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Abstract:
The main objective of this research is to revisit the estimation of the effect of a common currency on international trade by applying the new methodology proposed by Helpman, Melitz and Rubistein (2008) and incorporating tourism to the theoretical framework. Rose (2000) estimates an empirical model of bilateral trade, finding a significant coefficient for a currency union variable of 1.2, suggesting an effect of currency unions on trade of over a 200%. Rose (2000)'s finding did not receive full acceptance and further research was consequently devoted to find reasons of such high effect. This still remains as a major puzzle in the International Economics. Rose and Van Wincoop (2001) hold that there may still be some omitted factors that drives countries to both participate in currency unions and trade more. In this research a gravity equation for trade is estimated controlling by international tourism.

1. Introduction

In the last decade a growing literature in international trade focuses on the effect of the creation of a common currency on the volume of international trade. The issue is simple since sharing a currency eliminates exchange rate uncertainty and reduces transaction costs, and as a consequence it fosters trade. What is more controversial is the magnitude of this influence and it still remains as a *puzzle* in the International Economics.

In a seminal paper, Rose (2000) estimates a surprising large effect of a currency union on trade. His results suggest that members of currency unions seemed to trade over three time as much as otherwise pair of countries. However, although economists widely believe that monetary unions could reduce transaction costs and promote trade, still many are surprised that the magnitude of the estimated effects of common currencies is so large. See for instance (Thom and Walsh, 2002; Glick and Rose, 2002 or Persson, 2001)

As an attempt to summarize the results reached in the literature, Rose and Stanley (2005) implement a meta-analysis to thirty-four studies that investigate the effect of currency union on trade. Combining these estimates, the authors found that a currency union increases bilateral trade by between 30 and 90%. This magnitude is lower than the early estimations but still it means a sizeable trade effect.

Another important cause of the non-acceptance of Rose's results is the traditional critique about the lack of theoretical underpinnings of the estimated gravity equations. However nowadays international economists recognize that the gravity specification can be supported by Heckscher-Ohlin models, models based in differences in technology across countries, and the new models that introduce increasing returns and product differentiation (Deardoff, 1998). Moreover, Anderson and Van Wincoop (2003) developed a method that consistently and efficiently estimates a theoretical gravity equation by considering multilateral and bilateral trade resistance. Rose and Van

Wincoop (2001) proposed the inclusion of country fixed effects as a way to approximate the multilateral resistances.

In the present paper, Rose's debate about the effect of currency unions on trade is revisited in two ways. First, the effect of common currencies on trade is estimated following the new methodology proposed by Helpman, Melitz and Rubistein (2008). This approach presents a theoretical framework to study bilateral trade flows across countries. According to these authors, not all firms in the country have a productivity level high enough to generate profits sufficient to cover fixed costs of exporting. In that sense, if fixed costs are high enough, no firms in a country may find it profitable to export and hence "zeros" naturally arise in trade data. This is known as country selection bias. The HMR approach holds that by disregarding countries that do not trade with each other, important information is not being considered and hence estimates could be biased.

Second, the potential omission of a relevant variable in trade gravity equations is addressed. In particular, we deal with the challenge from Rose and Van Wincoop (2001), i.e. *to find some omitted factor that drives countries to both participate in currency unions and trade more*. In this research the omission of international tourism is proposed as a suitable candidate to explain the possible overvalued estimate of the impact of a common currency on trade. Moreover, tourism is introduced in the well-founded HMR model by recognizing that tourism could reduce fixed and variable costs of exporting. If so, tourism arrivals arise as an explanatory variable in the probit equation for firm selection and in the gravity equation.

The paper is organized as follows. In Section 2 the HMR approach is presented in detail. Section 3 introduces and discusses tourism in the estimated equations. In section 4 the model is estimated avoiding estimation bias when tourism is omitted. Finally, Section 5 draws some conclusions.

1. The HMR approach

Gravity model is a workhorse in a number of empirical issues addressed by the International Economics. This model is used to estimate the effects of economic and non-economic events and factors on international flows of goods, migrants, investment and tourists. Indeed the evaluations of free trade agreements, international borders and currency unions are the main fields of application of gravity equations.

HMR presents a theoretical framework to study bilateral trade flows across countries. The model presents three features that make it suitable to describe empirical patterns of bilateral trade flows. First, the model can yield asymmetric trade flows between country pairs depending on the direction of export flows (from i to j versus from j to i). Second, it can generate zero trade flows in both directions between some countries, as well as zero exports from one country, say j, to a second country i, together with positive exports from country i to country j. Third, a well-founded empirical framework for estimating the gravity equation for positive trade flows is developed. Therefore, the HMR model has the potential to explain prevalent regularities in trade data reflected in the sample: the asymmetry in bilateral trade flows between country pairs and the high presence of zeroes.

The HMR approach generalizes the Anderson and VanWincoop (2003) model in two ways. First, it accounts for firm heterogeneity and fixed trade costs and second, deals with asymmetries in the volume of exports between two countries. HMR use their theoretical model to develop a two-stage estimation procedure. In the first stage, a probit equation is estimated for the probability that country j exports to country i while in the second stage predicted components of probit are used to estimate the gravity equation for positive exports flows.

In this section the HMR proposal is presented in detail as a suitable framework to revisit Rose's empirical findings. In their model, a utility function *à la* Dixit-Stiglitz is assumed to allow for product differentiation. Producers face both variable and fixed costs of exporting to each destination country by recognizing that profitability of exports to a particular destination depends on both a genuine transport cost and a fixed cost of serving that particular country. The monopolistic competition equilibrium yields a gravity equation as well as a firm selection equation.

2.1 Consumption

Let a world with J countries, indexed by j=1, 2,..., J, where a set of goods B_j is available for consumption in country j. Consumers of country j maximize a CES utility function given by

$$u_j = \left[\int_{l \in B_j} x_j(l)^{\varepsilon-1/\varepsilon} dl\right]^{\varepsilon/\varepsilon-1}, \ \varepsilon > 1$$

where $x_j(l)$ is the country j's consumption of product l and ε is the elasticity of substitution across products.

Solving the first-order conditions of the consumer problem yields the country j's demand for product l

$$x_j(l) = \frac{\breve{p}_j(l)^{-\varepsilon} Y_j}{P_j^{1-\varepsilon}} \qquad [1]$$

where Y_j is the income of country j, $\breve{p}_j(l)$ is the price of product l in country j and P_j is the country j's dual price index given by

$$P_j = \left[\int_{l \in B_j} \breve{p}_j(l)^{1-\varepsilon} dl\right]^{1/(1-\varepsilon)} \qquad [2]$$

Taking into account that

$$\frac{\partial P_j}{\partial \breve{p}_j(l)} = P_j^{\varepsilon} \breve{p}_j^{-\varepsilon} \qquad [3]$$

Price demand elasticity for the good l produced in country j is

$$\frac{\partial x_j(l)}{\partial \breve{p}_j(l)}\frac{\breve{p}_j(l)}{x_j(l)} = -\varepsilon - (1-\varepsilon)\frac{\breve{p}_j(l)^{1-\varepsilon}}{P_j^{1-\varepsilon}} \qquad [4]$$

The "large group" assumption assures that the second term in the right hand side is about zero, and as a result elasticity is approximated to $-\varepsilon$.

2.2 Production

Each firm of each country produces a distinct good and this may be supported by the presence of scale economies. The number of bundles used by a firm to produce one unit of output is a being c_j the (country-specific) cost of a bundle supported by a firm country j. As a result, $c_j a$ is the minimum cost of a firm of country j producing one unit of output. Moreover, a cumulative distribution function $G(a)$ with support $\lfloor a_{L,} a_H \rfloor$ describes the distribution of a across firms, where $a_H > a_L > 0$ and this distribution function is assumed to be the same in all countries.

A producer only supports a production cost when selling in the home market. However a producer of country j faces two types of additional costs of selling in country i: a transport variable cost τ_{ij} and a fixed cost $c_j f_{ij}$ of serving other market. τ_{ij} represents an iceberg transport cost so that only arrive to destination $1/\tau_{ij}$ units when one unit of product is shipped from j to i. Therefore, for domestic trade f_{jj} equals zero and τ_{jj} equals one while for international trade $f_{ij} > 0$ while $\tau_{jj} > 1$.

Profit maximization is carried out to find the price of a good l produced in country j that is sold in country i. The profit equation is

$$\Pi_{ij} = \breve{p}_j(l)x_j(l) - c_j a \tau_{ij} x_j(l) - c_j f_{ij} \qquad [5]$$

where the second term in the right hand side recognizes that $\tau_{ij} x_j(l)$ units of a good are shipped in order to sell $x_j(l)$ units in country i.

The first-order condition for a firm producing a good l in country j to be sold in country i is given by

$$\frac{\partial \Pi_{ij}}{\partial \breve{p}_j(l)} = \left(\breve{p}_j(l) - c_j a \tau_{ij}\right)\frac{\partial x_j(l)}{\partial \breve{p}_j(l)} + x_j(l) = 0 \quad [6]$$

Taking into account equations [3] and [4], the first-order condition [6] provides the price of a good l produced in country j that is sold in country i

$$\breve{p}_j(l) = \frac{\varepsilon}{\varepsilon - 1} c_j a \tau_{ij} \quad [6']$$

By substituting [6'] in [5], the maximized operating profits for a firm producing a good l in country j to be sold in country i are

$$\Pi^*_{ij}(a) = \frac{1}{\varepsilon}\left[\frac{\varepsilon \tau_{ij} c_j a}{(\varepsilon - 1)P_i}\right]^{1-\varepsilon} Y_i - c_j f_{ij} \quad [7]$$

Sales in country $i \neq j$ are profitable if profits in equation [7] are non-negative. This is the case when $a \leq a_{ij}$, since a is an inverse measure of productivity, being a_{ij} the threshold for a making operating profits equal to zero, so that

$$\frac{1}{\varepsilon}\left[\frac{\varepsilon \tau_{ij} c_j a_{ij}}{(\varepsilon - 1)P_i}\right]^{1-\varepsilon} Y_i = c_j f_{ij} \quad [8]$$

Only a fraction $G(a_{ij})$ of the N_j firms of country j have non-negative profits, so they will export to country i. Note that if $a_{ij} \leq a_L$, no firm in country j finds profitable to export to country i. Precisely, this may explain zero trade data for a number of country pairs. On the contrary, when $a_{ij} \geq a_H$ all firms from country j would export to country i.

2.3 International trade

Turning to bilateral trade, by combining [1] and [6'], and by aggregating across firms, the value of country *i*'s imports from *j* is

$$M_{ij} = \left(\frac{\varepsilon c_j \tau_{ij}}{(\varepsilon - 1)P_i} \right)^{1-\varepsilon} Y_i \int_{a_L}^{a_{ij}} a^{1-\varepsilon} dG(a) N_j \qquad [9]$$

Let

$$V_{ij} = \begin{cases} \int_{a_L}^{a_{ij}} a^{1-\varepsilon} dG(a) & \text{for } a_{ij} \geq a_L \\ \text{and zero otherwise} \end{cases} \qquad [10]$$

Therefore, equation [9] may be rewritten as

$$M_{ij} = \left(\frac{\varepsilon c_j \tau_{ij}}{(\varepsilon - 1)P_i} \right)^{1-\varepsilon} Y_i V_{ij} N_j \qquad [9']$$

which reflects the positive influence of multilateral resistance P_j to trade and the negative effect of bilateral resistance τ_{ij}. Again bilateral trade is zero if $a_{ij} \leq a_L$.

Finally, using equations [2], [6'] and [10], the price index of country *i* can be written as

$$P_i^{1-\varepsilon} = \sum_{j=1}^{J} \left(\frac{\varepsilon c_j \tau_{ij}}{(\varepsilon - 1)} \right)^{1-\varepsilon} N_j V_{ij} \qquad [11]$$

In order to obtain the empirical equations to be estimated, HMR approach assumes a truncated Pareto distribution for productivity *1/a* across firms, so that

$$G(a) = \frac{(a^k - a_L^k)}{(a_H^k - a_L^k)} \qquad [12]$$

and, as a consequence,

$$dG(a) = \frac{ka^{k-1}}{\left(a_H^k - a_L^k\right)} da \qquad [13]$$

where $k>\varepsilon\text{-}1$ determines the shape of the distribution. Now by substituting [13] in [10], V_{ij} can be expressed as

$$V_{ij} = \int_{a_L}^{a_{ij}} a^{1-\varepsilon} \frac{ka^{k-1}}{\left(a_H^k - a_L^k\right)} da \qquad [14']$$

and after some algebra

$$V_{ij} = \frac{ka_L^{k-\varepsilon+1}}{(k-\varepsilon+1)\left(a_H^k - a_L^k\right)_{ij}} \left[\left(\frac{a_{ij}}{a_L}\right)^{k-\varepsilon+1} - 1\right] \qquad [14']$$

where the term in brackets is denoted by W_{ij} by Helpman et al. (2008) and it is restricted to be non-negative. As a consequence, the expression for W_{ij} can be expressed as

$$W_{ij} = \max\left[\left(\frac{a_{ij}}{a_L}\right)^{k-\varepsilon+1} - 1, 0\right] \qquad [15]$$

Note that V_{ij} increases monotonically with a_{ij} and therefore with the share $G(a_{ij})$ of firms exporting from country *j* to country *i*. As a consequence, from equation [9'] a growth in the number of firms exporting from country *j* to country *i* increases the value of country *i*'s imports from *j*.

Taking logarithms in [9']

$$m_{ij} = (\varepsilon-1)\ln\left((\varepsilon-1)/\varepsilon\right) - (\varepsilon-1)\ln c_j + n_j + (\varepsilon-1)p_i + y_i + (1-\varepsilon)\ln\tau_{ij} + v_{ij} \qquad [16]$$

where lowercase variables denote logarithms of uppercase variables. HMR approach assume that the transport cost is given by

$$\tau_{ij} = \left[D_{ij}^{\gamma} e^{-u_{ij}} \right]^{1/\varepsilon-1}$$

where u_{ij} are i.i.d. unmeasured trade frictions and D_{ij} is the distance between countries *i* and *j*. Taking logarithms in the expression of the transport cost and in [14], and substituting in [16], the gravity equation to be estimated can be expressed as

$$m_{ij} = \beta_0 + \lambda_j + \chi_i - \gamma d_{ij} + w_{ij} + u_{ij} \qquad [16']$$

where

$\beta_0 = (\varepsilon - 1)\ln\alpha + \ln\left[\frac{k a_L^{k-\varepsilon+1}}{\left(a_H^k - a_L^k\right)\left(k - \varepsilon + 1\right)} \right]$ is the constant term

$\chi_i = (\varepsilon - 1) p_i + y_i$ is a fixed effect of the importing country

$\lambda_j = (1 - \varepsilon)\ln c_j + n_j$ is a fixed effect of the exporting country

Following HMR, their approach incorporates two main differences with respect to previous work. First, w_{ij} is included in equation [16']. This additional variable depends on a_{ij} which is determined by variables in equation [8], namely income and multilateral resistance of the destination country, as well as fixed and variable costs of serving market *i* from country *j*. Second, HMR approach considers zero trade data.

2.4 Firm selection into the export market

The selection of firms into export markets, represented by the variable W_{ij} is determined by the cut-off value of a_{ij}, which is implicitly defined by the zero profit condition. In that sense, HMR approach proposes a latent variable from the operating profits in equation [8] so that

$$Z_{ij} = \frac{\frac{1}{\varepsilon}\left[\frac{\varepsilon\tau_{ij}c_j a_L}{(\varepsilon-1)P_i}\right]^{1-\varepsilon} Y_i}{c_j f_{ij}} \qquad [17]$$

which is the ratio of operating variable profits for the firm with the highest level of productivity, as measured by $1/a_L$ to the fixed costs of serving country *i* from country *j*. Z_{ij} lower than one suggests that the most productive firm of *j* cannot find profitable the export to *i*. In that case zero trade between the pair of countries is observed. On the contrary, Z_{ij} higher than one implies positive exports from *j* to *i*.

Precisely, when Z_{ij} is higher than one, W_{ij} is increasing in Z_{ij}. In other words, the variable that controls for the fraction of firms that export from *j* to *i* is increasing in the new latent variable Z_{ij}. This relationship can be examined from [8] by calculating the ratio

$$\frac{a_{ij}}{a_L} = \left(\frac{\varepsilon c_j f_{ij}}{Y_i}\right)^{1/1-\varepsilon} \frac{P_i(\varepsilon-1)}{\varepsilon\tau_{ij}c_j a_L} \qquad [18]$$

As can be easily proved from equation [17], this ratio equals $Z_{ij}^{1/(\varepsilon-1)}$, and equation [15] can be rewritten as

$$W_{ij} = Z_{ij}^{(k-\varepsilon+1)/(\varepsilon-1)} - 1 \qquad [19]$$

Taking logarithms in [17] and by substituting the expression of the logs of transport costs

$$\begin{aligned} z_{ij} = {} & \ln\left(\frac{1}{\varepsilon}\right) + (\varepsilon-1)\ln\left(\frac{\varepsilon-1}{\varepsilon}\right) + (1-\varepsilon)\ln a_L - \varepsilon \ln c_j + (\varepsilon-1)p_i + y_i \\ & + (1-\varepsilon)\ln\tau_{ij} - \ln f_{ij} + u_{ij} \end{aligned} \qquad [20]$$

where lowercase variables denote logarithms of uppercase variables. A positive value of the new latent variable z_{ij} indicates that country *j* exports to country *i*.

Let define the term of fixed costs as

$$f_{ij} = \exp(\phi_{ex,j} + \phi_{im,i} + \kappa\phi_{ij} - v_{ij}) \qquad [21]$$

where $\phi_{ex,j}$, $\phi_{im,i}$ and ϕ_{ij} measure trade fixed costs for the export country, the import country and the pair of countries, respectively. v_{ij} are unmeasured trade frictions making trade fixed costs stochastic. By applying logarithms to [21] and substituting in [20], the latent variable can be expressed as

$$z_{ij} = \gamma_0 + \xi_j + \zeta_i + \gamma d_{ij} - \kappa\phi_{ij} + \eta_{ij} \qquad [20']$$

where

$\gamma_0 = \ln(1/\varepsilon) + (\varepsilon - 1)\ln((\varepsilon - 1/\varepsilon) + (1-\varepsilon)\ln a_L$ is a constant term

$\xi_j = -\varepsilon \ln c_j - \phi_{ex,j}$ which is an exporter fixed effect

$\zeta_i = y_i + (\varepsilon - 1)p_i - \phi_{im,i}$ which is an importer fixed effect

$\eta_{ij} = u_{ij} + v_{ij} \sim N(0, \delta_u^2 + \delta_v^2)$ is the error term correlated with the error term u_{ij} in the gravity equation [16'].

Using equation [20'], an indicator variable T_{ij} can be defined so that it equals 1 if country *j* exports to country *i*. Therefore the probability that country *j* exports to country *i* can be expressed using the following probit equation[1]

$$\rho_{ij} = \Pr(T_{ij} = 1 | \text{observed variables}) = \Phi(\gamma_0 + \xi_j + \zeta_i - \gamma d_{ij} - \kappa\phi_{ij}) \qquad [22]$$

where $\Phi(.)$ is the accumulative standard normal distribution function. HMR approach consists in the estimation of the probit equation [22] in a first stage and the gravity equation [16'] in a second stage.

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[1] Since $\delta_\eta^2 = \delta_u^2 + \delta_v^2 = 1$ is not imposed, (20') is divided by the standard deviation δ_η^2 to specify the probit equation [22].

2. Adding tourism to the HMR approach

As presented in the introduction of this paper, one of the contributions of the present analysis is the consideration of tourism as a relevant factor to explain trade flows and the surprisingly high estimated effect of common currencies on trade. In this section tourism is included in the HMR model.

A simple way to introduce tourism in HMR framework is by recognizing that bilateral tourism can reduce both trade variable costs and trade fixed costs associated with exports. For instance, tourism may improve the knowledge about foreign culture and, as a consequence, about business habits and practices in other countries. Furthermore, tourism facilitates and stimulates to learn other languages, making bilateral trade easier. In addition, international tourism needs good basic facilities, services, and infrastructure such as transportation and communication systems that are also necessary for trade activity to function

Tourist arrivals may result in the promotion of trade in terms of both, the existence of bilateral trade and its volume. Therefore, the promotional effect of trade through tourism may be interpreted as the consequence of a reduction of both trade fixed costs, as measured by f_{ij}, and trade variable costs, as measured by τ_{ij}. In this research the equations for variable and fixed trade costs of serving a market are rewritten respectively as

$$\tau_{ij} = \left[D_{ij}^{\gamma} Tou_{ij}^{-\psi} e^{-u_{ij}} \right]^{1/\varepsilon - 1}$$

and

$$f_{ij} = Tou_{ij}^{-\beta} \exp(\phi_{ex,j} + \phi_{im,i} + \kappa \phi_{ij} - v_{ij})$$

where Tou_{ij} represents tourist arrivals to country j from country i and parameters β and ψ are positive.

By substituting these two expressions in [16'] and [22], the gravity equation and the probit equation can be expressed respectively as

$$m_{ij} = \beta_0 + \lambda_j + \chi_i - \gamma d_{ij} + \psi Tou_{ij} + w_{ij} + u_{ij} \qquad [23]$$

and

$$\rho_{ij} = \Pr(T_{ij} = 1 | \text{observed variables}) = \Phi(\gamma_0 + \xi_j + \zeta_i + (\beta + \psi)\ln Tou_{ij} - \gamma dij - \kappa\phi_{ij}) \qquad [24]$$

A look at equations [23] and [24] shows that tourism promotes both, the probability that *j* exports to *i* and the magnitude of this export, *via* a reduction of variable and fixed trade costs.

3. Empirical results

The empirical analysis of this section is supported by the HMR theoretical framework. This methodology accounts for zero trade flows between pair of countries. The first stage of the model involves the estimate of a probit model for the probability that country *j* exports to country *i*. To that end, a dataset containing enough zero trade flows between country pairs is necessary.

Therefore, a panel dataset which considers 200 countries as exporters and 164 countries as importers for the period 1995 to 2006 is used[2]. For a total of 303,541 observations, 167,077 present positive exports which suppose a 55% of the sample. Figure 1 presents the percentage of country pairs with positive exports flows in our dataset.

[Figure1, here]

[2] The list of countries used in the analysis is presented in Table A.1 and A.2 in the appendix.

The dependent variable, export flows from country *j* to country *i*, comes from the *Direction of Trade* dataset published by the *International Monetary Fund*. The data comprises bilateral merchandise trade and requires to be converted into real terms by using US GDP deflator, obtained from the *World Development Indicators* (2006) and the *UNCTAD Handbook of Statistics* (2008).

Tourism data, tourist arrivals to country *j* from country *i*, is obtained from the *United Nations World Tourism Organisation (UNWTO)* and includes annual international arrivals by country of origin. The distance variable and dummy variables for common language (*Lang)*, common border (*Border)*, colonial ties (*Colony)* and number of landlocked countries in the pair (*Landl)* are collected from the *Centre d'Etudes Prospectives et d'Informations Internationales (CEPII)* dataset while number of islands in the pair (*Island),* Free Trade Agreements *(FTA)* and common currency (*CC)* were obtained from Andrew K. Rose's website and the *CIA Factbook*[3].

HMR follows a two-stage estimation procedure. In the first stage a Probit, equation [24], is estimated by maximum likelihood and two controls are generated. In the second stage, the gravity equation [23] is consistently estimated by adding the two control variables saved from the first stage. Let $\hat{z}_{ij} = \Phi^{-1}(\hat{p}_{ij})$ be the predicted value of the latent variable. The first control is for country selection into trading, captured by the inverse Mills ratio defined by $\hat{\bar{\eta}}_{ij} = \phi(\hat{z}_{ij}) / \Phi(\hat{z}_{ij})$, where $\phi(.)$ is the standard normal density function. The second control is the endogenous number of exporters defined by $\hat{\bar{w}}_{ij} \equiv \ln(\exp[\delta(\hat{z}_{ij} + \hat{\bar{\eta}}_{ij})] - 1)$ with $\hat{\bar{z}}_{ij} = \hat{z}_{ij} + \hat{\bar{\eta}}_{ij}$. Therefore, equation [23] can be estimated using the transformation:

$$m_{ij} = \beta_0 + \lambda_j + \chi_i - \gamma d_{ij} + \psi Tou_{ij} + \vartheta \hat{\bar{\eta}}_{ij} + \ln(\exp[\delta(\hat{z}_{ij} + \hat{\bar{\eta}}_{ij})] - 1) + u_{ij} \qquad [23']$$

As previously mentioned, the main objective of our research is to analyse whether tourism, which has been a traditionally omitted factor in gravity equations for trade, reduces the impact of common currency on trade. Hence, all the equations are estimated

[3] The common currency cases considered in the analysis are presented in Table A.3 in the Appendix.

twice, without tourism and with tourism. The results of the HMR approach appear in Table 1.

[Table 1, here]

The estimates for the Probit regression without including and including tourism are presented in column 1a and 1b of Table 1, respectively. These results suggest that variables commonly considered in gravity equation also affect the probability that two countries trade which each others. Particularly, countries that are closer are more likely to trade. Moreover, sharing a common border, a common language, a common currency (CC) and belonging to the same regional free trade agreement (FTA) increase the probability to trade while the existence of islands or landlocked countries in the pair as well as the existence of colonial ties between the countries reduce this probability[4]. As presented in section 3, tourist arrivals may increase the probability of trading between countries since tourism flows reduce trade fixed-costs.

Estimates from the first stage are used to construct $\hat{\bar{\eta}}_{ij}$ and $\hat{\bar{w}}_{ij}$.[5] In the second stage, both the non-linear coefficient δ and the linear coefficient for $\hat{\bar{\eta}}_{ij}$ are estimated. Columns 2a and 2b of Table 1 present the results for the benchmark gravity equation estimated by ordinary least squares (OLS) without these controls while columns 3a and 3b present the estimate of the maximum likelihood (ML) by not including and including tourism, respectively. As found in Helpman et al (2008), the heterogeneity bias in the estimated effects of trade barriers is important. Consequently, the estimates of the effects of trade frictions in the benchmark gravity equation are biased upward.

Focusing on the estimates of the ML presented in columns 3a and 3b, the significance and sign of the variables are as expected. Results suggest that exports decrease in

[4] For identification reasons, one variable from the first stage requires to be excluded in the second stage. According to Gil-Pareja (2009) this could be a variable that affects the probability of exporting to a country but not the volume. Alternatively, a variable which affects both decisions in opposite directions would also work. Colony is excluded in the second stage since it affects negatively in the probit but is expected to affect positively the volume of exports as traditionally obtained in gravity equations for trade.
[5] Following HMR (2008), there are country pairs whose characteristics are such that their probability of trade is indistinguishable from 1. Therefore, the same $\hat{z}_{ij}$ is assigned to country pairs with an estimated $\rho_{ij} > 0.9999999$.

distance and increase in tourist arrivals to country *j* from country *i.* According to the extended theoretical model that incorporates tourism, both distance and tourist arrivals affect transport costs, the former increasing them while the later decreasing costs. Sharing a common border, common language and belonging to the same FTA affects positively the volume of exports while landlocked countries and islands in the pair reduce trade.

Regarding the variable of interest, the coefficient of common currency is positive and significant. Without including tourism in the regression, the coefficient of CC is 0.6777 which suppose an increase of exports of around 97% while the coefficient after including tourism drops to 0.6177, implying an effect on trade of 85%. Thus, tourist arrivals appears to be a relevant factor in the explanation of trade flows and the impact of CC on trade is reduced around a 10% after including tourism in the model.

Finally, following HMR (2008), the parameterization assumptions that determine the functional forms are progressively relaxed. In this sense, the Pareto distribution assumption for the inverse of productivity *a* is relaxed, allowing for a general specification of V_{ij}. Hence, the control function $\hat{\bar{w}}_{ij}$ is approximated by a polynomial in $\hat{\bar{z}}_{ij}, v(\hat{\bar{z}}_{ij})$. As the nonlinearity is eliminated, this second stage can be easily estimated by OLS.

As in the seminal paper, the $v(\hat{\bar{z}}_{ij})$ is expanded until a cubic polynomial[6] and the results are very similar to the ML estimates. In that case, the inclusion of tourism in the model reduces the magnitude of the common currency coefficient in around 22%. This reduction of the coefficient of interest differs from the one obtained from NLS estimation and must be taken with caution. Although polynomial approximation allows for more statistical flexibility, ML estimation deals with the well-founded HMR model presented in sections 2 and 3.

[6] In practice, the polynomial is expanded until a tenth power although not noticeable changes for expanding $v(\hat{\bar{z}}_{ij})$ beyond a cubic polynomial are found.

4. Synthesis and conclusions

There is a debate in the literature about the impact of currency unions on trade. Rose (2000) estimates an effect of currency union on trade of a 300% but this result has received little acceptance and, as a consequence, has directed the research to find reasons of such high impact. One of the reasons could be that there is some omitted factor that drives countries to both participate in currency unions and trade more. In this paper, two contributions to this debate are made. First, the recent method proposed by Helpman, Melitz and Rubinstein (2008) is used, and second, tourism is introduced as an explanatory variable in the trade equation.

Helpman, Melitz and Rubinstein (2008) develop a theoretical model that deals with positive and zero trade flows. The model proposes a two-stage estimation procedure that uses an equation for selection into trade partners in the first stage and a trade flow equation in the second stage. In this research the model is simply modified to incorporate tourism. It is expected that tourism reduces both, variable costs and fixed costs of trade. Thus, the consideration of tourism as an explanatory variable in trade equation is theoretically justified.

Two main results are reached. First, tourism affects positively both, the probability of exporting and the volume of exports between two countries. Thus, the results suggest that tourist arrivals are a relevant factor explaining trade flows. Second, the effect of a common currency is positive and after controlling by tourism, a noticeable reduction in its impact is found. As a consequence, the omission of this relevant variable may contribute to explain the presence of an upward bias in the estimation of the effect of a common currency on international trade.

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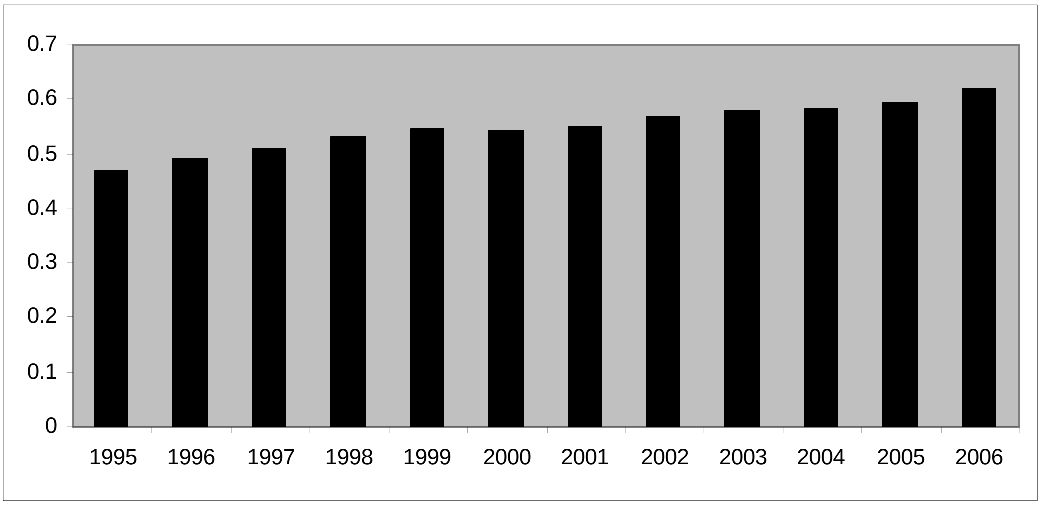
Table 1. HMR two-stage estimation of the effect of common currency on trade

	1st Stage		2nd Stage					
	Probit		Benchmark		Non Linear Model		Polynomial Model	
Variables	**(1a) Without tourism**	**(1b) With tourism**	**(2a) Without tourism**	**(2b) With tourism**	**(3a) Without tourism**	**(3b) With tourism**	**(4a) Without tourism**	**(4b) With tourism**
Tourism		0.1048		0.0902		0.0536		0.0487
		(43.89)		(36.42)		(7.39)		(2.04)
Distance	-0.2322	-0.1594	-1.1198	-0.9599	-1.0524	-0.9070	-1.0745	-0.8903
	(-33.91)	(-22.49)	(-124.07	(-95.94)	(-35.51)	(-28.53)	(-30.64)	(-18.72)
Border	0.4699	0.1531	0.8077	0.5968	0.7005	0.5774	0.8616	0.6053
	(11.57)	(3.56)	(20.60	(15.12)	(5.36)	(4.57)	(11.75)	(4.83)
Language	0.4884	0.3750	0.7067	0.6014	0.6242	0.5208	0.6669	0.4839
	(47.61)	(36.29)	(37.37)	(31.56)	(11.75)	(10.15)	(9.73)	(5.36)
Colony	-0.1722	-0.4067						
	(-3.11)	(-7.20)						
CU	0.5056	0.5552	0.7747	0.7309	0.6777	0.6177	1.0560	0.8242
	(11.25)	(12.97)	(15.51)	(14.69)	(5.03)	(4.60)	(12.33)	(4.97)
FTA	0.2061	0.1633	0.7789	0.6975	0.6610	0.6184	0.8596	0.7403
	(7.03)	(5.54)	(29.85)	(26.74)	(10.07)	(9.52)	(21.22)	(9.90)
Island	-0.3078	-0.3055	-0.9085	-0.8986	-0.8285	-0.8055	-0.8007	-0.7370
	(-19.27)	(-19.02)	(-27.56)	(-27.36)	(-9.00)	(-8.79)	(-14.86)	(-6.80)
Landlocked	-0.1523	-0.1697	-0.6950	-0.6883	-0.6448	-0.6259	-0.6432	-0.6062
	(-8.15)	(-9.13)	(-17.41)	(-17.31)	(-6.30)	(-6.17)	(-13.56)	(-5.57)
σ					0.0618	0.0898		
					(1.87)	(2.83)		
$\hat{\bar{\eta}}_{ij}$					0.5426	0.4052	1.4716	1.2907
					(8.31)	(6.87)	(13.54)	(6.81)
$\hat{\bar{Z}}_{ij}$							2.7917	3.2332
							(14.49)	(8.76)
$\hat{\bar{Z}}_{ij}^2$							-0.4541	-0.5639
							(-12.92)	(-7.20)
$\hat{\bar{Z}}_{ij}^3$							0.0171	0.0306
							(5.87)	(4.80)
Constant	0.9446	1.0154	13.3584	12.4239	16.4085	14.7624	12.9866	10.9746
	(4.41)	(3.94)	(34.68)	(32.31)	(22.68)	(25.54)	(21.94)	(12.08)
Obs	303,541	303,541	167,077	167,077	167,077	167,077	167,077	167,077
F	65904	76258	839	847	23240	21873	201	201
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
% Reduction			6%		9%		22%	

Note: Results from columns 1a and 1b correspond to the first stage of the approach where a probit is estimated. The rest of the columns correspond to the second stage of the model where a gravity equation is estimated. Columns 2a and 2b refers to the benchmark equation estimated by OLS. Results from columns 3a and 3b are obtained by ML while results from column 4a and 4b are obtained by OLS. Imported, exporter and year fixed effect are included in both stages. t-statistics appear between parenthesis and p-values appear between brackets.

Figure 1. Percentage of country pairs with positive exports



Appendix

Table A.1 Countries considered as importers/origins

Afghanistan, I.S. of	Dominica	Kuwait	Réunion
Albania	Dominican Rep.	Kyrgyz Rep.	Saint Helena
Algeria	Ecuador	Lao, P. D. Rep.	Saint Kitts and Nevis
Angola	Egypt	Latvia	Saint Lucia
Antigua & Barbuda	El Salvador	Lebanon	Saint Pierre & Miquelon
Argentina	Equatorial Guinea	Lesotho	Saint Vincent
Armenia	Eritrea	Liberia	Samoa
Aruba	Estonia	Libya	Saudi Arabia
Australia	Ethiopia	Lithuania	Senegal
Austria	Falkland Islands	Luembourg	Serbia and Montenegro
Azerbaijan	Feroe Islands	Macao	Seychelles
Bahamas, The	Fiji	Madagascar	Sierra Leone
Bahrain	Finland	Malawi	Singapore
Bangladesh	France,	Malaysia	Slovak Rep.
Barbados	French Guiana	Maldives	Slovenia
Belarus	French Polynesia	Mali	Solomon Islands
Belgium	Gabon	Malta	Somalia
Belize	Gambia, The	Martinique	South Africa
Benin	Georgia	Mauritania	Spain
Bermuda	Germany	Mauritius	Sri Lanka
Bhutan	Ghana	Mexico	Sudan
Bolivia	Gibraltar	Mongolia	Suriname
Bosnia and Herzegovina	Greece	Morocco	Swaziland
Botswana	Greenland	Mozambique	Sweden
Brazil	Grenada	Namibia	Switzerland
Brunei Darussalam	Guadeloupe	Nauru	Syrian Arab Rep.
Bulgaria	Guatemala	Nepal	São Tomé & Príncipe
Burkina Faso	Guinea	Netherlands	TFYR of Macedonia
Burundi	Guinea-Bissau	Netherlands Antilles	Tajikistan
Cambodia	Guyana	New Caledonia	Thailand
Cameroon	Haiti	New Zealand	Togo
Canada	Honduras	Nicaragua	Tonga
Cape Verde	Hong Kong	Niger	Trinidad and Tobago
Central African Rep.	Hungary	Nigeria	Tunisia
Chad	Iceland	Norway	Turkey
Chile	India	Oman	Turkmenistan
China	Indonesia	Pakistan	Uganda
Colombia	Iran, Islamic Rep. of	Palau	Ukraine
Comoros	Iraq	Panama	United Arab Emirates
Congo	Ireland	Papua New Guinea	United Kingdom
Costa Rica	Israel	Paraguay	Tanzania
Cote d'Ivoire	Italy	Peru	United States
Croatia	Jamaica	Philippines	Uruguay
Cuba	Japan	Poland	Uzbekistan
Cyprus	Jordan	Portugal	Vanuatu
Czech Rep.	Kazakhstan	Qatar	Venezuela
Czechoslovakia	Kenya	Rep. of Moldova	Vietnam
Dem. Rep. of Congo	Kiribati	Romania	Yemen, Rep. of
Denmark	Korea, dem	Russia	Zambia
Djibouti	Korea, rep of	Rwanda	Zimbabwe

Table A.2 Countries considered as exporters/destinations

Albania	Czech Rep.	Lao People's Dem. Rep.	Rwanda
Algeria	Côte d'Ivoire	Latvia	Saint Kitts and Nevis
Argentina	Denmark	Libya	Saint Lucia
Armenia, Rep. of	Dominica	Liechtenstein	Saint Vincent
Aruba	Dominican Rep.	Lithuania	Sao Tome and Principe
Australia	El Salvador	Luxembourg	Senegal
Austria	Estonia	Macedonia, FYR	Serbia and Montenegro
Azerbaijan, Rep. of	Ethiopia	Madagascar	Seychelles
Bahamas, The	Fiji	Malawi	Singapore
Bahrain, Kingdom of	Finland	Malaysia	Slovak Rep.
Bangladesh	France	Maldives	Slovenia
Barbados	Gabon	Mali	Solomon Islands
Belarus	Gambia, The	Malta	South Africa
Belgium	Georgia	Martinique	Spain
Belize	Germany	Mauritius	Sri Lanka
Benin	Ghana	Mexico	Sudan
Bermuda	Greece	Moldova	Suriname
Bolivia	Grenada	Monaco	Sweden
Bosnia and Herzegovina	Guadeloupe	Mongolia	Switzerland
Brazil	Guatemala	Monserrat	Syrian Arab Rep.
British Virgin Island	Guinea	Morocco	Tajikistan
Brunei Darussalam	Guinea-Bissau	Mozambique	Tanzania
Bulgaria	Haiti	Nepal	Thailand
Burkina Faso	Honduras	Netherlands	Togo
Cambodia	Hong Kong	New Caledonia	Tonga
Cameroon	Hungary	New Zealand	Trinidad and Tobago
Canada	Iceland	Nicaragua	Tunisia
Cape Verde	India	Niger	Turkey
Central African Rep.	Indonesia	Nigeria	Turkmenistan
Chad	Iran, Islamic Rep. of	Norway	Turks and Caicos
Chile	Iraq	Oman	Uganda
China	Ireland	Panama	United Arab Emirates
Colombia	Israel	Papua New Guinea	United Kingdom
Comoros	Italy	Paraguay	United States
Congo	Jamaica	Peru	Uruguay
Congo (Dem. Rep. of the)	Japan	Poland	Vanuatu
Cook Islands	Kazakhstan	Portugal	Venezuela
Costa Rica	Kenya	Puerto Rico	Vietnam
Croatia	Korea, Rep. of	Reunion	Yemen, Rep. of
Cuba	Kuwait	Romania	Zambia
Cyprus	Kyrgyz Rep.	Russian Federation	Zimbabwe

Table A.3 Currency Unions in the sample

(Australian Dollar)	**(New Zealand Dollar)**
Australia	Cook Islands
Kiribati	New Zealand
Nauru	
	(Danish Kroner)
(Euro-since 2002)	Denmark
Austria	Feroe Islands
Belgium	Greenland
Finland	
France,	**(East Caribbean Dollar)**
Germany	Antigua & Barbuda
Greece	Dominica
Ireland	Grenada
Italy	Monserrat
Luxembourg	Saint Kitts and Nevis
Netherlands	Saint Lucia
Portugal	Saint Vincent and the Grenadines
Spain	
	(French Franc)
(US Dollar)	France
United States	French Guiana
Bahamas	Guadeloupe
Bermuda	Martinique
El Salvador	Monaco
Panama	Réunion
Puerto Rico	Saint Pierre & Miquelon
Turks and Caicos	
	(Swiss Franc)
(West African Franc)	Liechtenstein
Benin	Switzerland
Burkina Faso	
Central African Republic	**(Indian Rupee)**
Chad	Nepal
Congo	India
Cote d'Ivoire	
Equatorial Guinea	**(Comptoirs Francais du Pacifique francs)**
Gabon	New Caledonia
Guinea-Bissau	French Polynesia
Mali	
Niger	**(British Pound)**
Senegal	United Kingdom
Togo	Falkland Islands
	Gibraltar
(Brunei-Singapore Dollar)	Saint Helena
Brunei Darussalam	
Singapore	