Simultaneity between export and import flows and the Marshall–Lerner condition: the Turkish case (1998–2013)

By

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Abstract

This paper examines the Marshall–Lerner condition under the simultaneity of exports and import flows in the Turkish economy. Due to the high interdependence between ratios of export and import flows to GDP, the traditional version of the Marshall–Lerner condition is not sustained. In the case of Turkey, the long-term estimations of the price elasticities of exports and imports, and the respective cross elasticities, lead us to conclude that currency devaluation would, in the long run, improve the balance of trade.

Keywords: Marshall–Lerner condition, price elasticity, Turkey, export and import flow simultaneity.

JEL classification: F 14; F11; F44

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1. Introduction

The current account deficit of Turkey has increased to become over the last decade one of the largest in the country's history. It has been argued that one of the remedies for the deficit problem is to reduce the value of the domestic currency. The effects of currency depreciation on a countries' trade balance are traditionally analysed by examining the Marshall–Lerner condition (MLC). The MLC suggests that the depreciation of a currency will improve the country's trade balance if the sum of the absolute values of the import and export demand price elasticities are greater than the value of 'one' in the long run.

Since Lerner (1934, 1952), there have been number of theoretical and empirical studies in the economic literature about the impact of exchange rate variations on the balance of trade, for example, those of Miles (1979), Bahmani-Oskooee (1985, 1998), Wilson (2001), Kale (2001), Mahmud et al. (2004), Gomes and Paz (2005), Matesanz and Fugarolas (2009), Çelik and Kaya (2010), Hsing (2010), Yazici and Klasra (2010), Welfens (2012), Sastre (2012) and Soleymani and Chua (2014). Despite the number of such studies, they have failed to agree on the effect of currency devaluation on trade balance; thus, it remains an open question.

Kale (2001) employed long-run and short-run methods using quarterly Turkish data between 1984 and 1996, and caried out the cointegration test to estimate the long-term elasticities. The study concluded that a real depreciation improved the Turkish balance of trade in those years well before large scale structural change took place in Turkey. Çelik and Kaya (2010) analysed Turkey's bilateral trade dynamics with respect to a panel of seven countries for the period 1985 Q1 to 2006 Q4. They questioned the existence of the J-curve[1] by analysing the relationship between real exchange rates, real income and the trade balance for Turkey, concluding that the effect of a devaluation of the currency on the trade balance is country-specific, and that there is no J curve effect. Yazici and Klasra (2010) used the quarterly data for the period 1986 to 1998. Their study examined the J-curve effect in two sectors of the Turkish economy: manufacturing and mining. They highlighted a special structural issue of the Turkish economy – the import content of exports – and concluded that in neither sector did the J-curve exist, and that the violation of the J-curve effect is more severe in the sector with a higher import content. Sastre (2012) focused on the issue of simultaneity between export and import flows in the Spanish economy. This issue is also important for the Turkish economy. Sastre reformulated the Marshall–Lerner condition in open economies and argued that in the long run the impact of exchange rate variations on the balance of trade of countries with open economies not only depends on export and import price elasticities but also on the cross-elasticity values between exports and imports.

2. Reformulation of the Marhsall–Lerner Condition

[1] The theory of the J curve: as a result of devaluation, the trade balance will first worsen and then with the passage of time it will start to improve.

In the standard Marshall–Lerner argument the following applies:

lnTB = LnX –LnM *(3)*

where TB is the trade balance. $\frac{\partial TB}{\partial e} > 0$ when $\left(\varepsilon_{x,e} + \varepsilon_{m,e}\right) > 0$ where $\varepsilon_{x,e}$ and $\varepsilon_{m,e}$ are the export demand elasticity and import demand elasticity, respectively. Sastre's reformulation of the Marshall–Lerner condition, according to the classification of countries in relation to cross elasticities between exports and imports, consisted of four propositions.

Firstly, if $\varepsilon_{m,x} = 0$ and $\varepsilon_{x,m} = 0$ where $\varepsilon_{m,x}$ and $\varepsilon_{x,m}$ are cross elasticities of imports and exports, respectively, the Marshall–Lerner condition is satisfied when $\left(\varepsilon_{x,e} + \varepsilon_{m,e}\right) > 0$. In other words, it characterizes an economy that depends little on other countries.

The second proposition states that if $\varepsilon_{m,x} \neq 0$ and $\varepsilon_{x,m} = 0$, $\frac{\partial TB}{\partial e} > 0$ when $\left(\varepsilon_{x,e}\left(1 + \varepsilon_{m,x}\right) + \varepsilon_{m,e}\right) > 1$. This is an economy where the demand for imports depends on exports, but does not depend on imports. This condition applies to those economies in which many industries import raw materials or intermediate goods rather than export final goods.

Sastre's third proposition considers the case where exports depend on imports, but imports do not depend on exports. The proposition outlines that $\frac{\partial TB}{\partial e} > 0$ when $\left(\varepsilon_{x,e} + \varepsilon_{m,e}\left(1 + \varepsilon_{x,m}\right)\right) > 1$.

The fourth case states that export demand depends on import demand and vice versa; so, the Marshall–Lerner condition is valid when $\left(\varepsilon_{x,e}(1 + \varepsilon_{m,x}) + \varepsilon_{m,e}\left(1 + \varepsilon_{x,m}\right)\right) > 1$.

3. **The Data and the Models, Simultaneity Between Export and Import Flows**

This study uses quarterly data from between 1998 and 2013 and Sastre's analytically developed reformulation of the Marshall–Lerner condition for Turkey. Foreign trade data are taken from TurkStat, while the source of real exchange rate data is taken from OECD sources. National investment expenditure, which gives the best result in the analysis as an indicator of domestic demand is gathered from the national income identity (TurkStat). The total gross domestic product (GDP) of the EU-18 countries, which was identified as a world demand indicator, was taken from Eurostat. Before applying the empirical models, the series were transformed into log form and adjusted for seasonality. The seasonality adjustment is done by using the TRAMO/SEATS (Time Series Regression with ARIMA Noise, Missing Observations, and Outliers) method.

Turkish import and export demand equations and their determinants are represented in the following equations:

lnX = f(lnre, lnEAD, lnM) *(1)*

lnM = f(lnre, lnI(tr), lnX) *(2)*

where M is the volume of imports of goods and services, I(tr) is the national investment expenditure, EAD is the total GDP of the Euro-18 as a proxy for foreign demand and, finally, lne is the real exchange rate (ln stands for logarithm).

The maximum likelihood cointegration procedure proposed by Johansen was used to check whether a long-term equilibrium relationship exists between the variables in Equations (1) and (2) for Turkey. After obtaining a cointegrated relation among the variables, the residual of the long-run equation was used in the short-run specification as an error correction process.

To conduct cointegration analysis, it is necessary to determine the degree of integration of the variables. Before conducting this analysis, the augmented Dickey Fuller (ADF; Dickey and Fuller, 1979) and Phillips-Perron (PP; Phillips and Perron 1988) unit root tests were performed to determine whether all the variables have the same integration order. The test results confirmed that all variables are stationary in their first differences. In addition, trend, intercept and lag options for each cointegration equation were determined by testing all the available options. The results indicated that the level export data have no deterministic trends while the import data have quadratic deterministic trends.

4. Turkish Case: Facts and Results

After the introduction of Inward Processing Regime (IPR) as a pathway to stimulate exports, which was in parallel with the Customs Union with the EU in 1996, foreign trade figures exhibited an upward course in Turkey. The Customs Union has been a crucial instrument for the integration of the Turkish economy into global market. Bilateral trade between Turkey and the EU has expanded considerably. Thus, between 1998 and 2013 Turkey's exports to the EU increased more than fourfold while Turkey's imports from the EU rose 3.6-fold during the same time. Moreover, in 1998 the total amount of exports and imports were USD 27 and 46 billion, respectively. After the integration of the Turkish economy into the global market, both sets of trade figures recorded an average 12% annual increase. By 2013, the total exports had increased to USD 152 billion and the total imports were USD 252 billion, owing to both IPR and the integration of Turkish firms into the worldwide trade networks in line with the acceleration of globalization.

In this period, the trade composition supported the view that IPR allowed firms to import intermediate goods, which are used in the production of export goods. The indecisive dependence of the figures indicated a strong link between exports and imports in Turkey. According to the TurkStat data, 72% of total imports between 1998 and 2013 were made up of intermediate goods, while the imports of consumption goods were just 12% of the total imports in the same period. Additionally, the intermediary goods' content of Turkish exports during this period was 47%, while 42% of Turkey's exports consisted of consumption goods. So, import and export price elasticities may vary with the composition of trade, which clearly depends upon the economic structure of a country.

The energy dependence of the Turkish economy, which is evaluated as a major structural drawback, may lead to vague results being obtained from foreign trade models. According to the data, oil's share of the total imports was about 20% between 1998 and 2013. Considering

the demand for oil from a developing country such as Turkey, it is anticipated that the effects of the hike in the oil price on the devaluation of local currency would be limited. So in this study, the oil-excluded total imports are also used as an import indicator to specify the price elasticity of imports.

The results of Johansen's test for both for two and six lag orders support the hypothesis that there are two cointegrating relationships between imports and exports (Table 1). Moreover, at least two valid cointegration equations were obtained when all variables in Equations (1) and (2) were included in the analysis. The estimated coefficients for the cointegration vectors were normalized in order to interpret the results, which enabled us to identify the elasticities directly from the cointegrating vectors.

Table 1: Results of Johansen's test

Johansen cointegration test results	Number of cointegrating equations*	Trace statistics**	Probability
1.lnX=f(lnM,lner,lnEAD)	*At most 1*	30.91	0.03
2.lnM=f(lnX,lner,lnI(tr))	*None*	37.24	0.03
3.lnX=f(lnOEM,lner,lnEAD)	*At most 2*	16.77	0.03
4.lnOEM=f(lnX,lner,lnI(tr))	*None*	72.06	0.00

(*) Null hypothesis states that there are no cointegration relations between variables.
(**) Critical values for Oswald–Lenum (95%) were 29.68 for *At most 1*, 15.41 for *At most 2* and 47.21 for *None*.

The results indicated that all models have at least one cointegration equation. The cointegration vectors obtained were:

$$lnX = 0.99\, ln\, M - 0.66 lnre + 0.59 lnEAD \quad (3)$$

$$lnM = 0.49\, ln\, X + 0.60 lnre + 0.44 lnI(tr) \quad (4)$$

$$lnX = 0.99\, ln\, OEM - 0.90 lnre + 0.96 lnEAD \quad (5)$$

$$lnOEM = 0.48\, ln\, X + 0.59 lnre + 0.49 lnEAD \quad (6)$$

The results obtained from the analysis reveal that the coefficients in both import models are not statistically different. This is counter to the presumptions about the distorting effects of oil imports on import elasticity, and it brings another aspect to the fore: oil imports exhibited a similar course to the other sectors of imports.

Not only in both of the import models, but also in both of the export models, the coefficients of the real exchange rate are statistically significant and economically coherent with the theory. Furthermore, the sum of both import and export elasticities are greater than one, which corresponds to the standard Marshall–Lerner condition being valid for the Turkish economy in the long run.

This result contradicts the findings of similar studies previously conducted on the Turkish economy. However, the previous works have generally captured the situation in the period

before 2000, when the Turkish economy struggled with the high inflation, strict trade tariffs with neighbours and inadequate financial market regulation. Thanks to the financial sector adjustment and the restructuring of the banking sector implemented in the aftermath of the financial crises of 1999–2001, many economic achievements have been attained elaborately in both the real economy and the public sector. So, it is considered that the distorting effects of external factors on the relations between foreign trade figures and the exchange rate have been relatively limited in the 2000s compared to the previous decades.

The results also indicate that the condition expressed in the fourth proposition is verified for Turkey. In other words, imports and exports in Turkey are simultaneously dependent on each other and the condition $\left(\varepsilon_{x,e}\left(1+\varepsilon_{m,x}\right)+\varepsilon_{m,e}\left(1+\varepsilon_{x,m}\right)\right)>1$ was satisfied: $\left(0.66_{x,e}\left(1+0.49_{m,x}\right)+0.60_{m,e}\left(1+0.99_{x,m}\right)\right)=2.18.$

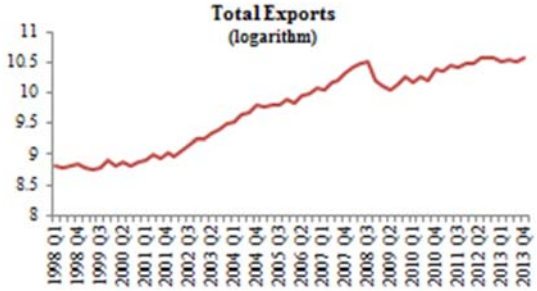
In the case of Turkey, the long-term estimations of the price elasticities of exports and imports, and the respective cross elasticities, lead us to conclude that currency devaluation would, in the long term, improve the balance of trade.

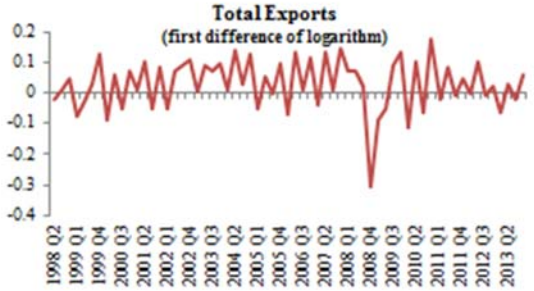
5. **Conclusions**

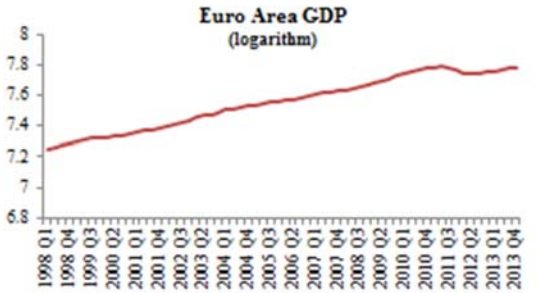
The main goal of this paper is to assess the long-term effects of real exchange rate depreciation on the Turkish trade balance in recent decades. According to the traditional Marshall–Lerner condition, if the sum of export and import price elasticities is more than one, then the impact of currency devaluation on the trade balance will be positive. This condition implicitly assumes that GDP is independent from the exchange rate. In fact, one of the main determinants of investment is the import volume (imports of most of the investment goods such as machinery and advanced technology products), and exports also depend on imports in the Turkish economy (see figures in the Appendix). There is a clear case for the simultaneity of export and import flows. Thus, the long-term estimates of the price elasticities of exports and imports (i.e. the traditional Marshall–Lerner condition case) will not by themselves be enough to estimate the Marshall–Lerner condition. The respective cross elasticities are also important. Our analysis, which includes the respective cross-price elasticities, concludes that a devaluation of the Turkish Lira would, in the long run, improve the balance of trade, even using the non-traditional Marshall–Lerner measure.

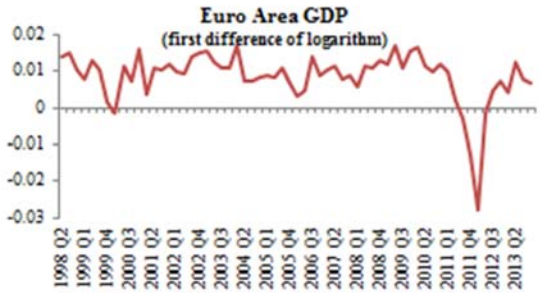
Appendix

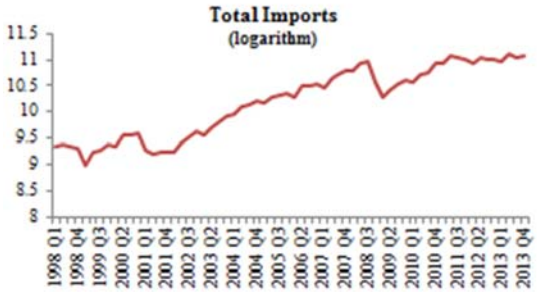
This section contains the graphic analysis of the series to illustrate the relations between dependent variables. The mini graphs are constructed to demonstrate the existence of the unit roots of the variables.

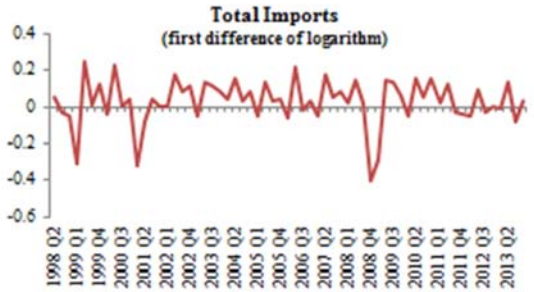


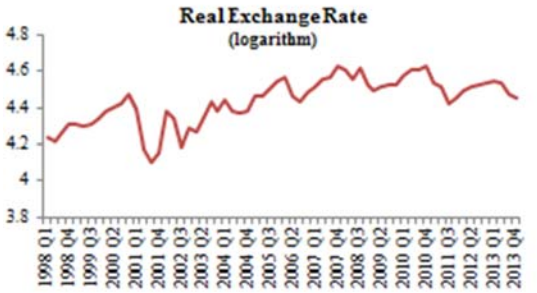


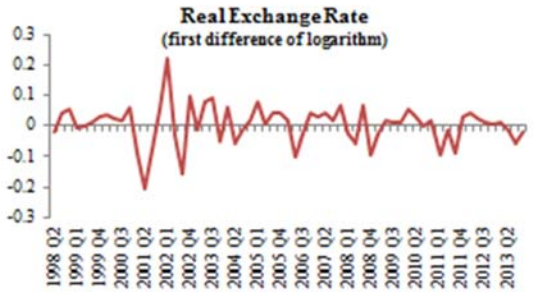


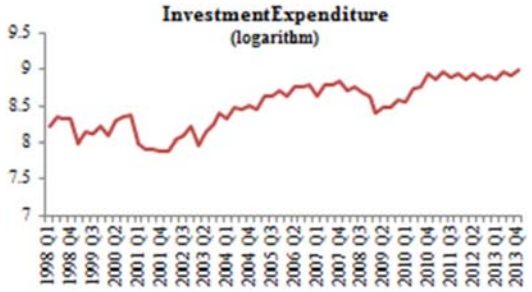


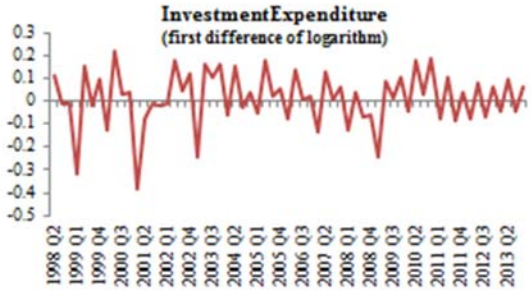


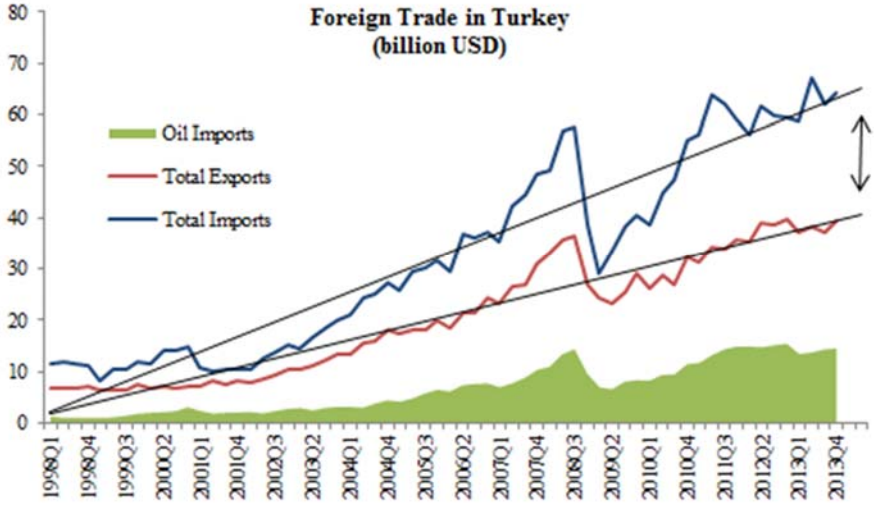


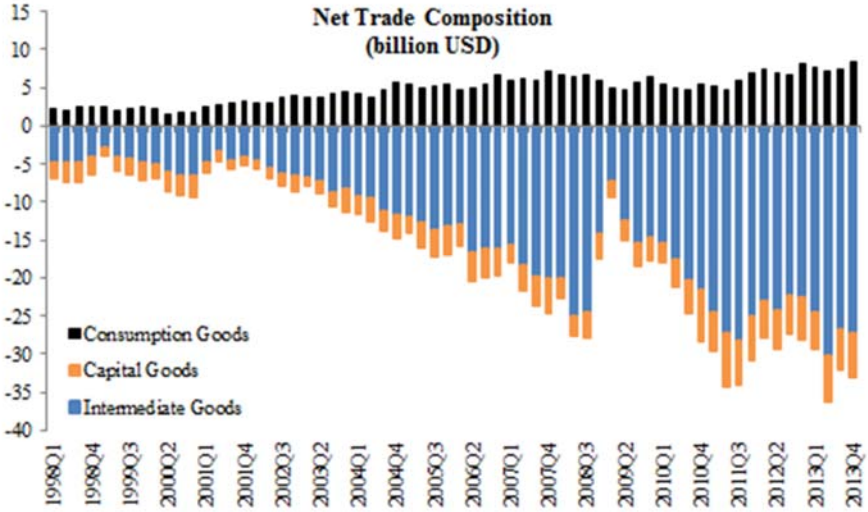


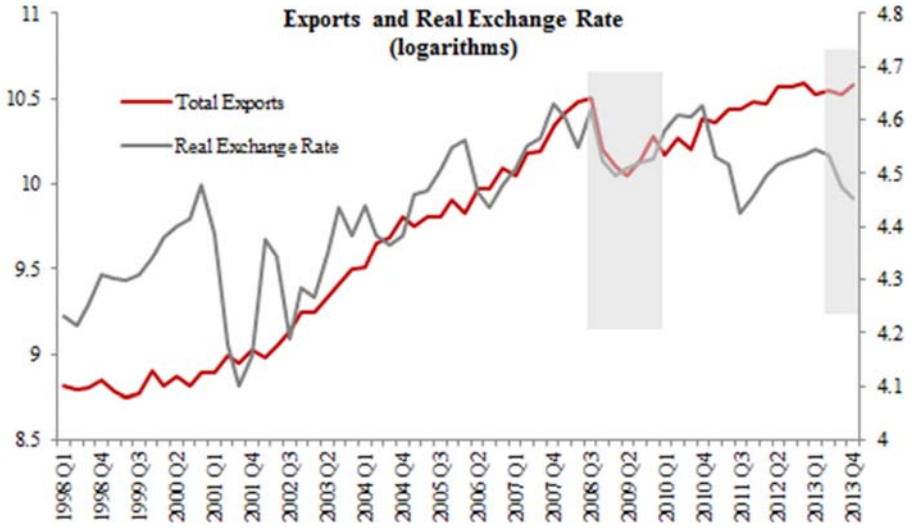



InvestmentExpenditure
(logarithm)


InvestmentExpenditure
(first difference of logarithm)


Foreign Trade in Turkey
(billion USD)
Oil Imports
Total Exports
Total Imports


Net Trade Composition
(billion USD)
Consumption Goods
Capital Goods
Intermediate Goods


Exports and Real Exchange Rate
(logarithms)
Total Exports
Real Exchange Rate
11
10.5
10
9.5
9
8.5
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
1998 Q1
1998 Q4
1999 Q3
2000 Q2
2001 Q1
2001 Q4
2002 Q3
2003 Q2
2004 Q1
2004 Q4
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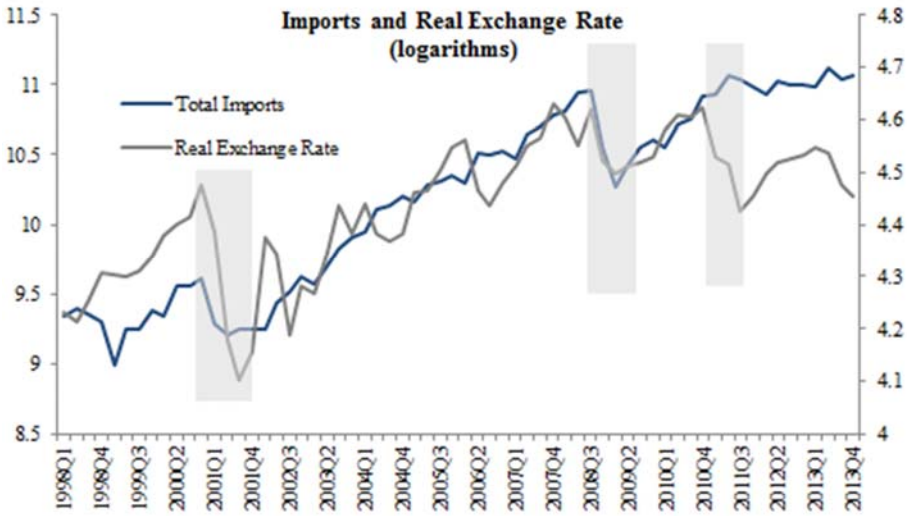
2012 Q2
2013 Q1
2013 Q4


Imports and Real Exchange Rate
(logarithms)
Total Imports
Real Exchange Rate
11.5
11
10.5
10
9.5
9
8.5
4.8
4.7
4.6
4.5
4.4
4.3
4.2
4.1
4
1998Q1
1998Q4
1999Q3
2000Q2
2001Q1
2001Q4
2002Q3
2003Q2
2004Q1
2004Q4
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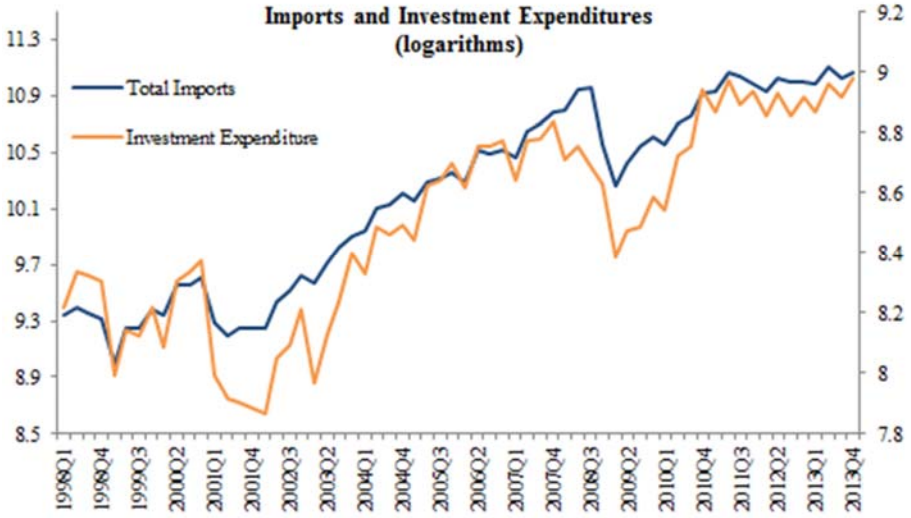
2012Q2
2013Q1
2013Q4


Imports and Investment Expenditures
(logarithms)
Total Imports
Investment Expenditure
11.3
10.9
10.5
10.1
9.7
9.3
8.9
8.5
9.2
9
8.8
8.6
8.4
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7.8
1998Q1
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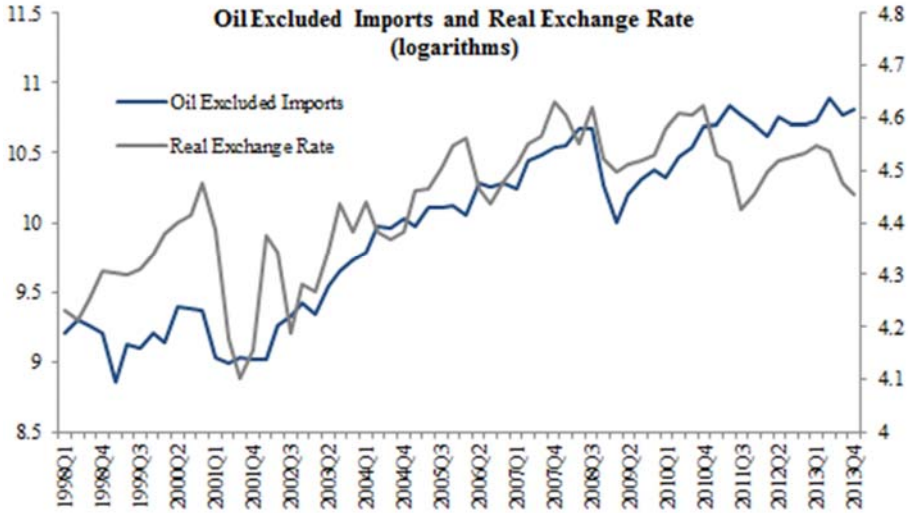

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