

Real Exchange Rate Misalignment and Economic Growth in China: Nonlinear Effects, Causal Identification, and Transmission Mechanisms

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Abstract. Real exchange rate misalignment remains a major issue in international macroeconomics, especially for emerging economies undergoing structural transformation. As the world's second-largest economy and one of the largest trading nations, China provides an important case for examining how deviations of the RMB real exchange rate from its equilibrium level may affect economic growth. This proposal investigates whether RMB real exchange rate misalignment has significant long-run and short-run effects on China's growth, whether these effects vary with trade structure, and through which channels they may operate. Using quarterly data from 1996Q1 to 2025Q4, the study proposes to construct a detrended misalignment indicator to reduce spurious regression risk and to apply unit root and cointegration tests, baseline regressions, IV-2SLS estimation, an LSTR nonlinear threshold model, and a Bootstrap-based mediation framework. The study expects to show that moderate RMB undervaluation is more strongly associated with long-run growth than with short-run fluctuations, and that productivity-related channels may be more robust than a complete export-driven transmission chain.

Keywords: real exchange rate misalignment, economic growth, RMB, trade structure, total factor productivity

1. Introduction

The exchange rate is among the greatest relative prices in an open economy. Its effects are on resource allocation between tradables and non-tradables sectors, on export competitiveness, on import costs and it is closely linked to inflation, capital mobility and stability in the macroeconomy. The real exchange rate tends to be greater than a pure market-based price in developing and emerging economies. This variable can also be regarded as policy-sensitive and might impact on structural change, industrialization, and long-term economic development. This is why the connection between exchange rate misalignment and economic performance has been one of the most hotly debated issues in international economics over the past several decades.

In particular, China is a very significant example on the issue that can be studied. Since the reform, China has had an incredible pace of economic growth, becoming the second-largest global economy and the main trader of merchandise. All this time the country has undergone important

changes in the foreign exchange regime, namely, it has moved towards a less hard system shifting to a managed float system with an ever-growing degree of freedom. The actual value of the RMB has shifted many times due to domestic reforms, overseas finance, changes in productivity, and trade deficits. The RMB real exchange rate has frequently deviated from its equilibrium level, and this misalignment has become one of the most debated issues in discussions of China's macroeconomic growth.

The problem is very significant because the misalignment of exchange rates can lead to positive and negative implications. On the one side, an undervalued real exchange rate could stimulate exports, increase the size of production, enhance learning-by-doing, and build overall factor productivity. They can be particularly significant in an economy that has traditionally been dependent on industrialization and export-oriented growth. Conversely, long term deviations in exchange rates can alter resource allocation, lower real purchasing power of households, generate trade conflicts, or decrease macroeconomic performance. Excessive overvaluing may damage the competitiveness of exports and export growth drive whereas overvaluing too much may instigate new imbalances. Thus, the problem is not whether exchange rate changes are important, it is when they are important, how they are transmitted and how big of a significance they have.

Despite the huge amount of academic literature on exchange rates and development, there are still a number of unresolved issues when it comes to China. To begin with, most of the available empirical papers rely on macroeconomic time series that are highly trended, and thus can produce misleading correlational relationships unless stationarity and detrending concerns are appropriately taken care of. Secondly, endogeneity continues to be a problem, since economic growth, exports and capital flows may all cause exchange rate movements. Third, earlier studies frequently deal with average linear relationships, and do not consider a possibility that exchange rate misalignment might impact growth at various phases of structural change in diverse manners. Lastly, the transmission mechanism of exchange rate conditions into growth has been conceptualized but not necessarily entirely tested empirically.

The present proposal is organized around several central research questions. Does RMB real exchange rate misalignment have a significant effect on China's economic growth? Do the effects differ between the short run and the long run? Does the relationship display a nonlinear threshold pattern related to trade structure? Through which channel does exchange rate misalignment affect output growth? They are not only important in an academic context but they also have a great relevance to policy makers in terms of balancing between exchange rate stability, competitiveness of exports, structural improvement, and long term economic growth goals.

In order to respond to such questions, the suggested research work will analyze quarterly Chinese data dated as of 1996Q1 to 2025Q4. Such a sample interval is particularly useful as its coverage includes large exchange rate reforms and other major macroeconomic events of China, such as joining the WTO, the financial crisis of the world, the period since 2005 when reforms were implemented, the current COVID-19 event, and the stage after 2020 adjustments. The initial stage that the study will undertake is to create a misaligned indicator of the real exchange rate, an element of the methodological advances highlighted in the PPT. This is a vital stage since the real exchange rate and GDP share very strong trending characteristics over the long term, and simply by regressing one trending series on another it is simple to produce spurious results. Detrended misalignment variable is created so that it could not be subject to this problem essentially.

This proposal will use various empirical instruments. Initial statistical analysis, such as ADF unit root analysis and Johansen cointegration analysis, will help in identifying time-series properties of variables as well as the presence of long-run equilibrium relations. Baseline regressions will be used

to predict a relationship between the misaligned exchange rates and growth. Endogenous variables will be tackled using instrumental variable two-stage least squares estimation method and causal effects identified. The Logistic Smooth Transition Regression model will see if the growth effect of exchange rate misalignment is different when the trade structure index passes a threshold. Last but not least, a Bootstrap chain mediation model will be employed to explore whether RMB undervaluation can boost growth by increasing the manufacturing export and further improving its manufacturing TFP.

This proposal has three expected contributions. The first is that it will enhance variable measurement using a detrended misalignment indicator. The second is that it offers a more precise empirical identification plan because it includes long-term estimation, short-term dynamics, correcting endogeneity and non-linear modeling. And thirdly, it tries to check one full transmission mechanism not merely the reduced-form association. In so doing, the research aims to offer a relatively organized explanation of the manner in which exchange rate misalignment can be related to trade structure, productivity and economic growth in China.

2. Literature review

2.1. Theoretical foundations of real exchange rate misalignment

Real exchange rate misalignment is a general term used to describe the deviation between the observed real exchange rate and its equilibrium position. Theoretically, the real exchange rate ought to be based on fundamentals like relative productivity terms of trade, capital flows, external balance situation, and policies. In case the observed real exchange rate deviates persistently with respect to the level indicated by these fundamentals, the economy can suffer overvaluation or undervaluation.

An early critical contribution to the literature is the purchasing-power parity and productivity-based perspective. Balassa has contended that productivity disparities across tradable and non-tradable sectors may cause systematic variations of price levels amongst different countries, which in turn influences the real exchange rate [1]. It was later used as a basis of the Balassa-Samuelson effect, whereby fast-growing economies might encounter a real appreciation due to increased productivity in tradable sectors. Nevertheless, the ability to justify appreciation in terms of fundamentals does not necessarily mean that all the exchange rate changes that are observed are consistent with equilibrium. The difference between equilibrium adjustment and misalignment continues to dominate.

A different theoretical framework focuses on structural change and the tradeable sector. The tradeable sector in developing countries usually provides more vigorous productivity spillovers, learning-by-doing, and scale economies compared to the non-tradeable sector. An under-estimated real exchange rate which moves resources into tradables can be a source of faster industrialization and growth. There is one concept that explains why exchange rate policy is frequently mentioned as an indirect instrument of development, particularly when discussing the export orientation approach to economic development.

On the other hand, theory also points to the potential costs of exchange rate disequilibrium. The overestimation could be used to reduce the competitiveness level of exports, make imports more dependent, and deteriorate the balance of trade and even damp the pace of output growth. Severe undervaluation or prolonged exposure to it may cause a decrease in internal buying power, misallocation of capital, disruption of consumption trends, and escalation of international policy disagreements. Therefore, the theoretical literature cannot suggest that all deviations of equilibrium

are inherently advantageous. Instead, the economic consequences depend on the orientation, degree, length and the structural environment of misalignment.

2.2. Exchange rate undervaluation and growth: supportive arguments

Extensive empirical evidence indicates that exchange rate underestimation can contribute to promoting economic growth in developing and emerging countries. According to Rodrik, it has a connection with faster growth as it contributes to the advancement of the tradable segment that usually faces failures of the market and positive externalities [2]. Taking this point of view, an undervalued exchange rate acts as an implicit subsidy on tradables and an implicit tax on non-tradables and thus reduces distortions that would otherwise slow the process of industrialization.

Gala gives similar evidence on how relative competitiveness of real exchange rates can cause economic growth through the increase in profitability of manufacturing and promoting capital accumulation [3]. Export composition is also emphasized by Hausmann, Hwang, and Rodrik, who argue that countries focusing on more complex tradable products will probably see higher productivity improvements and better growth [4]. According to such reasoning, the devaluation of the exchange rate is not a mechanical growth promoter, but rather it helps to implement a development strategy focused on the development of exports, industrial diversification and production efficiency.

The given literature is especially useful in regard to China as the country has been developing its model by large-scale manufacturing increase, export growth, and globalization. Exchange rate undervaluation could serve to maintain competitiveness of imports and exports in such a context, promote investments in manufacturers and continue to achieve growth in the production of goods. Based on this argument, in this research, it will be suggested that there is a chain reaction where RMB undervaluation leads to manufacturing export expansion leading to TFP improvement and finally it supports economic growth.

2.3. Skeptical and conditional views

There was no support in all the research carried out regarding undervaluation. Williamson points to the fact that deviation of the exchange rates by a large margin in any direction will be very expensive [5]. The overvaluation is particularly damaging to outside competitiveness, although under-valuation can cause distortions and welfare losses as well. Eichengreen observes that the effect of the real exchange rate on growth remains conditional not universal. Institutional quality, financial depth, policy coordination, and the level of development may all contribute to outcomes [6].

Others argue that the positive association between undervaluation and growth is not a case of causality but a case of reverse correlation. Capital can flow into high-growth economies, they can go through productivity changes, and have trade surplus which in turn affect the exchange rate. Without a plausible identification mechanism, there is little chance of understanding whether the exchange rate misalignment leads to growth, or just goes hand in hand with it. This problem especially affects China since during the last few decades the development, industrial policy, trade performance, and exchange rate management had been closely intertwined in that country.

Another weakness of the literature is the common belief of linearity. Most researches calculate one average coefficient of misalignment between exchange rates assuming it has a constant growth impact. Nonetheless, the economic structure of a country can change with time. Undervaluation of exchange rates might exert more influence on manufacturing export-oriented economies compared

to countries where growth continues to be led by services or household spending. The implication of this is that the association between exchange rate misalignment and growth could be non-linear, and that explicit testing of threshold effects or regime shifts ought to be done.

2.4. Empirical studies on China

China has a prime position in the exchange rate literature due to its particular growth profile and the worldwide argument on RMB evaluation. The methods used by various studies to calculate equilibrium exchange rates and misalignment are quite different. Cheung, Chinn, and Fujii demonstrate that the results of RMB misalignment estimates are highly dependent on the methodology used highlighting the significance of the model design [7]. In the same vein, Coudert and Couharde also determine that the estimation of equilibrium real exchange rate in China is responsive to productivity and trade structure [8].

More recent studies have reached a more conditional interpretation. Couharde, Grekou, Mignon, and Morvillier argue that the growth effect of undervaluation should not be treated as universal and may vary with development stage and the magnitude of misalignment [9]. In addition, Chen, Huang, and Lin show that the positive effect of undervaluation may weaken as countries become more integrated into global value chains [10]. This argument is particularly relevant for China, where the export structure has become increasingly embedded in global production networks. Specifically, with the increased shift of China to more technology-intensive production and to an increasingly developed local market, the relative role of price competitiveness could have altered.

The issues in the current study are unresolved. The chosen research design is thus a sample period to allow the inclusion of several reform episodes as well as significant economic events in China, as it analyzes long run and short run effects, causality identification, non-linear threshold behavior and export and productivity transmission mechanism. It particularly focuses on elimination of spurious regressions by developing a detrended exchange rate misalignment indicator, which solves a typical issue in macro time-series analysis.

2.5. Research gaps and proposed contributions

Based on the literature above, four major gaps can be identified.

To begin with, most studies have failed to properly consider the non-stationarity in macroeconomic variables. The real exchange rate, GDP, openness and financial depth tend to have significant trends. When regressing such variables upon one another in absence of adequate testing and transformation, the resulting relationship might be spurious and not substantive. As a solution to this problem, the research proposes the creation of a detrended misalignment measure and applying the unit root and cointegration tests.

Next, endogeneity is also a very real threat. This is where growth, exports and policy responses can have an effect on the exchange rate which leads to problems in using the estimates of ordinary least squares causally. This concern is directly being tackled by the proposed use of IV-2SLS.

Finally, there is not enough literature on whether misalignment of exchange rates impacts trade structure. Recent studies have begun to address this issue more explicitly. For example, Chen, Huang, and Lin highlight the role of global value chain participation in weakening the growth effect of currency misalignment [10], while Couharde, Grekou, Mignon, and Morvillier provide a more reconciled interpretation of why misalignment may support growth in some contexts but not in others [9]. However, because the trade structure index is treated as the core threshold variable in the

LSTR model, structural composition is regarded as a critical conditioning factor in the proposal rather than as an additional control.

Further, a lot of articles refer to mechanisms in general theoretical terms. Contrast with the proposed project that aims at examining the entire process of exchange rate misalignment leading to manufacturing exports increase, followed by TFP increase and subsequently growth via the Bootstrap chain mediation model. It is one of the most specific aspects of the proposed research.

To sum up, the current proposal is a contribution to literature as it is adding cleaner measurement with stronger identification, structural nonlinearities, and mechanism testing to an integrated empirical framework that has been developed specifically to accommodate economic development in China.

3. Methodology

3.1. Research design

The research uses a quantitative approach to macroeconometric analysis grounded on quarterly Chinese data spanning the timeframe between 1996Q1 and 2025Q4. The selected sample period was chosen economically and methodologically because it contains significant changes in exchange rates along with critical macroeconomic phenomena in China. Economically, it records the important exchange rate reforms in China and the most significant macroeconomic events that influence the real exchange rate, trade structure, and growth. Methodologically, it is long enough to examine the equilibrium relationships over a long time and at the same time, short-term dynamics and structural breaks can be studied.

This empirical approach involves six interrelated steps. Firstly, the research will gather and process the data, paying particular attention to trend elimination and stationarity tests. Secondly exploratory analysis will be done as it will be attempted to describe the history of the key variables and discover general stylized facts. Thirdly, estimated long-run and short-run baseline models will determine the connection between exchange rate misalignment and growth. Fourth, IV-2SLS estimation will be employed to deal with endogeneity and determine causality. Fifth, a model of LSTR will examine the condition under which growth effects vary by the trade structure index. Sixth, a Bootstrap-based chain mediation architecture will investigate how both industrial exports and industrial TFP transmit the impact of exchange rate misalignment to total output growth.

The sequence is logically coherent in its empirical sense, in that it starts with variable construction and statistical testing before pre-estimation, baseline estimation, causal identification, non-linear threshold analysis, mechanism examination, and robustness assessment.

3.2. Data sources

The data that will be used in the proposed study will be taken only from authoritative official or internationally recognized databases. They include:

- the Bank for International Settlements for real effective exchange rate data;
- the National Bureau of Statistics of China for GDP and related macroeconomic indicators;
- the People's Bank of China for monetary and financial statistics;
- the Federal Reserve Economic Data platform for relevant benchmark variables used in identification;
- the General Administration of Customs of China for trade and manufacturing export statistics.

The implementation of these sources has two intentions. First, it will guarantee that the dataset is in line with internationally acceptable academic practice. Secondly, it makes the measurement of variables more reliable particularly in a research on the dynamic nature of exchange rates, foreign trade as well as macroeconomic development during a large sample period [11-15].

3.3. Variables

3.3.1. Dependent variable

China's real GDP growth rate is the dependent variable. The study is concerned with the effects of exchange rate misalignment on macroeconomic performance; therefore, output growth can be used as the most straightforward aggregate measure. Year-by-year or quarter-by-quarter changes in growth may be used in the short-run specifications subject to the stationarity conditions of the model.

3.3.2. Core explanatory variable

The central independent variable is RMB real exchange rate misalignment. Rather than directly taking the raw measure of the real exchange rate, the proposal creates an indicator of how the actual real exchange rate deviates from its equilibrium trajectory. The study makes this contribution as a major methodological contribution. The raw real exchange rate exhibits a pronounced long-term trend and may move together with GDP over time, creating a substantial risk of spurious regression if it is used directly in estimation. Conversely, the misalignment series of the detrended exchange rate is stationary and hence it is more appropriate to use it in regression analysis.

Also, the direction of the deviation is fundamental. Depending on the sign convention chosen at the end specification, a negative deviation may show overvaluation, and a positive one can indicate undervaluation, respectively. Since the hypothesis is based on whether undervaluation promotes growth, the research focuses specifically on those times when the undervaluation of the RMB continues.

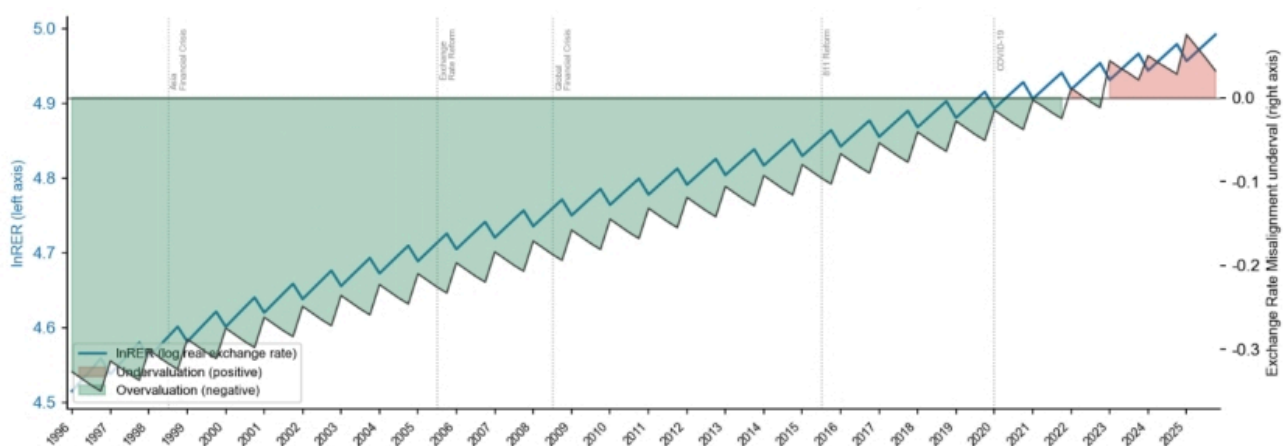


Figure 1. Log real exchange rate and exchange rate misalignment (1996Q1-2025Q4)

According to Figure 1, log real exchange rate can be characterized by a trend in the long run, whereas cyclical components of deviation from the trend are recorded by the detrended misalignment indicator. Since this figure is crucial to the methodology section it clearly illustrates

the reasons why the detrending process is needed and why the stationary misalignment variable must be considered as opposed to the raw exchange rates series.

3.3.3. Threshold variable

The trade structure index is the threshold variable. In this study, the trade structure index captures long-term changes in China's trade structure and is closely associated with the growth of manufacturing exports. It is therefore the main threshold variable of the LSTR model. The basic concept is the growth impact of exchange rate misalignment is probably a function of the nature of the export sector. With larger shares of manufacturing exports in total exports, exchange rate undervaluation might produce high growth payout.

As it is demonstrated in Figure 2, the trade structure index increases gradually with the time and manufacturing exports experience fluctuations due to significant shocks. According to the figure, there is evidence that China export structure is upgraded over a very long period and that exchange rate policy plays different roles in this transformation.

3.3.4. Mediating variable

The main mediating variable is manufacturing total factor productivity. Preliminary evidence suggests that manufacturing TFP growth is closely associated with GDP growth and therefore serves as the central mediating variable in the mechanism analysis. When the under-valuation of exchange rates helps increase the volume of manufacturing exports and the latter helps to increase the level of efficiency, learning, the adoption of technology, and scale economies, TFP can naturally be used as the bridge that combines the exchange rate conditions and the overall growth.

Figure 3 indicates that there is a general synchronization between the GDP growth and manufacturing TFP growth throughout most of the sample. Their synchronicity lends some preliminary evidence to the notion that productivity enhancement is an important mechanism within the growth framework.

3.3.5. Control variables

The full empirical model includes four key control variables: financial development depth, the fiscal expenditure ratio, the real interest rate, and trade openness.; they include financial development depth, the fiscal expenditure ratio, the real interest rate, and trade openness. These variables represent the macroeconomic factors in which exchange rates work. Financial depth can influence the allocation of capital and investments. Fiscal spending has impact on total demand and structural support. Real interest represents monetary and financial circumstances. The trade openness represents the larger external participation of China. By adding such variables the omitted-variable bias is decreased and the credibility of the estimated exchange rate effect is increased.

Figure 4 demonstrates that the control variables are changing along the lines that are generally aligned with macroeconomic realities of China. Depth of finance increases with time and the fiscal ratio tends to increase and decrease on a cyclical basis, the actual rate of interest decreases significantly and trading openness increases until it reaches a maximum level. These tendencies make them suitable to be included in the empirical framework.

3.4. Data preprocessing

As can be seen on the data, various preprocessing stages are mentioned which will be used in the proposal. To eliminate excessive short-run fluctuations, flow variables will either be smoothed or transformed as needed. To mitigate heteroscedasticity, some variables will be reduced to logarithmic forms. Trending variables will, where required, be differenced or de-trended to get stationary time series. All the assumptions associated with the use of econometric models will be checked using full-sample unit root and cointegration tests.

Such preprocessing activities are not just technical procedures. They have implications on how interpretable the results become. When working with time series in macroeconomics, it may seem that variables sharing the same trend tend to do so regardless of any economically sensible connection. Detrended misalignment is thus a crucial aspect of the proposal in the quest to have an appropriate relationship between exchange rate conditions and growth.

3.5. Preliminary statistical testing

As stated in the data, prior to estimating the primary models, the paper will undertake pre-model mandatory tests which are the ADF unit root test and Johansen cointegration test.

Based on the data findings on the pilot study outcomes, the given variables, i.e., lnGDP, lnREER, and lnTFP are not stationary in their level, but when they are first-differenced, a stationarity is established, while the detrended undervaluation variable and the trade structure index are level stationary. The existence of long-run cointegration relationships between the main macroeconomic variables is supported by the Johansen test. This discovery is economically rational and statistically significant. It means that using detrended misalignment variable in regression is safe because it does not have a spurious correlation risk and the use of this variable is reasonable to estimate long run equilibrium.

Table 1. ADF unit root test results

Variable	ADF Statistic	p-value	Order	Conclusion
lnGDP	-2.153	0.512	I(1)	Non-stationary, stationary after 1st diff
lnREER	-1.987	0.615	I(1)	Non-stationary, stationary after 1st diff
lnTFP	-2.034	0.588	I(1)	Non-stationary, stationary after 1st diff
underval	-4.872	0.000***	I(0)	Stationary at 1% level
str	-4.215	0.001***	I(0)	Stationary at 1% level

Table 2. Johansen cointegration test results

Null Hypothesis	Trace Statistic	5% Critical Value	p-value	Conclusion
None ($r=0$)	48.215	29.797	0.000***	Reject H0
At most 1 ($r \leq 1$)	21.368	15.495	0.006***	Reject H0
At most 2 ($r \leq 2$)	6.825	3.841	0.006***	Reject H0

1. underval is stationary (I(0)); no spurious regression risk. *** $p < 0.01$

2. Long-run cointegration exists; stable equilibrium relationship. ** $p < 0.05$, *** $p < 0.01$

3.6. Baseline empirical model

The study will start by using a baseline model, which will look at the association between exchange rate misalignment and economic growth:

$$Growth_t = \alpha + \beta Misalignment_t + \gamma' Controls_t + \varepsilon_t$$

with $Growth_t$ being real GDP growth, $Misalignment_t$ ade-trended measure of exchange rate misalignment indicators, and $Controls_t$ is a vector consisting of financial depth, fiscal expenditure, real interest rate, trade openness, and possibly other macroeconomic controls.

Should there be cointegration between the dependent and explanatory variables, the research will also calculate an error-correction representation:

$$\Delta Growth_t = \alpha + \lambda EC_{t-1} + \beta \Delta Misalignment_t + \gamma' \Delta Controls_t + u_t$$

where EC_{t-1} source of the lagged error-correction term is the long-run cointegration relationship. The coefficient λ represents the rate at which the system will restore equilibrium in case of a short-run shock. This specification makes it possible to discern clearly the impact of the long-run equilibrium effects and the response of growth rates in the short run.

3.7. Visual motivation for the baseline hypothesis

Before moving to identification, the proposal uses descriptive figures to motivate the central hypothesis.

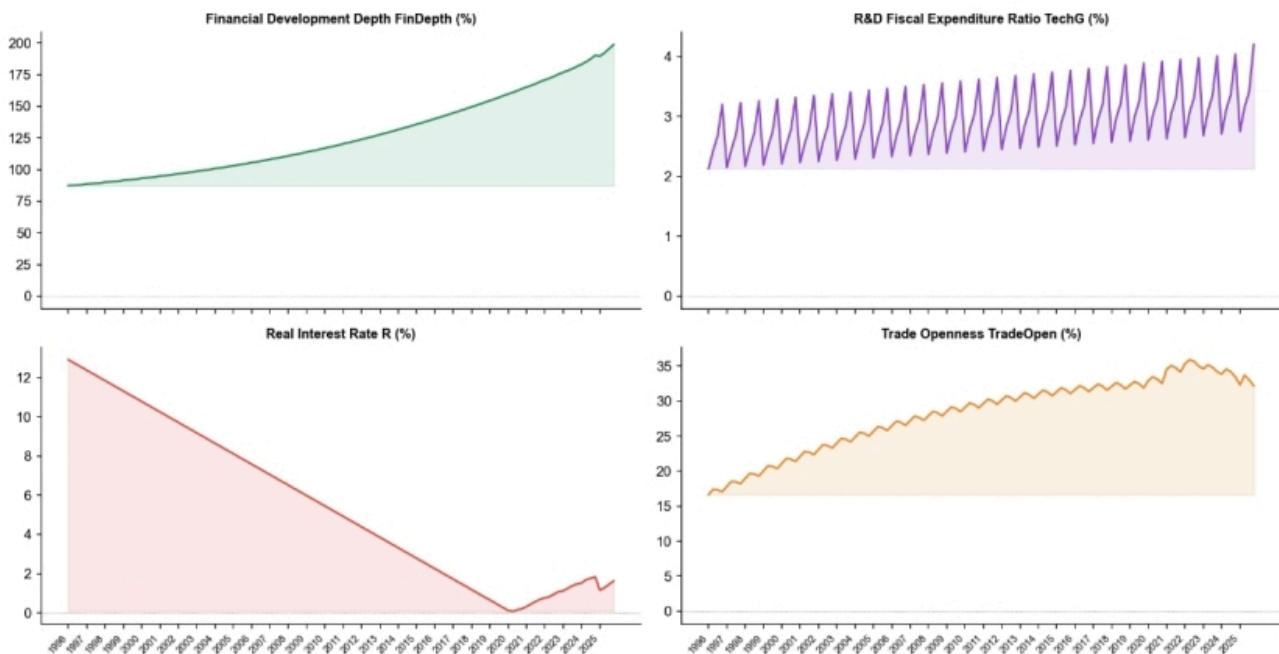


Figure 2. Key control variables (1996Q1-2025Q4)

Figure 2 illustrates that there is a strong relationship between the movement of exchange rate misalignment in the time-series and the growth of GDP. The growth is usually negative as RMB overvaluation becomes severe and steady or positive as RMB moves towards undervaluation. The figure does not establish causation but offers an important stylized fact which supports the main hypothesis of the proposal.

As shown in figure 3, the scatter plot of the full sample also indicates a strong relationship between exchange rate misalignment and GDP growth, but the slopes in the various sub-periods seem to vary. The given visual information confirms both statements. Firstly, there will probably be a strong connection between the central explanatory variable and growth. Secondly, this connection might have changed over time, which enhances the value of nonlinear-threshold testing.

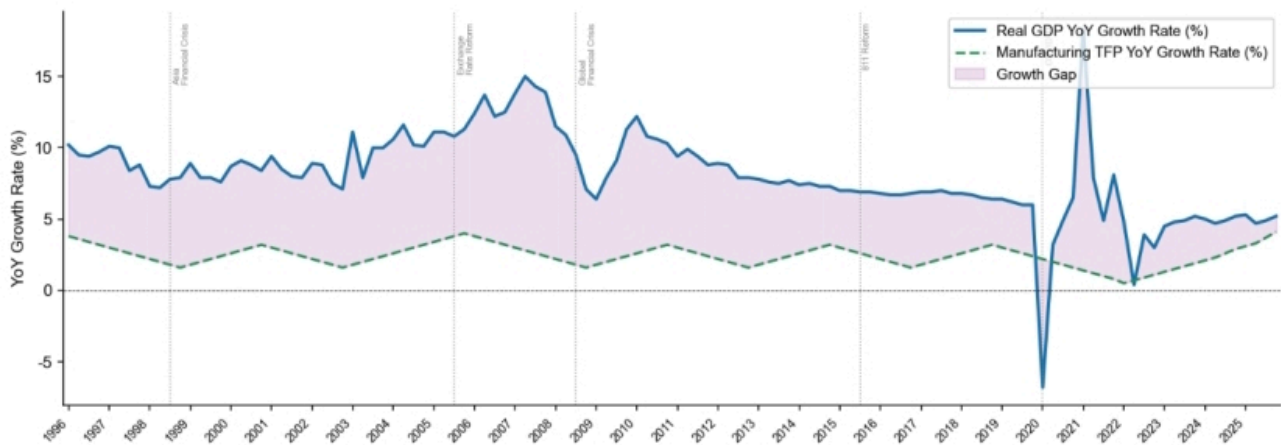


Figure 3. GDP growth vs. manufacturing TFP growth - mechanism analysis (1996Q1-2025Q4)

3.8. Instrumental variable strategy

As economic development can have an impact on exchange rate movements, there is a need to consider the problem of reverse causality. The research uses IV-2SLS estimation to determine the cause effect of exchange rate misalignment. Instruments used will be determined based on the empirical method of the research and could consist of external benchmark indicators and lagged indicators that are associated with exchange rate misalignment but theoretically exogenous to current domestic growth shocks.

In order to guarantee the legitimacy of the instrumental variable method, several conventional identification tests will be applied, which include the under-identification test, the weak instrument test, and the over-identification test. As Table 3 indicates, the preliminary identification findings indicate that the chosen instruments meet the key statistical criteria of relevance and exogeneity. These findings offer preliminary backing on the applicability of IV-2SLS estimation in the entire study.

Table 3. IV-2SLS causal identification tests

Test Item	Statistic	p-value	Result
Underidentification Test (KP LM)	19.825	0.000***	Pass
Weak Instrument Test (Cragg-Donald F)	28.36	—	Pass ($F > 10$)
Overidentification Test (Hansen J)	2.368	0.124	Pass

Following the validation of instruments, the second stage regression outcomes will be helpful in determining the causality effects of exchange rate misalignment on economic progress. Table 4 indicates that early estimates of coefficients reveal that undervaluation variable is positively related to economic growth and is statistically significant in the IV specification. These results serve as a preliminary indication of the validity of the proposed causal estimation strategy, and indicate that it is highly unlikely that the growth effect of exchange rate misalignment could be explained merely by reverse causality.

Table 4. IV-2SLS core coefficient results

Stage	Variable	Coefficient	p-value	Conclusion
First Stage	IV_FFR	-0.182	0.001***	Significant
First Stage	L2.underval	0.625	0.000***	Significant
Second Stage	underval	0.792	0.001***	Significantly Positive

3.9. Nonlinear threshold model

The proposal adopts a Logistic Smooth Transition Regression model to test structural nonlinearity. In LSTR specification, the impact of exchange rate misalignment on growth can change gently with the trade structure indicator. It is better than a rough split-sample approach since the export structure in China did not change dramatically but over time.

A simplified LSTR representation may be expressed as:

$$Growth_t = \alpha + \beta_1 Misalignment_t + \beta_2 Misalignment_t \cdot G(str_t; c, \gamma) + \delta' Controls_t + \varepsilon_t$$

and where $G(str_t; c, \gamma)$ is a logistic transition function, str_t is a trade structure indicator, c is a threshold parameter, and γ is a smooth transition parameter.

In this model, the effect of exchange rate misalignment is determined based on whether the trade structure index is less or more than the threshold. In case there is threshold effect, a high coefficient on undervaluation is expected in the high-manufacturing-export regime.

The preliminary estimate of the threshold given in Table 5 indicates that there may be a substantial nonlinear relationship between exchange rate misalignment and economic growth. To be more precise, the stimulating influence of RMB undervaluation on growth has been observed to increase as trade structure indicator goes over specific threshold values. Within the framework of this proposal, these results are preliminary evidence of a standpoint that the efficacy of undervalued exchange rates is dependent on the level of manufacturing exports orientation and more generalised structural upgrading.

Table 5. LSTR nonlinear threshold effect results

Core Indicator	Value	p-value	Conclusion
Trade Structure threshold Value	182.3 ^o	-	Significant at 1% level
Underval Coefficient(low trade structure regime: $str < 182.3^{\circ}$)	0.618	0.002** *	Significantly positive
Underval coefficient (high trade Structure Regime: $str \geq 182.3^{\circ}$)	0.925	0.000** *	Significantly positive, with a stronger growth effect

Table 5. (continued)

Smooth Transition Parameter	4.26	0.001** *	Significant transition process
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P<0.01

3.10. Chain mediation model

In addition to direct estimation, this research will also examine if exchange rate misalignment has an indirect effect on growth via exports and productivity. The suggested chain mechanism is:

RMB undervaluation → manufacturing export growth → manufacturing TFP growth → GDP growth

The study will test this sequence of events by making use of the Bootstrap chain mediation framework. Indirect effects commonly do not follow normal distributions, and bootstrap sampling is appropriate since it offers improved confidence interval estimates.

The mediation analysis will estimate:

1. the effect of exchange rate misalignment on manufacturing export growth;
2. the effect of manufacturing export growth on manufacturing TFP growth;
3. the joint effect of export growth and TFP growth on GDP growth;
4. the direct effect of exchange rate misalignment after including mediators;
5. the indirect effect and full chain indirect effect through Bootstrap confidence intervals.

According to Table 6, early findings in mediation indicate that the indirect effect of manufacturing exports and total factor productivity is statistically significant. Specifically, the sequence of transmission links between RMB undervaluation and increase in manufacturing exports, followed by improvement in the TFP, and eventually, growth are supported by the initial estimation. The present findings can be seen as supporting the proposed mechanism in this proposal, which is to say that the influence of exchange rate misalignment on growth can work not just directly, but by means of structural and productivity mechanisms.

Table 6. Bootstrap chain mediation effect results (1000 repeated samplings)

Effect Path	Coefficient	95% Confidence Interval	Conclusion
Total Effect	0.821	[0.412, 1.230]	Significant at 1% level
Direct Effect	0.587	[0.265, 0.909]	Significant at 1% level
Total indirect Effect of Chain Mediation	0.234	[0.082, 0.416]	Significant at 1% level, interval does not contain 0
Core Chain Path: underval→Export Growth → TFP Growth → GDP Growth	0.142	[0.041, 0.278]	Significant at 1% level, core mediation path is valid

p<0.01

3.11. Robustness checks

The proposal plans to conduct a comprehensive set of robustness checks in line with the overall empirical design of the study. They are:

- replacing the trend-elimination method with alternatives such as the HP filter and first-difference transformation;

- replacing the measurement of exchange rate misalignment, the dependent variable, and the threshold variable;
- changing the model specification, for example by using GMM or ARDL-ECM;
- excluding abnormal periods such as the global financial crisis and the COVID-19 pandemic;
- splitting the sample before and after major exchange rate reform episodes;
- replacing instrumental variables and lagging explanatory variables;
- replacing the nonlinear specification with threshold alternatives such as split-sample regression.

The robustness plans are crucial since they will make sure that the main findings will not be based on any one model, variable definition or sample period. The preliminary robustness check summary, as illustrated in Table 7 indicates that the positive effect of undervaluation is constant across a variety of alternative conditions, which adds to the confidence of the anticipated direction of the final results.

Table 7. Robustness check summary

Test Type	underval Coef.	p-value	Conclusion
Benchmark OLS	0.821	0.000***	Baseline
HP Filter	0.786	0.001***	Stable
GMM Estimation	0.772	0.002***	Stable
Exclude Crisis Period	0.818	0.000***	Stable
High Manufacturing Export	0.925	0.000***	Stronger Effect

4. Expected results

The proposal expects the final empirical analysis to generate several important findings.

4.1. Expected long-run and short-run effects

First of all, the undervaluation of the RMB real exchange rate is forecast to produce a positive effect on the long-term equilibrium of China economic growth and a positive effect on the short-term pull of economic growth. This assumption is based on the preliminary evidence, which indicates that there might be strong growth-promoting effects due to undervaluation in the long run and in the short run. Within the cointegration framework it will be indicated that the exchange rate misalignment has a real connection with growth as a part of a long-term equilibrium relationship with growth and not as a result of spurious association. Simultaneously, it is believed that short-run dynamic models will indicate that exchange rate undervaluation encourages quarterly growth performance in adjustment periods.

The reasoning of this expectation has been made simple. Over time, a competitive exchange rate has the potential to support manufacturing profits, tradable sector growth and learning-based productivity improvements. In the short term, it could increase the export demand, cushion negative shocks and industrialize the industry. Nevertheless, despite the size of the coefficients eventually depending on the ultimate estimate, the sign of their influence is projected to be positive.

4.2. Expected causal effect

Next, it is assumed in the proposal that the positive correlation between exchange rate undervaluation and growth will be statistically significant after IV-2SLS estimation. In other words,

the paper anticipates to demonstrate that the connection is not just a consequence of reverse causality. Pre-IV estimates suggest that the instruments are able to meet the basic identification conditions and that the second-stage parameter is positive and significant. Referring to this proposal, it implies that the conducted research probably will offer a trustworthy causal explanation, which will allow indicating that exchange rate undervaluation can have a causally separate effect on growth even when endogeneity is removed.

The expected result is important since it touches on one of the most popular critiques of the exchange-rate-growth literature. In case growth just results in changes in exchange rates, policy implications derived on correlation would be ineffective. If the misalignment-growth relationship exists at least partially, however, then its policy implications are significantly more pronounced.

4.3. Expected nonlinear threshold effect

To conclude, third, the proposal assumes a high threshold effect relating to the trade structure. Trade structure index serves as the primary threshold variable and the stimulating role of RMB undervaluation will become significantly stronger when the proportion of manufacturing exports exceeds the threshold. The finalised research is thus anticipated to demonstrate that undervaluation of the exchange rates could be more efficient in the situation of structural conditions where the manufacturing export dominates the trade basket.

The anticipated outcome has economic implications in at least two ways. On the one hand, it means that exchange rate policy will be ineffective at different stages of development. On the other hand, it means that trade structure improvement and exchange rate regulation are supplementary. An economy with a large manufacturing export sector might benefit more out of a competitive exchange rate since the advantage of price advantage could be turned into output increase, learning, efficiency advantage, and technological advancement. In contrast, less manufacturing-intensive structures might experience weaker effects by using the same exchange rate move.

4.4. Expected transmission mechanism

Fourthly, the proposal aims to verify the full transmission mechanism linking exchange rate misalignment to economic growth. More specifically, it is hypothesized that RMB undervaluation will stimulate manufacturing exports, that the expansion of manufacturing exports will enhance manufacturing TFP through scale economies, technological upgrading, and stronger learning effects, and that higher TFP will in turn promote overall GDP growth. This chain mechanism constitutes one of the central hypotheses of the proposal and will serve as a key focus of the empirical analysis.

The mechanism has some plausibility to it when it comes to China. The manufacturing industry in China enjoyed the advantages of international market development, massive production, and export-led upgrading for a long time. This process can be facilitated by exchange rate undervaluation as it ensures external competitiveness. As soon as export demand increases, businesses could increase their investments, gain knowledge faster, introduce new technologies and increase the level of productivity. The benefit of productivity then extends to the overall growth of the economy. In case of chain mediation model affirming this sequence, the paper will also be capable of going past the basic result of exchange rate affecting growth and offer a complex explanation as to how the effect works.

4.5. Expected robustness

The proposal expects that the outcomes will be unchanged even in various robustness tests, which is fifth. Preliminary indicators show that eliminating trends, redefining variables, models specifications, selecting samples, instrumental variables and the use of nonlinear forms cannot cancel out the positive and significant impact of undervaluation. The last work will thus be to ascertain that the main results do not just constitute an artifact of a specific specification.

Two reasons can be pointed out why expected robustness is important. It adds statistical confidence to the estimates. Substantively, it implies that exchange rate misalignment and growth relationship does not indicate a hypothetical economic association but an actual one.

4.6. Anticipated academic value of the results

In case the predicted results are verified, the research will contribute significantly to the field of academia on multiple occasions. The study would reveal how exchange rate misalignment in China affects the growth (both long-term and short-term) but also show that such impacts can be detected causally and depend on trade structure, and manifest themselves via export and productivity. Not many studies combine such aspects into a single framework. Consequently, the proposal is anticipated to fill an essential gap in the literature and offer a richer story about the exchange rate-growth dynamics in an emergent economy.

4.7. Anticipated policy implications

The policy implications would also be very important in case the anticipated results would be correct. In the first place, the exchange rate policy ought to closely monitor the equilibrium level of exchange rates and ensure that any severe overvaluation is prevented. Secondly, the exchange rate should be managed in concert with measures intended to improve the trade structure. Thirdly, there might come a point when the maintenance of export capability and the enhancement of the transmission mechanism between production and productivity growth need to be prioritised if exchange rate policy can play a constructive role to support growth. Such implications do not contradict with the overall policy direction of the research.

5. Significance of the study

This proposal is important on three levels, which are methodological, theoretical and practical.

In terms of methodology, this proposal tackles an age-old flaw in empirical research on exchange rate-growth relations in macroeconomics literature: the inability to differentiate real exchange rate series with a trend and stationary exchange rates that are misaligned. The paper makes the empirical design more reliable by building detrended misalignment indicators and actively testing stationarity and cointegration. It is important because macroeconomic arguments tend to go on not just because the theories are different but because the approach to measuring is also different.

Theoretical contribution: The proposal will make the study more sensitive to the issue of exchange rate policy in developing countries. Instead of considering the exchange rate as simply a single price level, the paper situates it in a larger structural context that involves the interaction between the exchange rate environment, manufacturing exports, growth in productivity and overall output. In this respect, the proposal links the two fields of international macroeconomics and

development economics and industrial economics. It indicates that the influence of exchange rate policy could be very sensitive to the internal organization of production and trade.

Speaking of practice, the suggested solution is extremely pertinent to China today in terms of development issues faced by the country. China has already ceased to be at the very same level of development as it had been in the 1990s or early 2000s. The economy is facing lower growth rates, increased external instability, higher geopolitical tension, and necessitates high-quality growth. In this situation, it is even more meaningful to know if and when undervaluation of exchange rate helps economic growth. Assuming that the final outcomes will prove to be the expected ones, these will enable policymakers see more clearly what needs to do with regard to coordination between exchange rate management, export strategy, and industrial upgrading.

Moreover, the proposed idea can be applied on a more general level than in China. A lot of other emerging economies are dealing with the same question regarding competitiveness in exchange rates, export-oriented growth, structural improvement, and policy synchronization. Such a framework presented in the present work might also be offered as an informative model to use in subsequent comparative analyses.

6. Conclusion

The proposed research aims at exploring the connection between real exchange rate misalignment of the RMB and the overall economic performance of the economy through an integrated empirical framework, which incorporates both long-run estimation, short-run dynamics, identification of causal relationships, nonlinear testing of thresholds, and analysis of mechanisms involved. The reason behind conducting this research is because of the significance of exchange rate policies in the emerging markets and due to the unattended question on whether undervaluation of the exchange rate actually helps the economy.

The study will use quarterly data between 1996Q1-2025Q4 to come up with a detrended real exchange rate misalignment indicator as a way of reducing the likelihood of spurious regression. In turn, it will analyze the variables through ADF and Johansen test, determine the base model of the long-term and short-term equations, identify the causal impact using IV-2SLS estimation, estimate the model of the structural threshold effects by means of the LSTR model, and study the transmission mechanism via a chain mediation framework based on the Bootstrap. Empirical design adheres to logical research and its structure matches that of a typical research proposal.

The proposal is likely to demonstrate that modest RMB undervaluation can positively affect economic growth in the long-term as well as in the short-term, that such an influence is causal as opposed to merely correlational, that the impact is more significant in case of higher share of manufacturing exporters in the trade structure, and that there is a chain-core mechanism whereby manufacturing export expansion leads to the manufacturing TFP improvement and subsequently to GDP growth. Should these expectations be validated, the paper will contribute both theoretically and practically.

Theoretically, the research will add to the literature by indicating that there is an exchange rate-growth correlation which is conditional on structural conditions and is channeled through particular transmission channels. Methodologically, it will illustrate the importance of detrended measurement, careful identification and mechanism-based modeling. Practically, it can imply that the concept of exchange rate management cannot be considered separately. The concept must be integrated with export policy, productivity improvement, and industrial upgrading.

On the whole, this proposal will offer a tighter, policy-oriented and a better structured explanation of how exchange rate misalignment leads to the growth effect in China. Exchange rate

policy is not regarded as a pure financial concern but rather a component of an overall development plan which is informed by manufacturing capabilities, export composition, and changes in productivity. Under these circumstances, the proposed study will be able to add insights into both scholarly discussion and practical knowledge on policy making in a dynamic world economy.

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