Decentralization and International Trade

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Abstract

Globalization of economic activities and decentralization of government organization are occurring alongside each other. We consider the relationship between the form and degree of decentralization of government structures and international trade. Allowing for horizontal as well as vertical decentralization, we find significant effects on the amount of international trade. Vertical decentralization increases international trade whereas horizontal disintegration reduces it. These results are explained in line with several theoretical insights from the theory of federalism.

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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 Great Britain have recently 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 have been widely observed and debated, but they have not ordinarily been linked with each other. This article considers decentralization and international trade jointly and analyzes some of the connections that exist between them. We ask, how decentralization affects international trade, and examine the impact of different forms of decentralization on foreign trade.

Countries differ substantially in the degree and form in which legislative, executive, administrative, and judicial powers are allocated across different bodies of government. Traditionally, the optimal allocation of government responsibilities across horizontally and vertically distinct government actors has been considered in a closed economy setting. Here, however, we stress the interaction between the domestic architecture of government and the degree of decentralization of government functions on the one side and the economic integration with the rest of the world on the other side.

Conceptually, we distinguish between the *horizontal* and the *vertical* dimension of decentralization. The horizontal dimension deals with the division of sub-national government layers into mutually exclusive territorial units, such as states, regions, counties, etc. This dimension causes economic agents to become subjects of different local jurisdictions, with potentially different regulations, taxes, and public infrastructure. The vertical dimension comprises the number of government tiers to be found in a country and

[1] According 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.

relates to the fact that decentralization makes the economic agents subject to several vertically differentiated government levels. We argue that these different dimensions of decentralisation affect international trade differently, and we find support for these claims in our empirical analysis.

Our central argument maintains that decentralization affects the costs of intra-national trade. This modifies the relative prices of imported goods, and consequently the demand for domestic and foreign goods. Whenever decentralization increases the costs of internal transactions, foreign goods will become relatively cheaper, and we will observe an increase in imports. On the other hand, if decentralization facilitates internal transactions, domestic goods become relatively cheaper, and we should observe a reduction in imports. Analogous arguments can be made for exports. We claim that vertical decentralization increases domestic trade costs, whereas horizontal decentralization creates different effects on the profitability of internal transactions with a combined effect whose direction is theoretically ambiguous.

Consider first the vertical dimension. As stressed by Keen (1998), Keen and Kotsogiannis (2002), and Wrede (1997, 2000), among others, the overlap of authorities results in vertical fiscal externalities if more than one level of government levies taxes on the same tax base, and this, typically, results in overtaxation. While this argument has been developed in the context of capital income taxation, it can be applied analogously to other elastic tax bases. Our argument regards domestic trade as such a potential tax base. A standard sales tax could well qualify as such a tax. Thus, if one assumes that internal transactions are likely to be subject to some kind of taxes or fees, negative vertical externalities between the different layers of government are likely to arise. These externalities would imply that internal transactions should be more costly, as the number of government levels in a country increases. A similar argument can be made with regard to trade costs resulting from regulatory provisions and red tape. They are increasing in the number of government tiers and will make intra-country trade more expensive in countries with more government tiers. International transactions become relatively more attractive and we therefore expect that international trade is increasing in the number of government tiers of the trading countries.

Now, consider the horizontal dimension of decentralization. Theoretically, two possibilities arise. First, as the number of mutually exclusive jurisdictions increases, this may increase internal barriers to trade if the internal borders between jurisdictions impede trade. However, as the number of mutually exclusive jurisdictions increases, competition between these jurisdictions also increases. Economic agents trading domestically will have wider choice regarding the jurisdictions to trade with and through. This puts pressure on individual jurisdictions to reduce the regulatory and tax burden on private transactions. This makes domestic trade cheaper. Conceptually, it is therefore unclear whether horizontal decentralization will make domestic trade relatively cheaper or relatively more expensive, so that its theoretical effect on international trade is also ambiguous: an increase in the degree of horizontal competition may have a positive effect, a negative effect, or no effect at all on international trade.

Our formal analysis of the relationship between decentralization and international trade is cast in the framework of the gravity model. Specifically, we build on Anderson and van Wincoop (2003), henceforth AvW, who stressed that bilateral barriers to trade had to be considered relative to the average barriers to trade of these two countries with the rest of the world. We augment this approach by additionally considering barriers to trade within countries. Here, given our particular interest in the relationship between decentralization and international trade, we consider these costs to be a function of the form and degree of decentralization within a country. The empirical implementation follows the approach of Baier and Bergstrand (2006), which allows estimation of our augmented gravity equation by OLS.

We find significant effects of decentralization on trade. As suggested by our theoretical approach, vertical decentralization increases international trade. The amount of trade between countries is positively related to the number of government tiers in the exporting as well as in the importing country. On the other hand, increased horizontal decentralization reduces international trade. We take this as evidence for the dominance of a strong competition effect that creates favorable conditions for domestic transactions.

The present 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. Second, some other contributions have considered the interaction of economic integration and the degree of decentralization. In particular, it has been argued that decentralization may help to attract foreign direct investment (FDI), as competition between regional governments can reduce the hold-up problem in FDI and creates a favorable investment climate (Brennan and Buchanan (1980), Weingast (1995)). More recently this view has been partly challenged by Kessing et al. (2006a, 2006b), who argue, and provide empirical evidence, that the vertical dimension of 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. Since we focus on the intra-country organization of government, our results can be seen as complementary to theirs. Interestingly, our results indicate that a unidimensional perspective of trade and the level of political integration may be misleading. It is not sufficient to regard decentralization as an intermediate degree of independence between the extremes of total centralization and complete separation, i.e. secession. We show that only with respect to vertical decentralization is a more decentralized economy more integrated into the world economy, whereas more horizontal decentralization actually implies less integration.

The paper is organized as follows. In section 2, we modify a gravity model of international trade to allow for decentralization within countries. Section 3 describes our econometric approach, and section 4 discusses the data. We present the empirical results in section 5. Section 6 concludes.

2 The Theoretical Model

Our theoretical approach uses a general equilibrium foundation of empirical gravity equation models first pioneered by Anderson (1979). More particularly, we build on a recent formulation of the model by AvW, but extend it to allow for decentralization within countries affecting international trade. Consider a number of countries $i = 1, ..., N$, each of which produces a differentiated good. Further, we assume homothetic preferences such that the aggregator of varieties is identical across countries and of the constant elasticity of substitution (CES) form. The representative consumer in country j maximizes the CES utility function

$$U_j = \left[\sum_{i=1}^{N} (c_{ij})^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \tag{1}$$

subject to the budget constraint

$$Y_j = \sum_{i=1}^{N} p_{ij} c_{ij}, \tag{2}$$

where c_{ij} and p_{ij} denote the consumption and the price in country j of goods from country i, respectively, and Y_j stands for the aggregate income and expenditure in country j. Finally, θ, $\theta > 1$, denotes the elasticity of substitution between the differentiated goods.

Transactions across country borders are costly due to tariffs and other trade barriers that are not directly observable. These trade costs are proportional to trade and represented here by Samuelson's (1954) iceberg costs factor $A_{ij} > 1$ for all goods imported from country i to j. We depart from the usual assumption in the literature which considers trade within countries as frictionless, i.e. $A_{jj} = 1$. Instead, within each single country there exist iceberg costs of trading domestically, so that we allow $A_{jj} \geq 1$. Conceptually, it is important to stress that these costs are only incurred on domestic transactions and are not incurred by trading internationally. In other words, these are costs that arise on transactions between cities A and B within the same country, but do not arise if an agent located in either city A or B trades with abroad. In principal, there are many potential reasons for such costs, but given our specific interest the relationship between decentralization and international trade, we consider these costs to be a function of the horizontal and vertical dimensions of decentralization:

$$A_{jj} = A_{jj}\left(d_h, d_v, .\right), \tag{3}$$

where d_h and d_v are measures of the horizontal and vertical decentralization, respectively. From our theoretical perspective, we expect the domestic trading costs to be increasing in d_v. An increase in vertical externalities should make domestic trading less attractive. On the other hand, domestic trading costs should be falling in d_h if horizontal decentralization unleashes a strong competition effect. If horizontal decentralization creates additional obstacles to domestic trade, the reverse is also possible.[2]

Further, we use p_{ij} and p_{jj} to denote the price of the imported goods from country i to j and the price of the domestic goods in j, respectively, inclusive of transport costs and tariffs. The exporter is the trading partner who bears the transport costs. Combining the assumptions about international and intra-national trade costs, we model the c.i.f. prices as $p_{ij} = A_{ij}p_i$ and $p_{jj} = A_{jj}p_j$, where p_i and p_j result from the profit maximization problem of the firms and are net of any transport costs and international or intra-national trade costs. We can think of $A_{ij} > 1$ as the units of production that must be shipped from i to j for a country j to get one unit of the product, as $A_{ij} - 1$ will sink along the borders and can be considered as an ad-valorem tax equivalent of trade costs.

By solving the utility maximization problem above, we get the demand in country j for goods from country i, as well as the domestic demand for domestic goods in country j as

$$c_{ij} = \frac{Y_j}{P_j}\left(\frac{p_i A_{ij}}{P_j}\right)^{-\theta} \text{ and } c_{jj} = \frac{Y_j}{P_j}\left(\frac{p_i A_{jj}}{P_j}\right)^{-\theta}, \tag{4}$$

[2] Of course, the internal iceberg costs depend, in practice, on other aspects of the country as well. We return to these considerations in our empirical implementation. This demonstrates that our approach is actually more general and lends itself to testing the influence of other domestic factors on international trade as well.

where P_j, the minimum cost of obtaining a unit of the consumption bundle in country j, is given by the consumer price index of country j,

$$P_j = \left(\sum_{i=1}^{N} (p_i A_{ij})^{1-\theta} \right)^{\frac{1}{1-\theta}}. \tag{5}$$

Naturally, import demand in (4) is decreasing in the size of the iceberg costs of international trade, and domestic demand in (4) is decreasing in the size of the iceberg costs of domestic trade. Directly from (4), we have the nominal demand of country j consumers for country i goods

$$x_{ij} = p_{ij} c_{ij} = \left(\frac{p_i A_{ij}}{P_j} \right)^{1-\theta} Y_j. \tag{6}$$

In order to complete the model, we include market clearing, which implies $Y_i = \sum_{j=1}^{N} x_{ij}$. Thus we have

$$Y_i = \sum_{j=1}^{N} x_{ij} = \sum_{j=1}^{N} \left(\frac{p_i A_{ij}}{P_j} \right)^{1-\theta} Y_j = (p_i)^{1-\theta} \sum_{j=1}^{N} \left(\frac{A_{ij}}{P_j} \right)^{1-\theta} Y_j. \tag{7}$$

Following AvW, we define world income as $Y_w \equiv \sum_{j=1}^{N} Y_j$, and shares in world income as $s_j \equiv Y_j / Y_w$, and derive $p_i = \frac{1}{\Pi_i} (\frac{Y_i}{Y_w})^{\frac{1}{1-\theta}}$, where $\Pi_i = \sum_{j=1}^{N} [(\frac{A_{ij}}{P_j})^{1-\theta} s_j]^{1/(1-\theta)}$. Resubstituting into (6), we arrive at the gravity equation we are interested in,

$$x_{ij} = \left(\frac{A_{ij}}{\Pi_i P_j} \right)^{1-\theta} \frac{Y_i Y_j}{Y_w}. \tag{8}$$

This equation is central for the analysis of our theoretical model and the derivation of the econometric model. Furthermore, AvW show that assuming symmetric bilateral trade costs ($A_{ij} = A_{ji}$) implies $\Pi_i = P_i$. The price indices can accordingly be expressed as the multilateral resistance terms

$$P_i = \left(\sum_{j=1}^{N} s_j \left(\frac{A_{ij}}{P_j} \right)^{1-\theta} \right)^{\frac{1}{1-\theta}}, \tag{9}$$

$$P_j = \left(\sum_{i=1}^{N} s_i \left(\frac{A_{ij}}{P_i} \right)^{1-\theta} \right)^{\frac{1}{1-\theta}}. \qquad (10)$$

These expressions are functions of domestic and bilateral trade barriers and income shares, and can be regarded as summary measures of trade costs for a particular country, be it i or j, with all its trading partners including itself.

It follows from (8) that an increase in international trade barriers reduces bilateral trade, as it is straightforward to show that $\partial x_{ij}/\partial A_{ij} < 0$, just as in AvW. Of course, this is a rather trivial result that has been widely supported by the trade literature on trade costs and borders. The central result of our analysis regards the effects of intra-country barriers to trade. These are stated in the following propositions.

Proposition 1 *An increase in intra-national trade barriers increases imports into that country.*

Proof. Whenever $\Pi_i = P_i$, we have the multilateral resistance term (10) equivalent to the price index (5) and the same applies to i. Thus, plugging the expressions for the consumer price indices P_i and P_j into (8) and taking derivatives gives $\partial x_{ij}/\partial A_{jj} > 0$. ■

We can consider exports in a similar way.

Proposition 2 *An increase in intra-national trade barriers increases exports from that country.*

Proof. Plugging the expressions for the consumer price indices P_i and P_j into (8) and taking derivatives gives $\partial x_{ij}/\partial A_{ii} > 0$. ■

Extending the gravity equation to allow for internal barriers, we derive a clear positive correlation between bilateral trade and such internal barriers to trade. Increasing intra-national barriers to trade will, in a general equilibrium setting such as the one presented here, cause an increase in imports as well as an increase in exports.

It is interesting to look at the comparative static effects in more detail. Not only do exports increase, but we also observe a decline in domestic demand c_{ii} when domestic trade costs, say through an increase in vertical disintegration of government, raise, as $c_{ii} = (Y_i/P_i)(p_i A_{ii}/P_i)^{-\theta}$ decreases with a rise in domestic barriers A_{ii}. Firms shift to foreign markets and increase their exports.

3 Econometric Implementation

In the previous section, we derived the gravity equation as a function of all of the domestic and bilateral trade barriers. Trade costs are not included in the marginal cost of producing a good but rather are incurred in getting the good from the manufacturing plant to the end consumer. As is common in the literature, we construct the trade costs in our model as a function of some observables representing borders and distance.[3] However, as we assume internal trade costs in the trading countries, we construct equations both for bilateral trade costs A_{ij} and domestic trade costs A_{jj} as functions of observables z_{ij}^m and z_{jj}^m, respectively:

$$A_{ij} = \prod_{m=1}^{M} (z_{ij}^m)^{\alpha_m} \tag{11}$$

and

$$A_{jj} = \prod_{m=1}^{M} (z_{jj}^m)^{\alpha_m}. \tag{12}$$

As bilateral trade costs, we include the lack of a common language and the distance between the two countries. As domestic trade costs, we use measures of vertical and horizontal decentralization and a measure of internal distance/area. All variables and their sources are described in detail in section 4.

The empirical gravity equation, which takes multilateral resistance terms into account, is derived by substituting (9) and (10) into (8), and taking logs,

$$\ln x_{ij} = \ln\left(\frac{Y_i Y_j}{Y_w}\right) - (\theta - 1)\ln A_{ij} - \ln P_i^{1-\theta} - \ln P_j^{1-\theta}. \tag{13}$$

[3] There has been some disagreement in the literature on the appropriate form and variables of a trade costs function. Davis (1998) differentiates between direct (insurance, freight, tariffs) and indirect costs. Anderson and van Wincoop (2004) give an exhaustive overview of the definitions and possible measures of trade costs.

Note that the domestic trade costs, which are determined by the form and degree of decentralization, enter (13) through the aggregate price indices. There are various ways to estimate the gravity equation (13).[4] We follow Baier and Bergstrand (2006), who suggest an ordinary-least-squares (OLS) estimation procedure after a first-order log-linear Taylor expansion of the gravity equation. To employ this method, from (9), one can express the multilateral resistance term P_i as

$$e^{(1-\theta)lnP_i} = \sum_{j=1}^{N} e^{lns_j} e^{(\theta-1)lnP_j} e^{(1-\theta)lnA_{ij}}, \tag{14}$$

and analogously for P_j. The Taylor expansion requires an arbitrary value around which to center the expansion. We follow Baier and Bergstrand (2006) and assume a symmetric world where countries have the same size, $Y_i = Y_j = Y = const.$, and therefore $s_j = 1/N$, and equal trade costs, $A_{ij} = A_{ii} = A_{jj} = A > 1$. The multilateral resistance term simplifies to

$$P^{1-\theta} = NsP^{\theta-1}A^{1-\theta} \tag{15}$$

and, since $s = 1/N$, we obtain, eventually, $P = A^{1/2}$, which is the steady state value around which to center the expansion. It is now straightforward to develop a first-order Taylor approximation of (14), and an analogous expression for P_j. Resubstituting these expansions into the gravity equation (13) leads to a modified gravity equation which can be estimated by OLS,

$$\begin{aligned} \ln x_{ij} &= \beta_0 + \ln Y_i + \ln Y_j - (\theta-1)\ln A_{ij} + \\ &\quad (\theta-1)\left[\frac{1}{N}\left(\sum_{j=1}^{N}\ln A_{ij}\right) - \frac{1}{2N^2}\sum_{i=1}^{N}\sum_{j=1}^{N}\ln A_{ij}\right] + \\ &\quad (\theta-1)\left[\frac{1}{N}\left(\sum_{i=1}^{N}\ln A_{ij}\right) - \frac{1}{2N^2}\sum_{i=1}^{N}\sum_{j=1}^{N}\ln A_{ij}\right], \end{aligned} \tag{16}$$

[4] AvW estimate (13) directly by using non-linear least squares. Alternatively, one may use country-specific dummy variables as in Eaton and Kortum (2002), Anderson and van Wincoop (2003), and Feenstra (2004). This approach, however, is not feasible given the nature of our data. As a third alternative, authors like Baier and Bergstrand (2001) estimate the gravity equation by OLS directly using data on price levels. This is also problematic because price indices may be affected by nominal rigidities, non-tradable goods, or local taxes and subsidies.

where $\beta_0 = -lnY_w - ((1/N)\sum_{j=1}^{N} lns_j - ln(1/N))$ is a constant across trading country pairs. The large term in parentheses in β_0 represents deviations of GDP around symmetries and equals zero if all countries are of the same economic size. However, increasing asymmetries in the economic size of the trading partners will apparently diminish bilateral trade. This statement is largely supported in different branches of the economic literature.

Both square-bracketed terms in (16) correspond to the two non-linear price indices in (13) with the main difference being that the former are linear functions of trade costs and estimable by OLS. Let us dwell on the terms in the first bracketed expression, i.e. the log-linear form of $lnP_i^{\theta-1}$. The first term can be interpreted as the weighted sum (by the income share $s_j = (1/N)$) of the trade costs facing exporter country i across all trading partners, inclusive of domestic trade costs A_{ii}. The idea behind this is the higher this average is, under the assumption of constant bilateral trade costs, the lower relative bilateral costs are with respect to multilateral ones, which means bilateral trade flows x_{ij} will increase. The second component in the first brackets should be interpreted as the world resistance, which is actually constant across all countries, but diminishes the positive effect on the bilateral trade flows of the average discussed above. The same implies for the second bracketed term. In the estimation section, we will discuss these expressions in connection with the empirical results.

4 Data

The gravity equation in its basic form (6) postulates that the value of exports tend to increase with decreasing international trade barriers between the trading partners and with increasing economic size (measured by income). Further, our augmented gravity model also allows us to consider the effects of domestic factors on international trade. We focus on variables measuring the horizontal and vertical dimension of decentralization, respectively. Building on our theoretical approach, in our empirical implementation we consequently use two sets of variables: those related to the barriers to trade between countries, and the decentralization variables as determinants of domestic trade costs.[5]

Our dependent variable $Trade_{ij}$ is the (log) export value in US dollar units between each pair of trading countries, where i stands for exporter and j for importer, respectively. We consider a sample of 129 countries and, consequently, 16512 different country-pairs over the period 1993-2000. We obtain bilateral trade data derived from the import side and organized by the 4-digit Standard International Trade Classification (SITC) from the Center for International Data at UC Davis, which, for its part, uses NBER-UN world trade data (see Feenstra et al. 2005).[6]

As a principal measure of the degree of vertical decentralization, we use Daniel Treisman's variable for the number of tiers in a country, $Tiers_i$ and $Tiers_j$. In Treisman (2002), the following definition of a tier can be read: "A level of territorial subdivision of the state was said to constitute a tier if: 1) subdivisions at this level had an executive with government authority; 2) this executive had responsibility for general administration, not just provision of a particular public service; and 3) the superior tier of government (or, for first-tier units, the entire state) was subdivided territorially into units of this type (at least in some areas)". The variable takes discrete values between 1 and 6, and there are three countries in our sample with 4.5 tiers each (See Data Appendix for the whole list of countries). If we consider, for example, the number 3 for the $Tiers$ variable, we can say that there are two government levels below the central government in a certain country. The $Tiers$ variable depicts the potential vertical externalities and the potential effects stemming from vertical overlap particularly well.

The other dimension of decentralization, namely horizontal decentralization, is presented by the variables $Horizontal_i$ and $Horizontal_j$. This variable has also been compiled by Daniel Treisman and measures the average

[5] An overview of all variables used in the analysis is given in the Data appendix.

[6] Anderson and van Wincoop (2004) address in detail the measurement problems and limitations of the existing trade data bases, such as missing data and aggregation bias. Here, we also deal with incomplete data, as only trade flows exceeding 100,000 US dollar are recorded and as a result we have 6445 missing trade values.

surface area (in square kilometers) attributed to a single unit of the first-tier level[7], i.e. "the highest level of subnational government below the center". According to Treisman (2002), "these [subnational jurisdictions] will have the greatest ability to set up alternate regulatory or tax regimes to compete for capital" and to that extent will represent a good measure of horizontal decentralization. An increase in the value of this variable means that more surface area will be assigned to a certain subnational unit, so that an increase implies a lower number of regions and, according to our reasoning, less horizontal decentralization.

As a measure of the iceberg costs involved with trading domestically, we use a measure of (log) internal distance or surface area, $Size_{ii}$, for each single country i, which is constructed as $Size_{ii} = \ln(0.67\sqrt{area/\pi})$. Using this variable as a control also helps to ensure that the effect of the decentralization variables are not driven by country size, since the decentralization variables are systematically correlated with country size. This variable is provided by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

The international borders will be measured partly by the linguistic variable $Language$. This is a binary variable which takes the value of zero, when the trading partners share a common official language, and one, otherwise.

$Distance_{ij}$ denotes the (log) bilateral distance between the capitals of the two countries. It is calculated following the great circle formula, which uses latitudes and longitudes of the most important cities (in terms of population) or official capitals. The bilateral distance variable is one of the core explanatory variables in the gravity model and has always proven to be highly significant and robust. The latter two variables are again obtained from CEPII.

As a proxy for economic size (i.e. income), we use the (log) gross domestic product GDP of the trading partners. For this purpose, we draw data in constant 2000 US dollar units for the period 1993-2000 from the World Bank World Development Indicators.

[7] $Horizontal_i$ *and* $Horizontal_j$ are the (log) average surface areas attributed to a single unit of the first-tier level in the exporter and the importer country, respectively.

5 Estimation Results

We estimate the following regression equation with A_{ij}, A_{jj}, and A_{ii} being substituted into (16):[8]

$$\begin{aligned}\ln x_{ij} &= \beta + \beta_1 \ln GDP_j + \beta_2 \ln GDP_i \qquad (17)\\ &-(\theta-1)[\alpha_1 Language_{ij} + \rho_1 \ln Distance_{ij}]\\ &+(\theta-1)\frac{1}{N}[\alpha_2 \ln Decentralization_{jj} + \rho_2 \ln Size_{jj}]\\ &+(\theta-1)\frac{1}{N}[\alpha_3 \ln Decentralization_{ii} + \rho_3 \ln Size_{ii}]\\ &+(\theta-1)\frac{1}{N}[\alpha_4 \sum_{i\neq j}^{N} Language_{ij} + \alpha_5 \sum_{j\neq i}^{N} Language_{ij}\\ &+\rho_4 \sum_{i\neq j}^{N} \ln Distance_{ij} + \rho_5 \sum_{j\neq i}^{N} \ln Distance_{ij}],\end{aligned}$$

where $\beta = -\ln Y_w - ((1/N)\sum_{j=1}^{N} lns_{ij} - ln(1/N)) - (1/N^2)\sum_{i=1}^{N}\sum_{j=1}^{N} \ln A_{ij}$ is the constant term. *Decentralization* will be measured once by the federal tiers $Tiers_i$ and $Tiers_j$ and, in an alternative specification, by (log) horizontal decentralization $Horizontal_i$ and $Horizontal_j$. An important feature of the equation above is that the disintegrated internal trade costs, constituted by decentralization and surface area, are considered separately from the aggregate multilateral resistance terms in order to estimate the direct effect of decentralization on bilateral trade. Since our key explanatory variables for the impact of federalism on trade, $Tiers$ and $Horizontal$, are constant over the sample period, in the analysis we use average values of all our variables for the period 1993-2000.

In the interpretation of the results, our attention focuses on the decentralization variables *Tiers* and *Horizontal* of the importer and exporter countries

[8] The theoretical variables take the following forms: $A_{ij} = e^{\alpha_1 Language_{ij}} Distance_{ij}^{\rho_1}$, $A_{jj} = e^{\alpha_{2,v} Tiers_j} Distance_{jj}^{\rho_2}$ in the case of vertical decentralization, and $A_{jj} = Horizontal_j^{\alpha_{2,h}} Distance_{jj}^{\rho_2}$ in the case of horizontal decentralization. Similarly $A_{ii} = e^{\alpha_{3,v} Tiers_i} Distance_{ii}^{\rho_3}$ or $A_{ii} = Horizontal_i^{\alpha_{3,h}} Distance_{ii}^{\rho_3}$.

(i refers to the exporter and j to the importer country). We estimate equation (17) using OLS and present our results in Table 1, the first column of which lists the pure gravity model that provides our baseline model. The second specification of the model considers the effect of vertical tiers on trade, and, in the third specification, we account for the impact of horizontal decentralization on bilateral trade. We should keep in mind that besides the gross domestic products, all of the coefficients which we report in the columns **(1)**, **(2)**, and **(3)** of Table 1 are functions of the elasticity of substitution $\theta > 1$ and some also of the number of countries in our sample.[9] All explanatory variables exhibit significance at the 1% level. The core variables of the gravity equation, GDP_i, GDP_j, and $Distance_{ij}$, provide coefficient signs in line with our theoretical model and the empirical literature. The aggregate distance terms, $(Sum\ over\ distance)_j$ and $(Sum\ over\ distance)_i$, in the three specifications have positive impacts on trade, which can be intuitively explained: two countries will trade more with each other when the bilateral distances to all other trading partners increase, i.e. the relative bilateral distance within the country pair ij decreases. Our sample consists of 129 countries and we assume each country trades with the remaining 128 countries. An increase in the sum of the bilateral distances between countries i/j and the other 127 partners, ceteris paribus, will boost bilateral trade between i and j. The first aggregate distance variable $(Sum\ over\ distance)_j$ is calculated as the sum of the log distances from country j to all trading partners[10]. $(Sum\ over\ distance)_i$ and $(Sum\ over\ Language)_i$ are constructed in the same way but from the perspective of the exporter i, and their effects on bilateral trade should be interpreted similarly following the intuition given above.

According to our theoretical model, intra-national (within the same country) trade costs have a positive impact on bilateral trade. We constructed

[9] The listed coefficients of the multilateral resistance terms and of the internal trade costs for the importer j and exporter i include $N = 129$. Column **Parameters** describes the coefficients.

[10] The geographic size of country j is excluded from the sum. The same applies to the construction of the other aggregate variable $(Sum\ over\ language)_j$; i.e. we exclude $Decentralization_j$ from the aggregate term.

the intra-national costs as a function of decentralization and geographic size. The latter also serves as a control variable to ensure that the decentralization variables, in particular $Tiers$, do not pick up the effects of country size. The results given in Table 1 indicate that the level of decentralization, vertical and horizontal, plays a significant role in trade. On the one hand, an increase in vertical decentralization, i.e. in the number of subnational government tiers, within the country pair ij increases bilateral trade between the trading partners i and j. This hypothesis is supported by the positive sign coefficients for $Tiers_i$ and $Tiers_j$. On the other hand, an increase in horizontal decentralization will cause less bilateral trade. We associate a higher degree of horizontal decentralization with higher competition between the different jurisdictional units in a country. In the Data description, we mentioned that a rise in $Horizontal$ equals a decrease in horizontal decentralization and, consequently, a decline in competition between the regions in a country. Eventually, the country will end up with higher retail prices like in the case of vertical decentralization and this phenomenon will facilitate international trade, which results from the positive coefficients for $Horizontal_i$ and $Horizontal_j$.

With respect to international barriers, we use lack of common language $Language_{ij}$ as a measure of bilateral borders. In the model specifications from Table 1, we get apparently negative coefficients for the language border. We recall here that our language variable is constructed to equal 1, when the country-pair does not share the common language, and zero, otherwise. Therefore, the negative effect is fairly reasonable and, moreover, fits the results presented in the literature.

Table 1: Estimation results

Dependent variable: $Trade_{ij}$ 1993-2000							
	Parameters	**(1)**		**(2)**		**(3)**	
GDP_j	β_1	0.939***	(0.008)	0.945***	(0.008)	0.936***	(0.008)
GDP_i	β_2	0.991***	(0.008)	0.996***	(0.008)	0.981***	(0.008)
$Language_{ij}$	$-(\theta-1)\alpha_1$	−0.613***	(0.053)	−0.612***	(0.053)	−0.641***	(0.056)
$Distance_{ij}$	$-(\theta-1)\rho_1$	−1.078***	(0.023)	−1.090***	(0.023)	−1.071***	(0.024)
$Size_j$	$\frac{1}{N}(\theta-1)\rho_2$	−0.198***	(0.016)	−0.249***	(0.018)	−0.345***	(0.038)
$Size_i$	$\frac{1}{N}(\theta-1)\rho_3$	−0.091***	(0.016)	−0.138***	(0.018)	−0.207***	(0.038)
(Sum over language)$_j$	$\frac{1}{N}(\theta-1)\alpha_4$	0.004***	(0.001)	0.005***	(0.001)	0.006***	(0.001)
(Sum over language)$_i$	$\frac{1}{N}(\theta-1)\alpha_5$	0.008***	(0.001)	0.010***	(0.001)	0.011***	(0.001)
(Sum over distance)$_j$	$\frac{1}{N}(\theta-1)\rho_4$	0.003***	(0.000)	0.004***	(0.000)	0.002***	(0.000)
(Sum over distance)$_i$	$\frac{1}{N}(\theta-1)\rho_5$	0.004***	(0.000)	0.005***	(0.000)	0.003***	(0.000)
$Tiers_j$	$\frac{1}{N}(\theta-1)\alpha_{2,v}$			0.108***	(0.019)		
$Tiers_i$	$\frac{1}{N}(\theta-1)\alpha_{3,v}$			0.096***	(0.019)		
$Horizontal_j$	$\frac{1}{N}(\theta-1)\alpha_{2,h}$					0.107***	(0.020)
$Horizontal_i$	$\frac{1}{N}(\theta-1)\alpha_{3,h}$					0.108***	(0.020)
Number of observations		9765		9765		9059	
adjusted R^2		0.73		0.73		0.74	
F-statistic		2648.48***		2224.52***		2112.39***	

Notes: i) $Trade_{ij}$, GDP_i, and GDP_j are averaged over the 1993-2000 period; ii) All of the variables are in logs, except for $Language_{ij}$, $Tiers_i$, and $Tiers_j$; iii) *** denotes significance at the 1% level; iv) Robust standard errors are in parentheses; v) The parameters in the second column inclusive of θ refer to equation (18); vii) $N = 129$ denotes the number of countries (not of country pairs) in our sample; the elasticity of substitution $\theta > 1$.

We need to make assumptions about the elasticity of substitution θ in order to obtain estimates for the decentralization and language border variables. By calculating $\alpha_{2,h} = 0.107N/(\theta - 1)$ and $\alpha_{3,h} = 0.108N/(\theta - 1)$, we find the elasticities of domestic trade costs with respect to horizontal decentralization for both importer and exporter countries. The results can also be interpreted as direct effects of horizontal decentralization on bilateral trade. A decrease in horizontal decentralization in the importer country will foster bilateral trade $1.53 - 1.97$ times more for θ between 10 and 8, and the same phenomenon, but in the exporter country, will increase bilateral trade $1.55 - 1.99$ times, again for $\theta \in (10; 8)$. Since vertical decentralization and language bilateral borders are represented by the discrete variables $Tiers$ and $Language$, their coefficients are not directly useful. Therefore, we use the equations $A_{ij} - 1 \approx \alpha_1 Language$, $A_{jj} - 1 \approx \alpha_{2,v} Tiers_j$, and $A_{ii} - 1 \approx \alpha_{3,v} Tiers_i$ to interpret them in terms of the price premium, i.e. ad-valorem equivalent, they imply. The results are presented in Table 2. For the tax equivalent associated with speaking different languages between the trading partners, we get results similar in size to those of Hummels (2001) and AvW (2004), namely 8.7% and 6.8% for θ equal to 8 and 10, respectively. For the price premiums of the vertical decentralization, we are confronted with very large coefficients. The results differ for different θ, and the lower the elasticity of substitution, the more sensitive domestic trade costs will be with respect to tiers. The tax equivalents range between $155\% - 199\%$ (importer country) and $138\% - 177\%$ (exporter country) for $\theta \in (10; 8)$ for each additional tier. Put simply, this means that an increase in vertical decentralization in either the exporter or importer country will force the economic agents to trade internationally in order to avoid the price premiums on domestic trade.

We should scrutinize whether the extremely high values of our model can be plausible at all? First, for the econometric model we assumed a symmetric world[11] which ends up multiplying the α coefficients of the decentralization variables by the factor of $N = 129$. While avoiding the simplification of

[11](The income shares $s_i = (Y_i/Y_w)$ are identical across different countries and equal to $1/N = 1/129$)

Table 2: Ad-valorem Equivalents

	OLS parameter	Tax equivalent/ Elasticity of trade costs	
Elasticity θ		8	10
$Language_{ij}$	−0.613	8.7	6.8
$Tiers_j$	0.108	199	155
$Tiers_i$	0.096	177	138
$Horizontal_j$	0.107	1.97	1.53
$Horizontal_i$	0.108	1.99	1.55

Notes: i) The tax equivalent for lack of common language = $100 * exp[\beta/(\theta - 1)]$; ii) The tax equivalents for vertical tiers = $100 * exp[N\beta/(\theta - 1)]$, where $N = 129$; iii) The elasticity of trade costs with respect to horizontal decentralization is calculated as $N\beta/(\theta - 1)$; iv) The OLS parameters for vertical and horizontal decentralization are taken from Table 1 columns **2** and **3**, correspondingly.

symmetry, we obtain $\beta_i = \alpha_i(\theta - 1)s_i$, where s_i ranges between 0 and 1. The estimates will decrease with increasing income shares s_i, which means that the biggest countries in economic size (GDP) will allow just for an infinitesimal effect of their government structure on international trade. Another important issue is that these estimates depend substantially on the elasticities of substitution. We have seen from Table 2 how drastically the ad-valorem equivalents fall off with a tiny 2-point increase in θ. In our model, we assumed identical consumption aggregates for the different countries. Moreover, differentiated goods (from ore to food stuffs) are presumed to be symmetric substitutes[12], which, of course, may also be a reason for the results we get. Using disaggregated international and intra-national trade data as well as better estimates of substitution elasticities and disregarding symmetry assumptions are likely to improve our understanding of the impact of decentralization on trade. However, as the data do not exist for a wide range of countries to date, this intention may only be realized in further research work in the field.

In the econometric model, we constructed the trade costs, both cross-

[12] θ is the same for all sectors. Actually, we do not differentiate between sectors at all and work only with aggregate data and a one-sector model.

country and intra-country barriers, as a function of borders (language border, federal tiers, and horizontal decentralization) and geographic factors (surface area and bilateral distances). We obtain highly significant results for all of the terms. Language barriers, which contribute partly to the bilateral trade costs, show a negative impact on bilateral trade, as is common in the literature. The tiers of importer and exporter influence trade positively and an increase in horizontal decentralization has a negative impact on bilateral trade. The factors we obtain depend strongly on the assumptions about the elasticity of substitution θ and the income share s_i of the country considered calculated as the ratio of domestic income to world income.

Our results on the number of government tiers have a further important implication. Our theoretical exposition has stressed the effects of the nature of decentralization on the relative profitability of domestic transactions vis-à-vis international transactions. This perspective receives support given that we find significant effects of vertical decentralization in the exporter and importer country. An alternative theoretical perspective would be to consider the substitution (or, potentially, complementarity) nature between trade and foreign direct investment. Kessing et al. (2006b) provide evidence that the number of government levels of a country negatively affects the amount of foreign direct investment (FDI) this country receives from the rest of the world. Our findings on the importers' number of government tiers would be in line with a view that stresses the substitution of FDI by trade. However, such a perspective has more difficulties explaining the significant effects of similar size of the number of government tiers in the exporter country. Our theoretical perspective, however, is very well in line with these findings.

Endogeneity of Decentralization

So far we have assumed the level of decentralization to be exogenous, and have considered the impact of the level of decentralization on bilateral trade flows. Of course, it may be argued that our estimates suffer from endogeneity bias. It is natural to consider that the level of decentralization itself depends on the extent of economic integration with the rest of the world. Just as

Alesina et al. (2000) have considered the size and number of nations to be determined by the openness of international markets, the costs of decentralization of higher internal barriers may be less severe if the country is more integrated with the rest of the world. In this view, decentralization implies a more gradual step towards a complete secession, but the motives for moving towards more decentralization can be seen as analogous to the ones for secession.[13]

We tackle the plausible endogeneity problem by estimating (17) with instrumental variable techniques. As instruments for the degree of decentralization, we use variables that account for ethnic ($Ethnic_i$ and $Ethnic_j$) and linguistic ($Linguistic_i$ and $Linguistic_j$) fragmentation constructed by Alesina et al. (2003). The variables range between 0 and 1, where higher values stand for greater diversity.[14] We assume that ethnic and language fragmentation in a country should be positively correlated with the degree of vertical and horizontal decentralization, because groups of different ethnicity or language can contribute to more diverse regions in a country and thus to more decentralization. Furthermore, ethnic and language diversities are given by history and cannot be explained by trade. These facts account for the lack of correlation between the instruments and the error term and, thus, the two requirements for valid instruments are satisfied.

In Table 3, we present the results of two IV regressions. The first specification considers the vertical tiers and the second one provides results for the instrumented horizontal decentralization variables. In each of the specifications, we instrument two variables with four instruments, namely $Tiers_i$ and $Tiers_j$ with $Ethnic_i$, $Ethnic_j$, $Linguistic_i$, and $Linguistic_j$ (the same applies for $Horizontal_i$ and $Horizontal_j$). We run a two-stage least squares (2SLS) regression and should note that the instruments perform remarkably well

[13]As we have argued above, such a unidimensional view of decentralization may be misleading given the different results for horizontal and vertical decentralization.

[14]The authors use the following formula for computing the fractionalization measures in a certain country: $Fractionalization = 1 - \sum_{k=1}^{N} r_k^2$, where r_k is the share of an ethnic, linguistic, or religious group k in a country. The data is collected mainly from Encyclopedia Britannica, CIA World Factbook and the national censuses of some countries.

from a statistical perspective. The F-statistic from the first stage regression in both specifications is highly significant and therefore a good measure of the fit of the instruments with the endogenous variables, i.e. the first condition for our instruments to be valid is fulfilled. The second stage regression also provides very reliable results for the instruments, but only for the first specification. We establish that the fragmentation variables are not correlated to the trade residuals (P-value 0.96) and thus meet the second requirement for good instruments. The Sargan-statistic[15] nearly rejects the instruments in the second specification, which may stand for weak instruments or for lack of endogeneity of the horizontal decentralization variables. Apparently, the 2SLS effects of decentralization on trade increase substantially in comparison to the OLS results, but the coefficient signs of the explanatory variables stay the same.

We use the Hausman test to check the endogeneity problem. For the regression on trade with the instrumented tiers' variables, we can always reject the zero hypothesis of no systematic difference between the OLS and the IV regression. This indicates the endogeneity of the vertical decentralization. On the other hand, running the same Hausman test for the second specification, including the horizontal decentralization variables, we cannot definitely reject the zero hypothesis. This fact may, actually, explain the unsatisfactory 2SLS results for the second specification in Table 3.

[15]The Sargan statistic tests the zero hypothesis that the instrumental variables are uncorrelated to the set of residuals of the trade equation

Table 3: 2SLS estimation results

Dependent variable: $Trade_{ij}$ 1993-2000					
	Parameters	**(1)**		**(2)**	
GDP_j	β_1	0.956^{***}	(0.009)	0.963^{***}	(0.012)
GDP_i	β_2	1.028^{***}	(0.009)	1.046^{***}	(0.013)
$Language_{ij}$	$-(\theta-1)\alpha_1$	-0.626^{***}	(0.057)	-0.627^{***}	(0.062)
$Distance_{ij}$	$-(\theta-1)\rho_1$	-1.143^{***}	(0.025)	-1.124^{***}	(0.027)
$Size_j$	$\frac{1}{N}(\theta-1)\rho_2$	-0.389^{***}	(0.034)	-0.914^{***}	(0.195)
$Size_i$	$\frac{1}{N}(\theta-1)\rho_3$	-0.403^{***}	(0.035)	-1.698^{***}	(0.192)
(Sum over language)$_j$	$\frac{1}{N}(\theta-1)\alpha_4$	0.008^{***}	(0.002)	0.010^{***}	(0.002)
(Sum over language)$_i$	$\frac{1}{N}(\theta-1)\alpha_5$	0.016^{***}	(0.002)	0.023^{***}	(0.002)
(Sum over distance)$_j$	$\frac{1}{N}(\theta-1)\rho_4$	0.005^{***}	(0.000)	0.002^{***}	(0.000)
(Sum over distance)$_i$	$\frac{1}{N}(\theta-1)\rho_5$	0.007^{***}	(0.000)	0.002^{***}	(0.000)
$Tiers_j$	$\frac{1}{N}(\theta-1)\alpha_{2,v}$	0.391^{***}	(0.062)		
$Tiers_i$	$\frac{1}{N}(\theta-1)\alpha_{3,v}$	0.620^{***}	(0.063)		
$Horizontal_j$	$\frac{1}{N}(\theta-1)\alpha_{2,h}$			0.427^{***}	(0.111)
$Horizontal_i$	$\frac{1}{N}(\theta-1)\alpha_{3,h}$			0.954^{***}	(0.109)
Number of observations		9590		8967	
adjusted R^2		0.71		0.68	
F-statistic		1997.39^{***}		1706.87^{***}	
F-statistic from 1st stage regression (P-value)		<0.001		<0.001	
Sargan-statistic (P-value)		0.96		0.11	

Notes: i) $Trade_{ij}$, GDP_i, and GDP_j are averaged over the 1993-2000 period; ii) All of the variables are in logs, except for $Language_{ij}$, $Tiers_i$, and $Tiers_j$; iii) *** denotes significance at the 1% level; iv) Robust standard errors are in parentheses; v) $Tiers_i$ and $Tiers_j$, and $Horizontal_i$ and $Horizontal_j$ are instrumented by $Ethnic_i$, $Ethnic_j$, $Linguistic_i$, and $Linguistic_j$; vi) The parameters in the second column inclusive of θ refer to equation (18); vii) $N = 129$ denotes the number of countries (not of country pairs) in our sample; the elasticity of substitution $\theta > 1$.

6 Conclusion

In this paper, we use the theory-based gravity model to investigate the effects of decentralization on international trade. We augment the approach by allowing for domestic trade costs, which depend on the form and the degree of decentralization. We distinguish between horizontal and vertical decentralization, conceptually as well as empirically. We find significant evidence that vertical decentralization increases international trade, whereas horizontal decentralization decreases international trade. These results are robust for allowing for potential endogeneity of decentralization.

From a theoretical perspective, our findings are in line with a picture of vertical decentralization that makes domestic trading relatively less favorable due to vertical fiscal and regulatory externalities. This results in a substitution of domestic trading by international transactions. Regarding horizontal decentralization, the results are in line with the presumption of a competition effect between jurisdictions. This competition makes domestic trading relatively more favorable, with a consequent negative effect on international trade. The results show that the form and the degree of decentralization have substantial effects on countries' economic integration into the global economy.

Table 4: Data sources

Variables	Description	Sources
$Trade_{ij}$	Nominal value of exports in logs from country i to country j in US dollar	Center for International Data at UC Davis
GDP for i,j	Gross domestic product in logs in constant 2000 US dollar	World Bank WDI
$Language_{ij}$	A binary variable equal to 0 when two countries share the same language and 1 otherwise	CEPII
$Distance_{ij}$	Distance in logs in km between the capitals of the trading partners	CEPII
Tiers for i,j	A discrete variable between 1 and 6 equal to the number of central and sub-central government levels	Treisman (2002)
Horizontal for i,j	The average size in logs of a unit of the highest subnational government below the the central government	Treisman (2002)
Size for i,j	Great circle distance in logs between the cities of the country	CEPII
Ethnic for i,j	A measure of ethnic diversity between 0 and 1	Alesina et al. (2003)
Linguistic for i,j	A measure of linguistic diversity between 0 and 1	Alesina et al. (2003)
(Sum over language) for i,j	Multilateral language resistance terms constructed as sum of the language borders of all trading partners of i, j	Own calculations
(Sum over distance) for i,j	Multilateral distance resistance terms constructed as sum of the log distances to the capital cities of all trading partners of i, j	Own calculations

Table 5: Our sample countries with the corresponding values for vertical (V) and horizontal (H) decentralization measured by the number of tiers and the average size of the first subnational tier in square kilometers, respectively

Country	V	H	Country	V	H	Country	V	H
Albania	3	805.5556	Germany	4	22,312.5	Niger	4	158,375
Algeria	4	49,625	Ghana	6	23,900	Nigeria	4	29,806.45
Angola	4	69,277.78	Greece	4.5	10,153.85	Norway	3	17,052.63
Argentina	3	115,833.3	Guatemala	4	13,625	Oman	3	26,562.5
Armenia	3	810.8108	Guinea	4	30,750	Pakistan	4.5	132,666.7
Australia	3	967,625	Guyana	3	21,500	Panama	4	6,333.333
Austria	4	9,333.333	Honduras	3	6,222.222	Paraguay	3	23,941.18
Azerbaijan	3		Hong Kong	4	500	Peru	4	51,400
Bahamas	2	661.9048	Hungary	3	4,650	Philippines	4	
Bahrain	2	58.3333	Iceland	2	605.8823	Poland	3	6,591.837
Bangladesh	5	24,000	India	5	102,750	Romania	3	5,666.667
Barbados	2	33.3333	Indonesia	5	70,555.55	Russia	4	191,853.9
Belarus	4	34,666.67	Iran	4	68,041.66	Rwanda	4	
Belgium	4	11,000	Ireland	3	2,187.5	Saudi Arabia	3	153,571.4
Bolivia	4	122,111.1	Israel	3	3,500	Senegal	6	19,700
Brazil	4	316,555.5	Italy	4	15,050	Sierra Leone	4	18,000
Bulgaria	4	12,333.33	Jamaica	2	785.7144	Singapore	1	
Burkina Faso	4	9,133.333	Japan	3	8,042.553	Slovakia	4	1,289.474
Burundi	3	1,750	Jordan	3	11,125	Slovenia	2	317.4603
Cambodia	4	8,227.273	Kazakhstan	4	129,381	Spain	4	29,764.71
Cameroon	6	47,500	Kenya	6	72,500	Sri Lanka	4	7,333.333
Canada	4	830,916.7	Korea,North	4	10,041.67	Sudan	4	278,422.2
C.Afr.Rep.	4	36,647.06	Korea,South	4	6,600	Suriname	3	16,330
Chile	4	58,230.77	Kuwait	3	3,600	Sweden	3	19,565.22
China	5	309,580.7	Kyrgyzstan	4	28,428.57	Switzerland	3	1,576.923
Colombia	3	34,515.15	Lao PDR	4	13,166.67	Tajikistan	4	35,750
Costa Rica	4	7,285.714	Latvia	3	2,500	Tanzania	6	37,800
Cote Divoire	5	32,200	Lebanon	4	1,666.667	Thailand	5	6,750
Croatia	3	2,714.286	Lithuania	3	1,181.818	Togo	4	11,400
Cuba	3	7,393.333	Macedonia	2	764.7059	Trin.Tob.	2	392.3077
Cyprus	3	1,550	Madagascar	5	97,833.34	Tunisia	4	7,130.435
Czech R.	3	1,039.474	Malawi	4	39,333.33	Turkey	4	10,472.97
Denmark	3	2,687.5	Malaysia	3	25,384.61	Turkmenistan	4	97,600
Domin.Rep.	3	1,633.333	Mali	4	137,777.8	Uganda	6	6,179.487
Ecuador	4	13,523.81	Mauritania	4	78,923.08	Ukraine	4	22,370.37
Egypt	4.5	38,500	Mauritius	3	200	UAE	3	11,942.86
El Salvador	3	1,500	Mexico	3	61,187.5	UK	4	1,531.25
Estonia	3	3,000	Moldova	3	850	USA	4	187,280
Ethiopia	5		Myanmar	4	48,357.14	Uruguay	2	9,315.789
Finland	3	28,166.67	Nepal	3	1,960	Uzbekistan	4	34,384.62
France	4	21,230.77	Netherlands	3	3,416.667	Venezuela	4	9,600
Gabon	6	29,744.44	New Zealand	3	20,846.15	Zambia	3	83,666.66
Georgia	4	5,833.333	Nicaragua	4	14,444.44	Zimbabwe	5	48,875

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