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Document de Travail n° 2025 –02

Janvier 2025

Bureau d'Économie
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The industrial cost of fixed exchange rate regimes *

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Abstract

Premature deindustrialization in most emerging and developing economies is one of the most striking stylized facts of the recent decades. In this paper, we provide solid empirical evidence supporting that the choice of a fixed exchange rate regime accelerates this phenomenon. Relying on a panel of 146 developed, emerging, and developing countries over the 1974-2019 period, we show that fixed exchange rate regimes have had a negative, significant, and robust effect on the size of the manufacturing sector—developing countries being the most affected by the industrial cost of such a regime. Additional gravity model regressions show that the impact of fixed regimes passes through the trade channel. In particular, this regime has kept countries with low relative productivity in a state of structural dependence on imports of manufactured products to the detriment of the emergence of a strong local manufacturing sector.

JEL Classification: E42; F43; F45; F6; O14.

Keywords: Exchange rate regimes; (De)industrialization; Manufacturing; Developing countries; Emerging economies.

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1 Introduction

Industrialization patterns around the world have recently attracted renewed interest in both policy and academic circles. A typical illustration is the success stories of a number of Asian economies, namely China, Korea, and Taiwan, catching up with high-income countries within a few decades and —likely— set to dominate the next industrial and digital revolution. Highlighting the limits of unbridled globalization, the COVID-19 pandemic was a tipping point that gave rise to the urgency of strategic autonomy in industrial matters, particularly in advanced economies. This need for industrial rearmament has been reinforced by the emergence and amplification of geopolitical tensions and fragmentations, although it clashes with ecological considerations. Furthermore, whereas sustainability constraints remain crucial in the developing world, the Asian examples of industry-led economic development are regarded —more than ever— as the way forward. Falling into this context, our paper tackles the issue of industrialization through the lens of the choice of the exchange rate regime —a link that has not been investigated so far in the literature.

The benefits to economic growth and development provided by the industrial sector —especially manufacturing— are considerable, as evidenced by the pioneering contributions of Hirschman (1958), Kaldor (1963, 1966, 1967), and Kuznets (1971). Several recent contributions also point in the same direction, highlighting the central role of industrialization. Analyzing the relationships between structural characteristics and the ability to sustain growth for a large panel of countries over the 1960-2010 period, Foster-McGregor et al. (2015) find that sustained growth episodes are closely linked to higher shares of manufacturing, the latter also contributing to a more diversified structure of production. Berg et al. (2012) reach the same conclusion, emphasizing the important role of manufacturing exports in the sustainability of economic growth. Benefits from industrialization operate through different channels. The manufacturing sector has generally been the primary source of innovation, technology upgrades, and productivity gains, with strong positive spillover effects on the other sectors (Lall, 2005; Hauge and Chang, 2019; Mo et al., 2021). Additionally, manufacturing is associated with greater macroeconomic stability thanks to its employment-friendly characteristics —and therefore demand stimulus— and by cushioning terms-of-trade shocks —since prices of manufactured goods are less volatile than those of commodities. The benefits of industrialization in terms of sustainable development goals, including reducing poverty and inequality, have also been highlighted by international institutions (United Nations Industrial Development Organization, 2020).

Despite the promises, very few countries in the developing world have succeeded in increasing the contribution of the manufacturing sector to the economy. The failure to industrialize, however, cannot be attributed to a lack of political commitments. Indeed, a plethora of initiatives/programs have been undertaken, leading to various models of industrialization, from the original and active import substitution industrialization (ISI) to more adaptative strategies under the structural adjustment programs or, more generally, under the Washington Consensus era (Hirschman, 1968; Soludo, 1998; Irwin, 2021). Quite the contrary, a large number of studies has provided evidence of "premature deindustrialization" in emerging and developing countries, i.e., a declining share of manufacturing occurring at a lower stage of development (Dasgupta and Singh, 2007; Rodrik, 2016; Özçelik and Özmen, 2023). While deindustrialization per se can be seen as a natural process —manufacturing rises at the earlier stages of development and falls at later stages to the profit of services, hence describing an inverted U-shaped curve—, its earliness compared to past experiences of the advanced economies is worrisome.[1] As noted by Rodrik (2016), beyond the purely descriptive aspect, "t*urning into service economies without having gone through a proper experience of industrialization*" may significantly halt the growth momentum by depriving countries of the main channel(s) through which rapid growth has taken place in the past. Rekha and Babu (2022) confirm this view by showing that premature deindustrialization significantly raises the likelihood of growth slowdowns.

Deindustrialization patterns, whether premature or reflecting the failures of industrialization programs, have received some attention. Among the factors identified in the literature, the quality of governance and institutions appears central not only in the definition of industrial policies and to avoiding government failures, but also in countering market failures —either coordination or information externalities (Acemoglu and Verdier, 2000; Rodrik, 2004, 2008a; Mijiyama, 2017). Another strand of this literature attributes the bulk of the causes to more structural reasons, in particular comparative advantages (Chenery, 1960; Lin and Chang, 2009), highlighting a Dutch disease effect for most developing countries (Sachs and Warner, 1999; Sala-i-Martin and Subramanian, 2013; Dauvin and Guerreiro, 2017). Globalization and, more specifically, the accompanying waves of trade reforms and structural adjustment programs —under the auspices of international organizations— are also often evoked as the main reasons behind the failure of industrialization in developing economies (Lall, 1995; Rodrik, 2016; Irwin, 2022).

In this paper, we focus on an important blind spot in the literature, i.e., the industrial consequences of the choice of the exchange rate regime (ERR). Specifically, we investigate

[1]The hump-shaped relationship between manufacturing and the development level —proxied by the level of income per capita— is motivated by Engel's law of change in the composition of demand. As income increases, the food share of income should decrease to the profit of manufactured goods up to a certain threshold beyond which, in turn, demand for services augments.

whether a fixed ERR carries hidden costs detrimental to manufacturing expansion. This examination is motivated on several grounds, as there are reasons to believe that choosing a fixed ERR can impact the manufacturing sector dynamics. The first set of arguments relates to the specific nature of a fixed ERR. As it is characterized by the absence of exchange rate volatility against the anchor currency, a fixed ERR "mechanically" annihilates the expenditure-switching role of exchange rate movements. Say differently, all else being equal, prices of goods imported from the anchor currency country (or, more simply, reference country) are "stable". Hence, the competition in the local market between local producers and those from the reference country(ies) is exacerbated. Furthermore, since producers from the reference country(ies) —generally a developed country, e.g., the United States or euro area countries— are characterized by higher relative productivity, they tend to display a comparative advantage for manufactured goods. As a result, in the absence of changes in trade barriers or any other adaptative measures, manufactured goods imported from the reference country(ies) put a squeeze on local manufacturing, either due to the lower relative price or to better quality. Besides, by pegging their currencies to those of advanced economies (AEs) characterized by strong institutions and central bank independence, developing countries could import the real exchange rate overvaluation tendencies that these anchor currencies often display (Ugurlu and Razmi, 2023). Indeed, in a peg regime, developing countries systematically inherit unfavorable exchange rate developments, particularly appreciations, that affect the reference currencies. This is the case, for instance, of the CFA zone countries that have pegged their currency to the euro and whose economic fundamentals are not as solid as those of the eurozone members. Finally, acknowledging downward price rigidity (in goods and labor markets), fixed ERR could further hamper manufacturing expansion and exports in developing countries due to reduced adjustment capacities (Ghosh et al., 2003) that often translate into real exchange rate overvaluations (loss of price-competitiveness).

Secondly, fixed ERR are associated with a number of constraints, such as fiscal discipline and inflation control (Tornell and Velasco, 2000; Ghosh et al., 2003; Klein and Shambaugh, 2010). Each of these constraints, indissociable elements from any credible fixed ERR, is self-sufficient to harm the industrialization process. In fact, beyond purposes related to the conduct of monetary policy —i.e., ensuring the fixity of the exchange rate at any time—, both constraints heavily weight on the financing capabilities to initiate and/or sustain industrialization. This applies not only to the public but also to the private sphere, as reserve requirements generally imply a credit rationing or are associated with high interest rates, especially in developing countries. Hence, altogether, developing countries under a fixed ERR are left without sufficient financial space, with limited adjustment capacities (Shambaugh, 2004; Obstfeld et al., 2019), and with the fixity of the exchange rate acting as import subsidies.

The proposed account fits well with the existing big picture on the underlying causes of deindustrialization trends in developing economies. In the broad lines, the augmented story is as follows. As developing countries were strongly encouraged to embrace globalization, i.e., to open up to trade and remove any trade barriers (e.g., tariffs, subsidies), their manufacturing sector, while still in its infancy —and essentially aiming at substituting imports—, entered into competition with that of more developed countries. With low relative productivity, industrialization in many developing countries became a financial pit —as most governments defended it. Fixed ERR then exacerbated constraints in developing countries and turned into a "suction pump" for imported manufactured goods.[2]

This perspective is supported by the extensive literatures on ERR and trade. Since the seminal paper of Rose (2000), a large number of studies have established the trade-enhancing effect of fixed ERR, especially of currency unions (Frankel and Rose, 2002; Baldwin, 2006; Glick and Rose, 2016; Larch et al., 2019). Klein and Shambaugh (2006) extend the framework to country pairs —with one base country (reference) and the other pegging to it— and find that the trade gains can be extended to such arrangements —and so to fixed ERR in general. Meanwhile, as shown by Levy-Yeyati and Sturzenegger (2016), Couharde and Grekou (2021), and Ilzetzki et al. (2022), fixed arrangements maintained a relatively important proportion in the post-Bretton Woods era. Indeed, more than 50% of the developing countries have a fixed arrangement, and the proportion is comprised between 30% and 40% for emerging economies. Hence, the aforementioned potential effects of fixed ERR could still be at stake.

In this paper, we assess whether the persistence of fixed ERR ultimately leads to an atrophy of the national productive apparatus, making developing economies increasingly dependent on their partners. In other words, we investigate the plausibility of fixed ERR exerting a tapering effect on manufacturing in developing countries. We address this

[2]Our narrative does not overlook the powerful historical force that was globalization and the resulting emergence of some Asian countries such as China in manufacturing and trade in the late 1990s and 2000s. Such advent(s) can be seen as common shock(s) to all countries (Autor et al., 2016), leaving relevant the examination of the role played by the ERR. Furthermore, it is often argued that Asian countries sparred by the deindustrialization trend had a comparative advantage in specializing in manufacturing compared to other countries with natural resources (Rodrik, 2016). The latter comparative advantage definition is nevertheless questionable and appears to comply with the international division of labor rather than economic costs rationale —the Asian countries' emergence being largely facilitated by the willingness of advanced economies to confine to high value-added stages of value chains. Indeed, one could have quite safely postulated, during the 1960s and early 1970s, when most developing countries displayed similar levels of development, that moving down —even partially— the value chains would have been easier for countries already endowed with the needed natural resources. Through this lens, the effect of the ERR could be regarded as predating globalization forces, or at least, as having weighed on the "initial conditions" for industrialization in the post-Bretton Woods era.

question considering two complementary approaches, for a large sample of 146 countries over the 1974-2019 period. Specifically, we rely on panel data regressions to study the macroeconomic effects of ERR on the size of the manufacturing sector, and on auxiliary gravity regressions to examine the trade channel. We discuss and address the issue of endogeneity in both of our analytical approaches. The results confirm our conjecture as we find that the ERR significantly and negatively impacts manufacturing in developing countries. These findings are robust to a battery of robustness checks. Interestingly, our results suggest that the ERR effects in the recent period are more substantial than ever, highlighting the relevance and topicality of the issue.

At the crossroads of two fields of research —development economics concerning premature deindustrialization and international macroeconomics regarding the choice of ERR—, our paper provides key contributions to the literature. To our best knowledge, we are the first to analyze premature deindustrialization under the prism of ERR. As such, our paper not only improves the comprehension of the consequences associated with the ERR choice by highlighting an industrial cost for developing countries, but also sheds new light on industrialization fails/difficulties in many developing economies. Our paper echoes previous studies which show that developing countries have remained on the margins of the benefits of globalization. Indeed, we show that the reduction in transaction costs induced by the fixed exchange rate combined with an unfavorable productivity/development differential has created a structural dependence on imports of manufactured products to the detriment of the development of local manufacturing sectors. On a methodological level, our paper also makes a significant contribution by considering, in the gravity model, a global approach to fixed ERR relying on both direct and indirect bilateral ERR to construct a measure of *de facto* monetary unions or *peg networks*.

The remainder of the paper is structured as follows. Section 2 presents the empirical framework, i.e., the estimation strategies and the data. Section 3 discusses the results. Section 4 is devoted to sensitivity analyses and additional checks. Section 5 concludes.

2 Empirical framework

2.1 Estimation strategies

The objective of the empirical analysis is to shed light on the relationship between the ERR and the size of the manufacturing sector. More specifically, we aim to provide empirical evidence on whether the fixed ERR exerts a tapering effect on the manufacturing sector size. For that purpose, we adopt two complementary approaches. We first estimate panel regressions to unveil the overall macroeconomic effects exerted by the ERR. We then proceed by estimating a gravity model since the macroeconomic effects associated with the ERR, if any, should materialize in trade data. These two analyses are explained in more detail below.

2.1.1 On the macroeconomic effects of the exchange rate regime on the manufacturing sector

To investigate the relationship between the ERR and the size of the manufacturing sector, we build on previous empirical studies (e.g., Rodrik, 2016; Kruse et al., 2022) in the filiation of Chenery (1960) and Chenery et al. (1986). More specifically, we augment the "traditional" specification and estimate various versions of the following model:

$$\begin{aligned} Manuf_{it} = \ & \beta_0 + \ \beta_1 y_{it} + \ \beta_2 y_{it}^2 + \ \beta_3 pop_{it} + \ \beta_4 pop_{it}^2 + \ \delta_1 ERR_{it} \\ & + \delta_2 \big(ERR_{it} \times y_{it}\big) + \ \Theta X_{it} + \ \mu_i + \ \lambda_t + \ \varepsilon_{it} \end{aligned} \tag{1}$$

where $Manuf_{it}$ denotes the manufacturing value added (as a percentage of GDP), y_{it} (resp. y_{it}^2) is the natural logarithm of GDP per capita (resp. its squared value), pop_{it} (resp. pop_{it}^2) the natural logarithm of population size (resp. its squared value), ERR_{it} stands for the two-way de facto exchange rate regime classification (i.e., fixed vs. flexible), X_{it} is a vector of control variables, μ_i and λ_t indicate the country and time fixed effects, respectively, and ε_{it} stands for the error term.

Our main focus is on the asymmetries in the ERR-manufacturing sector relationship captured by δ_1 and, most importantly, by δ_2 which is the coefficient associated with the interaction term between the ERR and the development level. While δ_1 captures the impact of the ERR for the least developed countries, δ_2 broadly reflects how these effects are modulated along the distribution of y (i.e., for more developed countries). A negative δ_1 would indicate that the ERR has an unconditional negative effect on the manufacturing share. We expect δ_2 to be positive, supporting that the fixed ERR is —more— harmful for the manufacturing sector in less developed countries. To avoid any ambiguity with the other analyses in this paper, we refer to those pertaining to specification (1) as the "macroeconomic" framework.

2.1.2 Exchange rate regime and the manufacturing sector size: a look through trade data

As discussed above, it is of particular importance to go beyond the macroeconomic analysis and provide further supporting evidence. In this perspective, we hypothesize that the negative impact of the fixed ERR on the manufacturing sector of least developed countries occurs through a trade impoverishment effect. Since they are less productive and because of the cost-reducing effect of the fixed ERR on trade, less-developed countries would import more manufactured products, hence limiting the development of their own industrial sector, particularly the manufactured one. We test this hypothesis by estimating the following gravity model:

$$MS_{ij,t} = exp\bigg(D_{it} + D_{jt} + D_{ij} + \ \beta_1 ERR_{ij,t} + \ \beta_2 ERR_{ij,t} \times y^r_{ij,t} + \ \Theta Z_{ij,t}\bigg) + \nu_{ij,t} \quad (2)$$

where $MS_{ij,t}$ is the share of manufactured goods imports in total imports from country j in year t (i.e., $Imports^{Manuf}_{ij,t}/Imports^{Total}_{ij,t}$). $ERR_{ij,t}$ stands for the bilateral de facto ERR —a dummy variable taking the value 1 for a given year when the ERR between countries i and j is fixed, and 0 otherwise (see further details in the Data section). $Z_{ij,t}$ is a set of time-varying countries pair control variables which include: (i) $y^r_{ij,t}$, i.e., the relative GDP per capita between countries i and j —standing for the relative productivity/development level—, (ii) the squared value of the relative GDP per capita, and (iii) a dummy variable accounting for the existence of regional trade agreements ($RTAs$) between country pairs. D_{it}, D_{jt}, and D_{ij} stand for importer-time, exporter-time, and country pair fixed effects, respectively. $\nu_{ij,t}$ is the error term.

Again, the covariate of interest is the interaction term between the ERR and the relative development measure. β_2 captures how the ERR effect varies as a function of the relative —bilateral— development level. Turning to β_1, it measures the effect of the ERR for the least developed countries. As before, to avoid any confusion, we refer to analyses pertaining to specification (2) as the "trade" framework.

2.2 Data

2.2.1 Exchange rate regime classification

We rely on the *de facto* ERR classification proposed by Couharde and Grekou (2021) to define two types of ERR: fixed *versus* flexible. Two main reasons justify using this classification. First, it corresponds to a synthesis of the two most popular classifications —the one proposed by Levy-Yeyati and Sturzenegger (LYS, 2016) and the other introduced by Ilzetzki, Reinhart and Rogoff (IRR, 2019)— and, as such, allows to overcome their respective limits, and, most importantly, their divergence plaguing numerous empirical studies due to lack of robustness.[3] Second, by providing a unified framework,

[3]The synthesis classification has proved, on average, the highest agreement rates among the most popular *de facto* classifications (including also the IMF *de facto* classification). Therefore, it not only

it offers not only broader coverage but also encompasses a broader spectrum of exchange systems.

We consider the three-way synthesis classification (coarse grid) and collapse it into a two-way classification by lumping together the *intermediate* and *floating* categories into a *flexible* category. From this two-regime classification, we then define a dummy variable equal to 1 if the country is under a *fixed* ERR in year t, and 0 otherwise.

While our dummy variable is functional/effective in a panel data setting, further adjustments are needed to match the gravity model's bilateral framework. We thus use the reference currencies provided along with the synthesis classification to derive bilateral *de facto* ERR. In contrast with previous studies most related to our and focusing on the trade effects of currency unions, we do not limit ourselves to direct linkages between currencies but also consider indirect ones. We thus depart significantly from previous studies as we introduce the more realistic concept of *peg networks*, i.e., a network of currencies stable among themselves through direct and/or indirect "anchoring".[4] Considering both direct and indirect linkages, we build a dummy variable equal to 1 if both countries in the pair belong to the same *peg network* in year t, and 0 otherwise.

2.2.2 Manufacturing value added and imports share

Data on the manufacturing value added as a share of GDP are directly taken from the United Nations Conference on Trade and Development (*UNCTADstat* – Output and Income). Manufacturing activities correspond to the International Standard Industrial Classification (ISIC, revision 3) code D. International trade data used throughout the paper are also obtained from the UNCTAD (*UNCTADstat* - Merchandise Trade Matrix). The dependent variable in the gravity model —i.e., manufactured goods imports share— is the ratio of bilateral imports of manufactured goods to total bilateral imports. Manufactured goods considered by the UNCTAD are identified by codes 5 to 8 —(excluding 667 and 68)— in the Standard International Trade Classification (SITC, revision 3).

conveys more information and allows for greater comprehensiveness than the existing classifications, but also ensures somehow core results consistent with all the classifications —given its underlying unified framework (see Couharde and Grekou (2021) for further details).

[4]The generic term of "peg" designates the broad categories of fixed ERR. In the common framework, it refers to conventional pegs, currency boards, currency unions, and currency substitutions (e.g., dollarization). A *peg network* extends this definition to indirect relationships between the currencies. The two illustrative cases of *peg networks* are (i) different currencies *de facto* fixed to the same anchor currency, and (ii) different currencies *de facto* fixed to different anchor currencies that are themselves tightened. For example, the Comoros, the member countries of the Central African Economic and Monetary Community (CEMAC), and the West African Economic and Monetary Union (WAEMU) whose currencies are anchored to the euro form with the countries of the eurozone a *de facto* monetary union network. Figure A.2.2 in Appendix A.2 provides a graphical illustration of the different configurations.

2.2.3 Control variables and samples

The traditional macroeconomic specification links the manufacturing sector size to the income level and the population size —both in level and squared value as main control variables— along with a set of fixed effects (see Section 2.1.1). While this benchmark has proved robust and sufficient to address the issue of regional (de)industrialization patterns, we deemed it relevant to enrich the specification to control further for heterogeneity between countries and, most importantly, to insulate the ERR effects from potential biases. Indeed, since our analysis emphasizes the asymmetric effects of the ERR depending on the development level, it requires considering a large sample of countries with heterogeneous levels of development.[5] Regarding the latter measure, we do not consider the usual GDP per capita but the GDP off natural resource rents per capita as the benchmark measure.[6] The main reason is that GDP per capita can be a misleading measure in terms of the actual relative development level. Accordingly, we also control for natural resource rents in the specification as our main dependent variable is the manufacturing value added as a share of GDP. Besides this first reason, natural resource rents may also account for different forces underlying the dynamics of the manufacturing sector, such as the Dutch disease or competitive energy prices.

We also control for governance and institutional quality by considering a measure of the level of democracy and a corruption index. Indeed, both good governance and institutional quality are associated with a higher likelihood of successful industrial policies due to mitigated risks of government and market failures (Chang, 2012; Pellegrini, 2011).[7]

Furthermore, we account for the macroeconomic environment and policies. First, we control for trade openness, which has historically been considered to go hand-in-hand with better economic performance —across all sectors and at all development levels. Regarding the manufacturing sector, the transmission channels that generally emerge are threefold: (*i*) invigorated domestic demand, (*ii*) technology transfers fostering productivity and facilitating manufactured goods upgrade, and (*iii*) access to international markets (Mijiyawa, 2017). Trade openness also serves as a proxy to account for globalization, especially the trade reform waves in the developing world (Irwin, 2022) —a key component of the structural adjustment programs (or the so-called Washington Consensus)—, that have led to drastic changes in the manufacturing sector (Dijkstra, 1996; Lall, 1995). Linking both trade and macroeconomic policies, we account for the real exchange rate levels. Indeed,

[5]In other words, it prevents us from running regressions on a small number countries with relatively similar development levels to have full extent of the effects.

[6]Hence, in the gravity model, the relative development level is computed as the country pair relative GDP off natural resource rents per capita.

[7]See Lin and Chang (2009) and Rodrik (2004, 2008a) for discussions on market failures.

a large body of studies have stressed the key role played by the exchange rate in stimulating economic growth, through the size of industry (Rodrik, 2008b). More specifically, lower-than-otherwise or undervalued currencies are associated with competitiveness gains, acting as subsidies, and boosting manufacturing size. We measure the real exchange rate levels with the relative price levels computed as the geometric weighted average of bilateral relative domestic price levels —adjusted for the Balassa-Samuelson effect— vis-à-vis 177 trading partners.[8] Along the same lines, we also capture another facet of monetary policy through the price of investment, which accounts for the domestic credit market environment. Indeed, access to domestic credit for firms can facilitate technology adoption, raise productivity, and encourage diversification/sophistication, reinforcing the manufacturing sector (Munemo, 2013; Minetti and Zhu, 2011; Aghion et al., 2007). As an alternative financing source —mitigating domestic credit market imperfections— and also a vector of exports' upgrading (Gnangnon and Roberts, 2015), we include in the specification the foreign direct investments (FDI) stock—as a share of GDP. Finally, we control for crises, differentiating between currency ones and others.[9]

The above discussion on the control variables essentially applies to regressions in the macroeconomic framework. Indeed, in the gravity model (trade framework), excluding our relative development proxy that proved sufficient variability, all controls are wiped out by the three-way fixed effects (i.e., importer-time, exporter-time, and country pair). In addition to the relative GDP per capita and its squared value, as noted earlier, we control for the existence of regional trade agreements, relying on data from the CEPII gravity database.

Appendix A provides further details regarding the definitions, sources, and computations of the variables. Our sample for the macroeconomic analyses consists of 146 countries with data spanning from 1974 to 2019. We consider the same set of countries both as importers and exporters in our gravity model. Our bilateral trade flows data cover the 1995-2019 period.[10]

[8]This measure extends to the multilateral framework the usual definition of the real exchange rate as the relative price of traded and non-traded goods (see Couharde et al., 2021). We favor this measure since it has the advantage of being comparable across countries as well as over time —in contrast with the traditional exchange rate index, i.e., the bilateral exchange rate between the local currency and the US dollar.

[9]The various types of crises could have different effects on the manufacturing sector. In contrast with the other types of crises, one could argue that the depreciation of the exchange rate following a currency crisis can boost competitiveness and, hence, manufacturing exports (see the literature on the J-curve).

[10]This limited temporal dimension is due to the fact that we prioritized data consistency, i.e., the same source for the dependent variable in both panel data and gravity benchmark regressions.

3 Results

3.1 Macroeconomic evidence

Table 1 reports the baseline results of the estimation of different versions of Equation (1); from the traditional specification augmented with the ERR (columns (1.1) and (1.2)) to the "full model" with all the control variables (columns (1.5) and (1.6)).[11] To mitigate endogeneity concerns —particularly important in macro data— and also for reasons of consistency with the dependent variable's response horizon, estimates are derived considering five-year (non-overlapping) average data.[12]

The results support our conjecture regarding the effect of the ERR on the size of the manufacturing sector. Indeed, the coefficient associated with the ERR is always statistically significant, with a negative sign reflecting a tapering effect on the manufacturing value added —on average. When considered, the interaction term with GDP per capita is also significant with a positive sign, confirming the ERR's asymmetric effects. Overall, the results suggest a negative impact of the fixed regime that tends to diminish with the development level. Figure 1 illustrates this relationship between the ERR and the manufacturing share. Relative to low-income countries under a flexible regime, those with comparable income levels and under a fixed regime exhibit lower manufacturing share. As the income level increases, the negative effect of the fixed regime vanishes for middle-income countries, and turns positive for higher incomes. This positive effect associated with higher income goes along with a turning point at a higher income level —compared to the flexible regime. Hence, the effects associated with the ERR reverse from the bottom to the top of the income distribution.

These observations perfectly illustrate the different natures of the cost-benefit trade-offs underlying a rationale ERR choice. Indeed, while often presented as "universal", additional costs are at play when focusing on developing countries. Our finding of heterogeneous manufacturing "costs" has a direct implication in terms of potential trade gains from a fixed regime. Extending on our findings, one could attribute the manufacturing share "supplement" noted for higher income countries under fixed ERR —relative to those

[11]Specifications in columns (1.2), (1.4), and (1.6) include period dummies interacted with subregion fixed effects and further control for heterogeneity between countries. Indeed, while country fixed effects control for time-invariant country-specific factors and time effects capture the effects of factors that simultaneously affect all the countries, the subregion-period fixed effects allow for more spatial and temporal heterogeneity, hence capturing regional commonalities and/or shocks —e.g., integration processes, trade wave reforms (see Irwin, 2022).

[12]Consequently, our ERR variable is now bounded between 0 and 1. This new feature enriches the analysis as it adds information regarding the duration of the fixed regime over the five-year window. Evolving by increment of 0.2 per annum, a value of 0.4 (resp. 1) indicates a fixed regime for two (resp. 5) years.

under flexible ERR— to the extensively documented positive trade effects of the fixed regime (Frankel and Rose, 2002; Klein Shambaugh, 2006). As we observe the opposite effect for the bottom of the income distribution, our results suggest, at best, limited trade gains from a fixed regime for developing countries, especially those historically specialized in commodity exports. Due to their relatively low productivity and weak industries, demand for manufactured goods would most likely be satisfied by imports from other third countries.[13] In the case of a fixed regime —or a *peg network*— between developing countries and advanced economies, manufacturers from the more advanced economies would be "favored" to the detriment of the least developed country ones.[14]

[13]Note that as these countries do not move to higher value stages of their commodities-linked value chains, commodities' trade is also limited.

[14]These cases are investigated within the framework of the gravity model.

Table 1 – Panel regressions (5-year average data)

Dependent variable	Manufacturing value added (%GDP)					
	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)
ERR	-0.008***	-0.006**	-0.060*	-0.076**	-0.070**	-0.109***
	(0.002)	(0.002)	(0.032)	(0.037)	(0.029)	(0.042)
GDPpc[a]	0.105***	0.069***	0.106***	0.065***	0.097**	0.061*
	(0.025)	(0.024)	(0.025)	(0.022)	(0.041)	(0.035)
ERR×GDPpc[a]			0.006*	0.008**	0.008**	0.012***
			(0.003)	(0.004)	(0.003)	(0.005)
GDPpc squared[a]	-0.005***	-0.003**	-0.005***	-0.003***	-0.005**	-0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Population	0.222***	0.197***	0.210***	0.185***	0.267***	0.232***
	(0.024)	(0.021)	(0.020)	(0.022)	(0.020)	(0.024)
Population squared	-0.005***	-0.005***	-0.005***	-0.005***	-0.008***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Energy rents					0.399***	0.445***
					(0.096)	(0.169)
Other rents					-0.140***	-0.154***
					(0.008)	(0.025)
Crisis					-0.008***	-0.007***
					(0.002)	(0.002)
Currency crisis					0.002	0.000
					(0.006)	(0.006)
Democracy					0.001*	0.000
					(0.000)	(0.000)
Corruption					0.000	-0.010
					(0.012)	(0.012)
Relative price level					-0.015*	-0.007
					(0.009)	(0.007)
Trade openness					0.025***	0.031***
					(0.004)	(0.003)
Investment price					-0.010	0.010
					(0.010)	(0.010)
FDI					-0.001	-0.001*
					(0.001)	(0.001)
Constant	-2.476***	-1.839***	-2.380***	-1.774***	-2.629***	-1.972***
	(0.221)	(0.173)	(0.204)	(0.170)	(0.375)	(0.239)
No. observations	1,138	1,138	1,138	1,138	988	988
No. countries	146	146	146	146	142	142
R-squared	0.211	0.400	0.215	0.405	0.257	0.444

Notes: HAC and cross-sectional dependence robust standard errors (Driscoll and Kraay) are reported in parentheses. All estimations include country- and time-fixed effects. In (1.2), (1.4), and (1.6), we also include period dummies interacted with subregion fixed effects (United Nations definition). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a: GDP per capita off natural resource rents

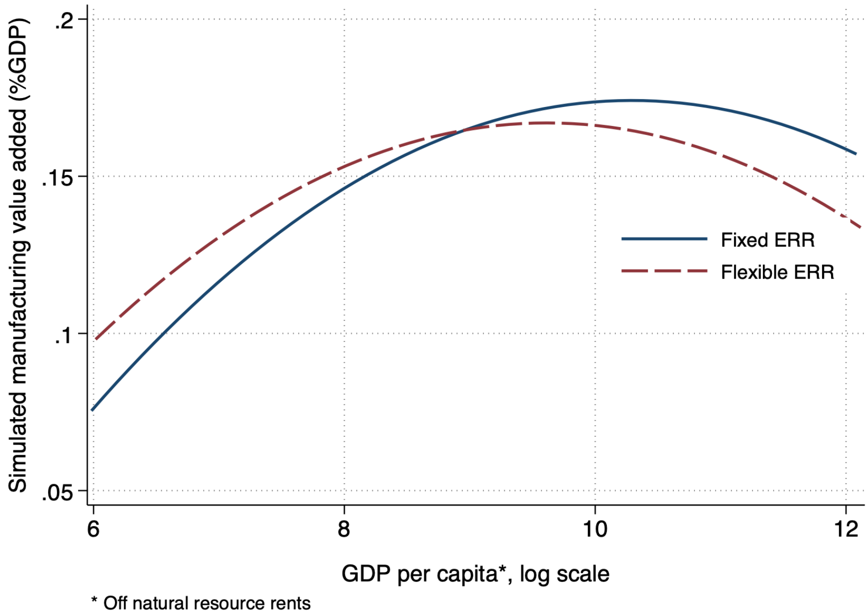


Figure 1 — Simulated manufacturing value added

Notes: Simulations based on estimates in column (1.5) in Table 1. The curves are drawn for two representative countries sharing all identical characteristics (set at the mean values of the variables) but the exchange rate regime.

Regarding the control variables, most of them are significant in at least one of the two regressions —columns (1.5) and (1.6). Looking first at the traditional controls, our results confirm the existence of an inverted U-shaped relationship between GDP per capita and the manufacturing sector size. The same relationship holds for the population size. Furthermore, the results also indicate differentiated effects for natural resource rents. While the non-energy natural resource rents appear to be associated with a lower manufacturing share —hence supporting the existence of a Dutch disease effect—, energy rents, on the contrary, tend to support the manufacturing sector. Regarding the role of governance and institutional quality, we only find weak evidence in our panel. Indeed, only the democracy index appears hardly significant with a positive sign, barely suggesting that more democratic countries display higher manufacturing share.[15] Turning to our macroeconomic control variables, we find significant effects for trade openness and the crisis dummy variable with the expected signs, i.e., positive for the former and negative for the latter. Both the relative price levels and FDI are negatively signed. However, support for these negative effects is weak as the coefficients appear significant half the time.

[15]This result is consistent with Giuliano et al. (2013) who find that more democratic countries implemented reforms more easily which, in turn, may have ensured the survival of a number of industries.

3.2 Gravity model results

Table 2 reports the estimation results of our structural gravity model, i.e., Equation (2). Columns (2.1) to (2.3) present the estimates obtained using the Poisson Pseudo-Maximum Likelihood (PPML) estimator and considering annual data. In columns (2.4) to (2.6), drawing on the findings of Weidner and Zylkin (2021), we implement (cluster-)bootstrap to obtain reliable inferences in the three-way PPML estimator setup.[16] For both procedures and for the sake of robustness, we consider three types of standard errors. In columns indexed by "Clustering: None", we report —in parentheses— the Huber-White heteroskedasticity-consistent standard errors. Columns indexed by "Clustering: D_{ij}", display —in brackets— standard errors clustered at the —directional— country pair level. Finally, in columns indexed by "Clustering: D_i, D_j, t", we report —in curly brackets— multi-way standard errors clustered by importer, exporter, and year.[17]

Overall, regardless of the estimation procedures, our point estimates remain close. However, due to the different clustering approaches, statistical significances differ. Before discussing the estimates of our variable of interest (i.e., the interaction between the ERR and the relative development level), let us discuss those of the control variables, especially those of non-interaction terms to facilitate subsequent discussions.

Whether we consider the PPML or the bootstrap-based estimates, the coefficients associated with the relative development level and its squared value are negative and positive, respectively. Hence, the results suggest a U-type relationship between the development level and the share of manufactured goods in total bilateral imports. More specifically, a higher value of relative development meaning a more "developed" destination country, the negative sign associated with the coefficients suggests lower shares of manufactured goods in total imports of destination countries as they develop —or for relatively more developed countries. However, beyond a certain level, the relationship turns positive. In other words, as the relative GDP per capita increases, countries import less manufactured goods (in proportion) up to a certain level beyond which higher manufactured goods im-

[16]Studying the incidental parameter problem for the three-way PPML estimator, Weidner and Zylkin (2021) shows that while PPML remains consistent, asymptotic confidence intervals are not correctly centered at the true parameter values in fixed T panels, and that cluster-robust variance estimates used to construct standard errors are generally biased. While providing an analytical bias correction, they acknowledge that bootstrap estimates deliver better inferential performances. Further note that we do not rely on the proposed correction as it is restricted to the sole case of —non-directional— country pair clustered standard errors.

[17]The multi-way clustering approach is the most conservative method since it allows for correlation in the error term within all six possible cluster dimensions, i.e., i, j, t, it, jt, and ij (Larch et al. 2019). As Egger and Tarlea (2015) note, ignoring interdependence of the disturbances in multiple dimensions leads to drastically biased standard errors of the coefficients of interest in structural gravity models of international trade.

ports match any further growth in the relative GDP per capita. This observation appears consistent with our findings on the relationship between income level and the size of the manufacturing sector. In fact, in a first phase, the rise in GDP per capita goes along with an increase in the manufacturing share in GDP; then, beyond a certain threshold, the increase in GDP per capita is accompanied by a decrease in the manufacturing sector —due to specialization processes and/or the development of services. Hence, the trade data depicts the same story as the macroeconomic data. The mirror image is also valid and perhaps more trivial; less developed countries tend to import more manufactured goods from more developed economies.

Turning to the ERR variable, the associated coefficient is positively signed although evidence of statistical significance is limited. Indeed, the coefficient is significant only when considering Huber-White type standard errors and the multi-way clustering in column (2.6). Based on the general preference in the literature for the country-pair clustering approach, we consider the ERR variable to be not statistically significant [18], meaning that the ERR does not influence the share of manufactured goods trade between developing countries.

Looking now at the interaction term between the ERR and relative GDP per capita, we find strong support for our predictions. Indeed, the coefficients are statistically significant with negative signs, indicating that more "productive" destination countries (i.e., higher destination-to-origin GDP per capita ratio) in *peg networks* (i.e., bilateral direct or indirect fixed regimes) import less manufactured goods in proportion to total imports. The mirror image of the results is that "less developed" countries within a *peg network* tend to import more manufactured goods (in proportion) from more developed economies. Hence, the above-noted negative macroeconomic effect of fixed ERR on manufacturing appears to translate in trade data, thus supporting this channel as both a vector of manufacturing weakening in developing countries, and an impediment to structural transformation.

[18] Similar conclusions are reached regarding the significance of the RTA variable.

Table 2 — Gravity model results

	Estimates			Bootstrap		
Clustering	None	D_{ij}	D_i, D_j, t	None	D_{ij}	D_i, D_j, t
	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)
ERR	0.007	0.007	0.007	0.008	0.007	0.008
	(0.003)**	[0.005]	{0.007}	(0.004)**	[0.005]	{0.004}**
Relative GDPpc [a]	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(0.001)***	[0.002]***	{0.002}**	(0.001)***	[0.002]***	{0.001}***
ERR × Relative GDPpc [a]	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.001)***	[0.001]**	{0.001}*	(0.001)***	[0.001]**	{0.001}***
Relative GDPpc squared [a,b]	4.269	4.269	4.269	4.407	4.209	4.348
	(1.010)***	[1.259]***	{1.452}***	(1.054)***	[1.370]***	{1.074}***
RTAs	0.009	0.009	0.009	0.008	0.008	0.008
	(0.004)**	[0.007]	{0.013}	(0.004)**	[0.007]	{0.004}**
Constant	-0.342	-0.342	-0.342	-0.331	-0.337	-0.331
	(0.003)***	[0.005]***	{0.007}***	(0.003)***	[0.005]***	{0.003}***
Observations	347,172	347,172	347,172	347,172	347,172	347,172
Pseudo-Rsquared	0.106	0.106	0.106			

Notes: The dependent variable is the share of country i manufacturing imports in total imports from partner j in year t. All the estimations include exporter-time, importer-time, and (directional) country pair fixed effects. For presentation purposes, estimates of all fixed effects are not reported. Robust standard errors (Huber-White) are displayed in parentheses. Standard errors adjusted for clustering at the —directional— country pair level (D_{ij}) are reported in brackets. Standard errors clustered by exporter, importer, and year (D_i, D_j, t) are reported in curly brackets. Bootstrap estimates are based on 1000 replications. Coefficients in columns (2.4) to (2.6) are the "bias-corrected beta". Significance levels for bootstrap estimates are based on percentile confidence intervals. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a: Relative GDP off natural resource rents per capita

b: rescaled to 10^{-5}

4 Sensitivity analyses

We carried out several sensitivity analyses to deepen the previous results and better understand their contours. The first series of analyses addresses the heterogeneity issue, while the second focuses on robustness tests.

4.1 Heterogeneity: which countries are really concerned?

To refine the narrative regarding the impact of the ERR on the development of the manufacturing sector, we reproduce the results of Table 1 (column (1.5)) for several groups of countries according to their level of development, geographical area, and specialization. For the sake of brevity, we only present the coefficients of our variables of interest, namely the ERR, real GDP per capita, and their interaction term (see Figure 2).

Examining the effect of the ERR depending on the level of development (panel a), we find that the negative impact of the fixed ERR on the manufacturing sector is higher in developing countries —i.e., those at the lower end of the GDP per capita distribution. By accelerating the integration of these economies into globalization —knowing their comparative disadvantage in industrial matters—, the fixed ERR contributed to deindustrialization in developing economies. In other words, fixed ERR clearly appear to have failed to achieve one of their main objectives, i.e., promoting technology transfer in developing economies. Instead, they have increased their dependence on manufacturing imports. The negative effect of the fixed regime is weaker but still significant at the 5% significance level for emerging economies. The latter appear, therefore, to have also been affected by the industrial cost of the fixed ERR although some of them were able to escape early deindustrialization. For the two groups of countries, in line with the general picture sketched above, the cost of the fixed regime tends to decrease with the income level. Turning to advanced economies, we do not find any significant negative effect of the fixed ERR. Such a result was expected —most of these countries displayed "mature" industries grounded on strong comparative advantages, historical "*savoir-faire*"—, as well as the negative coefficient associated with the income level, indicating that most of these economies are in the downward phase of manufacturing share.

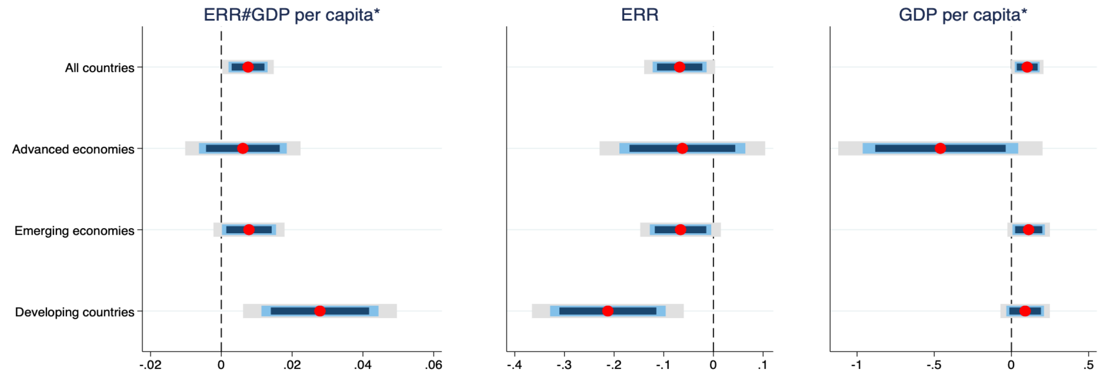
Our initial results are then analyzed using different geographic areas (panel b). Although a certain degree of heterogeneity emerges between regions, we find evidence of an active role played by the ERR in all areas except East Asia and Pacific (EAP) and the Middle East and North Africa (MENA). Results regarding the EAP region are interesting as they remain unchanged even when removing the set of advanced economies, hence echoing the narrative that countries from this region —actually most emerging economies (China, Hong Kong, India, Indonesia, Korea, Malaysia, Singapore, etc.)— were spared from the deindustrialization trend due to their comparative advantages in manufacturing (Rodrik, 2016).[19] In contrast, Sub-Saharan Africa (SSA), Latin America and the Caribbean (LAC), and South Asia (SA) are the regions concentrating the largest number of countries adversely impacted by the ERR fixity. Furthermore, while we find that rising GDP per capita has mitigated the negative effect of the fixed regime in the above regions, evidence regarding the direct income-induced manufacturing gains is missing, excluding LAC and EAP, and Europe and Central Asia for which the income level is associated with a negative coefficient.

Finally, we address the issue of heterogeneity considering trade specialization (panel c) by examining whether the effect of the ERR depends on the net importer/exporter status for manufacturing goods. We consider a country to be a net exporter of manufacturing goods when the share of its exports of manufacturing products exceeds that of its imports for the same products. Conversely, the country is a net importer of manufactured products. The results confirm our intuition and previous findings since they show that the negative effect of the ERR operates mainly for net importers of manufactured goods, although the increase in GDP per capita helps to reduce this effect.

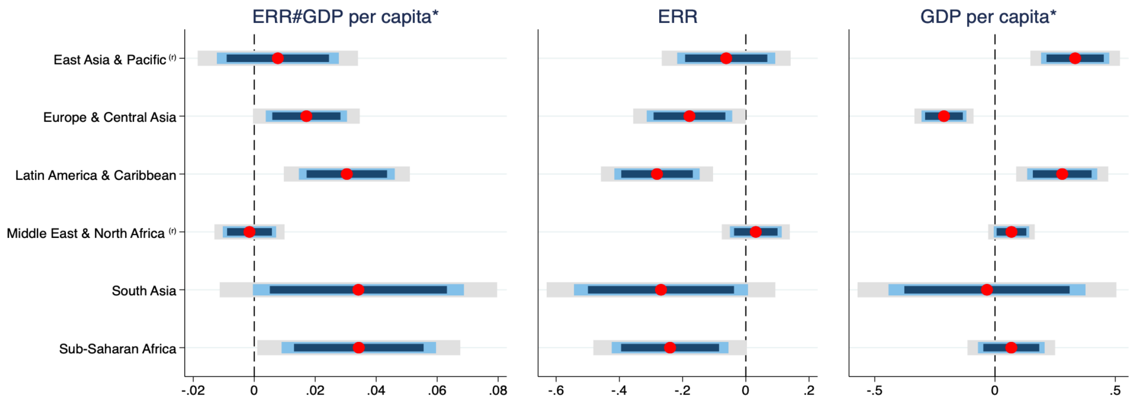
Overall, our results provide more background on the effect of ERR. In particular, the geographical, income, and specialization patterns are closely linked to globalization (Rodrik, 2016), suggesting that fixed regimes have played an even more catalytic role regarding manufacturing dynamics in the globalization era.

[19]Indeed, unlike developing countries whose endowment in natural resources has proven to be an obstacle to the development of a real industrial fabric, the EAP countries have focused more on specialization driven by skills and technology. This explains why these countries have been able to benefit from globalization without suffering the industrial cost of the fixed ERR —if not benefiting from the trade-enhancing effect of fixed ERR.

(a) — Development level



(b) — Geographical zones



(c) — Trade orientation

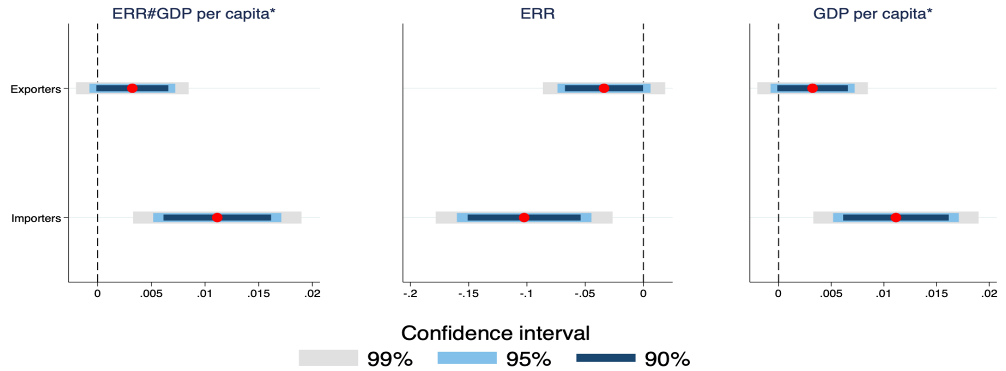


Figure 2 — Panel evidence, by country groups

Notes: The dependent variable is the manufacturing value added. The graphs display the estimates for each group sample considering specification in column (1.5) in Table 1. Statistical inferences based on HAC and cross-sectional dependence robust standard errors (Driscoll and Kraay). We consider regions defined by the World Bank (excluding North America). The "trade orientation" measure is defined as the ratio between the share of manufactures in total merchandise exports and the share of manufactures in total merchandise imports. We define as Exporters (resp. Importers) countries with a ratio higher (resp. lower) than 1.

*: GDP per capita off natural resource rents

4.2 Robustness checks and additional results

We perform several robustness analyses, starting with the macroeconomic framework, then the gravity model. For brevity, results are reported in Appendix B.1.[20]

The first set of robustness checks in the macroeconomic framework focuses on data issues (see Table B.1.1). As a first analysis, we re-estimate the models with annual data (columns (B.1.1.1) and (B.1.1.2)). Recall that, in contrast with the literature that relies on annual data, we consider five-year average data in our baseline regressions to mitigate endogeneity issues. The second analysis complies more with the existing literature as we consider GDP per capita instead of our benchmark measure, i.e., the GDP off natural resource rents per capita (columns (B.1.1.3) and (B.1.1.4)). In the third analysis (columns (B.1.1.5) and (B.1.1.6)), we address the issue of outliers, i.e., whether our results are due to extreme observations distorting the relationship between the ERR and the manufacturing share. To tackle this issue, we discard 10 percent of the observations of the manufacturing value added —5 percent at each tail of the distribution. In columns (B.1.1.7) and (B.1.1.8), we check the robustness of our results to alternative data, both the manufacturing value added and the standard controls (income and population). Specifically, we re-run our specifications considering the dataset used by Kruse et al. (2022).[21] In a collateral way, the shorter coverage of the data —both time and country— also serves as a sample robustness check.[22] Finally, we test the sensitivity of our results to the choice of the dependent variable by considering the share of employment in the manufacturing sector instead of the manufacturing share (see Figure B.2).

Overall, our previous findings are robust to these sensitivity analyses, particularly our results regarding the effect associated with the ERR.

The results also remain robust to the second-round checks devoted to alternative estimation procedures. First, we confront our results with OLS-based estimates with (heteroskedasticity) robust standard errors, the benchmark in the literature. As visible in columns (B.1.2.1) and (B.1.2.2) in Table B.1.2, our findings are still valid. Second, acknowledging structural changes along with the changing international economic envi-

[20]For the sake of brevity, we only run our robustness checks considering two models: (*i*) the usual specification augmented with the ERR variable and its interaction with the GDP per capita, and (*ii*) the full model with all control variables.

[21]Kruse et al. (2022) rely on the GGDC/UNU-WIDER Economic Transformation Database (ETD; de Vries et al., 2021). The comparable results are reported in their Table 5.

[22]It is worth noting that we also consider further control variables that, while not changing our results, failed to be statistically significant. These include, among others, applied tariff rates, currency misalignments, productive capacities index, and terms of trade. We kept the variables allowing us to have the largest coverage in our baseline model. Similarly, we discard variables that could have introduced collinearity issues due to high correlations with the retained controls (e.g., human capital and GDP per capita).

ronment, we estimate a smooth varying coefficient model (Hastie and Tibshirani, 1993; Li and Racine, 2010; Rios-Avilla, 2020). The main underlying motivation is to capture gradual changes and test the stability/temporal validity of our key result on the ERR effects. Against the backdrop of premature de-industrialization, this analysis is of particular interest. Figure B.1.1 displays the corresponding results.[23] The top left panel shows the evolution of the coefficient associated with the interaction term between the ERR (fixed regime) and GDP per capita. As visible, the coefficient displays an upward trend and becomes statistically significant —at the 10% level— from the late 1980s / early 1990s. Similar observations are made for the ERR (top right panel) but with a downward trend. Hence, while both variables display signs in line with our predictions from the early period, they gradually gain importance and statistical significance. These dynamics are entirely in line with the long-term decreasing trend in the proportion of fixed regimes (see Couharde and Grekou, 2021; Ilzetzki et al., 2022) initiated after the collapse of the Bretton Woods system (see Figure A.2.1 in Appendix A.2). As alternative regimes appeared, the effect of the fixed regime became more apparent. More importantly, our results suggest that the ERR effects in the recent period are more substantial than ever, making the issue a timely one. It is also interesting to note that the magnitudes of the above effects are independent from those of GDP per capita that flattened from the late 1990s (see bottom panels).[24]

As a final robustness check concerning the macroeconomic framework, we tackle the issue of endogeneity using GMM techniques —see columns (B.1.2.3) and (B.1.2.4) in Table B.1.2.[25] Again, our results prove to be robust. Regarding our ERR variable, it is worth noting that cases for endogeneity bias, especially the often and almost exclusively raised issue of reverse causality, are sparse —if any. Indeed, reverse causality in our case would imply a desire to raise manufacturing share as the rationale underlying the choice of the fixed ERR. While this is not explicitly in line with the main determinants identified in the empirical literature on the choice of fixed regimes, it can make sense from the trade perspective —both intensive and extensive margins.[26] However, such ratio-

[23]We consider the full model. For brevity, the coefficient plots for the population size (both level and squared value) as well as those of the additional control variables are not reported —but available upon request.

[24]It should also be noted that the dynamics of the coefficients associated with GDP per capita and its squared value are supportive of Rodrik (2016)'s findings of premature de-industrialization. Indeed, both coefficients lose importance over time, indicating that the income level played a less prominent and proactive role in the industrialization process. However, our results are also supportive of the recent findings of manufacturing renaissance in many low-income countries (Kruse et al., 2022) as we observe a start of trend reversals at the end of the period.

[25]The dynamic nature of GMM also allows us to link the current manufacturing share to its past value.

[26]The main determinants identified in the empirical literature on the choice of ERR are the optimum currency area criteria, exchange rate-based disinflation strategies, the economic size, greater cross-border

nale implies a positive relationship between the fixed ERR and the manufacturing share, not a negative one. Therefore, if there is a reverse causality issue, our estimates might suffer from an upward bias, reinforcing our findings on the negative effect of fixed regimes.

The above ERR endogeneity concern is even less relevant in our "trade framework", i.e., gravity model. This is due to several reasons. First, in contrast with the literature investigating the effect of currency unions or, more generally, fixed ERR on bilateral trade, we focus on the share of manufactured goods in total bilateral imports, which means that reverse causality would imply a desire to raise the share of manufactured goods in imports as the rationale underlying the choice of the fixed regime. This fits even hardly with the identified determinants of fixed regimes. Nevertheless, if one still thinks of reverse causality, invoking the traditional connection between trade and fixed regimes, economic rationales would go against a positive relationship between the manufactured goods import share and the fixed regime. Our results would thus appear as lower-bound estimates. Second, the symmetric nature of our sample makes it unlikely that our results could be driven exclusively by reverse causality. Indeed, we consider different types of fixed regimes. Except in currency unions where the regime can be regarded as endogenous (i.e., the different countries decide to share the same currency), the other types of regimes do not imply such commitment from all the parties, hence introducing exogeneity.[27] Finally, reverse causality only pertains to the cases of "voluntary" pegs, excluding the cases of "involuntary" and/or indirect pegs that constitute the bulk of our fixed regimes in the data.[28]

However, two issues are worth addressing. The first is the causal interpretation of the estimated exchange rate regime effect. We perform a series of placebo tests to highlight the causality link between the ERR and the import share of manufactured goods. More specifically, we re-estimate our model considering placebo (fake) bilateral fixed ERR dummies. Our Monte Carlo simulations based on 1000 draws of placebo ERR dummies show no significant association between the latter and our dependent variable since the estimated coefficients (ERR and its interaction with relative GDP per capita) are nor-

investment and trade (see among others Levy-Yeyati et al., 2010).

[27]For instance, in a conventional peg to the US dollar, the regime is endogenous from the anchoring countries viewpoint, but exogeneous from the US perspective. It should also be recalled that the use of country pair fixed effects mitigates endogeneity concerns with respect to bilateral trade policies.

[28]Furthermore, it should be noted that in the "problematic" cases of "voluntary" pegs, the latter are often announced before being put in place. Whether they are preceded or not by a formal convergence period, anticipation effects play before time. In such cases, relying on lagged regimes to deal with the issue of reverse causality does not address the endogeneity concern from the economic perspective. On the statistical side, the difference in the value of the variable recording the fixed regime in the year(s) prior to and following its implementation is null.

mally distributed around zero —see Figure B.1.3 in Appendix B.1. Hence, our causal interpretation of the effects of the ERR seems sound. The second issue is the potentially distorting effects of the bilateral manufactured goods trade with China. While China is the figurehead, similar concerns —i.e., extreme observations—could also apply to other countries. We address this issue in three different ways: (*i*) excluding China (both as importer and exporter), (*ii*) winsorizing, and (*iii*) trimming the data. Results are reported in Table B.1.3, and show that our previous findings remain vivid.

5 Conclusion

The choice of the ERR and its consequences is a central issue in economics. While the post-Bretton Woods era was shaping up to be a major shift towards flexible ERR, many countries worldwide remain with a fixed regime 50 years later. Indeed, the fixed ERR is deemed to ensure stability, which is essential for production and social development. However, by promoting unbalanced trade due to differences in productivity and technology, it can prove to be an industrial underdevelopment trap for less developed countries. Furthermore, by advocating strict inflation control, the fixed ERR can be a significant obstacle to financing a genuine industrialization policy in developing countries.

In this paper, we examine the effects of fixed ERR in light of the premature deindustrialization of most emerging and developing countries over the last decades. In particular, we study the effects of fixed ERR on the size of the manufacturing sector based on a sample of 146 developed, emerging, and developing countries over the 1974-2019 period. Using panel data regressions, our results show that the fixed ERR negatively, significantly and robustly impacts the manufacturing sector share. In other words, countries with a fixed ERR experienced a greater decline in the contribution of their manufacturing sector to national wealth. This effect is more significant in developing and emerging countries, showing that the currency peg has contributed to industrial underdevelopment or premature deindustrialization. Additional analyses based on gravity model regressions show that the peg system positively and significantly impacts the importation of manufactured goods by the least developed countries. These results reinforce our intuition that, by accelerating the integration of developing economies into globalization through reducing the cost of trade, the fixed ERR has accelerated the comparative industrial disadvantage of these countries. Consequently, the choice of the pegging regime is one of the plausible explanations for industrial underdevelopment or premature deindustrialization in emerging and developing countries.

In a post-COVID-19 crisis context, marked by the desire to reconnect with strategic autonomy in industrial matters in advanced economies and to reverse the course of premature deindustrialization in emerging and developing countries, our results have important policy implications. A more active exchange rate policy involving greater regime flexibility is necessary for emerging and developing countries to escape industrial underdevelopment or reverse the trend of premature deindustrialization. Such a policy would have the advantage of freeing up more room for maneuver in financing the economy and more actively protecting local manufacturing sectors from unbridled globalization.

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Appendix

A. Data

A.1. Variables and samples

Table A.1.1 — Data description and sources

Variable	Source
Crises	
Currency crisis: dummy variable (1 equals crisis; 0 otherwise) Other crises: dummy variable (1 in case of systemic banking and/or sovereign debt crisis; 0 otherwise)	Laeven & Valencia (2018)
Exchange rate regime classification: three-way synthesis classification	Couharde & Grekou (2021)
Foreign direct investment stock (%GDP)	UNCTAD
GDP	
GDP in current U.S. dollars	WDI
Real GDP at chained PPPs	PWT 10.0
Investment price: price level of capital formation	PWT 10.0
Institutional variables	
Corruption: political corruption index (from less to more corrupt) Democracy: level of democracy (from least to most democratic)	QOG[1]
Manufacturing	
Employment share (% total employment)	Kruse et al. (2022)[2]
Value added (% GDP)	UNCTAD
Natural resources rents (energy/non-energy, %GDP)	WDI
Population: total population	PWT 10.0
Regional trade agreements: dummy variable equal to 1 in case of regional agreements; 0 otherwise.	Gravity (CEPII)
Relative price level: multilateral price level computed as the geometric weighted average of the countries' bilateral relative prices relative to their trading partners (177) with time-varying weighting scheme (over 5-year non-overlapping windows)	MULTIPRIL (CEPII)
Trade: sum of exports and imports of goods and services (%GDP)	WDI
Trade flows: bilateral manufacturing and total merchandise flows	UNCTAD

Notes: PWT: Penn World Table; UNCTAD: United Nations Conference on Trade and Development statistics; WDI: World Development Indicators (World Bank).

[1] QOG: The Quality of Government basic dataset, version Jan20

[2] Original data from the GGDC/UNU-WIDER Economic Transformation Database

Table A.1.2 — Sample

Albania	Chile[EMEs]	Germany [AEs]	Latvia [AEs]	Oman	Sweden [AEs]
Algeria[EMEs]	China[EMEs]	Ghana	Lebanon[EMEs]	Pakistan[EMEs]	Switzerland [AEs]
Angola	Colombia[EMEs]	Greece [AEs]	Lesotho	Panama[EMEs]	Syrian Arab Rep.
Argentina[EMEs]	Congo, Dem.Rep.	Guatemala[EMEs]	Liberia	Paraguay[EMEs]	Tajikistan
Armenia	Congo, Rep.	Guinea	Lithuania [AEs]	Peru[EMEs]	Tanzania, U.R. of
Australia [AEs]	Costa Rica[EMEs]	Guinea-Bissau	Madagascar	Philippines[EMEs]	Thailand[EMEs]
Austria [AEs]	Côte d'Ivoire	Haiti	Malawi	Poland[EMEs]	Togo
Azerbaijan	Croatia[EMEs]	Honduras	Malaysia[EMEs]	Portugal [AEs]	Trinidad and Tobago
Bahrain	Cyprus [AEs]	Hong Kong, SAR [AEs]	Mali	Qatar[EMEs]	Tunisia[EMEs]
Bangladesh	Czech, Rep. [AEs]	Hungary[EMEs]	Mauritania	Korea, Rep. [AEs]	Turkey[EMEs]
Belarus[EMEs]	Denmark [AEs]	India[EMEs]	Mauritius	Moldova, Rep.	Uganda
Belgium [AEs]	Djibouti	Indonesia[EMEs]	Mexico[EMEs]	Romania[EMEs]	Ukraine[EMEs]
Benin	Dominican, Rep. [EMEs]	Iran[EMEs]	Mongolia	Russian Federation[EMEs]	United Arab Emirates[EMEs]
Bolivia	Ecuador[EMEs]	Iraq[EMEs]	Morocco[EMEs]	Rwanda	United Kingdom [AEs]
Bosnia and Herzegovina[EMEs]	Egypt[EMEs]	Ireland [AEs]	Mozambique	Saudi Arabia[EMEs]	United States [AEs]
Botswana	El Salvador[EMEs]	Israel [AEs]	Myanmar	Senegal	Uruguay[EMEs]
Brazil[EMEs]	Equatorial Guinea	Italy [AEs]	Namibia	Serbia[EMEs]	Venezuela[EMEs]
Bulgaria[EMEs]	Estonia [AEs]	Jamaica[EMEs]	Nepal	Sierra Leone	Vietnam
Burkina Faso	Eswatini	Japan [AEs]	Netherlands [AEs]	Singapore [AEs]	Yemen
Burundi	Ethiopia	Jordan[EMEs]	New Zealand [AEs]	Slovakia [AEs]	Zambia
Cambodia	Finland [AEs]	Kazakhstan[EMEs]	Nicaragua	Slovenia [AEs]	Zimbabwe
Cameroon	France [AEs]	Kenya	Niger	South Africa[EMEs]	
Canada [AEs]	Gabon	Kuwait[EMEs]	Nigeria	Spain [AEs]	
Central African Rep.	Gambia	Kyrgyzstan	North Macedonia[EMEs]	Sri Lanka[EMEs]	
Chad	Georgia	Lao People's D.R.	Norway [AEs]	Sudan	

Notes: "EMEs" (resp. "AEs") indicates emerging (resp. advanced) economies.

A.2. Data overview

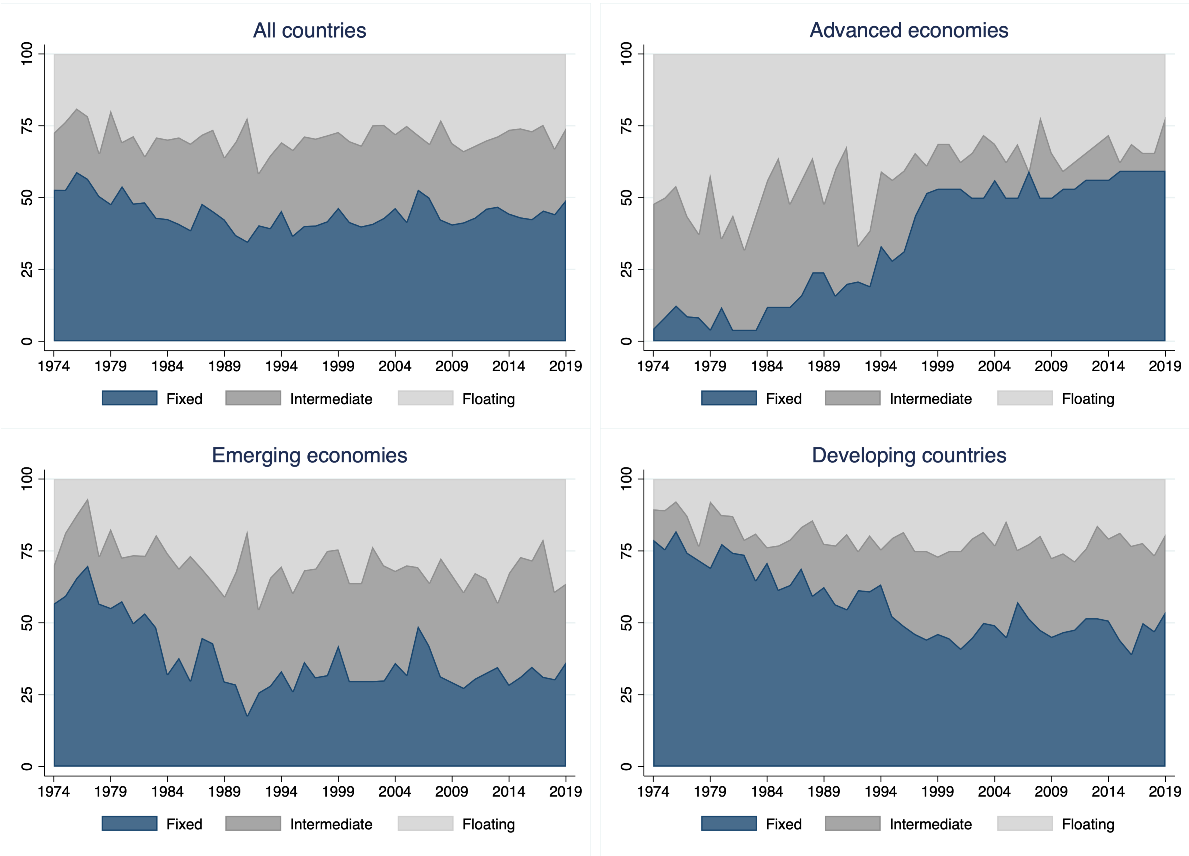


Figure A.2.1 — Synthesis classification: regime distributions over time

Notes: Distributions based on the regime frequencies in our largest regression sample (% annual observations).

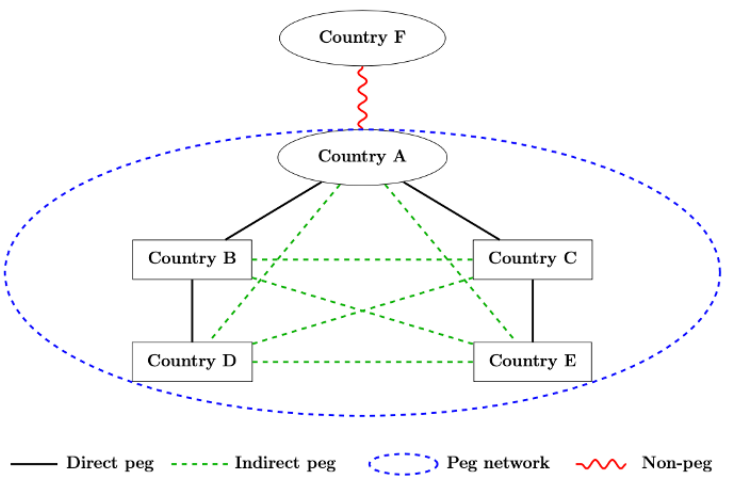


Figure A.2.2 — Defining bilateral exchange rate regime relationships

Notes: The generic term of "Peg" designates the broad categories of fixed ERR. In the common framework, it refers to conventional pegs, currency boards, currency unions, and currency substitutions (e.g., dollarization).

B. Additional results

B.1. Robustness checks and auxiliary analyses

Table B.1.1 — Robustness checks: data issues

Analysis	Annual data		GDP per capita	
	(B.1.1.1)	(B.1.1.2)	(B.1.1.3)	(B.1.1.4)
ERR	-0.021	-0.028***	-0.061*	-0.075***
	(0.013)	(0.010)	(0.032)	(0.028)
GDPpc [a]	0.127***	0.092***	0.101***	0.091**
	(0.019)	(0.027)	(0.024)	(0.041)
ERR×GDPpc [a]	0.002	0.003***	0.006*	0.008***
	(0.001)	(0.001)	(0.003)	(0.003)
GDPpc squared [a]	-0.006***	-0.005***	-0.005***	-0.005**
	(0.001)	(0.001)	(0.001)	(0.002)
Population	0.225***	0.258***	0.206***	0.259***
	(0.020)	(0.026)	(0.020)	(0.019)
Population squared	-0.006***	-0.007***	-0.005***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Energy rents		0.358***		0.395***
		(0.086)		(0.090)
Other rents		-0.098***		-0.159***
		(0.013)		(0.009)
Crisis		-0.006***		-0.008***
		(0.002)		(0.002)
Currency crisis		0.005		0.004
		(0.007)		(0.006)
Democracy		0.000		0.001**
		(0.000)		(0.000)
Corruption		0.008		-0.001
		(0.007)		(0.012)
Relative price level		-0.011***		-0.016*
		(0.004)		(0.008)
Trade		0.023***		0.023***
		(0.004)		(0.005)
Investment price		-0.015***		-0.010
		(0.005)		(0.009)
FDI stock		-0.001**		-0.001
		(0.000)		(0.001)
Constant	-2.671***	0.000	-2.327***	-2.585***
	(0.193)	(0.000)	(0.204)	(0.366)
No. observations / countries	5,401/146	4,365/142	1,138/146	988/142
R-squared	0.212	0.234	0.208	0.255

Notes: The dependent variable is the manufacturing share of GDP. HAC and cross-sectional dependence robust standard errors (Driscoll and Kraay) are reported in parentheses. All estimations include country- and time-fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
a: GDP off natural resource rents per capita (excluding columns (B.1.1.3) and (B.1.1.4))

(Continued on next page)

Table B.1.1 — Robustness checks: data issues (*Continued*)

Analysis	Outliers		Alternative data	
	(B.1.1.5)	(B.1.1.6)	(B.1.1.7)	(B.1.1.8)
ERR	-0.068***	-0.072***	-0.092**	-0.074**
	(0.026)	(0.020)	(0.042)	(0.038)
GDPpc [a]	0.124***	0.123***	0.142***	0.132***
	(0.022)	(0.032)	(0.013)	(0.028)
ERR×GDPpc [a]	0.006**	0.008***	0.009**	0.007*
	(0.003)	(0.002)	(0.004)	(0.004)
GDPpc squared [a]	-0.007***	-0.007***	-0.006***	-0.006***
	(0.001)	(0.002)	(0.001)	(0.002)
Population	0.138***	0.193***	-0.121***	-0.091**
	(0.040)	(0.009)	(0.038)	(0.036)
Population squared	-0.003*	-0.006***	0.002	0.001
	(0.002)	(0.000)	(0.001)	(0.002)
Energy rents		0.433***		0.266
		(0.083)		(0.221)
Other rents		-0.129***		-0.098**
		(0.021)		(0.048)
Crisis		-0.007***		-0.011***
		(0.002)		(0.001)
Currency crisis		0.006		0.000
		(0.006)		(0.004)
Democracy		0.000		-0.001*
		(0.001)		(0.000)
Corruption		-0.001		-0.000
		(0.014)		(0.004)
Relative price level		-0.023**		-0.000
		(0.010)		(0.007)
Trade		0.018***		0.048***
		(0.003)		(0.004)
Investment price		-0.009		0.016**
		(0.006)		(0.007)
FDI stock		-0.001***		-0.001
		(0.000)		(0.002)
Constant	-1.814***	-2.057***	0.000	0.562**
	(0.268)	(0.118)	(0.000)	(0.255)
No. observations / countries	1,026/145	909/140	347/59	340/58
R-squared	0.225	0.295	0.182	0.301

Notes: The dependent variable is the manufacturing share of GDP. HAC and cross-sectional dependence robust standard errors (Driscoll and Kraay) are reported in parentheses. All estimations include country- and time-fixed effects. In columns (B.1.1.5) and (B.1.1.6), the dependent variable is trimmed —5 percent at each tail. In columns (B.1.1.7) and (B.1.1.8), we consider five-year averages of the manufacturing shares, income and population data used by Kruse et al. (2022). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a: GDP off natural resource rents per capita (excluding columns (B.1.1.7) and (B.1.1.8)).

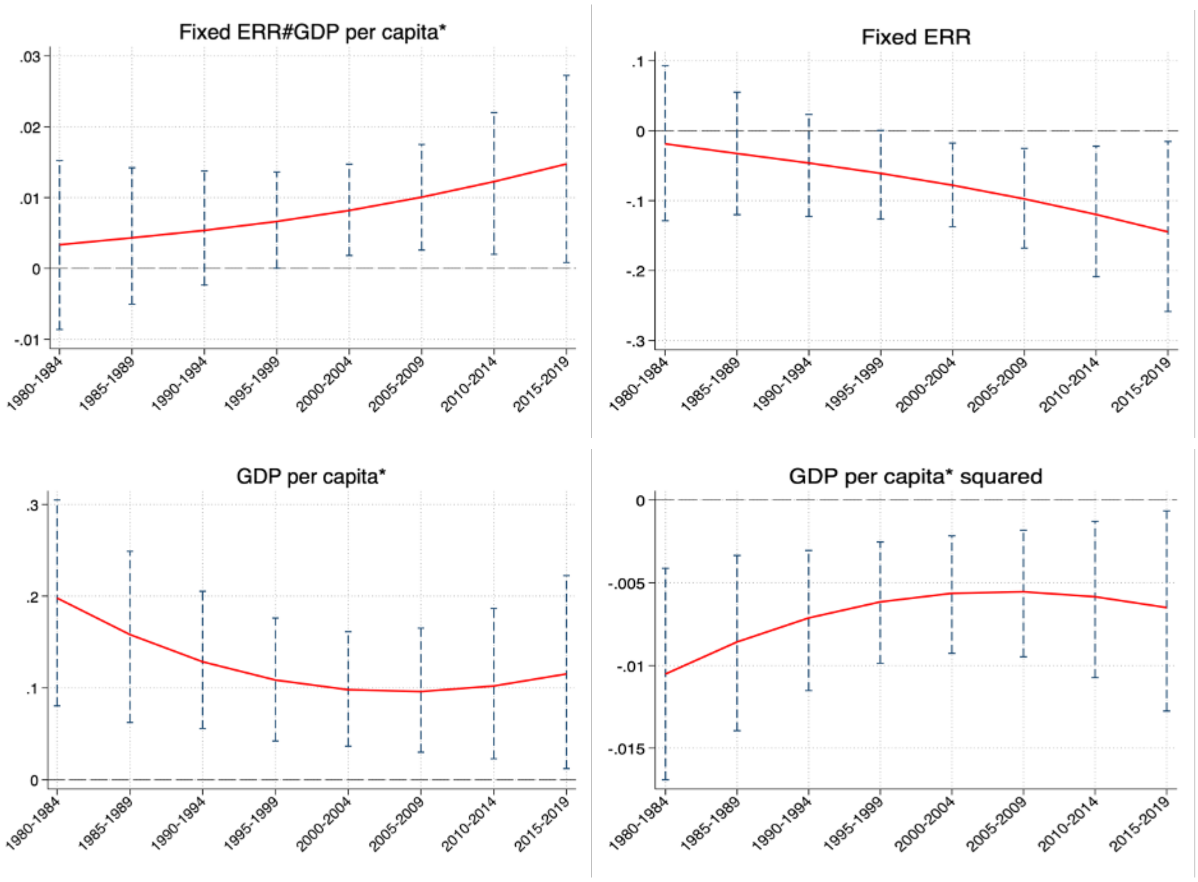


Figure B.1.1 — Robustness checks: accounting for dynamics in the relationships

Notes: The dependent variable is the manufacturing share of GDP. Estimates are derived from the full model, i.e., with all the controls included, and controlling for country-fixed effects. Results are obtained with 500 bootstrap replications. The solid (red) line indicates the evolution of the coefficients over time. The range plots give the 95% percentile confidence intervals. "#" denotes interaction between the variables.

* GDP off natural resource rents per capita

Table B.1.2 — Robustness checks: alternative estimation methods

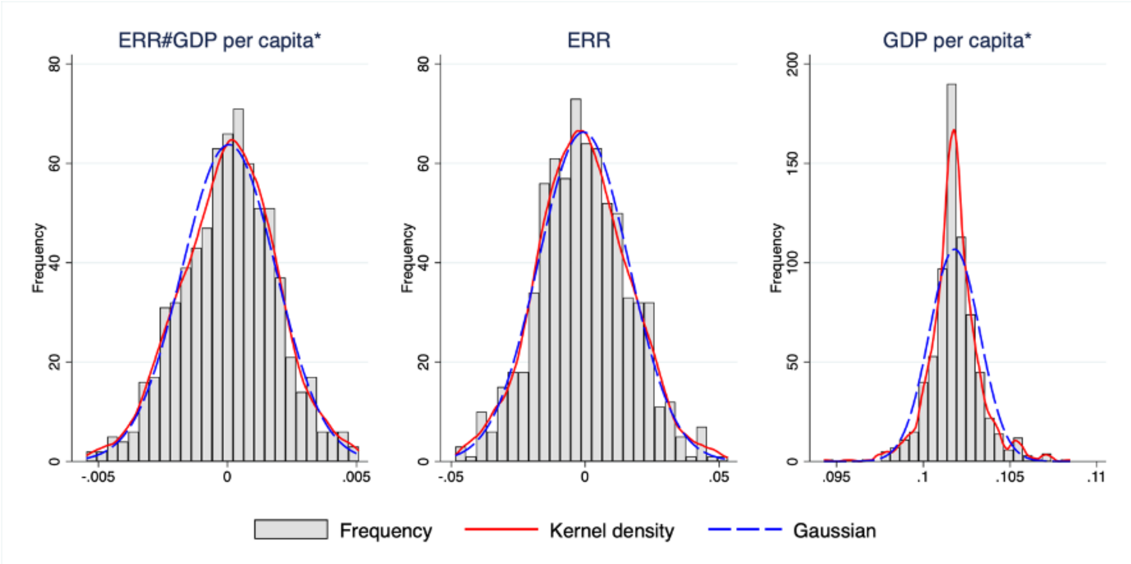
Analysis	OLS		GMM	
	(B.1.2.1)	(B.1.2.2)	(B.1.2.3)	(B.1.2.4)
L.Manufacturing VA			0.467***	0.572***
			(0.149)	(0.076)
ERR	-0.060*	-0.068**	-0.206**	-0.089*
	(0.032)	(0.034)	(0.092)	(0.047)
GDPpc [a]	0.106***	0.102***	0.126*	0.093**
	(0.037)	(0.036)	(0.064)	(0.036)
ERR×GDPpc [a]	0.006*	0.008**	0.020*	0.009*
	(0.003)	(0.004)	(0.011)	(0.005)
GDPpc squared [a]	-0.005**	-0.005**	-0.008*	-0.005**
	(0.002)	(0.002)	(0.004)	(0.002)
Population	0.210***	0.271***	0.217**	0.149**
	(0.054)	(0.065)	(0.086)	(0.073)
Population squared	-0.005***	-0.008***	-0.007**	-0.005**
	(0.002)	(0.002)	(0.003)	(0.002)
Energy rents		0.404*		0.387*
		(0.212)		(0.221)
Other rents		-0.138***		-0.132***
		(0.033)		(0.040)
Crisis		-0.008***		-0.005*
		(0.003)		(0.003)
Currency crisis		0.004		0.006*
		(0.004)		(0.003)
Democracy		0.001		-0.000
		(0.001)		(0.001)
Corruption		-0.002		0.021
		(0.016)		(0.017)
Relative price level		-0.016		-0.018
		(0.013)		(0.017)
Trade		0.024***		0.011
		(0.008)		(0.009)
Investment price		-0.009		-0.007
		(0.010)		(0.010)
FDI stock		-0.001		0.001
		(0.001)		(0.002)
Constant	-2.417***	-2.671***		
	(0.483)	(0.565)		
No. observations / countries	1,138/146	988/142	851/146	807/142
Adj. R-squared	0.782	0.809		
Adj. Within R-squared	0.136	0.154		
Hansen (*p*.value) [b]			0.274	0.565

Notes: The dependent variable is the manufacturing share of GDP. Robust standard errors are reported in parentheses. Results in (B.1.2.3) and (B.1.2.4) are two-step difference GMM estimates with small sample adjustment for standards errors (Windmeijer's finite-sample correction) and forward orthogonal deviations. Except *Democracy* and *Corruption* considered as weakly exogenous, all the variables are considered endogenous. "*L*" stands for the lag operator. All estimations include country- and time-fixed effects. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

a: GDP off natural resource rents per capita

b: Hansen test of overidentifying restrictions; Prob $> \chi^2$

(a) — Macroeconomic framework (Panel data model)



(b) — Trade framework (Gravity model)

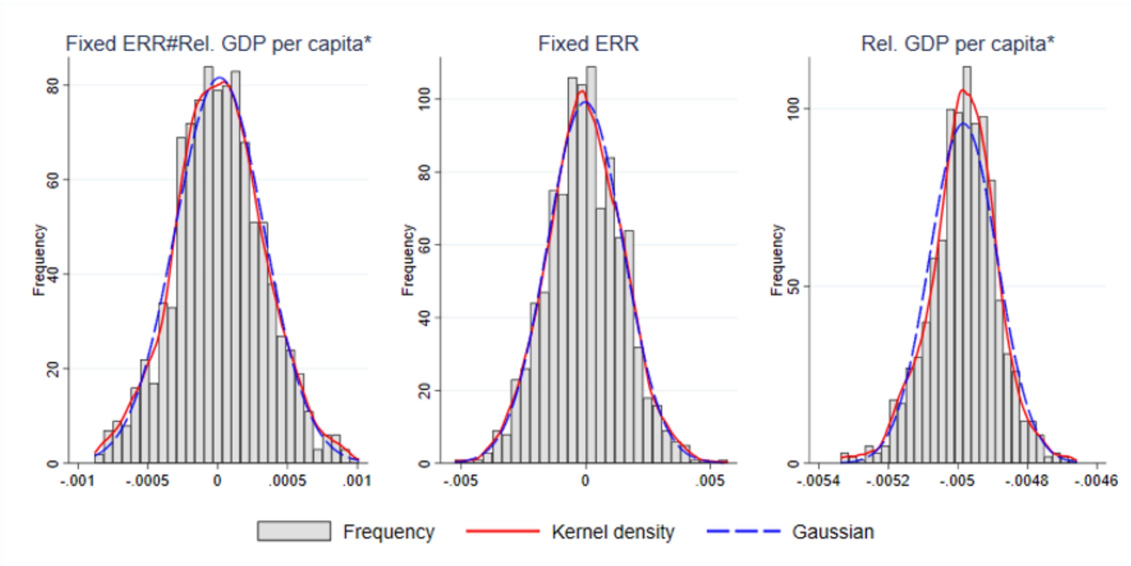


Figure B.1.3 — Robustness checks: data issues — ERR placebo tests

Notes: Displayed are the coefficients' distributions from the Monte Carlo permutations of the exchange rate regime variable (1000 replications). Each replication considers a placebo exchange rate regime variable obtained through permutations of the original data. The simulations are performed considering the models with all control variables.
* (Relative) GDP —off natural resource rents— per capita

Table B.1.3 — Robustness checks: Gravity model — dealing with extreme observations

	Excluding China	Winsorizing 5%	Trimming 5%
	(B.1.3.1)	(B.1.3.2)	(B.1.3.3)
ERR	0.008	0.007	0.008
	(0.004)**	(0.003)**	(0.003)**
	[0.005]	[0.005]	[0.005]*
	{0.007}	{0.007}	{0.007}
Relative GDPpc [a]	-0.004	-0.004	-0.005
	(0.001)***	(0.001)***	(0.001)***
	[0.002]***	[0.002]***	[0.002]***
	{0.002}**	{0.002}**	{0.002}**
ERR × Relative GDPpc [a]	-0.002	-0.002	-0.002
	(0.001)***	(0.001)***	(0.001)***
	[0.001]**	[0.001]**	[0.001]**
	{0.001}*	{0.001}*	{0.001}*
Relative GDPpc squared [a,b]	4.311	4.265	4.703
	(1.016)***	(1.009)***	(0.762)***
	[1.266]***	[1.257]***	[1.042]***
	{1.441}***	{1.450}***	{1.431}***
RTAs	0.007	0.009	0.008
	(0.004)*	(0.004)**	(0.004)**
	[0.008]	[0.007]	[0.007]
	{0.014}	{0.013}	{0.013}
Constant	-0.344	-0.342	-0.332
	(0.003)***	(0.003)***	(0.003)***
	[0.005]***	[0.005]***	[0.005]***
	{0.007}***	{0.007}***	{0.007}***
Observations	340,695	347,172	338,44
Pseudo-Rsquared	0.105	0.106	0.0959

Notes: The dependent variable is the share of country i manufacturing imports in total imports from partner j in year t. For the winsorization and trimming of the data we consider the top and lowest 2.5%. All the estimations include exporter-time, importer-time, and (directional) country pair fixed effects. For presentation purposes, estimates of all fixed effects are not reported. Robust standard errors (Huber-White) are reported in parentheses. Standard errors adjusted for clustering at the —directional— country pair level are reported in brackets. Standard errors clustered by exporter, importer, and year are reported in curly brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
a: GDP off natural resource rents per capita
b: rescaled to 10^{-5}

B.2. What about manufacturing employment share?

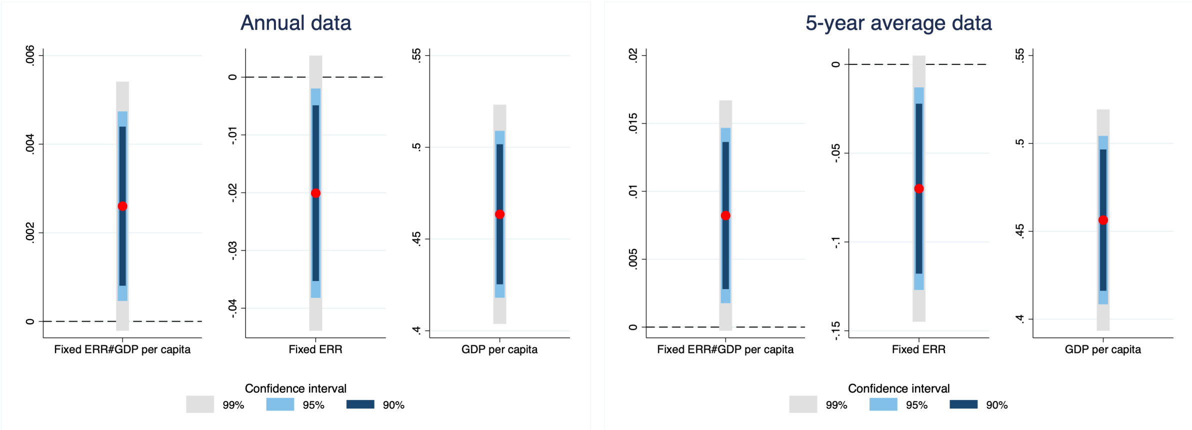


Figure B.2 — Basic evidence for manufacturing employment share

Notes: The dependent variable is the manufacturing employment share. The plots are based on estimations of specification (1) in Kruse et al. (2022) —i.e., controlling for income and population size (both level and squared values), country fixed effects and period (decades) dummies— augmented with the exchange rate regime variable and its interaction with the GDP per capita. For presentation purpose, we do not report estimates associated with the population size, country fixed effects and decade dummies. Excluding the exchange rate regime variable, the data and sample are those of Kruse et al. (2022). Statistical inferences based on HAC and cross-sectional dependence robust standard errors (Driscoll and Kraay).