World Factbook.

Population: Average population of partner country for the period chosen (in millions). Data on countries' population was obtained from the World Bank.

Average GDP: Partner's average GDP measured at PPP. GDP data at PPP was obtained from the Penn World Tables 6.1.

Per capita GDPs: Partner's average per capita GDP. Data was obtained from the Penn World Tables 6.1.

Absolute difference of per-capita GDPs: (between Spain and the partner country) measured as the time average over the referred period. Data was obtained from the Penn World Tables 6.1.

Similarity of oil dependency: constructed as the product of average oil dependency in Spain and a given country *i*:

$$\left(\frac{1}{T}\sum_{t}\frac{Moil_{i,t}-Xoil_{i,t}}{GDP_{i,t}}\right)\times\left(\frac{1}{T}\sum_{t}\frac{Moil_{ESP,t}-Xoil_{ESP,t}}{GDP_{ESP,t}}\right)$$

where $Moil_{i,t}$ and $Xoil_{i,t}$ are imports and exports of oil in country *i* at time *t* and *ESP* represents Spain. Data for oil imports and exports as well as nominal GDP (all in current US dollars) was obtained from the World Bank.

Comment

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1. Introduction

The paper by García-Herrero and Ruiz (henceforth, GR), studies the role of trade and financial integration in fostering business cycle synchronization across countries. This paper presents three main novelties with respect to the existing literature. First of all, GR have put together an impressive dataset of bilateral financial flows between Spain and 109 countries. Typically, most studies analyze the behavior of one economy *vis-à-vis* the rest of the world, using aggregate financial flows from balance of payments data. Hence, the level of disaggregation in this paper is very welcome. Second, the authors study the behavior of a true "small open economy" such as Spain, that can take trade and financial developments as exogenous. This is opposed to studies that focus on the U.S. economy, whose behavior can affect the rest of the world and hence, the exogeneity assumption might be not appropiate. Finally, the authors estimate a system of equations to take into account the multiple channels through which trade liberalization, financial liberalization and business cycle synchronization operate, and that might cancel out in the aggregate. The main results of the paper can be summarized as follows: GR find that the similarity of productive structure and trade links promote the synchronization of cycles, while, on the other hand, increased financial integration lowers the correlation of output at business cycle frequencies across countries.

In principle, and as discussed by GR, both trade and financial links can have positive and negative effects on business cycle synchronization. On the trade side, trade liberalization would increase business cycle synchronization if there is an increase in intra-industry trade between countries. But if trade liberalization encourages specialization across countries, then we would expect less synchronization. Also, increased financial integration can be associated with lower business cycle synchronization: in a two-country world, if a country experiences a positive productivity shock and there is perfect capital mobility, resources will flow into that economy, thereby increasing even further investment and output, and depressing investment and output in the other country. In order to fix some ideas and understand which forces are at play, in this discussion I will present some simulations based on international macroeconomic business cycle models, such as Backus et al. (1992) and Heathcote and Perri (2002), and then relate them to GR´s results.

2. TWO INTERNATIONAL BUSINESS CYCLE MODELS

2.1 One Good, Two Country Model

In order to understand the role of perfect versus imperfect financial integration, this section studies the implications of a simplified version of Backus et al. (1992)[1]. We assume this is a one good, two country economy, with perfect capital mobility across countries, but no labor mobility. Agents have access to complete markets, in the sense that they have access to a complete set of Arrow securities that pay one unit of the final good in each state of the economy. In the home country, the production function of the final good is:

$$Y_t = A_t K_t^{\alpha} L_t^{1-\alpha} \tag{1}$$

where K is capital, L is labor, α is the capital share of output and Y is the final good. The capital accumulation equation is

1. Backus et al. (1992) also introduce inventories in their model.

$$K_{t+1} = (1-\delta)K_t + X_t \tag{2}$$

where δ is the depreciation rate and X is investment. Finally, the utility function of agents is as follows:

$$\frac{[C_t^{\gamma}(1-L_t)^{1-\gamma}]^{1-\sigma}}{1-\sigma} \tag{3}$$

where C denotes consumption of the final good, γ is the share of leisure in the utility function, and ε is the inverse elasticity of intertemporal substitution. Similar expressions hold for the foreign country. Finally, the world resource constraint is given by

$$Y_t + Y_t^* = C_t + C_t^* + X_t + X_t^* \tag{4}$$

where variables with a star denote the foreign-country counterparts of the variables we described for the home country.

Finally, we assume that the TFP processes in both countries (A,A^*) evolves as a Vector Autoregression of order one, a VAR 1), as follows:

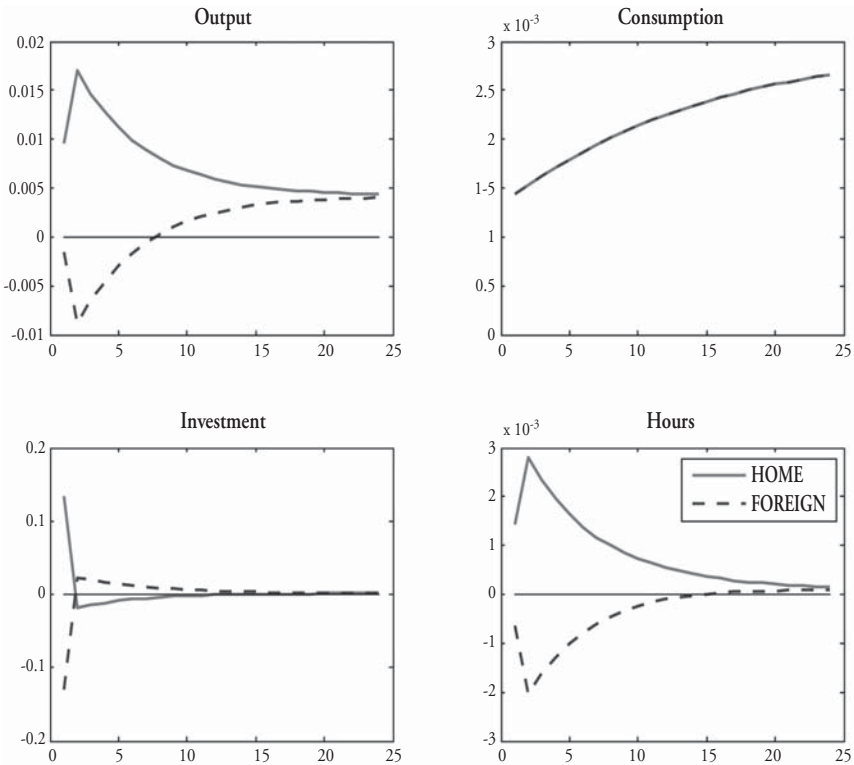
$$\begin{aligned} \begin{bmatrix} \log(A_t) \\ \log(A_t^*) \end{bmatrix} &= \begin{bmatrix} \rho_a & \rho_a^* \\ \rho_a^* & \rho_a \end{bmatrix} \begin{bmatrix} \log(A_{t-1}) \\ \log(A_{t-1}^*) \end{bmatrix} + \begin{bmatrix} \sigma_a \varepsilon_t \\ \sigma_a \varepsilon_t^* \end{bmatrix}, \\ E\left[\varepsilon_t \varepsilon_t'\right] &= \begin{bmatrix} 1 & \nu \\ \nu & 1 \end{bmatrix}. \end{aligned}$$

where we have assumed symmetry across the coefficients of the VAR. In the literature, the coefficient ρ_a^* is referred to as the *spillover* coefficient, and also it is possible that the innovations of the TFP shocks are contemporaneously correlated across countries if the coefficient v is different from zero.

In Figure 1, we present the impulse response of output, consumption, investment and hours to a positive TFP shock in the home country. The calibration of most parameters follows Backus et al. (1992) except that we have assumed separable preferences and there is no spillovers and zero correlation between the innovations across shocks.[2] Following a positive technology shock in the home country,

2. The calibration is as follows: γ =0:34, α =0:36, σ =01, β =0:99, δ =0:025, σ_a =0:0852, ρ_a=0:906, γ ρ_a^* =0, and v =0.

Figure 1.
Impulse Response to a Technology Shock in the Home Country.
All variables response is in percent deviation from steady-state values.



output, investment and hours increase in the home country, while-they decline inthe foreign country. Perfect financial integration implies that investment rates are highly negatively correlated, as foreign country households disinvest in their country to lend resources to the home country, which has higher rates of return. As a result, hours increase in the home country and decrease in the foreign country because of different marginal productivities of labor. Therefore the response of output is negatively correlated. Also, due to complete markets and separable preferences, the response of consumption is colinear.

Hence, this simple model has important main failures, but some useful lessons can be extracted. In the model, *(Corr C,C*)* =1 and *(Corr Y,Y*)* = –0.77, while in the data, *(Corr Y,Y*)* > *(Corr C,C*)* > 0 for most countries and sample periods. In Table 1, we present the

HP-filtered statistics of simulating more elaborate versions of the model, that include nonseparable preferences (σ = 2), imperfect financial integration, productivity spillovers (ρ_a^* = 0.088), and correlations between the innovations of the technology shocks (v = 0.258). When we introduce each new feature we calibrate it following Backus et al. (1992).

Table 1.
HP-Filtered Statistics, Backus et al. (1992) model

Complete Markets	Corr (C,C*)	Corr (Y,Y*)
Simple	1	-0.77
Spillovers and Correlation	1	-0.67
Spillovers, Correlation, and Non-Separable	0.71	-0.56
Imperfect Financial Integration		
Simple	-0.02	0.00
Spillovers and Correlation	0.77	0.08
Spillovers, Correlation, and Non-Separable	0.74	0.08

So what do we learn from simulating all these versions of the models? First of all, imperfect financial integration increases the correlation of output across countries, while spillovers and correlation of the innovations also play a role. Also, imperfect financial integration lowers the correlation between consumption across countries, but spillovers increase it again.

2.2 Two Good,Two Country Model

GR also want to study what happens as countries open up to trade, and their economies differ in productive structure. Therefore we need a more elaborate model than Backus et al. (1992). Hence, in this subsection we present the results from a two good, two country model as in Heathcote and Perri (2002). This model assumes that each country produces a different type of intermediate good, that can be traded internationally, and a final good, that is produced using the two types of intermediate goods. The final good is used either for final consumption, or it is invested.

The production function of the home intermediate good production is

$$\bar{Y}_{H,t} = A_t K_{t-1}^{\alpha} \left(L_t\right)^{1-\alpha}, \tag{5}$$

while the production function of the final good is

$$Y_t = \left[\omega Y_{H,t}^{\frac{\theta-1}{\theta}} + (1-\omega)\, Y_{F,t}^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}}. \tag{6}$$

Hence, this model allows us to study what happens as we change the degree of openness of the economy (the role of ω) and how similar are productive structures (the role of θ). In particular, the production function of the final good is linear as $\theta \to \infty$,, which is the case of perfect substitutability.

In Table 2 weshowthe HP filtered statistics for the cross correlations of output and consumption across countries. We show the case of imperfect financial integration, although changing the asset market structure does notchange the qualitative results.

Table 2.
HP-Filtered Statistics, Heathcote-Perri 2002) model

	Corr (C,C*)	Corr (Y,Y*)
Baseline Heathcote-Perri (ω = 0.85, θ = 0.9)	0.82	0.41
More Openness (ω =0.6, θ =0:9)	0.99	0.96
Higher Substitutability (ω =0.85, θ =6)	0.59	0.06
Both (ω =0.6, θ =6)	0.67	0.13

In this case, the model predicts that output correlation across countries should increase as economies open to trade (reflected in the model with a lower ω, that is, a lower fraction of domestically produced intermediate goods in the GDP). On the other hand, when products are more similar, that is, when we increase the substitutability coefficient θ, the correlation of output decreases. Why is that? If a country experiences a positive technology shock, it will be able to sell its product at a lower price. Since the elasticity of demand is θ, it will be able to gain a higher share of the market, and hence relative outputs will be negatively correlated. In the limiting case whenthe production function of the final good is linear, a reduction in price due to a technological improvement would imply that one country would sell all its product in the market and the other would not be able to sell anything.

2.3 Summary

What has been shown in this section it that in an IRBC model with technology shocks, output,correlation across countries should:

1. **decrease** with financial integration. In terms of GR´s regressions Eq.1), we should expect $\alpha_3 < 0$.

2. **increase** with trade openness. We should expect $\alpha_1 > 0$.

3. **decrease** with similar production structures. We should expect $\alpha_2 < 0$

GR find that the first two statements hold, so this is an encouraging result for the models. They find however, the opposite with the third statement, and link it to the role of common technology shocks and demand shocks.

3. CONCLUDING REMARKS

I will conclude commenting on the empirical strategy of GR. As we have shown, similar productive structures *per se* do not imply higher correlation of outputacross countries, since common (olr highly correlated) technology shocks are needed. If countries are hit by asymmetric TFP shocks, then similar productive structures actually reduce the correlation of output. In addition, the literature has solved some international macro puzzles by introducing some type of taste, demand, or fiscal shocks in the models (Stockman and Tesar, 1995; Rabanal and Tuesta, 2006). Hence, some type of demand indicator should be introduced in the set of control variables to assess the role of similar production structures.

GR estimate a system of equations to allow for all possible economic effects between business cycle syncronization, trade links and financial links. However, it is not clear if the coefficients can be biased depending on the degree of trade and capital liberalization in each country. Many countries have opened to international trade but have not liberalized their capital accounts, and I wonder how this policy choice might be affecting the estimated effect.

In this discussion, I have intentionally showed what are the predictions of IRBC models regarding the correlation of consumption across countries. Given the amount of work that GR have put in this paper, it would be interesting the authors could repeat the same exercise studying the correlation of consumption across countries.

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Discussion

Javier Andrés (Universidad de Valencia)

Greater similarity in financial structures should foster cyclical synchronicity and this should favour synchrony in Europe. A very different thing is the existence of investment flows and portfolio movements among countries, which may often respond to asymmetries and marked differences among financial structures. Many flows can represent what we might regard as great differences in financial systems from a structural point of view. Perhaps we should not call this financial integration as such, but rather financial connection or exposure or something like that.

Juan Ruiz (Banco de España)

I will begin with the last question. What is financial integration? What are we calling financial integration here? Perhaps that is a poor translation of what we call financial linkages in English, perhaps we should call it financial linkages. Yes, we are not talking

about whether financial structures are similar or not, but rather about flows. There is a very wide-ranging discussion in the literature on quantity indicators versus price indicators. Price indicators are better from the theoretical point of view, because first, we have a benchmark with which to compare. The problem may be the availability of data on bilateral relations at the price level. So normally, the second route is chosen, hoping that larger flows indicate markets are more closely related financially.

Pau's comments focused mainly on the relationship between productive structure and cycle synchronization and distinguished between productivity shocks and demand shocks. This is difficult and is something we have on our agenda. Two more of Pau's comments. Whether we should incorporate capital restrictions as relevant to financial integration or not. We probably should, but what has been seen in much of the empirical

literature is that when analyzing financial linkages, even trade linkages, de jure restrictions are usually less relevant than de facto linkages. That is why we have opted to incorporate flows instead of de jure restrictions. We have not incorporated capital restrictions in the empirical analysis. We will try to, but I suspect they may not be

very relevant, because of that dissociation between de jure restrictions and de facto flows.

Going a little beyond Miguel's comments, you were not very convinced by the fact that we have more financial integration, more financial linkages and lower cycle synchronization through the example of Spain in the Monetary Union or Spain in the European Union. That's true, Spain has increased its cycle synchronization with this country subset, but it's also true that we have included a variable in our empirical analysis that attempts to capture the direct influence of that integration, which is the dummy of belonging to the European Union, which has the same effect as the dummy we include for the Monetary Union.

The Determinants of Cross-Border Investment: A Value-Chain Analysis*

Claudia Canals
Marta Noguer
"la Caixa"

Abstract

This paper contributes to the literature on the determinants of FDI. We use a new data set covering greenfield and expansion projects to examine which factors influence the decision to invest abroad. Our empirical framework is an augmented gravity model that incorporates elements of factor proportions theory. At the aggregate level, we find that distance discourages FDI, size and sharing a language encourages it, and that FDI targets relatively capital scarce countries. When we classify investment projects according to their stage in the chain of production, we observe a lot of variation across stages. Nevertheless, economic size, distance, and capital abundance are still determining factors for most value-chain stages and preserve the sign of their effects. Moreover, even though the results confirm FDI targetting capital scarce countries, we find evidence of a minimum requirement on the host country's capital endowment in all the stages of production except extraction. Finally, ease of doing business is also important, especially so for the location of regional headquarters.

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1 INTRODUCTION

In the last decade, cross-border capital flows, and in particular Foreign Direct Investment (FDI), increased much faster than cross border trade or even than world GDP (see table 1) reaching 1.3 trillion in 2006[1]

Table 1.
FDI in the Global Economy (Growth rates)

	1986-1990	1991-1995	1996-2000	2002	2003	2004	2005	2006
FDI Inflows	21.7	21.8	40	-25.8	-9.3	31.6	27.4	38.1
GDP (current Prices)	1.1	5.9	1.3	3.9	12.3	12.4	7.7	8.6
Exports of goods and non-factor services	12.7	8.7	3.6	4.9	16.1	20.5	10.7	12.2

Data Source: World Investment Report 2007 and 2006

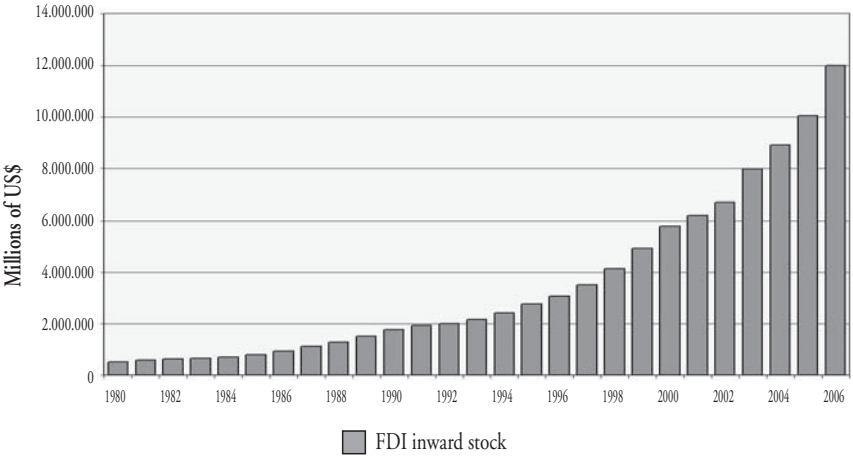
This recent surge in FDI (see Figures 1 and 2), and the positive qualities associated to this sort of international capital flow have fed a growing discussion over the effects and the determinants of FDI[2]. On the effects side, several theoretical studies have underscored different channels for foreign direct investment to enhance growth and economic performance. First, by providing long term financing that facilitates investment in both physical and human capital, specially so for those countries that are liquidity constrained. Secondly, by promoting efficiency, spillovers, and technological diffusion. Endogeneous growth tehory combined with a new conception of FDI activity that stresses its "enterpreneurship" component and the dependence of multinational activity on "property assets" have indeed expanded the set of potential benefits from foreign investment in productive capacity by attributing to it a decisive role as a channel of technology diffusion, information spillovers, productivity gains, physical and human capital accumulation including new managerial skills, new training for employees, and market access.

On the determinants side, there is also much light to shade on the factors that drive firms in a certain source country and in a certain industry to invest abroad, to do so in a particular host country, and to operate a specific stage of the chain of production. This paper contributes to the empirical literature on these determinants of FDI in

1. See World Investment Report (2007)

2. See for instance Romer (1993), Rappaport (2000) and Rodríguez-Clare(1996).

Figure 1.
World FDI Inward Stock



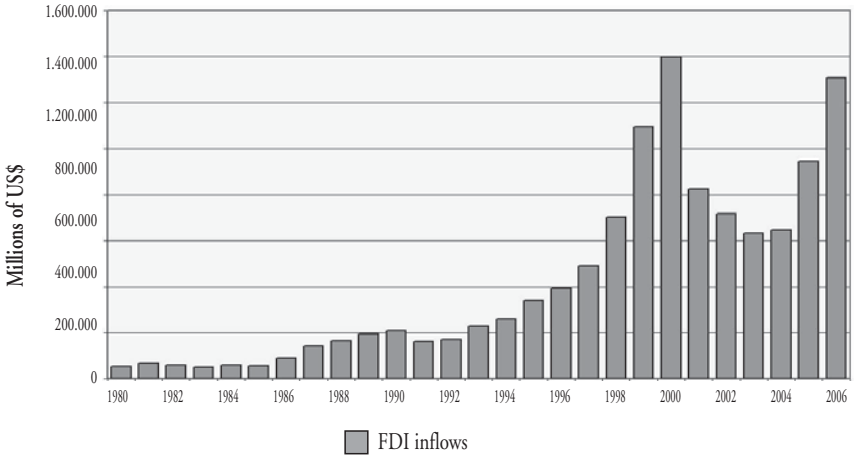
Data Source: UNCTAD

using a recently available data set on new and expansionary investment projects to examine which home and host country characteristics influence the decision of a firm to invest abroad, and whether those factors play a different role according to the stage of production that the firm intends to operate in the foreign country.

We take first an aggregate approach, that is, we study the determinants of aggregate FDI activity between two countries in a particular year, and, following previous studies, we focus on the relative importance of factor proportion versus proximity-concentration arguments. As a novelty, we allow the factors that influence the FDI decision to be different when the decision involves choosing to invest or not in a new country from those factors that determine the decision to invest further in an already active and familiar market. Next, and departing from previous empirical work, we exploit our data set at a higher level of disaggregation and classify investment projects into six different stages of the chain of production to analyze whether the factors considered as potential determinants of FDI play a different role depending on the stage of production of the investment project. These stages are extraction, manufacturing, business services, retail services, research and development (R&D), and regional headquarters (HQ).

Anticipating our main results, when we analyze the aggregate number of FDI projects, we find that FDI flows to relatively capital

Figure 2.
World FDI Inflows



Data Source: UNCTAD

scarce countries and that distance discourages FDI while size, and sharing a language or a border encourage it. At the disaggregate level, we observe that the effect of distance, and of all the other factors as well, vary a lot across stages. Moreover, even though the disaggregated results confirm the finding that FDI flows to relatively capital scarce countries, we find evidence of a minimum capital requirement in the foreign country for all the stages of production except extraction. Finally, ease of doing business appears to be particularly relevant for the decision of where to locate regional HQ.

The remaining of the paper is organized as follows. Section 2 reviews the literature and motivates the model. Section 3 describes the data set. Section 4 presents the empirical approach used and the results for the aggregate bilateral data. Section 5 analyzes the data at six different stages of production. Finally, Section 6 concludes.

2. THE DETERMINANTS OF FDI: WHERE DO WE STAND?

FDI includes aspects of international trade, international capital flows, and information asymmetries. Hence, any study of the determinants of FDI activity, must acknowledge first the complexity involved in the decision to invest abroad.

Theoretical studies depart from the premise that a firm investing abroad will be at some initial disadvantage with respect to the local firms and that they will incur significant higher costs to operate in the foreign market relative to those local firms. Therefore, there must be some sort of offsetting advantage in order for a firm to choose to become a multinational. Dunning (1977, 1981) provides a simple but systematic framework to understand what those advantages are. This framework is often referred to as the OLI (ownership, localization, internalization) framework. Dunning argues that the decision of a firm to invest abroad is based on ownership, location, and internalization considerations. First, a firm that invests must enjoy some economies of scale with respect to intangible assets such as knowledge capital or organizational know-how that can be easily exploited by investing abroad[3.] Second, the firm must have a reason to locate production abroad rather than concentrate it at home, especially if there are scale economies at the plant level. Hence, the decision to invest abroad will depend on the costs of investing there, the costs of operating there, and/or on the market access provided by that investment. Finally, the investing firm must have some incentive to want to exploit its ownership advantage internally, rather than licensing or selling its product or process to an unrelated foreign firm.

Hence, given that the decision to undertake an FDI project comprises many aspects, economic theory needs to connect all these ideas with firm and country characteristics in a consistent manner. The Knowledge-Capital model of FDI, which has become the workhorse of the multinational firm theory, does a serious effort in that direction, especially in the formulation of the OLI location aspect of the FDI decision[4].

According to this model, a firm will engage in FDI activity for two different reasons: market access or cheaper production. First, it may choose to produce abroad for market access purposes and in order to save on the trade costs associated to exporting. In this case, the firm

3. FDI is often understood as the acquisition of 10\% or more of the assets of a foreign enterprise. It is usually defined as an investment involving a long-term relationship and reflecting a lasting interest and control of a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate). FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. Conceptually, FDI is an extension of corporate control over national borders.

4. See Carr, Markusen and Maskus (2001) among others.

will set up foreign facilities that mirror those at home (*Horizontal Expansion*, *HE hereafter*). In this scenario, location advantages arise when the host-country is large and when trade costs are large, and FDI would serve as a substitute for trade[5]. Hence, this hypothesis would predict that cross-border investment will take place between countries with high transportation costs and high trade barriers, low investment barriers, and low scale economies at the plant level[6]. At the same time, multinational activity would be two-way. Finally, market size at home and abroad would also have a positive impact, in the former case by increasing the pool of potential investors abroad and in the latter by increasing the market potential. Since size and trade barriers appear as fundamental determinants of horizontal FDI, an adaptation of the gravity model, which relates trade with size and distance, provides a good departing framework to study multinational activity.

Second, a firm may choose to fragment the production process and to locate some stages abroad in order to arbitrage differences in factor prices (*Vertical Expansion*, *VE hereafter*). This is also known as the factor proportions hypothesis for the location of multinational activity[7]. In that case, FDI would be equivalent to a sort of capital (factor of production) flow[8]. Paraphrasing Arndt and Kierzowski (2001), fragmentation, which is the possibility of breaking a production process into physically separable phases (stages or intermediate inputs), is not a new concept. On the contrary, it dates back to the beginning of the Industrial Revolution or even earlier than that. What is relatively new is the possibility of locating different phases of the production process in very distant places. It is in this process of splitting the production process across borders where FDI fits in. Thus, when factor proportions are identical, the differential in GDP shares of the home and host countries and their

5. Krugman (1983), Horstman and Markusen (1992), Brainard (1992). A somewhat related motive would be what is referred to as Quid pro Quo FDI, a term coined by Bhagwati (1985) and that refers to a situation where a firm does FDI in response to a protectionist threat.

6. If scale economies at the plant level were high enough, the cost of replicating production in different locations might offset the gains from savings in transport costs.

7. Markusen (1984), Helpman (1984), Helpman and Krugman (1985), Ethier and Horn (1990).

8. As underscored in Ethier (1995), FDI does not always imply an actual movement of capital. For instance, a Japanese company may purchase a US firm by using the proceeds of selling its own US bonds. In that case, there would be no flow of capital from Japan to the US. Ethier notes that "the distinctive feature about direct investment, then, is not that one country is on balance acquiring the assets of another [...]. The distinctive feature is that firms in one country are acquiring control of business operations in another country."

joint income should be the only determinants of trade volumes, and there should be no multinational activities. At the same time, and again understanding FDI as an international movement of a production factor (capital flow), multinational activity should arise only in a single direction and between countries with large factor proportions differences[9]. Note, as well, that this type of FDI may require shipment back to the home country to complete the production process. In sum, for a vertical firm, location advantages arise when trade costs are low, stages of production differ in factor intensities, and countries differ in relative factor endowments. Hence, in order to capture the central motivations for Vertical FDI, we shall extend the gravity framework to control for factor endowment characteristics.

In accordance to the discussion above, an extended gravity model that includes elements of factor proportions theory, is our basic framework to analyze the determinants of FDI from a macroeconomic perspective. The gravity model of trade is well known as the workhorse of any empirical analysis of bilateral trade flows. Its success started in the empirical arena to later receive theoretical grounds[10]. Although the theoretical foundations of the gravity equation for bilateral FDI are less clear than for trade flows it is still possible to derive a gravity-type framework to analyze bilateral FDI activity[11]. In this case, GDP of the host country captures the size of the market to be served by affiliates while the GDP of the home country is assumed to be proportional to the pool of potential investors in that country. The distance term accounts for the various transaction costs of carrying out international investment.

In the empirical arena, Eaton and Tamura (1994) provide an early example of the application of the gravity to FDI. Brainard (1993, 1997) also applies a gravity-type framework to FDI and she finds evidence on trade frictions increasing FDI, and hence in support of the horizontal firm's location advantages. Carr, Markusen, and Maskus (2001) provide the first empirical examination of the knowledge-capital model of FDI. From simulation of the model they derive a

9. Brainard (1993, NBER) provides evidence that contradicts this line of thought.

10. See for instance Anderson and van Wincoop (2003). Refer to Feenstra (2004) for a review of theoretical foundations of the gravity model for trade.

11. See Brainard (1993).

gravity-like empirical specification that relates affiliate sales in a host country to the GDP of both source and host countries, trade costs, FDI costs, plus differences in factor endowments. The authors use a panel data set on bilateral country-level US outbound and inbound affiliate sales and find evidence for both the horizontal and the vertical motivations for FDI. Yeaple (2003) also finds evidence in support of the vertical motive[12].

The approach in this paper follows that of Carr, Markusen, and Maskus (*op.cit*) in including factor endowment variables on top of the gravity determinants. However, as opposed to Carr et al., we do distinguish between stages of production of foreign investment projects. Moreover, the scope of our data set is international (covering up to 29 source countries) in contrast to the US-only bilateral FDI data set they use. Last but not least, we introduce the possibility that the determinants on FDI when a country enters a new market differ from those that drive further FDI to an already exploited market.

3. THE DATA

Our main data set is a panel covering 6,728 investment projects (new and expansions) over 29 source countries and 131 destinations, between January 2002 and June 2005[13]. The source of this data is the Locomonitor database that documents 29,139 cross-border investment projects during that same period. We follow Gual and Torrens (2006), and our final sample includes only those projects undertaken by the 190 most important multinational firms. These firms are selected according to the following criteria: (1) firms that are listed in the top 100 MNEs by the UNCTAD world investment report (2004), (2) firms that are listed in the top 500 by Fortune (2004), and (3) firms that report more than 20 investment projects during the period considered[14].

For each project, the Locomonitor data base reports the following information: source country (or home, *h* hereafter); destination

12. See also Hanson, Mataloni and Slaughter (2003) and Freinberg and Keene (2001).

13. For a complete list of the source and host countries, refer to Appendix A.

14. For a complete description of the selection process see Gual et al. (2006).

country (host or foreign, *f* hereafter), sector, and value-chain stage where the firm invests; whether the project represents a new investment, expansion or relocation; the name of the investing firm; and a brief description of the project. For some of the projects, it also provides information on the technology or product of the investment, the motivation that drove the investment decision, the public incentives that influenced the decision to invest in that location, or the value of the investment. Nonetheless, the latter is provided for a small number of projects only, too small to carry out a thorough analysis of the determinants of FDI based on the value of the investment. For that reason, when analyzing the determinants of FDI, we focus on the number of projects, that is, on the frequency of FDI activity, and not on the value of the investments. However, the value of the investment for this subset of projects is useful in reassuring the robustness of our results.

In the first part of the analysis we consider the number of investment projects between countries *h* and *f* in a particular year *t*. Given the number of investments per firm, the source, and the destination countries at each point in time, we can compute the number of projects for each country pair and year, including those observations (country pair-year) where that count is zero, that is, when no investment project takes place between two countries in a particular year. Our final sample for analysis includes a total of 14,384 observations for our dependent variable, which is defined as the number of FDI projects from firms in country *h* to invest in country *f* at time *t*[15].

In the second part of our study, we classify the projects according to their stage in the value-chain. This further disaggregation of the data allows a better understanding of the determinants of the foreign investment decision of a firm. In that part of the analysis, we have a sample of 61,488 observations where 2,199 of them are non-zero. Similarly to the aggregate case, we include all country-value-chain observations that are zero but do engage in an FDI relationship in another stage of the value-chain. Per contrary, we exclude country-pairs that do not engage at all in FDI. Thus, for each value-chain regression we have a sample of 6,966 observations (given the restriction just mentioned and other data restrictions like the availability of

15. Note that a sample of 29 source and 131 host countries of over 4 years would correspond to a panel of 15,080 observations. However, missing data on GDP and other regressors for some of the countries forces us to drop a few observations.

GDP data and other), with a minimum of 139 non-zero observations per value-chain stage.

In all our study, we consider two different sets of independent variables. The first set includes standard gravity regressors while the second set controls for elements of factor proportion models. The data for all these variables is briefly described below and more detail is provided in Appendix B.

3.1 Descriptive Statistics

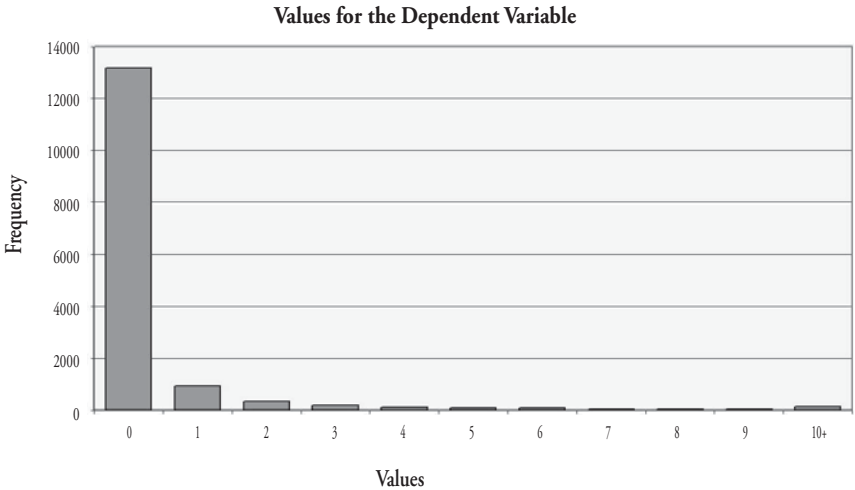
We start by summarizing the basic features of our dependent and independent variables.

In the first part of the analysis, our dependent variable records the number of projects between two countries in a particular year. Hence, it is a count variable that takes nonnegative integer values, with great predominance of zeros as we can see in Figure 3. More precisely, it ranges from 0 to 85 and is strongly right-skewed, with 87% of the observations being zero counts (refer to Table 2 for the summary statistics of the main variables).

We shall note that using OLS with such a dependent variable would yield biased and inconsistent estimates. Instead, the Poisson model is considered the standard way of describing count data. Nonetheless, the Poisson distribution imposes a strong assumption on the data, namely that the conditional variance equals the mean.

In our case, the mean is 0.4 and the standard deviation 2.4, and, moreover, formal regression-based tests rejected equality of the mean and variance. With such evidence of overdispersion in the data, the application of a negative binomial in generalized linear models appears as a better option to deal with the lack of normality in the data. Still, given the excess zero counts, the Zero Inflated Negative Binomial distribution (ZINB) is an even better option to deal with both, overdispersion and predominance of zeros. ZINB models are negative binomial models that allow for additional over-dispersion via a splitting process that models the probability of a zero outcome by logistic regression, while the continuous count outcome is modeled using a negative binomial error structure. In other words, ZINB assumes that two different underlying mechanisms are involved in generating zero and non-

Figure 3.
Overdispersion and Excess Zero counts



Source: Locomonitor data set and own calculations.

zero counts. A negative binomial process generates both zero and positive counts, and in addition, zero counts can arise separately through a logistic process.[16] In our case, for example, where we have a panel containing the number of FDI projects for country-pairs *hf* at time *t*, the outcome *# projects=0* may arise from two different scenarios: *# projects=0* is the number of projects by a foreign firm from country *h* in country *f* in a particular year *t* while, at another time *t'*, that same firm may choose *# projects=j > 0* . Alternatively, *# projects=0* may occur when a foreign firm in country *h* never considers entering a country *f* market by FDI, regardless of the characteristics considered in the model.

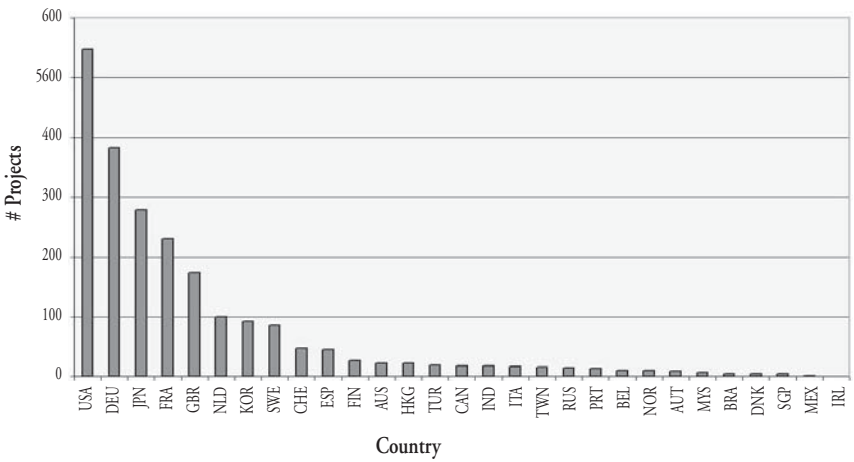
In terms of the distribution of project counts across source and host countries, we observe a lot of variation with USA being the country projecting more FDI operations abroad, 547 in 2003 for instance, followed by Germany, Japan, and France (see Figure 4)[17]. The country receiving the largest number of projects is, by far, China, receiving half the projects, followed by USA, and Russia (see Figure 5).

16. We tested the appropriateness of the ZINB over a regular binomial using the Vuong statistic a and we obtained high positive values in all our specifications, which favors zinb over negative binomial. Refer to Appendix C for a more detailed description. For further reference see Greene (2005).

17. This figure is based on data for the year 2003 because it has the largest number of FDI projects in our sample.

Our basic set of regressors includes the product of GDPs, and the product of host and source host country's Population, as measures of size; distance between the two countries in the pair (measured as the great circle distance between the main cities in each of the two countries) which accounts for transportation and other transaction costs influencing FDI that increase with distance; relative education between both countries, measured as the ratio of net

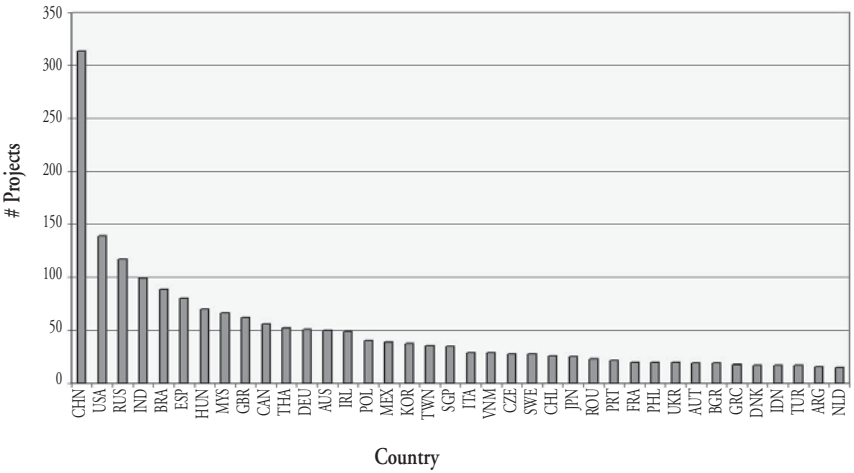
Figure 4.
Number of Outward FDI Projects by Source Country (2003)



Source: Locomonitor data set and own calculations.

enrollment in secondary education over net enrollment on primary education in the host relative to the source country; density of the foreign country relative to home (where density is measured as total population over land area); the capital labor ratio of the host country relative to the source country; and a measure for ease of doing business in the host country, where the more favorable the environment to set up a business in the host country is, the lower the values the measure takes. Notice that the measures for size and distance would correspond to gravity arguments, the following three variables are related to the factor proportion approach, and the latter is a proxy for other transaction costs. Table \ref{TSummary} reports the basic descriptive statistics for all these regressors. It is interesting to notice that, on average, host countries tend to be less "educated", in secondary over primary

Figure 5.
Number of Inward FDI projects by host country (2003)



Source: Locomonitor data set and own calculations.

terms, and more labor-abundant than the source countries, a mean of -0.19 for the former versus -1.55 for the latter. In regards to simple correlations between all these variables, the largest correlation is by far that between the relative level of education and the relative capital labor ratio, which equals 0.63. This high correlation suggests that including one of these two variables while omitting the other may bias the results and attribute to the one included some or all of the effects of the omitted one.

When turning to the dependent variable in the second part of the analysis, that is, the number of projects between two countries in a particular year and value-chain stage, we observe that the stages with the higher average number of projects are retail services and manufactures (see Table 3). Moreover, we see that the maximum number of projects per country-pair is in manufactures and between Japan and China (see column 3 to 5), and the second largest is the one from USA to China in Retail Services, which coincides with the maximum in retail services as well.

After this preliminary description of the variables, a more detailed study follows aimed at providing further insight on the determinants of FDI.

4 THE DETERMINANTS OF FDI: AGGREGATE

We use a combination of a standard Gravity model and Factor Proportion models of trade as the basic framework to analyze which factors influence the decision to invest in a particular project abroad. We take a macroeconomic perspective and consider country-pair characteristics that might drive FDI patterns. In the first part of the analysis we pool together all the investment projects recorded in our sample. In the second part, we work at a higher level of disaggregation and classify the investment projects per year and country pair, according to their stage in the value-chain.

4.1 The Gravity Model

To derive our empirical specification, we start with a basic gravity model where the number of investment projects by firms from country *h* (for home) in country *f* (foreign) at time *t* is explained by the size of countries *h* and *f* and the distance between them. Thus:

$$\begin{aligned} n_{hft} &= \alpha + \beta_1 ln\left(GDP_{ht} \cdot GDP_{ft}\right) + \beta_2 ln\left(dist_{hf}\right) + \epsilon_{hft} \\ & \quad h = 1, ...29; f = 1, ..., 131; t = 2002, ..., 2005 \end{aligned} \tag{1}$$

where n_{hft} stands for the number of projects that country *h* establishes in country *f* at time *t* and can take integer values greater than or equal to zero[18]; GDP_{ht} is the gross domestic product of country *h* at time *t*: similarly for GDP_{ft}, and $dist_{hf}$ is the distance between country *h* and *f*.

Regarding Equation (1) we expect market size to enter with positive sign, that is, a positive β_1. In regards to the sign on β_2, it depends on what distance is proxying for. If, on one hand, it is proxying for trade costs, the sign on β_2 would be ambiguous, and dependent on the complementarity or substitution between FDI and trade. In particular, if FDI is a substitute for trade, distance will raise export costs and the profitability of setting up affiliates in the foreign country mirroring the ones at home (*HE*), thus,

18. Note that each of the 29 potential "investing" countries (home) does not invest in all of the 131 potential "host" countries (foreign). However, we still consider the complete set of (29home*130foreign*4year) observations which means that there is a large number of zero counts in our dependent variable

implying a positive β_2. If instead, FDI and trade are complements, higher distance will be associated with higher costs of production and lower profitability of an investment abroad. That would be the case of vertical expansion, since the cost of putting together the different fragments increases with distance, which implies a negative β_2. On the other hand, if distance acts like a proxy for the overall transaction costs of doing FDI abroad, and if these costs increase with distance, then we would expect β_2 to be negative. Note, however, that some costs of doing FDI activity abroad may be totally independent from distance (ex. legal costs, information costs, etc.). Hence the sign on β_2 is again ambiguous.

Before discussing the results, an explanation on how to read them is warranted. When estimating Equation (1) with ZINB, we obtain two sets of results: those corresponding to the inflated model, and those corresponding to the main model. The inflated part corresponds to a logit, where the dependent variable would be the odds of a zero event, that is, the probability of no FDI activity between the two countries in the pair. Hence, if the coefficient on distance is positive in the inflated part it indicates that larger distance increases the probability of no FDI projects, or analogously, higher distance decreases the probability of FDI relationship between a country-pair. In the main model, the results can be read as the effect of each independent variable in increasing the expected frequency of FDI activity (expected number of project counts) between two countries[19].

In sum, estimated coefficients in the negative binomial part of the model (main part) are interpreted as in count models, while coefficients from the logistic part (inflated part) are related to the probability of a zero outcome.

Table 4 column (1) reports the results of estimating Equation (1) above by maximum likelihood based on a zero-inflated negative binomial distribution (ZINB). As aforementioned, we present two sets of coefficient estimates, corresponding to the logit and the negative binomial parts of the model. In the main model, the coefficient on the product of *GDP*s is positive and equals 0.71, as expected, while the one for distance is negative and equal to -0.41, suggesting complementarity between trade and FDI, that is, vertical expansion

19. We consider the same factors as potential determinants in both the logistic and the negative binomial parts of the model.

motives or, in general, higher costs of FDI activity associated to distance. In the inflated model, the coefficient on *GDP* is negative indicating that economic size increases the probability of FDI relationship between countries *f* and *h*. Distance enters positively re-affirming the previous reasoning.

In the subsequent columns we extend the basic gravity to include other size controls, like population (L_i) or *GDP* per capita, and other geographical controls such as sharing a common border, sharing an official language, number of landlocked countries in the pair, and number of island countries in the pair. We observe that the coefficients on *GDP* and *distance* preserve their sign, however, the magnitude varies with the inclusion of the new gravity variables. In particular, the coefficient on GDP divides by half, (from 0.71 to 0.38), and that on distance decreases slightly in absolute terms from -.041 to -.031, in the main part. Population size and sharing a common language, both have a positive impact on the expected number of FDI projects. Sharing a border increases the likelihood of an FDI link (-2.82 in the inflated part), but it seems to affect negatively the expected number of projects once an FDI link is likely to occur (-.244 in the main). Island is never significant, and landlock is only significant in the main part, incentivating FDI.

4.2 Magnitude of the Effects

If we look at the elasticities for each of the regressors, that is, the percentage change in the expected number of projects from country *h* in country *f* in year *t* when a particular regressor increases by one percent if the regressor is a continuous variable, and, the increase in the expected number of projects when one of the discrete regressors increases by one unit (from zero to one), we find that: one percent increase in the product of GDPs raises the expected number of projects by roughly one percent; one percent increase in distance decreases the expected number of projects by a magnitude ranging between 0.45 and 0.77 percent; the effect of population is not robust and sometimes not even significant, but overall seems to be positive; sharing a border or a language both slightly increase the expected number of projects, as does being landlocked. Island is not significant. The positive sign on landlock could suggest substitution between

trade and FDI, given that no access to sea routes makes trade more difficult[20].

4.3 Introducing Factor Proportion Considerations

We turn now towards comparative advantage motivations for FDI and extend the basic gravity above to include elements from Factor Proportion models. The new estimating equation becomes

$$\begin{aligned} n_{hft} &= \alpha + \beta_1 ln\left(GDP_{ht} \cdot GDP_{ft}\right) + \beta_2 ln\left(dist_{hf}\right) + \beta_3 ln\left(L_{ht} \cdot L_{ft}\right) + \\ &+ \beta_4 ln\left(\frac{Sec_{ft}/\operatorname{Pr}im_{ft}}{Sec_{ht}/\operatorname{Pr}im_{ht}}\right) + \beta_5 ln\left(\frac{Density_{ft}}{Density_{ht}}\right) + \beta_6 ln\left(\frac{K_{ft}/L_{ft}}{K_{ht}/L_{ht}}\right) + \\ &+ \beta_7 \ln(EaseBus_{ft}) + Z_{hf} + \epsilon_{hft} \end{aligned} \tag{2}$$

where $\frac{Sec_{ft}/\operatorname{Pr}im_{ft}}{Sec_{ht}/\operatorname{Pr}im_{ht}}$ stands for the relative level of secondary education over primary education between foreign country, *f*, and home country, *h*, at time *t*; similarly for $\frac{Density_{ft}}{Density_{ht}}$, and capital-labor ratio $(\frac{K_{ft}/L_{ft}}{K_{ht}/L_{ht}})$; $EaseBus_{ft}$ stands for ease of doing business in the host country, and controls for some of the transaction costs between country-pair (lower values corresponding to better environment to set up a business); finally, Z_{hf} stands for other controls such as sharing a common border or a common language, and the number of landlocked countries or island countries in the pair *hf*.

Table 5 presents the results of estimating Equation (2) by ZINB. The signs on the basic gravity regressors, GDPs and distance, remain unchanged all over the different specifications. In other words, GDP increases FDI while distance discourages it, the latter suggesting, again, either a vertical motive for FDI or transaction costs of FDI that increase with distance. In Column (1), we introduce our first factor proportion control, namely, the relative ratio of secondary educated workers over primary educated workers abroad and at home, that proxies for the ratio of relative skilled over unskilled workers. It gets a positive coefficient in both the main (which ranges between 1.2 and 1.7 depending on the specification of controls) and the infla-

20. All these elasticities and marginal effects are based on the estimates for Equation 1 and they provide a summary figure of the coefficients in both parts of the model, main and inflated. All the elasticities are evaluated at the mean of the regressors. The complete list of figures are available upon request.

ted model (between 2.8 and 4.6). Note that these effects work in opposite directions. The inflated part indicates that FDI activity is less likely the more abundant the foreign country is in secondary over primary educated workers relative to home, suggesting that FDI is searching for cheap unskilled labor, or that FDI travels from "North" (developed countries) to "South" (less developed countries). However, the results in the main part of the model suggest that once an FDI link is established between two countries, the more skilled the host country is relative to the source one, the higher the frequency of FDI activity between them.

The second column adds a measure of relative density (or relative land abundance) and the results (not significant in the main part and positive in the inflated model) indicate that the more dense the foreign country is relative to home, the less FDI activity will exist between them.

Column (3) adds a measure of capital-labor abundance in the foreign country relative to home. On top of it, column (4) adds the additional geographical factors aforementioned, and column (5) adds the measure of ease of doing business in the host country. The results in both parts of the model, inflated and main, show that the more capital abundant the foreign country is relative to home, the lower the frequency of FDI activity between them. This is consistent with the idea of FDI being a sort of capital flow, since you would expect capital to target countries with relatively higher return to capital, that is, those relatively labor-abundant or relatively capital-scarce.

Geographic variables behave similarly as they did before. Finally, ease of doing business gets a positive coefficient in the inflated part, thus, suggesting that countries where the process of setting up a business is easier, are more likely to attract FDI. The result in the main part is not significant, indicating no effect of that measure on the frequency of FDI.

To sum up, the main results when controlling for gravity and factor proportion elements together, based on elasticities corresponding to the estimates in column (5), indicate that one percent increase in the product of GDPs yields a one percent increase in the number of FDI projects. A particular pair of countries will trade around 0.6 percent more than another pair of countries that are one percent farther away from each other. Both the effects of population and relative skilled abundance are small and not significant. One percent increase in the relative density of the foreign country decreases the number of

projects by 0.1 percent. One percent increase in the relative capital abundance of the foreign country yields 0.4 percent less projects. Hence, the more capital abundant the foreign country is relative to home, the lower the frequency of FDI activity between them, consistent with the idea of FDI being a capital flow. Ease of doing business gets a negative elasticity, thus, suggesting that countries where the process of setting up a business is easier (lower regressor value), are more likely to attract FDI. As for all the geographic variables, their effects are similar to those in the basic gravity case. That is, border, language, and landlocked all have a positive overall effect on the expected number of FDI projects between two countries, while island is not significant.[21]

5 The Determinants of FDI: Stages of the Value-Chain

In this section we classify FDI projects according to their stage in the value-chain of production. We consider six potential stages in the production of a good: extraction, manufacturing, business services, retailing services, R&D, and regional HQ.

For each stage v, we estimate Equation (2) above with the dependent variable counting the number of projects between countries h and f at time t that belong to that stage (v). Hence, we are allowing for the possibility that the βs differ across stages in the value-chain, that is, for the possibility that the independent variables have a different effect on the likelihood and frequency of FDI activity, depending on the stage in the value-chain the project belongs to.

Tables 6 and 7 summarize the results of estimating Equation (2) for each stage while Table 8 reports elasticities for each of them[22]. Even when the detail provided by the first two tables helps in understanding the underlying mechanisms, we focus our attention on the

21. Note that these numbers are the result of a combination of the estimates of both, the main and the inflated coefficients in Table 5. For instance, the figures for education in the first column are negative and significant because the effect in the main part of the model is stronger and dominates the effect (in the opposite direction) in the inflated part. However, the figures for education in the last three columns are positive but not significant because the coefficient estimates in the main and the inflated part of the model go in opposite directions and they are so similar in magnitude that they cancel each other

22. For simplicity, we only present the results for the full regression, that is, with all the independent variables.

last table, since it provides a summary of the overall effect of each of the regressors on the expected number of FDI projects in stage *v* and how they compare across stages.

We can summarize the main results as follows:

- **Economic size** (GDPs) is a determining factor and increases the expected number of FDI activity in all stages. The magnitude of its effect is especially important for manufacturing, business services, and retailing services. Overall, this effect ranges between 0.6 and 1.3 (1% increase in the combined economic size of two countries raises the expected number of projects between 0.6 and 1.3 percent).
- **Distance** discourages FDI activity in all but extraction. This makes sense from an economic perspective since factors driving extraction investment have little to do with distance and a lot more with the specific location of natural resources. Distance has the largest impact on the number of regional HQ projects, indicating that investing firms would rather locate regional HQ nearby. Monitoring purposes could be an explanation.
- For **Population**, the sign, and magnitude of the effect varies a lot across stages in the value-chain.
- The overall effect of **relative skill abundance** of the host country is positive on the frequency of FDI activity in all the stages of production, except in Business Services, where it gets a negative sign. In general education incentives FDI, especially in R&D and HQ. Hence, if an economy wants to attract R&D and HQ over other types of FDI it will have to invest more heavily in education than those economies interested in Business Services or manufactures FDI. Nevertheless a note of caution is warranted with respect to these estimates since our measure of relative skill abundance is a noisy proxy for the true level of skilled-unskilled labor abundance.
- **Density** has a negative but modest effect on FDI activity, indicating that the more dense the foreign country is relative to home, the less FDI activity will exist between them. This result suggests that firms would rather do cross border investment in countries such as the USA (or even China that has a density below the mean) than in countries such as Mauritius or Malta with densities well above the mean.
- As in the aggregate analysis, the effect of relative **capital-labor-abundance** of the foreign country is always negative, although the

magnitude of its effect varies considerably across stages. We interpret this as FDI targeting capital scarce countries where its rentability is higher. However, in this particular case, we can get further insight into the mechanisms behind this effect if we look at the regression results from the main and inflated part of the ZINB model (Tables 6 and 7). While the coefficient of capital-labor abundance in the main part is always negative (except for extraction), thus, suggesting that the frequency of FDI activity increases with the relative capital abundance of the home country (or capital scarcity of the foreign), the coefficient on the inflated part is negative as well, which would indicate that FDI is less likely the more relatively capital scarce the foreign country is. This result can be interpreted as a minimum requirement of capital on the host country in order for and FDI link to be established. In other words, the host country must have a minimum level of capital in order to increase the likelihood of receiving an FDI project. Once this threshold is set, FDI flows to relatively-labor abundant countries. This minimum requirement, that is, the negative effect of capital scarcity in the foreign country on the likelihood of FDI, is quite important for R&D, that gets a coefficient of -3.13 in the inflated part, much larger that in all the other stages of production (except extraction) where magnitudes range between -.33 and -.53. The divergence in the magnitude of the minimum required level of capital in the host country among different stages of production gives us some policy insights. In that respect, it might be key in some economies for their governments to invest in productive capital and infrastructures in order to achieve that minimum level needed to attract that first FDI project. *Caeteris paribus*, the larger the investment efforts, the more R&D projects they will be able to attract. Again, extraction behaves differently, with capital scarcity in the foreign country increasing the likelihood of FDI and exerting no significant effect on the frequency of projects. Once more, it seems plausible that the decision to invest in extraction projects is based on location of natural resources more than on any other factor.

- **Geographic** variables, exert in general a weak impact when looking stage by stage.
- Finally, **ease of doing business** gets the expected sign (negative) in all the stages of production, except again extraction. Remember that lower values of the variable correspond to more favorable

environment to set up a business. Thus, the negative sign says that high values in the ease of doing business (bad environment) decrease the quantity of projects between two countries. The largest impact of the business environment is on regional HQ projects.

6. CONCLUDING REMARKS

The recent surge in Foreign Direct Investment (FDI) activity and the increased complexity of production processes that split tasks across borders warrant an investigation on the driving factors behind this type of cross border investment.

This paper contributes to the literature on the determinants of FDI on two grounds. First, it uses a recently available data set on new and expansionary investment projects to reexamine which home and host country characteristics influence the decision of a firm to invest abroad. Second, it uses one further level of disaggregation in the data to investigate how the goal of the investment affects the influence of the different determinants of FDI. We define the goal of the investment in terms of the stage of production that the firm intends to operate in the foreign country.

At the aggregate level, our most robust findings can be summarized as follows. On the gravity side, size and sharing a common language promote FDI while distance discourages it. This negative effect of distance could be interpreted as evidence suggesting vertical motives for FDI, as opposed to horizontal motives. However, this interpretation considers distance, exclusively, as a measure of trade costs and ignores other barriers to FDI that increase with distance. If we take a broader interpretation of our "distance" measure, then we can only conclude that any barrier to FDI that increases with distance has a negative impact on FDI. For instance, it could well be that investments in nearby countries are easier to monitor than businesses in far-away countries, discouraging FDI in the latter. In regards to factor proportion differences, our results indicate that FDI targets countries that are relatively capital-scarce (or relatively labor-abundant).

When we classify investment projects according to their stage in the chain of production, that is from a disaggregate standpoint, we conclude that, in general, the effect of all the regressors varies substantially across stages. Thus, depending on the sort of FDI project a

country intends to attract, certain policies will turn out to be more effective than others. Nonetheless, there are some regularities. Economic size, as well as distance, are determining factors in explaining the number of FDI projects between countries in a particular value-chain stage, and preserve their sign with respect to the aggregate analysis. Even though the results confirm the aggregate finding that FDI targets capital-scarce countries, we find evidence of a minimum requirement on the foreign country's capital endowment in all the stages of production except extraction, and this requirement appears to be specially important for R&D projects. Ease of doing business is important for all types of FDI, especially so for regional HQ. Geographic variables have a small effect. Finally, FDI in extraction behaves in a way that differs from all the other stages and seems to get little impact from the regressors considered in our study. This finding is not at odds with economic intuition since factors driving extraction investment have little to do with distance or relative factor proportions and a lot more with the specific location of natural resources.

In a nutshell, our findings underscore an important role for both economic size and transaction costs associated with distance and language barriers in determining FDI activity. Furthermore, FDI in stages of production other than extraction targets capital-scarce countries and requires a minimum level of capital in the host country, while a favorable business environment promotes inward FDI in all stages and especially regional HQ.

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APPENDIX A: COUNTRY LIST

Home Countries (Source)

Australia	Germany	Netherlands	Switzerland
Austria	Hong Kong	Norway	Taiwan
Belgium	India	Portugal	Turkey
Brazil	Ireland	Russia	UK
Canada	Italy	Singapore	USA
Denmark	Japan	South Korea	
Finland	Malaysia	Spain	
France	Mexico	Sweden	

Host Countries (Destination)

Afghanistan	El Salvador	Liechtenstein	Serbia & Mont.
Albania	Ecu. guinea	Lithuania	Singapore
Algeria	Estonia	Luxembourg	Slovakia
Angola	Ethiopia	Macau	Slovenia
Argentina	Finland	Macedonia	Somalia
Armenia	France	Madagascar	South Africa
Australia	Georgia	Malaysia	South Korea
Austria	Germany	Maldives	Spain
Azerbaijan	Ghana	Malta	Sri Lanka
Bahamas	Greece	Mauritius	Sudan
Bahrain	Guatemala	Mexico	Suriname
Bangladesh	Guinea	Moldova	Sweden
Belgium	Haiti	Morocco	Switzerland
Bolivia	Honduras	Mozambique	Syria
Bosnia & Her.	Hong Kong	Namibia	Taiwan
Brazil	Hungary	Netherlands	Tanzania
Brunei	Iceland	New Zealand	Thailand
Bulgaria	India	Nicaragua	Trinidad & Tob.
Cambodia	Indonesia	Nigeria	Tunisia
Canada	Iran	Norway	Turkey
Chad	Iraq	Oman	Turkmenistan
Chile	Ireland	Pakistan	UAE
China	Israel	Panama	UK
Colombia	Italy	Paraguay	USA
Costa Rica	Jamaica	Peru	Uganda
Croatia	Japan	Philippines	Ukraine
Cuba	Jordan	Poland	Uruguay
Cyprus	Kazakhstan	Portugal	Uzbekistan
Czech Republic	Kenya	Puerto Rico	Venezuela
Denmark	Kuwait	Qatar	Vietnam
Dominican Rep.	Latvia	Romania	Zambia
Ecuador	Lebanon	Russia	Zimbabwe
Egypt	Libya	Saudi Arabia	

APPENDIX B: DATA DESCRIPTION AND SOURCES

Variable	Description	Source
# of FDI Projects	Number of FDI projects in country *f* from firms in countries *h*, recorded in the Locomonitor	Locomonitor data base, January 2002-June 2005.
GDP; GDP/cap	Gross domestic product, in current US$, and Gross domestic product per capita, in current US$.	World Economic Outlook, IMF, September 2006.
Distance	Great-circle distance in kilometers between the principal cities in countries *h* and *f*.	Own calculations based on area, latitude, and longitude data from the CIA World Factbook, 2006.
Population	Total Population.	World Bank, GDI 2006.
Border	Equals 1 if countries *h* and *f* share a common border. Zero otherwise.	Own construction based on data from CIA World Factbook, 2006.
Language	Equals 1 if countries *h* and *f* share a common (official or widely spoken) language. Zero otherwise.	Own construction based on data from CIA World Factbook, 2006.
Landlock	Number of landlocked countries in the pair *hf*.	Own construction based on data from CIA World Factbook, 2006.
Island	Number of island countries in the pair *hf*.	Own construction based on data from CIA World Factbook, 2006.
Secondary-Primary	Enrollment ratio in secondary education over Enrollment ratio in primary educatio in the host country, relative to the equivalent in the source country.	UNESCO, Statistical Yearbook. Use Net enrollment in primary education and secondary education. For missing values we use either the Gross enrollment or estimate them from gross or net enrollment rates available. For specific extrapolations refer to the authors.
Density	Population over land area in kilometers.	Population data from World Bank WDI; area data from CIA World Factbook, 2006.
Capital-Labor	Capital endowment over population. Capital accumulation is calculated using perpetual inventory method from 1978.	Population data from World Bank WDI; Investment data from Penn World Tables 6.1; initial capital from Hall and Jones (1999).
Easiness Bus.	Easiness of Doing Business measure, with lower values indicating worse scenario.	Easiness of doing business from the World Bank, http://www.doingbusiness.org

APPENDIX C: COUNT DATA MODEL

Our dependent variable, n_{hf} (the number of investment projects in country *f* from firms in country *h*), is a count variable. Since OLS estimates would be biased and inconsistent, we use a standard count data model that specifies the probability that the jth host country attracts n_{hf} investment projects from firms in country *f*, as a function of a vector of country-pair-*hf's* specific attributes (X_{hft})[23]:

$$\Pr(n_{hft} = n) \;=\; F(X'_{hft}\beta) \tag{A1}$$

where β is the vector of unknown parameters to be estimated. The most common way to specify such a probability function is to use a Poisson process. In that process, the integer property of the dependent variable is modeled as:

$$\begin{aligned} \Pr(n_{hft} \;&=\; n) \;=\; \frac{\exp(-\mu_{hft})\mu_{hft}^{n_{hft}}}{n!} \\ \text{where } n \;&=\; 0, 1, 2, ... \text{ and } \mu_{hft} = \exp(X'_{hft}\beta) \end{aligned} \tag{A2}$$

The shortcoming of the Poisson model in Eq. A2 is its implication that μ_{ijt} is both the mean and the variance of the process. This restriction is often violated due to over- or under-dispersion of the data. In our empirical analysis, we tested and rejected this equi-dispersion assumption in all cases. The Negative Binomial model relaxes this assumption by allowing μ to vary systematically, which in turn allows the variance of the process to differ from the mean and makes it more appropriate to estimate models in the presence of overdispersion of the data. In the NB model, the probability distribution becomes:

$$\begin{aligned} \Pr(n_{hft} \;&=\; n) \;=\; \frac{\exp(-\mu_{hft})\mu_{hft}^{n_{hft}}}{n!} \\ \mu_{hft} \;&=\; \exp(X_{hft}\beta + u_{hft}),\ \exp(u_{hft}) \sim \Gamma(1/\alpha, \alpha) \\ &\quad\ \alpha \text{ being the overdispersion parameter} \\ n \;&=\; 0, 1, 2, ... \end{aligned} \tag{A3}$$

23. See Hausman, Hall and Griliches (1984) for further details.

Unlike the Poisson model, the NB has an additional parameter α, and, therefore n_{hft} is and iid NB process with mean μ_{hft} and variance $\sigma^2 = \mu_{hft} + \alpha\mu_{hft}$. Note that when $\alpha = 0$, the NB reduces to a Poisson.

Our data not only shows signs of over-dispersion but also of excessive zero counts of FDI projects. Excessive number of zeros may arise for various reasons. First, due to adverse host-country characteristics (inherent natural features or political factors), many countries may not appeal to potential foreign investors. In that case, some countries may always attract zero counts of foreign investment projects. Second, even if a country has "good characteristics" as a potential recipient of foreign investment it may receive no investment in a particular year from a particular country. In the latter case, assuming a general probability distribution for zero and non-zero counts shouldn't be a problem. In the former situation, though, there is the possibility that the zeros follow a different process. Zero-inflated models allow each process to be modeled separately[24]. The common strategy is to map a logit onto a count model. We adopt such a strategy and model our dependent variable as the product of two latent variables, a binary (0,1) following a logistic distribution function, and a discrete count variable following a NB as specified above (ZINB):

$$\begin{aligned} n_{hft} &= z_{hft} n^*_{hft} \\ z_{hft} &= 0 \text{ with prob } q_{hft},\ z_{hft} = 1 \text{ with prob } 1 - q_{hft} \\ q_{hft} &= (\exp(Z_{hft}\gamma))/(1 - \exp(Z_{hft}\gamma) \\ & \quad Z_{hft} \text{ is a set of observables} \\ n^*_{hft} &\sim NB(\mu_{hft}, u_{hft}) \text{ as specified in Eq. A3} \end{aligned} \tag{A4}$$

This means that the probability structure will be:

$$\begin{aligned} \Pr(n_{hft} &= 0) = \Pr(z_{hft} = 0) + \Pr(z_{hft} = 1, n^*_{hft} = 0) = q_{hft} + (1 - q_{hft}) f(0) \\ \Pr(n_{hft} &= n) = \Pr(z_{hft} = 1, n^*_{hft} = n) = (1 - q_{hft}) f(n), n = 1, 2, ... \\ & \quad q(.) \text{ is a logit process and } f(.) \text{ is a NB as specified above} \end{aligned} \tag{3}$$

24. See Cameron and Trivedi ("Regression Analysis of Count Data", Econometric Society monographs No. 30. Cambridge: Cambridge University Press, 1998) for a thorough discussion of the different empirical approaches to account for excess zeros.

In all our estimations we assume the vector of observables Z_{hft} to be identical to our vector of explanatory variables X_{hft}. We follow Vuong (1989) and test for the choice between the ZIP and the ZINB[25] and the results favor the use of a ZINB.

25. It is straight forward as models are nested. Large positive values of the Vuong test favor ZINB while large negative models favor the ZIP. See Vuong, Q.H. (1989), "Likelihood Ratio Tests for Model Selection and Non-Nested Hypotheses." Econometrica 57: 307-333 and Greene (1994), "Accounting for Excess Zeros and Sample Selection in Poisson and Negative Binomial Regression Models," Stern School of Business WP, EC-94-10, 1994

Table 2.
Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Number of Projects	15080	.40	2.40	0	85
$ln\,(GDP_{ht} \cdot GDP_{ft})$	14384	9.97	2.20	4.04	17.86
$ln\,(dist_{hf})$	15080	8.65	.82	4.16	9.90
$ln\,(L_h \cdot L_f)$	13776	33.38	2.19	27.75	41.81
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	15107	-.19	.49	-2.71	.86
$ln\left(\frac{Density_f}{Density_h}\right)$	13776	.37	2.33	-7.84	7.88
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	9396	-1.55	1.78	-6.01	3.55
$ln\,(EaseBus_f)$	1308	3.97	1.04	0	5.15

Summary of the "aggregate" dependent variable and the main regressors in logarithmic terms

Table 3
Number of Projects by Value Chain Stage

Value-Chain	Avg Num. Projects	Max	Home	Foreign
Extraction	.03	4	USA	United Kingdom
Manufactures	.19	54	Japan	China
Bus. Serv.	.09	11	USA	India
Retail Serv.	.22	30	USA	China
R&D	.04	18	USA	China
HQ	.02	4	Germany	USA

Year 2003.The second column shows the average number of projects by each value chain stage, the third column shows the maximum flow, thus, indicates the flow with the maximum number of projects; column fourth and fifth between which countries the maximum flow occured.

Table 4.
Basic Gravity Regression

Main (Expected # counts)	(1)	(2)	(3)	(4)
$ln\,(GDP_{ht} \cdot GDP_{ft})$	.71	.38		.38
	(.02)***	(.03)***		(.03)***
$ln\,(dist_{hf})$	-.41	-.31	-.31	-.32
	(.04)***	(.03)***	(.04)***	(.04)***
$ln\left(\frac{GDPpc_{ht}}{GDPpc_{ft}}\right)$			.38	
			(.03)***	
$ln\,(L_h \cdot L_f)$		.28	.66	.30
		(.02)***	(.02)***	(.02)***
$border$				-.24
				(.13)*
$language$				.13
				(.09)[1]
$landlock$				.29
				(.09)***
$island$				.01
				(.06)

Table 4.
Basic Gravity Regression (Cont.)

Inflated (Prob zero count)	(1)	(2)	(3)	(4)
$ln\,(GDP_{ht} \cdot GDP_{ft})$	-.67	-.99		-1.08
	(.07)***	(.07)***		(.08)***
$ln\,(dist_{hf})$	.31	.80	.80	.67
	(.14)**	(.12)***	(.12)***	(.12)***
$ln\left(\frac{GDPpc_{ht}}{GDPpc_{ft}}\right)$			-1.00	
			(.07)***	
$ln\,(L_h \cdot L_f)$		.38	-.61	.47
		(.06)***	(.05)	(.07)***
$border$				-2.82
				(1.20)**
$language$				-1.16
				(.29)***
$landlock$				-.30
				(.21)[1]
$island$				.06
				(.16)
N	14384	13664	13664	13664
Non-Zero	1904	1872	1872	1872

Standard errors are reported in parentheses. *, **, and *** denote significance at the 10%, 5%, and 1% levels of significance
[1] Denotes 15% level of significance

Table 5.
Gravity Regressions Adding Factor Abundance Variables

Main (Expected \# counts)	(1)	(2)	(3)	(4)	(5)
$ln\,(GDP_{ht} \cdot GDP_{ft})$	.40	.39	.49	.48	.48
	(.03)***	(.03)***	(.04)***	(.04)***	(.04)***
$ln\,(dist_{hf})$	-.27	-.27	-.22	-.28	-.27
	(.04)***	(.03)***	(.04)***	(.04)***	(.05)***
$ln\,(L_h \cdot L_f)$	.33	.34	.18	.22	.22
	(.03)***	(.03)***	(.04)***	(.04)***	(.04)***
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	1.18	1.20	1.69	1.72	1.72
	(.13)***	(.13)***	(.18)***	(.18)***	(.18)***
$ln\left(\frac{Density_f}{Density_h}\right)$		-.02	-.03	-.03	-.03
		(.02)	(.02)	(.02)*	(.02)
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$			-.37	-.34	-.35
			(.07)***	(.06)***	(.07)***
$ln\,(EaseBus)$					-.02
					(.05)
$border$				-.41	-.36
				(.15)**	(.15)**
$language$				.11	.10
				(.09)	(.09)
$landlock$				.14	.17
				(.10)[1]	(.10)*
$island$				-.13	-.03
				(.06)	(.07)

Table 5.
Gravity Regressions Adding Factor Abundance Variables (cont.)

Inflated (Prob zero count)	(1)	(2)	(3)	(4)	(5)
$ln\,(GDP_{ht} \cdot GDP_{ft})$	-.83	-.82	-1.03	-1.16	-1.11
	(.06)***	(.062)***	(.08)***	(.09)***	(.09)***
$ln\,(dist_{hf})$	1.11	1.02	.75	.53	.72
	(.13)***	(.13)***	(.13)***	(.15)***	(.17)***
$ln\,(L_h \cdot L_f)$	.30	.32	.30	.41	.32
	(.06)***	(.05)**	(.06)***	(.07)***	(.09)***
$ln\left(\frac{Sec_f}{Prim_f}/\frac{Sec_h}{Prim_h}\right)$	4.57	4.46	2.80	3.38	3.92
	(.47)***	(.44)***	(.48)***	(.58)***	(.63)***
$ln\left(\frac{Density_f}{Density_h}\right)$		.16	.12	.12	.16
		(.05)***	(.04)***	(.05)**	(.05)***
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$			.11	.12	.19
			(.07)1	(.08)1	(.09)**
$ln\,(EaseBus)$					.35
					(.16)**
$border$				-5.32	-4.76
				(1.99)***	(1.71)***
$language$				-1.27	-1.20
				(.29)***	(.29)***
$landlock$				-.76	-.79
				(.29)***	(.29)***
$island$				-.11	-.00
				(.20)	(.21)
N	13664	9288	9288	9288	8856
Non-Zero	1872	1872	1497	1497	1484

Standard errors are reported in parentheses. *, **. and *** denote significance at the 10%, 5%, and 1% levels of significance

[1] Denotes 15% level of significance

Table 6.
Value Chain Regressions (Part I)

Main (Expected \# counts)	Extraction	Manufactures	Bus Serv
$ln\,(GDP_{ht} \cdot GDP_{ft})$	.91	.58	.44
	(.18)***	(.05)***	(.12)***
$ln\,(dist_{hf})$	.27	-.32	-.23
	(.17)	(.06)***	(.08)***
$ln\,(L_h \cdot L_f)$	-.47	.18	.18
	(.21)**	(.05)***	(.11)
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	-.01	.12	3.78
	(.36)	(.33)	(.49)***
$ln\left(\frac{Density_f}{Density_h}\right)$	-.05	-.08	-.06
	(.06)	(.02)***	(.03)*
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	.07	-.87	-1.00
	(.13	(.08)***	(.15)***
$ln\,(EaseBus)$	.55	-.22	-.03
	(.18)***	(.06)***	(.08)
$border$	1.62	-.27	-.87
	(.78)**	(.21)	(.29)***
$language$	.53	-.18	.67
	(.26)**	(.14)	(.16)***
$landlock$	.71	.59	.24
	(.55)	(.14)***	(.18)
$island$	-.09	-.08	-.08
	(.21)	(.09)	(.12)

Table 6.
Value Chain Regressions (Part I, cont.)

Inflated (Prob of zero count)	Extraction	Manufactures	Bus Serv
$ln\,(GDP_{ht} \cdot GDP_{ft})$	1.30	-1.54	-1.35
	(.39)***	(.19)***	(.27)***
$ln\,(dist_{hf})$	1.15	.71	.97
	(.50)**	(.23)***	(.34)***
$ln\,(L_h \cdot L_f)$	1.92	.54	.35
	(.45)***	(.16)***	(.29)
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	-3.35	-.53	6.44
	(1.71)**	(.47)	(1.44)***
$ln\left(\frac{Density_f}{Density_h}\right)$	.22	.10	.15
	(.14)	(.08)	(.11)
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	2.43	-.36	-.33
	(1.14)**	(.17)**	(.25)
$ln\,(EaseBus)$	1.35	.65	.97
	(.41)***	(.34)*	(.40)**
$border$	2.59	-15.99	-2.01
	(1.34)*	(608.38)	(2.00)
$language$	-.53	-.76	-.81
	(.68)	(.41)*	(.53)
$landlock$	3.93	-1.03	-1.48
	(1.35)***	(.41)**	(.67)**
$island$	-.57	-.23	-.02
	(.53)	(.26)	(.43)
N	6642	6642	6642
Non-Zero	152	623	385

Standard errors are reported in parentheses. *, **. and *** denote significance at the 10%, 5%, and 1% levels of significance.
[1] Denotes 15% level of significance.

Table 7.
Value Chain Regressions (Part II)

Main (Expected \# counts)	Retail Serv	R and D	HQ
$ln\,(GDP_{ht} \cdot GDP_{ft})$	.65	.40	.45
	(.06)***	(.09)***	(.13)***
$ln\,(dist_{hf})$	-.49	-.68	.17
	(.07)***	(.14)***	(.14)
$ln\,(L_h \cdot L_f)$	.00	.49	.10
	(.06)	(.08)***	(.12)
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	1.26	6.82	-1.18
	(.49)**	(.76)***	(1.21)
$ln\left(\frac{Density_f}{Density_h}\right)$	-.09	.01	.06
	(.03)***	(.04)	(.04)
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	-.70	-2.07	-.68
	(.10)***	(.19)***	(.25)***
$ln\,(EaseBus)$	.07	-.71	-.45
	(.07)	(.12)***	(.14)***
$border$	-.38	-.53	.48
	(.21)*	(.39)	(.59)
$language$	.27	.13	-.06
	(.16)*	(.19)	(.29)
$landlock$	-.02	.39	.40
	(.15)	(.26)	(.39)
$island$	-.16	.16	.02
	(.10)*	(.15)	(.19)

Table 7.
Value Chain Regressions (Part II, cont.)

Inflated (Prob of zero count)	Retail Serv	R and D	HQ
$ln\,(GDP_{ht} \cdot GDP_{ft})$	-1.46	-1.39	-.62
	(.26)***	(.32)***	(.63)
$ln\,(dist_{hf})$	.51	-1.63	2.01
	(.22)**	(.42)***	(1.07)*
$ln\,(L_h \cdot L_f)$	.63	.91	-.92
	(.24)***	(.35)**	(.81)
$ln\left(\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}\right)$	1.19	15.96	-6.45
	(.79)	(3.15)***	(4.01)
$ln\left(\frac{Density_f}{Density_h}\right)$	.10	.12	.30
	(.11)	(.17)	(.22)
$ln\left(\frac{(K/L)_f}{(K/L)_h}\right)$	-.40	-3.13	-.53
	(.21)*	(.66)***	(.97)
$ln\,(EaseBus)$	.75	-.93	2.26
	(.50)	(.49)*	(.95)**
$border$	-16.28	-6.78	7.06
	(377.03)	(2.81)**	(4.28)*
$language$	-.26	-1.41	-.02
	(.52)	(.79)*	(1.17)
$landlock$	.15	-1.58	.93
	(.46)	(.86)*	(1.59)
$island$	-.24	.76	.69
	(.31)	(.61)	(.85)
N	6642	6642	6642
Non-Zero	669	218	139

Standard errors are reported in parentheses. *, **. and *** denote significance at the 10%, 5%, and 1% levels of significance.
[1] Denotes 15% level of significance.

Table 8.
Elasticities - Value-Chain

Expected \# counts	(1) Extraction	(2) Manufactures	(3) Business	(4) Retail	(5) R and D	(6) HQ
$GDP_{ht} \cdot GDP_{ft}$	.60	1.27	1.26	1.34	.74	1.05
$dist_{hf}$	.01	-.64	-.81	-.73	-.27	-1.79
$L_h \cdot L_f$	-.02	-.07	-.03	-.30	.26	.99
$\frac{Sec_f}{Prim_f} / \frac{Sec_h}{Prim_h}$	.77	.36	-.12	.70	2.85	5.10
$\frac{Density_f}{Density_h}$	-.10	-.12	-.15	-.13	-.02	-.24
$\frac{(K/L)_f}{(K/L)_h}$	-.49	-.71	-.80	-.51	-1.29	-1.6
$EaseBus_f$	.23	-.51	-.62	-.28	-.47	-2.65
$border^1$	.02	.05	.00	.05	.00	.00
$language^1$	.02	.01	.04	.04	.01	.00
$landlock^1$	.00	.07	.03	-.01	.01	.00
$island^1$	.00	.00	.00	.00	.00	.00

In the disaggregate case the delta method used to compute the standard errors does not always converge, thus, they are not reported in the table. Nonetheless, the model estimates presented in the two previous tables show that most of the results are significant.
(1) For this variable, the marginal effect is reported for a discrete change of the variable from 0 to 1.

Comment

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INTRODUCTION

Two key features characterize the paper. First, it integrates factor proportion variables into the set of determinants that influence the allocation of foreign direct investment. A second defining element is the use of a highly disaggregated dataset that contains information on the stage of the production chain in which the investment project is embedded. This allows the authors to engage in an inquiry about the determinants of highly specific FDI operations, rarely seen in the empirical literature. If to this we add the fact that the dataset also identifies the source and destination country of the investment, the paper goes deeper than much of the existing work on the field, which has generally relied on less sophisticated databases.

Most of my comments will focus on how these characteristics influence the paper's insights. First, I will reflect on the relative benefits and costs that the gravity specification brings to the empirical analysis. Then, and derived from both the inclusion of factor proportion variables and the sample employed in the analysis, I will argue that the study might be inheriting an explanatory bias towards North-South flows. Finally, and in what in my view constitutes the greatest comtribution of the paper, I will conclude with some remarks on the value chain analysis.

GRAVITY MAY MAKE YOU FALL: PROS AND CONS OF BILATERAL DATA

The use of gravity models in FDI research has been undermined on the grounds that they lack strong theoretical foundations[1]. Shortcomings

that have not precluded this type of studies to exhibit better predictive power than those based exclusively on the characteristics of the country receiving the investment. This indeed seems to be the case of the present paper, as it does a very effective job in confirming trends firmly established in the literature. For instance, the paper highlights the positive influence of joint market size, common language, or a business-friendly institutional setting over FDI activity. Results that are essentially unchanged across specifications, and which integrate the paper into the standard view on FDI location determinants.

The choice for a gravity specification comes however at a price, particularly regarding the design of some regressors. A case in point is the variable on population density: the literature on FDI has used demographic proxies to control for the existence of agglomeration economies[2] in the host economy. In doing so, it is expected that locating firms and individuals within regional clusters will enhance business performance, through –for instance- greater labour availability, or lower transportation costs. But the intuition behind this choice fades away when we turn the analytical focus towards the relative differences in density between home and host country. This might be a tempting choice given the nature of the dataset, but it lacks a clear economic interpretation when compared to an indicator based exclusively on agglomeration economies in the host country. Not surprisingly, the explanatory power of the population density ratio is virtually negligible in the study.

A similar case could be made of the bilateral variable on education, although for different reasons. The stock of human capital in the host economy has been widely used as a variable for explaining FDI inflows[3]. More specifically, large skills differentials between home and host country are deemed to be a significant consideration for certain types of vertical FDI, particularly in manufacturing industries that are intensive in labor (e.g., textiles). But besides the greater variation on the data series, it is not conceptually clear that a ratio on the relative differences between secondary and primary education

1. This is nevertheless a critique that could be extended to much of the empirical literature on FDI determinants, usually an example of an methodological approach based on "measurement without theory".

2. Positive externalities derived from locating firms within large concentrations of population and economic activity. These arise in the form of greater availability and choice of suppliers, potential employees, etc.

3. For evidence on this matter, see for instance Noorbakhsh and Paloni (2001).

would outperform an indicator based on the level of education in the host economy. Hence, the chosen variable on education seems to yield some confusion throughout the course of the analysis: In the inflated model, FDI turns to be less likely the more skilled is the host country, a result that points to the importance of efficiency-seeking FDI. This result is later compromised in the empirical model for established FDI relations, where education is identified as a positive influence for FDI location. Another puzzling outcome is the idea that education promotes FDI in extractive industries, a result that stands against the standard view on this type of investment projects, generally immune to the skill endowment of the host economy. Therefore, it would be interesting to see how the role of education affects these dynamics through non-gravity specifications of the proxy on education.

FACTOR PROPORTION VARIABLES: TOWARDS A NORTH-SOUTH BIAS?

The focus on the role of factor proportion variables constitutes another central element of the study. Given that the first analytical mould of FDI research was the Heckscher-Ohlin model, country differences in factor proportions were one of the earliest reasons for FDI to unravel, if not the first. Under this rationale, multinational corporations dissect their production process following efficiency concerns, establishing production segments according to variations in input prices. Hence, the inclusion of these variables implicitly inclines the analysis to explain vertical FDI, an investment purpose that arises when two conditions are at play: first, when the firm's productive process involves several stages that vary in the intensity of their inputs. And second, when factor prices and availability between home and host countries differ substantially, a situation that is more frequent in exchanges between developed and developing nations. With these considerations, an econometric specification with factor proportion variables should a priori be better prepared to explain North-South FDI.

But probably more important than the choice of regressors, the previous North-South bias is reinforced by the characteristics of the dataset: the 2002-2005 interval is a limited timeframe for a study on

location determinants of FDI, not only because this is a flow particularly affected by the global economic cycle. More importantly, the period under consideration marks a substantial recovery of global FDI flows, especially those accruing to emerging markets: according to World Bank data, FDI inflows to middle and low income countries jumped from 157 USD billion in 2002 to 280 billion in 2005, an increase of 78%. During the same period, flows to developed nations increased by 22%. Here, extraordinarily low interest rates in the industrial world had a commanding role for nurturing this increase in cross-border flows, as they led to very favourable financing conditions for multinational corporations. Moreover, declining rates in the developed world also increased the attractiveness of emerging markets assets, which were already favoured by a renewed compromise of much of the developing world with macroeconomic stability. In all, the period under study combined better access to financing FDI operations, and risk aversion entering a downward path. It is therefore likely that the sample overstates the importance of North-South flows, when a lengthier one would probably have found that FDI flows are, by and large, an economic exchange between developed countries.

Among the factor proportion variables included in the analysis, it is the relative weight of capital-labor intensities what gives the most interesting insights. Specifically, the results on the main model imply that FDI is more likely when the home country is more abundant in capital (or the host less so), while the results on the inflated model suggest exactly the opposite. The authors aim to reconcile these apparently contradictory findings by suggesting the existence of a minimum threshold of capital that the host country must satisfy in order for FDI to arrive. Once this level is surpassed, factor proportion dynamics would be at play, so that FDI would flow to capital scarce locations. The idea of a minimum input threshold is not new in FDI research, but its presence in the literature is slightly different from the previous causal link. Borenzstein et al (1998) find that a minimum level of "absorptive capacity" (i.e., human capital stock) is the fundamental factor that facilitates the existence of productivity spillovers over the host economy. This has been a recurrent research question for the empirical literature, while claims about the influence of the existing physical capital over the decision to locate FDI have received less attention. Thus, combining both the evidence advanced in Borenzstein et al (1998) and the

present paper, the existence of minimum factor production thresholds would be a crucial consideration, not only for luring FDI inflows, but also for making these more beneficial to the receiving economy.

VALUE CHAIN ANALYSIS

As we already stated, one of the most interesting features of the present study comes from having a dependent variable that identifies the segment of the production process associated with the FDI project. In my view, the ability to incorporate this kind of information is a very positive development for FDI research. Not only it enables the researcher to go beyond the traditional divide between horizontal and vertical FDI, but also seems a critical necessity in order to disentangle the factors that lead to the arrival of *high-quality* FDI[4]. In contrast with the early research on FDI, which tended to see this flow as inherently advantageous for the receiving economy, later contributions have adopted a more scrutinizing view to the developmental role of foreign investment. A pioneering effort on this account is the work of Aitken and Harrison (1999), one of the first papers that unveiled negative consequences to local enterprises derived from international investment presence[5]. In all, the underlying idea that has emerged from this line of research is that not all FDI is good, as it does not necessarily fosters job creation, knowledge dissemination to the local workforce, or other alleged benefits.

While a more exhaustive analysis is needed in order to categorize the host-country impact of FDI according to its position in the production chain, we can assume that activities related to R&D, or the establishment of regional HQ, are the type of foreign involvement best suited to upgrade the domestic technological base and the workforce know-how. At the other end of the spectrum, extractive activities usually entrench into the host country in the form of "enclave economies", with little linkages to other industries, high dependence on imported capital goods, and limited impact on employment cre-

4. For a key contribution on this regard, see Kumar (2003

5. These essentially come in the form of crowding out effects to local firms, while the gains from foreign investment presence appear to be entirely seized by joint ventures.

ation. As a result, these FDI projects are the least likely candidates to promote development in the economies where they choose to locate.

With the previous taxonomy in mind, the paper is the first, to my knowledge, to identify which location determinants influence the various categories of investment projects. For instance, the paper yields fairly sound results regarding the role of economic size, possibly the most robust determinant of the literature on FDI location, which in the study affects positively all types of investment projects. Another intuitive result is the lack of explanatory power of source-host distance to explain extractive FDI, since this one is essentially determined by the availability of the natural resource.

The paper arrives to a more stimulating set of results through those related to the relative capital endowment of the host economy and its institutional structure. First, the idea of a necessary capital threshold turns out to be particularly important for R&D activities, while an adequate business regulatory framework is so for the establishment of regional headquarters. In sheer contrast, extractive activities show the lowest sensibility to the previous factors.

In all, I find these to be the most relevant contributions to the literature. the paper empirically confirms the need of a minimum level of development in the host economy, with this one broadly defined in terms of institutional quality and capital stock. If we take these insights as valid, we can also conclude that FDI is more likely to be a growth-enhancing type of external financing in middle income countries, which combine the economic potential typical of developing nations with an institutional foundation that can facilitate the entrance of a type of FDI more able to leave positive externalities over the host economy. With these conclusions in mind, and as a possible extension of this research agenda, it would be interesting to see how the previous results change if they are controlled by the role of investment incentive programs, to this date the main policy effort for attracting FDI.

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Comment

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The paper by Canals and Noguer is a contribution to the empirical explanation of the determinants of the important increasing trend of worldwide FDI in recent years, specifically between January 2002 and June 2005. The data used comes from the new database Locomonitor.

The paper is very well structured. The theoretical background is presented in such a way that the empirical instrument used in the econometric application, the gravity equation, follows naturally. Afterwards, the instrument is applied in several versions, considering the explanatory variables, the aggregation level, and the error term. The explanatory variables included in the model are divided into two groups: the basic and extended traditional gravity equation variables and the variables referring to the factor proportions theory. With respect to the error term, it is necessary to tackle the problem of the important number of zero observations, which leads to the use of the zero inflated negative binomial distribution (ZINBD). This option appears to be a correct solution to the problem at hand.

The knowledge-capital model of FDI is presented as the theoretical justification because the flows of capital that are considered are those of the multinationals and this model is the workhorse of the multinational firm theory. This model leads to two clear and alternative explanations of the FDI: Horizontal Expansion and Vertical Expansion, corresponding to market access and cheaper production, respectively. The gravity equation provides an adequate empirical framework because country size and trade barriers are the determinants of horizontal FDI, corresponding to the main variables of its

basic version: the GDP of each pair of countries and the distance between them. Moreover, as the key element in the explanation of the vertical FDI is factor proportions, the gravity equation is extended with factor endowment characteristics.

Going on to the empirical application, the main data set has 6,728 investment projects corresponding to 29 source countries and 131 destinations. The total number of investment projects that the data base contains is 29,139. The projects selected are undertaken by the 190 most important multinational firms. The most outstanding feature of the database is the predominance of zero values. The number of possible bilateral flows is 3,799 per year and 15,196 in four years. 87% of these observations are zeros.

The empirical application is carried out in three steps. First, the basic gravity model is used to explain the aggregate FDI. Second, factor proportions considerations are added to this basic model. Finally, the model with factor proportions is applied to the disaggregate FDI in several stages of the value chain.

The main results are that distance discourages FDI, while size and sharing a language encourage it. Moreover, capital tends to flow towards capital-scarce countries and ease of doing business is important, especially for locating regional headquarters. Other effects are that sharing a border and being landlocked encourage FDI, but being an island does not.

In the second step when factor proportions characteristics are introduced, the more skilled the foreign country, the more FDI it receives, but with a positive sign also in the inflated model. As these effects are opposite, the interpretation must be that there exists a maximum of the ratio in order to have FDI flows. The capital/labor endowment conflicts with the skill endowment variable because, when it is incorporated, the latter has no effect. The interpretation offered is that the skill indicator used is of bad quality.

When the gravity equation is applied to six stages of the value chain, the conclusions presented are that, although a lot of variation is found across stages, the aggregate effects of economic size, distance and capital abundance are maintained. Furthermore, a minimum requirement of capital is added in all the stages except Extraction. Finally, the ease of doing business is also importance, especially for headquarters.

My assessment of the paper is organized in two parts. Firstly the general comments are presented and then the specific ones.

1.- General comments

The general comments follow two main lines of argument. The first is that, in my opinion, the way in which the factor proportions theory is considered in the gravity equation can be improved. Secondly, the results in the phase of the empirical application to the stages of the value chain are richer than those reflected in the conclusions of the paper.

The factor proportions theory and per capita GDPs

The theoretical justification of the gravity equation can take the factor proportions theory as a point of departure. Then, the resulting explanatory variables are well defined, the explicit introduction of the different factor proportions not being necessary. This means that, when they are introduced, a problem of specification arises. The addition of the population as an explanatory variable is also inappropriate except in one of the versions of the gravity equation. Precisely, the version compatible with the factor proportions theory is when per capita GDPs, distance and populations are considered. This version is the most robust of the gravity equation. The population then acts as the size variable. When aggregate GDPs and populations are considered jointly, the interpretation of the latter is not clear at all because per capita GDPs also contain the information corresponding to factor proportions. When this approach is followed, the results obtained for populations and factor proportions variables are problematic, as happens in this paper.

When per capita GDPs are considered as explanatory variables in column (3) of Table 4, they are significant, the role played by distance is the same as in the other columns and population has a leading role. But these results are not commented in the text. Thus, an opportunity is missed to improve the results because we can find subsequent problems of interpretation. The conclusions related to capital, labor and skill scarcity can be drown from the way per capita GDPs are introduced as a ratio: factor proportions are positively correlated between themselves and with per capita GDP. In my opinion, it would have been worth considering the complete analysis with this version of the equation.

The application to the stages of the value chain

The conclusions of the application of the gravity equation to the six stages of the value chain are obtained from Table 8 instead from Tables 6 and 7. Table 8 displays the results of the estimation of the elasticities, does not inform about the significance of the effects, and contains much less information than Tables 6 and 7. These two tables allow us to deduce a richer typology of the FDI flows than the conclusions contained in the paper. In Table 1 below, we summarize the results of the estimation of Tables 6 and 7 of the paper. We present, for each stage of the value chain, the variables with a significant effect (at least at 5%), indicating only the sign of the effect. In each cell we include two signs. The one on the left corresponds to the effect on the number of projects and the one on the right to the probability of foreign investment.

Table 1.
Summary of the results of the value chain regressions

	Extraction		Manufacturing		Business Services		Retail Services		R&D		HQ	
GDP	+	+	+	-	+	-	+	-	+	-	+	
Distance		+	-	+	-	+	-	+	-	-		
Population	-	-	+	+				+	+	+		
Secondary Education		-			+	+	+		+	+		
Density			-	-			-					
Capital		+	-		-		-		-	-	-	
Easdoingbus	+	+	-			+					-	+
Border	+				-					-		
Language	+				+							
Landlock		+	+	-		-						

We can see that the explanatory variables affect the different stages of the value chain in different ways. It is difficult to derive general conclusions. Each type of activity has a clear behavior profile. Below, we analyze the effect of the variables and summarize the profile of each activity.

GDP: It always has a positive effect on the number of projects in all the stages of the value chain and on the probability of FDI in four of them. It does not affect the probability of HQ investment and negatively affects the probability of Extraction projects. The meaning of this last effect is that the greater the size of the country, the lower the probability, which could be interpreted as the capacity of exploiting its own resources. Following the interpretation of the authors, it

would mean that a maximum bound exists in the economic size for investment in Extraction but, when the investment is positive, the greater the size, the greater the number of projects.

Distance: It negatively affects the number of projects in four activities: Manufacturing, Business Services, Retail Services and R&D. It does not affect the number of Extraction and HQ projects. In the latter, it also does not affect the probability of investment. In the first four activities, the effect on the probability is only incoherent with the effect on the number of projects in R&D, from which we can deduce the existence of a minimum distance for foreign investment in this activity.

Population: This variable has a strange effect. It does not affect HQ and Business Services investment at all, while in Extraction it negatively affects the number of projects and positively the probability of investment. The greater the population, the lower the number of projects, but there is a minimum requirement of population for foreign investment in this activity. In the other stages with a significant effect, Manufacturing, Business Services and R&D, the higher the population, the lower the probability of foreign investment but the greater the number of projects. This can be interpreted as the existence of a maximum bound for population in order for investment to take place. In Retail Services, this maximum bound also exists but the population does not affect the number of projects.

The rest of the explanatory variables have very varied effects. The abundance of skilled population has the greatest effect on Business Services and R&D investment. There is a maximum bound but it has a positive effect on the number of projects. In Retail Services, the effect is only on the number of projects and it is negative, while in Extraction it affects the probability of investment positively. The greater the skill abundance, the greater the probability of investment but there is no effect on the number of projects. The capital abundance has a negative effect on the number of projects in all the activities, except in Extraction, where it has no effect. This variable negatively affects the probability of investment in Extraction, the opposite of Manufactures and R&D. In these two latter cases, the existence of a minimum of capital can be deduced and a maximum in Extraction. The ease of doing business favors foreign investment (its probability) in Extraction, Business Services and HQ and increases the number of projects in Manufactures and HQ, but lowers it in Extraction. Sharing a border only affects the probability of investment in R&D

positively, but affects the number of projects in Business Services negatively and the number of projects in Extraction positively. Sharing a language positively affects the number of projects in Extraction and Business Services. Finally, being landlocked affects the probability of investment in Extraction negatively and in Manufactures and Business Services positively, and positively affects the number of projects in Manufactures.

Table 2.
The profile of the stages of the value chain

	Extraction	Manufacturing	Business Services	Retail Services	R&D	HQ
Positive effect on number of proyects	GDP Border Language Easdobus	GDP Population Landlock	GDP Sec. Educat. Language	GDP Sec. Educ.	GDP Population Sec. Educ. Easdobus	GDP Easdobus
Negative effect on number of proyects	Population	Distance Capital Density	Distance Capital Border	Distance Capital Density	Distance Capital	Capital
Positive effect on probability	Population Sec. Educ.	GDP Capital Landlock	GDP Landlock	GDP	GDP Distance Capital Border	Easdobus
Negative effect on probability	GDP Distance Capital Landlock Easdobus	Distance Population	Distance Sec. Educ. Easdobus	Distance Population	Population Sec. Educ.	

Table 1 contains a clear profile for each of the stages in the value chain, that is summarized in Table 2. FDI in HQ is more likely and with more projects in friendly contexts for doing business, the number of projects also growing the more capital scarce the country and the higher its economic size. Investment in R&D is likelier the higher the size, the distance, the capital abundance and sharing a border and the lower the population and the skill level. The number of projects grows with economic size, population and skill level and decreases with distance and capital abundance. In Retail Services, the probability decreases with distance and population and increases with size, while the number of projects increases with economic size and population and decreases with distance, density and capital abundance. In Business Services, the probability of investment grows with economic size and being landlocked and decreases with distance, skill level and ease of doing business, while the number of projects

increases with size, skill level and sharing a language and decreases with distance, capital abundance and sharing a border. In Manufacturing, the probability grows with size, capital abundance and being landlocked and decreases with distance and population, while the number of projects grows with economic size, population and being landlocked and decreases with distance, density, ease of doing business and capital abundance. Finally, in Extraction, the most peculiar activity, the probability grows with skill level and population and decreases with economic size, distance, capital abundance, ease of doing business and being landlocked. The number of projects grows with economic size, sharing a border or a language and ease of doing business, while it decreases with population.

2. Specific comments

Some specific comments are added to the two main general comments made previously:

1. The functional form used is not the double logarithmic gravity equation (zero values in the dependent variable). This fact complicates conclusions about the effect of some explanatory variables.

2. The way the elasticities of Table 8 have been obtained could have been better explained. Moreover, their significance should have been included.

3. The results of the paper are not compared to those of the empirical references included at the beginning.
4. The inclusion of dummy variables for trade agreements like EU, EFTA, or NAFTA has traditionally been helpful to improve the results of the gravity equation and could have been so in this paper.

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