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macroeconomic trade elasticities in a developing economy

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From macro to micro and macro back: macroeconomic trade elasticities in a developing economy

Trade elasticity
Real exchange rates
Developing countries
Productive structure

A long tradition in economic theory has seen the real exchange rate (RER) as a key determinant of trade performance. Several empirical studies, however, have found low estimates of macro trade elasticities and, as a result, questioned this argument. In this paper, we show that to understand and estimate the effect of RER on trade performance, it is crucial to explore the existence of heterogeneous responses of individual products to RER movements. Using trade data from Argentina, we employ the Mean Group method to estimate macro trade elasticities by individual products disaggregated at four digits of the SITC; rev.2. We find a wide range of heterogeneous responses of exports and imports to RER movements at the individual product level. We find that the estimated RER-elasticities in differentiated products and labor-intensive manufacturing goods are substantially larger than those of primary and homogeneous products. Based on the estimated elasticities at the product level, we obtain a "low" aggregate RER-elasticity of exports when we weigh them by the country's trade basket. We show that this result is a consequence of Argentina's economic structure, a country whose exports are heavily specialized in primary and homogeneous products. Our results are important because they help build a bridge between two conflicting views in the RER-economic development literature. Even in countries with ``low'' aggregate macro RER-elasticities, the real exchange rate may be an important variable for economic performance. An undervalued RER, for instance, may facilitate economic growth by stimulating investment in activities producing more complex/differentiated goods in countries that specialize in the production of primary and homogenous goods and, as a result, have "low" trade elasticities. This seems to be the case of several countries in Latin America, including Argentina.

De lo macro a lo micro y otra vez a la macro: elasticidades macroeconómicas del comercio exterior en una economía en desarrollo

Elasticidades del comercio exterior
Tipo de cambio real
Países en desarrollo
Estructura productiva

Una larga tradición en la teoría económica ha considerado al tipo de cambio real (TCR) como un determinante clave del resultado de la balanza comercial. Sin embargo, varios estudios empíricos han encontrado estimaciones bajas de las elasticidades del comercio exterior a nivel agregado y, en consecuencia, han cuestionado este argumento. En este trabajo, mostramos que para entender y estimar el efecto del TCR sobre la balanza comercial es crucial explorar la existencia de respuestas heterogéneas de los diferentes productos transables respecto a los movimientos del TCR. Utilizando datos del comercio exterior de Argentina a cuatro dígitos de de desagregación del CUCI; rev.2, estimamos las elasticidades macroeconómicas del comercio exterior a través del método del Mean Group, el cual permite heterogeneidad de respuesta entre productos en las estimaciones. Encontramos una amplia gama de respuestas heterogéneas de las exportaciones e importaciones a los movimientos del TCR a nivel de producto. La elasticidad estimada del TCR en los productos diferenciados y en los bienes manufactureros de uso intensivo de mano de obra es sustancialmente mayor que la de los productos primarios y homogéneos. Partiendo de las elasticidades estimadas a nivel de producto, obtenemos una "baja" elasticidad-TCR agregada de las exportaciones cuando las ponderamos por la canasta comercial de Argentina. Mostramos que este resultado es una consecuencia de la estructura económica del país, debido a que las exportaciones están fuertemente especializadas en productos primarios y homogéneos. Consideramos estos resultados relevantes ya que permiten tender un puente entre dos visiones contradictorias en la literatura sobre el desarrollo económico y el rol del TCR. Incluso en países con "bajas" elasticidades agregadas, el tipo de cambio real puede ser una variable importante para el desempeño económico de largo plazo. Un tipo de cambio real competitivo y estable, por ejemplo, puede facilitar el crecimiento económico al estimular la inversión en actividades de producción de bienes más complejos/diferenciados en países que se especializan en la producción de bienes primarios y homogéneos y, por tanto, tienen “bajas” elasticidades agregadas. Este parece ser el caso de varios países de América Latina, entre ellos Argentina.

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1 Introduction

Conventional macroeconomic models establish that exports and imports depend on the real exchange rate (RER) and the domestic and foreign aggregate demand.[1] However, the empirical relevance of the real exchange rate has been questioned, giving rise to the famous term "elasticity pessimism" (Orcutt, 1950). This concept received particular attention in the developing economies in which the main export products are based on exploiting natural resources. The "pessimism" was not only based on empirical estimations but also on theoretical grounds from several development economists. For example, the Presbisch-Singer hypothesis about the secular deterioration of terms of trade assumed that exports of primary products and imports of capital goods were mainly inelastic to exchange rate movements. Therefore, the real exchange rate was considered an irrelevant variable for developing economies (Prebisch, 1950; Singer, 1950).

The "elasticity pessimism" hypothesis has gradually lost adherents as a growing body of empirical studies began to consistently show a positive correlation between real exchange rate levels and economic growth (Hausmann *et al.*, 2007; Rodrik, 2008; Eichengreen, 2007; Frenkel *et al.*, 2004).[2] Moreover, the evidence suggests that the correlation is more important in developing than developed economies (Rapetti *et al.*, 2012). One of the main theoretical hypotheses in this literature suggests that a higher real exchange rate level positively influences the profitability and rate of investment in modern tradable sectors and, through this channel, fosters economic growth. Despite the evidence, skeptics persist. Many raise the following question: if the effect of the real exchange rate on tradable sector growth is relevant, why do we get "low" macro RER-elasticities in empirical work?[3]

In this paper, we provide empirical evidence to help build a bridge between these two conflicting views. We argue that the estimations of aggregate macroeconomic trade elasticities may hide significant heterogeneity in the response of individual products to the real exchange rate.[4] Given the wide range of individual responses, aggregate estimations of RER-elasticities are largely influenced by the composition of the export baskets. Put differently, the estimation of aggregate macro trade elasticities is biased by the economic structures of countries. Those that specialize in exports of homogenous (differentiated) products, which are less (more) sensitive to RER movements, would likely get lower (higher) estimated aggregate RER-elasticities. Moreover, this is also critical from an econometric viewpoint since several empirical works have already shown that overlooking the existence of heterogeneous elasticities may bias the estimation of aggregate trade elasticities (Pesaran, 2015; Imbs & Mejean, 2015).

This issue may be particularly relevant for developing economies that are exporters of natural resources. In such countries, it is likely to find "low" aggregate RER-elasticities because primary commodities are mainly insensitive to RER movements. However, such a finding should not necessarily lead to the conclusion that the level of the RER is irrelevant for economic growth. Although neutral for the main bulk of existing exports, the RER level may be highly relevant for potential exports. It could be the case that an undervalued RER may stimulate investment in tradable activities like manufacturers producing differentiated goods or tradable services, which are underdeveloped in a natural resource economy. As a result of such a strategy, the economy may end up with a more diversified export basket —because of the expansion of more complex manufacturing goods and services exports— and a higher aggregate RER-elasticity. If structural change and economic development are driven by the expansion of these kinds of modern tradable activities —as argued by the literature of the growth-enhancing effects of the RER— an undervalued RER may be a valuable instrument to promote

[1] We define the exchange rate as the domestic price of a foreign currency. Consequently, a rise (fall) in the nominal/real exchange rate implies a nominal/real depreciation (appreciation) of the domestic currency. The RER is the relative price between tradables and non-tradables. Given our definition, an undervalued level of the RER is one that is above its equilibrium level. We use competitive and undervalued RER interchangeably throughout this article.

[2] Rapetti (2020) and Demir & Razmi (2021) are recent and thorough literature reviews. They found favorable evidence of a link between stable and competitive real exchange rates and economic growth.

[3] Ribeiro *et al.* (2020) point out another reason why the economic growth and competitive real exchange rate literature might fail. They argue in favor of a negative link between real exchange rate and income distribution, which harms economic growth.

[4] Macroeconomic trade elasticities refer to the elasticity of export and import to RER movements. It differs from the microeconomic trade elasticities that capture the elasticity of exports and imports to their own price movements or tariff changes. Aggregate macroeconomic trade elasticities weigh individual macro elasticities by country's trade basket.

growth even in countries with a "low" aggregate RER-elasticity like natural resource economies. This is not trivial from an economic policy perspective. Finding incorrect evidence in favor of the "elasticity pessimism" hypothesis could lead policymakers to dismiss the importance of the RER, favor overvaluation, and, consequently, a primarization of the economic structure, with negative consequences for long-run growth (Corden, 1984; Hausmann *et al.*, 2007; Rodrik, 2008; Cimoli *et al.*, 2013; Rapetti *et al.*, 2012; Bresser-Pereira *et al.*, 2014; Missio *et al.*, 2015; Guzman *et al.*, 2018).[5]

Argentina is a paradigmatic case of these economies, given the volatility of the exchange rate in the last 40 years, with more than 60% of exports concentrated in natural resources and derived products. A simple example illustrates the econometric risk we run if we omit the structural heterogeneity in the calculation of elasticities: suppose the main export products are insensitive to the real exchange rate – i.e., soybeans and soybean oil – and a severe drought reduces their export volume and, then, put pressures on the exchange rate value of the domestic currency relative to the US dollar (USD). In this case, we should expect to find a biased aggregate estimate because of reverse causality. As a result, the coefficient estimated will not reflect the reality of any of the export products and might even reverse the aggregate elasticity sign.[6] The disaggregated calculation not only diminishes that risk but also discovers how the real exchange rate affects the rest of the country's tradable goods.

To explore this hypothesis, we estimate macroeconomic trade elasticities of both the real effective exchange rate (REER) and aggregate income, considering the heterogeneity of the response of the different tradable products. We use data from Argentina, which is an excellent example of the kind of economy we just described. We perform regressions using a database composed of exports and imports at four digits of SITC classification (revision 2), spanning from 1980 to 2015. We use the Mean Group (MG) estimator proposed by Pesaran & Smith (1995) and Pesaran *et al.* (1999) since it allows for slope heterogeneity. The MG method reports the simple average elasticity for the panel of products –based on the elasticity of each individual product– and performs inference through the computation of their variance. This estimator has five advantages: (a) it is robust to the existence of heterogeneity in the responses of the different products to movements in the real exchange rate and aggregate demand; (b) it allows for the recovery of the heterogeneity in the responses, obtaining an individual estimate for each product exported and imported at a 4-digit disaggregation; (c) it prevents the results from being determined by the performance of a few products subject to exogenous shocks that simultaneously impact the result of the trade balance and the level of the real exchange rate (i.e., droughts); (d) the identification of the elasticities relies on the time-series dimension. This fact is vital since the explanatory variables are – mainly – macroeconomic ones and, therefore, the cross-sectional dimension is correlated between the different goods; (e) lastly, this method allows us to control for lagged variables and estimate long-term relations.

We obtain six specific results that are worth highlighting: (a) the REER-elasticity for the (simple) average of exports is 0.86 in the preferred estimation, while for imports, it reaches -1.04; (b) these elasticities vary considerably across the over 500 products estimated both in exports and imports, going from values of around -10 up to 10; (c) primary products and homogenous products are those that respond the least to the exchange rate incentive while low- and medium-technology products, as well as differentiated products, show higher REER- elasticity in exports and imports. Also, labor-intensive sectors respond more intensively to the REER in exports and imports; (d) if we weigh individual elasticities by their share in Argentina's trade basket, exports accumulate a REER-elasticity of 0.3 and imports of -0.8. These results indicate that the trade balance would improve by 1.1% in the face of a 1% depreciation of the RER, ceteris paribus the income level. However, (e) if we weigh the REER-elasticities of exports by the share of each product in the worldwide trade basket, the aggregate elasticity reaches 0.73, tripling the value reached when using the weights from Argentina's trade basket. This result shows that the lower REER-elasticity of Argentina's aggregate exports is due to a composition effect explained by the country's productive specialization in homogeneous and primary products.

[5] See also Libman *et al.* (2019) for new evidence about RER and investment surges relationship.

[6] Note that it would not even reflect the true elasticity of soybean exports as it would suffer from reverse causality bias. The drought could lead to an aggregate elasticity estimated with a negative coefficient even though the actual elasticity of soybeans could be equal to 0.

Finally, (f) on the long-term GDP-elasticity side, exports and imports – weighted by their share in Argentina's trade basket – show similar elasticities (around 1.5).

Seen from a broader perspective, our results provide two main contributions. First, we show wide heterogeneity in the estimated macroeconomic trade elasticities. As previously mentioned, this result is important from an econometric view, as it allows us to obtain better estimations of the trade elasticities at the country level, avoiding inconsistent coefficients (Pesaran, 2015) and reducing the risk of heterogeneity bias recently found in Imbs & Mejean (2015, 2017). Having accurate estimates of aggregate trade elasticities at the country level is relevant because it allows us to evaluate the degree of adjustment that a real exchange rate depreciation causes to the trade balance in the short run and, therefore, permits us to analyze the possibility that the RER might be a variable that can smooth external shocks.

Second, the finding of heterogeneity of elasticities has another implication that is even more relevant from the lens of a development economist, as discussed at the beginning of this introduction. By studying their disaggregated behavior, we find that exports of differentiated products and labor-intensive manufacturing goods tend to be more elastic to the level and stability of the exchange rate. Consequently, a configuration of relative prices favorable to these activities could bias aggregate investment towards modern tradable sectors, promoting structural change and economic growth. Thus, we provide evidence of a connection between RER undervaluation and economic growth through the promotion of modern tradable activities.

Thus, our results help build a bridge between the two conflicting views on the role of the real exchange rate in the macroeconomic performance discussed above. Low estimates of aggregate trade elasticities are not the result of a weak effect of the real exchange rate on tradable activities but may be the consequence of an economic structure which is biased towards RER-insensitive products. In many developing countries like Argentina, primary and homogenous commodities are the main tradable goods produced domestically. Since these activities are mainly insensitive to real exchange rate movements, low aggregate elasticities are the expected result of the high weight of such activities in their productive structure. Consequently, the real exchange rate may be an imperfect —but not ineffective— instrument for macroeconomic adjustments, as it does not foster exports substantially in the short term, and most of the adjustment occurs through imports. However, low aggregate elasticities do not imply that the real exchange rate is neutral for growth. On the contrary, our findings show that a large proportion of differentiated products and labor-intensive manufacturing goods are quite elastic to the level and stability of the real exchange rate, which helps explain the evidence that favors a positive correlation between undervalued RER and economic growth. In short, low aggregate macroeconomic trade elasticities in many countries like Argentina are not evidence to claim that the real exchange rate is an ineffective instrument to promote economic growth, but rather that manufacturing and differentiated goods are underdeveloped in such economies.

The paper is structured as follows. After this introduction, in section 2, we review the literature to contextualize our findings, explain the methodology, and analyze the statistical properties of the data series used. Section 3 describes the result of the estimations of the macroeconomic elasticities of exports and imports. In section 4, we analyze the wide range of heterogeneity found in both export and import elasticities, focusing on the differences between five categories of goods —primary products, natural resource-based manufacturing goods, and low-, medium-, and high-technology content manufacturing goods—, as well as the heterogeneity according to their degree of product differentiation and intensity in the use of labor. In section 5, we recover the aggregate macroeconomic elasticities weighing by each product share in Argentina's and the world's trade basket. Finally, we offer some concluding remarks in section 6.

2 Background, methodology, and statistical properties of the database

2.1 Elasticity pessimism and previous research on trade elasticities in Argentina

Since the emergence of the "elasticity pessimism" term (Orcutt, 1950), its empirical validity has been tested on several occasions for different groups of countries and periods. Rose (1990) is among the most relevant papers in the literature in favor of pessimism for a group of developed countries, while Reinhart (1995) stands out for its focus on developing countries. These papers found aggregate RER-elasticities that were non-statistically significant or, if so, fell below the necessary threshold to make the Marshall-Lerner condition hold. However, the collected evidence throughout the years in favor of pessimism has been far from conclusive, and specialists in the field have criticized its reliability (Obstfeld, 2002) or highlighted the existence of a great variety of results that prevent conclusion (Auboin & Ruta, 2013; Bahmani *et al.*, 2013; Leigh *et al.*, 2017). Indeed, some researchers have recently argued in favor of "elasticity optimism" when estimating microeconomic and macroeconomic trade price-elasticities in disaggregated calculations (Imbs & Mejean, 2015, 2017; Feenstra *et al.*, 2018).[7]

Interestingly, it can be argued that an incipient stylized fact emerges when analyzing the results by region. For example, Senhadji & Montenegro (1999) study the elasticities of exports for 53 developing and developed countries, finding that the former tends to show lower REER-elasticities than industrialized countries, except for Asian countries that show the highest price and income elasticities. In this line, research focused on Latin America tends to find lower price-elasticities in aggregate estimations, although with nuanced results depending on the specific country (Moguillansky, 1995; Bernat, 2015). For instance, Paiva (2003) finds a relative optimist result for Brazil, which is known for a more diversified productive structure than other Latin American countries.[8] On the contrary, for Chile (Monfort, 2008) and Uruguay (Mordecki & Piaggio, 2008; Brunini & Mordecki, 2011), pessimist results prevail. Overall, these results may show the association between the specialization of developing countries in homogeneous goods and natural resource commodities and low macro elasticities, with Asia being the most obvious exception to this economic structure pattern.[9]

There is extensive empirical literature estimating macroeconomic trade elasticities for Argentina, showing a large variability of results both for income-elasticities and even more significant for RER-elasticity of exports. Most empirical works have focused on aggregate macroeconomic trade elasticities, although some efforts have been made to appreciate differences based on trade flows' destinations or sources. Table 6 of the appendix summarizes the main results and papers of the literature.

There is some consensus that the income-elasticity of imports is somewhere between 2 and 3.5, while the RER-elasticity of imports is usually in the 0.6-0.8 range, except for Zack & Dalle (2016), which find an elasticity close to 0.3. Estimates of income-elasticity of exports are usually between 1 and 2 when estimated at the aggregate level. However, when focusing on exports to Brazil or MERCOSUR, income-elasticity rises to between 2.5 and 2, respectively (Heymann & Navajas, 1998; Catao & Falcetti, 2002). Regarding REER-elasticity of exports, the estimations variability is even higher. The lower bound is in Zack & Dalle (2016) at 0.07, statistically significant, followed by Berrettoni & Castresana (2009), who obtain 0.3, Heymann & Navajas (1998), who get 0.84 for exports to Brazil, and Catao & Falcetti (2002), who find a price-elasticity of 1.2 for MERCOSUR.

Fares & Zack (2018) is perhaps the closest work to this paper as they calculate aggregate elasticities and some disaggregated elasticities but only by broad economic categories (BEC) and technological content. In aggregate terms, they find a long-term income-elasticity at 3.7 for imports (but it goes down to 2.4 since 2003), while the REER-elasticity is around -0.4. In the case of aggregate exports, income-elasticity is close to

[7] These papers, however, have not focused on the estimation of the RER-elasticity. For a discussion on differences between the calculation of price-elasticity and RER-elasticity, see Ruhl *et al.* (2008), Fitzgerald & Haller (2014), and Fontagné *et al.* (2018). For estimates favorable to long-term compliance of the Marshall-Lerner condition in industrialized countries (OECD), (Boyd *et al.*, 2001) is recommended.

[8] See also Marconi & Rocha (2012) on rol of overlatuion in early deindustrialization of Brazil. Additionally, Zack & Dalle (2016) and Bernat (2015) are helpful articles for a more thorough literature review.

[9] Brazil, in turn, is one of the countries with the most extensive industrial bases in South America, especially during the period covered by the mentioned paper.

1.85, while REER-elasticity reaches 0.2. Disaggregate results show that REER-elasticity in low and medium-low technology sectors have the highest response on REER in the case of exports but not in imports.

Some additional remarks on previous results are in order. First, note that the income-elasticity of Argentina and its trading partners might imply a clear limitation to economic growth in the sense of Thirlwall (1979), given the high value of Argentina's income-elasticity of imports usually found. However, it is essential to highlight that income-elasticities well above one has as a corollary that imports would increase above the total GDP in the long term. This fact would be at the antipodes of any international experience, and income-elasticity of aggregate imports should stabilize at around one. An income-elasticity around 3 in the long term could be an early warning of omitted variables or bias in the estimation.

Second, there is much variability around RER-elasticities for exports and imports, which prevents any conclusions about the magnitude of the response of net exports to changes in the real exchange rate level. Also, none of the previously mentioned estimations control for extreme climate events, nor do they propose an estimation strategy that diminishes the inverse causality risk on such occasions. This risk is critical when estimating elasticities in economies exporting mainly natural resource-based products.

Finally, the differences between the RER-elasticities related to Argentina's trade with Brazil or MERCOSUR might not be due to the destination but rather to the type of product exported. The difference in magnitude of these elasticities may be because most trade with those destinations concentrates on manufacturing goods, not homogeneous goods. Palazzo & Rapetti (2017) and Palazzo (2021) support this claim since they find differences in reaction to RER movements according to Lall's categories, differentiation degree, and labor intensity of the goods.[10]

In short, we believe there is still much left to contribute to the discussion, and the methodology used in this paper provides new and novel evidence on the subject. Studying the heterogeneity of the elasticities could prevent biases in the aggregate estimate elasticities – both for REER and GDP/income. At the same time, it allows us to delve into differences in macroeconomic trade elasticities for different observable product characteristics. The higher elasticities found in industrialized countries and Asian economies than elasticities in Latin America and Africa (Senhadji & Montenegro, 1999; Bernat, 2015) and the REER-elasticities found in Argentina's exports to Brazil and MERCOSUR point in favor hypothesis that the bias generated by the tradable structure in developing countries could be the reason for such differences.

2.2 Methodology and hypotheses

The database provided by COMTRADE is composed of export and import panels at four digits of disaggregations of SITC (rev. 2). Each trade flow is evaluated separately. We focus on estimating the elasticity of the exports and imports relative to two main macroeconomic variables: real effective exchange rate and aggregate demand.

Aggregate demand variables are proxies of the income effects on trade flows because of variations in the home country's GDP or its trading partners' GDP. The coefficient associated with the real effective exchange rate (REER), on the other hand, captures the effect of this critical relative price on the flow of exports and imports.

It is important to note that the estimations we made of the effect of REER are agnostic as to whether it captures a phenomenon of supply, demand, or both simultaneously. Our agnosticism is because the REER-elasticity in exports could capture different kinds of phenomena depending on the reaction of prices. For example, if the change in the nominal exchange rate causes a proportional change in the price paid by potential consumers, it would be a demand phenomenon. Instead, if the product's price remains fixed for the client in the face of an exchange rate depreciation, no demand phenomenon will occur. In this last case, however, a higher exchange rate would imply a fall in non-tradable production costs for the exporter measured in foreign currency – mainly wages – leading to an increase in profitability that encourages the expansion of the tradable supply. As prices

[10] See Dao *et al.* (2021) for similar conclusions regarding the role of labor intensity and its relationship to tradable goods performance.

of exports in emerging countries are usually invoiced in USD and remain stable in that currency (Gopinath, 2015; Gopinath *et al.*, 2020), we consider that a supply phenomenon is more likely in the case of exports.

In the case of imports, however, the adjustment of prices in domestic currency is almost instantaneous and similar to the variation of the nominal exchange rate. Then, it is most likely that our estimations of imports capture a demand phenomenon. Nevertheless, our estimates could still capture both effects since the local import parity price will also change. As a result, the local producer will be able to get higher profitability and then expand the local tradable supply, fostering the substitution effect.

In terms of the econometric strategy, the focus on the calculation of income-elasticities and REER-elasticities forces us to consider three relevant data characteristics when choosing the estimation method. First, although there is a panel of exported and imported goods, the explanatory variables are macroeconomic variables, and their main variability occurs over time and not in the cross-sectional dimension. Although REER and GDP indices are constructed for each product using their particular trading partners' shares in each case, many products share a large number of trading partners. On the other hand, the most significant changes in the levels of REER of each product are guided mainly by the evolution of the bilateral nominal exchange rate with the USD. Thus, the cross-sectional dimension will hardly add any information for the estimation because the movement of REER is guided by common shocks that only vary over time. In short, identifying the parameters of interest should be based on the temporary variations of the real exchange rate and the aggregate demand and not on cross-sectional differences.

Second, it is critical for a correct estimation to consider the role of exchange rate expectations in the incentives to expand tradable goods supply. If the main channel by which the exchange rate affects exports is an increase in the profitability that boosts higher investment, exchange rate expectation is essential for a full effect. The investment plans will materialize only if investors and export firms perceive the increase in profitability as long-lasting. For this reason, exports are not expected to adjust instantaneously to exchange rate movements, and transitory movements should not lead to great incentives to expand their supply. In the case of imports, it can also be argued that temporary exchange rate movements -within certain bounds- should not cause significant changes in their demand due to the substitution effect. The explanation may lie in the possibility that the resulting savings would not make up for the cost of searching implied by the change in supplier if the change in the REER is temporary and relatively small. Therefore, both the exchange rate level and its stability are expected to influence consumption and production decisions. If this is so, control variables capturing the exchange rate stability should be considered, as should the existence of adjustment processes in which the agents observe and learn about the evolution of the variables of interest to decide to invest in projects that expand the tradable supply. Then, it is necessary to include lagged variables in the estimation to capture these adjustment processes. Therefore, the estimation strategy should consider a dynamic panel.

Third, we already mentioned good reasons to suspect that the different kinds of exported and imported goods respond heterogeneously to the exchange rate stimulus. For example, some primary products, notably in the agricultural industry, have natural production limits, and their production will not change much in the face of exchange rate fluctuations. Additionally, because of seasonal limitations, changes in profitability will not be able to affect production decisions if planting has already been done. Finally, an extreme climate event would imply a drop in these exports, and, given its importance in Argentina's total exports, it could trigger foreign exchange rate crises. Therefore, aggregate estimations without control for extreme climate events or a strategy to reduce this problem would face endogeneity bias, and the elasticities estimated would reflect neither the agricultural REER-elasticity nor the aggregate REER-elasticity in exports.

The importance of taking into account slope heterogeneity does not end there. It is enhanced by the fact that labor-intensive sectors are the ones with the most ups and downs in their profitability rate as a result of real exchange rates movements and, therefore, the ones with the most incentives to change their tradable supply (Frenkel & Ros, 2006; Palazzo & Rapetti, 2017; Palazzo, 2021; Dao *et al.*, 2021). Additionally, specific imported inputs are hard to substitute in the production process in the short term and will probably show different REER-elasticity from final consumer goods. These are just a few examples showing that we should expect heterogeneity in REER-elasticities. Omitting the possibility of slope heterogeneities in the estimation would provide inconsistent estimates (Pesaran, 2015).

These three data characteristics inform us about the estimation models that do not fit our research question. On the one hand, a panel regression with fixed effects is not suitable to incorporate the lagged dependent variables and, in this way, capture the adjustment process dynamics, due to the existence of Nickell's bias (Nickell, 1981). On the other hand, an alternative to dynamic panels would be the generalized method of moments (GMM) proposed by Arellano & Bond (1991). However, if the identification strategy lies in the temporary variation of a relatively common shock among products (REER movements and changes in aggregate income), it would not be advisable to use GMM, as the model would lose force by not having variability in the cross-sectional dimension. Lastly, GMM and the fixed effects panel methods assume homogeneity on the slopes to be estimated, which would result in non-consistent estimates if the heterogeneity is proven (Pesaran, 2015). In sum, GMM and habitual panel techniques do not appear to be the most suitable for the research questions we try to answer.

This reasoning leads us to think of models in which the identification strategy is given by the time dimension, allows estimating heterogeneous slopes, and incorporates lagged variables. The Mean Group (MG) and Pooled Mean Group (PMG) methods are based on the estimation of autoregressive distributed lag models (ARDL). The MG model estimates the coefficients for each product using time series techniques. Then it calculates the arithmetical average of the estimated coefficients and calculates their variance to perform the statistical inference over the average estimator. This method allows all the coefficients of the variables to vary in each individual estimate (Pesaran, 2015).

Additionally, the MG method can be used for stationary variables or cointegration relationships in which short-term and long-term coefficients can differ for each product (cross-sectional dimension). Pesaran *et al.* (1999) also develop the PMG method to estimate dynamic heterogeneous panels. In this model, unlike in the MG, long-term coefficients must be homogenous, while the short-term adjustments can differ among products (Pesaran *et al.*, 1999). If there is a cointegration correlation, both the MG method and the PMG method are susceptible to expressing the model as an error correction vector in which the adjustment coefficients should show a negative sign and be lower than one, ensuring a long-term equilibrium relationship between variables.

Pesaran *et al.* (1999) point out that the PMG estimation method is less sensitive to outlier coefficients than MG one, in which the long-term coefficient reported is a simple average of the individual values. However, if there is no homogeneity in the long-term coefficients, PMG is inconsistent, while MG is always consistent. Given the recent literature (Imbs & Mejean, 2015; Feenstra *et al.*, 2018) and our hypothesis about the existence of heterogeneous responses by kinds of goods, the MG estimator is the preferred method. Nevertheless, we test the hypothesis of the slopes' homogeneity and perform robustness exercises with both estimation methods.

Then, the preferred model matches a dynamic panel assuming the heterogeneity of the slopes of the variables. In general terms, the regression can be expressed as follows:

$$y_{it} = \lambda_i y_{i,t-1} + x'_{it}\beta_i + u_{i,t} \tag{1}$$

In which x_{it} is a vector of assumed exogenous variables, $u_{i,t}$ is assumed as independent, equally distributed along the time (t) and with a zero mean and σ_i^2 variance. All the parameters to estimate can be summarized in $\psi_i = (\lambda_i, \beta_i)$. The heterogeneity implies that $\psi_i = \psi + n_i$, in which n_i is the differential component of each elasticity. The estimator suggested by the MG method takes the average of the individual estimates and calculates its variance as follows:

$$\hat{\psi}_{MG} = \frac{1}{N}\sum_{i}^{N}\hat{\psi}_i \quad (2)$$

$$\hat{Var}[\hat{\psi}_{MG}] = \frac{1}{N(N-1)}\sum_{i}^{N}[(\psi_i - \psi)(\psi_i - \psi)'] \quad (3)$$

The MG estimator is asymptotically normal for a large N and T, provided that $\sqrt{N}/T \rightarrow 0$ when both N and T $\rightarrow \infty$.

2.3 Database and statistical properties of the series

The database on exports and imports is provided by COMTRADE and disaggregated at four digits of the SITC (revision 2). Trade flows are expressed at 1996's USD prices, using the Törnqvist price indices calculated inPalazzo (2021) and based on the Fares *et al.* (2018) methodology. These price indices are obtained through COMTRADE's unit values and seek to eliminate outliers by different statistical criteria. The period covered is from 1980 to 2015.

The main explanatory variables for exports are foreign demand and the real effective exchange rate. Both indices are calculated for each product, using their trading partners' shares in exports for the year 1996. The foreign demand index uses trading partners' GPD in constant dollars. The REER is calculated using bilateral nominal exchange rates, trading partners' consumer price indices, and Argentina's consumer price index. The data are provided by the World Bank in the case of GDP and the IMF and National Institute of Statistics and Census of Argentina (INDEC) in the case of the REER.[11]

The main explanatory variables for imports are a domestic aggregate demand indicator and the real effective exchange rate by import product. In the case of domestic demand, GDP values are used at constant prices provided by the World Bank. The REER is calculated identically to the one used for exports but weighed according to the 1996 imports' share origin. In all cases, we use annual data.

Another group of variables is used as control variables in the main exercises. On the one hand, as we already mentioned, there are reasons to suppose that the exchange rate stability is relevant to the different sectors' export and import plans. With this in mind, we use an indicator of the nominal stability of the exchange rate provided by Aizenman *et al.* (2013). This index is calculated as the annual standard deviation of the monthly nominal exchange rate of the domestic currency relative to the USD, normalized between 0.01 y 1: $ERS = 0.01/[0.01 + st.dev(\Delta log(TCN))]$. Also, we use the output gap as a control variable calculated through the Hodrick-Prescott filter. The output gap captures when domestic demand is below the potential supply, and exportable surpluses are released.

In the case of imports, controlling for an opening trade variable is crucial to prevent biases in the coefficients of interest. Given Argentina's tariff history, the preferred variable to perform this control is a dummy that takes values 0 until 1990 and 1 from that moment on. This variable is preferred to the tariff position as Argentina's import tariff data at four digits of disaggregation are available from 1992 on. In the following sections, we argue that thanks to econometric methods used that allow for heterogeneity in estimated coefficients, we will be able to capture the different intensities of trade openness changes in each product with the dummy. However, we perform some robustness tests restricting the data sample to the period coinciding with the availability of tariff data. In that case, we will control for trade tariffs for both countries of destination and origin and upstream tariffs of final exported goods.[12] Table 7 of Appendix A summarizes the main statistics of the variables used.

[11] From 2006 onwards, Argentina's consumer price index was merged with the data provided by Ecolatina.

[12] The upstream tariff variable is built using upstream linkages provided by Greenstone *et al.* (2010) for the United States. Bahar *et al.* (2019) and Palazzo (2021) use the same database.

Finally, in the online Appendix B, we show and discuss the results of the unit root and cointegration tests. We carried out a battery of tests and found evidence of cointegrated panels. For this reason, the Mean Group estimation models are expressed as an error correction model (ECM) to consider this data generation process characteristic. However, as the cointegration test of the series is not conclusive, we also report the results in their ARDL version without assuming long-term relations.

3 Results

3.1 Exports

We carried out our baseline estimations through an ARDL model using the MG and PMG methods. The results show the simple average of the elasticities of different exported goods. Control variables include: (a) REER, (b) foreign demand (trading partners' GDP) by product, (c) nominal exchange rate stability, and (d) output gap. The coefficients of interest are those associated with the REER and, secondly, the foreign demand. Nominal exchange rate stability and the output gap are relevant control variables for correctly identifying the coefficients of interest.

The inclusion of nominal exchange rate stability as a control variable is justified by the mechanism that we expect the real exchange rate operates through. Since export prices are invoiced in USD, a nominal depreciation does not lower their prices (Gopinath, 2015; Gopinath *et al.*, 2020). Instead, what it does is reduce non-tradable costs measured in USD. Thus, the mechanism by which exports are affected is through an increase in profitability, with the resulting incentive being to invest and expand the supply. However, increased profitability must be perceived as stable in order to foster investment plans. Conversely, if an increase in the real exchange rate takes place within contexts of high nominal instability, the positive effect of the RER would be reduced. Therefore, this variable is considered fundamental for the impact of the exchange rate on exports.

We choose to include nominal exchange rate stability instead of real exchange rate stability because the main variable of interest already captures RER movements, while the nominal behavior of the economy is otherwise excluded from the analysis. In one economy with nominal instability (for example, high inflation or high volatility of the nominal exchange rate), it is difficult to form expectations about the real exchange rate. Even if the central bank seeks not to compromise real exchange rate competitiveness, exporting firms will be reluctant to make long-term investments due to the difficulty in forming stable expectations in an environment of nominal instability. For this reason, we believe that taking nominal exchange rate stability is a better variable to capture exporters' ability to form expectations for investment decisions. In any case, the correlation between the stability of the nominal and real exchange rate is 0.95 for the Argentine case, and the results are robust when using either variable (see Figure 2, Appendix A).

We include the output gap to control for the increase in exports due to a fall in domestic absorption, which is compensated with an increase in exportable surplus. This behavior may turn relevant in cases in which a currency depreciation triggers a recession in the domestic economy. If we neglect this possibility, we may obtain biased coefficients in the REER-elasticity. We calculate the output gap using Argentina's GDP at constant prices through the Hodrick-Prescott filter. The variable is normalized with a standard deviation equal to 1 and zero mean to facilitate its interpretation. Given that the output gap is by construction a stationary variable, we only include it as a short-term variable and not as a long-term determinant.

The estimated model is represented by equation 4:

$$x_{it} = \alpha_i + \sum_{j=1}^{p} \lambda_{i,j} x_{i,t-j} + \sum_{j=0}^{q} \gamma_{i,j} REER_{i,t-j} + \sum_{j=0}^{q} \rho_{i,j} y_{i,t-j} + \sum_{j=0}^{q} \delta'_{i,j} z_{i,t-j} + u_{i,t} \quad \text{where i=1,2,...,N} \tag{4}$$

In which x_{it} are the exports of the product i in the period t at 1996's USD prices. $REER_{it}$ is the real effective exchange rate by product, and y_{it} captures foreign demand by product. z_{it} accounts for the rest of the control variables that vary according to the econometric exercises performed. Given the evidence of cointegration analyzed in Appendix A, equation 4 can be expressed equivalently in terms of an error correction model:

$$\Delta x_{it} = \phi_i \left(x_{i,t-1} - \gamma_i^* REER_{i,t} - \rho_i^* y_{it} - \delta_i'^* z_{it} \right) + \sum_{j=1}^{p-1} \zeta_{1,i,j} \Delta x_{i,t-j} + \sum_{j=0}^{q-1} \zeta_{2,i,j} \Delta REER_{i,t-j} + \sum_{j=0}^{q-1} \zeta_{3,i,j} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \zeta_{4,i,j} \Delta z_{i,t-j} + u_{i,t} \quad \text{where i=1,2,...,N} \tag{5}$$

In which, $\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_i j)\right)$, $\gamma_i^* = \frac{\sum_{j=1}^{q} \gamma_{i,j}}{1-\sum_{j=1}^{p} \lambda_{ij}}$; $\rho_i^* = \frac{\sum_{j=1}^{q} \rho_{i,j}}{1-\sum_{j=1}^{p} \lambda_{ij}}$; $\delta_i'^* = \frac{\sum_{j=1}^{q} \delta'_{i,j}}{1-\sum_{j=1}^{p} \lambda_{ij}}$; $\zeta_{1,i,j} = -\sum_{m=j+1}^{q} \lambda_{i,j}$; $\zeta_{2,i,j} = -\sum_{m=j+1}^{p} \gamma_{i,j}$; $\zeta_{3,i,j} = -\sum_{m=j+1}^{p} \rho_{i,j}$; y $\zeta_{4,i,j} = -\sum_{m=j+1}^{p} \delta'_{i,j}$. The coefficients γ_i^* and ρ_i^* denote the long-term elasticity of the variables of interest, and ϕ_i accounts for the speed of adjustment of the variables to their long-term relationship. If there is a long-term relation, ϕ_i is expected to be negative and be between 0 and -1 (Blackburne & Frank, 2007). Throughout this paper, we mainly focus on analyzing the long-term elasticities.[13]

Table 1 shows the results with different control variables and estimation methods. The first four columns use the MG method, while the last four use the PMG. Columns (1) and (5) only incorporate the REER and the GDP of trading partners as control variables; columns (2) and (6) include the nominal exchange rate stability; columns (3), (4), (7) and (8) only add controls for the short-term impact. They correspond to the output gap and a dummy equal to 1 since 1995, seeking to capture the effect of the MERCOSUR trade agreement on exports. Incorporating these variables only for the short-term has an economic explanation as well as a statistical one. In the first case, the very nature of the variable (output gap) captures a short-term effect, in which deviations in demand from the economy's potential supply level could release or constrain exportable surplus. In the second case, the aim is to control for the possible existence of a structural change at the export level with the entry into MERCOSUR.

Table 1. Export elasticities: Mean Group (MG) and Pooled Mean Group (PMG) methods

	(1) D.ln(exports) b/se	(2) D.ln(exports) b/se	(3) D.ln(exports) b/se	(4) D.ln(exports) b/se	(5) D.ln(exports) b/se	(6) D.ln(exports) b/se	(7) D.ln(exports) b/se	(8) D.ln(exports) b/se
LR								
ln(REER)	.1174	.8676***	.8795**	.6924**	.1443***	.4303***	.5108***	.3275***
	(.1016)	(.2555)	(.3958)	(.3352)	(.0290)	(.0426)	(.0432)	(.0320)
ln(trading partners' GDP)	1.7080***	1.0384***	.8050	.6001*	1.5822***	1.1459***	1.0214***	.8663***
	(.1860)	(.2621)	(.7151)	(.3161)	(.0450)	(.0528)	(.0531)	(.0628)
ln(Stability)		.2746***	.4025***	.1263**		.1677***	.2570***	.0918***
		(.0524)	(.1308)	(.0640)		(.0151)	(.0170)	(.0125)
SR								
ECT	-.4615***	-.5029***	-.5234***	-.5463***	-.3185***	-.3220***	-.3287***	-.4169***
	(.0118)	(.0124)	(.0126)	(.0130)	(.0097)	(.0097)	(.0099)	(.0106)
D.ln(REER)	.1142***	.0564	-.0906*	.0131	.0945***	.0989**	.0167	.0854**
	(.0333)	(.0443)	(.0463)	(.0443)	(.0320)	(.0421)	(.0454)	(.0399)
D.ln(trading partners' GDP)	1.4485***	-.7771	.3110	-.4213	1.9771***	1.1324**	1.7869***	.9663**
	(.4371)	(.5226)	(.5317)	(.5310)	(.4244)	(.4503)	(.5028)	(.4531)
D.ln(Stability)		-.0371***	-.0635***	-.0146		-.0062	-.0192*	.0107
		(.0128)	(.0131)	(.0127)		(.0102)	(.0103)	(.0100)
z.Output gap			-.0879***				-.0539***	
			(.0088)				(.0076)	
Mercosur				.3519***				.2741***
				(.0352)				(.0288)
Constant	2.1860***	2.0597***	2.2265***	4.1109***	1.9033***	2.2416***	2.3739***	3.5084***
	(.3545)	(.3828)	(.3949)	(.4522)	(.0684)	(.0755)	(.0785)	(.0972)
Obs.	16432	16432	16432	16432	16432	16432	16432	16432
No. of products	502	502	502	502	502	502	502	502
Model	mg	mg	mg	mg	pmg	pmg	pmg	pmg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

All the coefficients show the average elasticity across the 502 export products, obtaining the degree of significance by the variance between the individual estimates. The main variable of interest is the long-term elasticity relative to the REER. This variable captures how much the REER level affects exports once the short-term adjustments have been made. Column (1) is the only one in which the estimated coefficient is not significant,

[13] Since the database is annual, we use one lag in all the explanatory variables. Additionally, the tests performed to check the existence of unit roots favor the adoption of one lag. See Appendix A.

while column (5) – which has the same controls but is estimated by the PMG method– shows a coefficient of similar magnitude but, in this case, statistically significant. The trading partners' GDP-elasticity averages 1.7 through the MG method and 1.5 through the PMG method; both are significant at 1%.[14]

Column (2) is our favorite estimation as it controls for nominal exchange rate stability. The REER average elasticity reaches 0.87 and is significant at 1%. The estimate of the trading partners' GDP-elasticity is 1.04 and is statistically significant, while the estimate of nominal exchange rate stability implies that an increase of 1% in the stability variable boosts exports by 0.27%. Results are qualitatively similar using the PMG method (column 6). Both estimations highlight the relevance of nominal exchange rate stability. When this variable is included, both the magnitude and statistical significance of the REER-elasticities increase substantially. The rest of the econometric exercises show that the results are robust and the magnitudes of the estimated coefficients very stable. Obtaining a significant coefficient for nominal exchange rate stability is relevant both in theoretical and policy terms. It suggests that exchange rate volatility harms export supply.

The output gap is included as a control variable in Columns (3) and (7). In both cases, the estimated coefficients are negative and statistically significant. The coefficients are -0.09 and -0.05 for each standard deviation, respectively. We obtain the expected sign, suggesting the existence of exportable surplus in recessions and higher domestic consumption of exportable goods during expansions. The REER-elasticity coefficient remains unchanged, indicating that its omission was not biasing the results. Finally, we also find a positive impact of the MERCOSUR trade agreement dummy in columns (4) and (8), but it does not significantly change the REER-elasticity.

What is the preferred estimation method? The PMG estimator shows greater robustness to outlier coefficients, but it is only efficient and consistent when assuming homogeneity in long-term elasticities across the different products. If the true model has heterogeneous long-term coefficients, the PMG estimate is not consistent. The MG estimator is consistent in both cases. To select the best method, we performed the Delta test proposed by Pesaran & Yamagata (2008), in which the null hypothesis is that slopes are homogenous.[15] For the whole sample, as well as for sub-samples by types of products (by technological content (Lall, 2000) or differentiation degree (Rauch, 1999)), the results always reject the null hypothesis, favoring the idea that slopes cannot be treated as homogenous. The p.value is 0.0000 in every case, and results remain unchanged when controlled for autocorrelation of errors.[16]

Our preferred specification is the one that controls for nominal exchange rate stability and assumes heterogeneity on the slopes (column 2). On the one hand, the inclusion of nominal exchange rate stability plays a key role in the theory of how the exchange rate impacts exports. On the other hand, this specification includes a shorter number of variables and therefore saves degrees of freedom given the limited extension of the database sample. However, most results are robust to the inclusion of the output gap or the MERCOSUR dummy in all specifications.

Our estimate of the average REER-elasticity is substantially higher than those found in many previous studies but closer to the one obtained by Heymann & Navajas (1998) (0.84) for bilateral trade with Brazil and that of Catao & Falcetti (2002) for exports to MERCOSUR (1.2). This result is interesting as trade with Brazil and MERCOSUR has a larger share of manufactured products. Given that our elasticity is the simple average of the 502 products, the weight of manufacturing goods is not dwarfed by that of primary products despite Argentina's specialization on the latter. Our strategy also avoids the heterogeneity bias due to the omission of this characteristic. Moreover, our approach decreases the risk that climate events distort the aggregate result due to reverse causality problems. In the following sections, we will delve into these points.

[14] Table 8 shows the regression results in an ADRL form (in levels) without expressing the equation as an error correction model.

[15] The test was performed through the command proposed by Ditzen & Bersvendsen (2020) for the Stata statistical software.

[16] Additionally, we performed the traditional Hausman test. As is well-known, this test is valid under the assumption that long-term coefficients are homogeneous, and the test only evaluates the efficiency of the estimators. Under that null hypothesis, the Hausman test in models (2) and (6) (incorporating stability) and (3) and (7) (incorporating nominal exchange rate stability and output gap variables) favors the adoption of the PMG model. In the first case, the statistic is 1.79, and the p-value is 0.6174, while in the second case the statistic is 1.93, and the p-value is 0.5867. However, we have enough evidence to state that the effect of REER is heterogeneous by type of product; for this reason, the MG model is the best choice. However, we replicate all the analyses using the PMG method.

3.2 Imports

The model estimated replicates equation 5 but for the logarithm of imports at four digits of SITC. The explanatory variables are the REER of each imported good, Argentina's GDP at constant prices, and a group of control variables. Given the extension of the temporal series, we incorporate control variables in a non-simultaneous way to avoid reducing the degrees of freedom of the estimated model too much.

In the case of imports, we must include a variable that captures the trade opening process that took place in Argentina during the period analyzed.[17] The economy entered the 1980s decade with an average tariff of 30%. However, this level resulted from two precedent processes of trade opening (1967-1976 and 1976-1979) that sought to dissolve the tariff structure that corresponded to the import substitution regime (Brambilla *et al.*, 2018).[18] During the 1980s, average tariffs remained relatively constant, and only in the 1990s did two new events of trade opening take place, which are very important to include in our estimations. The first, and more critical episode, was between 1989 and 1991 when tariffs went down from 30% to 18% on average, compressing the tariff dispersion and eliminating import licenses (Beker, 2012; Brambilla *et al.*, 2018). The second episode was the MERCOSUR agreement coming into force between 1994 and 1996. This last trade agreement resulted in a reduction in the common external tariff of the bloc, negotiated between its members. However, while there was a tariff reduction in some cases, in others, commercial protection increased (an example of the latter is Argentina's food products). Intra-zone tariffs were reduced to zero.

There is a time availability constraint regarding tariff position data at four digits of desegregation. This data is available from 1992 onwards, while the trade database used in this paper covers from 1980 to 2015. For this reason, we decided to incorporate a dummy as a control variable of trade openness that captures the effect of the 1990s trade opening on the different imported products. This way of controlling the opening would be problematic if we assumed homogenous slopes. In that case, the dummy variable would not capture the different opening intensities in the different import products because its effects are considered homogeneous in the entire sample. However, our estimation method assumes the existence of heterogeneous coefficients; therefore, the estimated coefficient associated with the dummy variable captures different liberalization intensities. This means that if the opening for the product y faces a tariff reduction of 0.01%, while for product x, it is 20%, the dummy variable will show an estimated coefficient of different magnitude in one case or the other, capturing the differences in trade opening intensity. The problem will occur if the tariff change does not happen during the same period, which seems baseless.

Two different variables are chosen to capture trade opening. First, our favorite control variable for trade opening is a dummy variable that takes values 0 until 1989 and 1 from 1990 onwards. We consider this control variable crucial because of the broad and considerable reduction of the average tariff and non-tariff trade barriers during the trade opening in the early 1990s. Second, we also include a dummy variable that takes value one from 1995 onwards to control for the MERCOSUR trade agreement. Both proxies are incorporated to check if a structural change related to the trade opening could bias the rest of the coefficients. Finally, as an additional control variable, we include the nominal exchange rate stability as in the case of exports.

Table 2 shows results with the MG method (columns 1 to 4) and the PMG method (columns 5 to 8). In every case, the estimate of REER-elasticity and GDP-elasticity shows significant coefficients with the expected sign. The average long-term REER-elasticity is between -1.2 and -0.68 for MG models and around -0.88 and -0.54 for PMG models. The highest level of such elasticity is when control variables are not included, and the lowest (in absolute terms) occurs when we simultaneously control by trade opening variable and the nominal exchange rate stability. The dummy variables that proxy trade opening and the beginning of MERCOSUR show the expected sign. The former, however, shows a higher coefficient, in line with our expectations due to the magnitude and widespread nature of the trade opening in the early 1990s when compared with the latter. For this reason, column (2) – which controls for the trade opening from the 1990s onwards – will be our preferred estimation.

[17] See Brambilla *et al.* (2018) for a detailed account of Argentina's trade protection and opening process.

[18] In the first stage, tariffs moved from an average level of 200% to 100%. In the second stage, they reached 30%, also reducing their dispersion.

Table 2. Import elasticities: Mean Group (MG) and Pooled Mean Group (PMG) methods

	(1) D.ln(imports) b/se	(2) D.ln(imports) b/se	(3) D.ln(imports) b/se	(4) D.ln(imports) b/se	(5) D.ln(imports) b/se	(6) D.ln(imports) b/se	(7) D.ln(imports) b/se	(8) D.ln(imports) b/se
LR								
ln(REER)	-1.2348***	-1.0435***	-1.2175***	-.6875***	-.8832***	-.7079***	-.8145***	-.5418***
	(.1312)	(.0647)	(.3020)	(.0735)	(.0329)	(.0240)	(.0239)	(.0285)
ln(GDP)	1.4011***	.8285***	.7977***	.7294***	1.5383***	1.1969***	.9507***	1.1430***
	(.2396)	(.1032)	(.2629)	(.1049)	(.0408)	(.0358)	(.0481)	(.0382)
ln(Stability)				.1573***				.1099***
				(.0227)				(.0097)
SR								
ECT	-.4307***	-.5666***	-.5212***	-.6201***	-.2820***	-.4117***	-.3864***	-.4203***
	(.0105)	(.0096)	(.0106)	(.0105)	(.0086)	(.0089)	(.0096)	(.0091)
D.ln(REER)	-.0033	.2403***	.0275	.1294***	-.2568***	-.0014	-.2030***	-.0449
	(.0380)	(.0358)	(.0380)	(.0422)	(.0331)	(.0306)	(.0326)	(.0330)
D.ln(GDP)	3.8762***	3.3574***	4.1542***	2.9773***	3.6897***	3.2526***	3.7667***	3.0804***
	(.1284)	(.1288)	(.1324)	(.1343)	(.1217)	(.1191)	(.1196)	(.1247)
Trade openness (1990s)		.6538***		.6562***		.5251***		.4999***
		(.0370)		(.0374)		(.0340)		(.0340)
Mercosur			.4315***				.2629***	
			(.0235)				(.0221)	
D.ln(Stability)				-.0632***				-.0217***
				(.0095)				(.0080)
Constant	5.2231***	7.4530***	9.0530***	8.1669***	2.9697***	4.4585***	5.1980***	4.4224***
	(.3211)	(.3463)	(.3536)	(.3863)	(.0919)	(.1029)	(.1324)	(.1030)
Obs.	19652	19652	19652	19652	19652	19652	19652	19652
No. of products	584	584	584	584	584	584	584	584
Model	mg	mg	mg	mg	pmg	pmg	pmg	pmg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In terms of Argentina's GDP-elasticities, the long-term coefficients estimated show values from 1.4 to 0.72 (MG models) and 1.5 to 0.95 (PMG models). Interestingly, the short-term and long-term coefficients show large differences. While in the short term, the increase in GDP shows an elasticity around 3, the adjustment process leads to a coefficient far closer to unitary elasticity in the long term. This finding is coherent in theoretical terms because it would not be reasonable for the ratio of imports to GDP to constantly increase at a 3 to 1 rate in the long-term, as previous research estimations and our short-term coefficients in Table 2 suggest. The lowest response in the long term could indicate that, initially, a greater proportion of the aggregate demand growth is met with imports, but later the domestic supply partially adjusts to the higher demand level. Additionally, it is interesting that the average GDP-elasticity decreases from 1.4 to 0.82 (columns 1 and 2) precisely when controlling for trade openness. This reduction shows the importance of this variable when performing the estimation, preventing changes in trade openness from biasing the coefficients of interest.[19]

Finally, the nominal exchange rate stability shows a positive sign, as in the case of exports. This result implies that nominal stability also fosters trade with foreign countries in imports. A stable economy is expected to increase the benefit of searching for foreign suppliers in the face of higher certainty of the future cost of imported inputs and the profitability expected for its domestic production. However, the role of the nominal stability is lower in imports than in exports.

The Delta test is again performed to define whether the MG model or the PMG one is preferable. In all regression models, the results always reject the null hypothesis, favoring the idea that it is not possible to treat slopes as homogeneous as results would be biased. The p-value is 0.0000 in every case, and the results are robust to be controlled for the autocorrelation of errors. The same occurs in subsamples by types of goods (Lall's or Rauch's classifications), with just one exception. This exception is for highly technological goods in which the null hypothesis is accepted when no controls for error autocorrelation are performed, and the MERCOSUR and trade-openness dummies are not included.[20] These results suggest that the right way of estimating elasticities corresponds to the MG model due to the existence of heterogeneity on the slopes.

[19] Table 9 in the appendix replicates the results from the ARDL model without expressing it as a correction model. This way, it becomes more evident the adjustment process of imports when an increase in domestic demand occurs.

[20] Under that null hypothesis, the Hausman test in models (1) and (5) (baseline model which only controls for REER and domestic GDP) rejects the null hypothesis that there are no systematic differences between coefficients and, therefore, favors the adoption of MG (the statistic is 6.22 and the p-value 0.0447). The same occurs when controlling for trade opening (1990 onwards), where the statistic is 30.29, and the p-value is 0.0000), thus favoring the use of the MG model. However, when the regression controls for the beginning of the MERCOSUR agreement, the test favors the adoption of the PMG model (statistic 1.7 and p-value 0.4276).

3.3 Robustness of the results

We perform a battery of additional exercises to ensure the robustness of the results. First, Tables 10 and 11 of Appendix A replicate the results for exports and imports – respectively – using the price indices provided by Feenstra & Romalis (2014), which control for changes in product quality. The database covers a shorter period (1984-2011), but the results do not change qualitatively or quantitatively.[21]

Second, we perform another series of exercises in which we include new control variables that could potentially be biasing the results. In the case of exports, Table 12 of Appendix A checks the robustness of the results through different specifications. Column (1) replicates the preferred estimation to facilitate the comparison with the new results. Column (2) modifies the dependent variable, using the exports in current dollars as an explained variable. Column (3) uses the exports in current dollars again but adds each product's unit price in dollars as an explanatory variable. Column (4), in turn, incorporates the Vegetation Health Index (VHI) provided by FAO as a control for climate events, in which an increase in the index shows good vegetation health after planting.[22]

Column (5) replicates the base regression but also controls for a trade opening dummy that takes a value equal to 0 until 1990 and 1 from then onwards. Column (6) repeats the exercise but without controlling for nominal exchange rate stability because the drastic change in the nominal stability coincides with a trade opening controlled by the dummy variable. Columns (7), (8), and (9) control for the import tariffs that exporters face in the destination countries, but the sample shrinks to 1992-2015 due to data availability. Columns (7) and (8) control for the simple and weighted averages – respectively – of the tariffs faced by Argentine exports abroad. Column (9) incorporates the specific tariffs of Latin American countries and the import tariffs paid by Argentina in upstream positions of its exports. Controlling only for Latin American tariffs is justified, on the one hand, because of the relevance of MERCOSUR since 1994 and, on the other hand, because average tariffs have decreased in the region since 2004.

All exercises confirm the results reported previously. The average REER-elasticity of exports yields robust results in every specification. Specifically, the average elasticity is between 0.84 and 1.6. The only case in which the REER-elasticity is not significant is in column (5), where we simultaneously control for nominal stability and the 1990 trade opening. The p-value is, however, 0.112, which is very close to the consensus value required to reject the null hypothesis. Moreover, when nominal stability is removed (not significant in column 5), the positive and significant result is recovered at 1%.[23] Finally, the REER-elasticity doubles when controlling for the import tariffs of the trading partners or the upstream inputs.[24]

In the case of imports, Table 13 of Appendix A shows eight additional regressions that prove the robustness of our main exercise. The first column replicates our preferred estimation to provide the reader with a comparison base. Columns (2) and (3) control simultaneously for trade opening and MERCOSUR (column 2) and nominal exchange rate stability (column 3). Columns (4), (5), and (6) use imports in current dollars as an explained variable. While column (4) replicates our preferred regression using imports in current dollars (controlling for trade opening), columns (5) and (6) incorporate the logarithm of the unit value of imports. The difference between columns (5) and (6) is that the latter does not control for trade liberalization in the 1990s. Finally, columns (7) and (8) limit the sample from 1992 onwards to make it possible to control for the simple (7) and weighed (8) averages of Argentina's import tariffs.[25] All the results keep the signs and significance of

[21] The only case in which the robustness exercise is not satisfactory is in imports, when we add a control for the beginning of the MERCOSUR agreement. In this case, there is a significant increase in the GDP-elasticity (up to a 10.5), but all long-term coefficients turn out insignificant.

[22] In this case, the database began in 1984, losing four years of data regarding our baseline exercises.

[23] If we include the MERCOSUR or output gap controls (not reported), the coefficient would also be significant and has the expected sign.

[24] Tariffs in export destinations or upstream input tariffs show non-significant results or an erroneous sign in long-term coefficients. However, they are always significant in the short term and with the expected sign. It is necessary to point out that the coefficients are estimated only through the time dimension variability of the series, and incorporating many control variables can generate complications in the estimates due to the loss of degrees of freedom.

[25] We incorporate these control variables as the logarithm of 1 + tariff rate.

the coefficients of interest, except column (8), where the sample is reduced, and tariffs weighed by trading partners' shares are added as a control.

Taken together, the base exercises and the robustness tests indicate that REER-elasticities are close to 1.0 and significant for the simple average estimator of the import elasticities, and around 0.8 for the average coefficient of exports. Also, controlling for nominal exchange rate stability plays a fundamental role in correctly estimating the REER-elasticity of exports and its direct impact on their dynamics. Regarding the long-term income elasticities, we find coefficients between 0.82 and 0.72 for imports, and between 1.03 and 0.6 for exports.

These results should not be interpreted as a rejection of the Bickerdike, Robinson, and Metzler or Marshall-Lerner condition because they only inform on the (simple) average elasticity at four digits of disaggregation. They do not consider the share of each product in Argentina's export or import basket. Nevertheless, individual elasticities allow us to understand how macroeconomic variables influence Argentina's productive structure. Thus, before evaluating the aggregate results, we inquired about the heterogeneities found and their role in a discussion on economic development.

4 From macro to micro: the impact of the macroeconomic variables at the microeconomic level

Are there any patterns in the magnitude of the elasticities according to some observable characteristics of the products? The answer to this question is relevant from an economic development standpoint, where the macro-micro interactions of the economy are taken into account.[26] If there is a specific pattern, then different real exchange rate levels influence the productive structure of an economy differently. This result is relevant because of the extensive evidence which states that the productive specialization in specific tradable products is not neutral to the future economic growth rate (Hausmann & Klinger, 2006; Hausmann *et al.*, 2007; Hausmann & Hidalgo, 2011; Hidalgo *et al.*, 2007). With this in mind, we explore how macroeconomic trade elasticities vary through different goods classifications used in the literature. Although all the estimated elasticities are evaluated, we focus on the REER-elasticity and nominal exchange rate stability because the economic authorities have some tools to influence them. This, of course, is not the case with trading partners' economic growth.[27]

We start our analysis of heterogeneity elasticities by breaking the exported and imported goods by Lall's and Rauch's classifications (Lall, 2000; Rauch, 1999). In the first classification, goods are divided into five categories: primary products, natural resource-based manufacturing, and three categories based on the technological content of the manufacturing goods (low, medium, high). The second classification, in turn, distinguishes between differentiated products, products with world reference prices, and homogeneous products.[28]

Table 3 shows the results of our preferred regression model for exports according to the previously mentioned categories.[29] Each column corresponds to a sample that groups products of each category. Thus, column (1)

[26] In the online Appendix C, heterogeneity analysis is complemented by visualizing the distribution of density Kernel functions for the different long-term elasticities estimated.

[27] In our estimations, the initial REER impulse would be extinguished if it were not complemented with other productive policies or if a process of innovation or adoption of technology were not triggered. However, Palazzo (2021) shows that the exchange rate impulse encourages the development of new productive sectors. Furthermore, the paper found a hysteresis effect that lingers when the competitive exchange rate period finishes.

[28] Bernini *et al.* (2018) offers a more precise classification for the differentiation analysis of goods. However, a deeper disaggregation level is necessary than the one used in this paper for its application.

[29] We found six outliers estimated elasticities across the individual coefficients of the preferred regression of exports. They correspond to the 6651, 11, 7783, 5824, 149, and 545 positions. The first three show non-significant elasticities lower than -30, while the three last show non-significant elasticities higher than 20. Although these outlier coefficients are compensated with the average in the general sample estimate, this might not be the case when the sample is subdivided. Actually, the MG method loses power when the cross-section dimension is small. For this reason, we decided to remove these positions from the analysis of heterogeneity so that the average coefficients are not biased in small subgroups of products.

estimates the elasticities by only using the subsample of primary products, column (2) only resource-based manufacturing goods, and columns (3), (4), and (5) for manufacturing goods of low (3) medium (4) and high (5) technological content. Columns (6), (7), and (8) do the same with Rauch's classification: column (6) reports the average elasticity of differentiated goods, column (7) of those products with reference prices, and (8) of products considered homogeneous. All regressions are estimated by the Mean Group method.

Some interesting patterns emerge. First, results vary in magnitude and statistical significance among the different categories. When Lall's categories are used (columns 1 to 5), the low and medium technological content goods are the categories with the greatest REER-elasticities, followed by the high-technology manufacturing goods. Indeed, the elasticities of primary products and resource-based manufacturing goods do not obtain significant average coefficients. As to the orders of magnitude, low-technology sectors obtain an average elasticity of 1.23 (column 3), while sectors of medium-technology reach 0.98 (column 4) and high-technology manufacturing goods reach 0.77 (column 5).

Table 3. Export elasticities by types of products: Lall's and Rauch's classifications (MG method)

	(1) PP D.ln(exports) b/se	(2) Resource-based D.ln(exports) b/se	(3) LT D.ln(exports) b/se	(4) MT D.ln(exports) b/se	(5) HT D.ln(exports) b/se	(6) D D.ln(exports) b/se	(7) RP D.ln(exports) b/se	(8) H D.ln(exports) b/se
LR								
ln(REER)	.2667	.3736	1.2325***	.9832***	.7746*	.9866***	.4619*	.2085
	(.2281)	(.2544)	(.2073)	(.2271)	(.4470)	(.1395)	(.2578)	(.3179)
ln(trading partners' GDP)	.4316	2.3063***	.6210*	1.3249***	1.0624**	1.3580***	1.3242***	.2405
	(.3794)	(.3340)	(.3680)	(.3499)	(.5167)	(.2178)	(.3937)	(.4600)
ln(Stability)	.1778***	.1971**	.3670***	.3358***	.5382***	.3434***	.2899***	.1192**
	(.0483)	(.0793)	(.0536)	(.0660)	(.1293)	(.0390)	(.0840)	(.0592)
SR								
ECT	-.5859***	-.4857***	-.4592***	-.5148***	-.5803***	-.5143***	-.4444***	-.6005***
	(.0326)	(.0255)	(.0214)	(.0239)	(.0499)	(.0156)	(.0243)	(.0375)
D.ln(REER)	-.0064	.1300	.0144	-.0013	.2295	.0334	.0605	.0203
	(.1003)	(.0881)	(.0902)	(.0828)	(.2240)	(.0565)	(.0947)	(.1182)
D.ln(trading partners' GDP)	-.8169	.9139	.7124	-2.6224**	-7.2689**	-1.3956*	1.6027**	-1.5243
	(1.1271)	(.8877)	(.9288)	(1.0379)	(3.0506)	(.7263)	(.8025)	(1.4796)
D.ln(Stability)	-.0089	.0268	-.0935***	-.0581**	-.0678	-.0643***	-.0086	-.0073
	(.0183)	(.0265)	(.0274)	(.0237)	(.0622)	(.0170)	(.0268)	(.0256)
Constant	6.4806***	.7471	.9834	1.1934*	3.7567**	1.0017**	1.9624***	8.2229***
	(1.1932)	(.7510)	(.6406)	(.6604)	(1.8410)	(.5092)	(.5811)	(1.4942)
Observaciones	2406	4216	3838	4384	1195	8998	4253	1783
No. de productos	73	127	118	135	37	276	129	54
Modelo	mg	mg	mg	mg	mg	mg	mg	mg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Another pattern emerges concerning the impact of nominal exchange rate stability. We find a positive and significant impact of exchange rate stability on all products. However, the high-technology manufacturing goods show a higher coefficient than the others, reaching a 0.53 elasticity (column 5). This group of products is followed by manufacturing goods of low and medium technological content with elasticities at around 0.36/0.33 (columns 3 and 4). Lastly, in a lower rung are the natural resource-based manufacturing goods with elasticities at around 0.18 (columns 1 and 2).

When we analyze REER-elasticities by the categories proposed by Rauch, homogeneous products (column 8) do not show – on average – coefficients significantly different from 0, while the differentiated products (6) and products with reference prices (7) do. However, the differentiated products show the highest average elasticity relative to the real exchange rate. The REER-elasticity of the differentiated products reaches a value of 0.98, which doubles the associated value for products with reference prices (0.46). This pattern also repeats itself in the nominal exchange rate stability elasticities. While the differentiated products (column 6) have an average elasticity of 0.34 relative to nominal stability, sectors with reference prices reach a value of 0.28, and the homogeneous products only 0.11.

What patterns are observed in imports? Table 4 repeats the exercise of the preferred regression model – controlled for 1990's trade opening – for each subcategory of import goods. The patterns that emerge are similar to the case of exports, especially for the REER-elasticities. In this case, there are significant average coefficients for every type of product but with differences in their magnitudes. If we focus on Lall's categories (columns 1 to 5), primary products (1) show the lowest average REER-elasticity in absolute terms. In contrast, the low-technology manufacturing goods (column 3) show the highest REER-elasticity as in the case of export goods. They reach a value of -1.6 and double the elasticity of the medium and high-technology manufacturing goods and natural resource-based manufacturing goods.

In the case of Rauch's categories, the pattern is even more evident. The differentiated goods reach a REER-elasticity of -1.29 (column 6), followed by goods with reference prices (-0.7, column 7) and homogeneous goods (-0.41 reported in column 8). Regarding GDP-elasticity, the medium-technology manufacturing goods are the most elastic, followed by the natural resource-based manufacturing goods. In turn, both the category that groups primary products and the one that groups homogeneous products show a non-significant coefficient for GDP-elasticity.

Table 4. Import elasticities by types of products: Lall's and Rauch's classifications (MG method)

	(1) PP D.ln(imports) b/se	(2) Resource-based D.ln(imports) b/se	(3) LT D.ln(imports) b/se	(4) MT D.ln(imports) b/se	(5) HT D.ln(imports) b/se	(6) D D.ln(imports) b/se	(7) RP D.ln(imports) b/se	(8) H D.ln(imports) b/se
LR								
ln(REER)	-.6497***	-.9381***	-1.6056***	-.9311***	-.8113***	-1.2968***	-.7024***	-.4113**
	(.1781)	(.1229)	(.1986)	(.0754)	(.1277)	(.0927)	(.1049)	(.1646)
ln(GDP)	-.0610	.9366***	.7958***	1.3267***	.5638	.8002***	.8117***	.3284
	(.3521)	(.1840)	(.2171)	(.1475)	(.4277)	(.1403)	(.2059)	(.2928)
SR								
ECT	-.5758***	-.5594***	-.5484***	-.5947***	-.5425***	-.5527***	-.5418***	-.6686***
	(.0272)	(.0221)	(.0197)	(.0165)	(.0279)	(.0120)	(.0197)	(.0333)
D.ln(REER)	.0494	.2063***	.2798***	.3023***	.2342**	.2725***	.0942	.2257**
	(.1121)	(.0734)	(.0769)	(.0648)	(.0942)	(.0489)	(.0659)	(.1037)
D.ln(GDP)	2.6115***	2.9744***	3.6289***	3.4459***	4.3290***	3.8389***	2.6282***	2.6838***
	(.3720)	(.2950)	(.2321)	(.2306)	(.3825)	(.1721)	(.2231)	(.4967)
Trade openness	.5329***	.6276***	1.1147***	.4839***	.2755***	.7436***	.4972***	.6947***
	(.0985)	(.0747)	(.0813)	(.0640)	(.0724)	(.0510)	(.0625)	(.1215)
Constant	9.4549***	7.0954***	7.1248***	6.9279***	7.6996***	7.8117***	6.7599***	9.4100***
	(1.3197)	(.7500)	(.6121)	(.5767)	(1.0718)	(.3887)	(.8018)	(1.3224)
Obs	2313	4644	4400	6128	1965	11051	5217	1871
No. of products	71	138	132	180	57	327	155	57
Model	mg	mg	mg	mg	mg	mg	mg	mg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Given that even within these categories – in exports and imports – the hypothesis of homogeneous slopes is rejected, we complement the analysis with figures 3 and 5 of Appendix A. Those figures show the Kernel density functions for all estimated coefficients and those statistically significant in individual terms for the REER-elasticities of the exports and imports, distinguishing them by types of goods. We show that our conclusions do not depend on specific coefficients but that the distributions of the elasticities of each category show differences between each other.[30]

In short, we observe rich heterogeneity in estimating the REER-elasticity both in exports and imports. Moreover, this heterogeneity shows different patterns by types of goods analyzed. The main conclusions are that the differentiated products and manufacturing goods tend to show higher REER-elasticities than the homogeneous products and primary products. On the other hand, in exports, the nominal stability is relevant mainly for high-technology manufacturing goods and differentiated products. Overall, we find evidence favoring the adoption of a stable and undervalued real exchange rate. This macro-micro interaction means that such an exchange regime works as an incentive to make the tradable supply of the economy more complex and diverse and could be a facilitator of structural change and a higher economic growth rate. This evidence supports the channel proposed by Rodrik (2008), Rapetti *et al.* (2012), and Razmi *et al.* (2012) and is in line with Cimoli *et al.* (2013).

However, no categorization manages to group goods with similar slopes between each other, which means that there is still a relevant proportion of heterogeneity not captured by the proposed categories. For this reason, a new dimension is explored to analyze the differences in the elasticities associated, in line with the theoretical channel through which the real exchange rate acts. This characteristic refers to the degree of labor requirements each product uses in its production function.

[30] Figures 4 and 6 of Appendix A do the same with the rest of the long-term coefficients estimated for the exports and imports, respectively.

4.1 The role of labor intensity in export and import REER-elasticities

The real exchange rate can affect trade flows through mechanisms that involve tradable supply curves or tradable demand curves. For example, export demand would change if exporters set their selling price in local currency and later changed it into USD by dividing the price by the current exchange rate. In such a case, a depreciation diminishes the price in terms of the US dollar (or any foreign currency), and leads foreign customers to increase their consumption due to the relative cheapening of the good. In this channel, there is no obvious role for the degree of use of labor to have any relation with the REER-elasticities of exports.

However, if exporters invoice their prices in USD, currency depreciation does not diminish the price the overseas customer faces. Instead, the depreciation increases the exporter's profits in domestic currency as it diminishes their production costs -measured in USD- in all those non-tradable inputs or factors of production. Labor is the most important non-tradable factor in any production function since capital goods are usually considered tradable. Given that the final export price in USD remains unchanged in this case, the most labor-intensive sectors will benefit the most from the drop in costs in USD, and this will lead to a higher increase in profitability. Then, we expect that those sectors will have higher incentives to invest and expand their tradable supply.

As mentioned before, the estimations performed in this paper are agnostic as to whether they capture a supply or a demand phenomenon or both simultaneously. However, in the case of exports, there is vast evidence gathered by Gopinath (2015) and Gopinath *et al.* (2020) that developing countries tend to set their export prices in USD. This evidence favors the idea that, in this case, the mechanism by which the real exchange rate has influence is through incentives to expand the tradable supply. Then, we expect a positive relationship between REER-elasticities of the exports and the degree of the labor intensity of each product.

On the side of imports, the price faced by the consumer is given by a combination of the price in foreign currency and the nominal exchange rate. Movements in exchange rate automatically make imported goods more expensive, encouraging substitution for other domestic goods. This mechanism, in principle, is a demand phenomenon. However, the increase in prices of imported goods allows the local producer – a competitor of the foreign firm –to increase the price of the substitute good and, therefore, increase their profit margin. With such a new profit margin, the local producer will be encouraged to expand the supply to offer a higher number of domestic substitute goods.[31]

Then, there are two simultaneous phenomena that occur in imports. On the one hand, the consumer will substitute imported goods with domestic goods at a lower price. That is a demand phenomenon. Nevertheless, on the other hand, the producer of tradable goods competing with imports will enjoy an increased profit margin and have incentives to invest and expand their production. This supply phenomenon will be more relevant as labor intensity becomes more important in the firm's production function and less relevant as the share of capital or imported inputs in the production function increase. While the demand phenomenon has little to do with labor intensity, the supply one might have a relationship. In sum, it is interesting to analyze the link between REER-elasticities and the labor intensity, both for exports and imports. A similar argument is proposed by Dao *et al.* (2021).

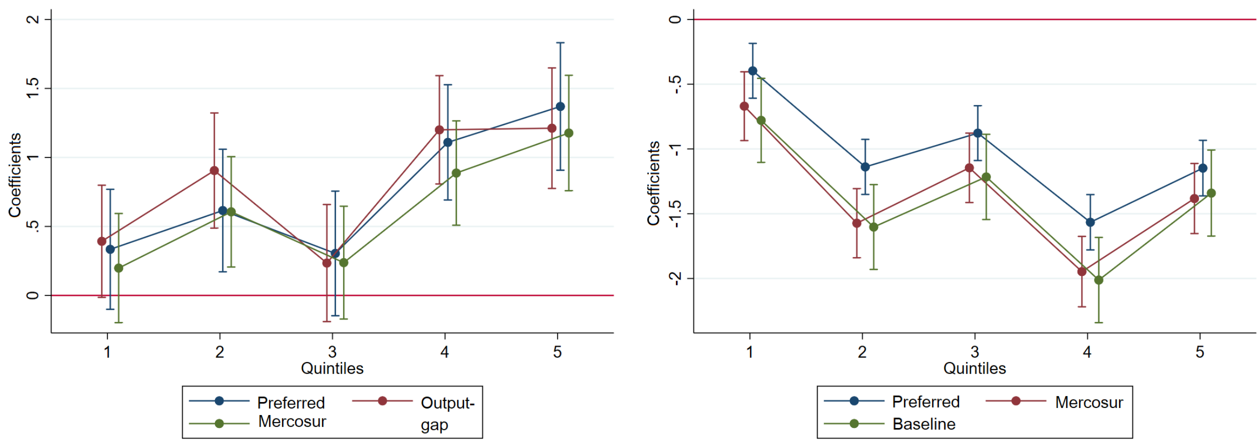
We explore the relationship between REER-elasticities and labor intensity in Figure 1. This figure shows the REER-elasticities of exports and imports of our main regressions (Tables 1 and 2) by their quintile of labor intensity. The labor intensity index was approximated by workers to millions of gross production value in prices of 2004. This indicator is at four digits of ISIC for 2004 and is provided by INDEC and MECON. Grouping by quintiles facilitates and avoids matching problems with the level of disaggregation used for trade flows (4 digits of SITC). The figures show the average of the coefficients according to each quintile of labor intensity. We calculate confidence intervals (95%) and the simple average elasticities by quintile through a regression model of ordinary least squares: REER-elasticities are regressed against dummy variables for each quintile of labor intensity.

[31] The quality of the domestic goods will probably be lower than the imports as they need the extra profit caused by the exchange rate to be competitive. However, this does not prevent domestic goods from being an imperfect substitute for imported ones.

Thus, Figure 1a shows the results using the estimated elasticities in Table 1 via the MG method in the case of exports. We use long-term REER-elasticities of: (a) our preferred regression, controlled for the nominal exchange rate stability (column 2); (b) the one controlled for the output gap (column 3); (c) the one controlled for the MERCOSUR agreement dummy (column 4). Figure 1b shows the estimates performed for the imports in Table 2 using the MG method. In this case, we use the long-term REER-elasticity of: (a) the preferred regression for imports, controlled for the trade opening of the 1990s (column 2); (b) the one controlled for the MERCOSUR dummy (column 3), and the base regression without any other control except the REER and GDP of Argentina (column 1).

The results show interesting facts. On the exports side, we find a significant increase in the simple average of long-term REER-elasticities in labor-intensive sectors. For example, in the preferred estimation, the fourth and fifth quintile group of products are the most sensitive to the REER and reach an average elasticity of 1.1 and 1.3, significant at 1%. In line with our hypothesis, the first and third quintiles do not show significant elasticities different from 0, while the second one does it moderately with an average level of 0.6. The results are qualitatively and quantitatively similar to the other two specifications.

Figure 1. Labor-intensity and REER-elasiticities: exports and imports results.



(a) REER-elasticity in exports

(b) REER-elasticity in imports

Source: own elaboration based on COMTRADE's and IMF's databases.

In the case of imports, results show a similar pattern. There is a negative relation between REER-elasticities and the quintiles of labor intensity. As the sign of REER-elasticity of imports is negative, the most elastic imports are also the most labor-intensive. However, differences are more subtle among quintiles. If we focus the analysis on the preferred regression, the least labor-intensive quintile is the least elastic relative to the REER (-0.39). However, the higher elasticity is in the fourth quintile (-1.56), while in the fifth quintile (-1.14) it diminishes to values similar to those in quintile 3 (-0.87) and quintile 2 (-1.13). The results are similar to the rest of the specifications. Interestingly, in every case, the elasticities are different from 0 in statistical terms, probably due to the characteristic of the demand phenomenon previously mentioned. This fact, in turn, might explain the lower clarity in terms of differences according to the degree of labor intensity.

These results support the findings of Palazzo & Rapetti (2017), Palazzo (2021), and Dao *et al.* (2021), which show that the most labor-intensive sectors are those that respond the most to REER. Part of the heterogeneity found is explained by the productive structure of each sector, in which the predominance of non-tradable costs encourages the expansion of the tradable supply. On the other hand, our results suggest that the REER can foster export supply and import substitution through the supply mechanisms mentioned above.

The economic relevance of this result does not finish here. If labor-intensive sectors are the ones that most respond to the real exchange rate level, there are important implications for the analysis of the labor market.

This mechanism is in line with the labor channel proposed by Frenkel & Ros (2006) and Frenkel *et al.* (2004), in which the authors postulate this hypothesis and evaluate the REER impact on employment. Additionally, our results support the work of Damill *et al.* (2002), which points out the importance of Argentina's currency appreciation during the 1991-2001 decade as a determinant of employment and other poor-performing indicators in the labor market. Similarly, a large part of the employment growth during 2003-2008 may have been positively influenced because the high real exchange rate level boosted labor-intensive sectors. No doubt, this channel opens the possibility of delving into a wide range of lines of research that link the exchange rate, the employment level, and other labor indicators.[32]

5 Aggregate trade elasticities: back to macro

The previous section dealt with macroeconomic trade elasticities from a development economics standpoint. The focus was on understanding the heterogeneity impacts of changes in macroeconomic variables on different kinds of products. Now, we attempt to walk the path from the microeconomic impact to the analysis of the aggregate macroeconomic impact. In other words, once we avoid the heterogeneity biases found in the literature (Imbs & Mejean, 2015) and properly estimate individual elasticities, it is possible to explore the magnitude of macroeconomic trade elasticities of imports and exports but in aggregate terms.

In this case, the elasticity of interest will be an average of the individual elasticities but weighted according to their share in Argentina's import or export basket. Thus, it will be possible to break down another fundamental macro-micro interaction: the productive structure determines the aggregate macroeconomic trade elasticities that are important elements for the overall performance of an economy.

Knowing the aggregate elasticities turns out to be relevant for at least two reasons. First, GDP-elasticities of exports and imports show whether it is possible to grow at the same pace as Argentina's trading partners without generating balance-of-payments crises. For example, if the GDP-elasticity of imports is higher than the GDP-elasticity of exports, economic growth itself would generate exchange rate pressures resulting from the ongoing deterioration of the balance of payments (Thirlwall, 1979, 2011; Blecker, 2013). This mechanism is one of the explanations usually given concerning the economic cycles of countries like Argentina.

Second, related to foreign shocks, the aggregate REER-elasticities determine the capacity of the exchange rate to induce adjustments in the current account balance. This aggregate elasticity is, actually, the one associated with the literature on elasticity pessimism mentioned previously.

In this regard, we should make some clarifications before showing the results. The literature on international macroeconomics denominates Bickerdike, Robinson, and Metzler's (BRM) condition to the one that studies the exchange rate's effect on the trade balance.[33] The requisites for a real exchange rate depreciation to improve net exports depend on the assumptions made on Argentina's supply and demand elasticities and those of the rest of the world. Suppose a small country that is an international price-taker; we can assume that the import RER-elasticity of demand and the export RER-elasticity of supply from the rest of the world are perfectly elastic. In such a case, the condition for improving the trade balance in dollars only depends on the sum of absolute values of REER-elasticities (supply of export and domestic demand for imports) are higher than 0. Now, suppose that the export supply of Argentina and the export supply RER-elasticity of the rest of the world are perfectly elastic. Only in this case do the requisites for improving the trade balance come down to the well-known Marshall-Lerner condition. This means that the sum of the absolute value of the REER-elasticity of the demand for Argentina's exports and imports must be higher than one.

While our estimation is agnostic on whether our estimates capture demand or supply elasticities, we have argued that we likely capture supply elasticities in exports but demand elasticities in the case of imports. The difference is due, precisely, to the fact that we suppose that the country is small and a price-taker. If

[32] See also Ekholm *et al.* (2012) for a similar finding.
[33] See Dornbusch (1975) for a discussion on the Bickerdike, Robinson, and Metzler condition.

these assumptions are accurate, the trade balance in dollars improves if the sum of absolute values of estimated aggregate elasticities is higher than 0. Notwithstanding, we choose to remain agnostic and analyze the magnitude of the elasticities in order to understand the balance-of-trade adjustment expected in the face of exchange rate changes.

Table 5 shows the different estimated elasticities weighed by Argentina's basket of imports and exports.[34] Additionally, the table recalculates the aggregate elasticities, also weighted, but for the share of each product in world international trade. These calculations show what Argentina's macroeconomic trade elasticities would like if the country had a basket of exports and imports similar to the world's trade basket. Thus, they help us understand whether Argentina's magnitudes of aggregate elasticities are explained by its own individual elasticity values or by a particular exports/imports basket.[35]

To provide robustness to the analysis, we show the results using some of our main regression models calculated. However, we concentrate the analyses on the first line of each quadrant in which the results of the preferred models are explained. In the case of imports, the preferred model is the one controlling for the trade opening in the 1990s, while for exports, it is the one controlling for the nominal exchange rate stability.

The left panel of the table shows the weighted averages for the main estimated elasticities in the case of imports, while the right panel does the same for exports.[36] On the other hand, figures 7 and 8 of Appendix A show the adjustment process toward the long-term impact of aggregate exports and imports after a standard deviation shock of each relevant explanatory variable.[37]

The analysis focuses on evaluating the magnitude of the aggregate REER-elasticities and whether the economy cannot grow at the same pace as its trading partners without suffering balance-of-payments crises.

5.1 GDP-elasticities and balance-of-payments constrained?

We analyze the results of the GDP-elasticities through the lens proposed by the balance-of-payments constrained growth model. The canonic model argues that in the long term, the growth rate at which an emerging economy can grow without balance-of-payment pressures is given by the ratio between the income-elasticity of its exports and the income-elasticity of its imports multiplied by the growth rate of its trading partners. If the economy grew above that rate, the increase in imports would trigger an increase in the current account deficit, which could become unsustainable in the long term. Therefore, the accumulation of imbalances in the balance of payments would be the seed of the subsequent crisis, returning the economy to its maximum rate of growth constrained by the balance of payments. Under this lens, if the income-elasticity of imports were higher than the income-elasticity of exports, the economy would not be able to grow at the same pace as its trading partners' economies (Blecker, 2013).

What does tell us the results obtained in our previous regressions? Unexpectedly, if we analyze the result of the preferred regressions weighted by their share in Argentina's basket, the GDP-elasticity of the imports reaches 1.38. By contrast, the GDP-elasticity of exports reaches 1.64. These aggregate elasticities mean that the GDP-elasticity of exports exceeds the GDP-elasticity of imports, releasing the growth constrained by the balance of payments. Moreover, the result is consistent across the different regression models proposed, with minimum differences between the elasticities of exports and imports. Interestingly, the result remains unchanged even if the elasticities are weighted by the world's trade basket. Altogether these calculations

[34] The share of each product is defined as the simple average of its share from 1980 to 2015. In previous versions of this paper, we used 1996's share with slightly different aggregated results.

[35] We are particularly thankful to Juan Carlos Hallak for suggesting the idea. As usual, errors, omissions, and conclusions are our own.

[36] To improve the precision of the estimations, we eliminated outlier values from the estimated elasticities. We define outliers as those below percentile 5 and above percentile 95, as long as they are not significantly different from 0. That means that the estimated coefficients identified as outliers are at the tail of the distribution, and they are not statistically significant.

[37] As in the previous case, outlier values are eliminated using the same criterion used in long-term elasticities. However, it is possible to find minimum differences between the identification of outliers in one or the other as the outlier values of the lags can be compensated between each other and go unnoticed as outliers when we concentrate on the analysis of the long-term elasticities. However, the differences are atypical and not significant, and thus do not affect our ability to interpret the results.

show no biases in Argentina's productive specialization which determine an idiosyncratic GDP-elasticity that prevents the country from growing at the same speed as its trading partners.

Table 5. Estimated elasticities: aggregate results weighted by the share in Argentina's and the world's trade basket

Imports				Exports			
Long-term elasticities	Estimated regressions	Weights		Long-term elasticities	Estimated regressions	Weights	
		Argentina	World			Argentina	World
GDP ARG	Trade Openness (2)	1.388	1.334	Trading partners' GDP	Stability (2)	1.645	2.232
	Mercosur (3)	1.021	1.045		Output gap (3)	1.201	1.494
	Baseline (1)	2.093	2.209		Mercosur (4)	1.013	1.425
REER - Imports	Trade Openness (2)	-0.841	-0.949	REER - Exports	Stability (2)	0.273	0.731
	Mercosur (3)	-1.173	-1.305		Output gap (3)	0.233	0.524
	Baseline (1)	-1.273	-1.397		Mercosur (4)	0.187	0.577
Openness/Mercosur Imports	Trade Openness (2)	0.628	0.728	Stability Exports	Stability (2)	0.183	0.433
	Mercosur (3)	0.424	0.431		Output gap (3)	0.235	0.360
	Baseline (1)	–	–		Mercosur (4)	0.053	0.236

Note: own elaboration based on COMTRADE and our estimates.

This result only changes when the GDP-elasticities are estimated without any control variable to capture the trade opening of the 1990s. In that case, the GDP-elasticity of imports reaches a value of 2 in the long-term, higher than any other GDP-elasticity of exports. However, this is a clear example of an omitted variable, and it only highlights the importance of a correct specification of the regressions before jumping to conclusions.

Our calculations are unexpected with respect to the literature summed up in Table 6, for which we are cautious and encourage further research in this regard. However, no previous research was robust enough to the heterogeneity bias into which it would fall if it omitted this characteristic of data. The values found in our paper suggest that the frequent balance of payments crises suffered by the Argentine economy are not due to an intrinsic dynamic generated by the structure of exports and imports. The seed of the crisis would not relate to the channels suggested by the balance-of-payments constrained growth models. However, it is necessary to mention three caveats.

First, our results only establish that Argentina can grow as fast as its trading partners. In other words, the elasticities estimated allow maintaining the relative GDP gap with its main partners with no significant pressures from a balance-of-payments crisis standpoint. However, problems could emerge if Argentina seeks to converge to levels of income per capita of developed countries quickly. In that case, the balance of payment constraint does not afford a positive margin, and policies that increase the level of exports become necessary.

Second, even if the goal is only to grow at the same speed as its trading partners, this growth cannot go hand in hand with an appreciation of the real exchange rate. If the growth is accompanied by an appreciation of the currency, the external deficits will increase, given that exports and imports depend on the real exchange rate level. This observation highlights that the conclusions about not balance-of-payments constraint assumes that the initial balance of payments is in equilibrium, with a real exchange rate level keeping that balance. Therefore, the estimated GDP-elasticities imply that there should not be pressures on the exchange rate, only if that real exchange rate level is maintained.

Lastly, it is not possible to rule out that the productive structure will interact with unmet social demands that steer leaders to make decisions that affect the macroeconomic equilibrium and cause stop-and-go cycles (Gerchunoff & Rapetti, 2016; Cimoli *et al.*, 2016; Razmi, 2021). In this case, part of the solution to the problem calls for political consensus and social agreements that ensure good macroeconomic management and thus avoid recurrent balance-of-payment crises.

5.2 Aggregate REER-elasticities: the missing link between pessimists and optimists

As mentioned previously, a currency devaluation can improve the trade balance depending on the magnitudes of the estimated elasticities. Indeed, the elasticity pessimism literature doubts the usefulness of the exchange rate movements as a variable of external adjustment by looking at this aggregate trade elasticity.

The magnitude of this coefficient is relevant to understanding the percentage of depreciation necessary to balance the current account, ceteris paribus the GDP level of the economy.

This adjustment is independent of any other recessionary effect that a depreciation might have on domestic absorption because the regressions have already considered GDP movements. If there is a recessionary effect, the variation of the GDP should capture its impact on the trade balance adjustment, so it will not bias the coefficient associated with the REER. In the case of exports, a recession could favor the emergence of exportable balances. However, the results are robust enough to include the output gap as a control variable.[38]

The preferred regression for imports shows an aggregate REER-elasticity of -0.841, while the REER-elasticity for exports reaches 0.273. These elasticity coefficients imply that the sum of their absolute values is around 1.11. That is, weighting the individual estimates by their shares, we can conclude that the imported volumes fall by 0.8%, and the exports increase by 0.3% in the face of a 1% depreciation. As a result, net exports would improve by 1.1%.

Thus, if we consider that the economy is a price-taker, the condition to improve the trade balance in dollars is easily met. This is because the sum of absolute values of the elasticities is above 0 by a wide margin.[39] However, even if our estimates correspond to demand elasticities both for exports and imports, and we assume that the supply elasticities are completely elastic, the Marshall-Lerner condition would be met in all of our estimations.

Notwithstanding, the most significant part of the adjustment is on the imports side, while aggregate exports hardly respond to the exchange rate level. In this sense, pessimists are right to point out that the aggregate adjustment of the exports is scarce. This result, however, depends on the structural bias caused by the productive specialization of a country like Argentina, where the homogeneous products are overrepresented in its export basket, while modern tradable sectors and manufacturing are underrepresented.

For this reason, the low level of aggregate elasticity fades when we use the world's trade shares of each good as a weighing factor instead of each good shares in the Argentine basket. As a result, the REER-elasticity moves from 0.273 to 0.731 in the preferred regression of exports, multiplying the elasticity by 2.6 times. The three regression models reported show similar increments in the magnitude of REER-elasticities when using the world's trade basket, which gives robustness to our finding. Interestingly, on the imports side, this difference is virtually insignificant in economic and statistical terms.

The most feasible explanation of this phenomenon is that Argentina's export basket is biased by certain types of products where the individual REER-elasticities are relatively low. The lower aggregate elasticity is due to the concentration of exports in primary and homogeneous products in which the REER-elasticity is "low". However, it could also be possible for the country to be specialized in those products that are less sensitive to REER within each category. For this purpose, Tables 14 and 15 in Appendix A show the aggregate elasticities by Lall's and Rauch's categories – for exports and imports – using both Argentina's and the world's trade basket shares.

Interestingly, there are no significant quantitative differences in the export REER-elasticity within each category of goods if they are weighted by the world's trade or by Argentina's specific basket (Table 14 of Appendix A). This result repeats itself whether we classify goods by primary products, resource-based manufacturing and manufacturing goods with varying degrees of technological content (Lall) or by the degree of product differentiation (Rauch). These results show that Argentina's productive profile is the main reason for finding a lower REER-elasticity in aggregate exports. Over 60% of the exports are concentrated in primary products and related manufacturing, corresponding with mostly homogeneous goods or with world reference prices.[40]

[38] In Argentina, depreciation of the exchange rate is usually considered recessionary. Different mechanisms are possible for the existence of a recessionary effect. They are discussed by Diaz-Alejandro (1965); Díaz-Alejandro (1969), and Krugman & Taylor (1978).

[39] For this to be the case, it is necessary to assume that the estimated elasticities match supply elasticity for exports and demand elasticity for imports.

[40] As expected from the aggregate results obtained, there are no significant differences in the REER-elasticities of imports depending on the weights chosen. Table 15 of Appendix A shows the different aggregate elasticities of imports by types of goods.

Furthermore, these results confirm that the differences found in the previous sections between types of products hold, despite being weighted by their share in Argentina's basket or by each good's share in the world trade basket. Therefore, the REER-elasticity differences do not depend on using simple averages for their comparison.

In short, there is evidence that the substitution effect implied by movements in the exchange rate could be a shock-absorber and facilitate the balance-of-payments adjustments necessary for recovering macroeconomic equilibrium, regardless of its contractionary or expansive effects on the aggregate demand. While both trade flows improve, it is essential to highlight that the most significant part of net exports adjustment occurs due to a contraction of imports and, to a lesser degree, due to an improvement in exports. We insist that this result does not undermine the positive role that an undervalued RER level could play as a facilitator of structural change and economic growth. In any case, it highlights the underdevelopment of modern tradable activity in this semi-industrialized economy.

6 Conclusions

In this paper, we estimate the macroeconomic trade elasticities at four digits of disaggregation of SITC for Argentina, a developing economy specialized in primary products. The main methodological novelty of this article lies in estimating the macroeconomic trade elasticity heterogeneity using the Mean Group method. This identification strategy allows us to analyze their slope heterogeneities, avoid the heterogeneity biases in the aggregate coefficients and diminish the risk of reverse causality.

We find a wide range of heterogeneity in the macroeconomic trade elasticities. The simple average of the REER-elasticities reaches 0.86 for exports and -1.04 for imports in our preferred regressions. However, the estimation range goes from -10 to 10, approximately. In the case of the income-elasticities, the simple average is close to one both for exports and imports, with a similar variability to the case of the REER-elasticities. The high degree of heterogeneous responses we found suggests that the macroeconomic environment —i.e., the real exchange rate level or GDP growth— does not homogeneously affect sectoral performance.

Additionally, we find that differentiated products have a greater response both to the level of the real exchange rate and nominal exchange rate stability than less differentiated goods. On the other hand, if we divide the tradable basket by technological content, medium and low technological manufacturing goods show higher REER-elasticities, and high-technology goods show the highest elasticity to nominal exchange rate stability. We also find a positive relationship between the REER-elasticity and the degree of the labor intensity of products, both in exports and imports. This result is in line with a mechanism through which the real exchange rate fosters tradable supply: an increase in the real exchange rate boosts investment in tradable activities because it augments profitability by reducing costs (measured in foreign currency) of the non-tradable factors; i.e., labor. This mechanism is particularly relevant in exports.

We then calculate the aggregate macro REER-elasticity from the elasticities at the product level. When we weight the elasticities by the participation of each product in Argentina's trade basket, aggregate exports reach a REER-elasticity of 0.3 and imports -0.8. As a result, the trade balance in dollars improves 1.1% in the face of a 1% increase in the real exchange rate level. However, when we use the world's trade shares of each good as a weighing factor instead of its share in the Argentine basket, the REER-elasticity moves from 0.273 to 0.731 in the preferred regression of exports. This result suggests that the "low" REER-elasticity of the exports is a consequence of Argentina's economic structure, which is biased towards primary and homogeneous products that are rather insensitive to RER movements.

We believe this paper builds a bridge between the literature arguing that an undervalued RER is a facilitator of structural change and economic growth and literature skeptical of its benefits due to elasticity pessimism. We find that the RER affects the productive structure of the economy, and, in turn, the productive structure affects the magnitude of macroeconomic trade elasticities. If a country like Argentina tries to diversify its tradable basket towards more differentiated manufacturing sectors, an undervalued RER will facilitate this diversification. Diversification, in turn, would improve the aggregate REER-elasticity, which would help absorb shocks and macroeconomic adjustment. This micro-macro interaction is relevant when defining a long-term development strategy.

APPENDIXES

Appendix A: Tables and figures

Table 6. Literature review on aggregate trade elasticities in Argentina. Long-term estimations.

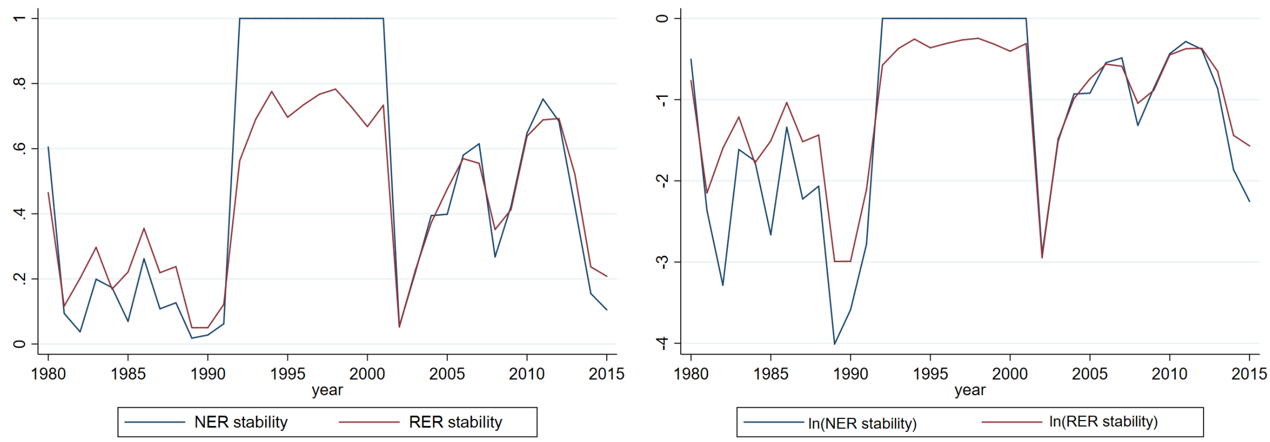
Study	Description	Long-term elasticity	Method
Heymann & Navajas (1998)	Bilateral trade Argentina-Brasil (1970-1997).	1. Imports from ARG to BRA: (a) GDP-elasticity 2,48, (b) RER-elasticity 1,16, (c) Trade openness (1990) dummy. Significant. 2. Exports from ARG to BRA: (a) GDP-elasticity 2,54, (b) RER-elasticity 0,84, (c) Structural break in 1990s.	ARDL model expressed as an Error correction model (ECM)
Catao & Falcetti (2002)	Imports and exports (1986-1996). Divides exports into those to MERCOSUR y those to extra-MERCOSUR.	1. Imports: (a) GDP-elasticity between 2 and 2.5; (b) price-elasticity between 0.7 and 0.8. 2. Exports to extra-MERCOSUR: (a) price-elasticity (unit value in dollars) 1; (b) GDP-elasticity 1; (c) REER volatility 1; (d) Net Capital Stock 2, (e) Convertibility plan dummy. Significant. 3. Exports to Mercosur: 3.a Demand equation: (a) GDP-elasticity 2; (b) price-elasticity 1.2. 3.b Supply equation: (a) price-elasticity 1.29.	Export supply equation to extra-MERCOSUR and import equation use an ARDL model expressed as ECM. Export demand equations to intra-MERCOSUR use a VECM.
Heymann & Ramos (2003)	Imports (1975-2001)	(a) GDP-elasticity 3.3; (b) RER-elasticity -0.7.	Error correction model (ECM)
Bus & Nicolini-Llosa (2007)	Imports (1970-2007)	1. From 1970 to 1989: a. Method CM-JJ: (i.a) GDP-elasticity 1.62 (ii.a) elasticidad-TCR de largo plazo -0.7 b. Method OLS-EG: (i.b) GDP-elasticity 1.46, (ii.b) RER-elasticity -0.4 2. From 1990 to 2007: a. Method CM-JJ: (i.a) GDP-elasticity 2.89; (ii.a) RER-elasticiy -0.33 b. Method OLS-EG: (i.b) GDP-elasticity 3.81, (ii.b) RER-elasticity -0.44	Two methods: (a) Johansen-Juselius's Cointegration Method (CM-JJ). Preferred method. (b) Ordinary least square using Engle's and Granger's method (OLS-EG) .
Berrettoni & Castresana (2009)	Exports and imports (1993-2008)	1. Imports: (a) RER-elasticity -0.34, (b) GDP-elasticity 2.76, (c) exchange rate volatility -0.24 2. Exports: (a) RER-elasticity 0.3, (b) GDP-elasticity 1.84, (c) exchange rate volatility -0.25.	Error correction model (ECM)
Zack & Dalle (2016)	Exports and imports (1996-2013)	1. Imports: (a) GDP-elasticity 1.81-1.72; (b) RER-elasticity -0.34-0.3 2. Exports: (a) GDP-elasticity 1; (b) RER-elasticity 0.07	Error correction model (ECM)
Fares & Zack (2018)	Exports and imports (1997-2017)	1. Imports: (a) GDP-elasticity 3.7 until 2003 (b) GDP-elasticity 2.4 from 2003; (b) RER-elasticity -0.4 2. Exports: (a) GDP-elasticity 1.85; (b) RER-elasticity 0.2	Error correctiton model (ECM)

Table 7. Descriptive statistics

Variable	Obs.	Mean	SD	Median	p(5)	p(95)	Time frame
Exports (millions USD 1996)	17,219	50.68	245.94	4.32	0.0366	176.66	1980-2015
Exports in current USD (millions)	17,757	55.8	326.61	4.12	0.0492	177.55	1980-2015
Imports (millions USD 1996)	20,495	36.19	128.69	8.78	.1032	138.32	1980-2015
Imports in current USD (millones)	21,005	39.04	147.94	8.71	.1040	154.34	1980-2015
Trading partners' GDP (base 1980=100)	18,072	166.94	62.89	62.89	99.6	244.8	1980-2015
REER of exports (base 1980=100)	18,072	196.74	77.84	186.51	104.91	315.23	1980-2015
REER of imports (base 1980=100)	21,024	213.40	245.37	193.71	115.00	346.27	1980-2015
Argentina GDP (in billions. Constant prices)	36	475.241	134.345	445.463	321.189	720.407	1980-2015
Output gap (HP)	36	-0.000721	0.03682	0.0055	-0.0777	0.05012	1980-2015
NER stability	36	0.4861	0.3741	0.4102	0.02768	1	1980-2015
Export prices (base 1996=1)	17,219	5.06	90.27	1	0.42	5.1	1980-2015
Import prices (base 1996=1)	20,495	1.36	1.77	1	0.52	2.96	1980-2015
Export Tariffs (sa)†	13,782	7.9	8.2	6.52	0.42	19.97	1988-2015
Export Tariffs (wa)††	13,782	6.92	8.65	4.42	0.04	20.16	1988-2015
Export tariffs to Latin America (sa)	13,176	9.8	9.62	8.04	0.84	27.25	1989-2015
Export tariffs to EU (sa)	13,369	4.47	12.35	0.2	0	18.98	1988-2015
Export tariffs to USA (sa)	12,462	2.43	6.29	0	0	12.35	1989-2015
Import tariffs (sa)†	13,195	11.34	6.41	11.59	0.8	21.5	1992-2015
Import tariffs (wa)††	13,195	9.64	6.75	9.1	0.02	21	1992-2015
Import tariffs from Latin America (sa)	12,846	6.38	6.62	4.13	0	19.5	1992-2015
Import tariffs from EU (sa)	12,600	12.83	6.84	13.26	1.56	23	1992-2015
Import tariffs from USA (sa)	12,292	12.65	6.69	13.17	2	22.49	1992-2015
Upstream import tariffs (sa)	10,848	11.06	2.77	10.81	6.7	15.82	1992-2015
Upstream import tariffs from Latin America (sa)	10,848	6.96	5	6.57	0.82	14.82	1992-2015
Upstream import tariffs from EU (sa)	10,848	12.39	2.45	12.29	8.6	16.46	1992-2015
Upstream import tariffs from USA (sa)	10,848	11.94	2.88	11.79	7.61	16.31	1992-2015
Labor intensity 2004†††	502 (584)	3.98	2.08	3.95	0.82	7.57	2004

Note: To deflate exports and imports we use Törnqvist index prices (1996=1) calculated in (Palazzo, 2021). † *sa* refers to the simple average of the series. †† *wa* refers to the simple average of the series. ††† We have done the correspondence between the 146 sectors of CIIU classification at four digits to CUCI classification at 4 digits. Between parentheses are the values that change in the case of imports.

Figure 2. Stability of the nominal and real exchange rate. In levels and logarithms.



(a) Levels

(b) Logarithms

Source: own elaboration based on Aizenman *et al.* (2013).

Table 8. Export elasticities in levels (MG method)

	(1)	(2)	(3)	(4)
	ln(exports)	ln(exports)	ln(exports)	ln(exports)
	b/se	b/se	b/se	b/se
L1.ln(exports)	.5385***	.4971***	.4766***	.4537***
	(.0118)	(.0124)	(.0126)	(.0130)
ln(REER)	.1510***	.3658***	.2614***	.2908***
	(.0376)	(.0451)	(.0473)	(.0454)
L1.ln(REER)	-.1142***	-.0564	.0906*	-.0131
	(.0333)	(.0443)	(.0463)	(.0443)
ln(trading partners' GDP)	2.3259***	.0105	1.0884**	.0643
	(.4425)	(.5267)	(.5343)	(.5376)
L1.ln(trading partners' GDP)	-1.4485***	.7771	-.3110	.4213
	(.4371)	(.5226)	(.5317)	(.5310)
ln(Stability)		.0962***	.1282***	.0748***
		(.0120)	(.0123)	(.0119)
L1.ln(Stability)		.0371***	.0635***	.0146
		(.0128)	(.0131)	(.0127)
z.Output gap			-.0879***	
			(.0088)	
Mercosur				.3519***
				(.0352)
Constant	2.1860***	2.0597***	2.2265***	4.1109***
	(.3545)	(.3828)	(.3949)	(.4522)
Obs	16432	16432	16432	16432
Model	mg	mg	mg	mg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9. Import elasticities in levels (MG method)

	(1)	(2)	(3)	(4)
	ln(imports)	ln(imports)	ln(imports)	ln(imports)
	b/se	b/se	b/se	b/se
L1.ln(imports)	.5693***	.4334***	.4788***	.3799***
	(.0105)	(.0096)	(.0106)	(.0105)
ln(REER)	-.5470***	-.3127***	-.6090***	-.2528***
	(.0332)	(.0318)	(.0331)	(.0377)
L1.ln(REER)	.0033	-.2403***	-.0275	-.1294***
	(.0380)	(.0358)	(.0380)	(.0422)
ln(GDP)	4.5720***	3.9678***	4.4951***	3.4865***
	(.1419)	(.1370)	(.1438)	(.1382)
L1.ln(GDP)	-3.8762***	-3.3574***	-4.1542***	-2.9773***
	(.1284)	(.1288)	(.1324)	(.1343)
Trade openness (1990s)		.6538***		.6562***
		(.0370)		(.0374)
Mercosur			.4315***	
			(.0235)	
ln(Stabiltiy)				.0487***
				(.0099)
L1.ln(Stability)				.0632***
				(.0095)
Constant	5.2231***	7.4530***	9.0530***	8.1669***
	(.3211)	(.3463)	(.3536)	(.3863)
Obs	19652	19652	19652	19652
Model	mg	mg	mg	mg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10. Export elasticities using Feenstra & Romalis (2014)'s database: MG and PMG methods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)	D.ln(X.FyR)
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
LR								
ln(REER)	.2237**	.7309***	.7030***	.5733***	.3500***	.7929***	.8546***	.3692***
	(.1051)	(.1276)	(.1594)	(.1639)	(.0315)	(.0559)	(.0579)	(.0358)
ln(trading partners' GDP)	2.8318***	1.8785***	1.9537***	2.1543***	2.4080***	1.9873***	1.9196***	2.0278***
	(.5523)	(.1953)	(.2427)	(.5559)	(.0498)	(.0719)	(.0750)	(.0719)
ln(Stability)		.1383***	.1261*	.0686		.1562***	.1821***	.0596***
		(.0326)	(.0669)	(.0593)		(.0172)	(.0200)	(.0121)
SR								
ECT	-.5745***	-.5996***	-.6147***	-.6474***	-.3597***	-.3514***	-.3512***	-.4594***
	(.0120)	(.0125)	(.0131)	(.0135)	(.0101)	(.0100)	(.0103)	(.0112)
D.ln(REER)	-.1304***	-.2791***	-.3393***	-.2892***	-.1266***	-.2961***	-.3235***	-.2547***
	(.0281)	(.0409)	(.0446)	(.0403)	(.0266)	(.0385)	(.0410)	(.0373)
D.ln(trading partners' GDP)	.8567**	.1241	.4617	.1554	1.9613***	1.4595***	1.6326***	1.2748***
	(.3763)	(.4078)	(.4563)	(.4140)	(.3565)	(.3546)	(.4041)	(.3556)
D.ln(Stability)		-.0610***	-.0711***	-.0504***		-.0562***	-.0605***	-.0430***
		(.0102)	(.0111)	(.0103)		(.0094)	(.0094)	(.0092)
z.Output gap			-.0220**				-.0114	
			(.0094)				(.0070)	
Mercosur				.1373***				.0674***
				(.0317)				(.0242)
Constant	-3.2528***	-2.9657***	-3.0562***	-2.5434***	-2.0771***	-2.0151***	-2.0043***	-1.7932***
	(.4040)	(.4156)	(.4273)	(.4687)	(.0759)	(.0743)	(.0758)	(.0690)
Obs	13730	13730	13730	13730	13730	13730	13730	13730
No. of products	524	524	524	524	524	524	524	524
Model	mg	mg	mg	mg	pmg	pmg	pmg	pmg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11. Import elasticities using Feenstra & Romalis (2014)'s database: MG and PMG methods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)	D.ln(M.FyR)
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
LR								
ln(REER)	-1.0344***	-.7106***	-.4107	-1.3576**	-.6813***	-.6204***	-.6209***	-.6158***
	(.1406)	(.0493)	(.4551)	(.5997)	(.0258)	(.0196)	(.0192)	(.0345)
ln(GDP)	2.7815***	2.2942***	10.5086	2.2704***	1.9010***	2.2744***	1.9573***	2.3810***
	(.3383)	(.1107)	(8.6029)	(.4537)	(.0421)	(.0347)	(.0488)	(.0491)
ln(Stability)				-.5211				-.0217*
				(.4522)				(.0126)
SR								
ECT	-.5269***	-.6843***	-.5974***	-.7293***	-.3113***	-.4323***	-.3988***	-.4225***
	(.0115)	(.0105)	(.0120)	(.0122)	(.0082)	(.0094)	(.0096)	(.0093)
D.ln(REER)	-.0408	.1319***	-.0284	.0694	-.2110***	-.0839***	-.1955***	-.0034
	(.0331)	(.0330)	(.0333)	(.0426)	(.0317)	(.0306)	(.0313)	(.0326)
D.ln(GDP)	3.1918***	2.6911***	3.2206***	2.2129***	3.7768***	3.3152***	3.6150***	3.0705***
	(.1114)	(.1151)	(.1155)	(.1222)	(.1096)	(.1078)	(.1085)	(.1076)
Trade Openness		.4048***		.4552***		.2831***		.2699***
		(.0390)		(.0435)		(.0315)		(.0313)
Mercosur			.1621***				.1002***	
			(.0211)				(.0175)	
D.ln(Stability)				-.0139				.0477***
				(.0097)				(.0083)
Constant	-1.1318***	-2.0614***	-.3469	-1.9155***	.2636***	-.9634***	.0217	-1.2260***
	(.3367)	(.3903)	(.3752)	(.4130)	(.0227)	(.0447)	(.0306)	(.0487)
Obs	15491	15491	15491	15491	15491	15491	15491	15491
No. of products	589	589	589	589	589	589	589	589
Modelo	mg	mg	mg	mg	pmg	pmg	pmg	pmg

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12. Robustness of export elasticities: Convertibility dummy, tariffs, droughts, and exports in current dollars (MG method)

	(1) D.ln(exports) b/se	(2) D.ln(X USD) b/se	(3) D.ln(X USD) b/se	(4) D.ln(exports) b/se	(5) D.ln(exports) b/se	(6) D.ln(exports) b/se	(7) D.ln(exports) b/se	(8) D.ln(exports) b/se	(9) D.ln(exports) b/se
LR									
ln(REER)	.8676***	1.2089***	.8451*	.8959***	.7175	.8253***	1.6522***	1.5759***	1.1018***
	(.2555)	(.2388)	(.5067)	(.2892)	(.4518)	(.2617)	(.3127)	(.3659)	(.1284)
ln(trading partners' GDP)	1.0384***	2.4622***	1.6658***	1.1199*	.9943*	.1371	1.5029	.2965	.6444
	(.2621)	(.6101)	(.3112)	(.6640)	(.5722)	(.5260)	(1.1218)	(.5862)	(.4038)
ln(Stability)	.2746***	.1757	.5082***	.2962***	.1340		.4506***	.3334***	.2800***
	(.0524)	(.1419)	(.1174)	(.0858)	(.1130)		(.1387)	(.1240)	(.0448)
ln(unit value in USD)			.3692						
			(.5132)						
ln(Vegetation Health Index)				.5934					
				(1.1067)					
Export tariffs (sa)							.6040***		
							(.2251)		
Export tariffs (wa)								.5448	
								(.4679)	
Export tarrifs to Latam (sa)									.0070
									(.2024)
Upstream tariffs from Latam (sa)									.2516*
									(.1409)
SR									
ECT	-.5029***	-.4506***	-.4796***	-.5430***	-.6214***	-.5741***	-.6691***	-.6490***	-.7793***
	(.0124)	(.0116)	(.0121)	(.0137)	(.0127)	(.0121)	(.0138)	(.0144)	(.0167)
D.ln(REER)	.0564	-.1686***	-.1548***	.1019*	-.0004	.1816***	-.3204***	-.3666***	-.2526***
	(.0443)	(.0361)	(.0363)	(.0531)	(.0452)	(.0352)	(.0579)	(.0560)	(.0850)
D.ln(trading partners' GDP)	-.7771	-.3855	-.2591	-1.5626***	-.4926	1.9083***	-.3574	-.4329	-1.3887**
	(.5226)	(.4047)	(.3931)	(.5011)	(.5156)	(.4348)	(.4731)	(.4628)	(.5430)
D.ln(Stability)	-.0371***	-.0653***	-.0658***	-.0587***	-.0837***		-.1177***	-.1250***	-.1223***
	(.0128)	(.0098)	(.0101)	(.0136)	(.0129)		(.0151)	(.0147)	(.0204)
D.ln(unit value in USD)			.1447***						
			(.0173)						
D.ln(Vegetation Health Index)				.4141***					
				(.0635)					
Trade openness (1990s)					.7660***	.7617***			
					(.0545)	(.0497)			
D.Export tariffs (sa)							-.1278***		
							(.0249)		
D.Export tariffs (wa)								-.0792***	
								(.0178)	
D.Export tarrifs to Latam (sa)									.0279
									(.0767)
D.Upstream tariffs from Latam (sa)									-.1610***
									(.0558)
Constant	2.0597***	.2046	1.1689***	3.7493***	3.7042***	3.8264***	3.1206***	4.2242***	1.5184
	(.3828)	(.3154)	(.3387)	(.4447)	(.4429)	(.4015)	(.7049)	(.6246)	(1.2014)
Obs	16432	17255	16432	15022	16432	16432	13022	13022	10285
No. of products	502	502	502	502	502	502	497	497	452
Model	mg	mg	mg	mg	mg	mg	mg	mg	mg

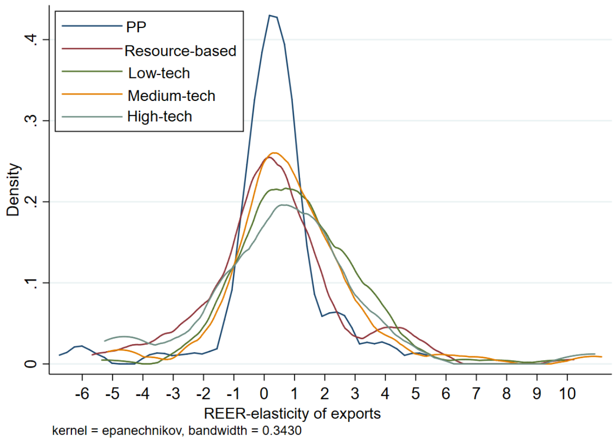
Standard errors in parentheses. (sa) abbreviate simple average. (wa) abbreviate weighted average.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13. Robustness of import elasticities: Convertibility dummy, tariffs, and imports in current dollars (MG method)

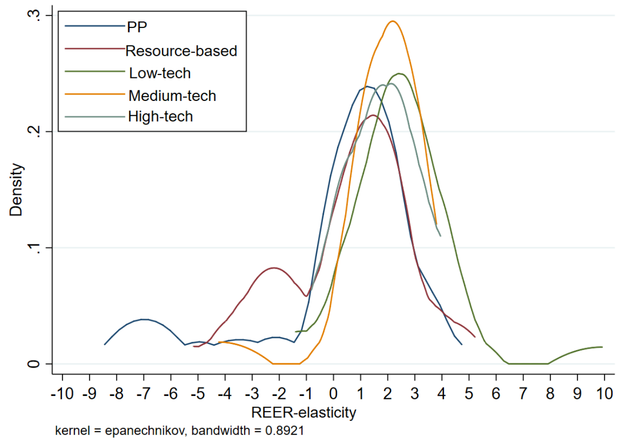
	(1) D.ln(imports) b/se	(2) D.ln(imports) b/se	(3) D.ln(imports) b/se	(4) D.ln(M.USD) b/se	(5) D.ln(M.USD) b/se	(6) D.ln(M.USD) b/se	(7) D.ln(imports) b/se	(8) D.ln(imports) b/se
LR								
ln(REER)	-1.0435***	-1.0884***	-.7985***	-.9131***	-.9228***	-.9477***	-.7150**	-.1864
	(.0647)	(.0625)	(.0788)	(.0513)	(.0659)	(.1470)	(.3347)	(.2059)
ln(GDP)	.8285***	.4688***	.5466***	2.0171***	2.0781***	2.5832***	-.3929	-.4309
	(.1032)	(.1217)	(.1089)	(.0860)	(.1162)	(.2098)	(1.1734)	(.6070)
ln(Stability)			.1176***					
			(.0237)					
ln(unit value in USD)					-.1984***	-.4000**		
					(.0636)	(.1620)		
Tariffs (sa)							-.6620	
							(1.1908)	
Tariffs (wa)								-.1479
								(.2372)
SR								
ECT	-.5666***	-.6238***	-.6649***	-.5602***	-.5822***	-.4704***	-.5865***	-.5790***
	(.0096)	(.0100)	(.0109)	(.0088)	(.0091)	(.0097)	(.0128)	(.0127)
D.ln(REER)	.2403***	.2436***	.1528***	.2324***	.1318***	-.0388	-.6269***	-.5609***
	(.0358)	(.0359)	(.0429)	(.0278)	(.0277)	(.0286)	(.0672)	(.0675)
D.ln(GDP)	3.3574***	3.5723***	3.2285***	2.9908***	2.8322***	3.2167***	2.3557***	2.4261***
	(.1288)	(.1284)	(.1325)	(.1042)	(.1059)	(.1060)	(.1921)	(.2848)
Trade openness (1990s)	.6538***	.5716***	.5953***	.5309***	.4098***			
	(.0370)	(.0407)	(.0405)	(.0341)	(.0313)			
Mercosur		.2585***	.1940***					
		(.0257)	(.0256)					
D.ln(Stability)			-.0588***					
			(.0094)					
D.ln(unit value in USD)					.1177***	.1218***		
					(.0213)	(.0233)		
D.Tariffs (sa)							-.0577	
							(.0513)	
D.Tariffs (wa)								-.0267
								(.0464)
Constant	7.4530***	9.4960***	9.7179***	3.5722***	3.4758***	2.1775***	8.0648***	9.1601***
	(.3463)	(.3842)	(.4172)	(.3043)	(.3433)	(.3116)	(.6001)	(.6480)
Obs	19652	19652	19652	20421	19478	19478	11879	11879
No. of products	584	584	584	584	584	584	576	576
Model	mg	mg	mg	mg	mg	mg	mg	mg

Standard errors in parentheses. (sa) abbreviate simple average. (wa) abbreviate weighted average.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

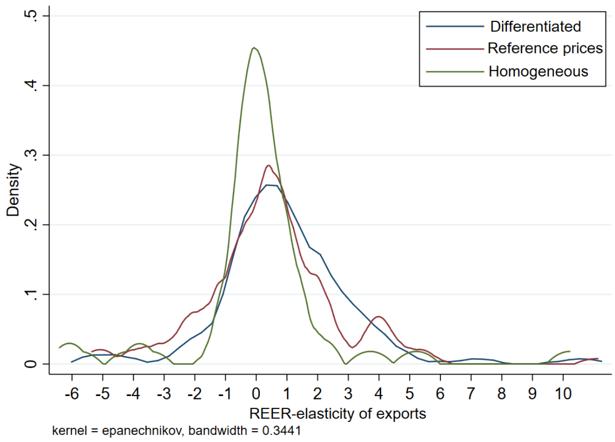
Figure 3. Long-term Export REER-elasticities by Lall's and Rauch's classifications: all coefficients (left) y significant coefficients at 10% (right)



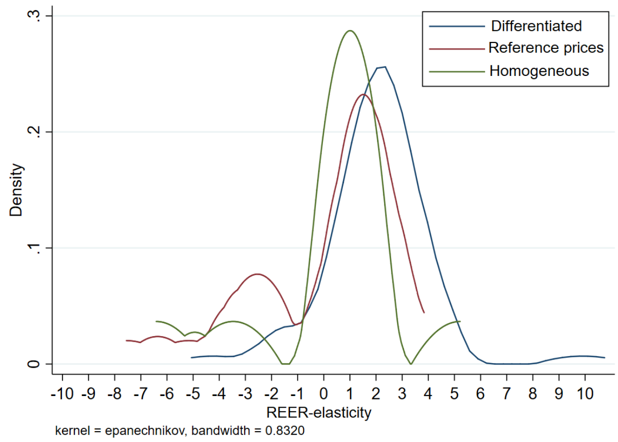
(a) Lall: All



(b) Lall: significant



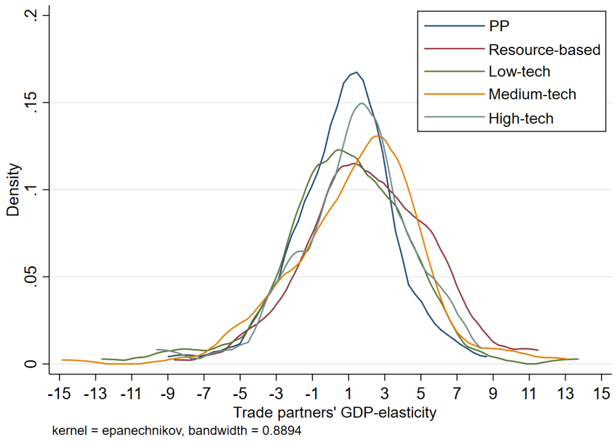
(c) Rauch: All



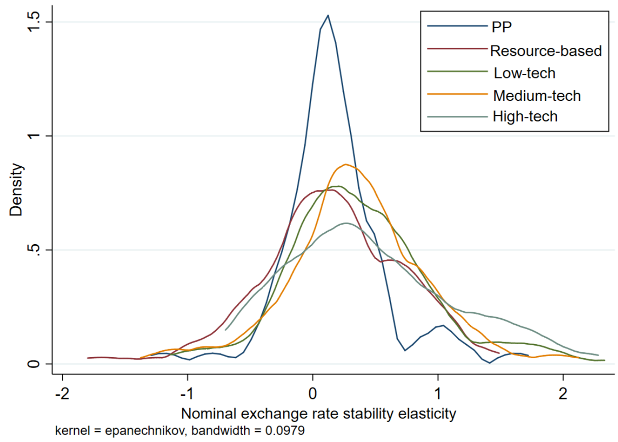
(d) Rauch: significant

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases.

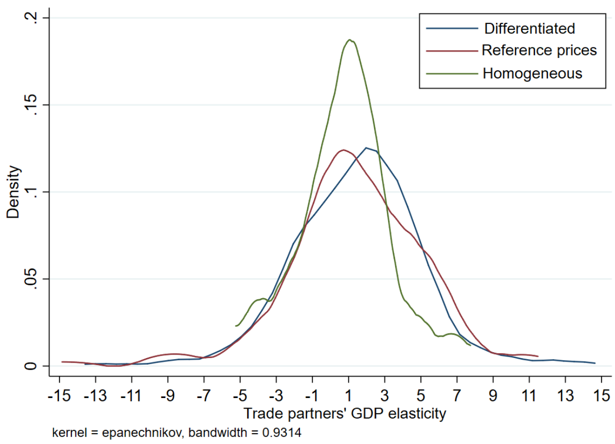
Figure 4. Long-term export elasticities relative to tradings partners' GDP and the nominal exchange rate stability by Lall and Rauch categories: all coefficients



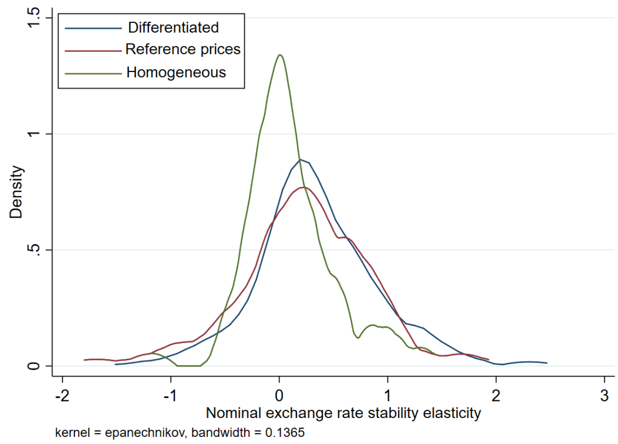
(a) Lall: trading partners' GDP



(b) Lall: NER stability



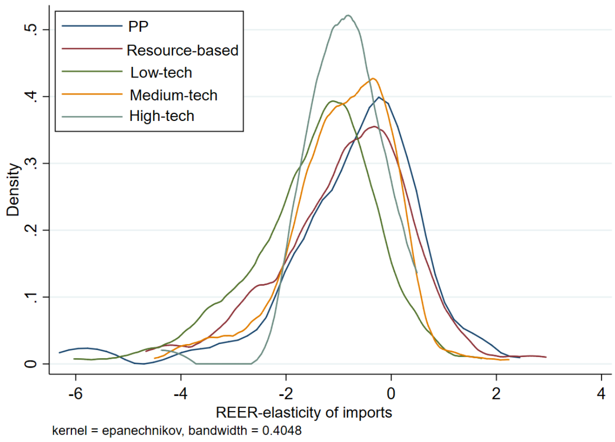
(c) Rauch: trading partners' GDP



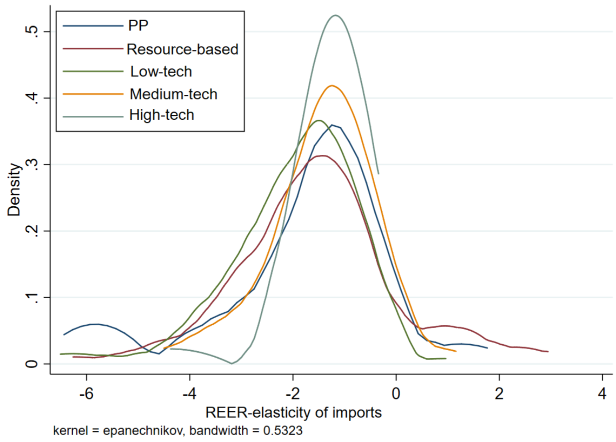
(d) Rauch: NER stability

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases.

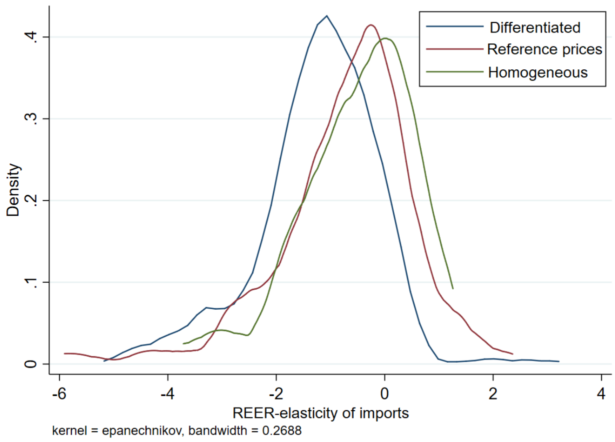
Figure 5. Long-term Import REER-elasticities by Lall's and Rauch's classifications : all coefficients (left) and significant coefficients at 10% (right)



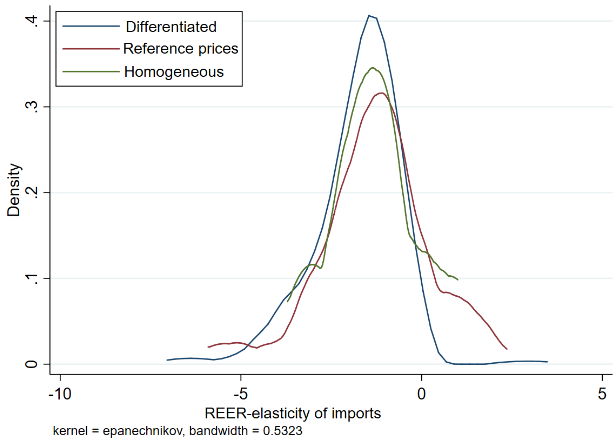
(a) Lall: all



(b) Lall: significant



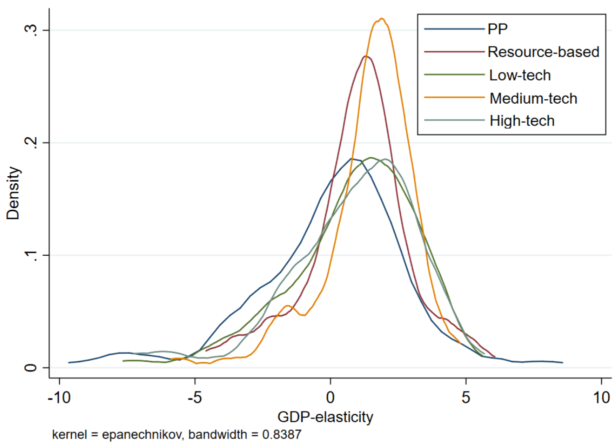
(c) Rauch: all



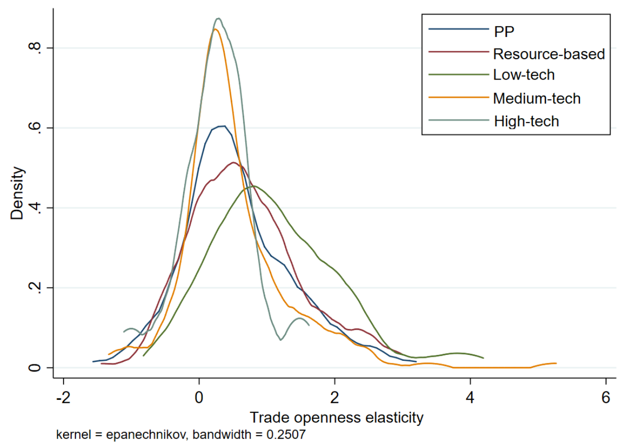
(d) Rauch: significant

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases.

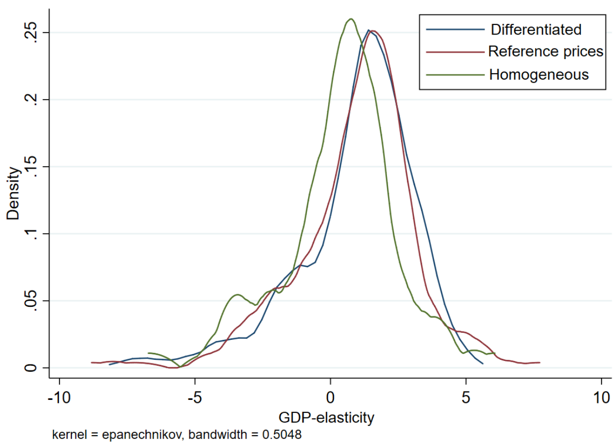
Figure 6. Long-term import elasticities relative to GDP and trade opening by Lall's and Rauch's classifications: all coefficients.



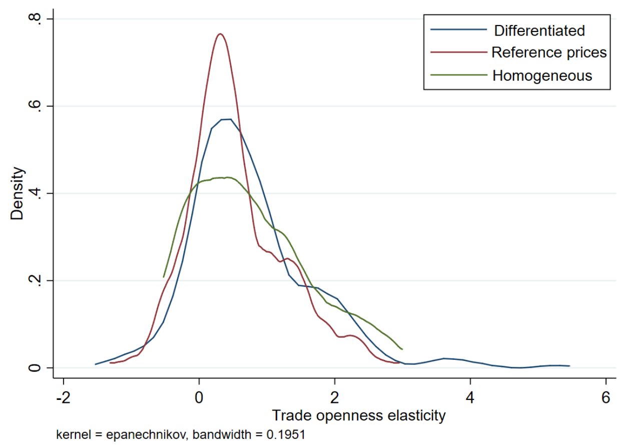
(a) Lall: GDP



(b) Lall: trade openness



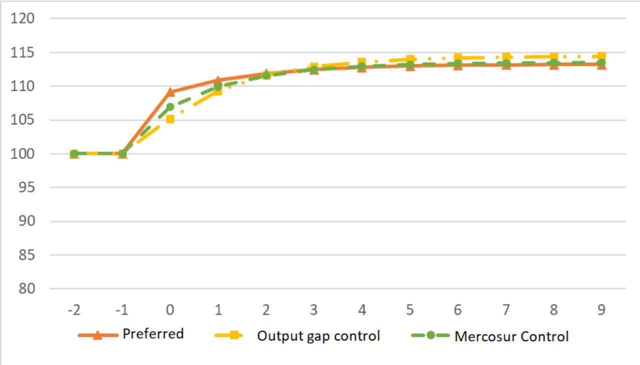
(c) Rauch: GDP



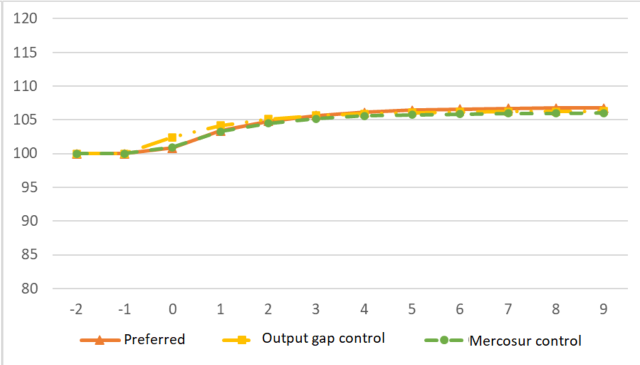
(d) Rauch: trade openness

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases.

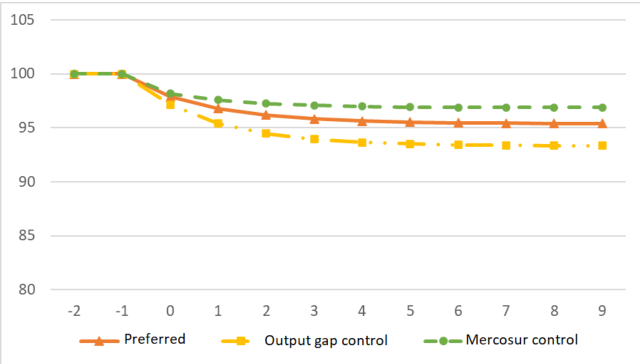
Figure 7. Impulse Response Functions (IRF) of aggregate exports



(a) REER



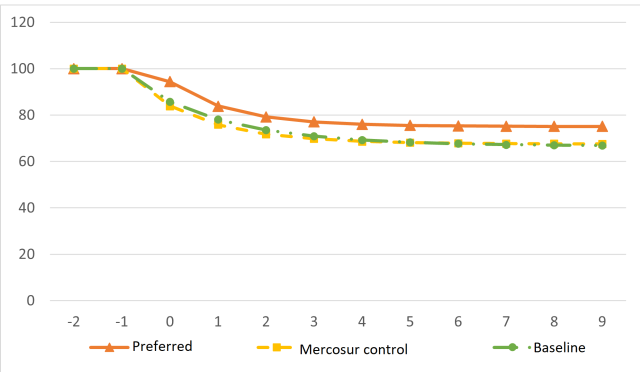
(b) Trading partners' GDP



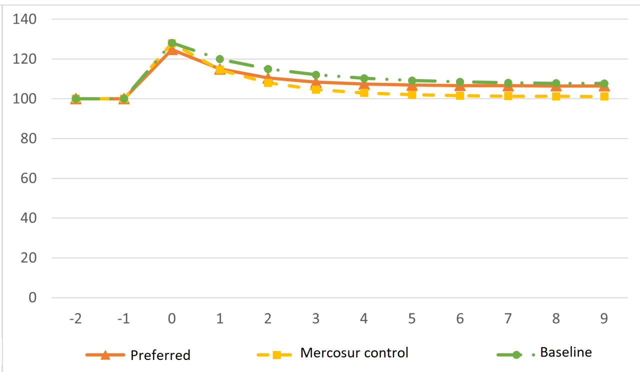
(c) NER stability

Source: own elaboration based on COMTRADE and IMF data. We used the coefficients calculated by the ARDL model of the Mean Group model for different specifications to calculate the elasticities. The shocks correspond to a standard deviation of the explanatory variables: (a) REER corresponds to a depreciation of 35.8%; (b) trading partners' GDP corresponds to an increase of 1.4%; (c) stability is set to fall by 21.9%, calculated based on the deviation of the variable over its mean.

Figure 8. Impulse Response Functions (IRF) of aggregate imports



(a) REER



(b) GDP

Source: own elaboration based on COMTRADE and IMF data. We used the coefficients calculated by the ARDL model of the Mean Group model for different specifications to calculate the elasticities. The shocks correspond to a standard deviation of the explanatory variables: (a) REER corresponds to a depreciation of 35.8%; (b) GDP-Argentina corresponds to an increase of 6%.

Table 14. Aggregate macroeconomic trade elasticities of the exports by types of goods

Long-term elasticities	Estimated regressions	Weights	Lall's classification					Rauch's classification		
			Primary products	Resouce-based manufacturing goods	Low-tech manufacturing goods	Medium-tech manufacturing goods	High-tech manufacturing goods	Differentiated	Reference prices	Homogeneous
REER Exports	Stability (2)	Argentina	0.114	0.099	0.892	0.703	0.716	0.698	0.525	0.020
		World	0.287	0.325	1.243	0.762	0.725	0.862	0.527	0.330
	Output gap (3)	Argentina	0.024	0.170	0.901	0.649	0.858	0.672	0.575	-0.055
		World	-0.699	0.593	1.161	0.732	0.809	0.856	0.680	-0.670
	Mercosur (4)	Argentina	0.081	-0.003	0.756	0.580	-0.210	0.548	0.353	-0.024
		World	0.210	0.240	1.084	0.625	0.438	0.670	0.439	0.189
Trading partners' GDP	Stability (2)	Argentina	1.245	1.558	-0.120	3.540	4.445	2.787	1.414	1.200
		Mundo	1.782	2.400	1.485	2.738	1.899	2.624	1.691	1.479
	Output gap (3)	Argentina	0.622	1.458	-0.335	3.154	3.840	2.359	1.379	0.648
		World	-1.166	2.235	1.032	2.702	1.623	2.348	1.610	-1.181
	Mercosur (4)	Argentina	0.508	1.249	-0.368	2.878	1.523	2.110	0.854	0.554
		Mundo	0.910	2.040	0.839	1.985	0.516	1.653	1.063	0.857
NER Stability	Stability (2)	Argentina	0.157	-0.032	0.406	0.517	-0.076	0.391	0.232	0.060
		World	0.750	0.158	0.416	0.436	0.323	0.397	0.292	0.662
	Output gap (3)	Argentina	0.144	0.070	0.526	0.634	0.192	0.519	0.332	0.059
		World	0.296	0.347	0.475	0.522	0.491	0.507	0.430	0.189
	Mercosur (4)	Argentina	-0.005	-0.124	0.245	0.434	0.009	0.317	0.057	-0.089
		World	0.078	0.027	0.190	0.338	0.311	0.298	0.070	-0.001

Note: own elaboration based on COMTRADE and our estimates.

Table 15. Aggregate macroeconomic trade elasticities of the imports by types of goods

Long-term elasticities	Estimated regressions	Weights	Lall's classification					Rauch's classification		
			Primary products	Resource-based manufacturing goods	Low-tech manufacturing goods	Medium-tech manufacturing goods	High-tech manufacturing goods	Differentiated	Reference prices	Homogeneous
REER Imports	Trade openness (1990s) (2)	Argentina	-0.291	-0.747	-1.136	-0.883	-0.796	-0.996	-0.530	-0.568
		World	-0.528	-0.975	-1.329	-1.023	-0.648	-1.143	-0.583	-0.647
	Mercosur (3)	Argentina	-0.357	-0.997	-1.474	-1.263	-1.167	-1.427	-0.765	-0.565
		World	-0.682	-1.292	-1.678	-1.481	-0.953	-1.598	-0.810	-0.837
	Base (1)	Argentina	-0.424	-1.143	-1.621	-1.372	-1.181	-1.507	-0.941	-0.679
		World	-0.778	-1.406	-1.864	-1.580	-0.938	-1.687	-0.951	-0.947
GDP Argentina	Trade openness (1990s) (2)	Argentina	0.523	1.344	1.127	1.896	0.642	1.423	1.309	1.083
		World	0.564	1.228	1.194	1.852	0.900	1.354	1.352	0.919
	Mercosur (3)	Argentina	0.011	0.433	0.873	1.752	0.191	1.299	0.650	-0.038
		World	0.246	0.740	0.955	1.787	0.346	1.251	0.896	0.130
	Baseline (1)	Argentina	0.873	1.645	2.113	2.782	1.090	2.437	1.583	1.421
		World	1.488	1.799	2.314	2.990	1.262	2.483	1.765	1.935

Note: own elaboration based on COMTRADE and our estimates.

Appendix B: Statistical properties of the series (online)

We perform two statistical analyses to define the preferred method of estimation in our regression analysis: (a) test of unit root test and (b) cointegration test. A battery of tests is done to evaluate whether the variables used are I(0) or I(1), and in the case of the existence of unit roots, evaluate whether there is a cointegration relationship. The variables to be analyzed are the volume of exports and imports, the trading partners' GDP, Argentina's GDP, the real effective exchange rate for imports and exports, and nominal exchange rate stability. We analyze those products with a minimum of 30 observations in a total of 36 years possible because the temporal dimension must be wide enough to estimate the parameters using MG and PMG methodologies. In the case there is no information on that number of years, we rule out that product. With this criterion, we retained 502 exported goods and 584 imported ones.

As a first exercise, we perform the unit root tests proposed by Im-Pesaran-Shin (IPS)and Fisher, as they do not require balanced panel data and, therefore, do not call for further reduction in the sample both in the cross-sectional and the time dimensions.[41] However, these tests share that the null hypothesis claims that all the panels have a unit root, while the alternative is that some panels are stationary. It means that, even if just a few panels are stationary, the test will reject the existence of unit roots.

The IPS test eases the assumption that the coefficient ρ is identical in all the panels and allows a different coefficient for each panel. The Fisher test performs the unit root test for each panel individually and combines their p-values to evaluate as a whole. We performed all the tests on the variables of interest in logarithms. The p-values reported in the Fisher test are for the statistic with the highest p-value. In the case of the series that only have a time dimension (GDP-ARG and nominal exchange rate stability), we used the Dickey-Fuller, Phillips-Perron, and ADF-GLES tests.

Table 16 shows that in the case of export and import volumes and the REER of imports and exports, the tests reject unit root hypotheses, which means there are at least some products that are stationary. This is not the case with the trading partners' GDP, where the null hypothesis is accepted, showing the existence of unit roots

[41] The Levin-Lin-Chu (LLC), Harris-Tzvalis (HT), Breitung, and Hadri LM tests require entirely balanced panels, a requisite not met by our database.

Table 16. Unit root tests

Variable	Method	P-value	Lags selection	Lags
Exports (USD 1996)	IPS	0.0000	AIC	0.49
	Fisher/DF	0.0000	-	1
	Fisher/PPerron	0.0000	-	1
Trading partners' GDP	IPS	1.0000	AIC	0.21
	Fisher/DF	1.0000	-	1
	Fisher/PPerron	1.0000	-	1
REER of exports	IPS	0.0000	AIC	0
	Fisher/DF	0.0000	-	1
	Fisher/PPerron	0.0000	-	1
Δ Trading partners' GDP	IPS	0.0000	AIC	0.25
	Fisher/DF	0.0000	-	1
	Fisher/PPerron	0.0000	-	1
Imports (USD 1996)	IPS	0.0000	AIC	0.72
	Fisher/DF	0.0000	-	1
	Fisher/PPerron	0.0000	-	1
REER of imports	IPS	0.0000	AIC	0
	Fisher/DF	0.0000	-	1
	Fisher/PPerron	0.0000	-	1
ARG-GDP	DFULLER	0.97 (0.91)	AIC-HQIC-SBIC-LR*	0 (1)
	DFULLER-Trend	0.21 (0.14)	AIC-HQIC-SBIC-LR*	0 (1)
	PPerron	0.97 (0.96)	AIC-HQIC-SBIC-LR*	0 (1)
	DF-GLS-Trend	> 0.1**	MAIC(SC)	1
Δ ARG-GDP	DFULLER	0.0001	AIC-HQIC-SBIC-LR	0
	PPerron	0.0001	AIC-HQIC-SBIC-LR	0
	DF-GLS	< 0.01	Ng-Perron	0
NER stability	DFULLER	0.07 (0.10)	AIC-HQIC-SBIC-LR*	0 (1)
	PPerron	0.05 (0.05)	AIC-HQIC-SBIC-LR*	0 (1)
	DF-GLS	< 0.1****	MAIC(SC)	1

Note: *Argentine GDP and the nominal exchange rate stability are evaluated using traditional time series tests because they have no cross-sectional variation. The lag selection criteria point toward one lag, coinciding with the selection order tests of FPE, AIC, HQIC, SBIC, and LR in both variables. However, we perform additional tests without adding any lag. In the case of Argentina's GDP, we add a trend as a robustness test, and a drift in the case of nominal exchange rate stability. (**) The DF-GLS mu statistic has a value of -2.387, and the critical value at 10% is -2.984, without being significant at 10%. The exercise includes a trend. (***) The DF-GLS mu statistic has a value of -3.888, and the critical value at 1% is -2.644. We do not include a trend. (****) The DF-GLS mu statistic has a value of -2.304, the critical value at 10% is -2.067, and at 5% is -2.374. We do not include a trend.

in the series. However, the three tests reject the null hypothesis in the first difference for the trading partners' GDP variable. Regarding the nominal exchange rate stability, the different tests reject the null hypothesis of a unit root.

However, as previously mentioned, the weakness of the tests performed is that they imply that if only some panels are stationary, the null hypothesis is rejected for all the panels. This criterion seems to be too demanding for selecting the estimation method. To go deeper into this problem, we perform the Hadri test, in which the null hypothesis is reversed. Rejecting the hypothesis implies that there are some panels with unit-roots.

Given that the test requires balanced panels, we must modify the data sample evaluated. In the case of exports, the variable constraining the analysis is the exported volume, as it already has 853 missing data points for a total of 18.072 (4.7%). In the case of imports, the missing data are 529 of 21.024 observations. Therefore, we carry out two strategies to evaluate the balanced panel with the highest number of observations possible to avoid this problem: (a) limiting the observations to the years 1991-2015. This period maximized the number of panels that we can test (445 for exports and 528 for imports), having 25 years of data; (b) completing the missing data with the previous data of the variable in question without constraining the sample in time terms.

Table 17 highlights the existence of unit-roots panels for all variables. Given the annual nature of the series and the fact that the AIC criterion of the previous tests never exceeded one, we chose one lag period for the test. However, the results remain unchanged if another lag is added.

This existence of non-stationary panels shows us that it is necessary to test whether the variables have a cointegration relation. For this purpose, we use three tests that have in common the existence of no cointegration as the null hypothesis. The test proposed by Kao (1999) and Pedroni (1999), in turn, are similar in that they have as the alternative hypothesis that all the panels are cointegrated. Finally, Westerlund (2005) allows that only some panels are cointegrated in the alternative hypothesis.

Table 17. Hadri test. Unit roots in panels – balanced panels

Variable	Number of panels	P-value	Lags selection	Lags
Exports (USD 1996)	445	0.00(0.00)	Bartlett(Parzen)	1
	502	0.00(0.00)	Bartlett(Parzen)	1
REER of exports	445	0.00(0.00)	Bartlett(Parzen)	1
	502	0.00(0.00)	Bartlett(Parzen)	1
Imports (USD 1996)	528	0.00(0.00)	Bartlett(Parzen)	1
	584	0.00(0.00)	Bartlett(Parzen)	1
REER of imports	528	0.00(0.00)	Bartlett(Parzen)	1
	584	0.00(0.00)	Bartlett(Parzen)	1
Δ Exports (USD 1996)	445	0.30(0.98)	Bartlett(Parzen)	1
	502	1.00(1.00)	Bartlett(Parzen)	1
Δ REER of exports	445	0.97(0.99)	Bartlett(Parzen)	1
	502	1.00(1.00)	Bartlett(Parzen)	1
Δ Imports (USD 1996)	528	1.00(1.00)	Bartlett(Parzen)	1
	584	1.00(1.00)	Bartlett(Parzen)	1
Δ REER of imports	528	0.95(0.99)	Bartlett(Parzen)	1
	584	0.99(1.00)	Bartlett(Parzen)	1

The results show that the variables are cointegrated for exports (Table 18) and imports (Table 19), being necessary to approach the panels as non-stationary. In sum, we consider that there is enough evidence to assume the existence of a long-term relationship between the interest variables and an adjustment process in the short term. However, the estimated models can be expressed equivalently in terms of ARDL models, with no need to assume cointegration relationships between variables.

Table 18. Cointegration tests for exports

Test	Statistics	Value	P-value	P-valuye incl. NER stability	Lags selection	Lags	Trend
Kao	Modified Dickey-Fuller t	-15.20	0.00	0.00	AIC	2.25	No
	Dickey-Fuller t	-16.85	0.00	0.00	AIC	2.25	No
	Augmented Dickey-Fuller t	-2.75	0.00	0.47	AIC	2.25	No
	Unadjusted modified Dickey-Fuller t	-42.88	0.00	0.00	AIC	2.25	No
	Unadjusted Dickey-Fuller t	-28.15	0.00	0.00	AIC	2.25	No
Pedroni	Modified Phillips-Perron t	-12.96 (-6.99)	0.00 (0.00)	0.00 (0.02)	AIC	3	No (Yes)
	Phillips-Perron t	-24.99 (-27.13)	0.00 (0.00)	0.00 (0.00)	AIC	3	No (Yes)
	Augmented Dickey-Fuller t	-14.05 (-13.69)	0.00 (0.00)	0.00 (0.00)	AIC	3	No (Yes)
Westerlund	Variance ratio	-14.58 (-3.15)	0.00 (0.00)	0.00 (0.45)	-	-	No (Yes)

Note: The sample has 502 panels in total. The Kao test assumes that the vector of the cointegration and the AR parameter is the same in every panel. The Pedroni and Westerlund tests allow both the vector and the parameter to be different in each panel. The null hypothesis is always of no cointegration. The alternative hypothesis in Kao and Pedroni demands that all the panels are cointegrated, while in Westerlund, just some. Between parenthesis are statistics and p-values, including a trend in the test when it is allowed. The reported tests are performed for exports, trading partners' GDP, the real effective exchange rate, and the nominal exchange rate stability when it is indicated.

Table 19. Cointegration test for imports

Test	Statistics	Value	P-value	P-value incl. trade openness (1990s)	Lags selection	Lags	Trend
Kao	Modified Dickey-Fuller t	-17.95	0.00	0.00	AIC	2.17	No
	Dickey-Fuller t	-15.65	0.00	0.00	AIC	2.17	No
	Augmented Dickey-Fuller t	-0.20	0.41	0.00	AIC	2.17	No
	Unadjusted modified Dickey-Fuller t	-41.16	0.00	0.00	AIC	2.17	No
	Unadjusted Dickey-Fuller t	-24.92	0.00	0.00	AIC	2.17	No
Pedroni	Modified Phillips-Perron t	-8.74 (0.24)	0.00 (0.40)	0.00 (0.00)	AIC	2	No (Yes)
	Phillips-Perron t	-19.08 (-11.88)	0.00 (0.00)	0.00 (0.00)	AIC	2	No (Yes)
	Augmented Dickey-Fuller t	-11.51 (-1.46)	0.00 (0.07)	0.00 (0.00)	AIC	2	No (Yes)
Westerlund	Variance ratio	-14.00 (-3.64)	0.00 (0.00)	0.00 (0.00)	-	-	No (Yes)

Note: The sample has 584 panels in total. The Kao test assumes that the vector of the cointegration and the AR parameter is the same in every panel. The Pedroni and Westerlund tests allow both the vector and the parameter to be different in each panel. The null hypothesis is always of no cointegration. The alternative hypothesis in Kao and Pedroni demands that all the panels are cointegrated, while in Westerlund, just some. Between parenthesis are statistics and p-values, including a trend in the test when it is allowed. The reported tests are performed for imports, domestic GDP, the real effective exchange rate, and the trade opening in the 1990s. The results are robust to the inclusion of the nominal exchange rate stability.

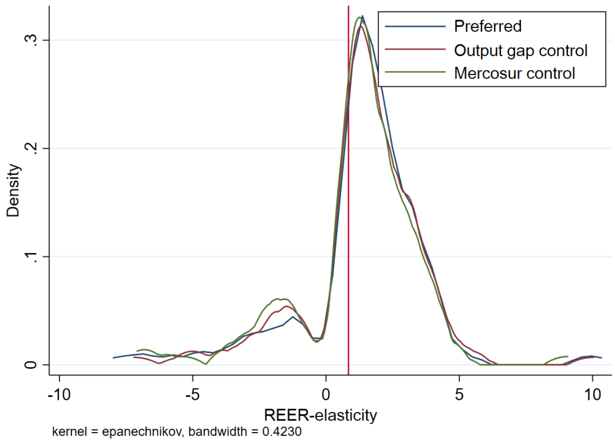
Appendix C: Descriptive analysis of the heterogeneity (online)

This section complements the heterogeneity analysis of the elasticities. Individual coefficients show different levels of precision in terms of the statistical significance they have. It means that each product has a coefficient associated, estimated with different degrees of confidence. Therefore, we can perform the heterogeneity analysis using all the estimated coefficients or constraining them only over those in which the individual coefficient is significant in statistical terms. There is no better choice than another because despite a coefficient not being significantly different from zero, the estimated specific value is the best estimate we have to assign to that product. Indeed, the MG method uses all the coefficients to make inferences on their simple average coefficient. It is the simple average coefficient that the MG method assures to be a consistent estimation. With this in mind, the following analyses switch between the description of those significant coefficients and all the coefficients.

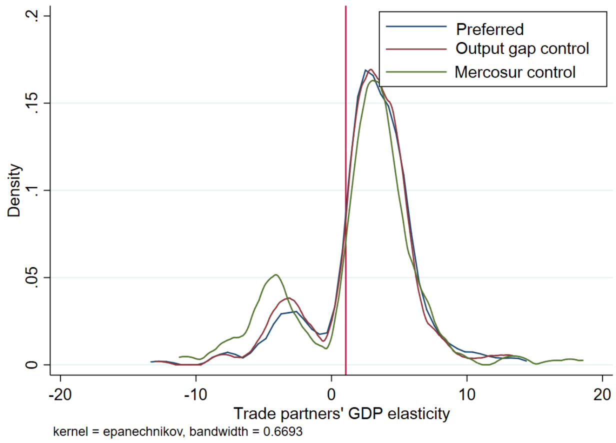
The coefficients for each product differ considerably in exports and imports. Figure 9 shows Kernel density functions for all the estimated coefficients significant at 90% of confidence in the case of exports. The different density functions represent the estimated elasticity distributions in the three regressions of Table 1, in which we have controlled for the nominal exchange rate stability (columns 2, 3, and 4). The vertical line in each plot marks the simple average of the coefficients – whether significant or not – which corresponds to the specific estimate of the MG model in the preferred regression (column 2). This line is used as a reference point to evaluate whether the simple average of all the coefficients is similar to the median of the significant coefficients in individual terms.

Panel (a) of the figure explores the REER-elasticities of exports. This panel shows that the specific estimate of the MG model of the preferred estimate – vertical line – is not far from the median of the significant coefficients of the different regressions. It means that even constraining for those more precise estimations, their median REER-elasticity is similar to the simple average of all the coefficients. There are 118 products showing significant elasticities at 10% in the preferred specification. In this subgroup, the REER-elasticity goes from a minimum of -7.5 to a maximum of 9.9, which justifies the decision to estimate assuming heterogeneous slopes. However, only 15 products have a coefficient with the opposite sign to the expected one. Interestingly, the Kernel density functions do not suffer significant changes according to the controls performed in the estimations. Figure 11 confirms all the results when coefficients are not constrained according to their individual significativity.

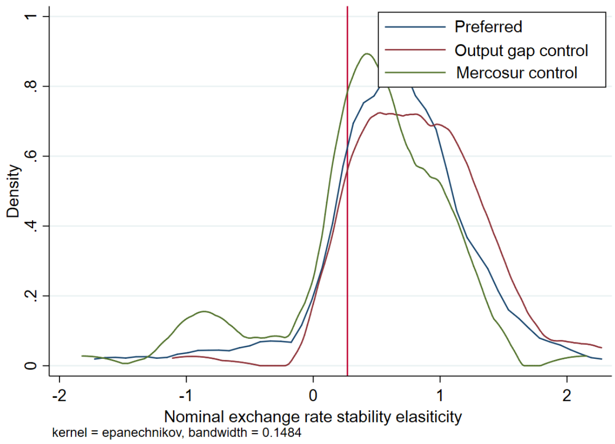
Figure 9. Long-term elasticities of exports: significant coefficients at 10%



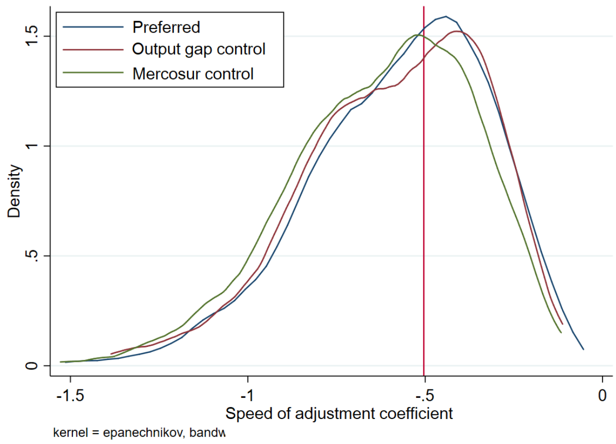
(a) REER



(b) Trading partners's GDP



(c) Stability



(d) Speed of adjustment

Source: own elaboration based on COMTRADE's, IMF's and World Bank's data. The vertical line corresponds to the simple average of the estimated coefficients by the regression of column (3) – preferred – of Table 1.

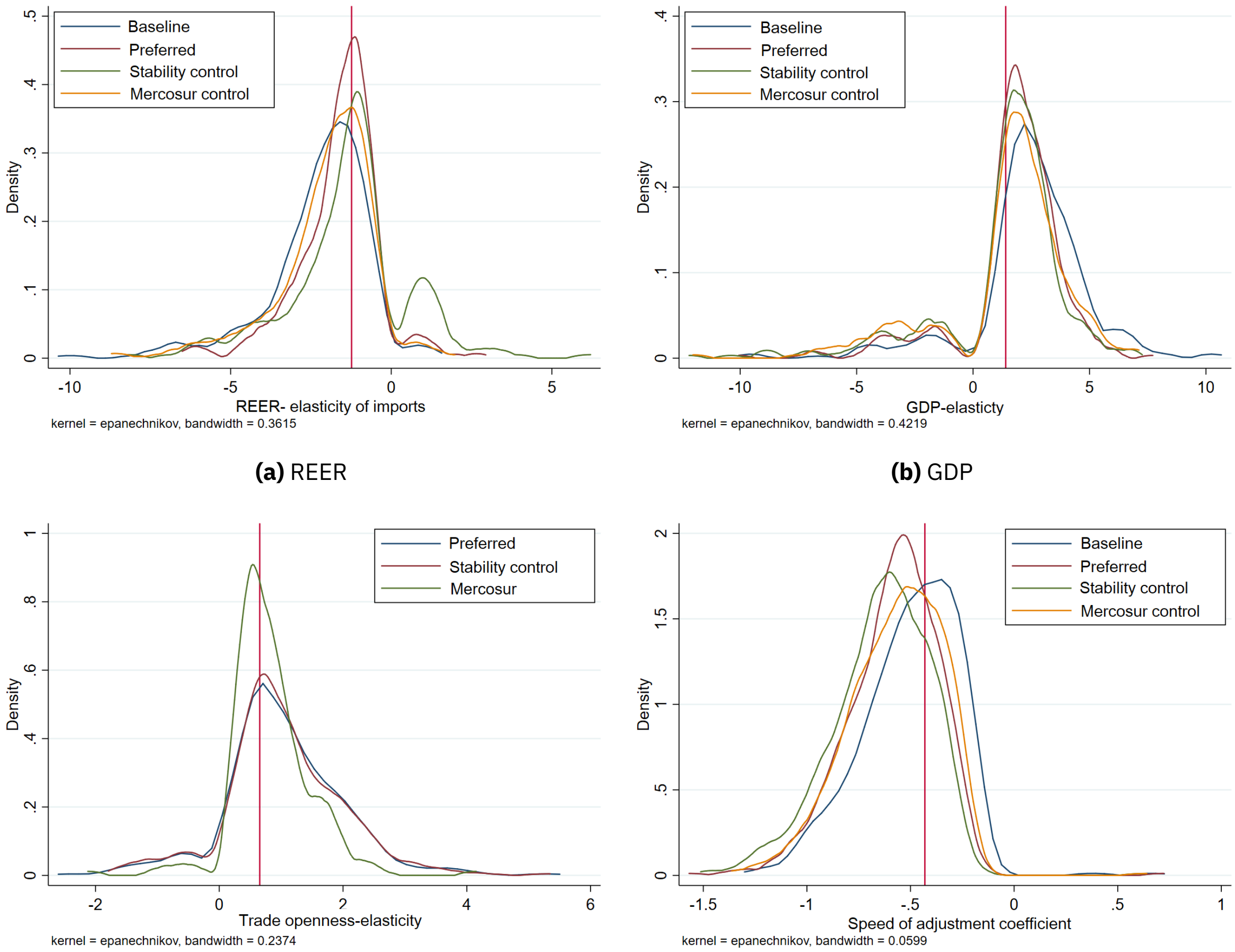
Panel (b), in turn, shows wide heterogeneity in the GDP-elasticities in exported goods. These go from values of -12.6 to 13.7 in the preferred regression. Again, the negative values take up a lower share of the total significant elasticities, which happens again in panel (c), where we show the Kernel density functions of the coefficients associated with the nominal exchange rate stability. In this case, the range covers values from -1.5 to 2.12. Finally, the density function of the adjustment velocity coefficients shows significant values from -0.12 to -1.4 in the preferred regression. In this case, 487 out of the 502 products produced are negatives, significantly different from zero, and lower than -1, supporting a long-term relationship in an extensive range of products.

Figure 10 repeats the exercise for the case of imports, while Figure 12 does the same without selecting by the degree of statistical significance at the end of this appendix. Again, we can see significant elasticity heterogeneity. In almost every case, significant coefficients with the opposite sign explain an insignificant share of Kernel density functions. The simple average of the elasticities estimated in the preferred regression of Table 2 (column 2) – vertical line – is usually located close to the median of those significant coefficients.

The range of the REER-elasticities of imports goes from -6.5 to 2.94 in the preferred estimate with a standard deviation of 1.36 and a mean and median of -1.6 and -1.4, respectively. In this case, 279 products have significant coefficients, while 265 of them show the expected sign. Also, when we control by the 1990s trade opening, Argentina's GDP -elasticity has a median of around 2 and shows a maximum of 7.7 and a minimum of -10.

In the case of the trade openness variables, we should highlight that not all proxies represent the same variable. In two regressions, the effect of the 1990s trade opening is estimated, while in the other, we capture the effects of the MERCOSUR agreement. The 1990s trade opening variable seems to have affected different products more widely and variedly, while the MERCOSUR agreement has a more homogeneous effect across the distribution. The significant coefficients that accompany the trade openness dummies are between 2.3 and 5.3, with a median and mean around one. Finally, the adjustment velocity coefficients are between -1.5 and 0.73, although only a single coefficient shows a positive value (0.72). More than 95% of them meet the conditions of showing negative, significant coefficients and being between 0 and -1, which confirms that it is reasonable to assume long-term relationships in the estimations.

Figure 10. Long-term elasticities of imports: significant coefficients at 10%



(a) REER **(b)** GDP

(c) Trade openness or Mercosur **(d)** Speed of adjustment

Source: own elaboration based on COMTRADE and World Bank data. The vertical line corresponds to the simple average of the estimated coefficients by the regression of the column (2) – preferred – of Table 2.

An interesting conclusion that emerges from the analysis of the figures of Kernel distribution functions is that the results remain stable regardless of the controls applied in the regressions. On the other hand, table 20 shows that imports usually exhibit a greater proportion of individually significant coefficients in REER-elasticities than exports. This result might be because, while the expansion of exports has supply issues as a constraining factor, the changes in imports are more related to demand responses, as mentioned in the main sections of this article.

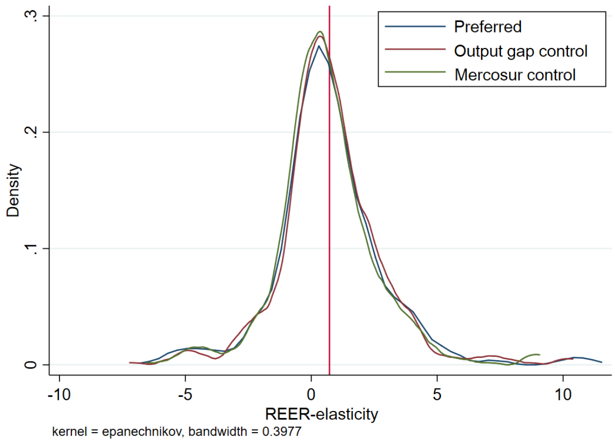
Lastly, table 20 adds some descriptive statistics of the estimated coefficients for exports and imports. We report the mean, median, maximums, and minimums of the elasticities of the different regressions estimated. Figures 11 and 12 replicate the Kernel functions but for all the coefficients, without restricting by their statistical significance.

Table 20. Elasticities by Mean Group regressions: disaggregate results without weighing.

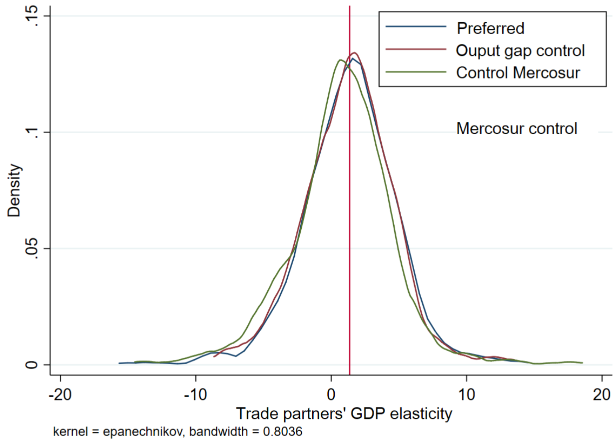
Long-term elasticities	Estimated regressions	All significant coefficients	Significant y expected sign					
			Total	Mean	Median	SD	Min	Máx
REER of exports	Preferred (2)	118	103	2.16	1.84	1.3	0.55	9.91
	Output Gap (4)	131	113	2.16	1.85	1.33	0.54	10.03
	Mercosur (5)	131	111	2.03	1.76	1.26	0.36	9.07
	Without stability control (1)	104	62	1.68	1.46	0.96	0.36	4.25
REER of imports	Baseline (1)	249	243	-2.26	-1.91	1.42	-7.92	-0.25
	Trade openness (1990s) (2)	279	265	-1.71	-1.48	1.01	-6.03	-0.25
	Mercosur (3)	295	285	-2.06	-1.74	1.34	-7.32	-0.25
	Trade openness and stability (4)	190	155	-1.83	-1.38	1.28	-5.95	-0.30
Trading partners' GDP	Preferred (2)	277	234	3.82	3.42	2.24	0.68	13.7
	Output gap (4)	281	232	3.77	3.44	2.17	0.57	13.5
	Mercosur (5)	214	159	4.06	3.6	2.68	0.73	18.54
	Without stability control (1)	319	279	3.8	3.49	2.15	0.63	15.17
ARG-GDP	Baseline (1)	333	301	3.03	2.69	1.50	0.51	10.23
	Trade openness (1990s) (2)	316	280	2.40	2.20	1.11	0.51	7.71
	Mercosur (3)	210	171	2.53	2.22	1.26	0.67	7.12
	Trade openness and stability (4)	301	253	2.35	2.13	1.14	0.49	7.26
NER stability	Preferred (2)	117	108	0.75	0.74	0.43	0.14	2.12
	From 1991	147	143	0.77	0.63	0.49	0.14	3.19
	Output gap (4)	153	150	0.85	0.8	0.46	0.16	2.27
	Mercosur (5)	92	77	0.67	0.57	0.41	0.14	2.15
Trade openness/Mercosur (Imports)	Trade openness (1990s) (2)	330	307	1.20	1.02	0.79	0.20	5.26
	Mercosur (3)	178	174	0.84	0.73	0.45	0.19	2.21
	Trade openness and stability (4)	329	303	1.21	1.01	0.61	0.21	5.34
Speed of adjustment (Exports)	Preferred (2)	499	467	-0.53	-0.52	0.2	-0.99	-0.12
	Output gap (4)	502	477	-0.55	-0.53	0.21	-0.99	-0.11
	Mercosur (5)	498	454	-0.57	-0.56	0.2	-0.99	-0.11
	Without stability control (1)	486	470	-0.51	-0.49	0.2	-0.99	-0.11
Speed of adjustment (Imports)	Baseline (1)	478	464	-0.48	-0.46	0.20	-0.99	-0.11
	Trade openness (1990s) (2)	558	531	-0.56	-0.55	0.18	-0.99	-0.14
	Mercosur (3)	511	489	-0.55	-0.53	0.19	-0.99	-0.16
	Trade openness and stability (1)	558	514	-0.60	-0.59	0.18	-0.99	-0.16

Note: elasticities estimated by Mean Group regressions. All the coefficients correspond to their long-term elasticities. In the case of speed of adjustment coefficients, we report the coefficients with the expected sign and between 0 and -1.

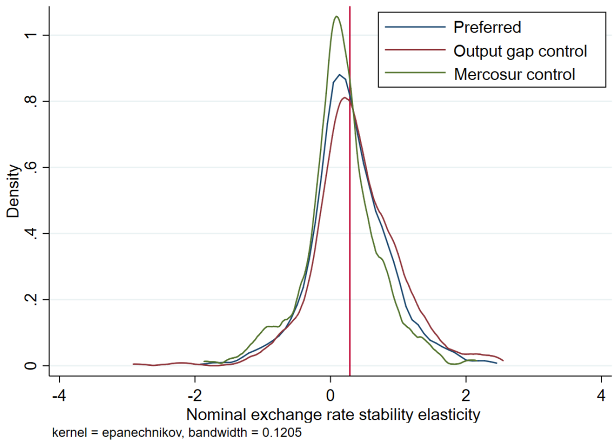
Figure 11. Long-term elasticities of exports: all the coefficients



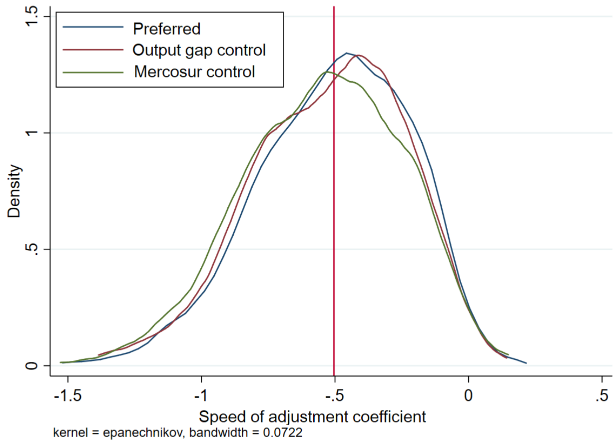
(a) REER



(b) Trading partners' GDP



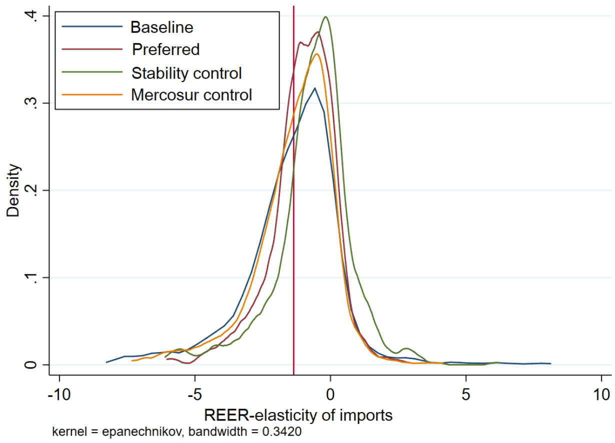
(c) Stability



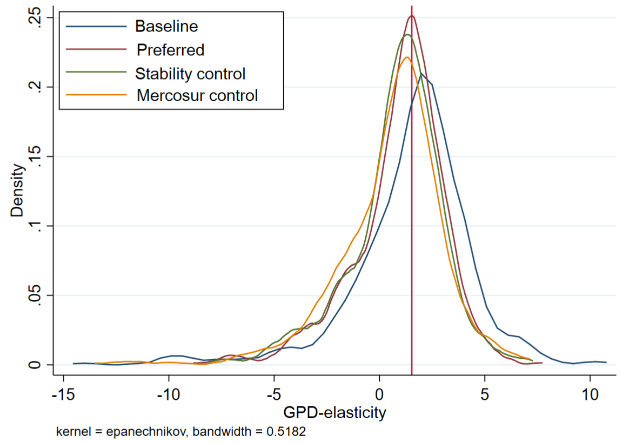
(d) Speed of adjustment

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases. The vertical line corresponds to the simple average of the estimated coefficients by the regression of the column (3) – preferred – of Table 1.

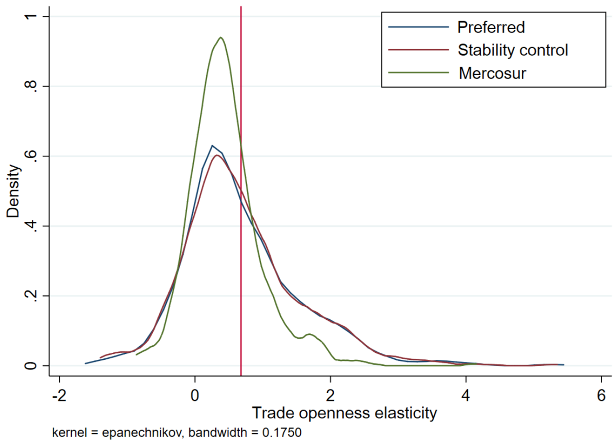
Figure 12. Long-term elasticities of imports: all the coefficients



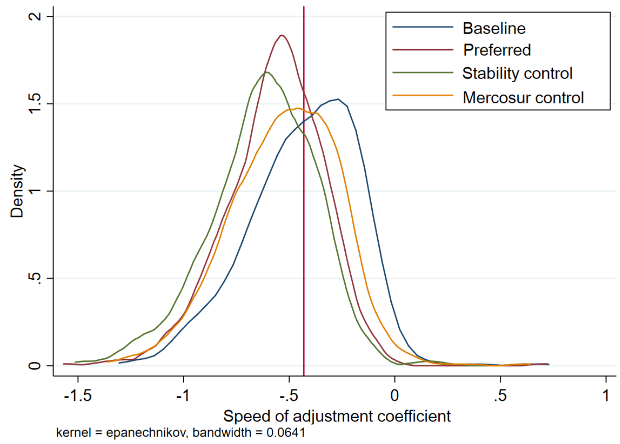
(a) REER



(b) ARG-GDP



(c) Trade openness or Mercosur



(d) Speed of adjustment

Source: own elaboration based on COMTRADE's, IMF's and World Bank's databases. The vertical line corresponds to the simple average of the estimated coefficients by the regression of the column (2) – preferred – of Table 2.

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