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The Impact of Oil Factor on the Car Import in Azerbaijan

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ABSTRACT

This paper analyzes the impact of oil exports and oil prices on car imports in Azerbaijan for the time span of 2010-2019 (monthly basis). There has been no study evaluating the direct effect of oil prices on import, especially, on car imports. However, similar issues have been studied in the context of the impact of oil prices on GDP or on many macroeconomic indicators of individual countries in general. The methodology used in this study is based on econometric methods which were used to analyse time series data. Stationary tests of variables (ADF, PP, and KPSS) were done. ARDL model was used as an research methodology. To investigate more specific aspects of the long run causality relationship between oil exports and oil imports, cointegration relationships are reassessed by using different econometric models such as FMOLS, DOLS and CCR. These estimates are consistent with the estimates obtained from ARDL model. Some remarkable contributions can be derived from this study toward the regulation of car imports in Azerbaijan. In general, it is concluded that in the long run, there is a positive effect of oil exports and oil prices on car imports in Azerbaijan.

Keywords: Oil Prices, Oil Exports, Car Imports, Revenues, ARDL
JEL Classifications: D12 D31 F16 Q41 Q43

1. INTRODUCTION

As import and export transactions are carried out in USD, automobiles imported to Azerbaijan are also purchased in USD. However, as the convertible currency (US dollars) flowing into our country is directly related to oil exports and oil prices in the world market, it can be stated that imports, namely, automobile imports are highly dependent on oil. There is no doubt that all factors affecting the import of automobiles and the car market are ultimately dependent on the conjuncture of the global oil market. Thus, after the devaluation in 2015, the import of vehicles into Azerbaijan has fallen more than 12 times compared to 2014-2016.

Generally, the main underlying reasons for the decline in imports of cars are the following:

- Reduction in public expenditures by government bodies.
- To adjust the exchange rate of the national currency, the central bank of Azerbaijan conducted a “sharp” devaluation in February and December 2015. As a result, the official exchange rate of 1 Azerbaijani manat was $ 1.05 in February and $ 1.60 in December. Declining purchasing power of manat due to almost twice depreciation of the national currency against the foreign currency;
- Decreases in car purchases on credit after devaluation. Imports of cars have also been affected by the suspension of consumer loans by banks for 2-3 months after devaluation. During that period, two out of every 3 cars sold in Azerbaijan were purchased on credit. After a while, a new law emerged and it stated that the initial payment for new cars had to be 50% of the price and 80% for the old ones. However, before this new legislation, the initial payment did not exceed 10% of

the price. Therefore the import of cars decreased by 30-40% after implementation of the new law;
- The motives of banks to issue loans in US dollars prevented people from taking loans. This was because people were afraid that Azerbaijani manat would fall again, the US dollar would rise, and they would not be able to repay the loan. Therefore, the demand for credits fell sharply.
- Due to the rise of the US dollar against manat, "administrative reduction" of prices in the local market was observed which influenced the import of foreign cars produced abroad;
- Except for Russian cars, the other automobiles are mainly bought in dollars and euros. So importing cars at the previous prices was not profitable. It was impossible to buy cars in dollars and sell them at affordable prices in the local market;
- The situation in Russia was also an important factor that could influence. The worsening of the situation in Russia reduced remittances flow from there to Azerbaijan by 2 times. Russia is the main source of income for some regions of Azerbaijan. That is why these regions were highly affected by the bad situation in Russia. The strict implementation of sanctions in Russia, the devaluation of the ruble affected the citizens of Azerbaijan who were sending large sums of money to their families in Azerbaijan.

The strengthening of the national currency thanks to targeted monetary and fiscal measures undertaken by the state, as well as the increase in the average salaries in the country, improved the automobile market. Starting from 2017, import of transport vehicles, especially cars, began to increase and its overall value was close to the figures of 2005-2010, while the value of vehicle imported in 2017 was unlikely to reach the level just before the devaluation. It is not only related to the financial resources of the government and the population but also the fact that the automobile market in Azerbaijan is saturated with cars so that during off-peak hours traffic jams can be observed on the roads.

Increasing traffic congestion in the capital city, Baku, is directly linked to the rise in the number of vehicles in the city. Many experts offer a variety of methods to prevent this. Some advocate restrictions on the purchase of cars based on the year of release, others support imposing restrictions according to their type (truck, car). Currently, there are no serious restrictions in this area, and our citizens are making a significant contribution to the import of cars. So supply for automobiles decreased with regard to switching to the standard and demand for cars dropped due to low willingness to take loans from banks.

The downturn in the car market is directly proportional to several factors such as the decline in oil revenues which is the outcome of falling oil prices, cuts in budget expenditure thanks to worsening oil revenues, and, ultimately, emerging unemployment stemming from the cessation of bridges and road construction at the expense of the budget spending.

The main reason for declining automobile imports is decreasing oil prices which lead to lower oil income flowing into the economy and, eventually, lower disposable income of individuals.

There are very serious ongoing economic processes in the world. The sharp decline in oil prices, devaluation of the national currency in the countries, including the devaluation process in Azerbaijan, certain dependence of Azerbaijan economy from oil, the sharp drop in oil prices, of course, caused certain problems and declines in people's incomes.

Generally, considering the statistics about the imports of automobiles and the dynamics of oil factors affecting those imports, some points can be summarized as follows: Crude oil exports increased 100.79 times from 292.7 thousand tons to 29498.3 thousand tons in 1995-2017. Exported crude oil in 2017 was 5.35 times more than those of 2000, and 4.65 times more than those of 2005. When 2017 was compared with some years, a drop of 7.5% compared to 2010, a rise of 18.6% compared to 2013, a drop of 25.8% compared to 2014, an increase of 35.5% compared to 2015, a decline of 13.5% compared to 2016 and a 3.3% decrease from 2017 can be observed. In terms of monetary value, during the investigated period (1995-2017), crude oil exports increased from $ 23413.6 thousand to $ 15719482.4 thousand by rising 671.38 times. In comparison to 2000, 15.9 times more oil export revenues were earned in 2017. But 7.08 times more revenues from oil exports were obtained in 2017 comparison with 2005. While distinguishing 2017 with 2010, 2013 and 2014, it can be seen that oil export revenues in 2017 were 15.0%, 23.6 %, and 15.0% lower than those of 2010, 2013 and 2014 respectively. However, revenues from oil exports in 2017 were 77.7%, 47.1 % and 29.1% more than those of 2015, 2016 and 2017.

Some points should be noted about the car imports. During the investigated period, imports of small cars were as follows: Between 1995 and 2017, it increased 9.12 times from 2864 and reached 26147. Imported cars in 2017 were 4.59 times more than those in 2000, 1.63 times more than those in 2005. If 2017 was compared with 2010, 2013 and 2014, a drop of 50% compared to 2010, a decline of 70.1% compared to 2013, a decrease of 45.8% compared to 2014 can be observed in 2017. Car imports in 2017 were 10.5% more in comparison to 2015, 5.23 times more than those of 2016 and 2.25 times more compared with 2017. In terms of monetary value, during the investigated period (1995-2017), the import of passenger cars increased 20.76 times from $ 19447.1 thousand to $ 407634.8 thousand. In 2017, the increases compared to 2000 and 2005 were 18.57 and 1.48 times accordingly. In comparison with 2010, 2013 and 2014, there were drops of 35.0%, 65.3% and 35.2% accordingly in 2017. However, an increase of 13.7% compared to 2015, an increase of 5.12 times compared to 2016 and an increase of 89.9% compared to 2017 can also be observed in 2017.

2. LITERATURE REVIEW

The impact of oil prices on imports of oil-producing countries has been analyzed in studies specific to each country. According to a study by the International Organizations (IMF, 2007; IMF, 2008), most of the oil-exporting countries have experienced fluctuations in demand (increases and decreases) since the 1970s. Error Correction Model (ECM) was operated in some of the oil-exporting countries to detect whether the import trend changed or not. After the selective forecasting, it was revealed that actual imports in OPEC countries were slightly lower than the projected import expenditure.

Common literature often overlooks the specific characteristics of oil exporting countries regarding import demand. Few existing

Table 1: Summary of similar empirical studies in the literature

Author(s)	Time period	Countries	Method(s)	Results
Mwega (1993)	1964-1989	Kenya	ECM	Import demand is less elastic than relative prices and income. Currency reserves are the main factor in determining imports
Senhadji (1998)	1973-1998	77 countries	OLS FMOLS Monte Carlo	In terms of profitability, elasticity is relatively low for oil-exporting countries. Because export revenues take a significant part of national income in these countries
Lim and Kim (2002)	1962-1992	North Korea	Cointegration	Some non-market factors are important determinants of imports
Tang and Nair (2002)	1970-1998	Malaysia	UECMBounds Test	Import demand, income and relative prices are cointegrated
Bahamani-Oskooee, and Kara, (2003)	1973Q1-1998Q2	9 industrialized countries.	ARDL	Long-term income elasticity is higher than the import demand function; trade flows from different countries react differently
Metwally (2004)	1968-2001	GCC Countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates)	VAR	The drop in oil prices led to a sharp drop in imports of all oil-producing countries Changes in GDP have a strong impact on import demand in GCC countries. However, changes in relative prices do not have a significant impact on imports in most of these countries In all the studied GCC countries (except Oman) over the past 30 years, the import demand against GDP has been very elastic
Dutta and Ahmed (2004)	1971-1995	India	UECM	There is a cointegration relationship among the volume of imports, relative import prices and real GDP GDP significantly affects import demand
Islam and Hassan (2004)	1974Q1-1998Q2	Bangladesh	VAR LM ARCH	Import demand is mainly determined by income and relative prices
Chang et al. (2005)	1980-2000	South Korea	ARDL UECM	The volume of imports, income and relative prices - these are all interrelated
Katsimi and Moutos (2006)	1948-1996	USA	VECM VAR	Income inequality affects import demand There is no sufficient evidence to support the existence of long-term import relationships (including imports, income and relative prices) There are cointegration equations for import, income and relative prices in the VAR specification. The level of income has a remarkable and positive impact on the import demand in the United States
Rehman (2007)	1975-2005	Pakistan	VAR Johansen–Juselius	There is a long-term equilibrium relationship between the variables The import demand function remains constant throughout the sampling period
Ziramba (2008)	1970-2005	South African	UECM	Import volume, relative prices and real income (GDP) are integrated
Oteng-Abayie and Frimpong (2008)	1970-2002	Ghana	ARDL	There is an inelastic and positive relationship between three expenditure components and import demand. Relative price is also inelastic but has a negative impact on the overall demand
Adam et al. (2008)	1970-1997	59 countries, developing and developed ones	OLS	Inequality has a great impact on import demand It affects positively in high-income countries and negatively in low-income countries
Shareef and Tran (2008)	1959Q3-2006Q3	Australia	ARDL UECM	The demand for imports does not depend on price or income. In the short run, the price is more elastic than income In the short run, price and income are the key factors of demand for imports
Ozturk and Acaravci (2009)	1975-2005	Latin American and Caribbean countries	Dynamic panel data methods	The volume of imports demanded is negatively correlated with relative prices and positively correlated with real income
Alam and Ahmad (2010).	1982Q1-2008Q2	Pakistan	ARDL	There is a long-term relationship between the demand for imports, the real economic growth, the relative price of imports, and the real effective exchange rate
Narayan and Narayan (2010)	1960-2005	Mauritius and South Africa	ARDL	There is a long-term relationship between imports, income and prices Domestic income and relative prices have a significant impact on import demand in both countries, and income is the most important factor
Serge and Yaoxing (2010)	1970-2007	Cote d'Ivoire	ARDL	In the long run, investment and exports are key factors in imports. In the short run, both components of expenditure are key determinants of import demand. However, import demand is not sensitive to price changes

(*Contd...*)

Table 1: (*Continued*)

Author(s)	Time period	Countries	Method(s)	Results
Muhammad and Masood (2010)	1980-2008	Bangladesh	ADRL	The long-term relationship between imports, national income and the relative price is proved
Alam and Ahmad (2010)	1982Q1-2008Q4	Pakistan	ARDL	There is a long-term relationship between import demand, real economic growth, the relative price of imports, and the real effective exchange rate General import demand has a positive impact on GDP. The relative price of imports does not reduce import demand The devaluation of the local currency has no effect on the reduction of import demand The import demand is inelastic against the exchange rate Change of import demand is a short-term event
Rashid and Razzaq (2010)	1975-2008	Pakistan	ARDL DOLS	There is a long-term certain relationship among variables included in the import demand model
Ozturk and Acaravci, (2011)	1993Q1-2003Q3	Slovakia	ARDL	Real import, relative price and real GDP are cointegrated. There exists a stable import demand function
Moutos and Katsimi (2011)	1948-2007	USA	VECM VAR	A long-term relationship exists between imports and income level There is cointegration among import, income and relative prices. The level of income has a large and positive impact on the import demand in the United State
Ozturk and Acaravci, (2011)	1993Q1-2003Q3	Slovakia	ARDL	There is a cointegration link among real imports, relative prices and real GDP. The import demand function is stable
Wang and Lee (2012)	1992M01-2011M07	China	ARDL	Import is related to internal economic activity, efficient exchange rates and global risks Domestic income has a significant positive impact on imports Real effective exchange rates have a negative impact Declining foreign market competitiveness (rising prices) will lead to lower imports
Knobel (2013)	2000-2010	Russia	OLS	The demand for imports is highly sensitive to real effective exchange rates and import prices changes
Gozgor and Oktay (2013)	1989Q1-2012Q2	Turkey	ARDL	The decline in the value of the Turkish lira has a limited impact on all imports GDP has a greater impact on fixed assets in the short run and consumer products in the long run
Durmaz and Lee (2015)	1980-2011	Turkey	ARDL	There is a long-term relationship between the dependent variable and the independent (explaining) variable in the import demand function. All explanatory variables are statistically significant both in the long-term and the short-term. All independent variables have an inelastic effect on imports, except for total consumption
Mishra and Mohanty (2017)	1980-1981 2013-2014	India	ARDL	There is a link between import demand, relative prices of imports, domestic activities and foreign exchange reserves In the long run, the reaction of import demand to relative import prices is negative and less than the unit
Mohamed (2017)	1970-2014	Egypt	OLS ECM	There is a positive and significant relationship between demand for imported goods and real GDP in both the long-term and short-term There is a negative and significant relationship between demand for imported goods and real effective exchange rates
Hor et al. (2017)	1993-2015	Cambodia	ARDL	Relative prices and exchange rates have a negative impact on import demand, both in the long-term and short-term The volume of exports has a positive impact on import demand
Umoru et al. (2018)	2000-2017	Nigeria	GLS	Import demand is heavily dependent on the availability of currency reserves, tariff policies, and final consumption expenditure
Olcay et al. (2019)	2003-2018	Turkey	LS 2SLS	The alteration in total imports is mainly due to changes in income and relative prices. The elasticity of income and expenditures over time decreases in total imports. Relative price elasticity remains almost unchanged for investment and import of consumer goods
Sharif and Abedin (2019)	1980-2016	8 frontier countries, 8 emerging countries, and 10 developed countries	Cointegration	There is a long-term relationship between import demand, relative prices, exchange rates and real GDP in all countries

papers examining the link between oil exports and demands for import consider the reaction of current account balance to changes in oil prices or trade conditions.

However, many economists have examined demand toward imports in developed countries (Giovannetti, 1989; Shaista, 2009; Dwyer and Kent, 1993; Abbott and Seddighi, 1996; Carone, 1996; Bahmani-Oskooee and Niroomand,1998; Dutta and Ahmed, 2001; Emran and Shilpi, 2001), others have investigated import demand in developing countries (Jayaraman, 1977; Kian et al., 1992; Ghatak et al., 1997; Kotan and Saygili, 1999; Mohammed and Tang, 2000; Mohammed and Othman, 2001; Mohamed, 2015; Mohammad, 2018; Muhammad and Riaz, 2018; Kamal, 2018; Yoon and Kim, 2019), and some have done comparative research on the same topic (Senhadji, 1998, Bahmani-Oskooee and Kara, 2003). The effects of the oil factor in Azerbaijan have been studied by economists of the new era (Aliyev et al., 2016; Musayev and Aliyev, 2017; Mukhtarov et al., 2017; Hasanov et al., 2017; Muradov et al., 2019; Mukhtarov et al., 2020).

Our research covers the impact of oil prices on the import of cars in Azerbaijan. There has been no study evaluating the direct effect of oil prices on import, especially, on car imports. However, similar issues have been studied in the context of the impact of oil prices on GDP or on many macroeconomic indicators (Table 1) of individual countries in general (Ozturk et al., 2008; La et al., 2020; Mukhamediyev and Temerbulatova, 2019; Flores-Chamba et al., 2019; Kriskkumar and Naseem, 2019; Polozova et al., 2019; Hakimah et al., 2019; Khan and Haque, 2019).

Ghalayini (2011), by examining oil price fluctuations, concluded that price shocks affect macroeconomic indicators in different ways. Other economists, such as Hamilton (1983), Bruno and Sachs (1985), studied the impact of oil prices on economic development, financial instability and inflation in Great Britain during 1950-1979 and concluded that these variables were closely connected. Increase in oil prices leads to higher prices in the economy, lower employment and productivity (Dornbusch, 2001).

The impact of prices on macroeconomic indicators has been widely studied by Hamilton. Hamilton was one of the first scientists to demonstrate the importance of changing energy prices for the US economy. He has proven (Hamilton, 2008) that rising oil prices are more important than their fall. Hamilton (2009) analyzed the US economy in 1948-1980 using the Sims et al. (1990) method and the VAR method, and then he concluded that oil prices and GDP in the United States were strongly correlated. Hamilton and other researchers (Gisser and Goodwin, 1986; Mork, 1989; Lee et al., 1995; Hamilton, 1996; Hamilton, 2003) concluded that oil prices had a negative impact on US GDP.

In addition, the impact of oil prices on the exchange rate of currencies has been the subject of research. Thus, some researchers have reported that oil prices had impact on the exchange rate (Amano and Van Norden, 1998; Akram, 2004; Benassy-Quere, 2005; Lizardo and Mollick, 2010). Others have proven the opposite of this statement (Brown and Phillips, 1986; Cooper, 1994): The exchange rate affects oil prices.

Interest toward oil price volatility and its role in macroeconomics revived in the early 2000s with the sharp rise in oil prices and the immediate fall in 2008 (caused by the Lehman crisis) (Hamilton, 2009; Hamilton, 2013; Yoshino and Taghizadeh-Hesary et al., 2016). A study by Peersman and Van Robays (2012) and Taghizadeh-Hesary et al. (2015) identified the winning and losing economies after the recent shock of oil prices. Aydoğan et al. (2017) assessed the relationship between oil prices and stock markets. It was revealed that that the correlation between oil prices and stock markets varied depending on whether the country was an oil exporter or an oil importer.

As a rule of thumb, oil price fluctuations have a significant impact on the oil importing countries' production costs and, consequently, the price level of those nations (Michael and Jeffrey, 1982). In the countries that are energy exporters, the change in oil prices has a major impact on revenues from oil export and state budget revenues. However, it is widely acknowledged that volatility in energy prices is not only an important cause of macroeconomic shocks, but also affects the fiscal and monetary policies of various countries.

3. MATERIALS AND METHODOLOGY

3.1. Data Descriptions

The datas used in the study were taken from the sites of Azerbaijan State Customs Committee (www.customs.gov.az) and OPEC (www.opec.org) (Table 2). Descriptive statistics was in Table 3. World oil prices, dynamics of oil exports and car imports (2010-2019) were described in Figure 1.

3.2. Methodology

The methodology used in this study is based on econometric methods which were used to analyse time series data. In this situation, we are considering two important steps in econometric methodology. The first step involves the investigation of stationarity of variables included in the model and the utilization of Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests for this

Table 2: Data and internet resource

$Export_{oil}$	Oil Exports	www.customs.gov.az
$Import_{gar}$	Car Imports	www.customs.gov.az
$Price_{oil}$	World Oil Prices	www.opec.org

Table 3: Descriptive statistics

	$lnExport_{oil}$	$lnImport_{gar}$	$lnPrice_{oil}$
Mean	13.97084	11.24261	4.338168
Median	14.18070	11.17300	4.346892
Maximum	14.94626	13.08473	4.827754
Minimum	12.88195	9.386486	3.427515
Std. dev.	0.486129	0.680910	0.355794
Skewness	−0.517297	0.061770	−0.409628
Kurtosis	2.106810	3.256103	2.017478
Jarque−Bera	8.562458	0.370568	7.500769
Probability	0.013826	0.830868	0.023509
Sum	1536.793	1236.687	477.1984
Sum sq. dev.	25.75904	50.53665	13.79824
Observations	110	110	110

Figure 1: World oil prices, dynamics of oil exports and car imports (2010-2019)

purpose. The purpose of using three different unit root tests is to compensate for the possible weakness in any of them and ensure the reliability of the test results which can be potentially affected by the limited quantity of data. Due to unit root test results, it will be revealed whether the variables used in the model are non-integrated (I(0)) or integrated of order 1 (I(1)). The second step includes the use of cointegration methods. More specifically, it is necessary to analyze existence of short and long term relationships among used variables. In this case, Johansen's multidimensional coordinate approach or the Auto Regressive Distributed Lags Model (ARDL) and the Pesaran and Yongcheol (1999) boundary test will be used. To test the long term relationship among variables, ARDL models and boundary tests for cointegration approach will be utilized.

3.2.1. ARDL bounds testing approach to cointegration

This research is based on ARDL models and boundary testing for the cointegration approach which was developed by Pesaran and Yongcheol (1999) and Pesaran et al. (2001). These models have recently been used extensively to test the existence of long-term relationship between various macroeconomic variables. The main advantage of this approach is that it does not require the same order of integration for each of the variables. In other words, this allows the inclusion of non-integrated time series data and time series data integrated of order 1 or more into the model simultaneously. The implementation of the ARDL method consists of three stages. The first stage examines the existence of unit roots for utilized time series data by using ADF (Dickey and Fuller, 1979), PP (Phillips and Perron, 1988), and KPSS (Kwiatkowski et al., 1991). Three tests are used to check the reliability of the results. In the second step, the following unrestricted ECM (Unrestricted Error Correction Model [UECM]) which is given in equations is investigated (3) and (4).

Lag p and q are selected based on the Akaike (AIC) information criterion. The Breusch-Godfrey Serial Correlation LM, Jarque-Bera Normality, ARCH and Breusch-Pagan-Godfrey tests are to be used to validate the estimated models. In addition, the following hypotheses are tested for each model: $H_0:\theta_0=\theta_1=0$ and $H_1:\theta_0\neq\theta_1\neq 0$. The null hypothesis assumes that there is a cointegration relationship between variables. Wald test is also developed for decision-making procedure based on the F-test. Critical values for the F-test were given in Pesaran et al. (2001), but complemented by Narayan (2005) which included small recent additions. There are two asymptotic critical values bounds: one is lower bound and the other is upper bound. A lower critical value assumes that the regressors are all non-integrated (I(0)), while an upper critical value assumes that regressors are all integrated of order 1 (I(1)). Their values depend on the number of observations, the number of independent variables and the probability levels. The null hypothesis is rejected when the value of F-statistics exceeds the upper critical value. In this case the variables are cointegrated. However, when the value of F-statistics is lower than the critical value, we can't reject the null hypothesis. We understand that variables are not cointegrated at this time. Finally, it is not possible to draw conclusions when F-statistics are located between two critical values.

$$\Delta lnImport_{gart} = a_0 + \sum_{i=1}^{p} a_i \Delta lnImport_{gar_{t-i}} + \sum_{j=1}^{q} a_j \Delta lnExport_{oil\,t-j} + \theta_0 \Delta lnImport_{gar_{t-1}} + \theta_1 \Delta lnExport_{oil\,t-1} + \varepsilon_t \quad (1)$$

Table 4: The unit root test results

			$lnExport_{oil}$	$lnImport_{gar}$	$lnPrice_{oil}$
The ADF test	Level	Constant	–1.600236	–8.137525***	–1.566225
		lag	2	0	1
		Constant, L.T	–1.883605	–8.395305***	–2.220506
		lag	2	0	1
		None	–0.001264	–0.024446	–0.188595
		lag	2	2	1
	1st difference	Constant	–12.41901***	–11.73975***	–7.313915***
		lag	1	1	0
		Constant, L.T	–12.36193***	–11.68604***	–7.284378***
		lag	1	1	0
		None	–12.48032***	–11.79455***	–7.349123***
		lag	1	1	0
The PP test	Level	Constant	–3.020350**	–8.512679***	–1.261608
		k	3	5	1
		Constant, L.T	–3.979358**	–8.665509***	–1.831733
		k	5	5	1
		None	0.187110	–0.059371	–0.258947
		k	60	108	2
	1st difference	Constant	–19.81996***	–39.45603***	–7.012640***
		k	22	26	9
		Constant, L.T	–20.21265***	–39.44440***	–6.975301***
		k	23	26	9
		None	–19.93394***	–39.65279***	–7.054491***
		k	22	26	9
The KPSS test	Level	Constant	0.605502**	0.385498*	0.647960**
		k	9	6	9
		Constant, L.T	0.157480**	0.134331*	0.148851**
		k	8	6	8
	1st difference	Constant	0.269130	0.362227*	0.128817
		k	69	71	2
		Constant, L.T	0.299760***	0.301743***	0.124237*
		k	75	70	3

*, **and *** indicate significance at levels 5%, 1% and 0, 1% respectively. The optimal lag length for Augmented Dickey-Fuller (ADF) (Mackinnon, 1996) tests was determined using the Schwarz criterion. Phillips-Perron (PP) (MacKinnon, 1996) and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) (Kwiatkowski et al., 1992) tests was operated by using Bartlett kernel spectral estimation method and Newey-West Bandwidth. The maximum lag used in the test calculations were given in the brackets. Assessment period: 2010:01-2018:12

Table 5: VAR lag order selection criteria

	Lag	LogL	LR	FPE	AIC	SC	HQ
ARDL (lnimportgar/lnexportoil)	0	–174.6290	NA	0.109433	3.463313	3.514783	3.484155
ARDL(1,5)	1	–118.9325	108.1167	0.039714	2.449657	2.604067*	2.512183
	2	–111.7932	13.57872	0.037347	2.388101	2.645451	2.492311*
	3	–106.0753	10.65098*	0.036120	2.354417	2.714707	2.500311
	4	–102.2505	6.974539	0.036262	2.357853	2.821084	2.545431
	5	–96.99527	9.376998	0.035408*	2.333241*	2.899411	2.562502
	6	–93.42439	6.231548	0.035746	2.341655	3.010765	2.612600
	7	–92.40263	1.742992	0.037953	2.400052	3.172102	2.712681
	8	–89.03720	5.609057	0.038504	2.412494	3.287485	2.766808
ARDL (lnİmportgar/lnpriceoil)	0	–140.7144	NA	0.056279	2.798322	2.849792	2.819164
ARDL(11,6)	1	21.18906	314.2832	0.002545	–0.297825	–0.143415*	–0.235299
	2	33.28444	23.00493	0.002172	–0.456558	–0.199207	–0.352348*
	3	36.44784	5.892622	0.002208	–0.440154	–0.079863	–0.294260
	4	40.06167	6.589918	0.002226	–0.432582	0.030649	–0.245004
	5	45.46229	9.636394*	0.002168*	–0.460045*	0.106126	–0.230783
	6	48.82786	5.873259	0.002197	–0.447605	0.221506	–0.176659
	7	49.99820	1.996457	0.002326	–0.392122	0.379929	–0.079492
	8	51.72921	2.885022	0.002437	–0.347632	0.527359	0.006682

*Indicates lag order selected by the criterion, LR: Sequential modified LR test statistic (each test at 5% level), FPE: Final Prediction Error, AIC: Akaike Information Criterion, SC: Schwarz Information Criterion, HQ: Hannan-Quinn Information Criterion

$$\Delta lnImport_{gart} = a_0 + \sum_{i=1}^{p} a_i \Delta lnImport_{gar_{t-i}} + \sum_{j=1}^{q} a_j \Delta lnPrice_{oil\,t-j}$$
$$+\theta_0 \Delta lnImport_{gar_{t-1}} + \theta_1 lnPrice_{oil\,t-1} + \varepsilon_t \quad (2)$$

Unrestricted ECM: Impact of changing oil exports and oil prices on import of cars.

3.2.2. Long run granger causality test

The long-term relationship equations are evaluated, when the results indicate that the variables are cointegrated. In this case, the unrestricted ECM (UECM) which is given in equations (3) and (4) is analyzed in order to determine the short-term dynamics and correction rate.

Table 6: Coefficients OLS model

Variable	Model 1	Model 2
	$\Delta ln\dot{I}mport_{gar}$	$\Delta ln\dot{I}mport_{gar}$
$\Delta lnExport_{oil}$	0.441672***	
$\Delta lnPrice_{oil}$		0.774389***
Constant	5.072074**	7.88317***

***, ** and *indicate rejection of the null hypotheses at the 0,1%, 1% and 5% significance levels respectively

Table 7: Coefficients ARDL model

Variable	Model 1	Model 2
	$\Delta ln\dot{I}mport_{gar}$	$\Delta ln\dot{I}mport_{gar}$
$\Delta InExport_{oilt-1}$	0.090082	
$InExport_{oilt-1}$	−0.468871***	
$\Delta InPrice_{oilt-1}$		0.513955
$InPrice_{oilt-1}$		−0.696575***
$\Delta Import_{gar\,(t-1)}$	−0.508886***	−0.499663***
$Import_{gar\,(t-1)}$	0.869924***	0.893430***
Constant	−3.232732*	−7.023751***

***, ** and *indicate rejection of the null hypotheses at the 0,1%, 1% and 5% significance levels respectively

Afterwards, long-term cause and effect relationship between dependent and independent variables is examined in each Unrestricted Error Correction Model (UECM). The negative sign (π) of the error correction coefficient indicates that there is a long-term causal relationship between the independent variables and the dependent variables.

$$\Delta lnImport_{gart} = a_0 + \sum_{i=1}^{p} a_i \Delta lnImport_{gar_{t-i}} + \sum_{j=1}^{q} a_j \Delta lnExport_{oil\,t-j} + \pi ECT_{t-1} + \varepsilon_t \quad (3)$$

$$\Delta lnImport_{gart} = a_0 + \sum_{i=1}^{p} a_i \Delta lnImport_{gar_{t-i}} + \sum_{j=1}^{q} a_j \Delta lnPrice_{oil\,t-j} + \pi ECT_{t-1} + \varepsilon_t \quad (4)$$

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Results of Unit Root Tests

As mentioned earlier, the stationarity of variables is tested using ADF, PP and KPSS tests. The results of the three unit root tests are shown in Table 4. Nearly all three tests give the same results, which confirm the validity of the test results. Therefore, it can be assumed that none of the variables are integrated at the second level.

4.2. Results of ARDL Models

Since all variables are found to be either I(0) or I(1), Johansen's multidimensional cointegration approach cannot be used. However, ARDL bounds test for cointegration can be used. Therefore, two ARDL models are presented and analyzed in equations (1) and (2). The results of model selection criterion are presented in Table 5.

Table 8: Diagnostic test results

		Diagnostic test results (LM Version)			
		Ramsey RESET Test	Normality Test (Jarque−Bera) J−B	Heteroskedasticity Test: ARCH χ2	Breusch−Godfrey Serial Correlation LM Test: χ2
$lnExport_{oil}$	Statistic	1.566937	8.680167	1.189351	2.095427
	Sig	0.1204	0.013035	0.2755	0.3507
$lnPrace_{oil}$	Statistic	0.630602	1.967636	0.582471	0.071282
	Sig	0.5301	0.373881	0.4453	0.9650

Table 8a: Diagnostic test results

Dependant variable	AIC lags	F−statistic	Significance							
			I0 Bound				I1 Bound			
			10%	5%	2.5%	1%	10%	5%	2.5%	1%
$lnExport_{oil}$	1	41.83352***	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84
$lnPrice_{oil}$	1	38.39193***	4.04	4.94	5.77	6.84	4.78	5.73	6.68	7.84

The stars *, **, and *** represent the 10%, 5% and 1% levels of the significance, respectively. The lower and upper boundaries at the significance level of 10%, 5% and 1% are determined by EVIEWS 9 software.

Figure 2: Plot of cumulative sum of recursive residuals

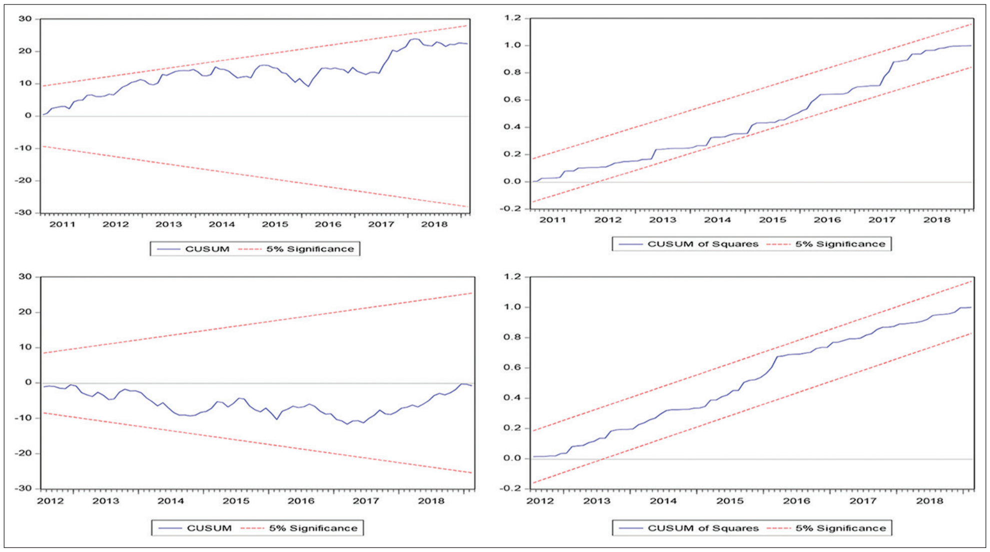

Table 9: Results from bound tests

	Variable	$M1_{ECT}$	$M2_{ECT}$
With intercept only	ADF−stat. Stationarity	−9.369614*** S	−9.271601*** S
With intercept and trend	ADF−stat. Stationarity	−9.334632*** S	−9.250331*** S
No intercept and no trend	ADF−stat. Stationarity	−9.412986*** S	−9.314620*** S

ADF denotes the Augmented Dickey–Fuller single root system respectively. The maximum lag order is 2. The optimum lag order is selected based on the Shwarz criterion automatically; ***, ** and *indicate rejection of the null hypotheses at the 0,1%, 1% and 5% significance levels respectively. The critical values are taken from MacKinnon (1996)

Table 10: Coefficients UECM model

Variable	Model 1	Model 2
	$\Delta ln\dot{I}mport_{gar}$	$\Delta ln\dot{I}mport_{gar}$
$\Delta InExport_{oilt-1}$	−0.062776	
$\Delta InPrice_{oilt-1}$		2.264395**
$\Delta Import$ gar $_{(t-1)}$	−0.125968	−0.087966
$ECT_{(t-1)}$	−0.764454***	−0.814177***
Constant	0.010132	0.010576

The dependence of car exports on oil prices and oil exports were given as a linear dependence (Table 6). Then ARDL model was drawn (Table 7). The results of the diagnostic tests applied to the models are shown in Tables 8 and 8a. The results of the Jarque-Bera Normality, Breusch-Godfrey Serial Correlation LM, ARCH, and Breusch-Pagan-Godfrey test show that in the two models given in (1) and (2), the residuals are normally distributed, homoscedastic, and there is no serial correlation among error terms at 5% significance level. Finally, the results of the tests of CUSUM and CUSUM squares are shown in Figure 2 respectively. Those outcomes indicate the effect of oil exports on car imports and the impact of oil prices on car imports. It has been shown that in 5% significance level calculated CUSUM and CUSUM of squares plots are between two boundary lines in all figures (Figure 2). Therefore, the coefficients of the models are dynamically constant. Thus, we can note the reliability of the ARDL models.

Table 11: Long run coefficients

Variable	Model 1	Model 2
	$\Delta ln\dot{I}mport_{gar}$	$\Delta ln\dot{I}mport_{gar}$
$\Delta InExport_{oilt-1}$	−0.062776	
$\Delta InPrice_{oilt-1}$		2.264395**
$\Delta Import$ gar $_{(t-1)}$	−0.125968	−0.087966
$ECT_{(t-1)}$	−0.764454***	−0.814177***
Constant	0.010132	0.010576

Table 12: ADF unit root test (At Level)

	Variable	$M1_{ECT}$	$M2_{ECT}$
With intercept only	ADF−stat. Stationarity	−9.369614*** S	−9.271601*** S
With intercept and trend	ADF−stat. Stationarity	−9.334632*** S	−9.250331*** S
No intercept and no trend	ADF−stat. Stationarity	−9.412986*** S	−9.314620*** S

ADF denotes the Augmented Dickey–Fuller single root system respectively. The maximum lag order is 2. The optimum lag order is selected based on the Shwarz criterion automatically; ***, ** and *indicate rejection of the null hypotheses at the 0,1%, 1% and 5% significance levels respectively. The critical values are taken from MacKinnon (1996).

Thus, all ARDL models given in equations (1) and (2) pass all diagnostic tests smoothly. Bound test examined the existence of long-term dependency (Table 9). The results of both models are given in Table 10. They show that there is a long-term relationship.

Due to test results, it can be claimed that there is a cointegration relationship between oil exports and car imports at the significance level of 5% (Table 11). However, long-term relationship exists between oil prices and car imports at the significance level of 1%.

$$Cointeq = lnExport_{oil} - (0.547926 * lnImport_{gar} + 3.592892)$$

$$Cointeq = lnPrice_{oil} - (0.845979 * lnImport_{gar} + 7.589331)$$

For long-term relationships, Unrestricted Error Correction Models are utilized to check for the presence of dynamic cause and result

Table 13: Estimation results of different cointegration techniques (FMOLS, DOLS and CCR)

	Model 1			Model 2		
$lnİmport_{gar}$	FMOLS	DOLS	CCR	FMOLS	DOLS	CCR
$lnExport_{oil}$	0.614046***	0.568902***	0.630140***	—	—	—
	(4.220045)	(3.606708)	(4.141879)			
$lnPrice_{oil}$	—	—	—	0.815576***	0.760309***	0.815132***
				(4.279375)	(3.902847)	(4.297224)
C	2.668525	3.307337	2.443904	7.708610***	7.952787***	7.710462***
	(1.311972)	(1.500351)	(1.149315)	(9.292396)	(9.372556)	(9.334330)
R−squared	0.085329	0.153750	0.082382	0.163720	0.230048	0.163730
J−Bstat	10.70873	9.376169	11.11929	12.94582	5.102136	12.93400
	(0.004727)	(0.009204)	(0.003850)	(0.001545)	(0.077998)	(0.001554)
Phillips−Ouliaris	−9.510416***	−9.510416***	−9.510416***	−9.395751***	−9.395751***	−9.395751***
tau−statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Phillips−Ouliaris	−103.4813***	−103.4813***	−103.4813***	−100.5914***	−100.5914***	−100.5914***
z−statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Engle−Granger	−9.412986***	−9.412986***	−9.412986***	−9.31462***	−9.31462***	−9.31462***
tau−statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Engle−Granger	−98.16740***	−98.16740***	−98.16740***	−96.93361***	−96.93361***	−96.93361***
z−statistic	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

***, ** and *indicate rejection of the null hypotheses at the 0,1%, 1% and 5% significance levels respectively

relationship between different variables. For this reason, equations (1) and (2) are estimated by the indicated models (Tables 6 and 7). The long-term Granger-causality relationship among different variables is determined by by *t* and ECT_{t-1} - error correction term in each equation. The estimation of the correction coefficients of the models in Equations (3) and (4), as well as the long-term and short-term estimations, are given in Tables 10 and 12. The results show that the error correction coefficient is negative and significant at the 1% significance level in both of the models. These results confirm the existence of long-term relationships between different variables. They indicate that there is a long-term causal link between oil exports and car imports, and a long-term causal link between oil prices and car imports.

The results of the estimates show that oil exports and oil prices have a significant impact on the growth of automobile imports in the long run.

4.3. Robustness of the Results

To investigate more specific aspects of the long run causality relationship between oil exports and oil imports, cointegration relationships are reassessed by using different econometric models such as Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR). Summaries of these reassessment and its results, as well as some diagnostic tests, are given in Table 13. In general, the results of the Jarque-Bera, Phillips-Ouliaris, and Engle-Granger tests indicate that all obtained estimates are valid. In addition, FMOLS, DOLS, and CCR estimates are consistent with the estimates obtained from ARDL model. Therefore, it can be claimed that the results obtained in this research are reliable.

5. CONCLUSIONS AND RECOMMENDATIONS

This paper analyzes the impact of oil exports and oil prices on car imports in Azerbaijan for the time span of 2010-2019 (monthly basis). Some remarkable contributions can be derived from this study toward the regulation of car imports in Azerbaijan. Likewise, this paper can play a valuable role for recent important economic topics such as the effect of oil revenues on economic growth. In this study, FMOLS, DOLS, and CCR are used to test the reliability of long-term ARDL results. The outcomes are similar for different cointegration methods and techniques. In general, it is concluded that in the long run, there is a positive effect of oil exports and oil prices on car imports in Azerbaijan.

As a result of the research, the following should be noted: First and foremost, economic growth in Azerbaijan, income of people, and the increase in car imports caused by them are mainly dependent on oil income. Secondly, more attention should be paid toward the utilization of oil revenues in Azerbaijan and automobile imports. Oil revenues should be directed to more productive projects that accelerate economic growth. Third, Azerbaijan needs to strengthen its diversification policy to reduce its dependence on oil revenues.

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