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**The Real Exchange Rate Role in a Resource-rich Developing Country:
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The Real Exchange Rate Role in a Resource-rich Developing Country: Heterogeneous Effects, Structural Bias and Hysteresis

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Abstract

What is the role of the real exchange rate in the performance of the tradable sector in a developing economy specialised in natural resource-related activities? In this article, we will answer this question, summarising the main results of three related papers of our own, which focus on the heterogeneity effects of the real exchange rate (RER) level on the export and import performance of different sectors in Argentina. The first paper employs the Mean Group method to estimate the RER-elasticities by individual products. Its main result highlights a wide range of heterogeneous responses of exports and imports to RER movements at the individual product level, being RER-elasticities in differentiated products and labour-intensive manufacturing goods substantially larger than those of primary and homogeneous products. This finding critically impacts the value of aggregate RER-elasticity –weighted by Argentina’s trade basket shares– given that Argentina’s economic structure is heavily specialised in primary and homogeneous products. The second and third paper takes advantage of the large devaluation of 2002 to study the development of new tradable sectors during a period of stable and competitive real exchange rate (SCRER). The third one studies the occurrence of import substitution episodes. Their main conclusions are: (i) the peak of the sectoral export surge and import substitution episodes occurred during the SCRER period; (ii) they are positively related to the labour intensity of sectors and their relatedness to already competitive sectors; (iii) sectors with export surges episodes show sign of hysteresis effects with a long-lasting increase of their export level after the end of the SCRER period; (iv) export surge episodes are positively correlated to sectors that have import substitution episodes during the SCRER period. The three papers highlight that the RER movements have heterogeneous effects on different sectors and that not every sector can take advantage of the higher tradable profitability.

JEL Classification: F43, F14, O11.

Keywords: developing countries, hysteresis, productive structure, real exchange rates, resource-rich countries.

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El papel del tipo de cambio real en un país en desarrollo rico en recursos: efectos heterogéneos, sesgo estructural e histéresis

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Resumen

¿Cuál es el papel del tipo de cambio real en el desempeño del sector transable en una economía en desarrollo especializada en actividades relacionadas con los recursos naturales? En este artículo, responderemos a esta pregunta, resumiendo los principales resultados de tres artículos, que se centran en los efectos de heterogeneidad del nivel del tipo de cambio real (TCR) sobre el desempeño de las exportaciones e importaciones de diferentes sectores en Argentina. El primer artículo emplea el método del grupo medio para estimar las elasticidades del TCR por productos individuales. Su principal resultado destaca una amplia gama de respuestas heterogéneas de las exportaciones e importaciones a los movimientos del TCR a nivel de producto individual, siendo las elasticidades del TCR en productos diferenciados y bienes manufactureros intensivos en mano de obra sustancialmente mayores que las de los productos primarios y homogéneos. Este hallazgo tiene un impacto crítico en el valor de la elasticidad TCR agregada –ponderada por la participación de la canasta comercial de Argentina– dado que la estructura económica de Argentina está fuertemente especializada en productos primarios y homogéneos. El segundo y tercer artículo aprovechan la gran devaluación de 2002 para estudiar el desarrollo de nuevos sectores transables durante un período de tipo de cambio real estable y competitivo (TCRSC). El tercero estudia la aparición de episodios de sustitución de importaciones. Sus principales conclusiones son: (i) el pico del aumento de las exportaciones sectoriales y de los episodios de sustitución de importaciones se produjo durante el período SCRER; (ii) están relacionados positivamente con la intensidad laboral de los sectores y su relación con sectores que ya son competitivos; (iii) los sectores con episodios de aumento repentino de las exportaciones muestran signos de efectos de histéresis con un aumento duradero de su nivel de exportaciones después del final del período SCRER; (iv) los episodios de aumento de las exportaciones están correlacionados positivamente con los sectores que tienen episodios de sustitución de importaciones durante el período SCRER. Los tres artículos destacan que los movimientos del TCR tienen efectos heterogéneos en diferentes sectores y que no todos los sectores pueden aprovechar la mayor rentabilidad comercializable.

Clasificación JEL: F43, F14, O11.

Palabras clave: estructura productiva, histéresis, países en Desarrollo, países ricos en recursos naturales, tipo de cambio real.

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 relevance of the real exchange rate has been questioned in the empirical ground -giving rise to the term “elasticity pessimism” (Orcutt, 1950)- and in the theoretical grounds -for example, the Prebisch-Singer hypothesis where the exchange rate is considered an irrelevant variable for developing economies specialised in primary products export (Presbich, 1950; Singer, 1950). The puzzle was even more enigmatic when 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; Rapetti *et al.*, 2012; Rapetti, 2020; Demir and Razmi, 2021). One of the main theoretical hypotheses in this literature suggests that a higher RER level positively influences the profitability and rate of investment in modern tradable sectors and, through this channel, fosters economic growth. In this article, we summarise the empirical evidence from three different papers to help build a bridge between these two conflicting views and unpack the role of the real exchange rate in the tradable performance of a developing country specialised in primary and homogenous products.²

The three papers use the Argentine case as a case study of a country specialised in natural resource-based products. The three papers focus on the heterogeneous effects of the real exchange rate on different products or tradable sectors. While the first paper estimates the magnitude of medium-run RER-elasticities (Palazzo and Rapetti, 2023), the other two focus on remarkable breaks in the trends of exports and imports at a disaggregated level (Palazzo, 2023a, 2023b). To put it simply, the first article examines how the exchange rate affects trade flows incrementally. However, the second and third papers explore whether a period of stable and competitive real exchange rate (SCRER) can stimulate the emergence of new export sectors (Palazzo, 2023a) or lead to import substitution episodes at the sectoral level (Palazzo, 2023b). Such events are defined with an algorithm that ensures whether the change in trade flows is sufficiently remarkable to assume that a new productive capability has been developed.

The Argentine economy is an interesting case study since it provides us with a real exchange rate dynamic that is sufficiently volatile to investigate the effects of this variable on tradable performance. This fact helped us to estimate the RER-elasticities of exports and imports and calculate their marginal impact at a very granular level. At the same time, the large devaluation that occurred in 2002 marks the beginning of the SCRER period that lasted at least six years (2003-2008), which helped us to test its role in the take-off of new tradable sectors in the second (exporters) and third (import competitors) papers in the face of a long-lasting change in tradable sectors' profitability. In all three papers, we use the SITC classification, revision 2, analyzing trade flows at 4-digit disaggregation. The period covered is from 1980 to 2015.

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 tradable and non-tradable goods and services.

² All these papers are part of my doctoral thesis. One of them is co-authored with Martín Rapetti.

The main conclusions of these papers, taken as a whole, are the following:

1. Regarding the marginal effects of the RER on tradable flows, we find a wide range of heterogeneity in the RER-elasticities. Their simple average reaches 0.86 for exports and -1.04 for imports in our preferred regressions. However, the estimation range goes from around -10 to 10 at the product level.
2. Given that the impact of the RER is heterogeneous and the sectors most sensitive to the exchange rate are manufacturing sectors, it is expected that aggregate RER-elasticities of exports are *low* in economies whose export baskets are concentrated in primary and homogeneous products. Indeed, if we weigh individual elasticities by their share in Argentina's trade basket, exports accumulate an RER-elasticity of 0.27 and imports of -0.84.
3. However, if we weigh the RER-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 RER-elasticity of Argentina's aggregate exports is due to a composition effect explained by the country's productive specialisation in homogeneous and primary products.
4. Regarding the development of tradable sectors, we found that SCRER periods encourage the development of new export sectors and the growth of import-competing domestic sectors. This occurs mainly in labour-intensive manufacturing sectors and in sectors related to those sectors where the economy already has productive capabilities. This last finding indicates that not all sectors can take advantage of the exchange rate stimulus, but mostly those where the current productive structure assures some degree of prior capabilities (Hidalgo *et al.*, 2007).
5. Moreover, in the case of exports, we find that the new level of exports reached in sectors with export surge episodes last after the loss of RER competitiveness. This fact is relevant for those who support currency undervaluation policy as a driver of tradable-led growth since it would undermine the criticism that denies the possibility of keeping an undervalued currency for long periods.
6. Finally, it is found that the sectors with substitution episodes and those with export surges are related to each other in productive terms. This correlation suggests that no tension exists between sectors with good domestic performance and those that manage to internationalise themselves and export to the world market.

The article is structured as follows. After this introduction, in sections 2, 3, and 4, we summarised the main findings of the three papers mentioned above and briefly discussed their methodology. In section 2, we will show some econometric results from the work of Palazzo and Rapetti (2023), while sections 3 and 4 will focus on discussing the main novel findings of the corresponding papers (Palazzo 2023a, 2023b) and justifying how they complement the relevant literature. All our results point in the same direction, highlighting the heterogeneous effect of the RER level on the tradable

performance in a developing economy and relevant macro-micro interactions. Finally, in section 5, we conclude.

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

This paper is already published in the Journal of Structural Change and Economic Dynamics (Palazzo and Rapetti, 2023). We estimate the marginal effect of RER on exports and imports. We use the Mean Group (MG) method, which estimates the RER-elasticities for each product using time series techniques and allows all the coefficients of the variables to vary in each individual estimate (Pesaran, 2015). Then, this method calculates the arithmetical *simple* average of the estimated coefficients and calculates their variance to perform the statistical inference over the simple average estimator. By doing this, we get a simple average RER-elasticity, and we can analyse the heterogeneous effect of RER in trade flows of different kinds of products. Moreover, we can calculate the aggregate RER-elasticity –weighing by Argentina’s or the worldwide trade basket – identifying if there exists any structural bias that may alter the *aggregate* RER-elasticity because of the trade specialisation of Argentina.

2.1. Exports

In our regression model, the main explanatory variables for the logarithm of exports are foreign demand and the real effective exchange rate (REER). The foreign demand index uses trading partners’ GDP in constant dollars at the product level. The REER is calculated using bilateral nominal exchange rates, trading partners’ consumer price indices, and Argentina’s consumer price index.

Table 1 shows the results of our preferred estimation, both for the total number of products analysed and for subsamples of different product categories. Thus, column (1) shows the simple average of the elasticities for the 502 products analysed; columns (2)-(6) show the simple average for the elasticities of primary products (2), natural resource-related manufactures (3), and manufactures with low (4), medium (5) and high (6) technological content (Lall, 2000). Columns 7 to 9, on the other hand, use the Rauch (1999) classification and show the simple average elasticities for differentiated goods (7), products with world reference prices (8), and homogeneous goods (9).

Although we have done a lot of robustness tests in the paper, the table shows only the long-run elasticities when controlling for the REER, trading partners’ GDP, and the nominal exchange rate stability. Including nominal exchange rate stability as a critical control variable is justified by the mechanism through which we expect the RER operates. Since export prices are invoiced in USD, a nominal depreciation does not lower their prices (Gopinath, 2015). 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, the higher profitability must be perceived as stable 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. With this in mind, we use an indicator of the nominal stability of the exchange rate provided by Aizenman *et al.* (2013).

Table 1. Export long-run elasticities: All products, Lall's and Rauch's classifications.

	All Product s	Lall's classification					Rauch's classification		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All b/se	PP b/se	Resourc e-Based b/se	LT b/se	MT b/se	HT b/se	D b/se	RP b/se	H b/se
Long Run									
In(REER)	0.8676*** (0.2555)	0.2667 (0.2281)	0.3736 (0.2544)	1.2325*** (0.2073)	0.9832*** (0.2271)	0.7746* (0.4470)	0.9866*** (0.1395)	0.4619* (0.2578)	0.2085 (0.3179)
In(trading partners' GDP)	1.7080*** (0.2621)	0.4316 (0.3794)	2.3063*** (0.3340)	0.6210* (0.3680)	1.3249*** (0.3499)	1.0624** (0.5167)	1.3580*** (0.2178)	1.3242*** (0.3937)	0.2405 (0.4600)
In(Stability)	0.2746*** (0.0524)	0.1778*** (0.0483)	0.1971** (0.0793)	0.3670*** (0.0536)	0.3358*** (0.0660)	0.5382*** (0.1293)	0.3434*** (0.0390)	0.2899*** (0.0840)	0.1192** (0.0592)
Obs.	16,432	2,406	4,216	3,838	4,384	1,195	8,998	4,253	1,783
No. of products	502	73	127	118	135	37	276	129	54
Model	mg	mg	mg	mg	mg	mg	mg	mg	mg

Standard errors in parentheses.

* p < 0.10, ** p < 0.05, *** p < 0.01.

Source: own elaboration.

Column (1) shows the simple average elasticity across the 502 export products, obtaining the degree of significance by the variance between the individual estimates. 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%. 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 and Navajas (1998) (0.84) for bilateral trade with Brazil and that of Catao and 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 specialisation in those empirical papers.

Are there any patterns in the magnitude of the elasticities according to some observable characteristics of the products? When we tried to answer this question, some interesting patterns emerged. First, results vary in magnitude and statistical significance among the different categories. When Lall's categories are used (columns 2 to 6), the low- and medium-technological content goods have 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 4), while sectors of medium-technology reach 0.98 (column 5), and high-technology manufacturing goods reach 0.77 (column 6). Another interesting and similar pattern emerges concerning the impact of nominal exchange rate stability.

When we analyse REER-elasticities by the categories proposed by Rauch, homogeneous products (column 9) do not show – on average – coefficients significantly different from 0, while the differentiated products (7) and products with reference prices (8) do. Indeed, 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.

2.2. Imports

In the case of imports, our preferred estimation is the one that includes the REER of each imported good, Argentina's GDP at constant prices, and a variable controlling for the widespread 1990s trade opening. Table 2 shows the results of our preferred estimation using the MG method, both for the total number of products analysed and for subsamples of different product categories. In every case, the estimate of REER-elasticities shows significant coefficients with the expected sign. The simple average of long-term REER-elasticity is -1.04 for all import products (column 1).

Table 2. Import long-run elasticities: All products, Lall's and Rauch's classifications.

	All Products	Lall's classification					Rauch's classification		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	PP	Resource-Based	LT	MT	HT	D	RP	H
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Long Run									
ln(REER)	-1.0435*** (0.0647)	-0.6497*** (0.1781)	-0.9381*** (0.1229)	-1.6056*** (0.1986)	-0.9311*** (0.0754)	-0.8113*** (0.1277)	-1.2968*** (0.0927)	-0.7024*** (0.1049)	-0.4113** (0.1646)
ln(GDP)	0.8285*** (0.1032)	-0.0610 (0.3521)	0.9366*** (0.1840)	0.7958*** (0.2171)	1.3267*** (0.1475)	0.5638 (0.4277)	0.8002*** (0.1403)	0.8117*** (0.2059)	0.3284 (0.2928)
Trade Openness (90s)	0.6538*** (0.0370)	0.5329*** (0.0985)	0.6276*** (0.0747)	1.1147*** (0.0813)	0.4839*** (0.0640)	0.2755*** (0.0724)	0.7436*** (0.0510)	0.4972*** (0.0625)	0.6947*** (0.1215)
Obs.	19,652	2,313	4,644	4,400	6,128	1,965	11,051	5,217	1,871
No. of products	584	71	138	132	180	57	327	155	57
Model	mg	mg	mg	mg	mg	mg	mg	mg	mg

Standard errors in parentheses.

* p < 0.10, ** p < 0.05, *** p < 0.01.

Source: own elaboration.

The patterns that emerge for each subcategory of import goods are similar to the case of exports, especially for the REER-elasticities. If we focus on Lall's categories (columns 2 to 6), primary products (2) show the lowest average REER-elasticity in absolute terms. In contrast, the low-technology manufacturing goods (column 4) 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 7), followed by goods with reference prices (-0.7, column 8) and homogeneous goods (-0.41 reported in column 9).

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 analysed. 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 of the exchange rate is relevant mainly for high-technology manufacturing goods and differentiated products. Overall, we find evidence favouring the adoption of a stable and competitive 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 facilitate structural change and a higher economic growth rate. This evidence supports the development channel proposed by Frenkel and Ros (2006), Rodrik (2008), Rapetti *et al.* (2012), Razmi *et al.* (2012), and Bresser-Pereira *et al.* (2014). Additionally, it is in line with Cimoli *et al.* (2013) and the empirical results provided by Caglayan and Demir (2019).

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

The previous subsection 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. Here, we attempt to walk the path from the microeconomic impact to the analysis of the aggregate macroeconomic implications. In other words, once we avoid the heterogeneity biases found in the literature (Imbs and Mejean, 2015) and properly estimate individual elasticities, we can 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 is 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.

Table 3 shows the different estimated elasticities weighed by Argentina's basket of imports and exports. 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 be like if the country had a basket of exports and imports similar to the world's trade basket. 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. Given a matter of space, we will only focus on RERR-elasticities. To provide robustness to the analysis, we show the results using some of our main regression models calculated in the paper that include other additional control variables. However, we concentrate the analyses on the first line of each quadrant in which the results correspond to the estimation of our preferred models (shown in Tables 1 and 2). 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.

Table 3. Aggregate macroeconomic trade elasticities: using Argentina's and the world's trade basket as weights.

Imports				Exports			
Long-term elasticities	Estimated regressions	Weights		Long-term elasticities	Estimated regressions	Weights	
		Argentina	World			Argentina	World
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
GDP ARG	Trade Openness (2)	1.388	1.334	Trade 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

Source: own elaboration.

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 0.84%, and the exports increase by 0.3% in the face of a 1% depreciation. As a result, net exports would improve by 1.1%. 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 exports is scarce.

This result, however, depends on the structural bias caused by the productive specialisation of a country like Argentina, where 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 share 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.

This result does not undermine the positive role that an undervalued RER level could play as a facilitator of structural change and economic growth. Indeed, it highlights the underdevelopment of modern tradable activity in a resource-rich and semi-industrialized economy like Argentina.

3. Real exchange rate, export surge episodes and long-lasting effects³

In the previous section (paper), we studied the marginal contribution of a change in the real exchange rate level on exports and imports. However, it would be possible to argue, given the characteristics of the estimated regressions, that the exported amounts would return to previous levels as soon as the real exchange rate appreciates. This will leave no role to the RER as a

³ This paper is forthcoming in the Journal of Structural Change and Economic Dynamics.

development policy to foster structural change. This issue leads us to ask another question: Could a period of a stable and competitive real exchange rate (SCRER) lead to the development of new export sectors that persist after the exchange rate becomes uncompetitive? If so, what are the characteristics of these sectors that take off during the SCRER period? Does it depend on the countries' previous productive capabilities? Palazzo (2023a) aimed to answer these questions by examining an interesting case study of a developing country that experienced a large change in the level of the RER over a long (enough) period to take place the take-off of new export sectors.

Argentina's real effective exchange rate (REER) depreciated 57% at the beginning of 2002, during the currency and financial crisis that put the end of a decade of the currency board regime. More importantly and in contrast to other currency devaluation events, the new real exchange rate level remained stable until 2008. On average, between 2003 and 2008, the REER was depreciated by 53% compared to 2001. The magnitude and persistence of this new RER level is an excellent natural experiment to study the connection between the real exchange rate and the development of tradable sectors. Since -in this case- our focus is not on the marginal effect of RER on exports, we take advantage of previous work done by Palazzo and Rapetti (2017) and analyse the cross-section characteristics of export surge episodes that occurred during this period. The so-called export surges capture those episodes in which sectoral exports experience a pronounced change in their growth trends, accelerate their export growth rates, and increase their international market share. In other words, they are episodes where these sectors developed capabilities and expanded their production capacity, increasing the country's tradable supply. The authors find that during the six years from 2003 to 2008, Argentina showed the highest peak of export surge episodes from 1980 onwards.

Our empirical strategy aimed to test and isolate some of the main theoretical channels through which the RER level might foster export surge episodes. Since in developing countries, exports are invoiced in US dollars (Gopinath, 2015), a more depreciated RER level only changes the profitability rate for exporters and, under some conditions, might encourage the expansion of tradable supply. As a result, the net exposure of an exporting firm to changes in the RER is given by the share that non-tradable goods represent in their costs. Since labour is the most important non-tradable cost of most production functions, the RER should affect sectors differently depending on their labour intensity (Frenkel and Ros, 2006). In addition, we argue that the likelihood of new export sectors taking off also depends on the existing capabilities of the economy. This means that RER should foster the occurrence of export surge episodes in those sectors related to already competitive sectors, showing path dependence in the country's productive structure. In simpler terms, a new sector is more likely to experience a surge in exports if the economy already possesses most of the necessary capabilities for that sector. These capabilities are present when they are similar to the ones used in already competitive sectors (Hidalgo *et al.*, 2007; Hausmann and Klinger, 2006; Bahar *et al.*, 2019).

Our main results confirm these hypotheses in Table 4. First, export surge episodes are more likely to occur in sectors with a higher share of non-tradable costs during the SCRER period. More precisely, the probability of an export surge episode increases by 2.5% by each standard deviation of a higher labour intensity index during the six years 2003-2008. These effects are significant and

economically relevant, given that the unconditional probability of export surges is only 9.1% from 1980 to 2015. Second, export surge episodes are also more likely to occur in sectors related to other already existing competitive sectors during this period (2003-2008). A standard deviation in the sector's agnostic relatedness density index increases the probability of an export surge by 4%.⁴ This finding indicates that not all sectors can take advantage of the exchange rate stimulus, but mostly those where the current productive structure assures some degree of prior capabilities (Hidalgo *et al.*, 2007). Moreover, the results are robust to more ($RCA \geq 1$) and less demanding ($RCA \geq$ percentil 50) density criteria in the definition of productive capabilities, with no relevant changes and stable coefficients. In short, we conclude that the large and long-lasting RER devaluation encouraged the emergence of export surges in those labour-intensive sectors and those with close connections to already competitive sectors.⁵

Table 4. Determinants of export surge episodes during currency undervaluation period: Labor Intensity and prior capabilities (agnostic relatedness index). Linear Probability Model. Export surge episodes 2003-2008.

	(1) Export surges b/se	(2) Export surges b/se	(3) Export surges b/se	(4) Export surges b/se	(5) Export surges b/se
ln(labor intensity)	0.0481** (0.0222)	0.0475** (0.0190)	0.0525*** (0.0202)	0.0498** (0.0197)	0.0525** (0.0204)
Agnostic relatedness ($RCA \geq p75$)		0.0470*** (0.0176)	0.0558*** (0.0195)		
Agnostic relatedness ($RCA \geq p50$)				0.0717 *** (0.0178)	
Agnostic relatedness ($RCA \geq 1$)					0.0522*** (0.0198)
RCA initial level	-0.0152*** (0.0042)		-0.0271*** (0.0060)	-0.0263*** (0.0053)	-0.0270*** (0.0063)
Lall's categories	Yes	Yes	Yes	Yes	Yes
Obs.	679	703	676	676	676
Model	ols	ols	ols	ols	ols
vcetype	Robust	Robust	Robust	Robust	Robust
Clusters	227	231	227	227	227

Standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: own elaboration.

In addition, another interesting result of the paper (not shown here) is that if we evaluate the specific connection channels to competitive sectors, we find that only upstream sectors of

⁴ The agnostic relatedness density index is provided by the product-space built by Hidalgo *et al.* (2007), measuring how likely is to be competitive in one sector if the economy is competitive in other related sectors. We called it agnostic since we do not identify the particular linkage (upstream, downstream, common labor skills, technology, among others) that relates the sectors.

⁵ We controlled for the initial level of RCA to avoid bias in our estimates because, for example, the less labour-intensive sectors might have a lower probability of export surges because they are already in the domain of diminishing returns to scale (high RCA levels). The negative sign of these estimates was expected. On the one hand, Argentina specialises in primary products and, in this type of products, we do not expect a strong response to the exchange rate stimulus because the agricultural frontier is a natural constraint to their expansion. On the other hand, even in manufacturing goods, sectors with a very high level of RCA are already on the technology frontier without the possibility that a catch-up phenomenon will cause an export surge episode. In this line, Bahar *et al.* (2019) find a negative relationship between export take-offs and initial RCA.

competitive ones manage to take advantage of the exchange rate impulse. There is no positive effect for downstream sectors, sectors that share similar workforce characteristics, or sectors that use or provide similar technology to competitive sectors. This finding is compatible with the hypothesis of Hirschman (1958, 1977).

3.1. The long-lasting effect of the RER: hysteresis in exports

Up to this point, we have shown evidence that the probability of export surges correlates positively with the degree of labour intensity and linkages with competitive sectors during the period of large and long-lasting RER devaluation (2003-2008). If this process is due to the payment of sunk costs, some persistence should be observed in these sectors' new level of exports, despite the continuous appreciation of the real exchange rate that started in 2010 in Argentina. In this sub-section, we explore how the export performances of the export surge sectors continued after the end of the stable and competitive RER period.

In particular, we study the average export performance of sectors with surges during 2003-2008 relative to sectors without export surges. We use annual export data in constant and current values, and we include fixed- and year-effect dummies to control for common temporary shocks and constant sector characteristics despite meeting the export surge requirements. In addition, we also control for tariffs and macroeconomic variables to prevent the export dynamics from being explained by different growth rates in the main destination countries, the evolution of the real effective exchange rate, or changes in tariffs in the destination countries. The hypothesis is that a group of exporting firms in the sectors with the export surges made the necessary investments, paying the sunk costs to open new markets or developing new production capabilities.

We estimate a flexible model where the sectors that had surges during the 2003-2008⁶ period are identified with values 0 or 1, and their export performances are evaluated yearly. The regression equation estimated is the following:

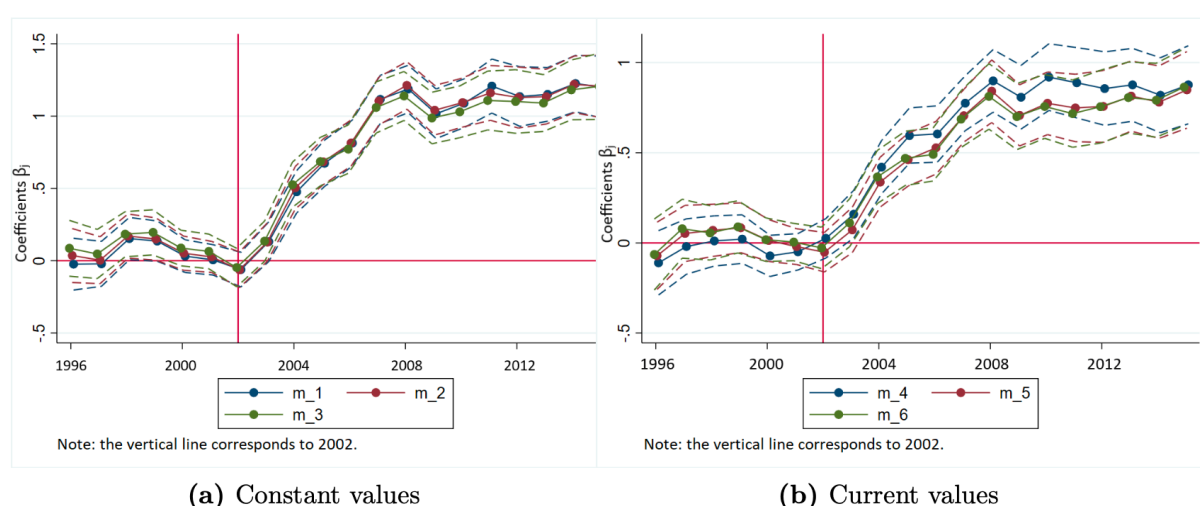
$$y_{i,t} = \sum_{j=1989}^{2015} \beta_j (Surges_i^{2003} Year_t^j) + \sum_{i=n} \alpha_i I_i^n + \sum_{j=1989}^{2015} \lambda_j Year_t^j + M'_{i,t} \Omega + \sum_{j=1989}^{2015} X'_i Year_t^j \Gamma_j + \epsilon_{i,t} \quad (1)$$

This equation allows us to identify the differential performance of those sectors with surges over the years. The coefficient of interest is β_j , which reflects the differential behavior of export in the sectors that had surges during 2003-2008. I_i^n is a 4-digit sectoral fixed effect, while $Year_t^j$ is the year fixed effect. M refers to macroeconomic controls by sectors that include trade partners' GDP, the real effective exchange rate by sector, and the simple average of import tariffs of Latin America, the European Union, and the United States. Finally, we include a series of cross-section controls by sector (X'_i), multiplied by the fixed effect per year to strengthen the control on previous trends. We seek to ensure that the effects come from fulfilling the condition of export surge episodes but are not related to sector characteristics. Robust errors are used.

⁶ This condition is fixed across all years and identifies in a cross-sectional way those sectors with surges during 2003-2008.

We estimate six regression models, including different set of controls and using either the logarithm of exports in constant values as the dependent variable or the logarithm of exports in current dollars. Figures 1a and 1b plot the estimated coefficient of the interaction between the year-fixed effect and the export surges dummy during 2003-2008 (β_j) when the dependent variable is at constant values (a) as well as current values (b). We plot the coefficients of the three regression models. As expected, during the period 2003-2008 there was a significant increase in the export level of these sectors. This dynamic is not interesting but tautological because of the definition of an export surge episode. From 2010 onwards, however, we do not observe a continuous export decrease, and the export gap between sectors holds, despite the real exchange rate appreciation from that year onwards.

Figure 1. Hysteresis? Evidence from export surge episodes. Estimated coefficient.



Source: own elaboration.

This finding suggests that export surge sectors are, on average, successful examples of international integration or acquired productive capabilities that imply the payment of sunk costs. Once their exports have taken off, the new level is maintained relative to the rest of the sectors when controlling for relevant explanatory variables. We should highlight that this finding holds even though Argentina 2010 started a process of fast currency appreciation, imposed capital controls, foreign exchange rate controls, and import restrictions that ended with another large devaluation in 2015. This fact is relevant for those who support currency undervaluation policy as a driver of tradable-led growth since it would undermine the criticism that denies the possibility of keeping for long periods an undervalued currency. With these findings, only transitory periods of some length would be needed to achieve permanent effects on export development.

4. Real Exchange Rate, Import Substitution Episodes and Complementarities with Export Surge Episodes

In this section/paper (Palazzo, 2023b), we study which sectors manage to substitute imports by taking advantage of the same natural quasi-experiment offered by Argentina's macroeconomic

history used in the previous paper. The RER acts as the first transmission channel for competition between domestic production and import goods and services. A competitive exchange rate level could be considered a horizontal policy that impacts the cost level in dollars and, therefore, defines the productivity threshold necessary for domestic firms to compete with imported goods. A rise in the RER level shifts the balance towards the local production of importable goods. At the same time, its appreciation, on the contrary, acts as a generalised trade opening. Therefore, the higher profitability of the tradable sector should also be reflected in an increase in the number of sectors with import substitution episodes and not only in export performance. Palazzo (2023b) seeks to provide new evidence on how the RER level impacts the performance of tradable sectors, avoiding restricting the analysis only to short-term adjustments or to the performance of export sectors.

We make three main contributions here. First, we propose a methodology for detecting sectors that substituted imports during the SCRER period. In this way, we offer a quantitative and potentially replicable approach to studying the development of domestic tradable sectors. Once this group of sectors has been identified, we analyse their characteristics to test both the theoretical transmission mechanisms that link currency depreciation with import substitution and to understand the role of the economy's productive structure in the probability that a sector shows an episode of import substitution. Finally, we analyse whether there is complementarity or potential conflict between sectors with import substitution and those sectors that were identified as *export surges* during the same period. By doing this, we inquired whether import substitution generates an export disincentive or, on the contrary, is related to sectors with good export performance.

We identify sectors with import substitution episodes through a quantitative method that captures those imported products that showed marked changes concerning their previous trends, once controlled for the performance of domestic aggregate demand. To this end, and as other papers did for the identification of export surges (Freund and Pierola, 2012; Palazzo and Rapetti, 2017; Palazzo, 2023a), we establish a series of requirements to reveal the existence of import substitution episode by sectors disaggregated at four digits of SITC classification. Then, we estimate a series of linear probability and probit models to analyse the heterogeneity of the sectors that showed import substitution episodes and test the theoretical links between RER and tradable growth.

In our main exercises, we apply these regression models to the cross-section of -approximately- 450 importing sectors for the period 2003-2008, for which we have complete data. The dependent variable is the dichotomous indicator (0 or 1) of an import substitution episode that occurred during the six-year period 2003-2008. Here, as in the case of export surges, we evaluate the same two hypotheses: (1) a higher level of the RER should show a greater impulse to substitute imports in labour-intensive sectors. As explained before, tradable activities where the costs of non-tradable productive factors -mainly labour- predominate would have a more remarkable improvement in their profitability with the new depreciated exchange rate level; (2) The higher level of the RER should show a greater impact on import substitution episodes in sectors where similar productive capabilities already exist in the economy. Finally, we add a third hypothesis: (3) given that the higher profitability granted by the exchange rate does not cause distortions in the prices of importable

goods to the detriment of the prices of exportable goods, there should be no contradiction between the development of exporting sectors and import substitution.

The main findings can be summarised as follows. First, in the SCRER period (2003-2008), the sectors identified with import substitution episodes reached 29.9% of the total number of sectors. Second, the probability of occurrence of an import substitution episode during this period increases by 3.89% for each standard deviation of the higher labour intensity of the sector. The effect is significant and economically relevant, given that the unconditional probability of substitution episodes from 1980 to 2015 is only 14.6 percent. Third, as for the relatedness to other already competitive sectors, we find that this variable increases the probability of an import substitution episode during the SCRER period. A standard deviation of greater relatedness to competitive sectors increases the probability of substitution episodes by 11%. This fact indicates that not all sectors can take advantage of the exchange rate incentive, but only those where the productive structure has previous capabilities. Finally, it is found that the sectors with substitution episodes and those with export surges are close to each other in productive terms. This correlation suggests no tension existed between sectors with good domestic performance and those that managed to internationalise during the SCRER period.

5. Conclusions

The three papers summarised in this article attempted to understand the role of the RER in the development and performance of the tradable sectors of a small economy specialised in exporting primary and homogeneous products. The main lessons obtained point in the same direction and can be synthesised in two concepts: heterogeneity and structural productive bias.

At this point in the article, the reference to heterogeneity should be evident. Both the calculation of sectoral RER-elasticities and the cross-sectional analysis of the export surge and import substitution episodes showed that not all sectors benefit and can take advantage of the higher profitability offered by a competitive exchange rate in the same way. In particular, we find that labour-intensive manufacturing sectors and differentiated products benefit more from higher profitability, increasing their incentives to invest and expand tradable supply.

Regarding the productive structure, its role is central for several reasons. First, we find that the aggregate RER-elasticity depends on the productive structure of the economy in question. In this sense, an economy specialised in primary and homogeneous products will have a *low* aggregate elasticity because of a structural bias due to its current international insertion. Given this, we cannot expect strong growth of aggregate exports after a RER devaluation, and most of the adjustment will come from imports. However, a competitive real exchange rate would favour the development of labour-intensive manufacturing sectors and differentiated products, helping -although not guaranteeing- the structural change of the economy. This reflects several macro-micro interactions that must be considered in the design of a country's macroeconomic and productive policy.

Secondly, and also related to structural factors, the sectors that manage to take off in the SCRER period are related to already competitive sectors. In other words, both the episodes of export

surges and import substitution occur in sectors where the economy already has some of the productive capabilities required. In particular, the linkage channel seems to be upstream of the already competitive sectors. This finding would again suggest a role for the productive structure in determining which sectors a competitive real exchange rate policy could promote.

Last but not least, we evaluated the subsequent performance of the sectors with an export surge episode during the SCRER once the exchange rate stimulus ended. We find evidence of persistence in their export levels compared to the rest of the export sectors, favouring the hypothesis of sunk costs or learning by exporting effects that generate hysteresis in trade. With these findings, only transitory SCRER periods would be needed to achieve permanent effects on export development (Rapetti, 2013).

We believe the three papers build a bridge between the literature arguing that an undervalued RER facilitates structural change and economic growth and the literature skeptical of its benefits due to elasticity pessimism. We hope it contributes to the academic and policy debate.

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