ASERC Journal of Socio-Economic Studies

Journal homepage: www.ajses.az Volume 3, Number 2,(2020) Pages 69-75

ESTIMATION OF IMPORT DEMAND: THE CASE OF AZERBAIJAN

Uzeyir Safarli

Department of Economics
METU - Middle East Technical University
Ankara, Turkey

ABSTRACT

International economic relations between countries are reaching a new peak every coming day thanks to globalization. One of the most important parts of these relations is the trade, which policymakers should scrutinize. Considering natural resource-rich economies within the Dutch disease framework, understanding demand for imported goods could be very useful for policy purposes. This research aims to estimate the import demand function of an oil reach country – Azerbaijan Republic. This research examines the relationship between import and GDP and exchange rate by using cointegration techniques for 1999-2014. Research findings reveal that there is a long term causality from GDP and exchange rate to imports of Azerbaijan. It must also be stated that the directions of effects of both GDP and exchange rate are consistent with what economic theory states.

Keywords: Import demand; cointegration analysis; GDP; international trade; Azerbaijan

INTRODUCTION

Recently, as an expected result of globalization, countries have gone a long way with their relationships. It is not expected that we will see more improved associations in the near future. These associations include several kinds of partnerships like military, cultural, and economic. One of the most important parts of economic partnerships is trade. Although mercantilism was mainstream in the years, people believed that countries could be beneficial only with exporting, and it was changed with the introduction of David Ricardo's (1817) famous trade theory. It stated that countries could be more beneficial by importing some goods. Ricardo said that to trade with countries with a comparative advantage on producing some goods and importing them may benefit the country, which is not advantageous. Thus, the exporting side's thought is always the gaining side is nothing more than another prejudice. Consequently, estimation of import demand started to be seen as a crucial task for both fiscal and monetary policymakers, as macroeconomic theory suggests. A carefully analyzed and truthfully resulted estimation procedure may give all the tools to implement a perfect import policy and reach that efficient import quantity.

In this paper, the main purpose is estimating the import function for the Azerbaijan case. Azerbaijan is one of the resources (oil and gas) rich developing countries that plays a central role in its fiscal policy implementation (Dehning, Aliyev and Nadirov, 2016; Aliyev and Gasimov, 2018). In this context, the existence of resource curse symptoms in Azerbaijan has also been at the center of discussions (Gahramanov and Fan, 2002; Egert, 2012; Shaw, 2013; Hasanov, 2013; Gasimov, 2014). It is noteworthy that resource curse symthoms have multidimensional effects over the economies (Aliyev and Gasimov, 2018).

So it becomes important to note that the research conducted by Hasanov (2013) found that relative de-industrialization has taken place in the non-oil tradable sector of Azerbaijan. De-industrialization means to move production factors to the industry with rich resources. Thus, the production of de-industrializing industries decreases significantly. Reasonably, as one of these countries, Azerbaijan meets most of its demands by importing them. Having a de-industrializing non-oil sector and all exports based on imported inputs means extra effort must be spent to expand the economy and reach a certain development level at the same time. A Well-behaved model may give a lot of important keys for import forecasts and effective trade planning.

To serve this aim, 15 years' annual data from 1999 till 2014 is investigated. As theory suggests, the import is defined by the importing country's income and the price of the imported goods. Income is defined by employing the GDP of Azerbaijan, which is quite sensible. Meanwhile, the exchange rate is employed in the model as in the place of price. It must also be noted that the real exchange rate is referred to as the price of foreign goods in local currency. The regression was tested for any possible structural break on the road, which is highly probable because of the 2008 financial crisis. Besides, there have been too many investigations on whether long-run relation exists or not between import quantity and exchange rate and income. And this paper will also check if it exists for the Azerbaijan case.

1. LITERATURE REVIEW

Looking through the macroeconomic theory, it becomes evident that import quantity is directly defined by the income of the country and exchange rate. Real GDP is taken as the income of the country in this project, and the real effective exchange rate is taken as the exchange rate. The more GDP means there is more income and more income means more resources to demand in order. That demand has no boundary like demanding only domestic goods and services, so more income means import will be increasing. Thus, income and imports have a positive relationship. Oppositely, import quantity has an inverse relationship with the exchange rate. The reason is that increasing the exchange rate means that the price of the imported goods and services is higher than domestic goods, so imports will decrease.

Egwaikhide (1999) investigated Nigeria's aggregate import demand and found out that aggregate import is significantly explained by relative prices, exchange rates, and Gross Domestic Products. Moreover, these findings are also backed up by Douglasan Omotor with his paper's help on the topic. He also found that import demand is affected mainly by income while relative prices affect much softly. Cointegration is another finding of his paper. These findings are just other proofs of relative theories in the same manner in practices. It is also helpful for us while choosing variables since Nigeria has many similarities with Azerbaijan with its resource-based economy. Thus, it will be useful to take this research as a reference.

Considering functional form, it is not sure to use whether a linear model or double-log model must be performed, and it is one of the first and most important tasks to estimate the model. The study by Khan and Ross (1977) may be useful to define the form that will be implemented. They performed a test to identify the model to use while estimating import functions for 3 countries, namely Canada, the USA, and Japan. The results implied that for these countries log-linear model is better than a linear model. Narayan and Narayan (2005) analyzed Fiji's disaggregated import demand function for the data from 1970 to 2000. One of the attractive findings generated from this paper is having a co-integrating relationship among quantity imported, exchange rate, and Gross Domestic Product components only when the amount imported is the dependent variable. We will further compare our findings of co-integration with this result.

Beyond the mentioned studies, there are some existing studies devoted to the estimation of import demand function in China (Tang, 2003a; Wang and Lee, 2012), India (Dutta and Ahmed, 2004; Emran and Shilpi, 2010), Japan (Tang, 2003b), South Korea (Chang, Ho and Huang, 2005), Jordan (Mugableh, 2016), Greece (Sinha and Sinha, 2000) and Turkey (Yavuz and Güriş, 2006) among others. However, in the case of Azerbaijan, the literature is old and very poor. The current study aims to fill this gap partially.

2. MODEL BUILDING

Considering all the theoretical and practical basis emphasized in the previous paragraphs, we can construct a general import demand formula like:

$$\mathbf{M_t = \alpha_1 + \alpha_2 Y_t + \alpha_3 R_t + \varepsilon_t}$$

$\mathbf{M_t}$: Quantity of Goods and Services Imported
$\mathbf{Y_t}$: National Income(GDP)
$\mathbf{R_t}$: Real Effective Exchange Rate
$\boldsymbol{\varepsilon_t}$: Error Term

As it is noted previously, according to macroeconomic theory, national income and exchange rate affect the quantity of goods and services imported differently. Thus, hypothetically coefficients - α_2, α_3 must have different signs, more precisely positive and negative, respectively.

3. DATA AND METHODOLOGY

Data covers 15 years between 1999 and 2014 and are mostly taken from open sources like World Bank National Account data files. Data for import of Azerbaijan has acquired thanks to World Bank. GDP data is also available in the same source, while data for exchange rate was taken from the Central Bank of Azerbaijan website. As it is suitable, they are all in real terms to account for the inflation effect.

Azerbaijan has come a long way in the short history. It has signed a few contracts which foreseeing a huge number of foreign investments. And results of those contracts can easily be seen in the data we acquired. It has also experienced the effects of a Global Financial Crisis. We can see its effect in exchange rate data, although GDP seems to be unaffected by the crisis.

The Ordinary Least Squares (OLS) estimation method is utilized in this research, while Eviews is being employed to estimate the model and conduct various tests.

4. MODEL ESTIMATION

Firstly, as theory suggests, a simple linear estimation that regresses import on GDP and exchange rate was estimated. However, hypothesis testing and several other tests revealed a problem with the functional form of the model. Following Khan and Ross (1977) findings on three countries' data, a log-linear model was constructed, and all the tests conducted revealed that the model is reliable to refer.

$$\boldsymbol{lnM_t = \theta_0 + \theta_1 Y_t + \theta_2 R_t + v_t}$$

$$\boldsymbol{lnM_t} = 1.90 + 0.052\,\boldsymbol{Y_t} - 1.58\,\boldsymbol{R_t}$$

Table 1. Test statistics for log-lin model

Coefficients	T-Stat	F-statistics	R-squared
$\boldsymbol{\theta_0}$	6.06	84.21	0.93
$\boldsymbol{\theta_1}$	9.55		
$\boldsymbol{\theta_2}$	-3.96		

It can easily be seen that all three coefficients are both jointly and individually statistically significant and their signs are theoretically consistent. However, when we employed Chow Breakpoint Test for this model, we will get an F-statistics of 8.27. That easily tells us the existence of structural break. To solve for structural break problem, dummy variables are used. After 2008, we assign a value of 1 and 0 for all observations before 2008. After that, the new model was constructed. Interaction Dummies are also used to get the effect of a structural break on independent variables.

$$\boldsymbol{lnM_t = \theta_0 + \theta_1 Y_t + \theta_2 R_t + \theta_3 D_t + \theta_4 Y_t * D_t + \theta_5 R_t * D_t + v_t}$$

$$\boldsymbol{lnM_t} = 3.31 + 0.049\,\boldsymbol{Y_t} - 3.11\,\boldsymbol{R_t} - 3.17\,\boldsymbol{D_t} - 0.02\,\boldsymbol{Y_t * D_t} + 4.19\,\boldsymbol{R_t * D_t}$$

Table 2. Test statistics after including dummy variables to the model

Coefficients	$\boldsymbol{\theta_0}$	$\boldsymbol{\theta_1}$	$\boldsymbol{\theta_2}$	$\boldsymbol{\theta_3}$	$\boldsymbol{\theta_4}$	$\boldsymbol{\theta_5}$
T-stats	7.88	11.73	-6.75	-3.98	-1.47	4.53
F-statistics	95.23					
R-squared	0.97					

These variables are individually and jointly significant, except the interaction term of national income with a dummy. And it is understandable, as I said in one of the previous paragraphs GDP was not so much affected by the financial crisis of 2008. The only problem with this model seems the existence of an insignificant variable, and if we get rid of this variable, we will get the following estimates:

$$\boldsymbol{lnM_t = \theta_0 + \theta_1 Y_t + \theta_2 R_t + \theta_3 D_t + \theta_5 R_t * D_t + v_t}$$

$$\boldsymbol{lnM_t} = 3.33 + 0.047\boldsymbol{Y_t} - 3.11\,\boldsymbol{R_t} - 3.49\boldsymbol{D_t} + 3.28\boldsymbol{R_t * D_t}$$

Table 3. Test statistics after excluding insignificant variables from the model

Coefficients	$\boldsymbol{\theta_0}$	$\boldsymbol{\theta_1}$	$\boldsymbol{\theta_2}$	$\boldsymbol{\theta_3}$	$\boldsymbol{\theta_5}$
T-statistics	7.57	11.11	-6.41	-4.32	4.51
F-statistics	107.23				
R-squared	0.97				

When we perform the RESET test to test the existence of misspecification error for this model, F-statistics is 1.67. It is quite an excellent value to fail to reject the null hypothesis of no misspecification. In conclusion, Khan and Ross (1977) findings are suitable for the Azerbaijan case, and there is no problem in this model. However, to find the best model fitting our case, we should check the logarithmic model. After taking all necessary steps that were taken for the previous model the following logarithmic model appeared for import demand estimation:

$$\mathbf{lnMt} = -2.20 + 1.16\,l\mathbf{nYt} - 2.06\,ln\mathbf{Rt} - 0.25\,Dt + 3.39\,lnRt * Dt$$

Table 4: Test statistics for logarithmic model

F-statistics	217.61
R-squared	0.99

Both of the models are significant and reliable. However, according to model selection theories logarithmic model is more favorable: its Akaike Information Criteria value reveals that it would be better to continue with a logarithmic model for further evaluations.

Some steps are taken to diagnose residuals for the potential problems of heteroscedasticity and autocorrelation. White and Durbin-Watson tests are utilized to test them, respectively. And they revealed that there is not any problem with our residuals in the model.

Our model is also tested for possible problematic issues related to the time-series characteristics of our data.

4.1. Testing for stationarity

Stationarity is the case of having constant expectation and variance on the time series process. It so means that any shock given to a variable will lose its effect as time passes. If the process is non-stationary, some problems will include difficulties and not relevant results while forecasting. Firstly, dependent variable (quantity of imported goods and services) will be investigated for its integration order.

For this purpose, quantity imported at time t must be regressed on a significant lag dependent variable. To choose augmentation, we will regress the variable on all augmentation orders and compare Akaike Information Criteria values of all models. As the data is annually maximum augmentation order is 4.

$$M_t = b_1 + b_2 M_{t-1} + v_t$$

$$M_t = b_1 + b_2 M_{t-1} + b_3 M_{t-2} + v_t$$

$$M_t = b_1 + b_2 M_{t-1} + b_3 M_{t-2} + b_4 M_{t-3} + v_t$$

$$M_t = b_1 + b_2 M_{t-1} + b_3 M_{t-2} + b_4 M_{t-3} + b_5 M_{t-4} + v_t$$

Table 5. AIC values used to define the augmentation order of M_t

AIC	3.09
AIC	3.20
AIC	3.24
AIC	3.44

The decision process gives us augmentation orders as 1. So we will continue with the following equation.

$$M_t = b_1 + b_2 M_{t-1} + v_t$$

$$\Delta M_t = b_1 + (b_2 - 1) M_{t-1} + v_t$$

H_0: b_2-1=0

H_1: b_2-1≤0

The alternative hypothesis means that as time passes, its effect will be weaker. So if we accept the null hypothesis, it means that our variable M_t is non-stationary. And in terms of including time-trend and intercept term, it would be better to include an intercept, as we need no zero mean for our variable.

$$\Delta M_t = 0.96 + 0.004\, M_{t-1}$$

For unit root tests, we can use only critical values taken from the Dickey-Fuller table. And critical value for the case with intercept term is (-2.93) and $tb_{2\text{-}1=0}$= 0.077, and it tells us that M_t is non-stationary. So we will go to the next step to find the exact integration order of the variable:

$$\Delta^2 M_t = \theta_1 + \theta_2 \Delta M_{t-1} + v_t$$

The aim is to find the integration order of ΔM_t, and if it is stationary, then M_t is I(1).

$$\Delta^2 M_t = 1.31 - 1.24 \Delta M_{t-1}$$

For this estimation $t_{\theta 2\ -1=0}=0$ is (-4.53), so we have to reject the hypothesis that ΔM_t is non-stationary. Thus if ΔM_t is I(0), then M_t is I(1).

To find the integration order of other variables, we applied the same steps. It is found that Y_t and R_t are I(4) and I(1), respectively.

4.2. Co-integration

Now, since we have all the variables' integration orders and know that they are not stationary, we have to check if there is co-integration. Co-integration is the measure of a long term relationship. The rationale is that if there is not a long term relationship between our variables, then our model is spurious- as u_t will be nonstationary, all Gauss-Markov assumptions will be collapsed. As mentioned, if residuals are nonstationary then model is spurious, so we checked the stationarity of residuals taken from our model. Engle-Granger Co-integration test was applied to find whether co-integration exists or not by regressing residuals on residuals of past times as many as augmentation order. Thus our Engle-Granger Co-integration order is set as following:

$$\Delta u_t = \phi_1 u_{t-1} + \phi_2 \Delta u_{t-1} + v_t$$

$\Delta u_t = -1.54 u_{t-1} + 0.49 \Delta u_{t-1}$ $t_{\phi 1=0}$=-4.17

It is important not to use intercept term to make residuals with zero means. Also, we can't use Dickey-Fuller critical values, and instead, critical values are tabulated by McKinnon. So, we can conclude that there is co-integration and our model is reliable in every term.

CONCLUSION

The research aimed to investigate some issues and contribute to the literature for the Azerbaijan case. The first thing it revealed is that the Import Demand Function of Azerbaijan is consistent with the theory. The import demand of Azerbaijan is affected positively by its income. Contrarily, the exchange rate negatively affects import quantity. This conclusion is clearly consistent with macroeconomic theory.

Additionally, it was found out that import demand is nearly unitary elastic to changes in income with the elasticity of 1.16. However, it is more elastic to changes in the exchange rate. And that seems reasonable since a change in exchange rate directly changes the prices of imported goods or services.

The first main model was estimated. However, something contradicts macroeconomic theory since it tells exchange rate must be in significantly inverse relation with import quantity. Firstly, the suitable functional form was investigated. It was pointed out that the linear model is not the correct model for import demand estimation for the Azerbaijan case. Either the double-log or log-linear model performs better. A log-linear model was tested because previous papers pointed out this functional form as consistent. Another contribution to the literature was about the functional form, so researchers aimed to dig deeply into the topic will have a source to give them light. It was also found out that there was a structural break in 2008 because of the financial crisis, which decreased the quantity imported significantly. After using dummy variables to correct for a structural break in the final model we got, it is easily observable that after 2008 exchange rate interaction with dummies positively explained import quantity. To explain this phenomenon, we took a look at Azerbaijan's Petrol Industry history, and it is seen that in 2006 there started a new pipeline to export oil. Obviously, with increasing oil export Azerbaijan's GDP increased suddenly, and rising income will result in more imports. And maybe there is not causation, and just a correlation exists because of oil export.

At last, the most important finding of this paper, at least for me, is the existence of a long term relationship in import demand function, which has been found by many.

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