The Effects of Exchange Rates on International Trade

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1. Introduction

Exchange rates are an important part of open-economy macroeconomics and have been used to determine international trade performance. Exchange rates have also been used to shape trade policies, as countries adjust them with the aim to boost exports and manage trade balances. In theory, currency depreciation should increase exports and decrease imports, leading to an overall increase in trade balance. When a local currency depreciates (i.e., the LCU/USD exchange rate increases), foreign buyers need less of their currency to purchase the same amount of goods from the local country, effectively making exports cheaper on the global market. This can stimulate foreign demand and increase export volumes. At the same time, a weaker currency makes imported goods more expensive in local terms, leading to a decline in import demand as domestic consumers and firms substitute towards local alternatives or reduce consumption altogether.

However, in practice, this relationship is far from straightforward. Exchange rates' impacts may be delayed, and other factors like currency invoicing, inelastic demands, psychological price sensitivity, and reliance on imported inputs can also play a role. Understanding the effects of exchange rate changes on exports and imports is crucial for evaluating the effectiveness of monetary and exchange rates policy, especially for economies that heavily depend on global trade. In addition, understanding the mechanism through which exchange rates can potentially affect trade flows can help create better trade policies.

Previous literature has found that exchange rate changes have a significant impact on exports and imports. For example, Karsten (2016) discovered that real effective exchange rates (REER) movements have a significant effect on the trade balances of Eurozone countries. However, these studies focus on the long-term effects of exchange rates, and the short-term effects of exchange rates remain mixed. This paper aims to uncover the effects of exchange rate changes on trade in the short term, as well as the mechanism through which these effects take place.

To examine the effects of exchange rate fluctuations on international trade, this paper uses monthly panel data on exports and imports (measured in millions of USD) from 21 countries. The primary independent variable is the monthly percentage change of the official exchange rate (local currency units per USD), while the real effective exchange rate (REER) will be used in the mechanism analysis. The dependent variables are exports and imports. The empirical method will be panel OLS, controlled for country, seasonality, and yearly fixed effects. In order to test the robustness of the model, this study will use lagged official exchange rates to account for potential delays in trade response due to sticky prices or contract rigidities.

The results show that OER changes have a statistically significant effect on both exports and imports in the short term. Specifically, an increase in OER has a negative effect on both exports and imports. In addition, the mechanism analysis showed that change in REER has an insignificant effect on exports compared to change in OER.

This paper contributes to the literature by providing empirical evidence on the short-term effects of exchange rate changes on both exports and imports. Unlike many studies that focus on annual data or long-run trade, this paper emphasizes short-run dynamics and captures both immediate and delayed responses by including analysis using lagged exchange rate terms. It also accounts for broad macroeconomic controls such as inflation, labor supply, GDP growth, and unemployment.

2. Background

According to World Bank data, global exports accounted for around 29.3% of world GDP in 2023, highlighting the importance of trade to economic growth. Many countries actively manage their exchange rates to support exports and improve trade balances. China has long been accused of maintaining an undervalued currency to boost exports, which could explain the rapid boom of the Chinese economy in the 1990s and 2000s. The Trump administration has also pushed for a weaker dollar to improve American export competitiveness.

The relationship between currency value and trade performance is not only theoretically important but can also be observed in real-world data. For example, Figure 1 illustrates the trade-weighted U.S. dollar index alongside the U.S. trade balance from 1995 to 2017. The graph shows a clear inverse pattern between the strength of the U.S. dollar (blue line) and the trade balance (green line).

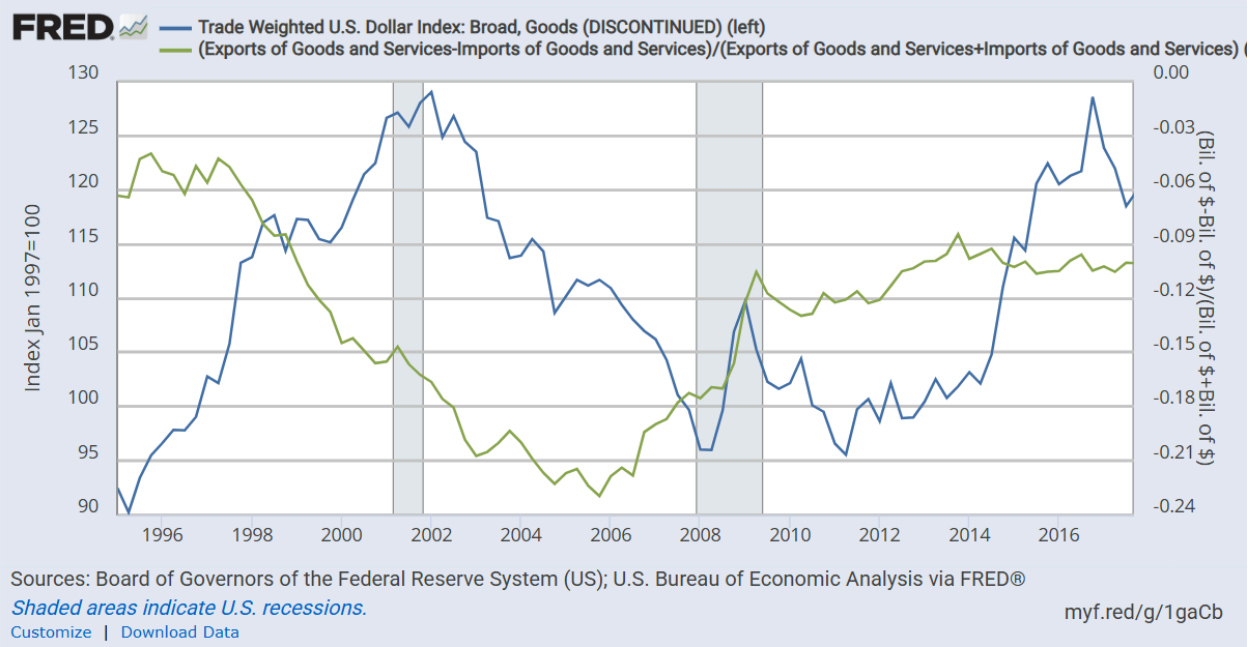

Figure 1: Relationship between U.S. Dollar Strength (Trade-weighted Index) and U.S. Trade Balance (1995–2017). Source: FRED, Federal Reserve Bank of St. Louis.

Given that exports and imports make up a large share of many countries, evaluating the effects of exchange rates on trade balances is important for exchange rates policy that can help drive the economy, especially for countries that are reliant on international trade or currency fluctuations.

3. Data and Empirical Method

The data is collected from two datasets, the Global Economic Monitor (GEM) and World Development Index (WDI) from the World Bank Group. These indexes obtain data primarily through official sources like national statistical agencies. Therefore, inconsistencies are common for many countries. Data from the GEM—which contains variables such as imports, exports, exchange rates—are monthly, while data from the WDI—which contains labor, GDP, exports and imports share of GDP statistics—are annual. The two datasets are merged by assigning the same yearly observations to all months of that year. Given that the GEM data is monthly, the dataset is particularly suited for examining the short-term effects of exchange rate fluctuations on trade, rather than long-term impacts.

The final dataset is in the form of panel data, consisting of around 2247 observations for the main regression. From around 200 countries listed in the two indexes, only 21 countries have reliable data that can be used for this study. The time period is between February 2010 and

December 2018. Most of the countries in this data are either developed, or are developing with a large economy.

To investigate the effect of exchange rates on trade, a range of variables are included in the analysis. The dependent variables are the changes of log exports and imports, capturing monthly growth in trade values. The study also compares two key independent variables, percent change OER and REER. While OER captures nominal exchange rate changes with respect to the USD, REER reflects real price competitiveness by accounting for inflation differentials and trade weights.

Table 1: Research variables

Variable	**Definition**
Dependent Variable	
$\Delta ln\_exports$	Difference of natural log of exports in million USD (Monthly).
$\Delta ln\_imports$	Difference of natural log of imports in million USD (Monthly).
Independent Variables	
official_exchange_rate_percent_change	Monthly percent change in official exchange rate (LCU/USD).
REER_percent_change	Monthly percent change in real effective exchange rate.
$official\_exchange\_rate\_percent\_change_{t-1}$	Monthly percent change in official exchange rate from previous month (LCU/USD).
Controls	
CPI_percent_change	Monthly inflation rate.
ln_labor	Natural log of labor force (Annual).
GDP_annual_growth	Annual GDP growth rate.
GDP_per_capita_annual_growth	Annual GDP per capita growth rate.
export/import_share_of_GDP	Percent export/import share of GDP (Annual).
unemployment_rate	Unemployment rate (% of labor force) (Annual).
winter	Seasonal fixed effects for winter.
spring	Seasonal fixed effects for spring.
summer	Seasonal fixed effects for summer.

Due to the large difference in magnitude between exports/imports and other variables, the model takes the natural logarithm of exports/imports. Furthermore, Figures 2 and 3 illustrate the logarithm of exports and imports of one of the countries, Belgium, as an example. The figures show dips and rises in certain years, likely due to trade shocks, as well as short term trends. To capture these patterns, the model uses the first difference of log exports/imports, in addition to yearly fixed effects.

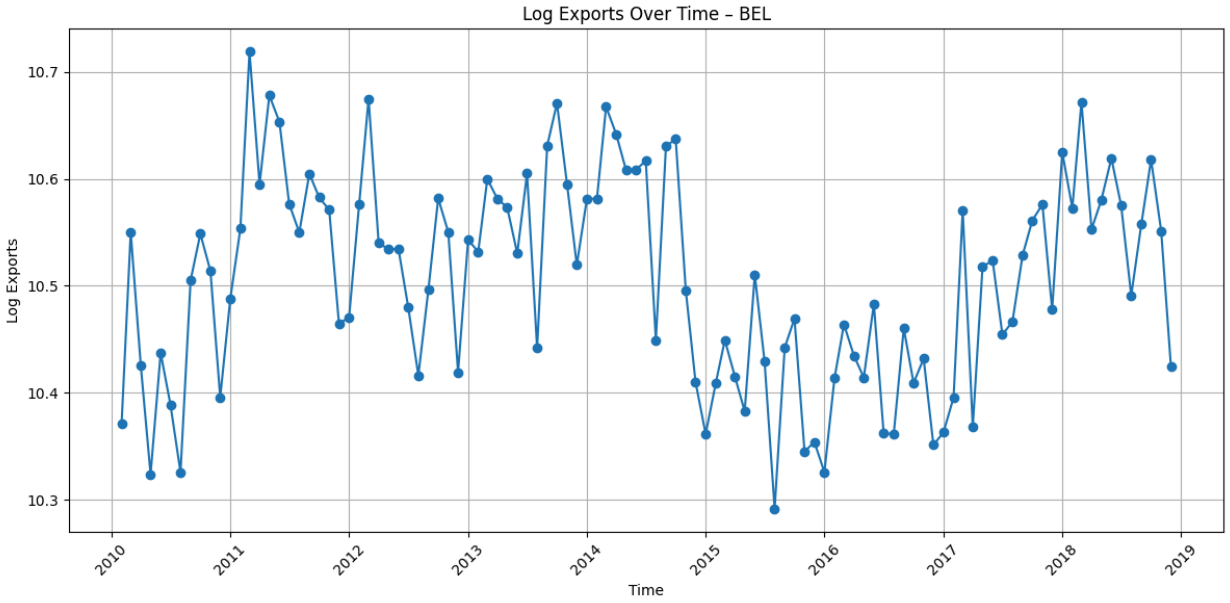

Figure 2: Monthly log exports of Belgium from 2010 to 2018

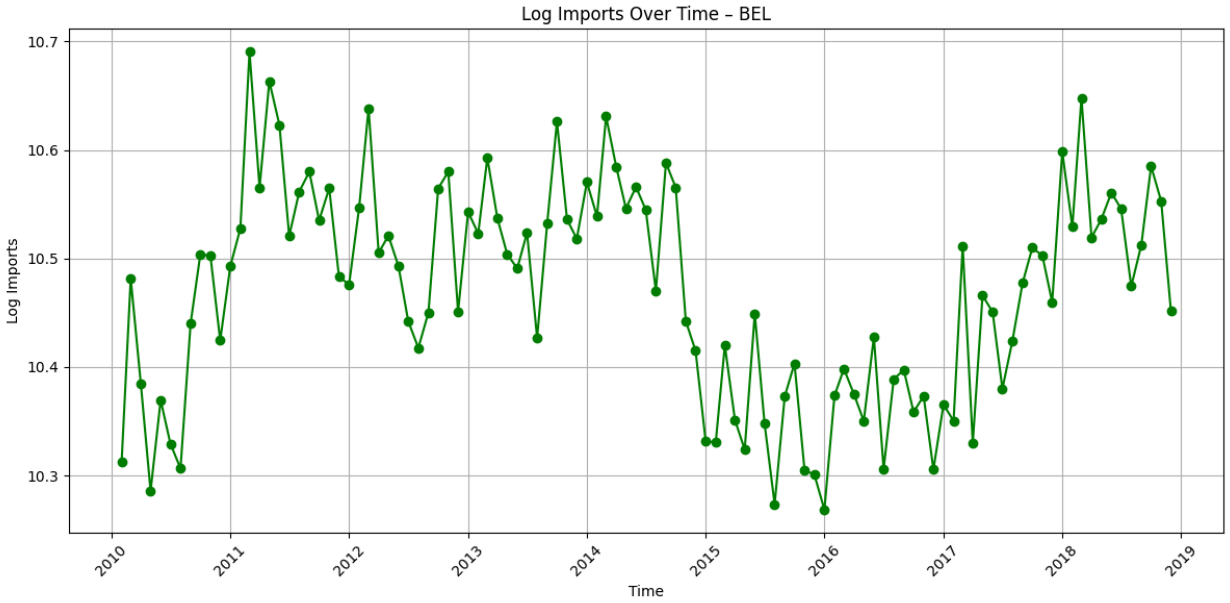

Figure 3: Monthly log imports of Belgium from 2010 to 2018

For the empirical method, this paper uses panel Ordinary Least Squares (OLS) regression to estimate the effects of exchange rates on trade. All regressions control for country fixed effects,

seasonal fixed effects, as well as yearly fixed effects to capture unobserved heterogeneity across countries, recurring seasonal trade patterns, and global events.

Empirical method includes three regressions. The first regression estimates the short-term effect of official exchange rate changes on exports and imports. The dependent variable is the first difference of the natural log of exports/imports (Δln_exports/Δln_imports), capturing monthly export/import growth. This is the main specification of the paper.

$$\begin{aligned}\Delta\ln\_exports_t/\Delta\ln\_imports_t = {} & \beta_0 + \beta_1 \times official\_exchange\_rate\_percent\_change_{it} \\ & + \beta_2 \times CPI\_percent\_change_{it} \\ & + \beta_3 \times ln\_labor_{i\gamma} \\ & + \beta_4 \times GDP\_annual\_growth_{i\gamma} \\ & + \beta_5 \times GDP\_per\_capita\_annual\_growth_{i\gamma} \\ & + \beta_6 \times export/import\_share\_of\_GDP_{i\gamma} \\ & + \beta_7 \times unemployment\_rate_{i\gamma} \\ & + \beta_8 \times winter + \beta_9 \times spring + \beta_{10} \times summer \\ & + \alpha_i + \gamma_\gamma + u_{it}\end{aligned}$$

To further investigate whether the exchange rate affects trade through changes in real price competitiveness, the second regression replaces the official exchange rate with the real effective exchange rate (REER), which accounts for inflation differentials and trade-weighted exchange rates against trading partners. CPI_percent_change is taken out of the equation due to REER already accounting for inflation.

$$\begin{aligned}\Delta\ln\_exports_t/\Delta\ln\_imports_t = {} & \beta_0 + \beta_1 \times REER\_percent\_change_{it} \\ & + \beta_2 \times ln\_labor_{i\gamma} \\ & + \beta_3 \times GDP\_annual\_growth_{i\gamma} \\ & + \beta_4 \times GDP\_per\_capita\_annual\_growth_{i\gamma} \\ & + \beta_5 \times export/import\_share\_of\_GDP_{i\gamma} \\ & + \beta_6 \times unemployment\_rate_{i\gamma} \\ & + \beta_7 \times winter + \beta_8 \times spring + \beta_9 \times summer \\ & + \alpha_i + \gamma_\gamma + u_{it}\end{aligned}$$

Finally, the third regression checks for robustness of the model by replacing the official exchange rate change of the current month with that of the previous month. Previous literature has demonstrated that exchange rates may have a delayed effect on exports and imports. Campa and Goldberg (2005) found that, in the short term (roughly one quarter), only about 46% of exchange

rate fluctuations are reflected in import prices. This increases gradually over time, reaching approximately 64% in the long term. Using a lagged official exchange rate variable not only helps confirm this mechanism but also proves the robustness of the model.

$$\begin{aligned}\Delta \ln\_exports_t / \Delta \ln\_imports_t = {} & \beta_0 + \beta_1 \times official\_exchange\_rate\_percent\_change_{it-1} \\ & + \beta_2 \times CPI\_percent\_change_{it} \\ & + \beta_3 \times \ln\_labor_{i\gamma} \\ & + \beta_4 \times GDP\_annual\_growth_{i\gamma} \\ & + \beta_5 \times GDP\_per\_capita\_annual\_growth_{i\gamma} \\ & + \beta_6 \times export/import\_share\_of\_GDP_{i\gamma} \\ & + \beta_7 \times unemployment\_rate_{i\gamma} \\ & + \beta_8 \times winter + \beta_9 \times spring + \beta_{10} \times summer \\ & + \alpha_i + \gamma_\gamma + u_{it}\end{aligned}$$

4. Empirical Analysis and Results

This section presents the estimation results from the three regression models examining the effects of exchange rate changes on trade. The results from the main regression for both exports and imports are reported in Table 2.

Table 2: Output of main regression

Dependent Variable	(1) $\Delta ln\_exports$	(2) $\Delta ln\_imports$
const	0.035***	0.040***
	(0.008)	(0.008)
official_exchange_rate_percent_change	-0.005***	-0.007***
	(0.001)	(0.001)
CPI_percent_change	0.001***	0.001*
	(0.000)	(0.000)
ln_labor	0.000	-0.000
	(0.000)	(0.000)
GDP_annual_growth	0.000	0.000
	(0.000)	(0.001)
GDP_per_capita_annual_growth	0.001	0.001
	(0.000)	(0.001)
export_share_of_GDP	0.000	
	(0.000)	
import_share_of_GDP		-0.000**
		(0.000)
unemployment_rate	0.000***	0.000
	(0.000)	(0.000)
Observations	2226	2226
R-squared	0.078219	0.073822

Notes: *** Statistically significant at the 1% level; ** 5% level; * 10% level.

The regression results show that changes in official exchange rates have a significant and negative effect on both exports and imports. Specifically, a 10% increase in the official exchange rate is associated with a 5% decrease in exports and a 7% decrease in imports. This result is contrary to the typical expectation that depreciation in currency boosts exports. However, considering that exports and imports are measured in USD, a depreciation in the LCU compared to the USD would lead to a lower revenue for the same volume of exports. In addition, demands may not be able to adjust quickly enough to the lower prices of exports in the short run, which can contribute to lower export revenues overall.

Table 3: Output of mechanism analysis

Dependent Variable	(1) $\Delta ln\_exports$	(2) $\Delta ln\_imports$
const	0.203	0.429
	(0.239)	(0.311)
REER_percent_change	0.002	0.006***
	(0.002)	(0.002)
ln_labor	-0.011	-0.024
	(0.015)	(0.019)
GDP_annual_growth	0.002***	0.001
	(0.001)	(0.001)
GDP_per_capita_annual_growth	-0.001*	-0.000
	(0.001)	(0.001)
export_share_of_GDP	0.000**	
	(0.000)	
import_share_of_GDP		-0.000
		(0.000)
unemployment_rate	0.000	0.000
	(0.000)	(0.000)
Observations	2226	2226
R-squared	0.068014	0.060532

Notes: *** Statistically significant at the 1% level; ** 5% level; * 10% level.

Table 3 presents the results of the mechanism analysis, which examines the effect of changes in the Real Effective Exchange Rate (REER) on exports and imports. It shows that a change in REER has a significant effect on imports, but not exports. In particular, a 10% increase in REER leads to a 6% increase in imports. The contrast between this regression and the main regression shows that in the short run, export values are more sensitive to the effects of nominal pricing captured by OER than to changes in real competitiveness (REER).

This is likely because factors such as production capacity and contract rigidity can make export volume inelastic in the short run. However, since exports are measured in USD, an increase in OER (LCU/USD) can have a direct effect as opposed to an increase in REER. This means that exchange rates mainly affect short term exports through nominal pricing channels instead of price competitiveness. In contrast, imports are more flexible in the short run, so an appreciation of local currency, measured by both OER and REER, can have a direct effect on imports.

Table 4: Output of robustness check

Dependent Variable	(1) $\Delta ln\_exports$	(2) $\Delta ln\_imports$
const	0.107	0.452
	(0.188)	(0.285)
lag_official_exchange_rate_percent_change	-0.003***	-0.003***
	(0.001)	(0.001)
CPI_percent_change	0.001*	0.000
	(0.000)	(0.001)
ln_labor	-0.005	-0.026
	(0.012)	(0.018)
GDP_annual_growth	0.001*	0.001
	(0.001)	(0.001)
GDP_per_capita_annual_growth	-0.001	-0.000
	(0.001)	(0.001)
export_share_of_GDP	0.000*	
	(0.000)	
import_share_of_GDP		-0.000
		(0.000)
unemployment_rate	0.000	0.000
	(0.000)	(0.000)
Observations	2226	2226
R-squared	0.071871	0.058914

Notes: *** Statistically significant at the 1% level; ** 5% level; * 10% level.

Table 4 presents the results of the robustness check. Specifically, a 10% increase in OER last month leads to a 3% decrease in both exports and imports. This suggests that the effects of exchange rates on trade may be delayed rather than immediate. The results of the robustness is consistent with the main findings, and further strengthens the evidence that changes in official exchange rates significantly affect exports and imports.

5. Conclusion

Exchange rates are key factors affecting trade. While previous studies have examined their short-term effects, the results are often mixed. This paper clarifies this issue by using monthly data and different exchange rate variables to better understand the effects of exchange rates on trade in the short run.

The results show that both exports and imports are affected by OER changes, while only imports are affected by REER changes. This suggests that exchange rates mainly affect exports through nominal channels, and highlights the inelasticity of short term exports compared to imports.

Nonetheless, this study still has certain limitations, such as limited sample size and country diversity. Additionally, data collected from the World Bank Group may contain inaccuracies due to the nature of self-reporting.

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