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Manufacturing and the real exchange rate: natural resource rents matter when measuring misalignments

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ABSTRACT

We analyse the relationship between the share of manufacturing in GDP and real exchange rate misalignments based on the purchasing power parity criterion (PPP) and a sample of 102 developing and transition economies (2003–2019). In a departure from usual practice, we subtract natural resource rents from GDP in order to correct misalignments for the productivity bias. A dynamic threshold panel model is used and we separate out the impact of undervaluation and overvaluation components in the same regression. Overvaluation has a negative linear effect, while undervaluation stimulates the manufacturing sector in a non-linear way. Above an 18% threshold, the marginal effect of undervaluation diminishes.

KEYWORDS

Real exchange rate; linearity; overvaluation; undervaluation; manufacturing sector

JEL CLASSIFICATION

F63; O14; O50; O25

I. Introduction

Premature deindustrialization is a major concern for many aspiring emerging countries (Cadot et al. 2016; Rodrik 2016). First, employing a fast-growing workforce is a challenge, and jobs that improve living standards are in manufacturing and some related tertiary activities (De Vries, Timmer, and de Vries 2015). Second, in the international catching-up process, manufacturing is a source of absolute convergence, whereas convergence in other sectors is predetermined by the national economic and institutional environment (Rodrik 2013). Third, the manufacturing sector disseminates technical progress more easily through backward and forward interactions (McMillan, Rodrik, and Verduzco-Gallo 2014; Rodrik 2009). Last but not least, the income elasticity of demand is higher for manufacturing than for primary products (Prebisch 1950). These arguments justify focusing on this deindustrialization movement, and more specifically on the role that exchange rates can play in breaking it in developing and transition economies.

Real exchange rate adjustments provide an incentive to stimulate the production of tradable goods, and can be an effective policy instrument for the realignment of the manufacturing/GDP ratio with that posted by high-income countries during their own development process. Recent literature suggests that while overvaluation penalizes the production of tradables, a deliberately undervalued exchange rate could improve welfare and prospects for structural change. This latter prediction applies in particular to developing and transition economies suffering from both market failures and institutional weaknesses (Guzman, Ocampo, and Stiglitz 2018; Rodrik 1986, 2008). However, there is no broad consensus regarding the effectiveness of this variable, and no clear-cut result regarding the presence of an asymmetry and/or linearity effect of misalignments in the explanation of economic performance.

We explore the role played by real exchange rate misalignments in the share of manufacturing value-added in GDP by testing asymmetric and/or non-linear impacts. An unbalanced panel of 102 countries is considered over the 2003–2019 period (see Appendix 1). Our contribution to the literature is twofold: in the way we model the share of manufacturing and in the measurement of real exchange rate misalignments. First, the non-linearity of misalignments is investigated using an estimation method based on an extension of the dynamic panel threshold model developed by

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Kremer, Bick, and Nautz (2013). Our methodological approach is original in terms of the possibility of having separate currency undervaluation and overvaluation thresholds in the same regression. We also adapt the Hansen (1999) non-standard bootstrapping test to investigate the presence of non-linearities and their impact. Threshold effects are then estimated in anticipation of the detection of non-monotonic phenomena for the components of real exchange rate misalignment. Second, we take the absolute purchasing power parity (PPP) criterion to calculate misalignments taking into account the misleading impact of natural resource rents from oil, natural gas, coal, mineral and forest products. Rents give rise to the overestimation of average domestic productivity as proxied by per capita GDP. This overestimation distorts the measurement of misalignments adjusted for the Balassa Samuelson productivity bias and thereby incentives to produce manufactured goods.

Our estimation of dynamic panel threshold regressions determines the influence of misalignment components, i.e. the impact of undervaluation (*Under)* and overvaluation (*Over)* on the ratio of manufacturing value-added to GDP. The effect of these respective variables is controlled for a set of covariates. The empirical results confirm the presence of asymmetries. *Over* is a major obstacle to an increase in the share of manufacturing while *Under* is a driver, but in a non-linear way. Above the 18% threshold, the marginal coefficient of *Under* is almost halved. Results prove robust to an alternative definition of exchange rate misalignments in which we measure heterogeneity in tradable price changes, i.e. variations in the terms of trade. The threshold and coefficient of the *Under* variable change only marginally in the explanation of the share of manufacturing. In a second robustness check, we revert to the standard measurement of misalignments with natural resource rents retained in the level of GDP. The threshold for the *Under* variable then rises to 33%, and the coefficient becomes curiously negative above that. We interpret this result as a justification for eliminating rents from GDP.

The rest of the paper is organized as follows. Section 2 discusses the evolution of the share of manufacturing over the development process and the effects that can be expected from real exchange rate misalignments. These misalignments are derived from the ratio of the purchasing power parity (PPP) conversion factor to the official exchange rate. The ratio is adjusted for the international productivity bias. Section 3 discusses how misalignments are calculated and the dynamic threshold panel models that we specify with a threshold for the *Unde*r and *Over* variables in the same regression. Section 4 comments on our empirical results. Section 5 presents some robustness checks. Section 6 summarizes and draws some conclusions for economic policy.

II. Determinants of the share of manufacturing and the role of exchange rate misalignments

Empirical studies focusing on explaining the share of manufacturing in GDP are still few and far between, although most countries have undergone a deindustrialization process. Africa as a whole illustrates this shift. In 2010, the share of manufacturing in GDP was around 10% compared with 15% in 1975 (Rodrik 2016), a far cry from what Ellis (2002) described as the sector's "golden age" (1960–1975). Developments were just as marked in Asia and Latin America, in contrast to Lewis's (1954) predictive normative scheme. This phenomenon affected both value-added and manufacturing employment (McMillan and Rodrik 2011). China and India's impressive, sustained economic growth constituted a major competitive shock that impacted on the development of this sectoral contraction. Developing and transition economies also suffered from their own structural adjustment policies in a context of global trade liberalization. Changes in the real exchange rate were generally insufficient to offset the impact of lower tariffs and trade barriers and the weakness of public institutions. In other words, the domestic production context made it hard to implement the Schumpeterian paradigm of 'creative destruction'. Job losses in the manufacturing sector drove shifts to low-productivity undertakings in agriculture and informal services (De Vries, Timmer, and de Vries 2015).

In our literature review of the potential determinants of the share of manufacturing, we obviously pay particular attention to the expected role of currency misalignments. In his seminal article, Rodrik (2008) finds for a set of predetermined ranges of misalignment rates that the marginal effects of undervaluation and overvaluation are similar and stable with respectively a positive and negative impact on the considered economic performance indicators. Over and above this review of the variable of interest, we focus on structural and economic policy factors that may together help explain the share of manufacturing.

Currency misalignment and manufactured goods

What does the applied literature tell us about exchange rate misalignments (Hinkle and Montiel 1999)? The econometric focus is generally on their effect on GDP or export growth. The misalignment criterion we refer to here is the result of deviations from the principle of purchasing power parity (PPP), which can be considered to reflect competitiveness via relative unit production costs.

Whatever the performance variable considered, there is a fairly broad consensus that overvaluation reduces collective well-being, even though moderate rates may have minor negative impacts (Easterly 2005; Razin and Collins 1997). Rapetti (2016) and the literature on Dutch disease highlight this phenomenon of crowding out manufactured goods, particularly those subject to increasing returns to scale and learning-by-doing externalities (e.g. Baldwin and Krugman 1989; Van Wijnbergen 1984). A high rate of overvaluation sends out the wrong price signals. It generally restricts convertibility, and creates currency shortages and a parallel foreign exchange market. Companies anticipating uncertain access to imported intermediate goods have to build up abnormal inventories, which increases production costs. Unlike the work on overvaluation, which is fairly consensual save with respect to the real economic cost of low rates, the relevance of discretionary undervaluation is more debated.

Starting with the positive arguments, in an environment of strong international competition, appropriate incentives are needed to ensure that the manufacturing sector drives structural transformation. An active exchange rate policy can contribute to this. Rodrik (2008) points up the advantages of an undervalued currency. To the extent that the variation in the relative internal price is sustainable, it supports the production of tradables by reducing the market failures and institutional weaknesses that disproportionately affect them. Undervaluation is tantamount to subsidizing the value-added of tradables. It instantly improves their profitability and, unlike public subsidies, the effectiveness of this support is not conditional on the availability of public funds (Rodrik 2016). Méon and Sekkat (2008) highlight the relationship between institutional weaknesses and currency undervaluation by pointing out that sophisticated goods are more intensive in contractual arrangements than primary goods, and more exposed to the problem of enforcement and ensuing costly legal procedures. Undervaluation mitigates these abnormal costs, which are akin to an implicit tax on the production of manufactured goods.

Price distortions favour the production of non-tradables. Assuming that demand in this sector is only weakly price-elastic, the absence of international competition enables costs to be passed on to local consumers and profit margins to be maintained. Since it is impossible to remedy every single market failure, undervaluation is a second-best solution for correcting these distortions. This obviously implies the absence of retaliation by the international community, i.e. a beggar-thy-neighbour policy comparable to that which prevailed in the 1930s. A competitive real exchange rate can be seen as a component of horizontal industrial policies, that is to say an instrument creating no distortion among tradables. It is not subject to the lobbying activities that are a shortcoming of public choice in vertical industrial policy design. This problem is well known when supported companies or industries are too narrowly targeted (cherry-picking), sometimes to defend private interests that conflict with collective well-being.

Rodrik's seminal article (Rodrik 2008) considers a panel of 11 five-year periods for 188 countries over the 1950–2004 period. Undervaluation has a positive impact on both economic growth and the share of industry in GDP. A 50% undervaluation is estimated to raise this share by 1.2% points. There is no statistical evidence for some undervaluation thresholds, which means that linearity is not rejected and that *Under* stimulates structural transformation just as much as *Over* slows it down.

Berg and Miao (2010) share this conclusion and reject neither the linearity hypothesis nor the invariant coefficient for *Under* and *Over*. Elbadawi, Kaltani, and Soto (2012) use panel data for 83 countries over the 1980–2004 period. They show that a one standard deviation change in misalignment leads to a loss of economic growth of around 1.1% points. They also point out that *Over* negatively affects structural change, and potentially the share of manufacturing, while *Under* facilitates it. Rapetti, Skott, and Razmi (2012) take a similar line, showing that a competitive exchange rate effectively stimulates structural change by increasing the profitability of labour-intensive tradables, including in manufacturing. Their results support Rodrik's findings, with a positive effect of undervaluation remaining for countries with per capita GDP between $9,000 and $15,000. Guzman, Ocampo, and Stiglitz (2018) also argue that a stable, competitive real exchange rate encourages the production of tradables, discoveries and learning processes in the uncertain environment of fixed and sunk costs associated with the production of manufactured goods. Active use of the real exchange rate instrument limits the need for public financial support. This is an important consideration for most developing countries where the opportunity cost of public funds is high. It also protects against the potential drawbacks of discretionary industrial policies in situations where bureaucrats are ill-informed or corrupt.

The abovementioned arguments come up against more critical literature on undervaluation and its economic consequences. In Subramanian, Ostry, and Johnson (2007), *Under* is found to be much less important than overvaluation. The analyses conducted by Galvarriato and Williamson (2008) are not totally conclusive for Latin American countries in the post-1870 period. They show that an incentive price ratio for tradables supported industrialization in Brazil and Mexico, but failed to achieve this objective in Argentina, Chile and Colombia. Levy-Yeyati, Sturzenegger, and Gluzmann (2013) and Glüzmann, Levy-Yeyati, and Sturzenegger (2012) emphasize the income redistribution effect of undervaluation from poor to rich households and from wage earners to companies. The authors take up the contractionary devaluation hypothesis for a closed economy (Díaz Alejandro 1981). Income redistribution can have the effect of reducing the level of aggregate demand. In this case, manufacturing output may fall if the drop in local demand is not offset by exports. Schröder (2013) also argues that undervaluation based on relative price criteria would not boost economic performance. The best real exchange rate management strategy would be to maintain the rate at its equilibrium level. This brings the author into line with neoclassical recommendations and the requirements of international cooperation. Couharde and Sallenave (2013) are less categorical in their empirical analysis of a sample of developed and emerging countries over the 1980–2009 period. Undervaluation has an incentive effect on tradables, but this positive effect is not without its limits. The panel smooth transition regressions they use show that above a threshold estimated at 25.9%, undervaluation would have contractionary effects on domestic production. The conclusion then conflicts with linearity hypothesis posited by Rodrik (2008), and confirms in part the doubts of the new structuralist school regarding a policy that would support sharp currency depreciation.

Structural determinants of the share of manufacturing

Some of the most influential development economics pioneers have documented normal long-term changes in the sectoral components of GDP. In the two-sector economy studied by Arrelano and Bovet (1995), inter-sectoral labour mobility is driven by productivity differentials. Low productivity in agriculture drives internal mobility by the working populationa to manufacturing activities where capital intensity is higher. Supply side changes are accompanied by changes in the composition of domestic demand. Higher income levels encourage consumpation of manufactured goods processed in urban areas. At an advanced level of development, a new intersectoral shift takes place, this time raising the share of services. Therefore, the relation over time between the share of manufacturing and per capita GDP takes the form of an inverted U-shape curve. Based on these long-run stylized facts, Chenery and Syrquin (1975), and Syrquin (1988) hypothesize this quadratic relation and round out their econometric specification with a set of structural determinants reflecting the economic impact of physical geography. In so doing, they draw attention to population size. Large domestic markets increase productive efficiency by increasing the intensity of competition. They also provide technological advantages by means of economies of scale that reduce the effect of the indivisibilities of investments and sunk costs in both production and trade.

Chenery and Syrquin (1975) were the first authors to focus on the economic impact of these factors in an international cross-section study. They assume that, once structural and geographical determinants have been taken into account, deviations from the regression line, i.e. regression residuals for the manufacturing industry share, reflect the impact of political variables. Today, such a methodological approach is obviously open to criticism. Over and above the potential endogeneity of some variables, which is not considered, the cross-sectional nature of the estimation means that there is no omission of specific national factors. In other words, regression residuals can be arbitrarily assigned to economic policy variables. A more adequate method of econometric estimation is obviously to specify the model with all the relevant regressors, preferably in a panel data analysis. The empirical estimates proposed later in this article are based on this approach.

Additional policy covariates of the share of manufacturing

The quality of institutions conditions human interactions and transaction costs. Weak institutions put a brake on structural change (North 1991). Effective rules, on the other hand, encourage trust, which is the "lubricant of a social system" (Arrow 1974). Acemoglu and Robinson (2012) point up that leaders and elites create 'extractive institutions' which undermine the production of tradables, including in the manufacturing sector, which requires higher levels of investment, with depreciation schedules extending over longer periods than agricultural activities. Costs lower profitability in an environment of competitive pressure. The authors argue that institutional quality accounts for as much as 75% of the variation in income levels around the world (Acemoglu et al. 2019). A business-friendly environment is created by a combination of political stability and inclusiveness, the rule of law and absence of violence, and a transparent and accountable government committed to rolling back public sector corruption. Good governance reduces transaction costs and uncertainty, and therefore the risks associated with capitalist investments with a long-term profitability profile, as is the case for manufactured production. The World Bank's Worldwide Governance Indicators (WGI) provide a set of six measures reflecting the quality of public governance. A composite index based on a principal component analysis (PCA) is considered in the estimation of our empirical model to manage the existing multicollinearity between individual components.

The impact of Foreign Direct Investment (FDI) is hard to determine accurately because it is conditional on the investment sector (Ocampo, Spiegel and Stiglitz 2008). In natural-resource-rich countries, FDI in this sector may hamper the production of manufactured goods, in keeping with the Dutch disease theory and the natural resource curse. On the other hand, FDI in manufacturing would be expected to bolster the sector due to foreign firms' technological and organizational expertise, with potential spin-offs for domestic firms. To avoid the ambiguity of the effect, rather than considering the ratio of total FDI flows to GDP, we focus on FDI in the manufacturing sector as provided by the *Financial Times' FDI Markets* database.

III. Misalignments adjusted for rents and the dynamic system GMM estimator with threshold effects

Natural resource rents and their effect

A high percentage of natural resource rents in GDP influences the share of manufacturing in a number of ways. Firstly, if the raw materials associated with these rents are not processed locally, they automatically inflate the level of GDP, but reduce the share of manufacturing industries. Natural resource rents represent more than 20% of GDP in a dozen countries in our sample (Appendix 4). Secondly, the domestic distribution of these rents also matters and plays out in different ways. When the economy's permanent income level is high because of them, then wages and the prices of non-tradables are also high. These high levels reduce the competitiveness of non-traditional goods and generally crowd out manufacturing goods. An alternative scenario is when natural resources rents fuel domestic undervaluation by subsidizing non-tradables. This phenomenon can be seen in developing countries exporting oil and gas.

As Eifert, Gelb, and Tallroth (2003) point out, just as political traditions determine the use of oil revenues, revenues themselves determine the political economy of oil-exporting countries. Elites in resource-rich countries often invest less in infrastructure and directly productive activities. They strive to appropriate the rents and distribute part of them to the population in order to preserve the stability of their political power (Van der Ploeg 2011). One way of implementing this strategy is to subsidize current consumption. Such a policy lowers the retail price of the consumer goods that account for a significant proportion of urban household budgets: foodstuffs, gas or light fuel-oil, public transport and social housing. A lower general price level can raise the share of the manufacturing industry. Yet, the flipside of this is the "resource curse". Many oil-, gas- and mineral-rich countries are authoritarian and domestically conflict-prone. Officials are reluctant to promote transparency with respect to the large revenues collected, and economic elites are rent-seeking, investing less in the sector exposed to international competition. Resource rents thus become a curse. Distorted domestic prices and weak institutions discourage risky investment in tradables, primarily export-oriented manufacturing. As a result, cronyism and the political economy rule out any incentive to invest in activities that promote a long-term, sustainable structural change in the productive base (Schwab and Werker 2018).

It is easy to control for these effects on the share of the manufacturing industry by introducing an explanatory variable reflecting the percentage of resource rents in GDP. All other things being equal, a higher percentage of rents automatically lowers the share of the manufacturing industry. However, there is also a more indirect impact through productivity levels. Resource rents increase permanent per capita GDP, which no longer reflects the real productivity of non-traditional tradables, those exposed to international competition.

We derive yearly real exchange rate (RER) misalignments from the absolute PPP criterion corrected for the Balassa (1964)-Samuelson (1964) effect. Before adjusting for productivity level, natural resource rents (*NRR*) are subtracted from GDP ($Per\ capita\ GDP_{NRR}$) (2). For a country i, the consolidated share of rents (θ_i) is taken from the World Bank's WDIs (3 and 4). The international convergence of productivity in tradables drives the long-run convergence of the price of non-tradables. We calculate misalignments from a long-run relationship (5) by considering a larger sample of countries than ours covering all per capita development levels. We define the RER as the ratio of the PPP conversion factor (i.e. the dollar exchange rate that enables the same amount of goods to be purchased in a given country as in the United States) to the official exchange rate for the US dollar (ER). This RER is then regressed on the per capita GDP level. In regression (5), f_t is a year fixed effect andα the constant. Misalignments, hereinafter MIS_{NRR} (6) are captured by the regression residuals of (5), where $u_{it} < 0$ refers to the percentage of *Under* and $u_{it} > 0$ to *Over*.

For country i at time t, MIS_{NRR} are calculated as follows:

$$RER_{it} = \frac{PPP_{it}}{ER_{it}} \tag{1}$$

$$(Per\ capita\ GDP_{NRR}) = (1 - \theta_i) Per\ capita\ GDP \tag{2}$$

$$\theta_i = \sum_{k=1}^{5} [(P_k - CM_{ik})\mu_{ik}] \tag{3}$$

$$\text{with } \mu_{ik} = Q_{ik}/GDP_{it} \tag{4}$$

$\theta_i\, \varepsilon\, [0, 1]$ is the difference between the world price for product k (P_k) and the related unit cost of production (CM_{ik}) weighted by the relative importance of product k in total rents (μ_{ik}).

$$\log(RER)_{it} = \alpha + \beta \log(Per\ capita\ GDP_{NRR})_{it} + f_t + u_{it} \quad (5)$$

$$MIS_{NRRit} = \log(RER)_{it} - \log\widehat{(RER)}_{it} \quad (6)$$

The dynamic SGMM estimator and threshold effects

First, we test for the presence of an asymmetry in misalignment by hypothesizing that *Under* and *Over* may have different impacts on the share of manufacturing in GDP, hereinafter referred to as *Manufsh*.[1]

$$Manufsh_{it} = \alpha + \rho Manufsh_{it-1} + \eta_1 Under_{it} + \eta_2 Over_{it} + \delta_1' X_{1it} + \delta_2' X_{2it} + \mu_i + \tau_t + v_{it} \quad (7)$$

In Equation (7), X is a vector encompassing endogenous (X_1) and exogenous (X_2) controls. μ_i and τ_t represent regional and time fixed effects, respectively, and v_{it} is the usual random error term. We estimate the equation using the dynamic system GMM estimator (Blundell and Bond 1998). We identify endogenous variables using the Hausman-Wu test. Second, we hypothesize that the impact of *Under* and *Over* may be non-linear using a Hansen (2000)-type estimator that prevents arbitrariness in the choice of ad hoc thresholds. In Equation (9), we rewrite Equation (10) with two threshold variables and two threshold parameters:

$$\begin{aligned} Manufsh_{it} = \alpha &+ \rho Manufsh_{it-1} \\ &+ \eta_{10} I(Under_{it} > \gamma_1) \\ &+ \eta_{1L} Under_{it} I(Under_{it} \le \gamma_1) \\ &+ \eta_{1H} Under_{it} I(Under_{it} > \gamma_1) \\ &+ \eta_{20} I(Over_{it} > \gamma_2) \\ &+ \eta_{2L} Over_{it} I(Over_{it} \le \gamma_2) \\ &+ \eta_{2H} Over_{it} I(Over_{it} > \gamma_2) + \delta_1' X_{1it} \\ &+ \delta_2' X_{2it} + \mu_i + \tau_t + v_{it} \end{aligned} \quad (8)$$

I (.) is the indicator function. It takes the value 1 if the argument in parenthesis holds and 0 otherwise. Parameter γ_1 indicates that when *Under* is below threshold γ_1, its impact on the share of manufacturing activities is η_{1L}. The marginal effect is η_{1H} when undervaluation is above that threshold. Both threshold parameter γ_2 and the impact of *Over* are interpreted similarly. *Over* and *Under* are both threshold variables and regime-dependent variables. The dynamic panel threshold model includes specific regime dummies for intercepts $I(Under_{it} > \gamma_1)$ and $I(Over_{it} > \gamma_2)$. Omitting these regime dummies may introduce a bias for both the parameter estimates and the thresholds (Bick 2010). To estimate Equation (8), we extend static panel threshold model developed by Hansen (1999) by adapting the dynamic panel data specification proposed by Kremer, Bick, and Nautz (2013).[2] Dang, Kim, and Shin (2012, 2014), Asimakopoulos and Karavias (2016), and Law et al. (2021) use a similar estimation procedure. Our dynamic model differs from that proposed by Kremer, Bick, and Nautz (2013) in two ways. First, we account for two endogenous threshold variables (*Under, Over*). Second, the two threshold variables are also endogenous. Before estimating Equation (8), let's start by considering the particular case where the two threshold levels are known, γ_1^* and γ_2^*. In this case, Equation (8) belongs to the standard dynamic panel data models that are estimated using the GMM type estimators including the GMM system (Blundell and Bond 1998).

In a first step, the endogenous threshold variables are regressed on their instruments, i.e. the lagged values of *Under* and *Over* plus the set of exogenous variables (matrix X_2). Predicted values are then calculated ($\hat{Under}$, $\hat{Over}$). A grid search procedure is used taken from an adaptation of the methodology proposed by Hansen (1999). We run system-GMM (SGMM) estimations and calculate the resulting sum of squared residuals $S(\gamma_1, \gamma_2)$for each value of $\gamma_1' s$ and $\gamma_2' s$ in the subset of the support of each threshold variable $\hat{Under}$ and

[1] *Under* is negative. A higher level of undervaluation results in a decrease in the ratio when, or an increase if $\eta_1 > 0$. To facilitate the interpretation of coefficient , the absolute value of the misalignment is considered. When undervaluation increases in absolute terms, a positive sign of means that undervaluation bolsters the ratio while the effect is adverse when .

[2] These authors extend the GMM estimation technique to the dynamic panel threshold models. They also consider endogeneity on a subset of explanatory regressors, but not threshold variables. Seo and Shin (2016) consider the endogeneity of the threshold variable. In these two studies, there is only one threshold variable.

$\hat{O}ver$.[3] The selected thresholds $\hat{\gamma} = (\hat{\gamma}_1, \hat{\gamma}_2)$ are those providing the smallest sum of squared residuals $S(\gamma_1, \gamma_2)$. Once estimated, $\hat{\gamma}_1, \hat{\gamma}_2$, are substituted for γ_1, γ_2 in Equation (9), which is estimated by the SGMM estimator. We also use two cut-off points, at 10% and 90%, to prevent extreme values from determining the thresholds (Hansen 1999). To maintain the uncorrelatedness of the errors, we use the forward orthogonal observation transformation as suggested by Arellano and Bond (1991), Arellano and Bover (1995). Kremer, Bick, and Nautz (2013), Osei and Kim (2020), and Law et al. (2021) also estimate their dynamic panel threshold models similarly to ensure that the error terms are not correlated.

To sum up, our estimator combines the SGMM estimator and the threshold model developed by Hansen (1999). Once estimated, a number of hypotheses are considered regarding the model's coefficients for the two regime-dependent variables. Specifically, the null hypotheses, which can be tested for Equation (8) are:

(i) No threshold effect on currency misalignment, *Under* and *Over*: $\eta_{10} = 0, \eta_{1L} = \eta_{1H}$, $\eta_{20} = 0, \eta_{2L} = \eta_{2H}$
(ii) A single threshold effect for *Under* only: $\eta_{20} = 0, \eta_{2L} = \eta_{2H}$
(iii) A single threshold effect for *Over* only: $\eta_{10} = 0, \eta_{1L} = \eta_{1H}$

These linear assumptions are tested by conducting a bootstrap-type test. Hansen (1999) proposes a procedure to simulate the asymptotic distribution of the test. In keeping with Seo and Shin (2016) and Dang, Kim, and Shin (2012, 2014), we adapt this procedure for our dynamic panel threshold regression and the three hypothesis tests using the following four steps. The null hypothesis is rewritten in its matrix form where R is a matrix of linear restrictions and $\theta$the parameters to be tested:

$$H_0 : R\theta = 0 \tag{9}$$

Step 1: Based on the data sample, let $\hat{\theta}(\widehat{\gamma})$ denote the GMM parameter estimates of Equation (9) under the alternative and the corresponding residuals, $\hat{\varepsilon}_{it}(\widehat{\gamma})$. Calculate the Wald test statistics:[4]

$$\Phi(\hat{\gamma}) = \left[R\hat{\theta}(\hat{\gamma})\right]' \left[R\widehat{Var(\hat{\theta}(\hat{\gamma}))}R'\right]^{-1} \left[R\hat{\theta}(\hat{\gamma})\right] \tag{10}$$

Step 2: Select a random draw in the residual's distribution $\hat{\varepsilon}_{it}(\widehat{\gamma})$, and for each j-th bootstrapped residual (sampling with replacement) denoted $\hat{\varepsilon}_{it}{}^{(j)}$, use these errors to generate a bootstrapped sample under H0. For example, for test (j) the corresponding equation used under H0 is:

$$\begin{aligned} Manufsh^{(j)}{}_{it} = \hat{\alpha} + \hat{\rho}\ Manufsh^{(j)}{}_{i,t-1} + \hat{\eta}_1 Under_{it} \\ + \hat{\eta}_2 Over_{it} + \widehat{\delta'_1} X_{1it} + \widehat{\delta'_2} X_{2it} \\ + \hat{\varepsilon}_{it}{}^{(j)},\ j = 1,., B \end{aligned} \tag{11}$$

The estimated coefficients $\hat{\theta} = (\hat{\alpha}, \hat{\rho}, \hat{\eta}_1, \hat{\eta}_2, \widehat{\delta'_1}, \widehat{\delta'_2})$ are those obtained from Step 1. Given the nature of the dynamic model, we treat in each replication j the initial conditions as given by $Manufsh^{(j)}{}_{i1} = Manufsh_{i1}$ and $Manufsh^{(j)}{}_{i2} = Manufsh_{i2}$ (Dang, Kim, and Shin 2012). Finally, B = 1000 is the total number of replications.

Step 3: Using the bootstrapped sample generated in Step 2, estimate the model under the alternative and calculate the Wald statistics, denoted $\Phi(\widehat{\gamma})^{(j)}$, using Equation (10).

Step 4: Repeat steps 2–4 B times and calculate the bootstrap p-value by the frequency that the simulated statistic $\Phi(\widehat{\gamma})^{(j)}$ exceeds the actual one $\Phi(\widehat{\gamma})$.

IV. Econometric analysis and comments

The empirical sample

We cover the 2003–2019 period. Although statistical data is available up to 2021, the last two years

[3]Estimation results may be sensitive to the number of instruments, which might exceed the number of countries and cause overfitting (see Roodman 2009). To reduce the number of instruments, the collapse option was used whenever the GMM estimator was employed. The Windmeijer small sample correction was not used as it is not clear whether it extends to non-linear GMM as in our case.

[4]Hansen (1999) proposes a likelihood ratio test requiring the estimation of the model under both the null and the alternative. Seo and Shin (2016) use a Wald test calling for the estimation of the model under the alternative only. This last test is more appealing in our case since the GMM-system estimation method is time consuming. The Wald test is therefore more appropriate.

were severely disrupted by the COVID-19 pandemic and its repercussions. In 2020 and 2021, the lockdowns of almost half the world's population impacted on GDP and its sector breakdown. Manufactured goods were particularly hard hit, as global value chains often use imported intermediate inputs. The other two sectors were less affected. Primary production is dominated by goods largely consumed locally and by non-containerized exports such as gas and oil. In the context of a major transport and logistics shock, low- and middle-income countries – those with the lowest volumes of international trade in manufactured goods – were also hardest hit (Plane 2021). The tertiary sector in developing economies consists mainly of non-tradable goods. Public sector production helped stabilize GDP, as civil servants generally continued to receive their salaries during lockdown. As a result, the COVID-19 pandemic and the transport and logistics shocks affected primarily manufacturing. Moreover, as most countries absorbed these shocks by means of changes to the real exchange rate, the introduction of years 2020 and 2021 would bias the estimation of the normal relationship between the share of manufacturing and levels of misalignment.

The empirical sample comprises 102 developing countries and countries in transition to a market economy in 2003. Although they were all supposed to be targeting industrialization, some were in a process of "early deindustrialization", shifting to services while the share of manufacturing activities remained very low. The list of countries considered was conditioned not only by the availability of statistical data, but also by their size. Countries with a population of less than 1.5 million in 2003 were not included. Most of them were primary or service economies. As trade openness only partially offsets the disadvantages of small population size, most of these countries had no ambition to develop their manufacturing sector. In the history of economic development, it is a fact that very few of them have succeeded in industrializing.

Regression results and comments

We derive MIS_{NRR} from Equation (12), which is run over the 2003–2019 period. The coefficient of *Per capita GDP*$_{NRR}$ is in line with the empirical literature (Elbadawi, Kaltani, and Soto 2012; Rodrik 2008), significant at the 99% confidence level. A 10% increase in per capita income gives rise to a 'normal' long-term appreciation in the RER of about 2.2%. Robust standard errors are in parentheses for a sample of 175 countries at all levels of development, which means we reach far beyond our empirical sample of 102 developing countries (see Appendix 1).[5]

$$\log(RER)_{it} = \underset{(0.03)***}{-2.702} + \underset{(0.004)***}{0.222}\log\left(Per\ capita\ GDP_{NRR)}\right)_{it} \tag{12}$$

$$R^2 = 0.505, \text{Observations} = 4393, \text{Countries} = 175,$$
$$\text{Year fixed effects} = \text{Yes}.$$

Let's start by testing the exogeneity of the explanatory variables. Population size aside, all of the covariates of Manufsh can be suspected of endogeneity. The Durbin Hausman Wu (DHW) test confirms this for both MIS_{NRR} and the FDI ratio (Table 1).

We hypothesize distinct thresholds for *Under* and *Over* in the same regression. Linearity is tested by the Wald bootstrap test, which rejects the

Table 1. The Durbin-Wu-Hausman, DHW test for endogeneity (2003–2019).

Pair of variables	Quality of Instruments Fisher Tests	*P*-value of DHW tests	Conclusion
Manufsh vs. MIS_{NRR}	F(11, 1374) = 92.18***	0.000	Endogenous
Manufsh vs. FDI	F(11, 1374) = 4.58***	0.000	Endogenous
Manufsh vs. Institutions	F(11, 1374) = 68.87***	0.421	Exogenous
Manufsh vs. ln per capita GDP	F(11, 1374) = 335.45***	0.417	Exogenous

Mis NRR: Exchange rate misalignments calculated as a 3-year moving average after adjusting Per capita GDP for the impact of natural resource rents (NRR). Institutions is the composite index of WGI components. It is calculated with the first axis of the Principal Component Analysis.

[5]*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2. Tests of threshold effects on misalignment components (2003–2019), (MIS NRR is corrected for per capita GDP excluding natural resource rents).

Null assumption	Restrictions	*p*-value
No threshold effects on *Under* and *Over*	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}, \eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.078
Threshold effect on *Under* only	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}$	0.026
Threshold effect on *Over* only	$\eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.780

p-value is the rejection probability for the bootstrapped Wald test, the number of replications B=1000.

hypothesis of no threshold, and suggests a threshold effect for *Under* only (Table 2). The Table 3 regressions are based on these results.

The estimation procedure we use for the Table 3 regressions combines the extension of the Kremer, Bick, and Nautz (2013) dynamic panel threshold model and the System Generalized Method of Moments with internal and external instruments. Regional dummies and year fixed effects capture unobservable heterogeneity. The reference region is East European countries. The regressions differ only in terms of the dummy variable reflecting the percentage of natural resource rents in GDP. The Roodman (2009) rule of thumb applies. The number of instruments is smaller than the number of countries to capture the efficiency/bias trade-off in finite samples. Although there is no clearly defined p-value threshold for the over-identification restrictions test, our standard Hansen statistic is well above the threshold of concern.

Let's briefly discuss the impact of covariates before moving on to more substantive comments regarding *Over* and *Under*. For these two variables of interest, a three-year moving average is used to prevent exchange rate volatility blurring the effect on the manufacturing/GDP ratio. The coefficient of the lagged dependent shows that the model is subject to a strong inertia phenomenon. The quadratic relation of Per capita GDP is rejected. The composition of the sample, which excludes high-income countries where a substitution effect over time is expected to occur between the share of manufacturing and services, contributes to this result. The ratio of FDI in the manufacturing sector is never statistically significant, unlike the quality of institutions as measured by the World Governance Indicators. Note, however, that the institutions coefficient and its statistical significance weaken when the specification includes the percentage of natural resource rents. The higher the percentage of the rents, the lower the quality of the institutions. This negative correlation bears out the "resource curse" hypothesis. "Extractive political institutions" place power in the hands of a few and generate extractive economic institutions with unfair regulations and high barriers to market entry (Acemoglu and Robinson 2012). "Vested interests" prevent producers from reaping the economic benefits of their personal and material investments.

Our results are therefore consistent with the idea that institutional quality is a driver of the long-term development and share of the manufacturing industry. Acemoglu et al. (2019) posit that full democratization would induce a 20% increase in per capita GDP over 30 years, estimated by Rodrik (2016) at 0.6% per year. Depending on whether we consider the instantaneous or long-term effect, a one-standard-deviation variation in WGI increases the share of the manufacturing industry by 0.1 to 1.3% points (regressions 1 and 2, Table 3). It would be interesting to disentangle the impact of this aggregate WGI, to identify the respective role of liberal democracy and market economy. Jha and Zhuang (2014) argue that low-income countries should strive for more effective government, a better quality of regulation and rule of law, adequate provision of essential public services and tighter control of corruption. At this level of development, the functioning of the market economy is important while the political regime also matters at higher income levels when the citizen participation process is more effective. As mentioned earlier, collinearity among components is a major issue for a detailed breakdown. The dummy variables reflecting the percentage of rents present the automatic negative effect we assumed earlier for values of at least 15% and 20%. On average, natural resource rents of at least 15% reduce the share of manufacturing by around three-tenths of a percentage point of GDP.

Let's now take a closer look at the misalignment (MIS_{NRR}) components. To adjust PPP for the Balassa-Samuelson effect, remember that these misalignments are calculated for a larger sample of 175 countries to cover all levels of development. Across our sample of 102 developing and transition countries, the average MIS_{NRR} displays an undervaluation of 9%. This distribution breaks down into an average undervaluation of 22% and an overvaluation of 16% (Appendix 2). We obtain the expected negative effect for *Over*. Based on a variation of one standard deviation, the short-run effect is limited to a loss of 0.1% point in Table 3, but 3.3 (Regression 2) to 3.6 (Regression 1) for the long-run effect. There are 418 country-year-observations in this overvaluation case. With respect to *Under*, the coefficients are fairly stable whatever the regression. Below the 18% threshold, the impact is some 0.25 and 3.3% points respectively for the short- and long-term effects, falling to 0.2 and 2.3 above this threshold. For the 852 observations concerned by *Under* (67%), other things being equal, the effect proves positive and lower in magnitude than for *Over*. We therefore agree with the argument that overvaluation clearly needs to be corrected, but reject neoclassical mantras or "Victorian virtues" (Krugman 1995). Maintaining the PPP exchange rate at its equilibrium level is not the most efficient strategy for stimulating structural change in developing and transition economies. Our empirical results differ from Rodrik (2008) in two respects. Firstly, the impact of *Under* is not found to be the same as

Table 3. Dynamic panel threshold regressions and exchange rate misalignment components (2003–2019 period).

	(1)	(2)	(3)	(4)
Threshold	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$
L.Manufsh	0.925***	0.918***	0.919***	0.909***
	(0.013)	(0.013)	(0.013)	(0.013)
Over	−1.793***	−1.747***	−1.734***	−1.685***
	(0.378)	(0.371)	(0.377)	(0.365)
I(Under$>\gamma_1$)	0.089	0.108	0.140	0.148
	(0.096)	(0.095)	(0.094)	(0.095)
UnderI(Under $\leq \gamma_1$)	1.548**	1.585**	1.542**	1.540**
	(0.756)	(0.741)	(0.772)	(0.759)
UnderI(Under$>\gamma_1$)	1.173***	1.135***	1.126***	1.059***
	(0.293)	(0.312)	(0.310)	(0.309)
FDI	−0.011	−0.008	−0.010	−0.009
	(0.014)	(0.014)	(0.015)	(0.015)
Institutions(PCA)	0.047**	0.039*	0.017	0.027
	(0.020)	(0.021)	(0.023)	(0.024)
Rents10%		−0.096		
		(0.084)		
Rents15%			−0.297***	
			(0.099)	
Rents20%				−0.321***
				(0.089)
LnGDPPC	−0.442	−0.488	−0.714**	−0.499
	(0.359)	(0.332)	(0.329)	(0.374)
$LnGDPPC^2$	0.017	0.022	0.038*	0.025
	(0.022)	(0.020)	(0.020)	(0.022)
LnPOP	0.065*	0.073**	0.057*	0.077**
	(0.035)	(0.034)	(0.034)	(0.035)
Africa	−0.057	−0.042	0.010	−0.031
	(0.098)	(0.108)	(0.108)	(0.111)
Asia	−0.219**	−0.207**	−0.140	−0.126
	(0.087)	(0.094)	(0.099)	(0.102)
Latin America	−0.075	−0.080	−0.073	−0.105
	(0.081)	(0.082)	(0.083)	(0.086)
Constant	2.191	2.222	3.203**	2.088
	(1.725)	(1.605)	(1.592)	(1.811)
No.of observations	1,270	1,270	1,270	1,270
Number of countries	102	102	102	102
Year fixed effects	Yes	Yes	Yes	Yes
#Instruments	85	86	86	86
Ar(1)_Pvalue	0.001	0.002	0.002	0.002
Ar(2)_Pvalue	0.938	0.928	0.933	0.930
Hansen_P−value	0.329	0.324	0.281	0.279

Standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. FDI, and mis components (*Over*, *Under*) are endogenous.

that of *Over*, and secondly, the marginal effect of *Under* is not monotonic. It decreases moderately, and increasingly so, as the percentage of rents in economies increases. This has the side-effect of rendering the institutions coefficient statistically non-significant.[6]

V. Robustness checks

We propose two robustness checks based on alternative measures of misalignments.[7] First, we check whether our empirical conclusions remain valid when the real exchange rate is normalized by the country's productivity level and the external terms of trade. So far, we have assumed that there is only one tradable good. We relax this restrictive assumption by taking into account the price ratio between exports and imports (TOT). This price ratio influences the manufacturing sector's competitiveness through various channels. In a second robustness test, we return to the RER adjusted only for the most standard Balassa Samuelson effect, i.e. natural resource rents maintained in GDP.

Misalignments relaxing the assumption of a single tradable

TOTs are exogenous and represent a potential channel for transmitting a competitiveness shock. Given that the composition of a country's exports differs from that of its imports, the price of tradables is likely to change. A permanent increase in this ratio translates into an appreciation of the RER. If primary exported products are the source of this increase, it pushes up the consumption level and may have a negative impact on manufactured tradables. Indeed, assuming that the income effect dominates the substitution effect, the relative price of non-tradables rises. Another transmission channel is import trade liberalization. A reduction in the level of customs duties or an easing of import quotas leads to a fall in the price of imports and a subsequent rise in the terms of trade. This increase is likely to have a negative effect on the competitiveness of domestic manufactured goods by lowering nominal protection. However, the effect may be beneficial if trade liberalization applies to imported capital and intermediate goods. Reducing tariffs therefore illustrates the Schumpeterian paradigm of "creative destruction" with concrete implications for the manufacturing industry. The augmented RER regression with TOTs is run on the same sample as before and new misalignment levels are obtained. The regression coefficient of TOTs is positive and the per capita GDP coefficient maintains its previous level (13).

$$\log(RER)_{it} = -2.814 + 0.212\log\left(Per\ capita\ GDP_{NRR)}\right)_{it} + 0.0359\log(TOT)_{it}(0.095)***(0.004)***(0.0185)*** \quad (13)$$

$$R^2 = 0.518, \text{Observations} = 3887, \text{Countries} = 175, \text{Year fixed effects} = \text{Yes}.$$

Let's now analyse the relationship between these new misalignments and the dependent variable (Table 4). Hansen's test for over-identifying restrictions is satisfactory and econometric results remain remarkably stable. *Over* keeps its negative impact and linearity is not rejected, whereas it is for *Under* with a threshold effect still maintained at 18%. Again, the coefficient of *Under* is slightly lower than that of *Over* and the marginal effect diminishes above the threshold. Furthermore, note that the percentage of rents remains negatively related to the share of manufacturing, and that their impact increases as before with their contribution to GDP.

Misalignments with no correction of GDP for natural resource rents

The second robustness check is the classic PPP criterion adjusted for the productivity bias with

[6]On page 379, Rodrik (2008) mentions that unlike Álvaro Aguirre and César Calderón, and Ofair Razin and Susan Collins, little evidence is found of non-linearity in the relationship between undervaluation and economic growth.

[7]The use of an alternative econometric technique to the GMM method proves difficult in the context of a dynamic model with endogenous variables of interest that are potentially non-linear. An alternative is to specify the model with a polynomial functional form, for example a quadratic relationship between *Under/Over* and the share of manufacturing. In this case the functional form a priori predetermines the threshold. Table 3 regressions have been rerun considering squared terms of misalignment components and the GMM estimator. *Under* displays an inverted U-shaped impact while the impact proves monotonous and negative for *Over*. These results are fairly close to those obtained in Tables 3 and 4. They are available on request from the authors.

natural resource rents maintained in GDPs (14). Empirical estimates are presented in Table 5.

$$\log(RER)_{it} = -2.714 + 0.220 \log(Per\ capita\ GDP)_{it} \quad (14)$$
$$(0.032)*** \ (0.004)***$$

$$R^2 = 0.477, \text{Observations} = 4398,$$
$$\text{Countries} = 175, \text{Year fixed effects} = \text{Yes}.$$

Once again, the Wald bootstrap test returns a non-linearity effect for *Under* only (Appendix 3). *Over*'s coefficient is slightly lower than in previous regressions, but remains negative. The coefficient of *Under* still reveals a positive incentive for manufacturing, but becomes negative above the 33% threshold, which is nearly twice as high as the previous threshold (18%). A number of reasons can be put forward to explain this humped relationship, which justifies removing natural resource rents from GDP.

First, for low- and middle-income countries, contractionary effects are likely to occur at high undervaluation rates. Take the case of a sharp real currency devaluation. In keeping with structuralist views, domestic demand falls instantaneously with the stabilization effect (Díaz Alejandro 1963, 1981). Given the low quality of products and the cost of redirecting flows to new, unknown foreign markets, it is unlikely that increased exports will quickly offset the loss of domestic demand. Second, some countries above the 33% threshold

Table 4. Dynamic panel threshold regressions and exchange rate misalignment components (misalignments normalized by per capita GDP without rents and TOT, 2003–2019 period).

	(1)	(2)	(3)	(4)
Thresholds	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$	$\hat{\gamma}_1 = 0.18$
L.Manufsh	0.935***	0.926***	0.929***	0.923***
	(0.012)	(0.013)	(0.012)	(0.012)
Over	−1.833***	−1.785***	−1.767***	−1.727***
	(0.424)	(0.413)	(0.417)	(0.407)
$I(Under > \gamma_1)$	0.044	0.060	0.084	0.089
	(0.095)	(0.093)	(0.095)	(0.096)
$UnderI(Under \le \gamma_1)$	1.580*	1.625*	1.611*	1.608*
	(0.850)	(0.835)	(0.851)	(0.837)
$UnderI(Under > \gamma_1)$	1.384***	1.339***	1.351***	1.301***
	(0.362)	(0.382)	(0.375)	(0.376)
FDI	−0.018	−0.013	−0.014	−0.014
	(0.014)	(0.014)	(0.015)	(0.015)
Institutions(PCA)	0.036*	0.035*	0.014	0.021
	(0.019)	(0.020)	(0.022)	(0.022)
Rents10%		−0.052		
		(0.084)		
Rents15%			−0.229**	
			(0.098)	
Rents20%				−0.237***
				(0.084)
LnGDPPC	−0.523	−0.485	−0.669*	−0.548
	(0.365)	(0.349)	(0.344)	(0.370)
$LnGDPPC^2$	0.022	0.021	0.034	0.027
	(0.022)	(0.021)	(0.021)	(0.022)
LnPOP	0.052	0.063*	0.048	0.057
	(0.036)	(0.036)	(0.035)	(0.038)
Africa	0.061	0.053	0.105	0.076
	(0.103)	(0.112)	(0.110)	(0.112)
Asia	−0.190**	−0.179*	−0.125	−0.114
	(0.084)	(0.094)	(0.097)	(0.097)
Latin America	0.005	−0.008	0.005	−0.009
	(0.091)	(0.092)	(0.093)	(0.097)
Constant	2.535	2.230	3.036*	2.442
	(1.725)	(1.643)	(1.623)	(1.770)
No.of observations	1,270	1,270	1,270	1,270
Number of countries	102	102	102	102
Year fixed effects	Yes	Yes	Yes	Yes
#Instruments	79	80	80	80
Ar(1)_Pvalue	0.001	0.001	0.001	0.001
Ar(2)_Pvalue	0.961	0.947	0.954	0.950
Hansen_P−value	0.250	0.250	0.223	0.218

Standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. FDI, *Under*, *Over* and PCA are endogenous variables.

Table 5. Panel threshold regressions: standard misalignment measurement (standard misalignments, normalized by per capita GDP, 2003–2019 period).

	(1)	(2)	(3)	(4)
Thresholds	$\hat{\gamma}_1 = 0.33$	$\hat{\gamma}_1 = 0.33$	$\hat{\gamma}_1 = 0.33$	$\hat{\gamma}_1 = 0.33$
L.Manufsh	0.932***	0.906***	0.909***	0.902***
	(0.014)	(0.017)	(0.016)	(0.017)
Over	−1.598***	−1.628***	−1.633***	−1.469***
	(0.392)	(0.405)	(0.417)	(0.394)
$I(Under > \gamma_1)$	0.839***	0.943***	0.984***	0.965***
	(0.182)	(0.181)	(0.184)	(0.180)
$UnderI(Under \leq \gamma_1)$	0.868**	1.052**	1.121***	1.228***
	(0.413)	(0.432)	(0.423)	(0.431)
$UnderI(Under > \gamma_1)$	−0.671*	−0.788**	−0.764**	−0.660*
	(0.344)	(0.351)	(0.360)	(0.339)
FDI	−0.007	0.001	−0.003	−0.001
	(0.013)	(0.013)	(0.013)	(0.014)
Institutions(PCA)	0.042**	0.027	0.008	0.013
	(0.019)	(0.019)	(0.023)	(0.025)
Rents10%		−0.265***		
		(0.098)		
Rents15%			−0.448***	
			(0.108)	
Rents20%				−0.473***
				(0.095)
LnGDPPC	−0.434	−0.523	−0.672**	−0.465
	(0.318)	(0.339)	(0.329)	(0.365)
$LnGDPPC^2$	0.016	0.026	0.037*	0.025
	(0.019)	(0.020)	(0.020)	(0.021)
LnPOP	0.058*	0.094***	0.075**	0.085**
	(0.030)	(0.032)	(0.032)	(0.034)
Africa	−0.132	−0.061	−0.030	−0.065
	(0.092)	(0.113)	(0.109)	(0.112)
Asia	−0.228**	−0.201*	−0.124	−0.116
	(0.100)	(0.109)	(0.113)	(0.118)
Latin America	−0.036	−0.043	−0.037	−0.041
	(0.085)	(0.099)	(0.097)	(0.104)
Constant	2.301	2.097	2.755*	1.764
	(1.402)	(1.468)	(1.442)	(1.642)
No.of observations	1,271	1,271	1,271	1,271
Number of countries	102	102	102	102
Year fixed effects	Yes	Yes	Yes	Yes
#Instruments	79	80	80	80
Ar(1)_Pvalue	0.002	0.002	0.002	0.002
Ar(2)_Pvalue	0.850	0.830	0.840	0.835
Hansen_P−value	0.155	0.146	0.152	0.116

Standard errors in parentheses: ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. FDI, *Over*, *Under* are endogenous.

have a floating or dirty floating exchange rate system. With a high level of international capital mobility, this exchange rate regime is subject to high volatility (Rapetti 2019) and creates episodes of "overshooting" (Dornbusch 1976). Financial assets adjust instantly to excessive growth in the money supply, so that capital outflows sharply depreciate the external value of the currency. As domestic absorption declines and production slowly shifts to exports, the share of manufacturing is bound to decline despite temporarily high rates of undervaluation. Episodes of overshooting fuel inflation and create a "fear of floating", a major concern for the production of tradables (Calvo and Reinhart 2002). The volatility of misalignments becomes a source of uncertainty, and the smoothing procedure we use – a three-year moving average – only partially corrects for this phenomenon. All in all, high levels of temporary undervaluation may therefore be correlated with circumstances that discourage manufacturing activity. The third and final explanation supports our methodological approach. Many resource-rich countries are above the 33% threshold of the *Under* variable (Appendix 4). We hypothesize that the negative sign of *Under* is due mainly to model misspecification when rents are not removed from GDP. Partly for mechanical reasons, the correlation between *Under* and the share of manufacturing industry then becomes negative. Firstly, as rents are part of GDP, other things being equal, they pull this share down. Secondly, per capita GDP with rents does not reflect productivity in the production of non-traditional tradables. Natural resource rents offer the possibility of high prices for non-tradables. If these do not rise accordingly, significant rates of undervaluation occur. Thirdly, these rates of undervaluation are amplified if rents are used to subsidize domestic products that drive down the consumer price index, as is the case of many oil- and gas-producing countries.

Table 6 and Appendix 4 consolidate the 237 annual observations of *Under* distributed above the 33% threshold. They concern 39 countries out of the 102 in the sample (38.2%) and account for 18.6% out of the 1,271 country-year observations. Table 6 breaks down these observations into five classes. The first two columns where the share of manufacturing industry is less than 15% account for 56.5%. Within these two categories, natural resource rents account on average for about 20% or more of GDP. Oil- and gas-producing countries are the countries most often above the *Under* threshold. In these two classes, they represent 71% (96/134) of observations and six of them account for 78.1% of the related country-year episodes (75/96). We provide the country-year observations above the 33% threshold in brackets for these six countries: Saudi Arabia (15), UAE (14), Qatar (13), Iran (12), Oman (11) and Kuwait (10) (See Appendix 4).

The classic Dutch disease argument – deindustrialization is the consequence of price distortions that penalize tradable goods – is irrelevant if rents are used to subsidize consumer goods, and lead to currency undervaluation. Administered prices can go hand in hand with cronyism and weak institutions, negatively affecting investment and the production of non-traditional goods. In Azerbaijan for example, the *manat* was 60% undervalued for several years. The average share of manufacturing remained at 5%, with natural resource rents accounting for 31% of GDP. Coady et al. (2006) assess that the distribution of these rents via consumer good subsidies stood at 12.7% of GDP in 2005. Iran is another example with 12 years above the 33% threshold. Up to 2010, the population benefited from subsidies for most basic consumer goods, including administered electricity prices of 1 to 2 US cents per kilowatt-hour, among the lowest in the world, but with frequent power cuts that affected manufacturing activities in particular. Short-sighted strategies maintained persistent dependence on oil activities. Current consumption took precedence over investment and the long-term diversification that conditions the development process. To summarize this second robustness test, we find that the relationship between *Under* and the share of manufacturing is not correctly identified when rents are retained in GDP. Ignoring rents when calculating the misalignment overestimates the threshold for *Under*.

VI. Conclusion

An increase in the share of manufacturing is key to the development process. In settings of market failures and institutional weaknesses, real exchange rate incentives can be conducive to the emergence of manufactured goods. We explore this role for a large sample of developing and transition countries by estimating dynamic threshold panel models. We modify the Kremer, Bick, and Nautz (2013) model to test asymmetries and non-linearities for each of the two misalignment components in the same regression. Absolute purchasing power parity is used as the equilibrium real exchange rate criterion. When we adjust this criterion for the Balassa-Samuelson effect, resource rents are removed from

Table 6. Characteristics of annual observations above the *under* threshold of 33% (237 observations over the 2003–2019 period).

Manufacturing value-added/GDP (%)	0–10	10–15	15–20	20–25	+25
Average share of manufacturing (% GDP)	7.4	12.1	17.1	22.1	31.5
Average natural resource rents (% GDP)	29.1	17.1	5.7	4.5	11.6
Average undervaluation level above the threshold (%)	−46.4	−47.4	−45.4	−38.9	−41.7
Country-observations above 33% (out of the 237 observations)	59	75	48	30	25
Average number of years above the threshold (out of 17 years)	9.6	7.8	9	10	9.8

Appendix 4, Table 5 for more details on the countries above the threshold.

GDP. By eliminating rents, we obtain a better approximation of the level of productivity in non-traditional tradable goods, and therefore the true level of exchange rate misalignment with respect to these goods. Overvaluation has a linear negative impact on the share of manufacturing, while undervaluation increases it, albeit non-linearly and with a smaller marginal impact above the 18% threshold. These results are controlled for a set of covariates and prove robust when we include the effect of the external terms of trade as an additional determinant of RER to per capita GDP. Ignoring the effect of rents is therefore found to be a source of misleading interpretation of the marginal effect of *Under* above the threshold.

The empirical implications of this study concern exchange rate policy first and, more indirectly, the management of natural resource rents in oil- and gas-producing countries. Results are partly in line with the literature and provide four main lessons. Firstly, overvaluation is a problem in a competitive environment, particularly for unsophisticated tradables, which is the case for most manufactured goods in developing economies. Secondly, undervaluation has a non-linear and lesser impact on the dependent variable than overvaluation. It can be an offsetting factor for institutional and market failures. Thirdly, the marginal impact is still positive and of significant magnitude above the 18% threshold. Fourthly, it is common to associate oil and gas resource rents with high domestic prices and income levels that lead to currency overvaluation. Price distortions then crowd out manufactured tradables. This classic Dutch disease argument ignores situations where rents are used to subsidize current consumption, leading to high percentages of undervaluation.

Cases where this happens are not marginal in developing and transition economies. Although rents drive undervaluation, they also favour extractive economic and political institutions, highlighting the phenomenon of the resource curse. When no correction is made to GDP for the percentage of rents, high rates of undervaluation are associated with a low share of manufacturing. Although political economy arguments make this strategy unlikely, rents would obviously be more effective if managed from an intertemporal perspective combining both savings and investment in basic infrastructure (Collier et al. 2010). This strategy, which would be consistent with the long-term development of the manufacturing sector, is unlikely to be adopted when the utility function of governments is short-termist, dominated by the ambition to hold on to power by buying clientelistic social peace.

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Appendix 1. List of countries for the empirical analysis and data source

Africa (30)		Asia (34)		Eastern Europe (17)	Latin America (21)
Algeria	South Africa	Armenia	Singapore	Albania	Argentina
Angola	Tanzania	Azerbaijan	South Korea	Belarus	Bolivia
Botswana	Togo	Bangladesh	Sri Lanka	Bosnia-Herzegovina	Brazil
Burkina Faso	Tunisia	Cambodia	Tajikistan	Bulgaria	Chile
Cameroon	Uganda	China	Thailand	Croatia	Colombia
Congo	Zambia	Georgia	Turkey	Czech Rep	Costa Rica
Côte d'Ivoire	Zimbabwe	India	Turkmenistan	Estonia	Dominican Rep
Djibouti		Indonesia	UAE	Hungary	Ecuador
Egypt		Iran	Uzbekistan	Latvia	El Salvador
Ethiopia		Jordan	Vietnam	Lithuania	Guatemala
Ghana		Kazakhstan		Macedonia	Guyana
Guinea		Kyrgyzstan		Moldova	Honduras
Kenya		Kuwait		Poland	Jamaica
Madagascar		Laos		Serbia	Mexico
Malawi		Lebanon		Slovakia	Nicaragua
Mali		Malaysia		Slovenia	Panama
Morocco		Mongolia		Ukraine	Paraguay
Mozambique		Oman			Peru
Namibia		Nepal			Trinidad and Tobago
Nigeria		Pakistan			Uruguay
Rep of Congo		Philippines			Venezuela
Rwanda		Qatar			
Senegal		Russia			
		Saudi Arabia			

List of variables and sources

Manufsh: *value-added of manufacturing (percent of GDP); RER: Real exchange rate; ER nominal bilateral exchange rate of the domestic currency for 1 US dollar; PPP: Purchasing Power Parity conversion factor;* Mis: *Misalignment of the exchange rate visa-vis the US dollar;* POP: *population;* GDPPC: *per capita GDP;* Rents 10%: *share of natural resource rents in GDP equal to or less than 10%. Similar definition for 15% (*Rents 15%*) and 20% (*Rents 20%); PC1 *first component of the Principal Component Analysis for the six economic and political institution items, respectively Government Effectiveness, Rule of Law, Regulatory Quality, Voice and Accountability, Political Stability and Absence of Violence*. Source: the source for all the above variables is the World Bank's World Development Indicators. FDI: *share of the foreign direct investment in manufacturing in GDP. Source: fDi Market, Financial Times. Africa: Dummy variable for African countries = 1 and 0 otherwise. A similar definition applies for Asia, Europe and Latin America.*

Appendix 2. Summary statistics for variables and sources

Variable	Mean	Std. Dev.	min	max	N
Share of manufacturing (% GDP)	13.68	5.93	1.64	49.88	1270
Misalignments (Table 3) (1)	−.09	.24	−.77	.79	1270
Under	.22	.16	0.0	.77	852
Over	.16	.15	.00	.79	418
Misalignments (Table 4)	−.10	.24	−.77	.82	1270
Under	.22	.16	.00	.77	865
Over	.18	.16	.00	.82	405
Misalignments (Table 5)	−.10	.24	−.83	.73	1271
Under	.23	.17	.00	.83	835
Over	.15	.14	.00	.73	436
Share of FDI in GDP (%)	1.48	3.2	0	33.1	1270
Institutions (PC1)	0.10	2.12	−4.63	6.61	1270
Institutional external instruments (2)					
Political Stability	−.29	.82	−2.81	1.62	1270
Regulatory Quality	−.10	.72	−2.16	2.26	1270
Government Effectiveness	−.13	.69	−1.75	2.44	1270
Voice and Accountability	−.27	.78	−2.12	1.23	1270
Control of Corruption	−.31	.70	−1.53	2.25	1270
Rule of Law	−.27	.70	−1.92	1.88	1270

(1) Three series of misalignments and their components are proposed in the paper. Each table in brackets refers to the concept we use in the text. The most standard method is with Table 5. *Under* is the absolute value of misalignment when negative. They refer to the different empirical options explored in Tables 3, 4 and Table 5. (2) For each of the six indicators, instruments are based on the arithmetic mean for each country's neighbours. Instruments are coded in such a way that higher values represent a better-quality institution. For a given country, institutional external instruments refer to the different WGI measures for its neighbouring countries.

Appendix 3. Tests of threshold effects on misalignment components (-)

Null assumption	Restrictions	*p*-value
Misalignments corrected for per capita GDP (excluding natural resource rents) and external terms of trade effects		
No threshold effects on Under and Over	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}, \eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.518
Threshold effect on Under only	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}$	0.020
Threshold effect on Over only	$\eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.970
Misalignments corrected for per capita GDP effect		
No threshold effects on Under and Over	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}, \eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.019
Threshold effect on Under only	$\eta_{10} = 0, \eta_{1L} = \eta_{1H}$	0.002
Threshold effect on Over only	$\eta_{20} = 0, \eta_{2L} = \eta_{2H}$	0.240

p-value is the rejection probability for the bootstrapped Wald test, the number of replications B = 1000.

Appendix 4. Countries observations above the % threshold of undervaluation (-)

Country	Average share of manufacturing 2003-2019	Share of resource rents 2003-2019	Undervaluation above the threshold	Number of years above the threshold
Albania	6.15	1.59	0.35	2
Algeria	38.43	26.46	0.42	10
Argentina	18.11	5.95	0.35	2
Armenia	11.2	1.15	0.39	3
Azerbaijan	5.19	31.09	0.46	9
Belarus	22.91	1.57	0.41	12
Bolivia	11.48	13.11	0.34	2
Egypt	16.19	9.49	0.58	15
Georgia	8.52	.42	0.43	4
Indonesia	23.59	6.38	0.43	11
Iran	13.23	24.85	0.49	12
Jordan	18.26	1.74	0.42	4
Kazakhstan	11.56	23.02	0.49	8
Kuwait	5.68	52.02	0.50	10
Kyrgyzstan	12.95	3.33	0.40	6
Laos	9.81	11.5	0.43	4
Macedonia	12.45	1.06	0.38	2
Malaysia	23.81	9.53	0.41	11
Moldova	11.65	.23	0.46	8
Mongolia	6.48	24.2	0.49	9
Oman	10.01	41.1	0.53	11
Pakistan	13.25	2.05	0.38	6
Paraguay	17.96	1.57	0.57	1
Poland	16.69	.78	0.35	3
Qatar	11.52	32	0.54	13
Russia	12.46	11.88	0.43	4
Saudi Arabia	10.95	39.7	0.62	15
Serbia	14.43	1.31	0.36	3
Singapore	21.38	0	0.38	11
Sri Lanka	17.27	.12	0.40	11

(*Continued*)

(Continued).

Country	Average share of manufacturing 2003-2019	Share of resource rents 2003-2019	Undervaluation above the threshold	Number of years above the threshold
Sudan	5.06	17.42	0.40	1
Thailand	28.65	2.4	0.39	11
Tunisia	14.35	2.46	0.40	2
Turkey	17.88	.28	0.45	4
United Arab Emirates	8.68	22.39	0.48	14
Ukraine	14.26	3.5	0.58	8
Uzbekistan	14.77	14.52	0.41	3
Venezuela	15.08	32.28	0.34	1
Vietnam	19.1	11.97	0.38	2

The first two columns present averages across the entire 2003–2019 observation period. The third column displays the average rate of *Under*, only for years above the 33% threshold. The fourth and last column provides the number of years in case *Under* is above 33%.