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Intra-national home bias: New evidence from the United States commodity flow survey

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HIGHLIGHTS

- We complement and extend Wolf's (2000) work on intra-national home bias for the US
- We estimate US home bias using all waves of the Commodity Flow Survey (1993–2012).
- PPML estimates point to a less relevant presence of border effects across US States.
- However, US internal market is less commercially integrated in 2012 than in 1993.
- Despite a lower presence of border effects across US States, those are increasing over time.

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ABSTRACT

This paper estimates the US intra-national home bias in trade using Poisson Pseudo-Maximum Likelihood methodology to complement and extend Wolf's (2000) work. We use Wolf's data from the 1993 Commodity Flow Survey (CFS) and add the 1997, 2002, 2007, and 2012 waves. We claim that Wolf's home bias magnitude is overestimated due to the log-linearization of the gravity equation and the control for distance used in the cross-sectional study. Our results with panel data and latest econometric estimators show that the levels of US States home bias are in between 50% and 60% lower than in Wolf's. However, since 2002 the home bias has experienced substantial growth, which suggests that the US market is less commercially integrated in 2012 than in 1993.

1. Introduction

The home bias, also known as border effect, exists when intra-national trade exceeds international trade. McCallum (1995) estimates the magnitude of the border barriers on trade between Canada and the US concluding that a Canadian province trades 22 times more with other Canadian province than with a US State.[1] Since then, a number of theoretical and empirical studies have dealt with the notion of home bias (HB) and how to correctly estimate its magnitude using gravity models (Tinbergen, 1962).

Anderson and van Wincoop (2003) study reveals that McCallum's estimations are biased due to omitted variables and the lack of control for the multilateral resistance term. Despite its shortcomings, McCallum's contribution has fostered a new line of research to quantify the HB magnitude and its determinants (Wei, 1996; Nitsch, 2000; Anderson and van Wincoop, 2003; Chen, 2004; Martínez-San Román et al., 2012). The first wave of papers transforms the gravity equation into a log-linear form to estimate the parameters of interest by Ordinary Least Squares (OLS). More recent studies favour the use of Pseudo Poisson Maximum Likelihood (PPML) methodology (Santos-Silva and Tenreyro, 2006; Baltagi et al., 2015; Martínez-San Román et al., 2016; Piermartini and Yotov,

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[1] McCallum (1995) controls for size and distance.

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2016). Two main reasons explain the use of PPML estimators. First, the OLS estimation drops all zero trade flows between partners. Second, due to the Jensen's inequality the expected value of the log-linearized error will generally depend on the covariates, leading to biased and inconsistent OLS estimates (Santos-Silva and Tenreyro, 2006).[2]

Wolf (2000) study is the first that quantifies the home bias within a particular country. The study uses data on US inter and intra State trade flows for 1993. The study concludes that a State trades about 3 times more with himself than with a different one. It reveals how prevalent the HB in trade is even when there are no formal trade barriers across States. Millimet and Osang (2007) extend Wolf's analysis and control for internal migrations, differences in prices and wages, although, they obtaining similar results.[3]

This paper reviews and extends Wolf's study on home bias. We use a panel data approach –instead of cross-sectional analysis–adding all data waves from the Commodity Flow Survey (CFS survey). We argue that HB estimations are very sensitive to the OLS methodology and the distance measure used. We use PPML estimation applied to the gravity equation to overcome the inconsistency problems of the log-linear estimation methodologies (Santos-Silva and Tenreyro, 2006). Additionally, we use a measure of distance that is not arbitrary. We use the actual distance for the intra- and inter-State shipments computed in the 2012 CFS survey. Our distance measure accounts for the distance that those commodities actually travel instead the distance between the State's major cities (as in Wolf's).[4]

2. Econometric model

We use a structural gravity model to quantify the magnitude and evolution of inter-State border effects between 48 US States from 1993 to 2012.[5] We follow Head and Mayer (2014) baseline specification:

$$t_{ij} = \frac{Y_i}{\Pi_i}\frac{X_j}{\theta_j}\psi_{ij} \tag{1}$$

where t_{ij} is the bilateral trade between States i and j. The value of production in State i is given by Y_i. Similarly, X_j is the value of the importer's expenditure. π_i and θ_j represent the Multilateral Resistance Terms (MRT) for the exporter and the importer State, respectively, which are a key feature of the structural gravity models (Anderson and van Wincoop, 2003). ψ_{ij} is the unobserved bilateral trade barrier. For our purpose, we proxy this unobservable trade barrier as a function of observables such as the distance between both States ($Dist_{ij}$) and the home bias (HB_{ij}):

$$\psi_{ij} = \exp\left(\vartheta \ln\left(Dist_{ij}\right) + \delta HB_{ij}\right). \tag{2}$$

Introducing the bilateral trade barrier function in the structural gravity model yields to:

$$t_{ij} = \frac{Y_i}{\Pi_i}\frac{X_j}{\theta_j}\exp\left(\vartheta Ln\left(Dist_{ij}\right) + \delta HB_{ij}\right). \tag{3}$$

In order to estimate Eq. (3) we need to address two important caveats. First, we need to take into account the MRTs (π_i, θ_j). Early attempts to control for the MRTs consider the location of a state/country relative to all other states/countries, the so-called remoteness (Wei, 1996; Nitsch, 2000; Wolf, 2000). Anderson and van Wincoop (2003) argues, however, that the sole inclusion of remoteness is not sufficient to control for MRTs. They propose the use of price indices and proxy variables such as distance, adjacency and income shares. Latest studies use fixed effects – importer-time, exporter-time, country-pair – to control for the MRTs (Baltagi et al., 2003; Requena and Llano, 2010; Baltagi et al., 2015; Martínez-San Román et al., 2016; Piermartini and Yotov, 2016). Second, Santos-Silva and Tenreyro (2006) demonstrate that the estimation of the gravity equation in its log-linearized version by ordinary least squares lead to inconsistent estimates. According to these authors PPML estimation is the appropriate estimation technique to overcome the disadvantages of the log-linear specification.

To empirically assess Eq. (3) by PPML we estimate:

$$t_{ijt} = \exp\left(\beta Ln\left(Y_{it}\right) + \gamma Ln\left(X_{jt}\right) + \vartheta Ln\left(Dist_{ij}\right) + \delta_t HB_{ij} + \eta_{it} + \eta_{jt}\right) + \varepsilon_{ijt} \tag{4}$$

where t_{ijt} represents either the bilateral commodity shipments from State i to State j if $i \neq j$ or the intra-State flows if $i = j$. Y_{it} and X_{jt} are the value of aggregate production for each State (GDPs). HB_{ijt} is a dummy variable which takes the value 1 when $i = j$ (intra-State shipments) and 0 otherwise. $Dist_{ij}$ stands for the bilateral distance between origin and destination States, and η_{it} *and* η_{jt} are fixed effects that account for the multilateral resistances across States. ε_{ij} refers to the error term.

3. Data and regression results

We employ inter- and intra-State trade flows from the Commodity Flow Survey for all the waves available (1993, 1997, 2002, 2007 and 2012). State GDP data are obtained from the Bureau of Economic Analysis. Finally, we use inter- and intra-State distance available from the CFS 2012 which represent the *de facto*, or actual, average distance of inter- and intra-State commodity shipments. The remoteness indexes are constructed as in Wolf (2000).

Table 1 reports the baseline cross-section OLS estimations for each of the CFS survey years. We can compare these estimates with the ones of Wolf (2000) and Millimet and Osang (2007). We compute the home bias effect as $\exp(Home_t)$, which measures the ratio of intra-State relative to inter-State trade for a certain year.[6] Estimations for 1993 are almost identical to those reported in previous works. The size of the home bias ranges from 4.66 to 5.93 depending on the model considered. This implies that, *ceteris paribus*, intra-State trade flows are around 5 times larger than inter-State trade. These estimates lie between the ones obtained by Wolf (3.28–4.39) and Millimet and Osang (4.9–7.14). The use of panel data with five available CFS waves allows us to calculate the evolution of the home bias over time. The home bias has declined from a magnitude of 5 in 1993 to a value of 3.6 in 2012.[7] This is, a State traded 5 times more with himself than with another State in 1993. However, in 2012 intra-state trade triples inter-state trade. In other words, States are more commercially interdependent.

[2] Jensen's inequality implies that the expected value of the logarithm of a random variable is different from the logarithm of its expected value. The PPML estimator does not linearize the gravity equation, therefore it takes into account both zero trade values and Jensen's inequality.

[3] Other studies that focus on intra-national home bias for different economies include Combes et al. (2005) and Wolf (2009) for the French and German cases. Requena and Llano (2010) quantify the home bias for the Spanish case and find a great home bias variation depending of the productive sector.

[4] See Hillberry and Hummels (2008) for further explanation on the convenience of using actual distances.

[5] Alaska, Hawaii, and Washington D.C. are not included in the study due to data quality and lack of availability. Data in current dollars has been deflated using the GDP deflator of the State for the different years from Bureau of Economic Analysis.

[6] Small HB values indicate that intra-State trade has low weight relative to inter-State trade.

[7] Results might be sensitive to the inter- and intra-State distance measure. In Table 1 we compute inter-state distance as the minimum bilateral distance between the largest city for every State (using google maps); intra-state distance is calculated as one-half the distance between a State and its closest neighbouring State. This particular measure make our results fully comparable to those reported by previous studies.