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Export manufacture competitiveness and commodity dependence: An empirical analysis of the Dutch Disease on Argentina and Chile during the commodity price boom

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# **Export Manufacture Competitiveness and Commodity Dependence: An Empirical Analysis of the Dutch Disease on Argentina and Chile During the Commodity Price Boom**

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# **Export Manufacture Competitiveness and Commodity Dependence: An Empirical Analysis of the Dutch Disease on Argentina and Chile During the Commodity Price Boom**

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## **Abstract**

Extensive economic literature has covered the effect of a natural resource boom on the performance of the manufacturing sector. Specifically, the Dutch Disease hypothesis establishes that increases in commodity prices should lead to a decrease in manufacturing exports, due to significant inflows of foreign currency that subsequently appreciate the real exchange rate. In 2003, a substantial increase in commodity prices, coupled with a pronounced appreciation of the real exchange rate, triggered a process of export primarization in Latin American countries. The paper aims to empirically assess whether the Dutch Disease framework can provide a suitable explanation for this phenomenon in Argentina and Chile. Despite both countries heavily depending on natural resources, they exhibit notable differences in economic scale, composition, and evolution of manufacturing exports, as well as their economic policy approaches throughout the designated period. This task is performed through the estimation of one VAR model for each country (2003-2019). The main results indicate that while there is insufficient evidence to assert that Argentina suffered from the Dutch Disease, the evidence for Chile remains inconclusive. These divergent results could potentially find clarification in an examination of disparities in export composition and integrated technology and thereby suggest a broader analysis regarding the policy implications.

**Keywords:** Dutch Disease, VAR models, Argentina, Chile, manufacture export, commodity price boom.

**JEL Codes:** C32; E12; F31; F41

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## **Introduction**

The discovery of natural gas in the Netherlands in the 1960s sparked a significant discussion about the potential impacts that a commodity extraction boom could have on the manufacturing export sector, potentially resulting in a loss of competitiveness. Neoclassical authors (Corden, 1981; Corden and Neary, 1982) originally formalized this phenomenon, known as the Dutch disease (DD). They argued that shocks in natural resources could lead to increased local demand, raising the prices of non-tradable domestic goods. In consequence, this could cause real currency appreciation and reduced competitiveness in the tradable sector. From a heterodox perspective, the New Developmentalism (ND) approach made well-known contributions in this regard, particularly that of Bresser-Pereira (2008, 2013) established a link between the effect of real exchange rate (RER) appreciation, resulting from increased foreign exchange inflows from a highly productive commodity sector, and the competitiveness of other tradable sectors. Unlike producers in these tradable sectors, the commodity sector can maintain profitability even after the RER decreases, enabling it to continue exporting.

In 2003, a sharp increase in commodity prices, coupled with a strong RER appreciation and a shift towards increased reliance on primary goods, marked the Latin American export landscape (Erten and Ocampo, 2021). This paper aims to empirically assess whether the DD framework can explain this phenomenon in the context of Argentina and Chile. These countries were selected due to their high dependence on natural resources, despite significant disparities in economic size, composition, and evolution of their manufacturing exports, and economic policy regimes during the studied period.

To achieve this goal, the authors employ two vector autoregressive (VAR) models for the period 2003 to 2019. The main finding of this paper is that while there is evidence to suggest that there was no Dutch disease effect on Argentine manufacturing exports during the studied period, there is not sufficient conclusive evidence to make a similar assertion for the Chilean economy. This is noteworthy, even considering the more pronounced RER appreciation in Argentina compared to Chile. One possible explanation for these results could be attributed to disparities in the technological content of the manufactured exports between the two countries. In this sense, the findings suggest significant implications in terms of policy consideration for future research.

The remainder of the paper is structured as follows: Section II reviews the theoretical literature related to the DD, followed by an overview of empirical studies on the subject. Section III provides a macroeconomic contextualization of Chile and Argentina. Subsequently, Section IV describes the methodology utilized and the data analyzed. Finally, Sections V and VI present the econometric results and the conclusions, respectively.

## Literature Review

The relationship between natural resources and economic development has been an important topic of debate in economic literature. The concept of the 'natural resource curse' has been used to describe the negative relationship between growth and natural resource exports (Auty, 2001). In this regard, the DD thesis has been proposed as an explanation for this phenomenon (Frankel, 2012), which has its roots in the discovery and exploitation of natural gas in the Netherlands in the 1960s (Kremers, 1985). The DD refers to how a boom in the production and export of a natural resource could lead to exchange rate appreciation that discourages the domestic production of other tradable sectors, mainly those involved in producing industrial goods (Davis, 1995). In addition to the capital inflows originating from a shock in natural resources, the economics literature has also recognized this phenomenon as arising from alternative forms of capital inflows, such as foreign direct investment or remittances. These various inflows subsequently contribute to currency appreciation (Magud and Sosa, 2013).

Based on the natural resource boom, different theoretical approaches have tried to explain this phenomenon. One of the first DD formal analyses from a mainstream perspective was performed by Corden (1981). Drawing inspiration from the Dutch experience, he developed a simple model that connects the boom in a new primary sector with real currency appreciation. This author explained that the capital inflows as a result of new sector growth stimulating local demand, generates heterogeneous effects across tradable and non-tradable sectors. While an increase in prices is expected in the non-tradable sector, the tradable sector will maintain its price level owing to its international definition. Consequently, the overall price increase in the economy leads to real appreciation, affecting the export-oriented industrial sector, which encounters a constricted profit margin due to price rigidities. Corden and Neary (1982) formalized this preceding dynamic by introducing the concept of 'spending effect' and incorporating the 'resource allocation' effect, developing a general equilibrium model. This effect is explained as the movement of factors from tradable sectors to the non-tradable sector due to the new marginal productivities of factors determined by the shock. As a result, this squeezes profits in those tradable sectors.

Van Wijnbergen (1984) extended this model to include the concept of learning by doing (LBD) in the analysis. The inclusion of LBD incorporates structural productivity dynamics specific to the manufacturing and primary sectors, given the assumption that most LBD can be found in the manufacturing sector. Van Wijnbergen (1984) concluded that the DD negatively affects manufacturing sectors with higher LBD and, consequently, long-term economic growth. Following this perspective, Krugman (1987) incorporated dynamic economies of scale in a trade model to address the role of LBD in the evolution of comparative advantage. According to Krugman (1987), a commodity shock and real appreciation could lead to permanent losses in competitiveness in the affected sector. Cherif (2013) incorporated the productivity gap of the exporter country as a determinant of the potential negative consequences of the DD. They developed a bilateral trade model with monopolistic competition and increasing returns to scale, predicting that the detrimental effect of DD on the manufacturing sector becomes more pronounced when the technological gap with the trading partner is larger.

These contributions lead to the conclusion that the DD will harm long-run growth. However, this is not a consensus in mainstream literature since some authors consider that the DD only leads to a change in the long-run growth equilibrium, but not necessarily a worse position (Edwards and Aoki, 1983). This difference depends on the benefits of an increase in manufacturing production in contrast to the increase in primary or non-tradable goods production (Magud and Sosa, 2013). Despite this discussion on the necessity of government intervention, both agree on the idea that a decrease in the real exchange rate will reduce the production and export of industrial tradable goods and enhance the production of non-tradable goods and the production and export of commodities.

The New Developmentalism stands out as the branch of economic literature that has predominantly focused on studying the Developmental State from a heterodox perspective. One of the main references in this regard is Bresser Pereira (2008, 2013), who primarily analyzes this phenomenon in a Latin-American context. According to Bresser Pereira (2013), the exchange rate constitutes a crucial element in economic development, a factor often excluded from orthodox analysis and mainstream development economics textbooks due to the prevailing belief that the exchange rate only exerts short-term effects. Concerning the origin of the DD, this author emphasizes the existence of Ricardian rents in commodity production sectors as the primary explanatory factor. This type of rent is defined as the difference between the international commodity price and the domestic production commodity cost. Since most developing countries possess a highly productive commodity-producing sector that has access to this kind of rent, significant foreign currency inflows occur that ultimately lead to nominal currency appreciation followed by a real currency appreciation (Bresser Pereira, 2008; 2013). This situation leads to a persistent overvaluation that undermines the profitability of the tradable sector. Nevertheless, the author asserts that this is a characteristic of medium-income countries that have access to a homogenous technology, which identify this issue on the demand side as a problem of a "false" overvalued exchange rate, whereas low-income countries might still grapple with supply-side problems such as technological lags, insufficient human capital for investment, among others.

In this context, Bresser Pereira (2008; 2013) asserts that the DD represents a structural characteristic that affects most of these countries. Diverging from the neoclassical approach, Bresser Pereira's (2008; 2013) explanation of DD does not rely on resource allocation or demand-led price explanations to account for this phenomenon. Instead, this author posits that the DD can be understood as a market failure since it is a market-driven phenomenon from the commodity sector that generates a negative externality that affects other tradable goods sectors.

According to Bresser Pereira (2008; 2013), this externality can be explained due to the presence of two different exchange rates: the current equilibrium exchange rate and the industrial equilibrium exchange rate. On the one hand, the former is the equilibrium exchange rate determined in the foreign exchange market by the inflows and outflows of foreign currency. It is the exchange rate that maintains the balance of the current account. If the DD is not neutralized, the tradable sector can only be competitive if its productivity surpasses that of international competitors. This condition is necessary to compensate real appreciation (Bresser Pereira, 2008; 2013).

In an industrialized country, the DD will lead to premature de-industrialization due to lower profitability in the manufacturing sector. Furthermore, in an economy with an undeveloped industrial sector, an appreciation of the RER will generate negative expectations regarding the benefits of the manufacturing sector, resulting in reduced investments in it. In addition to de-industrialization, as explained by Bresser-Pereira and Oreiro (2012), the DD can be one of the main drivers of a process known as 'primarization'<sup>12</sup>. In this sense, the RER appreciation weakens the competitiveness of domestic manufacturers in the international market, leading to a decrease in the share of manufactured exports (Marconi, 2012). Meanwhile, the primary sector will maintain its profitability and, as a result, its production and export levels will not be strongly affected (Bresser Pereira, 2008; 2013). Therefore, the relative share of primary exports within the total exports increases, while the share of manufactured exports decreases (Bresser Pereira and Oreiro, 2012). Considering that growth in developing countries is frequently balance-of-payment constrained<sup>3</sup>, Bresser-Pereira and Oreiro (2012) claim that export primarization could lead to lower long-term growth. Specifically, these authors assert that this process reduces the foreign income elasticity of export demand, thus exerting a long-run growth effect (Bresser-Pereira and Oreiro, 2012; Marconi, 2012).

Another heterodox interpretation of the DD can be found in the classical-sraffian approach (Dvoskin and Feldman, 2018; Dvoskin and Feldman, 2022), which considers that the profit rate does not determine investment. This is the reason why changes in the profit margin would not necessarily lead to a reduction in manufacturing production, according to empirical evidence found by several authors (Cuevas-Ahumada, 2011; Lanteri, 2019). In a model developed by Dvoskin and Feldman (2018), it is established that the rate of profit is defined initially, and then the relationship between wages and the exchange rate is determined. Thus, it wouldn't be the exchange rate that determines the competitiveness of the industry. When an economy with rent is incorporated into the theoretical model, both the rate of profit and the exchange rate and wage ratio are determined simultaneously. In this context, changes in the exchange rate, resulting, for example, from a shift in commodity prices, wouldn't necessarily have a direct impact on the export competitiveness of the manufacturing sector.

Dvoskin and Feldman (2022) focus on the argument presented by the ND regarding the competitive exchange rate for the industrial sector, discussing two shortcomings concerning this. Firstly, the 'current exchange rate' does not necessarily coincide with the 'equilibrium exchange rate,' a situation that might not be assured in the long term. Secondly, the assumptions posited by the ND that a 'sufficient' rate of profit would allow the industrial sector to access unlimited international demand may not align with the Keynesian principle of effective demand.

As a major concern, one of the main differences between the ND and the Post Keynesian is the consideration for the distributional impact of the devaluation as a

<sup>1</sup> Export primarization can be defined as the increased role of primary products in the total share of exports (Cypher, 2010).

<sup>2</sup> It's important to note that an increase in primary exports doesn't necessarily mean a higher share in the total exports. For this to occur, the growth of primary exports must outpace the growth of other export sectors.

<sup>3</sup> See Prebisch (1949) and Thirwall (1979) a deeper theoretical explanation of this concept.

policy application in this scenario (Dvoskin and Feldman, 2018; Dvoskin and Feldman, 2022)

Hence, the policy recommendations developed from heterodox currents, particularly from New Developmentalism (ND) and post-Keynesian criticism, are varied due to the diversity of approaches established and the assumptions considered. The ND approach advocates mainly for export taxes to mitigate the DD's effects (Bresser-Pereira, 2008). In this regard, Dvoskin and Feldman (2018), while formalizing ND proposals in a model that endogenizes the productive structure of a small open economy, show that export duties might be a more feasible policy than export taxes since they will not raise costs for primary producers, thus avoiding repercussions on the prices of commodities derived from these products. However, as demonstrated by Dvoskin, Feldman, and Ianni (2020) through a Sraffian model, conflict inflation is a limit to export diversification through exchange rate policies.

Moreover, Dvoskin and Feldman (2018) raise additional criticisms of ND policy recommendations. They assert that even though a 'competitive' exchange rate might be a necessary condition, it is not sufficient on its own, as the ultimate driver of exports remains foreign demand. These authors also suggest that an exchange rate increase could lead to prompt reactions from trading partners, potentially leading to a global reduction in real wages that could adversely affect export demand, especially if such a policy becomes globally adopted. Finally, Dvoskin and Feldman (2022) consider the regressive distributive effects of devaluation, and hence, argue that an exchange-rate differentiation would be a more suitable recommendation when considering the industrial and primary sectors, as it does not have negative effects on real wages.

Another significant limitation of this approach is its foundation in addressing market failures, which consequently disregards the role of industrial policies as crucial elements for fostering new competitive advantages. Palley (2021) states that these policy recommendations do not substantially differ from neoliberal ones. The ND simplifies the development issue by not considering the global productive structure (i.e., not considering the long-term dynamics explained in the center-periphery theory) and thus avoiding discussions surrounding productive transformation. Furthermore, Palley (2021) asserts that the implementation of an export tax establishes a development strategy based on the inflow of foreign currencies that impacts financial vulnerability due to the dependence on external finances.



## Empirical Literature Review

The empirical evidence regarding DD is extensive, yet it displays significant heterogeneity. This literature review will first present empirical evidence on DD regarding the effects of capital inflows<sup>4</sup> on manufacturing output. This will assist in reviewing the different methodologies and identification strategies used to study this phenomenon. Subsequently, evidence within the countries under investigation in this study will be described.

Within the context of Latin American countries, several studies have examined the effects of remittances and financial aid. Acosta *et al.* (2009) developed a Bayesian vector auto-regression (VAR) model that suggests the presence of DD in El Salvador. Specifically, these authors estimated the impact of remittances on RER as well as tradable and non-tradable output. Similarly, Amuedo-Dorantes and Pozo (2004) analyzed remittance inflows across 13 Latin American economies and observed a significant effect on real currency appreciation. It is important to note, however, that this study did not investigate the effects on outputs, offering only a partial view of the DD thesis. Rajan and Subramanian (2005; 2011) investigated the impact of aid on economic growth through a cross-country analysis of capital inflows from aid. The authors demonstrated that aid does not substantially contribute to enhancing growth performance and linked their findings to the DD theory. Moreover, they highlighted the negative impact of currency appreciation on the tradable sector. These results were reinforced by Rajan and Subramanian (2011) in their exploration of the manufacturing sector through cross-country estimations, revealing a negative effect on relative manufacturing growth attributable to aid inflows and currency appreciation.

Similar studies focusing on the boom in natural resources can be found in the literature. Bernat (2015) employed a fully modified ordinary least squares (FM-OLS) approach for the period 1991-2011 to estimate the effect of the real exchange rate on exported quantities in different sectors across nine Latin American countries. The study found heterogeneous effects contingent on the technological content of each exporting sector, particularly highlighting the significant effect of currency appreciation on low-tech manufacturing sectors. When considering the literature specifically focused on Argentina, Lanteri (2015) developed a structural VAR (SVAR) model for the period 1993 to 2015. Contrary to the expected implications of the DD hypothesis, the study revealed that price shocks in the agricultural sector positively influenced manufacturing production. Lanteri (2019) estimated a similar SVAR model and found consistent results, suggesting no evidence of DD for Argentina in terms of manufacturing production.

However, these studies did not address the effect of DD on exports. Campos (2018) focused on how the Comprehensive Balance Policy (CBP) influences economic performance volatility (total output), finding that price shocks exerted a negative impact on growth. Regarding the correlation between the RER and export activity, Cuevas-Ahumada (2011) estimated a generalized VAR model for Argentina and Mexico, finding that real depreciation did not affect manufactured exports. Zack and Dalle (2015) employed a Vector Error Correction Model (VECM) over the period from 1996 to 2013

<sup>4</sup> For the purposes of the DD literature, capital inflows can be explained by the inflows from natural resources, remittances, foreign direct investment (FDI), and foreign aid.

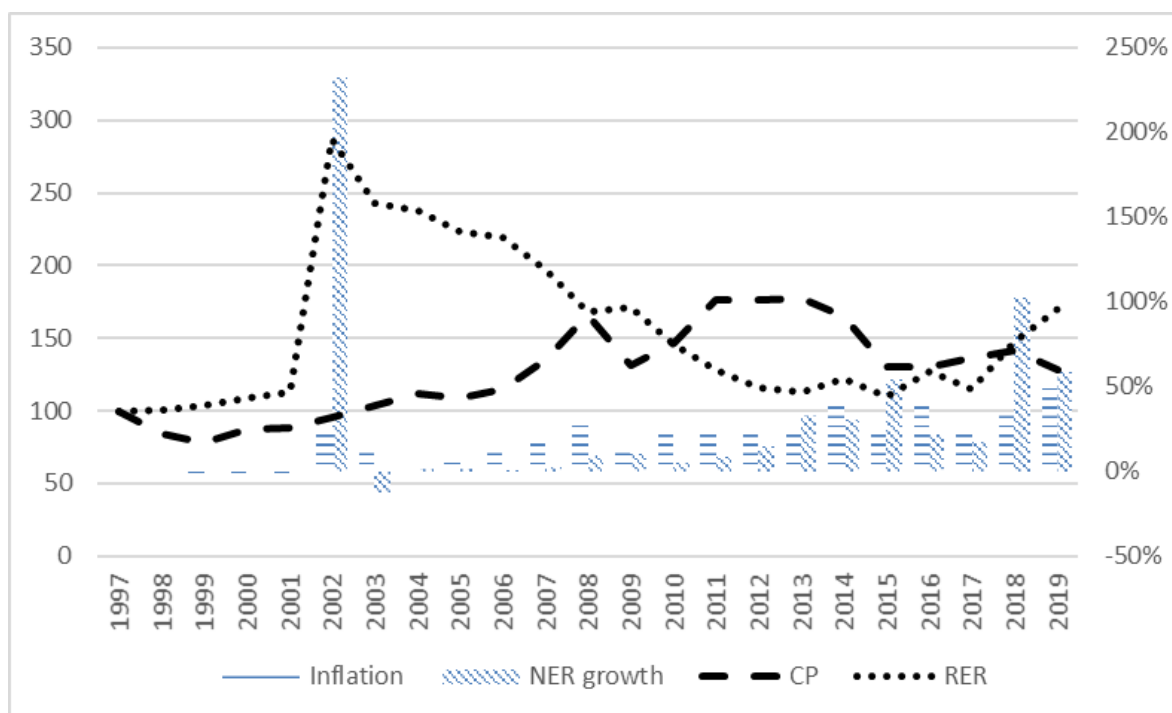
and found that the multilateral exchange rate had a small positive effect on total exports. Moreover, the authors identified that the Marshall-Lerner condition was not satisfied. Finally, Palazzo and Rapetti (2023) estimated exports and imports elasticities concerning the RER using mean estimators. Their results indicated that primary products were not substantially affected by exchange rate changes, while medium and high technology products exhibited higher export-RER elasticity.

The evidence for Chile is less abundant compared to the Argentinian case. On one hand, Huerta and Garcia-Cicco (2016) estimated the effect of copper prices on industrial total factor productivity using a VEC and VAR model, identifying a negative relation between the two factors. On the other hand, Medina (2018) and Marañón and Kumral (2021) performed VAR estimation models and presented evidence against the DD hypothesis in both cases. These outcomes were attributed to the fiscal policy rule applied in Chile. However, in both cases, the studies primarily centered on manufacturing output concerning the sector's GDP, without adequately taking into consideration the sector's export performance. To the best of our knowledge, no studies in Chile have assessed the DD based on manufacturing export performance.

### **Country Contextualization During the Commodity Price Boom**

The commodity price boom (CPB) started around 2003, a year in which Argentina was undergoing profound social and economic transformations. In the preceding decade, Argentina implemented a neoliberal economic program that continued the policies initiated during the final years of the Argentinian military dictatorship (1976-1983) (De Angelis, Calvento, and Roark, 2013; Kulfas and Schorr, 2003). The main policies applied during this period included trade liberalization, the establishment of a currency board that fixed the exchange rate with the US Dollar at 1, the privatization of major public companies, and a reduction in public spending (Basualdo, 2003). While these policies succeeded in curbing inflation (see Figure I), they also led to the worst economic crisis in Argentina's history in 2001, contributing to a significant de-industrialization of the economy (Kulfas, 2008). In 2002, following President De la Rúa's resignation, a transitional government was assumed. The main economic policy applied during this short administration was the dissolution of the currency board, resulting in a substantial 232% nominal devaluation (David, 2019). As illustrated in Figure I, this devaluation triggered a pronounced increase in the real exchange rate.

Figure I: Real exchange rate and its components<sup>5</sup>, Argentina, 1997-2019



Source: Own elaboration based on data from INDEC (2023), BCRA<sup>6</sup> (2023) and IMF (2023).

Throughout the administration led by Nestor Kirchner, (2003-2007), commodity prices maintained an increasing trend (see Figure I). During these years, significant economic policies were implemented, including reductions in the interest rate and the exercise of control over the nominal exchange rate (Kulfas, 2008; 2014; De Angelis *et al.*, 2013; Manzanelli and Basualdo, 2016; Barrera and Bona, 2018). These policies were further complemented during the subsequent administrations of Cristina Fernández (2008-2011; 2012-2015) with the introduction of income redistribution strategies, export levies, and the re-nationalization of previously privatized companies from the neoliberal era (Barrera and Bona, 2018; Kulfas, 2014; Manzanelli and Basualdo, 2016). This period also witnessed a declining trend in the real exchange rate. As indicated in Figure I, this trend can be attributed to the phenomenon wherein the increments in the inflationary level exceeded those in the nominal exchange rate (see Figure I). Multiple factors were proposed to explain the inflation surge, including rises in the nominal exchange rate, income distribution struggles (Zack, Montané, and Kulfas, 2018; Montes-Rojas and Toledo, 2022), and commodity prices, particularly between 2003 and 2008 (Trajtenberg, Valdecantos, and Vega, 2015). To mitigate inflation, during her administration, Cristina Fernández introduced several controls and interventions in the exchange rate market

<sup>5</sup> The inflation level reflects variations in the Consumer Price Index, while the growth of the nominal exchange rate stands for the growth of the exchange rate between the Argentinian peso and the American dollar. The Commodity Export Price Index reflects the prices of the commodities exported by Argentina, weighted by their share in total exports. The real exchange rate represents the actual exchange rate between Argentina and the United States.

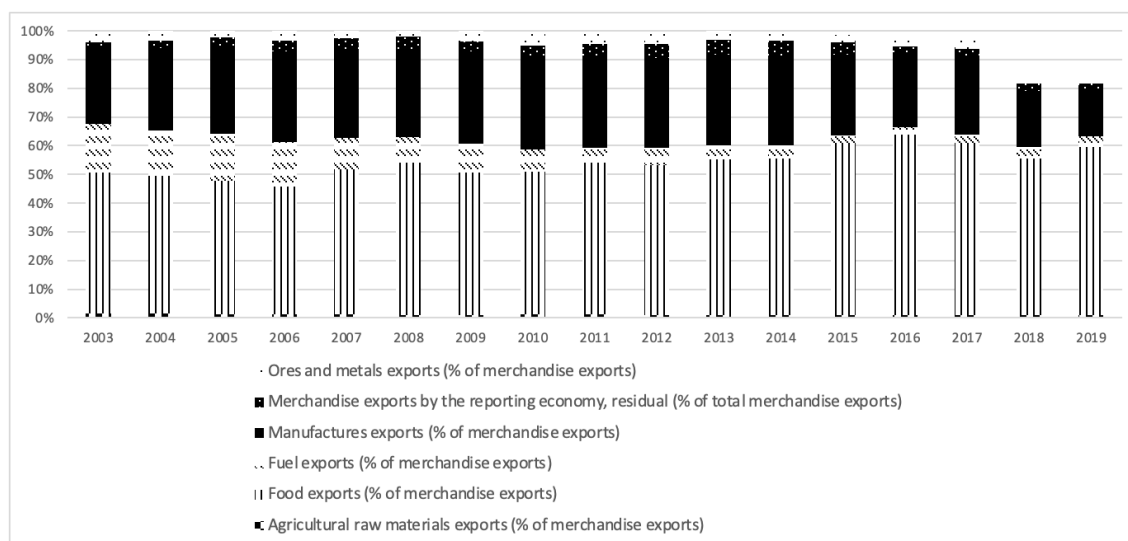
<sup>6</sup> BCRA is the abbreviation in Spanish for the Central Bank of the Argentinian Republic.

(David, 2019), which resulted in partial success (Manzanelli and Basualdo, 2016; Barrera and Bona, 2018).

Subsequently, the Mauricio Macri administration (2016-2019) confronted a decrease in commodity prices and considerable inflation (see Figure I). In contrast to preceding administrations, Mauricio Macri's economic policy focused on interest rate hikes, operating within an inflation-targeting regime (David, 2019). Furthermore, the administration liberalized the foreign exchange market and capital accounts, reduced taxes on exporters, and raised regulated prices for essential services like electricity (Barrera and Bona, 2018). These initiatives failed to mitigate inflation, exacerbating it instead (see Figure I). Moreover, these policies facilitated the formation of a 'carry trade system' which proved unsustainable, increasing pressure on the nominal exchange rate due to capital outflows (Barrera and Bona, 2018). Consequently, a substantial rise in the nominal exchange rate transpired, surpassing inflation, and resulting in a RER rebound in 2018.

Regarding the evolution of exports during the CPB (2003-2014), despite RER declines over these years, the share of exports in total GDP surged remarkably from levels observed during the currency board era, advancing from an average of 29% to an average of 37% (INDEC, 2023). Regarding export primarization, during the CBP, the share of food in total merchandise exports increased by 3% (see Figure II). Additionally, the share of ores and metals expanded by 1%. However, the share of manufactures in merchandise exports also expanded by 4% during the CPB period, nonetheless, a higher decline was observed during the following period explained mainly due to commercial liberalization policies that harmed the export competitiveness of the sector. The increase during the CBP is mainly attributed to a substantial decrease in the share of fuel exports. This indicates that the ND prediction of a primarization process due to reduced manufacturing exports does not clearly apply to the case of Argentina. Subsequent regressions in the following section aim to shed light on this matter.

Figure II: shares of merchandise exports by sector, Argentina, 2003-2019



Source: World Development Indicators, World Bank (2023).

Note: According to the World Bank, merchandise export distribution might not total 100 percent due to trade categorization discrepancies.

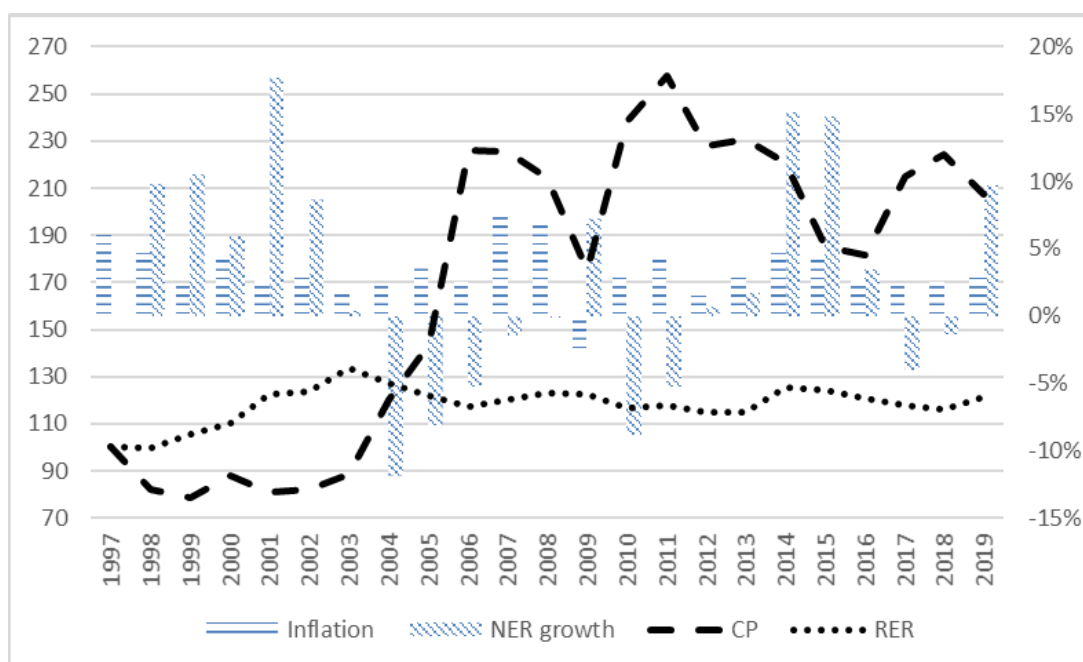
In contrast, the Chilean economy pursued a distinct trajectory in terms of economic policy and performance. The culmination of the military dictatorship in 1990 stated a new phase in social policy development, but not in the transformation of the economic structure. Throughout the military dictatorship, a neoliberal economic regime was enacted, characterized by the implementation of trade liberalization, privatization of strategically held state-owned entities, and the introduction of labor market flexibilization (Ostry *et al.*, 2016). Successive governments maintained the most distinctive elements of this neoliberal approach under the slogan of 'a change in continuity,' with notable short-term macroeconomic results including economic growth, a reduction in inequality, and poverty diminution (Ffrench-Davis, 2003). However, these successes were constrained in the long term, especially after the CPB, in terms of productivity (Palma, 2018). The monetary policy primarily aimed to manage inflation through an inflation targeting regime. Regarding fiscal policies, the Central Government Structural Balance Policy, introduced in 2003, aimed to establish long-term fiscal equilibrium on the public budget (Rodríguez *et al.*, 2015). Simultaneously, mechanisms were introduced to mitigate volatility arising from copper prices, such as the Copper Compensation Funds (replaced by the Fund of Economic and Social Stability in 2006), and the Fiscal Accountability Law, designed to encourage countercyclical public spending (Marcel, 2013).

In terms of trade policy, the importance of the external sector continued to expand, with total trade as a share of GDP increasing from 54.1% in 1997 to 65.7% at the beginning of the CPB (World Bank, 2023). Furthermore, the trade opening strategy was consolidated by the signing of Free Trade Agreements with the European Union (2002), the United States (2003), South Korea (2003), and China (2006), forming a cornerstone of the Chilean strategy of openness (Fuentes, 2006). Despite the benefits of these agreements, Chilean primary exports remained centered around copper. Consequently, the price of this

mineral emerged as a central indicator for the economy of Chile, influencing both public finances and real exchange rate dynamics (Calderon, 2004). Therefore, it becomes essential to examine how currency appreciation affects the local economy.

Figure III shows the evolution of CP, NER growth, and inflation rate, providing a window into the determination of the RER during the CPB. Notably, the NER demonstrates an inverse correlation with commodity prices, witnessing significant growth during periods of declining commodity prices and conversely. Although the Central Bank of Chile adopted a free-floating exchange rate regime in 1999, selective interventions in the exchange rate market were undertaken intermittently. These interventions, combined with consistently low inflation rates<sup>7</sup>, likely contributed to the relatively low exchange rate volatility witnessed during the CPB (Álvarez Espinoza and Hansen, 2017; Pérez and Vernengo, 2020).

Figure III: Real exchange rate and its components, Chile, 1997-2019



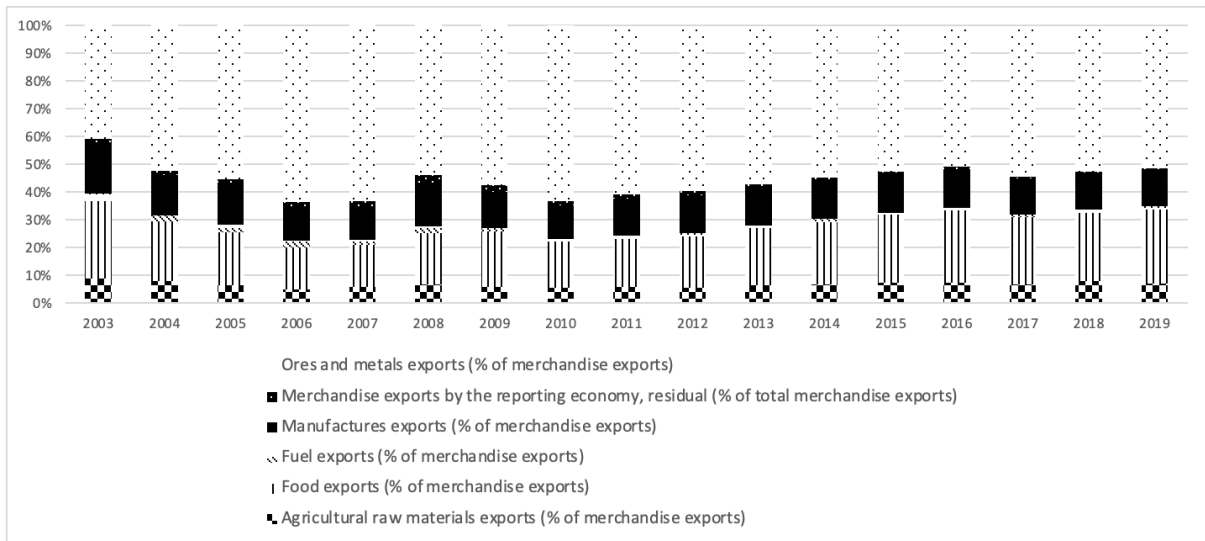
Source: own elaboration based on data from Central Bank of Chile (2023) and IMF (2023).

The composition of merchandise exports during the CPB period is depicted in Figure IV. Initially, the share of ores and metals exports began to rise from 41% in 2003, peaking at 64.3% in 2007. Following the 2008 financial crisis, the average share of ores and metals exported between 2009 and 2019 was 55.7%, reflecting a noteworthy rise in the share of the export portfolio. Conversely, the contribution of manufactured goods witnessed a less dramatic but persistent decline. After the financial crisis, the share of manufactured goods in merchandise exports fluctuated between 12% and 14%. Notably, the manufacturing exports comprised a relatively lower technological content. Between 2009 and 2014,

<sup>7</sup> There are various interpretations that would explain a low inflation rate. For instance, some authors (Montes-Rojas & Toledo, 2022) argue that inflation is a consequence of distributive struggles between capital and labor. Therefore, it could be plausible to interpret the low inflation in the Chilean context as a result of a labor market characterized by low unionization rates and flexible labor policies.

medium and high content manufacturing constituted an average of 12.2% of total manufacturing exports.

Figure IV: shares of merchandise exports by sector, Chile, 2003-2019.



Source: World Development Indicators, World Bank (2023).

Note: According to the World Bank, merchandise export distribution might not total 100 percent due to trade categorization discrepancies.

From this context, two principal divergences between the two countries can be pointed out. Firstly, as detailed in Table I, both nations encountered increasing commodity prices. However, Argentina experienced a markedly pronounced real exchange rate appreciation in contrast to Chile. This disparity can be attributed to differences in the origination of this phenomenon. In Argentina, the nominal exchange rate registered an average increase of 9% during the CPB, while inflation surged by an average of 20%. In contrast, Chile's RER appreciation resulted from a nominal exchange rate decrease of 1%, coupled with a modest inflation increase of 3%.

Table I: Average growth of real exchange rate and its determinants during the CPB (2003-2014).

	<b>RER Average Growth</b>	<b>NER Average Growth</b>	<b>Average Inflation</b>
<b>Chile</b>	-0,5%	-1%	3%
<b>Argentina</b>	-7%	9%	20%

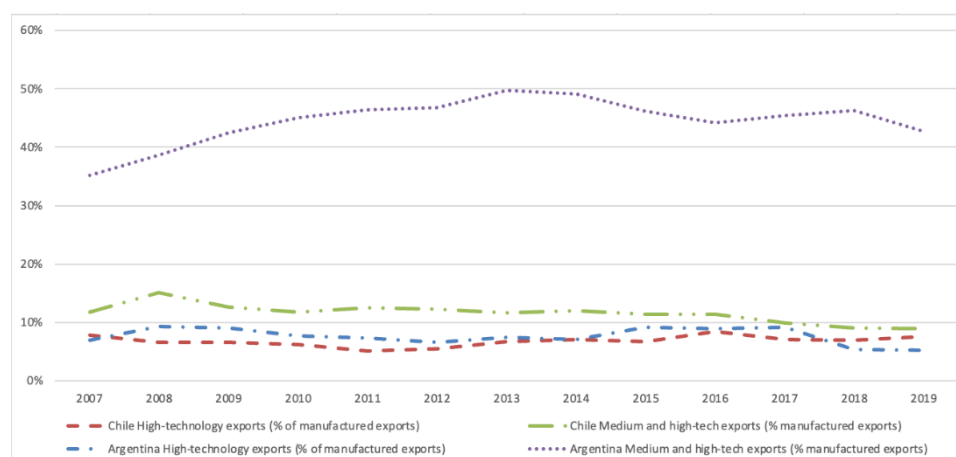
Source: INDEC (2023) and Central Bank of Chile (2023).

Secondly, the impact on the manufacturing sector's share exhibited more prominence in Chile compared to Argentina. While Argentina witnessed a rise in manufacturing share, Chile's economy witnessed a pronounced primarization of exports, in line with the DD hypothesis. However, a relevant distinction has to be incorporated regarding primarization. A higher share of exports indicates a greater relative participation of the primary sector compared to the manufacturing sector. However, this does not necessarily represent a setback for the sector as long as its exports have not been adversely affected in terms of quantity. To study the effect on the export competitiveness of the manufacturing sector, the empirical strategy will identify the index of the exported quantity of the manufacturing sector in order to assess its participation in levels rather than in portions.

Furthermore, another notable difference between both countries is the disparities in technology incorporation and natural resource intensity distinguish the activities within the manufacturing sectors. As indicated in Table II, high-tech exports show a similar composition in both countries. However, a notable divergence emerges in the significance of medium-tech products within manufacturing exports. In Argentina, 46.6% of manufacturing exports correspond to medium and high-tech exports, whereas in Chile this remains at 12.2% between 2009 and 2014.



Figure V: technological content of manufacture exports (2007-2019)



Source: World Development Indicator, World Bank (2023).

Table II: Most exported manufacture products, Argentina, and Chile, 2019.

Argentina		Chile	
Products	Share of manufacture export	Products	Share of manufacture export
Soy flour	25%	Wood pulp, cellulose, and paper remnants	16.1%
Soy oil	17.6%	Wood, wooden articles, and charcoal	14.2%
Delivery trucks	11.1%	Inorganic chemicals	12.6%
Cars	4.8%	Beverages, spirits, and vinegar	11.4%
Industrial fatty acids, oils, and Alcohols	4.3%	Preparations of vegetables, fruits, nuts, or other plant parts	4.2%

Source: OEC (2023).

Table II provides a more detailed view of the most exported manufactured products and their relative importance within this group. In both cases, the primary sector plays a significant role in defining the exported manufactured products. While in Argentina, products derived from agro-industry, particularly soy-based products, stand out, in Chile, the forestry and agricultural sectors have a prominent role. The main difference between these primary products, reflecting the previous figure XX, is that in Chile's leading manufactured exports, there isn't a notable participation from technologically more advanced sectors or those with higher technological requirements. This stands in contrast to Argentina, where the export of delivery trucks and automobiles represents 11.1% and 4.8% respectively, of the total manufacturing exports, highlighting a significant technological aspect.

## Methodology and Data

In this section, we conduct an econometric analysis to examine the presence of the DD phenomenon in the exports of Chile and Argentina. This analysis is performed through the estimation of two VAR models. VAR models involve estimating Ordinary Least Squares (OLS) regressions as endogenous variables included in the model (Stock and Watson, 2008). The estimated equation can be represented as follows:

$$y_t = v + \sum_{i=1}^p A_i y_{t-i} + u_t$$

Where  $y_t$  represents the vector of the variables included in the model,  $v$  is the vector of constants,  $A_i$  stands for the coefficient matrix and, finally,  $u_t$  expresses the error term.

This methodology was selected since, unlike structural VAR and traditional OLS estimations, this methodology allows for analysis without the need to predefine the structure of the model (Zack *et al.*, 2018). Moreover, VAR models were employed instead of vector error correction models due to the results of the stationarity tests for the case of Chile. Particularly, VEC models require all variables to be integrated in the same order, something that was not possible to determine for this country. In this sense, it was decided to continue with the VAR model to be able to perform a comparable analysis.

The primary goal of our empirical approach is to assess the impact of the real exchange rate on the performance of the export manufacturing sectors. According to the ND approach, it is anticipated that the real exchange rate would have a positive effect on this tradable sector (Bresser-Pereira, 2008; 2013). To explore this relation, the multilateral real exchange rate is used, following the existing empirical literature (Cuevas-Ahumada and Bernat, 2015; Zack and Dalle, 2015; Palazzo and Rapetti, 2023). Furthermore, manufacturing performance will be measured using the index of industrial export quantities for both Chile and Argentina. This variable is chosen over export share, as it provides insight into the sector's competitiveness by revealing the absolute value of its export capacity. Notably, the index of export quantities is not influenced—by design—by primary exports, making it a suitable choice.

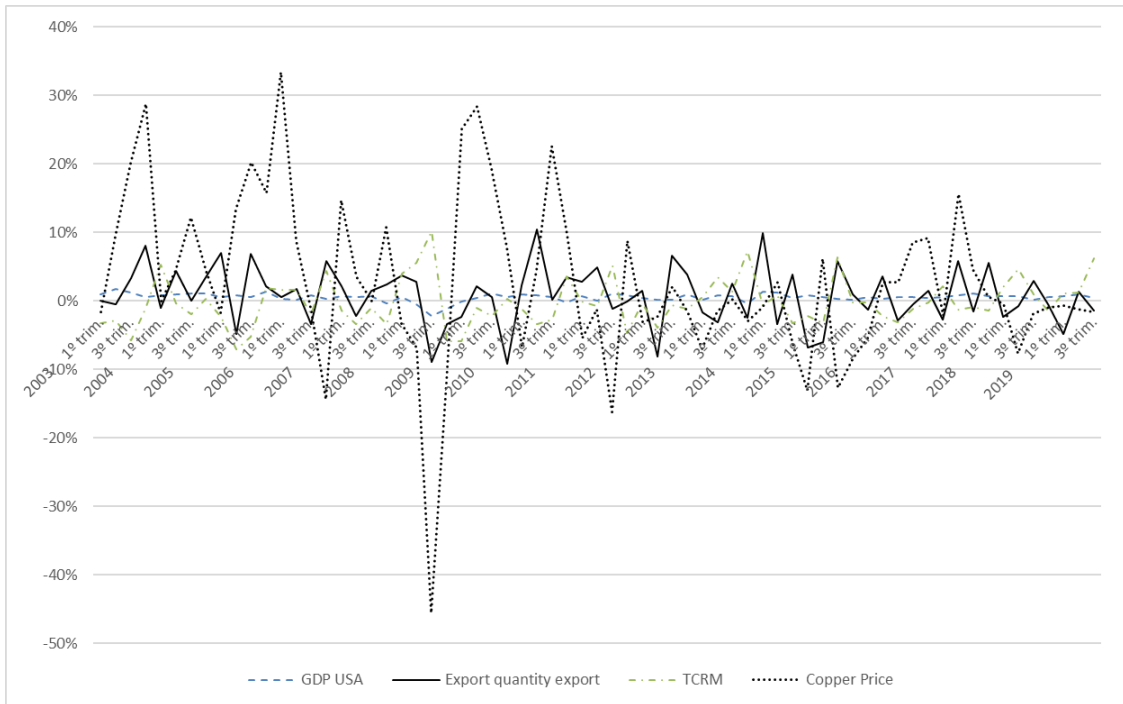
The model also incorporates several control variables. Particularly, the GDP of the main trade partners for Argentina and Chile, specifically Brazil and the US respectively, has been chosen<sup>8</sup>. Additionally, in line with the ND approach, commodity prices are included since this variable is expected to have a positive impact on the real exchange rate. In the case of Chile, For the case of Chile, the price of copper was chosen based on prior empirical studies (Medina, 2018; Marañón and Kumral, 2021). For Argentina, an index issued by the Argentine Central Bank was used, which considers the price of each commodity based on its share in total exports. Furthermore, a dummy variable accounting for the potential impact of the 2009 global financial crisis on the model was incorporated. Table III provides a summary of the included variables, and Figures V and VI depict the growth rates of the selected variables.

<sup>8</sup> As Dvoskin and Feldman (2018) states, despite the role of RER on explaining export, one of the main determinants of this variable is foreign demand.

Table III: Variable description

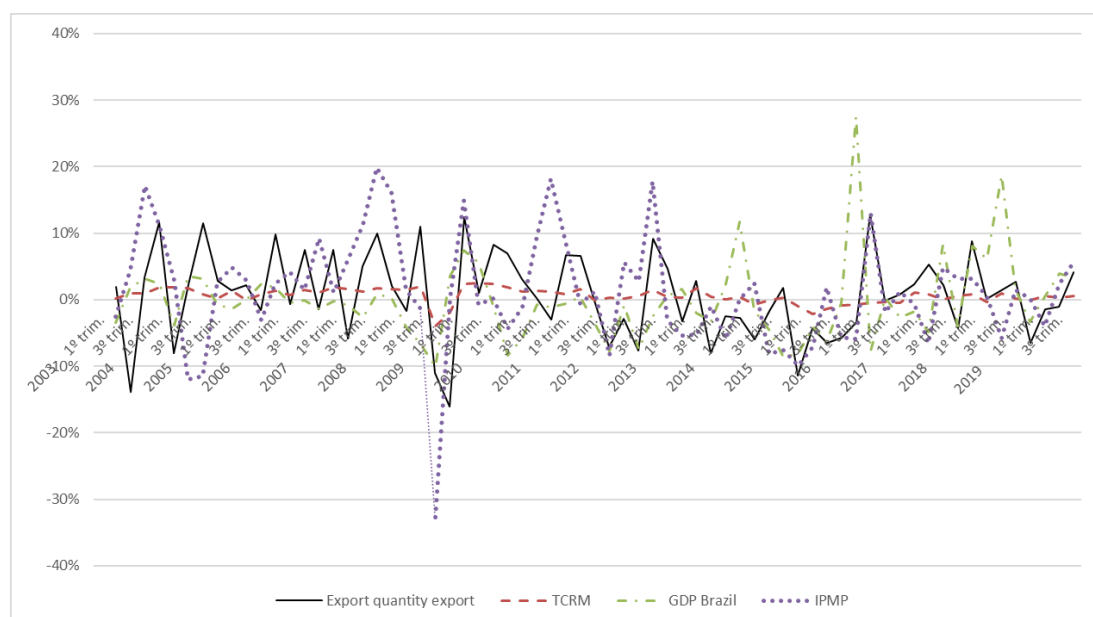
Variable	Label	Country	Frequency	Period	Source
Quantity of industrial exports	QIEXP	Argentina	Quarter	2003-2019	INDEC
		Chile			Central Bank of Chile
Multilateral Real Exchange Rate	MRER	Argentina	Quarter	2003-2019	Central Bank of the Argentinian Republic
		Chile			Central Bank of Chile
Cooper Price	CP	Chile	Quarter	2003-2019	Central Bank of Chile
Raw Material Price Index	RMPI	Argentina	Quarter	2003-2019	Central Bank of the Argentinian Republic
GDP of USA	USA	Chile	Quarter	2003-2019	OECD Statistics
GDP of Brazil	BRAZIL	Argentina	Quarter	2003-2019	OECD Statistics

Figure VI: rate of growth of the variables included in the VAR model, Chile, (2003-2019)



Source: Central Bank of Chile (2023) and OECD Statistics (2023).

Figure VII: rate of growth of the variables included in the VAR model, Argentina, (2003-2019)



Source: INDEC (2023), Central Bank of Argentina (2023) and OECD Statistics (2023)

The interpretation of both regressions employs impulse response functions (IRFs) and forecasting error variance decomposition (FEVD) analyses. Additionally, the Granger-causality test (Granger, 1969) was performed to enhance the robustness of the chosen model. Regarding the IRFs, establishing an exogeneity order among the variables is essential. Since commodity prices are determined internationally, mainly influenced by demand from China (Jenkins, 2011; Gallagher, 2016), and other variables within the regressions are unlikely to influence their determination, this variable was included in the model as completely exogenous. As a result, commodity prices are included as regressors in each OLS regression, but they are not considered dependent variables. Consequently, the most exogenous, but still endogenous variable, was defined as the main trade partner demand since they are less probable affected by the multilateral exchange rate and they should affect industrial. Finally, in line with the ND approach, the multilateral exchange rate should affect industrial exports. Therefore, the former variable holds the second position in the Cholesky decomposition, while the latter variable occupies the final position.

This paper contributes to the empirical literature on DD. In the case of Chile, to the best of our knowledge, there are no prior studies assessing the existence of DD and its effects on exports for the country. In the case of Argentina, certain similarities emerge. Firstly, Cuevas - Ahumada (2011) conducts a comparative analysis between Argentina and Mexico, employing a VAR regression for Argentina that resembles to the one performed in the present article. In addition to using more recent data, our work for Argentina includes the effect of commodity prices in the regression. Moreover, Dale and Zack (2015) make a significant contribution by estimating a VECM to estimate the elasticity of exports for different variables, including the RER. Besides using different

methodologies, this present paper focuses on the specific impact of RER on industrial exports instead of total exports, providing a closer insight into the effect of the DD. Finally, a recent and significant contribution has been made by Palazzo and Rapetti (2023) analyzing the RER's effect on exports, dissecting it by export technological content. This methodology offers exceptional insights into the unique characteristics of each sector. As the objective of the present paper was to shed light on the effect of the DD on the share of manufactured goods in total exports, it was preferred to employ a higher degree of aggregation.

## Results

### *Argentina*

The variables included in the VAR model should exhibit stationarity. Therefore, the Augmented Dickey Fuller (ADF) test<sup>9</sup> was applied to verify this assumption. As shown in Table IV, all variables are integrated of order one according to this test. As a result, all variables were employed in the regression as logarithmic first differences. Additionally, four lags were incorporated, achieving no discernible autocorrelation or heteroskedasticity.

Table IV: ADF results for the variables included in the regression of Argentina.

Variable	Level		Logarithm		FLD	
	t-statistic	p-value	t-statistic	p-value	t-statistic	p-value
<b>QIEXP</b>	-1.8186	0.3686	-1.8727	0.3430	-8.3356*	0.0000
<b>MRER</b>	-1.1669	0.6840	-1.2380	0.6532	-6.8992 *	0.0000
<b>BRAZIL</b>	-2.198	0.2090	-2.5655	0.1053	-4.8809 *	0.0002
<b>RMPI</b>	-2.3861	0.1495	-2.5639	0.1056	-6.0285*	0.0000

Regarding IRFs of the VAR model for Argentina, Figure VII indicates that the MRER has no discernible effect on QIEXP. Moreover, Brazil's economic growth rate exhibits a notably positive impact on QIEXP in the initial two periods and a negative impact in the fifth period (refer to Figure VIII). Subsequently, Figure IX presents the FEVD. These results suggest that the forecasting variance of QIEXP is predominantly explained by values of the same variable. Specifically, during most periods, this lag accounts for 63% of the forecasting variance. Furthermore, Brazil's GDP growth explains between 22% and 29% of the FEVD, whereas the MRER only accounts for 1% to 5%. Consequently, aligning with the IRF results, Brazil's GDP growth emerges as a more influential variable than the MRER in elucidating Argentina's industrial exports.

Lastly, following the logic of the preceding results, the Granger-causality test reveals that BRAZIL is the only variable that Granger-causes QIEXP. To conclude, there is no substantial evidence of an MRER effect on QIEXP, while there exists compelling evidence supporting the substantial role of trade partners in expounding this variable.

<sup>9</sup> The test was performed including trend and constant and excluding the trend, finding the same results. The results shown in table IV are the one of the ADF excluding trend

Figure VIII: response of QIEXP to a shock in MRER

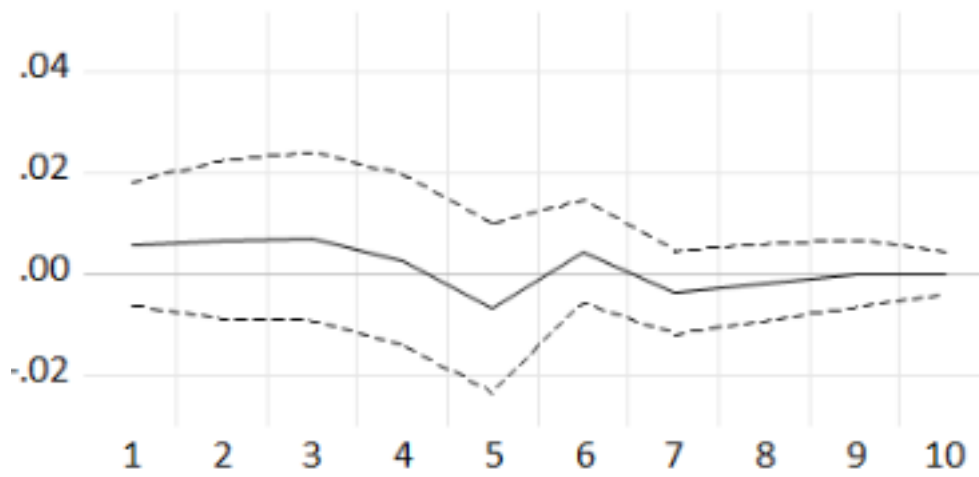


Figure IX: response of QIEXP to a shock in Brazil

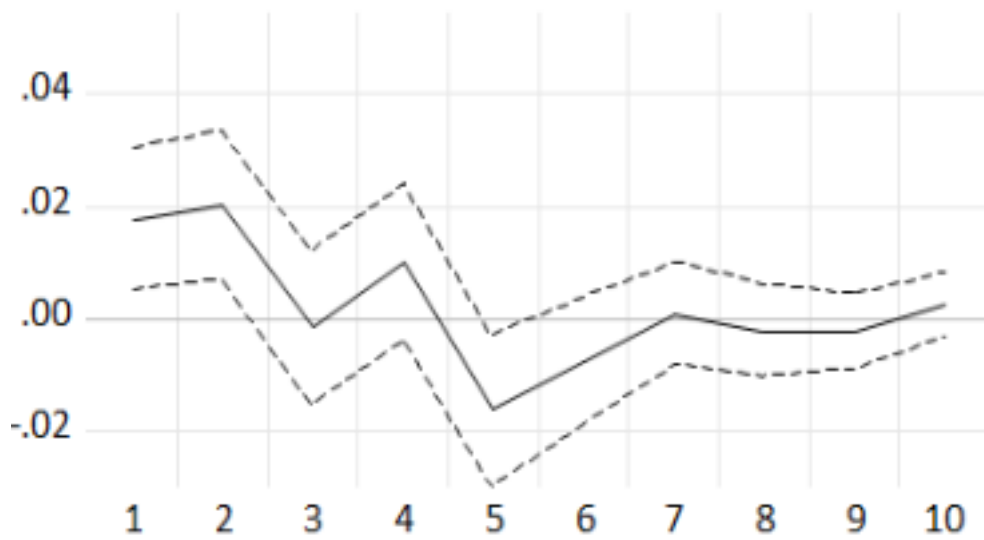
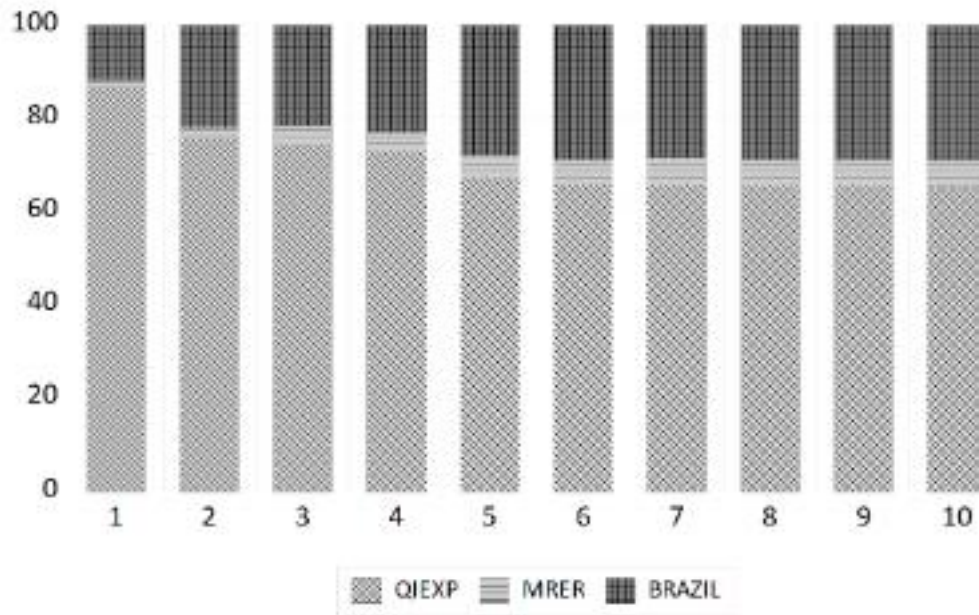


Figure X: forecasting error variance decomposition of QIEXP



### Chile

Regarding Chile's regression, the results of the ADF tests are presented in Table V. It can be observed that all variables are integrated of order one, except for MRER, which has an integration order of zero<sup>10</sup>. Consequently, all variables are incorporated into the model in terms of growth rates. Furthermore, the model was estimated using four lags, successfully achieving no autocorrelation and homoscedasticity.

Table V: ADF results for the variables included in the regression of Chile.

Variable	Level		Logarithm		FLD	
	t-statistic	p-value	t-statistic	p-value	t-statistic	p-value
<b>QIEXP</b>	-2.4915	0.9060	-2.7509	0.3430	-9.6238	0.0000*
<b>MRER</b>	-3.3690	0.0156*	-3.1486	0.0277*	-6.1793	0.0000*
<b>USA</b>	0.1355	0.9662	-0.4652	0.8907	-5.0844	0.0001*
<b>CP</b>	-2.8950	0.5078	-3.5708	0.0090*	-5.5768	0.0000*

Illustrated in Figure X, the USA exhibits a positive effect in the first period and approaches having an impact in the fifth period on QIEXP. As for the impact of a shock

<sup>10</sup> All variables were tested including intercept with and without trend finding the same results. The only exception is MRER which was found I (1) when the trend was included. Moreover, the Phillips-Perron stationarity test was applied to this variable to clarify these results, finding the same results as the ones found with the ADF test. Consequently, since it is necessary to ensure stationarity in the Variables included in the VAR model and it was not possible to define if this variable is I (0) or I (1) it was decided to include this variable in its first logarithmic difference to ensure stationarity. Moreover, the VAR was estimated using this variable in levels, finding similar results.

on MRER, no significant effect is observed between this variable and QIEXP (refer to Figure XI). However, there is a tendency for a significant effect on QIEXP in the second period. Regarding the FEVD, as can be observed in Figure XII, MRER explains a marginal portion of QIEXP's variance in the first period, but subsequently accounts for approximately 13.6% of the total variance. In contrast, the USA's GDP growth rate explains about 14% of the variance in industrial exports. Consequently, both the USA and MRER elucidate a similar proportion of the FEVD.

Lastly, the Granger causality test indicates that the USA Granger-causes both MRER and QIEXP, while MRER does not Granger causes the other two variables.

Figure XI: response of QIPEXP to a shock in the USA

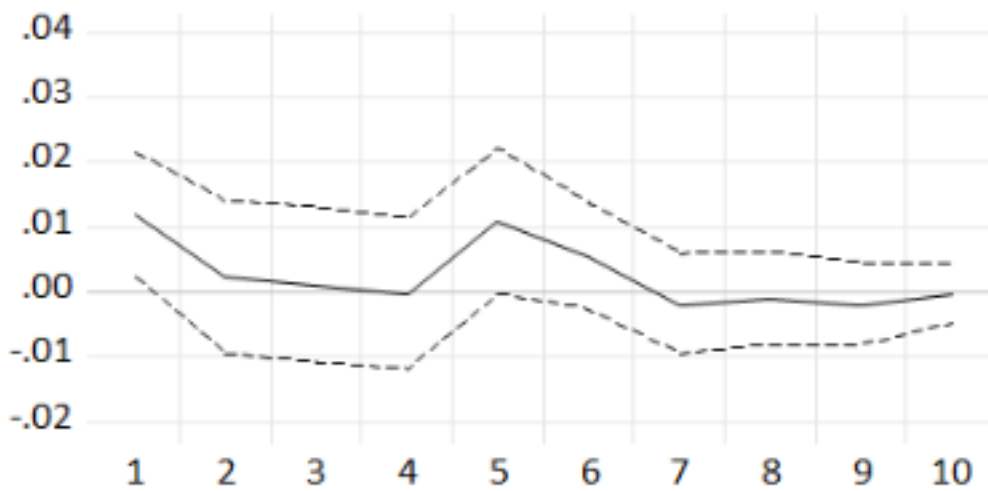


Figure XII: response of QIPEXP to a shock in MRER

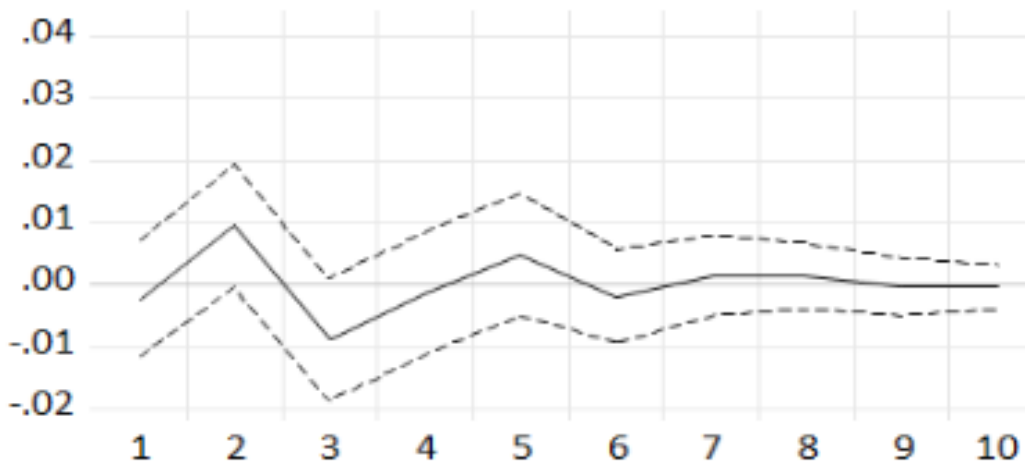
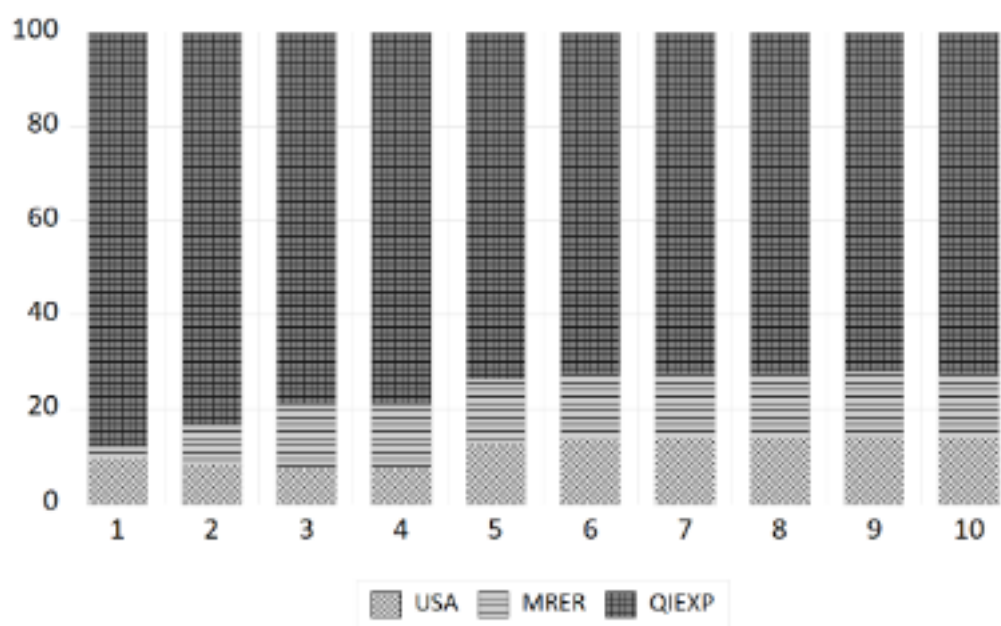




Figure XIII: forecasting error variance decomposition of QIEXP



### *Comparative Analysis*

The obtained results reveal different evidence for each country. In the attempt to discern the presence of DD based on the impact of the RER on the quantity index of manufacturing exports, the VAR estimation results indicate that there was no DD in Argentina during the considered period. Conversely, in the case of Chile, it is not straightforward to dismiss the possibility.

The main results of the estimation demonstrate that, first, while both countries' multilateral exchange rates show an insignificant effect on the quantity of manufactured exports, in the case of Chile, the IRF reflecting this relationship is nearly significant. Second, in both instances, the growth of the trade partner exhibits a noteworthy effect, in line with the literature's expectations (Dvoskin and Feldman, 2018). Third, in the case of Argentina, the FEVD illustrates a pronounced explanatory effect from the trade partner compared to the RER, while the effect is narrow for the Chilean scenario. Finally, concerning the Granger causality analysis, neither country provides evidence that the Real Exchange Rate Granger-causes the quantity of industrial exports; instead, this holds true for the rate of economic growth of both Chile's and Argentina's trade partners. Derived from these results, while the evidence in Chile regarding the DD effect on industrial exports is not conclusive, for Argentina, there is much stronger evidence suggesting the absence of DD during the CPB.

The results derived from the econometric estimation need interpretation within the specific macroeconomic context of each country. Among the various distinctions between the two countries, it has become significant to take into account that Argentina underwent a more substantial reduction in the RER than Chile. Nevertheless, contrary to the proposals of the DD approach, there is more evidence to suggest the presence of DD in Chile than in Argentina.

Within the framework of the economic structure and macroeconomic policies of each country, it becomes intriguing to examine this evidence considering current macroeconomic trends. In the case of Chile, potential signs of DD align with an increased dependence on primary goods in the country's export composition. This collectively could partially elucidate present production trends. Specifically, after the CBP, the Chilean economy experienced an economic slowdown in GDP growth and productivity stagnation (CNEP, 2016; Ordoñez and Silva Neira, 2019). While a prevalent explanation for this stagnation focuses on reduced demand from China, which significantly impacted commodity prices and consequently economic growth (Bing et al., 2019), a structuralist perspective underscores the lack of export dynamism (Ffrench-Davis, 2017; Palma, 2018; Ordoñez and Silva Neira, 2019). This aligns with the presence of DD constraining manufacturing export capacity. As a result, the once-acclaimed neoliberal policies of the 1990s are now under scrutiny due to their underwhelming long-term performance (Palma, 2018).

In the case of Argentina, this present paper contributes to previous empirical research on DD. In particular, it stands as the only econometric analysis that controls for commodity prices. This addition allowed interesting results, however, it did not alter the primary contribution found in analogous studies, such as Cuevas-Ahumada (2011), who discovered that the RER lacks an effect on manufactured exports. Additionally, the inclusion of this export disaggregation level falls between the other two studies related to this paper: Zack and Dalle (2015) and Palazzo and Rapetti (2023). The former paper assessed the role of the RER in total exports, finding only a minor significant effect. The latter paper concluded that solely exports with low technological content are prone to a low elasticity concerning the RER. This is attributed to the extensive presence of homogeneous products in Argentina's exports. This present paper contributes by revealing that manufactured exports, which mainly exhibit a medium technological content, remain minimally impacted by the RER.

The previous considerations may be useful to understand the different results found between Argentina and Chile. Particularly, the technological composition of manufacturing exports in both countries might be an element of interest. In Argentina, approximately half of the manufacturing exports possessed a medium or high technological content, whereas, in the case of Chile, only 12.2% fell within this category (Table II). Consequently, the technological composition of the industry could become a central factor in explaining the presence of DD, particularly when assessing the industry's vulnerability to RER changes. Although literature offers mixed opinions on the effect of price competition on exports (McCombie, 2011; Palazzo and Rapetti, 2023), this research might provide evidence favoring the claim that exports with a higher technological composition are less affected by RER appreciations. Nevertheless, delving deeper into this topic remains essential to better grasp manufacturing competitiveness dynamics within the international scenario. Consequently, this insight could provide direction for economic policies regarding the interaction between industrial and exchange rate policies.

This field of study entails vital policy discussions for nations heavily dependent on commodity exports. While the ND framework promotes export taxes to address market failures (Bresser-Pereira, 2013), a more suitable approach may concentrate on industrial policies promoting structural changes and shifts in export composition. This contrasts

with currency depreciations, which, as Dvoskin and Feldman (2018) pointed out, could result in inflationary spirals, and declines in real wages.

## **Conclusion**

The present paper aims to empirically assess whether the Dutch Disease framework can offer a suitable explanation for the manufacturing export performance in the cases of Argentina and Chile during the CPB. This effect, pointed out by the ND approach as one of the main constraints on economic development, is based on the idea that foreign exchange inflows resulting from primary activities lead to RER appreciation, harming manufactured exports. To evaluate the validity of this relationship, two VAR regressions were conducted. The results indicate that the expected negative relationship between RER appreciation and manufactured exports cannot be observed in the case of Argentina. However, in the case of Chile, the results are not conclusive.

Two relevant elements emerge from the study of this phenomenon, constituting the primary contributions of this work. First, this paper adds to the empirical literature in this field of research. In the case of Chile, previous studies have focused on the effects of copper prices on manufacturing and GDP, without delving into the export basket. Concerning the evidence recovered for Argentina, this research contributes to previous work by concentrating on the impact on manufacturing exports rather than total exports and by controlling for the effects of commodity prices. Additionally, to the best of our knowledge, this marks the first comparative study between Argentina and Chile in this context.

The second contribution of this paper is the discussion concerning export composition and subsequent policy implications. Delving into understanding the heterogeneity of manufacturing exports, is crucial for comprehending the vulnerability in the competitiveness of industries and, concurrently, fostering a policy debate that places the productive structure at the core. In the case of Chile, a dependence on the mineral and metal sector (particularly copper), exacerbated during periods of elevated commodity prices, may shed light on the reasons behind the recent debate concerning low export dynamism and stagnant productivity. Consequently, it may become imperative to deliberate on industrial policies that promote a production structure with reduced reliance on natural resources and fortify the manufacturing sector with higher technological content.

Certain limitations can be inferred from our study. First, our focus is on overall manufacturing exports, thus we have not empirically considered the intricacies of each individual industry. Moreover, our model is confined to assessing short-term relationships. Future lines of investigation could encompass sectoral analysis and long-term assessments, while also incorporating the role of heterogeneity within the manufacturing sector.

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