STRUCTURAL GRAVITY AND TRADE AGREEMENTS: DOES THE MEASUREMENT OF DOMESTIC TRADE MATTER?

2021

BANCO DE ESPAÑA
Eurosistema

Documentos de Trabajo
N.º 2117

Rodolfo G. Campos, Jacopo Timini and Elena Vidal

STRUCTURAL GRAVITY AND TRADE AGREEMENTS: DOES THE MEASUREMENT OF DOMESTIC TRADE MATTER?

STRUCTURAL GRAVITY AND TRADE AGREEMENTS: DOES THE MEASUREMENT OF DOMESTIC TRADE MATTER? (*)

Rodolfo G. Campos, Jacopo Timini and Elena Vidal

BANCO DE ESPAÑA

(*) In writing this paper we have benefited from comments by an anonymous referee and by seminar participants at Banco de España. The views expressed in this paper are those of the authors and do therefore not necessarily reflect those of the Banco de España or the Eurosystem.
Banco de España, Alcala, 48, 28014 Madrid, Spain; emails: rodolfo.campos@bde.es; jacopo.timini@bde.es; elena.vidal@bde.es.

Documentos de Trabajo. N.º 2117

April 2021

The Working Paper Series seeks to disseminate original research in economics and finance. All papers have been anonymously refereed. By publishing these papers, the Banco de España aims to contribute to economic analysis and, in particular, to knowledge of the Spanish economy and its international environment.

The opinions and analyses in the Working Paper Series are the responsibility of the authors and, therefore, do not necessarily coincide with those of the Banco de España or the Eurosystem.

The Banco de España disseminates its main reports and most of its publications via the Internet at the following website: http://www.bde.es.

ISSN: 1579-8666 (on line)

Abstract

Economic theory suggests including domestic trade flows when estimating structural gravity models. The inclusion of domestic trade flows helps to identify parameters that cannot be estimated with international trade flows alone. The complication is that domestic trade flows can be measured empirically in different ways. Does it matter which one is used? We compare the three most common approaches to measuring domestic trade and show that they lead to very similar estimates of the parameters that are usually estimated within a structural gravity framework.

Keywords: international trade, structural gravity model, domestic trade, trade agreements.

JEL classification: F13, F14, F15, F62.

Resumen

La teoría económica sugiere incluir el comercio interno al estimar un modelo de gravedad estructural. Esta inclusión permite identificar parámetros que no pueden ser estimados si tomamos en consideración solamente los flujos de comercio internacional. Sin embargo, el comercio interno puede medirse de diferentes maneras. ¿La elección del método tiene relevancia? En este trabajo comparamos los tres enfoques más comunes para medir el comercio interno y demostramos que no implican diferencias en las estimaciones de los parámetros propios de los modelos de gravedad estructurales.

Palabras clave: comercio internacional, modelo de gravedad estructural, comercio interno, acuerdos comerciales.

Códigos JEL: F13, F14, F15, F62.

1 Introduction

Gravity models are widely used to analyze trade policy, as they empirically relate trade between countries to economic size and to the underlying trade costs. In the past, these models have been estimated using data on international trade flows only, but a number of recent papers stress the importance of including intra-national (i.e., domestic) trade flows as well. The advantages of doing so are discussed at length by Yotov et al. (2016) and Yotov (2021). Three reasons are particularly relevant for this paper. First, the inclusion of domestic trade allows to estimate the effect of trade agreements, taking into account domestic-to-international trade diversion and controlling for other wider economic integration processes (Dai et al., 2014; Bergstrand et al., 2015; Borchert and Yotov, 2017; Anderson and Yotov, 2020).[1] Second, the presence of domestic trade enables the estimation of the effects of non-discriminatory trade policies, such as most favored nation (MFN) tariffs, which are otherwise collinear with various fixed effects usually included in the regression (Yotov et al., 2016; Heid et al., 2021).[2] Third, domestic trade is an input for the calculation of country-level gains from trade using the formula by Arkolakis et al. (2012), and also enters the estimation of the trade elasticity.

Because there are no readily available internationally comparable statistics on domestic trade, economists choose between three approaches to construct domestic trade flows.[3] The first approach consists in calculating domestic trade as the difference between GDP and total exports, a measure widely available across countries and time. The main shortcoming of using GDP is that it measures value-added and does not account for intermediate consumption, whereas exports are measured in gross terms. In the second approach, domestic trade is obtained by subtracting total exports from total gross production, avoiding the inconsistency of relating value added to a gross measure. The third approach uses information from input-output tables and provides a better approximation to domestic and foreign value-added when the production network is internationally fragmented, as argued by Timmer et al. (2015).

In this paper, we compare how using the three alternative measures of domestic trade affects the estimates of the coefficients related to trade policy in a typical structural gravity model. Our results show that all three ways of calculating domestic trade flows yield very similar overall results. More precisely, the estimates of both the partial effect of trade agreements and the trade elasticity are very close across methods.

[1] A trade agreement changes the relative costs of a domestic producer in two ways: first, by altering the costs of exporting to members relative to non-members; second, by changing the costs of selling to the domestic market relative to international members.

[2] For a description of theory-consistent fixed effects, and their motivation, see Anderson and van Wincoop (2003) and Yotov et al. (2016).

[3] An additional issue that we do not address in this paper is that of trade between regions within a country. At the sub-national level there has been some progress in compiling such statistics for specific countries. For example, Canada (Anderson et al., 2014; Agnosteva et al., 2019) and Spain (Llano et al., 2010) are two prominent examples.

2 Theory, empirical strategy, and data

2.1 Theory

We use a generic structural gravity model described by the following standard system of equations (Anderson and van Wincoop, 2003; Head and Mayer, 2014; Yotov et al., 2016):

$$X_{ij} = \frac{Y_i}{\Omega_i}\frac{E_j}{\Pi_j}\theta_{ij}, \tag{1}$$

$$\Omega_i = \sum_k \frac{E_k}{\Pi_k}\theta_{ik}, \tag{2}$$

$$\Pi_j = \sum_k \frac{Y_k}{\Omega_k}\theta_{kj}, \tag{3}$$

where X_{ij} denotes bilateral gross trade flows between exporter i and importer j, including the case $i = j$, which identifies domestic trade flows. The aggregate $Y_i \equiv \sum_k X_{ik}$ denotes total production in country i and $E_j \equiv \sum_k X_{kj}$ total expenditure in country j. The expressions Ω_i and Π_j are the outward and inward multilateral resistance terms. They can be interpreted as a measure of the exporter's access to foreign markets and the degree of competition in the importer's market (Fally, 2015). Finally, θ_{ij} includes all bilateral trade costs that potentially hinder trade between exporter i and importer j.

We compute domestic trade flows X_{ii} according to the three methods most commonly used in the literature: by relying on GDP, on gross output, and on input-output tables.

GDP-based method

In the first method, domestic trade is calculated as follows:

$$X_{ii} = GDP_i - \sum_{j \neq i} X_{ij}. \tag{4}$$

In this case, domestic trade equals the difference between the GDP of the exporter and the sum of all its bilateral exports to the world $\sum_{j \neq i} X_{ij}$. This approach has been used by Yotov (2012), El Dahrawy Sánchez-Albornoz and Timini (2021), and Timini and Viani (2020), among others.[4] The main advantage of using the GDP-based method is the wider country and time coverage and the main disadvantage is that GDP measures value added whereas trade flows are measured in gross terms.

Production-based method

The second method replaces GDP with gross production:

$$X_{ii} = PROD_i - \sum_{j \neq i} X_{ij}. \tag{5}$$

In this method, domestic trade is the difference between gross production in the exporting country $PROD_i$ and the sum of all its bilateral international exports $\sum_{j \neq i} X_{ij}$. This approach

[4] In principle, the difference between GDP and gross exports could yield a negative value for domestic trade because GDP is a value-added measure. However, this does not arise in our sample. The usual approach in the literature when this occurs has been to either drop negative values or to transform domestic trade data, so that the negative numbers are eliminated (for example, by interpolating positive values).

has been used by, for example, Baier et al. (2019), Larch et al. (2019), Borchert et al. (2020), Felbermayr et al. (2020), and Timini et al. (2020). The advantage of using gross production instead of GDP is that both production and export data are reported in gross terms (instead of value added). They are also available for a wider set of countries and sectors than input-output tables. Moreover, they are usually directly available in administrative datasets that involve no prior estimation step. It has been argued, for example by Borchert et al. (2020), that this makes them preferable for estimation purposes.

Input-output tables

In the third method, domestic trade is a sum of elements taken directly from input-output tables. Let $Z^I_{ijk\ell}$ denote the gross output of industry k in country i that is used as an intermediate input by industry ℓ in country j. The variable Z^F_{ijk} denotes gross output of industry k in country i that is delivered to final consumers in country j. Domestic trade X_{ii} can then be calculated as the sum of two components. The first component contains gross output sold within country i as intermediate input, summing over all domestic industries that supply it and all domestic industries that demand it. The second component contains domestic gross output that is sold to final consumers within the country. Stated formally:

$$X_{ii} = \sum_k \sum_\ell Z^I_{iik\ell} + \sum_k Z^F_{iik}. \tag{6}$$

This last approach has been used by Larch et al. (2018), Felbermayr et al. (2018), Felbermayr and Steininger (2019), among others. The main advantage of using input-output tables is that they directly capture transactions across sectors in the domestic economy. However, they have often been "constructed" by resorting to estimation methods (Yotov, 2021). This last characteristic renders their use for further estimation (rather than simulation) steps somewhat questionable (Borchert et al., 2020). Also, input-output tables are not available for many countries or years.

2.2 Empirical strategy

If the static system of equations (1)–(3) holds for all periods (years) t, then economic theory implies an estimating equation of the form:

$$X_{ijt} = \exp(\delta_{it} + \gamma_{jt} + b_{ijt}) + \varepsilon_{ijt}. \tag{7}$$

The dependent variable X_{ijt} denotes gross bilateral trade flows between the exporter i and importer j in year t. The special case $i = j$ corresponds to domestic trade. The variables δ_{it} and γ_{jt} are exporter-time and importer-time dummy variables. From the standpoint of economic theory, they account for the multilateral trade resistances defined by equations (2) and (3). In the estimation, they absorb features that vary at the country-year level, such as GDP, per-capita GDP, population, etc. The variable b_{ijt} encloses all bilateral trade costs modeled by θ in the theory and ε_{ijt} is an error term in the estimation.

In our specifications, bilateral trade costs b_{ijt} include both time-invariant and time-varying components of bilateral trade costs. Among the time-invariant components, in our initial specification we use the usual cultural and geographical distance variables (common language, distance, contiguity, and colonial relationship). In later specifications we absorb the distance variables using directional pair fixed effects. This latter option addresses the endogeneity of trade policy in a flexible way, as done by Baier and Bergstrand (2007), while also allowing for asymmetric trade costs (Waugh, 2010). In addition to the time-invariant components, we consider two sets of time-varying trade costs. The first set consists of various trade agreement indicators. The coefficient on these indicators measures the semi-elasticity of bilateral trade flows with respect to the presence of a trade agreement. In a second set of results, we focus on the effects of most favored nation (MFN) tariffs, a non-discriminatory trade policy. We construct the variable of interest as $\ln(1 + \tau_{ijt})$, where $\tau_{ijt} \geq 0$ is the tariff rate paid by imports to country j (exported from any country i) in year t. Tariffs for domestic trade flows are zero and for international trade flows they vary only by importer and year. For this specification, the coefficient of interest can be interpreted as a trade elasticity.

As is standard in the literature, we apply a Poisson pseudo-maximum likelihood (PPML) estimator (Santos Silva and Tenreyro, 2006), which allows to properly cope with zero trade values and heteroskedasticity, a typical feature of trade data.

2.3 Data sources

International trade data are from the OECD Trade in Value Added (TIVA) database and correspond to gross export values. Domestic trade flows are calculated as described in Section 2.1. Depending on the methodology used, we use GDP data from the World Bank World Development Indicators (WDI), gross production data from OECD TIVA database, and input-output table data from World Input-Output Database (WIOD). For the sum of all bilateral trade, we rely on the precompiled statistics contained in the OECD TIVA database, namely exports of country i to "the world". In this way, we avoid potential biases arising from missing bilateral data. Finally, we use two main data sources for trade policy variables: we retrieve trade agreements from the 2017 version of the Baier-Bergstrand EIA database, whereas tariff levels are from the World Bank WDI. We take the cultural and geographical distance variables (weighted distance, common language, colonial relationship, contiguity) from the CEPII database.

The final sample is determined by the availability of domestic trade data according to the three alternative methods, i.e., by the overlap among the three different databases used in the computations (WDI for GDP, TIVA for gross production, and WIOD for input-output tables). Our sample covers 39 countries over a 17-year period (1995–2011).[5]

2.4 Data description

The three different ways of calculating domestic trade lead to noticeable differences in the data. In general, the GDP-based measure tends to deliver a higher level of domestic trade than the other two methods and the TIVA and WIOD measures are more alike, also in their time-series properties. In Table 1 we report a measure of the co-movement between the three domestic trade series. We take the logarithm of domestic trade flows and compute correlations of first-differenced data. The correlation between TIVA and WIOD, at 0.88, is roughly 10 points higher than the correlation of the GDP-based measure with each of the other two measures.

The volatility of domestic trade flows does not differ much across computation methods. Compared to international trade flows, domestic trade flows are less volatile. In our data, standard deviations of the growth rate of domestic trade are roughly one third of those of

[5] The data appendix reports the full list of countries included.

Table 1: Co-movement of domestic trade measures across datasets

	Data			Residuals		
	GDP	TIVA	WIOD	GDP	TIVA	WIOD
GDP	1.0000			1.0000		
TIVA	0.8125	1.0000		0.9172	1.0000	
WIOD	0.7784	0.8848	1.0000	0.9054	0.9403	1.0000

Notes: The table reports correlations between different measures of domestic trade flows. In the three columns on the left, correlations are computed on first-differenced log-levels of domestic trade flows. In the three columns on the right, correlations are calculated on the first-differenced residuals from a regression of log-trade flows from each dataset on exporter-year, importer-year and exporter-importer dummy variables.

international trade in all three computations. The composition of the variation in the data is relatively more tilted towards variation within country pairs relative to variation across country pairs. The ratio of within to between variation in international trade flows is 5.0 whereas for domestic trade this ratio is slightly lower, at 4.7, and similar in all three computation methods for domestic trade.

3 Results

3.1 Gravity variables

To take a first stab at the problem, we first study how the different methods of obtaining domestic trade affect the estimated impact of the usual gravity variables: distance, colonial relationship, common language and contiguity. The results from this estimation are shown in Table 2. All specifications include exporter-year fixed effects and importer-year fixed effects. The results shown in the first column are from a regression that excludes domestic trade observations and the remaining columns from regressions that include them. The inclusion of domestic trade raises the estimated impact of distance and common language and lowers that of contiguity. It also allows to separately identify the impact of international borders and, for this variable, it seems that the different measurements of domestic trade seem to matter: it is larger for the GDP-based measure than for the other two. The point estimate of having a common language is lower in the GDP-based measure whereas the remaining cultural and geographical distance variables are close to each other across measurements. The last three columns show results from allowing the border effect to change over time. These results show a slightly weaker trend for the GDP-based measure than for the other two.

3.2 Trade agreements

We now turn to the impact of trade policies, the main focus of this paper. In Table 3 we exhibit the results from regressing trade flows on trade agreement dummy variables. In this specification, and in all that follow, we replace all time-invariant bilateral variables (e.g., distance) with directional pair fixed effects. Their inclusion is a standard practice to reduce the potential bias stemming from the endogeneity of trade policies. The first column shows results from an estimation that excludes domestic trade flows, the next three columns include domestic trade flows calculated using the three different methods, and the last three columns repeat the estimations with domestic trade for a more granular classification of trade agreements.[6]

Table 2: Cultural and geographical distance

VARIABLES	(1) w/o domestic trade	(2) GDP	(3) TIVA	(4) WIOD	(5) GDP	(6) TIVA	(7) WIOD
log(distance)	-0.888***	-0.934***	-0.938***	-0.930***	-0.934***	-0.938***	-0.930***
	(0.0576)	(0.0687)	(0.0799)	(0.0822)	(0.0686)	(0.0807)	(0.0830)
Colonial relationship	-0.149	-0.0133	0.0807	0.0814	-0.0126	0.0836	0.0842
	(0.128)	(0.110)	(0.114)	(0.120)	(0.110)	(0.114)	(0.120)
Same language	0.209	0.304***	0.452***	0.436***	0.305***	0.455***	0.439***
	(0.127)	(0.101)	(0.106)	(0.105)	(0.101)	(0.109)	(0.109)
Contiguous	0.404***	0.249***	0.284***	0.319***	0.251**	0.284***	0.319***
	(0.0995)	(0.0933)	(0.0818)	(0.0880)	(0.103)	(0.0992)	(0.108)
Intl. border		-3.178***	-2.622***	-2.565***	-3.065***	-2.532***	-2.476***
		(0.168)	(0.135)	(0.154)	(0.177)	(0.143)	(0.160)
INTL × 1995					-0.255***	-0.308***	-0.326***
					(0.0626)	(0.0306)	(0.0327)
INTL × 1996					-0.250***	-0.297***	-0.317***
					(0.0628)	(0.0312)	(0.0335)
INTL × 1997					-0.190***	-0.229***	-0.249***
					(0.0643)	(0.0325)	(0.0350)
INTL × 1998					-0.201***	-0.195***	-0.202***
					(0.0667)	(0.0311)	(0.0336)
INTL × 1999					-0.170**	-0.154***	-0.164***
					(0.0685)	(0.0342)	(0.0368)
INTL × 2000					-0.0645	-0.0775**	-0.0905**
					(0.0644)	(0.0386)	(0.0406)
INTL × 2001					-0.123**	-0.0961***	-0.108***
					(0.0519)	(0.0297)	(0.0320)
INTL × 2002					-0.170***	-0.103***	-0.108***
					(0.0425)	(0.0277)	(0.0281)
INTL × 2003					-0.174***	-0.0957***	-0.0940***
					(0.0286)	(0.0217)	(0.0206)
INTL × 2004					-0.121***	-0.0607***	-0.0480***
					(0.0265)	(0.0208)	(0.0185)
INTL × 2005					-0.0998***	-0.0611***	-0.0421***
					(0.0295)	(0.0200)	(0.0162)
INTL × 2006					-0.0465	-0.0214	-0.00326
					(0.0332)	(0.0182)	(0.0138)
INTL × 2007					-0.0335	-0.0238*	-0.00432
					(0.0326)	(0.0134)	(0.00901)
INTL × 2008					-0.0174	-0.0244*	0.00129
					(0.0351)	(0.0131)	(0.00913)
INTL × 2009					-0.255***	-0.138***	-0.156***
					(0.0394)	(0.0103)	(0.0132)
INTL × 2010					-0.0983**	-0.0503***	-0.0698***
					(0.0461)	(0.0162)	(0.0213)
Observations	41,106	41,769	41,769	41,769	41,769	41,769	41,769

Notes: Regressions estimated by PPML. Bilateral trade flows are the dependent variable in all specifications. Observations are indexed by exporter, importer and year. Explanatory variables are the logarithm of distance, dummy variables for being in a colonial relationship, using the same language, being contiguous, and whether trade flows over an international border. This last variable is also interacted with time in the last three columns. The variables INTL×year indicate the interaction with a year dummy. The excluded category is the interaction with the year 2011. All specifications include exporter-year and importer-year dummy variables. The first column excludes observations with domestic trade. The remaining columns use domestic trade constructed according to the three methodologies described in the text. Standard errors reported in parentheses are clustered by exporter, importer and year. The superscript *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

[6]In the more granular classification, the trade agreements are classified into one-way preferential trade agreements (GSP), two-way preferential trade agreements (PTA), free trade agreements (FTA), customs unions (CU), common markets (CM), and economic unions (ECU).

Table 3: Trade agreements

VARIABLES	(1) w/o domestic trade	(2) GDP	(3) TIVA	(4) WIOD	(5) GDP	(6) TIVA	(7) WIOD
TA (BB)	-0.0107	0.292***	0.280***	0.294***			
	(0.0437)	(0.0917)	(0.0784)	(0.0806)			
GSP					0.162*	0.140	0.153
					(0.0845)	(0.0864)	(0.0981)
PTA					0.423***	0.377***	0.394***
					(0.164)	(0.143)	(0.141)
FTA					0.235***	0.250***	0.262***
					(0.0603)	(0.0538)	(0.0577)
CU					0.692***	0.800***	0.880***
					(0.130)	(0.127)	(0.155)
CM					0.637***	0.689***	0.768***
					(0.108)	(0.110)	(0.117)
ECU					0.653***	0.779***	0.895***
					(0.123)	(0.125)	(0.129)
Observations	40,919	41,582	41,582	41,582	41,582	41,582	41,582

Notes: Regressions estimated by PPML. Bilateral trade flows are the dependent variable in all specifications. Observations are indexed by exporter, importer and year. Explanatory variables are dummy variables for any kind of trade agreement (TA (BB)) and for specific types of trade agreements in the Baier-Bergstrand database. All specifications include exporter-year, importer-year and exporter-importer dummy variables. The first column excludes observations with domestic trade. The remaining columns use domestic trade constructed according to the three methodologies described in the text. Standard errors reported in parentheses are clustered by exporter, importer and year. The superscript *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

When domestic trade is excluded from the specification, the average effect of a trade agreement on trade flows is economically insignificant and statistically not different from zero. In line with the prior results by Dai et al. (2014), once domestic trade is included, the effect becomes larger and economically significant, capturing the trade diversion from domestic to international trade.

The inclusion of domestic trade has a noticeable effect on the estimates but how they are calculated does not; the estimates in columns 2–4 are strikingly similar across computation methods. When we use the more granular specification shown in columns 5–7, we find larger impacts for certain types of trade agreement but again coefficients for the different computation methods are similar, and statistically indistinguishable. In all cases, the confidence interval for any given computation method contains the point estimates of the other two computation methods.

The possible reason behind these similar results is that most of the differences in computation methods might be captured by the exporter-year, importer-year and exporter-importer dummy variables, which are prevalent in structural gravity estimations. To check this explanation, in the panel on the right of Table 1, we report the correlations of the first-differenced residuals from a regression of log-trade flows from each dataset on exporter-year, importer-year and exporter-importer dummy variables. The correlations between these residuals exceed 0.90 in all cases, indicating that the remaining variation in the three datasets becomes very similar after purging the various fixed effects.

In Table 4 we repeat the estimations for trade agreements adding interactions of an international border dummy with year dummies to the specification, to take into account the potential effect of a world-wide common globalization trend. The ability to do so is one of the advantages of using domestic trade flows. As expected, the estimated impact of trade agreements is generally lower when this variable is added, given that it absorbs common globalization patterns (Bergstrand et al., 2015). Its estimates indeed reflect decreasing border effects over the period, as well as an increase in trade costs in recession years (2001–2002 and 2009). The GDP-based method yields a somewhat smaller estimate for the globalization trend whereas the other two methods roughly coincide. For example, taking the first year of the sample, trade flows in 1995 were on average 24% lower than in 2011 according to the GDP-based measure, 35% lower according to TIVA, and 38% lower according to WIOD. However, all three methods deliver estimates that are even closer than those obtained in Table 2 for the various types of trade agreement.

3.3 Trade elasticity

Table 5 shows the estimation of the trade elasticity parameter using tariff data according to the different methods. In columns 1–3 we report the results from using non-weighted tariffs and in columns 4–6 those from using tariffs weighted by the product share of each importer. The GDP-based measure delivers the lowest point estimates, followed by TIVA, and WIOD delivers the highest estimates. However, these coefficients are not estimated with enough precision to rule out that the estimates are, in fact, similar. As shown in Table 6, adding interactions of international border and year dummies increases the elasticity estimated from the GDP-based measure and decreases the other two, but point estimates for each individual method lie (again) within the confidence intervals of the other two.

3.4 Welfare impact

As a final exercise we translate the differences in estimates into a welfare measure using the formula by Arkolakis et al. (2012). According to this well-known formula, the welfare impact from a change in trade policy can be calculated from the resulting change in domestic trade flows and the trade elasticity:

$$\frac{\Delta W_i}{W_i} = \left(1 + \frac{\Delta \lambda_{ii}}{\lambda_{ii}}\right)^{1/\epsilon} - 1, \tag{8}$$

where W_i denotes welfare in country i, $\lambda_{ii} \equiv \frac{X_{ii}}{E_i}$ is the share of domestic trade flows in country i, and $\epsilon < 0$ is the trade elasticity.

To obtain the largest possible impact, we compute the welfare impact from eliminating all trade agreements in the world using estimated trade impacts and trade elasticities appropriate for each of the three computations of domestic trade. We apply this formula to the results that arise in general equilibrium and compute the general equilibrium trade impacts of the counterfactual scenario in a way that is standard in the trade literature.[7]

[7] We do not describe the details of the procedure here. A good description of the steps involved in obtaining the general equilibrium trade impacts of counterfactual experiments can be found in Section 4.3 of the handbook chapter by Head and Mayer (2014).

Table 4: Trade agreements and the globalization trend

VARIABLES	(1) w/o domestic trade	(2) GDP	(3) TIVA	(4) WIOD	(5) GDP	(6) TIVA	(7) WIOD
TA (BB)	-0.0107	0.240***	0.186***	0.188***			
	(0.0437)	(0.0679)	(0.0544)	(0.0538)			
GSP					0.174**	0.164***	0.179***
					(0.0685)	(0.0586)	(0.0656)
PTA					0.361***	0.246**	0.248**
					(0.128)	(0.106)	(0.101)
FTA					0.175***	0.147***	0.148***
					(0.0417)	(0.0346)	(0.0355)
CU					0.565***	0.577***	0.634***
					(0.0930)	(0.0858)	(0.0935)
CM					0.482***	0.433***	0.485***
					(0.101)	(0.0866)	(0.0940)
ECU					0.370**	0.306**	0.382***
					(0.153)	(0.126)	(0.132)
INTL x 1995		-0.268***	-0.419***	-0.475***	-0.270***	-0.425***	-0.472***
		(0.0826)	(0.0684)	(0.0757)	(0.100)	(0.0803)	(0.0891)
INTL x 1996		-0.267***	-0.400***	-0.452***	-0.273***	-0.410***	-0.453***
		(0.0841)	(0.0685)	(0.0775)	(0.101)	(0.0805)	(0.0907)
INTL x 1997		-0.206**	-0.332***	-0.376***	-0.210**	-0.340***	-0.376***
		(0.0842)	(0.0665)	(0.0777)	(0.100)	(0.0781)	(0.0899)
INTL x 1998		-0.204**	-0.306***	-0.343***	-0.209**	-0.314***	-0.342***
		(0.0839)	(0.0681)	(0.0807)	(0.101)	(0.0800)	(0.0929)
INTL x 1999		-0.197**	-0.282***	-0.321***	-0.179**	-0.265***	-0.301***
		(0.0858)	(0.0702)	(0.0834)	(0.0889)	(0.0715)	(0.0843)
INTL x 2000		-0.102	-0.202***	-0.235***	-0.0843	-0.186***	-0.216***
		(0.0819)	(0.0660)	(0.0787)	(0.0853)	(0.0677)	(0.0798)
INTL x 2001		-0.162**	-0.215***	-0.245***	-0.146*	-0.200***	-0.227***
		(0.0773)	(0.0602)	(0.0733)	(0.0818)	(0.0626)	(0.0751)
INTL x 2002		-0.203***	-0.208***	-0.234***	-0.187***	-0.192***	-0.215***
		(0.0643)	(0.0480)	(0.0603)	(0.0689)	(0.0505)	(0.0624)
INTL x 2003		-0.191***	-0.187***	-0.209***	-0.174***	-0.170***	-0.189***
		(0.0398)	(0.0286)	(0.0388)	(0.0457)	(0.0319)	(0.0422)
INTL x 2004		-0.128***	-0.137***	-0.150***	-0.128***	-0.136***	-0.149***
		(0.0222)	(0.0159)	(0.0253)	(0.0252)	(0.0180)	(0.0284)
INTL x 2005		-0.0988***	-0.120***	-0.126***	-0.0983***	-0.119***	-0.124***
		(0.0137)	(0.00861)	(0.0133)	(0.0144)	(0.00954)	(0.0166)
INTL x 2006		-0.0385***	-0.0703***	-0.0709***	-0.0379***	-0.0691***	-0.0691***
		(0.0119)	(0.00479)	(0.00773)	(0.00931)	(0.00534)	(0.0112)
INTL x 2007		-0.0113	-0.0529***	-0.0536***	-0.0134	-0.0543***	-0.0549***
		(0.0193)	(0.00875)	(0.00906)	(0.0152)	(0.00979)	(0.0112)
INTL x 2008		0.00951	-0.0391***	-0.0269***	0.00706	-0.0407***	-0.0285***
		(0.0133)	(0.00738)	(0.00881)	(0.0114)	(0.00714)	(0.0101)
INTL x 2009		-0.242***	-0.147***	-0.174***	-0.245***	-0.149***	-0.175***
		(0.00962)	(0.00763)	(0.0102)	(0.00959)	(0.00771)	(0.0102)
INTL x 2010		-0.0937***	-0.0522***	-0.0728***	-0.0939***	-0.0522***	-0.0727***
		(0.0166)	(0.0127)	(0.0199)	(0.0165)	(0.0136)	(0.0189)
Observations	40,919	41,582	41,582	41,582	41,582	41,582	41,582

Notes: Regressions estimated by PPML. Bilateral trade flows are the dependent variable in all specifications. Observations are indexed by exporter, importer and year. Explanatory variables are dummy variables for any kind of trade agreement (TA (BB)) and for specific types of trade agreements in the Baier-Bergstrand database. The variables INTL×year indicate the interaction of a dummy variable denoting international trade flows and a year dummy. The excluded category is the interaction with the year 2011. All specifications include exporter-year, importer-year and exporter-importer dummy variables. The first column excludes observations with domestic trade. The remaining columns use domestic trade constructed according to the three methodologies described in the text. Standard errors reported in parentheses are clustered by exporter, importer and year. The superscript *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

We use the estimates from tables 4 (columns 5–7) and 5 (columns 4–6) and calculate general equilibrium effects for the year 2011 from simulating the disappearance of all trade agreements. Because the general equilibrium computation also depends on the actual domestic trade flows (through the initial conditions for λ_{ii} from which trade the counterfactual deviates), and not just the estimates of the trade elasticity and the impact of trade policy, we first compute the welfare changes setting domestic trade flows to the values from WIOD for all three cases.

Results do not differ much across estimations—at least for the median country; we calculate that removing all trade agreements would reduce welfare in the median country by 1.47% in the GDP-based measure and by 1.09% and 1.15%, respectively, in the TIVA and WIOD-based measures. As expected, welfare losses for larger countries are mostly negligible regardless of which dataset is used for the estimations, but welfare losses for smaller countries, which also

Table 5: Trade elasticities

VARIABLES	(1) GDP	(2) TIVA	(3) WIOD	(4) GDP	(5) TIVA	(6) WIOD
TA (BB)	0.134***	0.0934**	0.0925**	0.118**	0.0845**	0.0825**
	(0.0480)	(0.0414)	(0.0420)	(0.0464)	(0.0411)	(0.0420)
Tariff	-7.445***	-9.400***	-10.17***			
	(2.563)	(1.885)	(2.046)			
Tariff (weighted)				-6.888***	-8.144***	-8.863***
				(2.106)	(1.453)	(1.520)
Observations	38,657	38,657	38,657	38,657	38,657	38,657

Notes: Regressions estimated by PPML. Bilateral trade flows are the dependent variable in all specifications. Observations are indexed by exporter, importer and year. Explanatory variables are dummy variables for any kind of trade agreement (TA (BB)) from the Baier-Bergstrand database and the natural logarithm of $(1+\tau)$ where τ is the tariff rate in a given year. Tariffs are taken from the World Bank's WDI. We report results for the average of effectively applied tariffs and for tariffs weighted by the product import share of each importer. All specifications include exporter-year, importer-year and exporter-importer dummy variables. The different columns use domestic trade constructed according to the three methodologies described in the text. Standard errors reported in parentheses are clustered by exporter, importer and year. The superscript *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

tend to be those most open to international trade, are sizable. For smaller countries, differences between datasets sometimes have a more noticeable effect. For example, Luxembourg, the most affected country in all three datasets, is estimated to suffer a welfare loss of 5.73% in the GDP-based measure, and of 4.15% and 4.64% using the estimates derived from the TIVA and WIOD datasets, respectively.

Using also trade flows from the three different datasets adds another layer of heterogeneity (although this added heterogeneity is unrelated to differences in the estimation of the parameters of the structural gravity model, the main focus of our paper). If trade flows for the year 2011 are taken for each dataset, then the GDP-based measure tends to deliver lower results (because it leads to higher levels of domestic trade, and therefore more closed economies). For the median country, the GDP-based measure delivers an estimated welfare loss of 0.63%, followed by TIVA (1.06%) and WIOD (1.15%).[8]

[8] For smaller countries, there are larger differences again, but the three datasets do not agree on which country is most affected.

Table 6: Trade elasticities with a globalization trend

VARIABLES	(1) GDP	(2) TIVA	(3) WIOD	(4) GDP	(5) TIVA	(6) WIOD
TA (BB)	0.125***	0.0888**	0.0904**	0.0981**	0.0765*	0.0780*
	(0.0473)	(0.0416)	(0.0414)	(0.0441)	(0.0407)	(0.0409)
Tariff	-9.942***	-8.805***	-8.859***			
	(2.611)	(2.064)	(2.091)			
Tariff (weighted)				-9.914***	-7.866***	-7.960***
				(2.396)	(1.890)	(1.919)
INTL × 1995	0.131	-0.0627	-0.122	0.188*	-0.0450	-0.104
	(0.0879)	(0.0708)	(0.0773)	(0.0966)	(0.0791)	(0.0866)
INTL × 1996	0.0170	-0.145***	-0.194***	0.0915	-0.112*	-0.161**
	(0.0706)	(0.0557)	(0.0687)	(0.0750)	(0.0623)	(0.0782)
INTL × 1997	0.0228	-0.125***	-0.164**	0.0747	-0.105**	-0.145**
	(0.0620)	(0.0468)	(0.0640)	(0.0585)	(0.0470)	(0.0635)
INTL × 1998	0.0451	-0.0820**	-0.111*	0.0757	-0.0771*	-0.105*
	(0.0548)	(0.0413)	(0.0588)	(0.0514)	(0.0427)	(0.0633)
INTL × 1999	0.0550	-0.0552	-0.0902	0.0165	-0.107***	-0.143**
	(0.0565)	(0.0393)	(0.0572)	(0.0523)	(0.0398)	(0.0593)
INTL × 2000	0.108*	-0.0121	-0.0403	0.0935**	-0.0409	-0.0693
	(0.0555)	(0.0439)	(0.0625)	(0.0465)	(0.0396)	(0.0617)
INTL × 2001	0.0837	0.00444	-0.0224	0.0859**	-0.0149	-0.0411
	(0.0511)	(0.0372)	(0.0532)	(0.0433)	(0.0363)	(0.0563)
INTL × 2002	-0.0700	-0.0867**	-0.109*	-0.0882**	-0.113***	-0.137***
	(0.0480)	(0.0400)	(0.0561)	(0.0426)	(0.0343)	(0.0508)
INTL × 2003	-0.0644*	-0.0693**	-0.0879*	-0.0474*	-0.0669***	-0.0862**
	(0.0384)	(0.0332)	(0.0463)	(0.0288)	(0.0251)	(0.0402)
INTL × 2004	-0.0430**	-0.0571***	-0.0688**	-0.0570***	-0.0756***	-0.0887***
	(0.0195)	(0.0193)	(0.0282)	(0.0163)	(0.0163)	(0.0255)
INTL × 2005	-0.0366**	-0.0648***	-0.0698***	-0.0461***	-0.0787***	-0.0853***
	(0.0163)	(0.0155)	(0.0188)	(0.0167)	(0.0151)	(0.0185)
INTL × 2006	0.00953	-0.0279**	-0.0283**	-0.0190	-0.0566***	-0.0594***
	(0.0161)	(0.0141)	(0.0131)	(0.0160)	(0.0117)	(0.0149)
INTL × 2007	0.0164	-0.0286**	-0.0295***	0.0106	-0.0369***	-0.0395***
	(0.0205)	(0.0132)	(0.0103)	(0.0201)	(0.0132)	(0.0130)
INTL × 2008	0.0266*	-0.0243***	-0.0123	-0.00173	-0.0497***	-0.0395**
	(0.0136)	(0.00905)	(0.00976)	(0.0168)	(0.0138)	(0.0165)
INTL × 2009	-0.235***	-0.143***	-0.169***	-0.251***	-0.159***	-0.185***
	(0.0104)	(0.00902)	(0.0105)	(0.0130)	(0.0165)	(0.0144)
INTL × 2010	-0.0878***	-0.0498***	-0.0704***	-0.0955***	-0.0580***	-0.0789***
	(0.0130)	(0.0107)	(0.0175)	(0.0150)	(0.0175)	(0.0207)
Observations	38,657	38,657	38,657	38,657	38,657	38,657

Notes: Regressions estimated by PPML. Bilateral trade flows are the dependent variable in all specifications. Observations are indexed by exporter, importer and year. Explanatory variables are dummy variables for any kind of trade agreement (TA (BB)) from the Baier-Bergstrand database and the natural logarithm of $(1+\tau)$ where τ is the tariff rate in a given year. Tariffs are taken from the World Bank's WDI. We report results for the average of effectively applied tariffs and for tariffs weighted by the product import share of each importer. The variables INTL×year indicate the interaction of a dummy variable denoting international trade flows and a year dummy. The excluded category is the interaction with the year 2011. All specifications include exporter-year, importer-year and exporter-importer dummy variables. The different columns use domestic trade constructed according to the three methodologies described in the text. Standard errors reported in parentheses are clustered by exporter, importer and year. The superscript *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

4 Conclusion

In a comparison of three different ways of measuring domestic trade flows, we find that the estimates for two commonly estimated parameters, the partial effect of trade agreements on trade flows and the trade elasticity, are similar. This result is encouraging for applied research because it suggests that similar conclusions can be obtained from different datasets.

In particular, our results imply that domestic trade measures based on GDP, which is more widely available than measures that are preferable in theory, are an acceptable alternative. The intuitive reason of why this seemingly worse measure of domestic trade is useful is that the collection of exporter-year, importer-year and country pair dummy variables common in gravity equations is effective in correcting the influence of variables that are imperfectly measured.

Estimating the impact of trade agreements and trade elasticities in a structural gravity framework is often only a first step before simulating counterfactual exercises. Our results show that the results for the median country from using different ways of measuring domestic trade flows are also roughly similar. The only noticeable difference is in the case of small open economies.

In conclusion, what matters primarily when estimating the impact of trade policies, is the inclusion of domestic trade flows, and not the way in which domestic trade is measured.

References

Agnosteva, D. E., J. E. Anderson, and Y. V. Yotov (2019). «Intra-national trade costs: Assaying regional frictions», *European Economic Review*, vol. 112, pp. 32–50.

Anderson, J. E., C. A. Milot, and Y. V. Yotov (2014). «How Much Does Geography Deflect Services Trade? Canadian Answers», *International Economic Review*, vol. 55, pp. 791–818.

Anderson, J. E., and E. van Wincoop (2003). «Gravity with Gravitas: A Solution to the Border Puzzle», *American Economic Review*, vol. 93, no. 1, pp. 170–192.

Anderson, J. E., and Y. V. Yotov (2020). «Short run gravity», *Journal of International Economics*, vol. 126, 103341.

Arkolakis, C., A. Costinot, and A. Rodriguez-Clare (2012). «New Trade Models, Same Old Gains?», *American Economic Review*, vol. 102, no. 1, pp. 94–130.

Baier, S. L., and J. H. Bergstrand (2007). «Do free trade agreements actually increase members' international trade?», *Journal of International Economics*, vol. 71, no. 1, pp. 72–95.

Baier, S. L., Y. V. Yotov, and T. Zylkin (2019). «On the widely differing effects of free trade agreements: Lessons from twenty years of trade integration», *Journal of International Economics*, vol. 116, pp. 206–226.

Bergstrand, J. H., M. Larch, and Y. V. Yotov (2015). «Economic integration agreements, border effects, and distance elasticities in the gravity equation», *European Economic Review*, vol. 78, pp. 307–327.

Borchert, I., M. Larch, S. Shikher, and Y. Yotov (2020). «The International Trade and Production Database for Estimation (ITPD-E)», *International Economics*, forthcoming.

Borchert, I., and Y. V. Yotov (2017). «Distance, globalization, and international trade», *Economics Letters*, vol. 153, pp. 32–38.

Dai, M., Y. V. Yotov, and T. Zylkin (2014). «On the trade-diversion effects of free trade agreements», *Economics Letters*, vol. 122, no. 2, pp. 321–325.

El Dahrawy Sánchez-Albornoz, A., and J. Timini (2021). «Trade Agreements and Latin American trade (creation and diversion) and welfare», *The World Economy*, forthcoming.

Fally, T. (2015). «Structural gravity and fixed effects», *Journal of International Economics*, vol. 97, no. 1, pp. 76–85.

Felbermayr, G., J. Gröschl, and T. Steinwachs (2018). «The Trade Effects of Border Controls: Evidence from the European Schengen Agreement», *Journal of Common Market Studies*, vol. 56, no. 2, pp. 335–351.

Felbermayr, G. J., M. Larch, E. Yalcin, and Y. V. Yotov (2020). «On the Heterogeneous Trade and Welfare Effects of GATT/WTO Membership», CESifo Working Paper Series, no. 8555, CESifo.

Felbermayr, G., and M. Steininger (2019). «Revisiting the Euro's Trade Cost and Welfare Effects», *Journal of Economics and Statistics (Jahrbuecher fuer Nationaloekonomie und Statistik)*, vol. 239, no. 5-6, pp. 917–956.

Head, K., and T. Mayer (2014). «Gravity Equations: Workhorse, Toolkit, and Cookbook», in Gopinath, G., Helpman, E., and Rogoff, K. (eds.) *Handbook of International Economics* Volume 4, Chap. 3, pp. 131–195, Elsevier.

Heid, B., M. Larch, and Y. V. Yotov (2021). «Estimating the Effects of Non-discriminatory Trade Policies within Structural Gravity Models», *Canadian Journal of Economics*, forthcoming.

Larch, M., J.-A. Monteiro, R. Piermartini, and Y. Yotov (2019). «On the Effects of GATT/WTO Membership on Trade: They are Positive and Large After All», School of Economics Working Paper Series, no. 2019-4, LeBow College of Business, Drexel University.

Larch, M., J. Wanner, and Y. V. Yotov (2018). «Bi- and Unilateral trade effects of joining the Euro», *Economics Letters*, vol. 171, pp. 230–234.

Llano, C., A. Esteban, J. Pérez, and A. Pulido (2010). «Opening the Interregional Trade "Black Box": The C-Intereg Database for the Spanish Economy (1995–2005)», *International Regional Science Review*, vol. 33, no. 3, pp. 302–337.

Santos Silva, J. M. C., and S. Tenreyro (2006). «The Log of Gravity», *The Review of Economics and Statistics*, vol. 88, no. 4, pp. 641–658.

Timini, J., N. Cortinovis, and F. López Vicente (2020). *The heterogeneous effects of trade agreements with labor provisions*, Working Papers, no. 2017, Banco de España.

Timini, J., and F. Viani (2020). *A highway across the Atlantic? Trade and welfare effects of the EU-Mercosur agreement*, Working Papers, no. 2023, Banco de España.

Timmer, M. P., E. Dietzenbacher, B. Los, R. Stehrer, and G. J. Vries (2015). «An Illustrated User Guide to the World Input–Output Database: the Case of Global Automotive Production», *Review of International Economics*, vol. 23, no. 3, pp. 575–605.

Waugh, M. E. (2010). «International Trade and Income Differences», *American Economic Review*, vol. 100, no. 5, pp. 2093–2124.

Yotov, Y. V. (2012). «A simple solution to the distance puzzle in international trade», *Economics Letters*, vol. 117, no. 3, pp. 794–798.

Yotov, Y. V. (2021). «The Variation of Gravity within Countries», School of Economics Working Paper Series, no. 2021-12, LeBow College of Business, Drexel University.

Yotov, Y. V., R. Piermartini, J.-A. Monteiro, and M. Larch (2016). «An advanced guide to trade policy analysis: The structural gravity model», WTO-UNCTAD.

Appendices

A Data appendix

The countries in the database are: Australia (AUS), Ireland (IRL), Austria (AUT), Italy (ITA), Belgium (BEL), Japan (JPN), Bulgaria (BGR), Republic of Korea (KOR), Brazil (BRA), Lithuania (LTU), Canada (CAN), Luxembourg (LUX), China (CHN), Latvia (LVA), Cyprus (CYP), Mexico (MEX), Czech Republic (CZE), Malta (MLT), Germany (DEU), The Netherlands (NLD), Denmark (DNK), Poland (POL), Spain (ESP), Portugal (PRT), Estonia (EST), Romania (ROU), Finland (FIN), Russia (RUS), France (FRA), Slovakia (SVK), United Kingdom (GBR), Slovenia (SVN), Greece (GRC), Sweden (SWE), Hungary (HUN), Turkey (TUR), Indonesia (IDN), United States (USA), India (IND).

BANCO DE ESPAÑA PUBLICATIONS

WORKING PAPERS

2001 JAVIER ANDRÉS, PABLO BURRIEL and WENYI SHEN: Debt sustainability and fiscal space in a heterogeneous Monetary Union: normal times vs the zero lower bound.

2002 JUAN S. MORA-SANGUINETTI and RICARDO PÉREZ-VALLS: ¿Cómo afecta la complejidad de la regulación a la demografía empresarial? Evidencia para España.

2003 ALEJANDRO BUESA, FRANCISCO JAVIER POBLACIÓN GARCÍA and JAVIER TARANCÓN: Measuring the procyclicality of impairment accounting regimes: a comparison between IFRS 9 and US GAAP.

2004 HENRIQUE S. BASSO and JUAN F. JIMENO: From secular stagnation to robocalypse? Implications of demographic and technological changes.

2005 LEONARDO GAMBACORTA, SERGIO MAYORDOMO and JOSÉ MARÍA SERENA: Dollar borrowing, firm-characteristics, and FX-hedged funding opportunities.

2006 IRMA ALONSO ÁLVAREZ, VIRGINIA DI NINO and FABRIZIO VENDITTI: Strategic interactions and price dynamics in the global oil market.

2007 JORGE E. GALÁN: The benefits are at the tail: uncovering the impact of macroprudential policy on growth-at-risk.

2008 SVEN BLANK, MATHIAS HOFFMANN and MORITZ A. ROTH: Foreign direct investment and the equity home bias puzzle.

2009 AYMAN EL DAHRAWY SÁNCHEZ-ALBORNOZ and JACOPO TIMINI: Trade agreements and Latin American trade (creation and diversion) and welfare.

2010 ALFREDO GARCÍA-HIERNAUX, MARÍA T. GONZÁLEZ-PÉREZ and DAVID E. GUERRERO: Eurozone prices: a tale of convergence and divergence.

2011 ÁNGEL IVÁN MORENO BERNAL and CARLOS GONZÁLEZ PEDRAZ: Sentiment analysis of the Spanish Financial Stability Report. (There is a Spanish version of this edition with the same number).

2012 MARIAM CAMARERO, MARÍA DOLORES GADEA-RIVAS, ANA GÓMEZ-LOSCOS and CECILIO TAMARIT: External imbalances and recoveries.

2013 JESÚS FERNÁNDEZ-VILLAVERDE, SAMUEL HURTADO and GALO NUÑO: Financial frictions and the wealth distribution.

2014 RODRIGO BARBONE GONZALEZ, DMITRY KHAMETSHIN, JOSÉ-LUIS PEYDRÓ and ANDREA POLO: Hedger of last resort: evidence from Brazilian FX interventions, local credit, and global financial cycles.

2015 DANILO LEIVA-LEON, GABRIEL PEREZ-QUIROS and EYNO ROTS: Real-time weakness of the global economy: a first assessment of the coronavirus crisis.

2016 JAVIER ANDRÉS, ÓSCAR ARCE, JESÚS FERNÁNDEZ-VILLAVERDE and SAMUEL HURTADO: Deciphering the macroeconomic effects of internal devaluations in a monetary union.

2017 JACOPO TIMINI, NICOLA CORTINOVIS and FERNANDO LÓPEZ VICENTE: The heterogeneous effects of trade agreements with labor provisions.

2018 EDDIE GERBA and DANILO LEIVA-LEON: Macro-financial interactions in a changing world.

2019 JAIME MARTÍNEZ-MARTÍN and ELENA RUSTICELLI: Keeping track of global trade in real time.

2020 VICTORIA IVASHINA, LUC LAEVEN and ENRIQUE MORAL-BENITO: Loan types and the bank lending channel.

2021 SERGIO MAYORDOMO, NICOLA PAVANINI and EMANUELE TARANTINO: The impact of alternative forms of bank consolidation on credit supply and financial stability.

2022 ALEX ARMAND, PEDRO CARNEIRO, FEDERICO TAGLIATI and YIMING XIA: Can subsidized employment tackle long-term unemployment? Experimental evidence from North Macedonia.

2023 JACOPO TIMINI and FRANCESCA VIANI: A highway across the Atlantic? Trade and welfare effects of the EU-Mercosur agreement.

2024 CORINNA GHIRELLI, JAVIER J. PÉREZ and ALBERTO URTASUN: Economic policy uncertainty in Latin America: measurement using Spanish newspapers and economic spillovers.

2025 MAR DELGADO-TÉLLEZ, ESTHER GORDO, IVÁN KATARYNIUK and JAVIER J. PÉREZ: The decline in public investment: "social dominance" or too-rigid fiscal rules?

2026 ELVIRA PRADES-ILLANES and PATROCINIO TELLO-CASAS: Spanish regions in Global Value Chains: How important? How different?

2027 PABLO AGUILAR, CORINNA GHIRELLI, MATÍAS PACCE and ALBERTO URTASUN: Can news help measure economic sentiment? An application in COVID-19 times.

2028 EDUARDO GUTIÉRREZ, ENRIQUE MORAL-BENITO, DANIEL OTO-PERALÍAS and ROBERTO RAMOS: The spatial distribution of population in Spain: an anomaly in European perspective.

2029 PABLO BURRIEL, CRISTINA CHECHERITA-WESTPHAL, PASCAL JACQUINOT, MATTHIAS SCHÖN and NIKOLAI STÄHLER: Economic consequences of high public debt: evidence from three large scale DSGE models.

2030 BEATRIZ GONZÁLEZ: Macroeconomics, Firm Dynamics and IPOs.

2031 BRINDUSA ANGHEL, NÚRIA RODRÍGUEZ-PLANAS and ANNA SANZ-DE-GALDEANO: Gender Equality and the Math Gender Gap.

2032 ANDRÉS ALONSO and JOSÉ MANUEL CARBÓ: Machine learning in credit risk: measuring the dilemma between prediction and supervisory cost.

2033 PILAR GARCÍA-PEREA, AITOR LACUESTA and PAU ROLDAN-BLANCO: Raising Markups to Survive: Small Spanish Firms during the Great Recession.

2034 MÁXIMO CAMACHO, MATÍAS PACCE and GABRIEL PÉREZ-QUIRÓS: Spillover Effects in International Business Cycles.

2035 ÁNGEL IVÁN MORENO and TERESA CAMINERO: Application of text mining to the analysis of climate-related disclosures.

2036 EFFROSYNI ADAMOPOULOU and ERNESTO VILLANUEVA: Wage determination and the bite of collective contracts in Italy and Spain: evidence from the metal working industry.

2037 MIKEL BEDAYO, GABRIEL JIMÉNEZ, JOSÉ-LUIS PEYDRÓ and RAQUEL VEGAS: Screening and Loan Origination Time: Lending Standards, Loan Defaults and Bank Failures.

2038 BRINDUSA ANGHEL, PILAR CUADRADO and FEDERICO TAGLIATI: Why cognitive test scores of Spanish adults are so low? The role of schooling and socioeconomic background

2039 CHRISTOPH ALBERT, ANDREA CAGGESE and BEATRIZ GONZÁLEZ: The Short- and Long-run Employment Impact of COVID-19 through the Effects of Real and Financial Shocks on New Firms.

2040 GABRIEL JIMÉNEZ, DAVID MARTÍNEZ-MIERA and JOSÉ-LUIS PEYDRÓ: Who Truly Bears (Bank) Taxes? Evidence from Only Shifting Statutory Incidence.

2041 FELIX HOLUB, LAURA HOSPIDO and ULRICH J. WAGNER: Urban air pollution and sick leaves: evidence from social security data.

2042 NÉLIDA DÍAZ SOBRINO, CORINNA GHIRELLI, SAMUEL HURTADO, JAVIER J. PÉREZ and ALBERTO URTASUN: The narrative about the economy as a shadow forecast: an analysis using Banco de España quarterly reports.

2043 NEZIH GUNER, JAVIER LÓPEZ-SEGOVIA and ROBERTO RAMOS: Reforming the individual income tax in Spain.

2101 DARÍO SERRANO-PUENTE: Optimal progressivity of personal income tax: a general equilibrium evaluation for Spain.

2102 SANDRA GARCÍA-URIBE, HANNES MUELLER and CARLOS SANZ: Economic uncertainty and divisive politics: evidence from the *Dos Españas*.

2103 IVÁN KATARYNIUK, VÍCTOR MORA-BAJÉN and JAVIER J. PÉREZ: EMU deepening and sovereign debt spreads: using political space to achieve policy space.

2104 DARÍO SERRANO-PUENTE: Are we moving towards an energy-efficient low-carbon economy? An input-output LMDI decomposition of CO_2 emissions for Spain and the EU28.

2105 ANDRÉS ALONSO and JOSÉ MANUEL CARBÓ: Understanding the performance of machine learning models to predict credit default: a novel approach for supervisory evaluation.

2106 JAVIER ANDRÉS, ÓSCAR ARCE and PABLO BURRIEL: Market polarization and the Phillips curve.

2107 JUAN de LUCIO and JUAN S. MORA-SANGUINETTI: New dimensions of regulatory complexity and their economic cost. An analysis using text mining.

2108 DANILO LEIVA-LEON and LUIS UZEDA: Endogenous time variation in vector autoregressions.

2109 CORINNA GHIRELLI, ANDREA GONZÁLEZ, JOSÉ LUIS HERRERA and SAMUEL HURTADO: Weather, mobility and the evolution of the Covid-19 pandemic.

2110 KLODIANA ISTREFI, FLORENS ODENDAHL and GIULIA SESTIERI: Fed communication on financial stability concerns and monetary policy decisions: revelations from speeches.

2111 YUNUS AKSOY, HENRIQUE S. BASSO and CAROLYN ST AUBYN: Time Variation in Lifecycle Consumption and Income.

2112 JENNIFER PEÑA and ELVIRA PRADES: Price setting in Chile: micro evidence from consumer on-line prices during the social outbreak and Covid-19.

2113 NEZIH GUNER, YULIYA A. KULIKOVA and ARNAU VALLADARES-ESTEBAN: Does the added worker effect matter?

2114 RODOLFO G. CAMPOS and JACOPO TIMINI: Unequal trade, unequal gains: the heterogeneous impact of MERCOSUR.

2115 JAVIER QUINTANA: Import competition, regional divergence, and the rise of the skilled city.

2116 PATRICK MACNAMARA, MYROSLAV PIDKUYKO and RAFFAELE ROSSI: Marginal Tax Changes with Risky Investment.

2117 RODOLFO G. CAMPOS, JACOPO TIMINI and ELENA VIDAL: Structural gravity and trade agreements: does the measurement of domestic trade matter?