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Trade and Decentralization*

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Abstract

Globalization of economic activities and decentralization of government organization are occurring simultaneously. We consider the implications of government decentralization for intra-national and international trade. Decentralization can create barriers to intra-national trade, but can make international trade relatively more attractive. Imports as substitutes to inbound foreign direct investment suggest a stronger positive effect of decentralization on imports relative to exports. Our empirical results from a standard gravity model find supportive evidence for these conjectures.

Keywords: decentralization, federalism, trade, gravity equation, border effect

JEL classification numbers: F15, H77

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1 Introduction

Policy reforms that change the degree of centralization of governance are high on the policy agenda. Countries such as Spain, Belgium, and the United Kingdom have moved to more federal systems, including a substantial devolution of government activities and finances to regional levels. With regards to the developing world, the World Bank and other international policy actors have developed decentralization programs and are actively encouraging countries to decentralize government activities. At the same time, foreign trade has been growing fast, outpacing world output growth more than twice in recent years.¹

Both developments, rapidly increasing economic integration and political decentralization, have been widely observed and debated. On the one hand, the international trade literature has extensively explored the determinants and consequences of international trade. On the other hand, the fiscal federalism literature has explored how countries differ in the degree and form in which legislative, executive, administrative, and judicial powers are allocated across different bodies of government and considered the optimality of different institutional arrangements. Traditionally, however, the optimal allocation of government responsibilities across horizontally and vertically distinct government actors has been studied in a closed economy setting, and has hardly considered the implications for international economic transactions. Here, however, we stress the interaction between the domestic architecture of government, on the one side, and international economic integration, on the other side. More specifically, the present study directly links decentralization to trade and asks, in particular, how decentralization affects international and intra-national trade.

There are several ways in which decentralization potentially can affect intra-national as well as international trade. First, in decentralized coun-

¹According to WTO (2006), average trade growth was about six percent over the last decade, whereas average growth of world GDP amounted to less than three percent.

tries, multiple governance levels and different jurisdictions on the same sub-national level may introduce rules that lead to fragmentation of the internal market and create *de facto* domestic customs (Tanzi 2000). Sub-national governments commonly use their regulatory powers for protective or revenue-raising purposes by imposing barriers to the free movement of goods, whether by taxes and subsidies, by regulation, by preferential procurement policies or by the design of local public goods and services.² Moreover, responsibilities of different government tiers often overlap which results in vertical externalities (Keen 1998, Keen and Kotsogiannis 2002, Wrede 1997, 2000) if more than one level of government levies regulations on the same economic activity. Such vertical externalities also imply that internal transactions become more costly, as sub-national governments receive more discretion. These effects on domestic trade also have important consequences for international trade. As a result of more expensive intra-country trade, international transactions become relatively more attractive. This implies that, *ceteris paribus*, increased decentralization results in higher exports and imports.

Another important channel that links decentralization to a country's international trade is via the relationship between international trade and foreign direct investment (FDI). Firms typically face a trade-off between serving a market via exports, or via establishing an on-site subsidiary through FDI. Recent theoretical and empirical work has shown that decentralization tends to negatively affect FDI. If a foreign investor has dealings with several layers of government, this can create i) problems of rivalry between the different levels, ii) coordination failures, iii) free-riding incentives between government decision makers from different government levels, iv) common pool problems between them when making independent tax and expenditure decisions, v) problems when it comes to the enforcement of implicit contracts between the government and private investors, and vi) moral hazard problems from

²Boadway et al. (1994), for example, report that in Brazil the VAT is levied at the state level which creates the potential for differing VAT systems across the country and thus disruption in the internal market.

joint accountability of politicians from different levels and jurisdictions. All these factors diminish a country's attraction as a location for FDI, which is supported by the empirical evidence, see Kessing et al. (2007) and Kalamova (2008). If FDI and exports are substitutes this creates an additional channel for decentralization to affect international trade. This substitution argument suggests a stronger effect of decentralization on imports.³

Our analysis considers empirically the role of decentralization measures on the set of bilateral imports of 39 countries, taken from the Directorate of Trade Statistics (DOTS) of the International Monetary Fund (IMF). As explanatory variables, we employ different decentralization measures and the variables used in the standard gravity approach. Decentralization turns out to be a significant determinant of intra- and international trade. It goes along with decreased domestic trade and increased bilateral trade. The effects tend to be quantitatively more important for imports. Our findings are robust to a number of alternative specifications, including the use of alternative decentralization measures.

Our study relates to several strands of literature. First, it contributes to the large literature concerned with the determinants of international trade; see, for example, Anderson and van Wincoop (2004) and Jamarchik and Ghosh (2005). We contribute to this literature by regarding decentralization as a *domestic* factor that determines international trade. Furthermore, we build our analysis closely on the related literature which pays special attention to the 'border' effect, or the so-called home bias⁴ and examines the causes of border effects (see, in particular, Chen 2004).

Second, some other contributions have considered the interaction of eco-

³A similar observation could be derived, if FDI mainly serves as a platform for exports. Less FDI would also imply a quantitatively smaller effect of decentralization on exports.

⁴This strand of literature was initiated by McCallum (1995), who showed that two Canadian provinces trade 22 times more with each other than with US states of similar size and distance, and many subsequent studies illustrated the negative effect of borders, among others, Helliwell (1996), Wei (1996), Nitsch (2000), Anderson and van Wincoop (2003).

nomic integration and the degree of decentralization. This literature has largely focussed on the relationship between decentralization and FDI. In this context it has been argued that the competition between regional governments can reduce the hold-up problem in FDI and create a favorable investment climate (Brennan and Buchanan 1980, Weingast 1995). More recently this view has been challenged by Kessing et al. (2006, 2007, 2009) and Kalamova (2008), who argue, and provide empirical evidence, that decentralization negatively affects FDI.

Finally, the present study also relates to the work of Alberto Alesina, Enrico Spolaore, and Romain Wacziarg on the size and number of countries; see, for example, Alesina et al. (2000), and Alesina and Spolaore (2003). They also study the relationship between economic integration and political disintegration, but focus on the extreme case of disintegration of government authority: secession. They argue that improved access to world markets reduces the importance of the home market, which results in higher incentives to break up nations. We return to this direction of causality in our discussion of endogeneity issues in Section 3.

The paper is organized as follows: Section 2 explicitly states our main conjectures regarding the relationship between decentralization and trade, and how we assess these conjectures empirically. Section 3 describes the data and the econometric methodology implemented. In Section 4 we present the results, and Section 5 concludes.

2 Conjectures and empirical strategy

Our theoretical perspective suggests that decentralization will have a direct negative impact on domestic trade by imposing internal trade barriers to trade. Furthermore, as a result of more expensive intra-country trade, international transactions become relatively more attractive for exporters and importers. Finally, the positive effect of decentralization should be stronger

for imports, since imports can be a substitute for reduced attractiveness for inbound FDI. We state our main conjectures accordingly:

Conjecture 1 *Decentralization has a direct negative effect on intra-national trade.*

Conjecture 2 *The degree of decentralization should have a positive effect on exports and imports.*

Conjecture 3 *The degree of decentralization should have a stronger positive effect on imports relative to the positive effect on exports.*

Our empirical strategy to assess these conjectures is to augment an empirical gravity model of trade, by exporter and importer-specific measures of decentralization. For this purpose, we use the degree of expenditure decentralization - the ratio of sub-national government expenditures to total government expenditures - which, despite some shortcomings, is the most widely used decentralization measure in the literature.⁵ In line with our conjectures, we expect this measure to exhibit a negative effect on intra-national trade (Conjecture 1), a positive effect on imports and exports (Conjecture 2), and a quantitatively larger positive effect on imports (Conjecture 3).

3 Data and econometric specification

To test the predictions derived above, our empirical analysis is based on a standard gravity model, which is the most robust device in empirical trade research and is consistent with several theoretical models of trade.⁶ Since

⁵In our robustness analysis we also use alternative measures of decentralization, such as the revenue decentralization or the number of government tiers.

⁶The theoretical motivation for the gravity framework is found in many general equilibrium models (including Anderson (1979), Bergstrand (1985), Deardorff (1998), Anderson and van Wincop (2003)) in which specialization generates the force of gravity. However, other studies show that the gravity equation can also arise from theories with incomplete specialization and trade costs (Haveman and Hummels (2004), Feenstra et al. (2001), among others).

we are interested in the impact of decentralization on both international and intra-national trade, the dependent variable includes bilateral $Trade_{ij(i \neq j)}$ and domestic $Trade_{ii}$ observations. We use bilateral trade data derived from the import side and organized by the 4-digit Standard International Trade Classification from the Direction of Trade Statistics (DOTS) of the International Monetary Fund (IMF). As common in the empirical literature on trade the imports are deflated by the US consumer price index to convert them into real terms, see, for instance, Rose (2004) and Subramanian and Wei (2007). Following other studies, such as Chen (2004), Wei (1996), Nitsch (2000), and Evans (2003), among others, we calculate domestic trade for country i as the difference between its gross domestic product and its total exports to the rest of the world. The gravity model considered here takes then the following form:

$$\begin{aligned} \ln Trade_{ijt} = & \beta_1 \ln GDP_{it} + \beta_2 \ln GDP_{jt} + \beta_3 \ln Dist_{ij} + \beta_4 TradeCosts_{ijt} \\ & + \beta_4 Decentral_{it} + \beta_5 Decentral_{jt} + \beta_6 (Decentral * Domestic)_{ijt} \\ & + \beta_7 Domestic_{ijt} + \lambda_t + \gamma_i + \gamma_j + c + \varepsilon_{ijt}, \end{aligned}$$

where i and j indicate the exporting and importing country, respectively, and t the time period. The left-hand side variable $Trade_{ij}$ represents the bilateral trade flow. $Decentral$ denotes the degree of decentralization. $Domestic_{ij}$ is a dummy variable equal to one for domestic trade $Trade_{ii}$ and to zero for international trade $Trade_{ij(i \neq j)}$.

The gravity equation in its basic form postulates that the value of trade tends to increase with decreasing international trade barriers between the trading partners and with increasing economic size. Gross domestic product, GDP , is our measure for economic size. International trade costs result from (not) belonging to the same customs union or free trade agreement, (not) sharing common border and same language, or (not) having common

colonial history for the exporter-importer pair. These are denoted by the vector $TradeCosts_{ij}$ which comprises the variables $Customs\ Union_{ij}$, $Free\ Trade\ Agreement_{ij}$, $Common\ Border_{ij}$, $Common\ Language_{ij}$, and $Common\ Colony_{ij}$.⁷ $Dist_{ij}$ denotes bilateral distance between i and j , and is one of the main explanatory variables in the gravity model, typically having proved to be highly significant and robust. International distance here is calculated by following the great circle formula, which uses latitudes and longitudes of the most important cities or official capitals. Our first measure of domestic distance is generated by taking a quarter of the distance to the economic center of the nearest trading partner, as suggested in Wei (1996), but we also provide results using alternative measures.

Motivated by Anderson and van Wincoop's (2003) multilateral resistance terms we include exporting γ_i and importing country γ_j fixed effects into the estimation.⁸ Otherwise, the estimation could lead to biased estimates since relative prices are ignored. Furthermore, we include fixed time effects λ_t to control for omitted, time-variant effects that affect all country-pairs in the same way; c denotes the intercept term and ε_{ijt} is a Gaussian white noise error term. In Table A-1 in the Appendix we describe all variables and the sources we collect them from.

The core explanatory variable of our analysis is the level of expenditure decentralization (*Decentral*) - the share of sub-national expenditures in total government expenditures - in both importer and exporter countries. These data come from the IMF's Government Finance Statistics (GFS) and the

⁷Each binary variable is equal to 1 when the importing and exporting countries belong to the same customs union or free trade agreement, share the same border and language, and have common colonial history, respectively, and 0 otherwise. Therefore, we expect these variables to enter with a positive sign into our regression. Each of these variables takes a value of zero in the case of domestic trade as in Helliwell (1997). Wei's (1996) way of building the variables by giving them a value of one for domestic trade yields very similar results.

⁸These authors show that, in equilibrium, bilateral trade depends on both exporter and importer price levels, which are themselves functions of trade barriers, the so-called multilateral resistance terms.

World Bank Decentralization Database. This variable is the most commonly used decentralization measure in the empirical decentralization and federalism literature. Although it is imperfect and cannot capture the differences in the discretion provided to states and local authorities over their fiscal responsibilities, it provides a useful proxy for the relative level of countries' fiscal decentralization. Variations in our measure of expenditure decentralization may result not only from changes in the assignment of competencies between the government levels, but also due to business cycle fluctuations. To address this problem of a cyclical relationship between decentralization and trade, we calculate four-year-averages for expenditure decentralization. Finally, we add the interactive term $Decentral_{i=j} * Domestic$ to the list of regressors, which has a value different from zero only in the cases of domestic trade. This allows us to assess the impact of decentralization on intra-national trade.

An overview of the values of the expenditure decentralization is presented in Table 1. The countries in our sample range from unitary states (for instance, Bahrain, Costa Rica, and the Dominican Republic) with a share of sub-national expenditures in total government expenditures close to zero to the traditional federations such as the United States of America, Switzerland, India, Canada, and others, where local and regional governments have an equal or higher share of fiscal responsibilities than the central governance level. While the level of decentralization remains relatively constant over time in most countries, there are a number of countries, in particular Argentina, Brazil, Mexico and Spain, which have gone through major reforms in the direction of increased regional autonomy over the two decades under consideration, which is reflected in substantial variation of our decentralization measure over time.

Before turning to our empirical analysis, we should discuss some further methodological issues. Firstly, around 7% of our sample contains zero trade observations. To address this issue, we mostly rely on Tobit estimations, although we also provide illustrative OLS results. Following Chen (2004) and

Table 1: Expenditure decentralization

country	1980-1983	1984-1987	1988-1991	1992-1995	1996-1999
Argentina	29.04	35.71	44.78	43.02	41.40
Australia	40.51	39.77	42.16	42.05	42.62
Austria	30.62	29.85	30.14	31.04	30.89
Bahrain	2.91	2.93	2.78	2.86	2.79
Bolivia	na	16.27	18.60	18.92	30.43
Brazil	32.45	32.95	33.73	36.16	42.80
Canada	57.83	56.45	55.99	57.18	58.25
Chile	6.87	7.68	9.78	7.60	8.49
Costa Rica	3.44	3.29	3.08	2.77	3.21
Denmark	45.20	43.81	44.67	43.37	45.35
Dominican Republic	3.57	4.56	2.28	2.17	2.64
Finland	38.97	40.20	39.60	34.24	35.62
France	21.85	19.22	17.56	17.65	17.42
Germany	42.50	41.25	40.66	41.30	39.26
Hungary	20.26	20.35	20.40	23.41	23.39
Iceland	25.51	22.40	22.04	23.55	27.04
India	47.43	44.77	44.23	45.69	45.60
Indonesia	11.63	10.55	10.93	12.61	11.86
Ireland	25.11	24.58	22.66	23.64	24.91
Israel	8.88	9.41	12.55	13.81	13.71
Italy	na	21.34	22.86	20.27	22.60
Malaysia	18.81	19.92	19.67	17.56	18.53
Mauritius	4.30	4.44	4.20	4.71	4.78
Mexico	19.09	14.06	17.43	27.79	28.30
Netherlands	25.57	24.95	23.93	24.34	23.34
Norway	33.09	33.31	33.03	31.75	33.36
Panama	1.91	1.97	2.52	2.46	na
Paraguay	5.54	5.33	2.65	2.19	na
Philippines	12.02	10.26	7.31	8.70	na
Poland	na	25.21	26.54	16.20	22.86
Portugal	na	7.23	8.99	11.04	12.41
Romania	19.19	13.16	10.84	10.58	12.64
Spain	14.70	21.79	27.65	30.14	31.69
Sweden	38.68	36.91	36.87	32.54	33.87
Switzerland	53.15	52.05	50.33	48.56	47.29
Thailand	9.69	7.29	7.42	7.65	8.74
United Kingdom	25.09	25.06	25.53	22.57	21.90
United States of America	41.96	42.06	43.92	46.28	47.91
Uruguay	8.62	8.30	10.20	9.95	11.02

Notes: i) The reported values represent four-year averages of the ratio of sub-national expenditures to total expenditures; ii) Data come from the Government Finance Statistics of IMF and the World Bank Decentralization Database.

others, we express the dependent variable as $\ln(Trade_{ijt} + 1)$ in order to contain the zeros in the natural logarithm. Secondly, we build a symmetric set of 39 countries on the exporter and importer sides. As common in the literature, our panel data set consists of observations for every 4 years beginning in 1983 and ending in 1999, which dwindle the time dimension to five periods in total.⁹ For expenditure decentralization we use the four-year-averages over the period 1980-1999 rather than just the observations for the years 1983, 1987, 1991, 1995 and 1999. Thirdly, endogeneity is a possible problem, if the value of trade between two countries has an impact on their levels of decentralization. Alesina et al. (2000) have considered the size and number of nations to be determined by the openness of international markets. Decentralization may imply a more gradual step towards a complete secession and, in this view, the motives towards more decentralization may be seen as analogous to the ones for secession. However, by using period-average-values of decentralization as an explanatory variable and end-of-period trade values, we largely avoid the potential problem of reverse causality.¹⁰

4 Empirical results

We first describe the results for the baseline model. Then we consider the robustness of the results by testing several modifications of the baseline model.

⁹Although the DOTS data cover a wide range of the world trade in goods beyond the period of 1980-1999, we are constrained by the availability of our main explanatory variable, the degree of expenditure decentralization. The latter exists for just around eighty countries and a high number of observations are missing for many of those countries along the time dimension. As a result, we include into our analysis all 39 countries, for which there is a coverage over the considered period.

¹⁰Using the predetermined lagged expenditure decentralization values delivers results, which are similar in sign, magnitude, and explanatory power to the reported empirical results.

4.1 Baseline results

In the baseline specification we regress by Tobit the bilateral import flows on expenditure decentralization of the exporting and importing countries controlling for the standard gravity variables. The first column of Table 2 shows the effect of decentralization on domestic trade, the second and third columns account for the direct impact of decentralization on international trade, and the fourth considers the three effects jointly. Since Tobit coefficients are not directly interpretable, we calculate the marginal effects by the McDonald and Moffit (1980) procedure, which are reported in the tables.

In column (5) of Table 2, we list the results of our baseline specification estimated by OLS, which we obtained after dropping the zero estimations. We report only heteroskedasticity-robust standard errors clustered by country-pairs. Given the relatively low number of zero observations, the results of the Tobit and OLS estimations turn out to be rather similar.

To assess Conjecture 1, consider the interaction term between the domestic trade dummy and expenditure decentralization in Table 2. Its coefficient is highly significant in all estimations and indicates the semi-elasticity of trade with respect to decentralization. It is equal to -0.056, suggesting that a one-percentage point increase in the ratio of sub-national expenditures to total government expenditures will decrease our measure of internal trade by 5.45% ($=100 * [\exp(-0.056) - 1]$). This supports our Conjecture 1. A simple exercise allows us to illustrate quantitatively the effects. We can compare the most decentralized country in our sample (Canada with a value of 58% for expenditure decentralization) with a very centralized country (such as Indonesia with 10% decentralization, on average).

The coefficients on *Domestic* and on the interaction term indicate for the former a *Domestic* marginal effect of $(4.929 - (0.056 * 58)) = 1.681$, whereas for the latter centralized country the results indicate a marginal effect of $(4.929 - (0.056 * 10)) = 4.369$. Thus, we do not only find support for conjecture 1, but these effects appear to be quantitatively substantial.

Table 2: Baseline results

Dependent variable: $\log Trade_{ij}$					
Variables	Tobit				OLS
	(1)	(2)	(3)	(4)	(5)
$\log GDP_exp$	1.159*** (0.109)	1.159*** (0.109)	1.165*** (0.107)	1.159*** (0.107)	1.028*** (0.098)
$\log GDP_imp$	0.842*** (0.120)	0.847*** (0.119)	0.838*** (0.120)	0.835*** (0.121)	0.672*** (0.101)
$\log Distance$	-0.876*** (0.049)	-0.882*** (0.049)	-0.882*** (0.049)	-0.874*** (0.049)	-0.833*** (0.044)
<i>Customs union</i>	0.116 (0.098)	0.138 (0.099)	0.144 (0.098)	0.130 (0.097)	0.326*** (0.088)
<i>Free Trade Agreement</i>	0.294*** (0.097)	0.325*** (0.097)	0.330*** (0.097)	0.307*** (0.096)	0.349*** (0.088)
<i>Common border</i>	0.487*** (0.166)	0.484*** (0.163)	0.484*** (0.163)	0.486*** (0.166)	0.495*** (0.152)
<i>Common language</i>	0.511*** (0.105)	0.495*** (0.106)	0.495*** (0.106)	0.512*** (0.105)	0.464*** (0.097)
<i>Common colony</i>	0.493*** (0.158)	0.512*** (0.157)	0.513*** (0.157)	0.496*** (0.158)	0.493*** (0.145)
<i>Decentralization_exp</i>		0.007* (0.004)		0.008** (0.004)	0.011*** (0.004)
<i>Decentralization_imp</i>			0.023*** (0.004)	0.024*** (0.004)	0.030*** (0.004)
<i>Decentralization*</i>	-0.056*** (0.013)			-0.056*** (0.013)	-0.046*** (0.013)
<i>Domestic</i>					
<i>Domestic</i>	4.929*** (0.454)	3.586*** (0.353)	3.590*** (0.353)	4.956*** (0.454)	4.760*** (0.430)
Observations	6973	6973	6973	6973	6499
Uncensored obs.	6499	6499	6499	6499	
(Pseudo) R-squared	0.452	0.448	0.449	0.453	0.901

Notes: i) *** - significant at 1% level, ** - significant at 5% level, * - significant at 10% level; ii) Robust standard errors in parentheses; iii) All estimations include year, exporter and importer dummies; iv) Columns (1)-(4) present Tobit marginal effects. Column (5) presents OLS estimates.

We also find consistent support for our next two conjectures outlined in Section 2. The decentralization coefficients of importing and exporting countries are statistically significant at least at the 10% level and enter with the expected positive signs. This supports Conjecture 2. Decentralized countries export and import more than their centralized counterparts. Columns (2) and (3) allow to consider quantitatively this direct impact of decentralization on international trade. The results indicate that a one-percentage-point increase in decentralization of the exporting and importing country translates into 0.80% ($=100 * [\exp(0.008)-1]$) and 2.43% ($=100 * [\exp(0.024)-1]$) increase in the bilateral trade between them, respectively. The fourth column reinforces the evidence by testing the three conjectures simultaneously. Again, the results indicate that the effect of decentralization is quantitatively important. The results also show that the impact of decentralization in the importing country is quantitatively more important than in the exporting country, providing support for our Conjecture 3.

The OLS estimation in column (5) yields slightly higher coefficients for the decentralization measure in both the exporting and importing countries, which may be due to the omitted zero observations containing information about why low levels of trade are observed. However, the OLS results underline the robustness of the findings.

In all specifications the gravity explanatory variables are highly significant and display coefficients with the expected signs. The country-specific gross domestic products enter with a positive sign (and their coefficients are close to unity) which verifies the theoretical prediction of the gravity model that the value of trade tends to increase with economic size. Distance has the correct negative coefficient, which means that countries trade more with geographically closer partners. Also the five different proxies for bilateral trade costs have a significant positive sign (except for the customs-union-dummy) as predicted by the theory. For instance, if the partners in a trading pair share the same border, language or colonial history, they will trade above 60%

more with each other.¹¹ Belonging to a free trade agreement also increases bilateral trade, in line with some recent studies.¹²

4.2 Robustness analysis

We begin our robustness analysis by considering an alternative measure of domestic distance. There has been wide debate about the correct measure of domestic distance in the absence of data on actual shipment distances which traces back to Wei (1996), Nitsch (2000), Head and Mayer (2002), and Chen(2004), among others. As previous studies show, the size of the estimated domestic trade bias will be proportional to the value of the average internal distance, which makes the last variable so crucial. We create an alternative measure of domestic distance based on Nitsch (2000), which is equal to the radius of a circle whose area is the area of the country ($r = \sqrt{\text{area}}/\sqrt{\pi}$). It becomes obvious from Table 3 that the signs and explanatory power of our main regressors, the country-specific decentralization measures, the interaction term and the domestic trade dummy, persist when we use this new distance measure. However, their magnitudes and levels of statistical significance have been slightly affected. The *Domestic* coefficient here is larger than with using Wei's measure in Table 2 (the same happens in Chen (2004)) at the expense of the interaction term, which is smaller now and significant only at 10%. Depending on the specification, countries tend to trade between 80 (=exp(4.41)-1 in columns (2) and (3)) and 160 (=exp(5.10)-1 in columns (1) and (4)) times more at home than abroad. Obviously, the magnitude of the home bias and, thus, of the interaction term is dependent on the choice of the distance measure, whereas the coefficients for *Decentral_i* and *Decentral_j* remain unaffected. These results underline the relative im-

¹¹Common border: $100 * [\exp(0.487) - 1] = 62\%$; Common language: $100 * [\exp(0.511) - 1] = 66\%$; Common colony: $100 * [\exp(0.493) - 1] = 64\%$.

¹²However, the potential impact of the World Trade Organisation and trade agreements on trade flows has become a controversial issue in the trade literature (see, for example, Rose 2004).

portance of the choice of the domestic distance measure, but also stress the robustness of the baseline results.

Our next robustness check follows from the argument that the degree of decentralization should be corrected for some measure of a country size, such as population or area. This would be in line with the insights of Oates (1972) in his classic study of federalism, where the optimal degree of decentralization is related to the size of the country in terms of population¹³. To control for that we add population and area into our estimation. Columns (1)-(3) in Table 4 show that the inclusion of these additional control variables does not change our previous results. The decentralization coefficients retain their magnitudes and levels of statistical significance as in the baseline specification.

Finally, it is important to check whether the results reported above are dependent on our measure of decentralization, the ratio of sub-national expenditures to total government expenditures. For this purpose we introduce alternative measures of decentralization to our baseline specification. First, we use the share of sub-national revenues in total government revenues which also comes from the GFS of IMF. According to this variable the most decentralized country in our sample is Canada with an average of 53% revenue decentralization, while the Dominican Republic is among the most centralized countries with less than 1% revenue powers on the sub-national level. Revenue decentralization may capture better barriers to trade created by tax overlap between different levels of government as discussed in section 1. However, in our sample these two forms of fiscal decentralization seem to

¹³“One important factor influencing the extent of centralization should be the size of the nation in terms of population . . . In a relatively small country, for example, there are likely to be real cost-savings in centralizing a substantial portion of the activity in the public sector. As a nation becomes larger, however, it becomes efficient for decentralized jurisdictions, because of their own significant size, to provide their own outputs of a wide range of public services. Moreover, as a country grows in size, central administration becomes more difficult and is likely to result in a less effective use of resources within the public sector. For these reasons we would expect the degree of fiscal centralization to vary inversely with the size of a country.” (Oates (1972, pp. 200–1))

Table 3: Alternative distance measure

Dependent variable: $\log Trade_{ij}$				
Variables	(1)	(2)	(3)	(4)
$\log GDP_exp$	1.162*** (0.108)	1.156*** (0.108)	1.162*** (0.106)	1.162*** (0.107)
$\log GDP_imp$	0.843*** (0.119)	0.841*** (0.119)	0.832*** (0.120)	0.836*** (0.120)
$\log Distance$	-0.875*** (0.048)	-0.896*** (0.047)	-0.895*** (0.047)	-0.872*** (0.048)
<i>Customs union</i>	0.122 (0.096)	0.111 (0.096)	0.117 (0.096)	0.135 (0.096)
<i>Free Trade Agreement</i>	0.317*** (0.096)	0.313*** (0.096)	0.319*** (0.096)	0.329*** (0.096)
<i>Common border</i>	0.467*** (0.164)	0.441*** (0.162)	0.440*** (0.162)	0.467*** (0.164)
<i>Common language</i>	0.519*** (0.105)	0.501*** (0.104)	0.501*** (0.104)	0.520*** (0.105)
<i>Common colony</i>	0.486*** (0.160)	0.503*** (0.160)	0.505*** (0.160)	0.489*** (0.161)
<i>Decentralization-exp</i>		0.007* (0.004)		0.008** (0.004)
<i>Decentralization-imp</i>			0.023*** (0.004)	0.024*** (0.004)
<i>Decentralization*</i>	-0.025* (0.015)			-0.026* (0.015)
<i>Domestic</i>				
<i>Domestic</i>	5.073*** (0.468)	4.411*** (0.293)	4.414*** (0.292)	5.100*** (0.469)
Observations	6973	6973	6973	6973
Uncensored obs.	6499	6499	6499	6499
Pseudo R-squared	0.453	0.452	0.453	0.454

Notes: i) *** - significant at 1% level, ** - significant at 5% level, * - significant at 10% level; ii) Robust standard errors in parentheses; iii) All estimations include year, exporter and importer dummies; iv) All columns present Tobit marginal effects.

be highly correlated. Columns (4)-(5) in Table 4 show that revenue decentralization yields very similar results, in size and magnitude, to the baseline model with expenditure decentralization.

As a second alternative measure of decentralization we use a variable which counts the number of government tiers in a country. It has been constructed by Treisman (2002) and takes discrete values between 1 and 6, where most of the countries in our sample are assigned 3-4 tiers. This variable is a good proxy for the number of decision makers in a federation, which we cannot capture by our measures of fiscal decentralization. However, since it is time invariant we drop the country fixed effects from the estimation, but still keep the time dummies. Column (6) reports the results for government tiers only and column (7) controls for population size. A one-tier increase in both exporting and importing countries results into a 10%-35% growth in bilateral trade.¹⁴ Contrary to the fiscal decentralization, however, the effects are quantitatively similar for importing and exporting countries. This sheds some doubts on the differential effects of decentralization on imports and exports as expressed in our conjecture 3 in section 2.

The impact on domestic trade as expressed by the interaction term between decentralization and the home dummy is significant, quantitatively important, and negative in sign, as expected. Relative to the fiscal decentralization measure, this variable has a much larger effect on trade. This results to a great extent from its discrete nature. A federalism reform which adds a government level to the federal structure of a country may translate into more than 10% increase in fiscal decentralization¹⁵ and thus reach the same statistical effect.

¹⁴ $10\% = 100 * \exp[(0.10)-1]$ in column (6); $35\% = 100 * \exp[(0.30)-1]$ in column (7).

¹⁵ Countries such as Spain and Mexico which have gone through major federalism reforms are good examples, where the inclusion of one more government level has led to a significant jump in the degree of fiscal decentralization.

Table 4: Alternative measures of decentralization

Dependent variable: $\log Trade_{ij}$							
Variables	Expenditure decentralization			Revenue decentralization		Government tiers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\log GDP_exp$	1.308*** (0.119)	1.159*** (0.107)	1.308*** (0.119)	1.192*** (0.110)	1.372*** (0.123)	0.880*** (0.019)	1.006*** (0.026)
$\log GDP_imp$	0.835*** (0.138)	0.835*** (0.121)	0.835*** (0.138)	0.874*** (0.122)	0.879*** (0.141)	0.821*** (0.018)	0.966*** (0.027)
$\log Distance$	-0.875*** (0.049)	-0.874*** (0.049)	-0.875*** (0.049)	-0.888*** (0.050)	-0.890*** (0.050)	-0.768*** (0.048)	-0.678*** (0.052)
<i>Customs union</i>	0.116 (0.099)	0.130 (0.097)	0.116 (0.099)	0.122 (0.101)	0.104 (0.103)	0.509*** (0.098)	0.317*** (0.101)
<i>Free Trade Agreement</i>	0.298*** (0.097)	0.307*** (0.096)	0.298*** (0.097)	0.315*** (0.098)	0.303*** (0.098)	0.438*** (0.101)	0.328*** (0.103)
<i>Common border</i>	0.487*** (0.166)	0.486*** (0.166)	0.487*** (0.166)	0.456*** (0.166)	0.457*** (0.166)	0.692*** (0.139)	0.895*** (0.170)
<i>Common language</i>	0.512*** (0.105)	0.512*** (0.105)	0.512*** (0.105)	0.497*** (0.108)	0.496*** (0.108)	0.323*** (0.107)	0.388*** (0.102)
<i>Common colony</i>	0.495*** (0.158)	0.496*** (0.158)	0.495*** (0.158)	0.509*** (0.161)	0.508*** (0.161)	0.597*** (0.192)	0.447** (0.189)
$\log Population_exp$	-0.647** (0.285)		-0.647** (0.285)		-0.776*** (0.290)		-0.202*** (0.036)
$\log Population_imp$	-0.016 (0.285)		-0.016 (0.285)		-0.036 (0.295)		-0.175*** (0.035)
$\log Area_exp$		-0.206** (0.086)	0.294 (0.224)		0.385* (0.228)		-0.010 (0.023)
$\log Area_imp$		-0.104 (0.094)	-0.222 (0.221)		-0.169 (0.229)		-0.070*** (0.022)

Table 4 continued: Alternative measures of decentralization

Variables	Expenditure decentralization			Revenue decentralization		Government tiers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>Decentralization_exp</i>	0.010** (0.004)	0.008** (0.004)	0.010** (0.004)				
<i>Decentralization_imp</i>	0.024*** (0.004)	0.024*** (0.004)	0.024*** (0.004)				
<i>Decentralization*</i>	-0.056*** (0.013)	-0.056*** (0.013)	-0.056*** (0.013)				
<i>Domestic</i>							
<i>Revenue decentralization_exp</i>				0.009** (0.004)	0.012*** (0.004)		
<i>Revenue decentralization_imp</i>				0.018*** (0.005)	0.018*** (0.005)		
<i>Revenue decentralization*</i>				-0.048*** (0.016)	-0.048*** (0.016)		
<i>Domestic</i>							
<i>Government tiers_exp</i>						0.104** (0.046)	0.306*** (0.056)
<i>Government tiers_imp</i>						0.096** (0.044)	0.314*** (0.052)
<i>Government tiers*Domestic</i>						-0.301** (0.143)	-0.295* (0.154)
<i>Domestic</i>	4.949*** (0.454)	4.956*** (0.454)	4.949*** (0.454)	4.403*** (0.467)	4.395*** (0.467)	6.108*** (1.046)	6.407*** (1.094)
Observations	6973	6973	6973	6748	6748	6673	6673
Uncensored obs.	6499	6499	6499	6285	6285	6204	6204
Pseudo R-squared	0.453	0.453	0.453	0.450	0.45	0.379	0.389

Notes: i) *** - significant at 1% level, ** - significant at 5% level, * - significant at 10% level; ii) Robust standard errors in parentheses; iii) All estimations include year, exporter and importer dummies; iv) All columns present Tobit marginal effects.

5 Summary and Conclusion

International economic integration and political decentralization have been two important trends over recent years, but the links between them have hardly been explored. In this study, we have developed three conjectures regarding the relationship between decentralization and trade. First, decentralization should reduce intra-national trade since decentralization creates obstacles to domestic transactions. Second, creating internal obstacles makes international trade relatively more attractive, so decentralization should increase international trade (exports and imports). Finally, since decentralization tends to negatively affect FDI, a differential effect on imports and exports can result. This is likely to cause a stronger positive effect of decentralization on imports relative to its effect on exports.

We investigate these conjectures empirically using the theory-based gravity model of trade augmented by measures of decentralization. We find that the explanatory power of different decentralization measures is significant. We find that decentralization decreases domestic trade and increases international trade. Furthermore, using fiscal decentralization measures, the positive effects of decentralization are stronger for imports than for exports. The latter effect could not be found using the number of government tiers as the decentralization measure. In summary, our conjectures regarding the relationship between decentralization and trade find empirical support and the findings are robust to a number of alternative specifications. The degree of decentralization plays an important role for domestic trade as well as for countries' integration into the world economy.

Table A-1: Data sources

Variables	Description
<i>Trade</i>	Bilateral import data in US dollars from the Directorate of Trade Statistics of the International Monetary Fund (IMF). We convert the variable into real terms by deflating it with the US consumer price index from the International Financial Statistics of the IMF; Domestic trade is calculated as the difference between GDP of the country and its exports to the rest of the world; Own calculations.
<i>GDP</i>	Gross domestic product of exporter and importer in constant US dollars with base year 2000; Source: World Development Indicators (WDI).
<i>Distance</i>	Bilateral distance in km between the capitals of the exporting and importing country; Source: Centre d'Etudes Prospectives et d'Informations Internationales (CEPII); Domestic distance is calculated as a quarter of the distance to the economic center of the nearest trading partner following Wei (1996); Own calculations.
<i>Common Language</i>	A binary variable equal to 1 if the country-pair shares the same language and 0 otherwise; Source: CEPII.
<i>Customs Union</i>	A binary variable equal to 1 if the country-pair belongs to the same customs union and 0 otherwise; Source: World Trade Organization (WTO), own compilation.
<i>Free Trade Agreement</i>	A binary variable equal to 1 if the country-pair belongs to the same free trade agreement and 0 otherwise; Source: WTO, own compilation.
<i>Common Border</i>	A binary variable equal to 1 if the country pair shares the same border and 0 otherwise; Source: CEPII.
<i>Common Colony</i>	A binary variable equal to 1 if the country pair shares the same colonial history and 0 otherwise; Source: CEPII.
<i>Population</i>	Number of citizens in each country; Source: WDI.
<i>Area</i>	Surface area in square meters for each country; Source: CEPII.
<i>Expenditure decentralization</i>	Ratio of sub-national government expenditures to total government expenditures with a range between 0 and 100; Source: Government Finance Statistics (GFS) of IMF and World Bank Decentralization Database.
<i>Revenue decentralization</i>	Ratio of sub-national government revenues to total government revenues with a range between 0 and 100; Source: GFS of IMF and World Bank Decentralization Database.
<i>Tiers</i>	A discrete variable between 1 and 6 equal to the number of central and sub-central government levels; Source: Treisman (2002).

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