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IS THERE A J-CURVE FOR AZERBAIJAN? NEW EVIDENCE FROM INDUSTRY-LEVEL ANALYSIS

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Abstract

This paper estimates the J-curve for Azerbaijan using quarterly industry-level data over the 2000-2009 period. A weighted average of the production indexes of Azerbaijan's major trading partners, which account for 70% of Azerbaijan's total trade turnover, was chosen as a proxy for foreign income. Ten non-oil industries, the core of Azerbaijan's non-oil foreign trade, have been analyzed. Empirical results show that in 3 of the 10 cases there is strong evidence for the fulfillment of the Marshall-Lerner condition, as the trade balance in each of those three industries improves in the long run in reaction to a currency depreciation. In most industries the J-curve pattern is observed in the short run. The price effect is strong and present in almost all industries. All 10 cases exhibit long-run cointegration and are stable according to the CUSUM and CUSUMSQ stability tests. These findings are largely consistent with the existing literature on the Azerbaijani J-curve. Our results carry important policy implications as Azerbaijan attempts to stimulate non-oil exports.

Keywords: J-Curve; ARDL Regression; Bounds Cointegration; Azerbaijan

JEL: C22, F14, F3

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1. Introduction

It has become conventional to believe that there exists some empirical relationship between a country's trade balance and the level of its exchange rate. Economic theory suggests that devaluing the domestic currency will affect the balance trade, and that the impact will be different in the short run and in the long run. In the short run, the trade balance will suffer from the price effect, which will make imports appear more expensive. In the long run, the dominating volume effect will rebalance the trade dynamic in favor of the exports. Such long-run improvement is usually called the fulfillment of the Marshall-Lerner condition. If sketched over time, the dynamic of the balance of trade will resemble a "J" letter shape (Magee, 1973).

The literature on the J-curve phenomenon is vast and first papers on this subject date back to the early 70s. Junz and Rhomberg (1973) explain the J-curve effect with the existence of a significant lag in the adjustment of trade contracts to the exchange rate innovations. Dornbusch and Krugman (1976) argue that the trade balance would always be negatively affected by an exchange rate devaluation in the short run, but would improve in the long run due to the higher export elasticity. Krueger (1983) offered an explanation of the J-curve that a time lag is required for producers to fulfill contractual obligations of the pre-devaluation regime, and that the short run is usually dominated by the completion of those old contracts.

With regards to empirical investigation, Bahmani-Oskooee and Hegerty (2010) provide an excellent review for the J-curve literature. In general, there have been 3 types of approaches towards the J-curve estimation. First, Bahmani-Oskooee (1985) proposed a trade balance model using the Almon lag structure which employed aggregate trade data. Following Bahmani-Oskooee (1985), others have built on this research line, such as Hsing (2008).

A second stream was initiated by Rose and Yellen (1989) who argued that using aggregated data in J-curve analyses created the so-called "aggregate bias". Therefore, they proposed to conduct a bilateral analysis instead. Bahmani-Oskooee and Brooks (1999), Bahmani-Oskooee et al. (2006), Halicioglu (2007), Bahmani-Oskooee and Kutan (2009), Perera (2011) have built on this premise. Overall, there has never been a systematic, final conclusion on the existence of the J-curve, as different studies show highly heterogeneous results.

A third major direction in the J-curve sphere of research was opened by a pioneering study by Bahmani-Oskooee and Wang (2008) who disaggregated the trade data even further to the level of industries and specific trade sectors. They used real bilateral exchange rates and information on industry-level trade balances to establish industry elasticities with respect to devaluations vis-à-vis concrete trade partners. Ardalani and Bahmani-Oskooee (2007), Erdem et al. (2009), Bahmani-Oskooee and Mitra (2009), Bahmani-Oskooee and Hajilee (2009), Bahmani-Oskooee and Hegerty (2009) contributed to the analysis of the J-curve at the industry level. Similarly to the results of prior research streams, the outcomes are not conclusive since effects of the exchange rate are very industry specific.

Literature on the Azerbaijani J-curve is practically non-existent. To the best of our knowledge, there has been just one attempt so far to estimate the J-curve for Azerbaijan using the standard error correction method (Jamilov, 2012). Results in Jamilov (2012) confirmed the presence of the operational Marshal-Lerner condition in the long run. However, the paper employed an aggregated analysis, without considering the aggregation bias and examining industrial heterogeneity of specific sectors of the economy. It's certain that no other industry-level analysis has been conducted for Azerbaijan. This paper is original in this regard, will attempt to fill the regional research gap and focus on an industry-specific investigation. Results of this paper will carry important policy implications, as Azerbaijan attempts to diversify its economy and boost exports. With regards to methodology, Halicioglu (2008) employed the auto-regressive distributed lag model (ARDL) approach to cointegration to discover a bilateral J-curve for Turkey versus its major trading partners. We will be building our strategy along the lines of Halicioglu (2008) and present a commodity-specific analysis for Azerbaijan using the ARDL method.

In this paper we are analyzing bilateral trade models of Azerbaijan vis-à-vis its major trade partners. Those are the Eurozone (Euro-17), USA, Israel, and India. Together, this four trade destinations account for 72% of Azerbaijan's overall trade turnover. We will be focusing on industry-level data. To that end, we have composed a list of Azerbaijan's 10 largest non-oil industrial sectors in terms of foreign trade. There are naturally several more, smaller trade segments, but our 10 sectors amount to 97% of Azerbaijan's total non-oil trade.

This study will focus on the non-oil exports and imports. We wish to contribute to the policy-level discussions on Azerbaijan's strategy of industrial diversification.

Currency depreciations, in theory, improve the performance of certain trade sectors due to an adjustment in export volumes in the long run. We therefore want to test if there are some industries in Azerbaijan which could be potentially improved with a depreciation. The remaining of this paper is structured as follows. Section 2 discusses the data used in the study and presents the econometric methodology. Section 3 provides the results. Finally, Section 4 concludes.

2. Data and Methodology

We will be using quarterly data for the timeframe of 2000-2009. The following variables were used in this paper: exports and imports in specific industries between Azerbaijan and its 4 major trade partners; real GDP of Azerbaijan; a weighted average of aggregate income for the Eurozone, USA, India, and Israel; and the real exchange rate of Manat to the US Dollar (Figure 1). Exports and imports on the industry level were needed to build industry-specific trade balances (ratio of exports to imports). Summary statistics on trade data is presented in Table 1. The trade data were taken from the Azerbaijan State Statistical Office (AZSTAT). GDP of Azerbaijan, used as a proxy for domestic income, was obtained also from AZSTAT (Figure 2). Aggregate income for the Eurozone is approximated by its Industrial Production Index, which was taken from Eurostat (Figure 3). For USA, India, and Israel, we are proxying aggregate income with respective values of Gross Domestic Product, which were taken from the St. Louis Federal Reserve (FRED).

[INSERT TABLE 1 HERE]

[INSERT FIGURES 1, 2, and 3 HERE]

Assuming that together these 4 partners account for 72% of total bilateral trade turnover, we weighted their incomes with respect to their contribution to those 72% of the turnover in focus. Eurozone's share is 50% of Azerbaijan's overall trade, USA – 8.5%, India – 7.2%, and Israel – 6.2%. Information on *country*-specific industry-level data was not obtainable[1]. In other words, we don't know how much polyester or ready-made food products Azerbaijan exports to India and how much it imports from the US. What we know is Azerbaijan's *overall* industry-level data, and we tried to approximate Azerbaijan's trading destinations with our 4 selected partners. We believe that since the chosen 4 partners account

[1] This is also the reason why we cannot use bilateral exchange rates vis-à-vis specific trade partners, because partner-specific non-oil trade information is not available.

for 72% of the whole trade turnover, this will work as a large enough approximation for “foreign income”.

In this study we are estimating a conventional trade balance model, the reduced form of which is formulated as:

$$\ln TB_{i,t} = \alpha_0 + \alpha_1 \ln Y_{d,t} + \alpha_2 \ln Y_{f,t} + \alpha_3 RFX_t + \varepsilon_t \qquad (1)$$

where TB is ratio of exports to imports between Azerbaijan and its major trading partners for a specific industry *i*, $Y_{d,t}$ is the domestic income which is approximated by Azerbaijan’s GDP, $Y_{f,t}$ is foreign income which is the weighted average of aggregate income for Azerbaijan’s 4 major trading partners, RFX is the real exchange rate of Manat vis-à-vis the US dollar, and ε_t is the error term. Basically, we will be running 10 separate versions of the same model (1) but each time for a different sector of Azerbaijan’s trade, thus obtaining trade balance models for all ten major industries.

There are no *a priori* expectations on the sign and size of the coefficients of domestic and foreign income. α_1 and α_2 could be either positive or negative, depending on how Azerbaijan’s GDP or the economic environment in its partners affect specific industries. Meanwhile, the primary focus of our paper is the coefficient for the exchange rate, α_3. We expect its long-run version to be positive because, in theory, a depreciation of the exchange rate (which is represented by an increase in RFX_t) would lead to an improvement in the trade balance in the long run. In the short run, however, the estimate of α_3 must be negative since the balance of trade must diminish due to a dominating price effect, which will in turn engineer the J-curve dynamic. Therefore, we need a method which would demonstrate both the long run and the short run behavior of the trade balance in response to exchange rate innovations.

This paper employs the ARDL approach to cointegration, which was described in Pesaran et al. (2001). ARDL methodology (or the bounds testing approach) is distinctively useful on several levels and mainly because it allows us to estimate both the short-run effects and the long-run cointegrating equation estimates of a given model. In addition, this method solves the problem of variable endogeneity and the inability to test hypotheses on the estimated coefficient. There are also scholars claiming that the performance of the ARDL-based bounds testing approach in small samples is superior to that of multivariate cointegration, a claim which is particularly useful for our case. Finally, ARDL regressions also do not require the variables in the model to be non-stationary in level forms; ARDL works regardless of whether there exists a unit root in the regressors or not. However, we will still perform and present results from three unit root tests: the Augmented Dickey-Fuller test (Dickey and Fuller, 1979; 1981), the Phillips-Peron test (Phillips and Peron, 1988), and the KPSS test (Kwiatkowski et al., 1992). If at least two of the test outcomes suggest non-stationarity in levels, then we will conclude that the variable is of I(1) order. It is important to ensure that variables are stationary at least in first differences, since I(2) processes will not work with the ARDL framework[1].

We can now put the trade balance model (1) in its ARDL form:

$$\ln TB_{i,t} = \alpha_0 + \sum_{j=1}^{m} \alpha_{1i} \Delta \ln TB_{i,t-j} + \sum_{j=0}^{m} \alpha_{2i} \Delta \ln Y_{d,t-j} + \sum_{j=0}^{m} \alpha_{3i} \Delta \ln Y_{f,t-j} + $$

$$+ \sum_{j=0}^{m} \alpha_{4i} \Delta \ln RFX_{t-j} + \alpha_5 \ln TB_{i,t-1} + \alpha_6 \ln Y_{d,t-1} + \alpha_7 \ln Y_{f,t-1} + \alpha_8 \ln RFX_{i,t-1} + \nu_t \quad (2)$$

where m means lag length. We can proceed with testing for cointegration. The bounds testing approach presented in Pesaran et al. (2001) achieves this by presenting an F-statistic which tests the null hypothesis of no cointegration (H_0: $\alpha_5=\alpha_6=\alpha_7=\alpha_8=0$) against the alternative hypothesis (H_1: $\alpha_5\neq0$, $\alpha_6\neq0$, $\alpha_7\neq0$, $\alpha_8\neq0$). For every significance level there are two sets of critical values. If the F-statistic exceeds the upper-bound critical value, then the null hypothesis is rejected. If the F-statistic is below the lower-bound, then the null is accepted and we have no cointegration. Finally, if the F-statistic is between the two bounds then the test has no conclusive result. There is another way of testing for cointegration, which is looking at the error correction term in the ARDL's short-run representation via an error correction model (Kremers et al., 1992). If the error correction term is statistically significant and negative, it implies that the variables are quick on approaching their long-run stabilizing conditions.

The general form of the error correction model, which we need in order to review the short-run dynamics of the balance of trade, is presented below:

[1] We thank the anonymous referee for pointing this out.

$$\ln TB_{i,t} = \alpha_0 + \sum_{j=1}^{m} \alpha_{1i}\Delta \ln TB_{i,t-j} + \sum_{j=0}^{m} \alpha_{2i}\Delta \ln Y_{d,t-j} + \sum_{j=0}^{m} \alpha_{3i}\Delta \ln Y_{f,t-j} + + \sum_{j=0}^{m} \alpha_{4i}\Delta \ln RFX_{t-j} + \lambda EC_{t-1} + u_t \quad (3)$$

where λ is the coefficient of the speed of adjustment to long-run equilibrium and EC is the residuals obtained from the estimation of (1). In the end, after performing the tests for cointegration, presenting the long-run and the short-estimates of our trade balance model, we will perform several posterior checks. First, we will present stability checks of Brown et al. (1975), which are mostly known as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests of the recursive regression residuals. Stability of the regression coefficients is proven if the plot of the statistics falls within the 5% significance bounds. These tests will be particularly relevant for our case since Azerbaijan is an emerging market economy. Evidence of robustness of our parameters will provide more relevance to our implications and conclusions. In addition to the CUSUM and CUSUMSQ tests, we will also report the results for tests of serial correlation, functional misspecification, normality, and heteroskedasticity.

3. Results

We begin to present the empirical results first by reporting the outcomes of the unit root tests. As stated earlier in the paper, the outcome of the tests will not affect substantially our empirical strategy, except for the fact that series must be proven to be of smaller order than I(2). Table 2 reports the results. Domestic demand and the exchange rate variables are found to be non-stationary in levels and stationary in first differences according to two of the three tests; foreign demand is stationary in level form. Half of the industries are of I(1) order, i.e. stationary in first differences. The remaining ones do not possess a unit root. None of the variables in our dataset are non-stationary in first differences, and the choice of the ARDL model is appropriate and technically feasible.

[Insert Table 2 HERE]

Results of the bounds approach to cointegration are presented in Table 3. We have run regressions for each of the 10 trade industries in focus, employing 2, 4, and 6 lags. It's clear that the results of the F-test are not contingent on the selection of lags. This is interesting, because literature often suggests that the F-test behaves differently depending on the choice of lags. In our case, either the variables in a particular model are cointegrated, or they are not. And lag selection seems not to be affecting the outcome of the test. 6 out of 10 industries show cointegration when 2 lags were chosen, and 5 cases of cointegration are recorded for the scenarios of 4 and 6 lags. Results of the cointegration test are still preliminary at this stage and will be confirmed with the analysis of the error correction term in the short-run analysis of the error correction model.

[Insert Table 3 HERE]

Now, in the second stage of the process, the maximum lag length was selected as 6.[1] We reran all ten regressions of the trade balance having selected the Akaike Information Criterion (AIC) for optimum lag length. We can now present the results for the long-run coefficient estimates, which are reported in Table 4.

[Insert Table 4 HERE]

From Table 4 we can conclude that 3 out of 10 cases show a significant positive coefficient for the exchange rate. In other words, for those three industries a depreciation of the manat would improve the industry-specific trade balance in the long run. Those industries are “Semi-precious metals”, “Land, air, and water transport facilities”, and “Polymer, rubber, and plastics”. The Marshall-Lerner condition is therefore fulfilled in these three industries. There were three other cases where the coefficients were positive, but those are not statistically significant. Peculiarly, four industries have delivered negative long-run exchange rate coefficients.

In order to analyze the short-run dynamics of our balance of trade models, and to detect any signs of the J-curve effect, we present the short-run estimates of our models in Table 5.

[Insert Table 5 HERE]

In general, a J-curve pattern is supported if the ECM model shows negative values for the initial lag of the exchange rate, followed by positive values in the higher lags. Based on the numbers in Table 4 we can conclude that there are J-curve related symptoms in at least 7 of the ten industries, for which short-run estimates of the exchange rate shock are negative. We particularly want to highlight the

[1] This choice was restricted mainly by our small sample size.

sectors of “Semi-precious Metals” and “Polymer, Rubber, Plastics”. For these two areas the trade balance exhibits a J-curve pattern in the short-run and the Marshall-Lerner like improvement in the long run, as shown in Table 4. It is therefore possible that Azerbaijan could benefit from industrial diversification in these two areas of the non-oil economy. We note that the price effect is visible in practically all (9 out of 10) industries, since the trade balance declines for at least one lag (and in most cases, for 2 lags and more) in almost every case.

With regards to the error correction terms, 9 out of 10 cases show a negative and statistically significant coefficient. This implies that there is evidence for cointegration in all of those nine models. For the 10th case for which the error correction term is insignificant (“Instruments and Apparatus”), the F-test for cointegration presented in Table 2 strongly rejected the null of no cointegration at all lag selections. In short, the series in our model achieve long-run equilibrating status, although sluggishly. The basic arithmetic average of the error correction term across all industries is -0.94, which suggests that cointegration is achieved after one quarter of a calendar year. In other words, the economy should expect substantial reactions from industry-specific trade balances to a exchange rate depreciation in less than six months, which is sooner than previous studies indicate (Jamilov, 2012). It is possible that disaggregated approach purges the aggregation bias out of the model and industry-specific cointegration is actually faster than for the aggregate economy.

Finally, we report the results of some posterior hypothesis tests and of the CUSUM and CUSUMSQ stability tests in Table 6.

[Insert Table 6 HERE]

As we can see from Table 6, all of the regressions are stable according to least one of the two stability tests. 9 out of 10 cases present very strong cases for parameter stability. For the purposes of illustration, we also present the graphical representation of the CUSUM and CUSUMSQ stability tests in Figures 4 and 5 for the case of the “Transport facilities” industry, which was chosen because we wanted to present the case with a Marshall-Lerner like trade balance improvement the long run (Table 4). The remaining graphics are not displayed here for brevity, but are available upon request. These results provide robustness to our conclusions and implications, which is particularly important for the case of Azerbaijan.

[Insert Figures 4 and 5 HERE]

4. Conclusion

This paper has presented a new view at the existence of the J-curve for Azerbaijan. Following the recent trend of commodity-level approaches to J-curve estimation, this study proposes an industry-level analysis of Azerbaijan's non-oil trade vis-à-vis its four major trade partners. Ten largest non-oil sectors were chosen for this disaggregated approach. An ARDL approach to cointegration has been used to estimate the reduced form trade balance model. Series are tested for stationarity and cointegration is found to be present in each of the 10 cases. Our results suggest that for 3 of the 10 industries there is evidence in favor of the Marshall-Lerner condition, i.e. the industry-specific trade balance improves in the long run following a depreciation in the currency. Symptoms of the J-curve effect are found in 7 of the 10 cases in the short run. In particular, "Semi-Precious Metals" and "Polymer, Rubber, Plastics" industries exhibit systematic textbook-level responses to exchange rate depreciation: the J-curve effect in the short run and a trade balance improvement in the long run. We therefore think that Azerbaijan may consider these two sectors as potential drivers of non-oil diversification in the country. Robustness of our results has been confirmed with CUSUM and CUSUMSQ tests for stability.

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Figure 1: Real Bilateral Exchange Rate

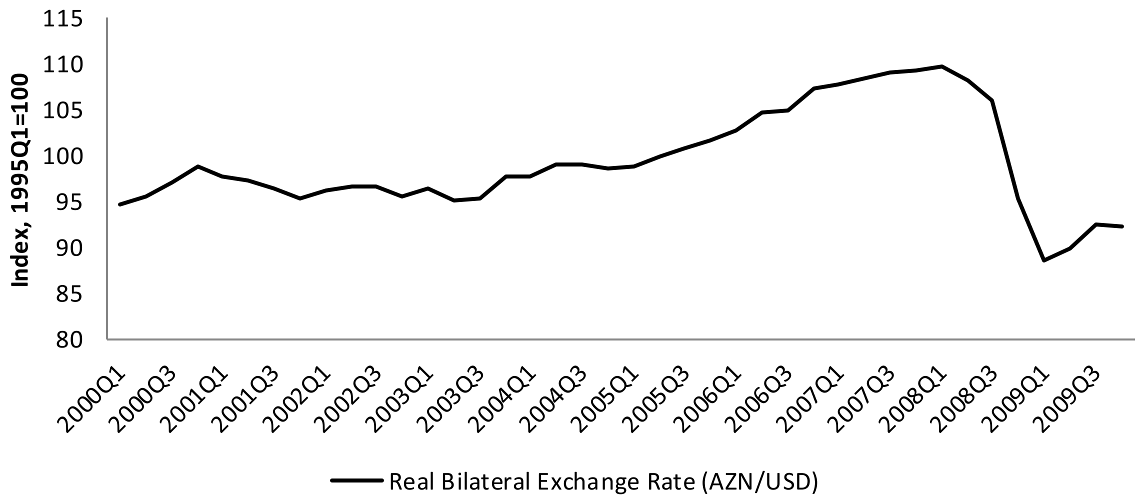

Figure 2: Domestic Demand - Azerbaijan's Gross Domestic Product

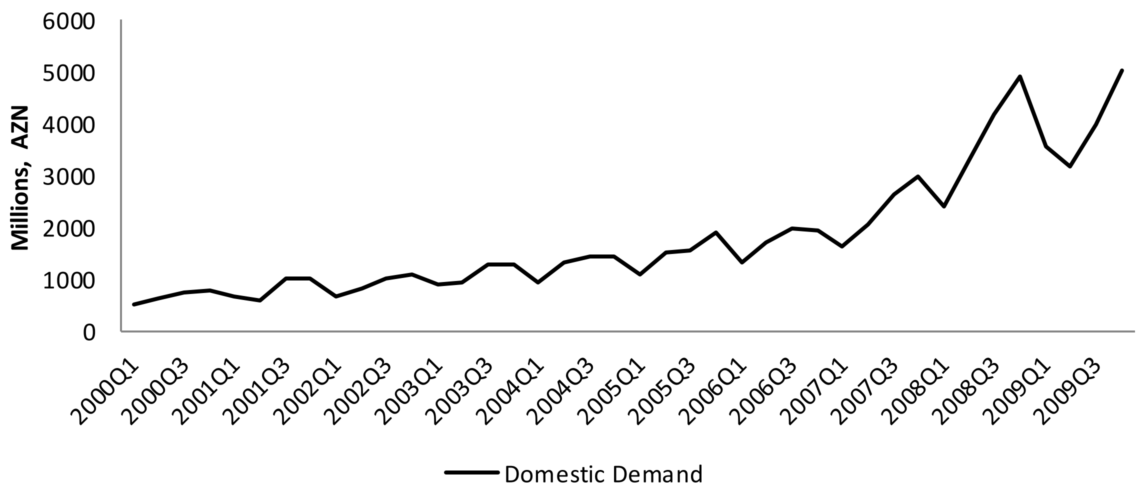

FIGURE 3: FOREIGN DEMAND - AZERBAIJAN'S MAIN TRADING PARTNERS

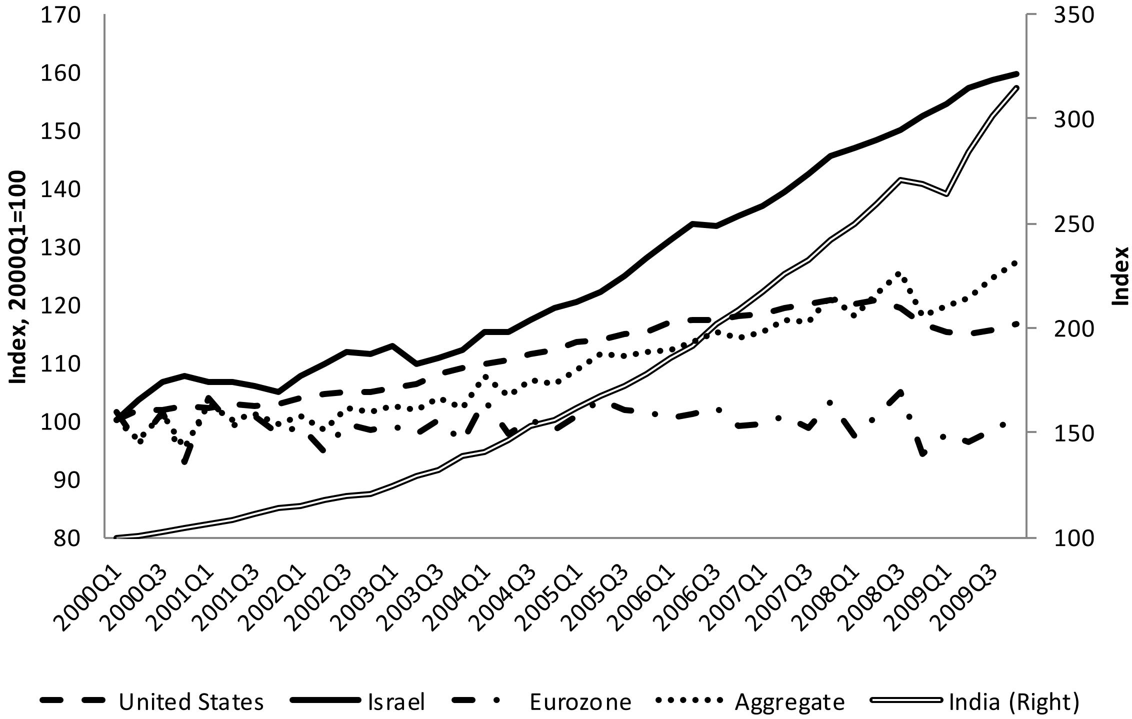

TABLE 1: TRADE DATA SUMMARY STATISTICS, 2000-2009

Azerbaijani Exports	Mean	Standard Error	Median	Range	Minimum	Maximum
Plants and vegetables	31536.22	4899.70	23036.40	107845.20	2885.60	110730.80
Semi-precious metals	14523.20	1856.97	14301.73	40019.60	325.40	40345.00
Transport facilities	21964.48	2960.50	12864.10	62548.30	3926.70	66475.00
Food Products and Beverages	19845.82	2201.04	15722.60	49732.70	2908.30	52641.00
Chemical products	15025.43	1602.68	13316.10	40828.60	526.70	41355.30
Polymer, rubber, plastics	11118.28	838.04	10616.05	20285.30	1749.80	22035.10
Animal and Plant oils	28952.46	5122.74	25569.80	197596.80	287.60	197884.40
Weaving products/materials	8447.09	464.58	8235.30	14469.60	642.70	15112.30
Machines and equipment	24619.77	7985.25	3841.80	264689.90	727.30	265417.20
Instruments and apparatus	1405.88	186.31	1114.10	5126.90	241.50	5368.40
Azerbaijani Imports	**Mean**	**Standard Error**	**Median**	**Range**	**Minimum**	**Maximum**
Plants and vegetables	57593.20	5934.21	42611.50	156049.20	15777.90	171827.10
Semi-precious metals	9121.38	989.47	7397.05	25206.80	738.70	25945.50
Transport facilities	58526.96	7224.93	34844.50	137479.70	9244.30	146724.00
Food Products and Beverages	52076.03	5523.62	37120.85	128812.90	15500.10	144313.00
Chemical products	27013.42	2847.06	24742.05	62954.10	4046.50	67000.60
Polymer, rubber, plastics	11961.19	708.39	12168.20	15130.60	4331.10	19461.70
Animal and Plant oils	122000.24	9765.13	127680.20	210213.10	22945.00	233158.10
Weaving products/materials	297010.07	30222.40	269335.85	680266.10	50420.70	730686.80
Machines and equipment	129204.63	17530.83	92546.65	397378.00	12115.00	409493.00
Instruments and apparatus	25501.85	3262.66	18130.80	93942.10	5033.90	98976.00

Source: Central Bank of Azerbaijan Bulletin of Foreign Trade

Table 2: Unit Root Test Results

Variable	ADF Level	ADF FD	KPSS Level	KPSS FD	PP Level	PP FD
Domestic Income	-2.6	-1.14	0.69	0.37*	1.05	-5.96*
Foreign Income	-8.05*		0.15*		-7.81*	
Exchange Rate	-2.20	-3.55*	0.24*		-1.59	-3.36*
Plants and vegetables	-1.37	-14.97*	0.59	0.14*	-3.97*	
Semi-precious metals	-4.34*		0.31*		-4.38*	
Transport facilities	-5.8*		0.10*		-6.23*	
Food Products and Beverages	-4.29*		0.11*		0.28*	
Chemical products	-1.61	-5.87*	0.31*		-1.70	-6.12*
Polymer, rubber, plastics	-6.58*		0.22*		-6.58*	
Animal and Plant oils	-2.58	-8.68*	0.74	0.28*	-2.49	-17.22*
Weaving products/materials	-5.99*		0.12*		-10.39*	
Machines and equipment	-2.72	-9.83*	0.56	0.24*	-2.54	-11.93*
Instruments and apparatus	-2.81	-7.16*	0.56	0.11*	-2.81	-8.95*

Note: AIC Lag Criterion was chosen to determine the optimal lag length. Statistics are presented for variables in level and first difference forms. ADF, KPSS, and PP unit root estimates are the t-statistic, Lagrange Multiplier, and adjusted t-statistic, respectively. *-indicates that the variable is stationary at the 5% level of significance.

Industry	F-statistics for different lag length selections		
	2 lags	4 lags	6 lags
Plants and vegetables	2.68*	5.71**	15.47**
Semi-precious metals	3.55**	3.02*	13.68**
Transport facilities	.563	1.08	.825
Food Products and Beverages	1.73	.76	1.30
Chemical products	4.69**	3.01*	4.14*
Polymer, rubber, plastics	1.01	1.00	2.20
Animal and Plant oils	1.47	1.37	1.46
Weaving products/materials	2.08*	1.70	1.25
Machines and equipment	3.07*	3.10*	17.13**
Instruments and apparatus	5.32**	5.41**	4.00*

TABLE 3: RESULTS OF F-TEST FOR COINTEGRATION

Note: The critical values for the F-test are 2.45-4.01 and 3.20-352 at the 5% and 10% significance levels, respectively. They were taken from Pesaran *et al*. 2001, pp.300-301. *,**- indicate statistical significance at the 5% and 1% levels, respectively. The null hypothesis is no cointegration.

TABLE 4: LONG-RUN COEFFICIENTS OF THE ARDL REGRESSION

Industry	ARDL Order^	Constant	t-stat	Domestic Income	t-stat	Foreign Income	t-stat	Exchange Rate
Plants and vegetables	AIC(6,6,6,5)	-144.50	-1.65	-0.35	-.41	3.45	1.62	0.01
Semi-precious metals	AIC(6,6,5,6)	-21.53	-1.33	0.51	.63	7.09	1.14	0.42
Transport facilities	AIC(0,5,0,1)	52.67	.23	0.29	.62	-0.74	-.87	0.39
Food Products and Beverages	AIC(2,6,5,2)	35.89	1.31	0.38	1.22	-2.21	-1.36	0.26
Chemical products	AIC(5,1,6,2)	-6.86	-1.32	-0.48	-1.03	4.84	.38	-0.51
Polymer, rubber, plastics	AIC(2,5,4,5)	-10.75	-2.30*	-0.61	-3.99*	-0.03	-3.93*	0.19
Animal and Plant oils	AIC(5,0,5,4)	20.99	1.82*	1.71	.72	-7.20	-2.95*	-1.87
Weaving products/materials	AIC(6,6,6,5)	-23.34	-.19*	-0.03	-.24	4.24	.15	0.04
Machines and equipment	AIC(4,6,4,6)	104.68	.87	0.00	-3.99*	-18.75	-.71	-0.16
Instruments and apparatus	AIC(6,6,6,6)	-653.28	-.61	-1.35	-4.39*	44.90	.62	-0.09

Note: Dependent variable is industry-specific trade balance. ^- the ARDL regressions were built using the Akaike Information Criterion. For example, for Chemical Products, the ARDL order of AIC (5,1,6,2) implies that the optimum of 5 lags were chosen for the constant, 1 lag for the variable of domestic income, 6 lags for foreign income, and 2 lags for the exchange rate. *-indicates significance at the 5% level.

TABLE 5: SHORT-RUN COEFFICIENTS OF THE ARDL REGRESSION

Plants and vegetables	Semi-precious metals	Transport facilities	Food Products and Beverages	Chemical products	Polymer, rubber, plastics	Animal and Plant oils	Weaving products and materials	Machines and equipment
-0.13	0.01	0.14	0.07	0.02	0.08	-0.12	-0.09	-0.22
(3.49)*	(1.47)	(0.87)	(2.01)*	(0.62)	(1.48)	(0.56)	(1.63)	(-2.05)*
-0.02	-0.85		-0.05	-0.01	0.01	0.17	-0.09	0.08
(0.41)	(1.91)*		(1.63)	(0.07)	(0.15)	(2.02)*	(1.28)	(-0.85)
-0.18	-0.81			0.03	-0.18	0.09	-0.05	-0.22
(4.39)*	(2.11)*			(0.36)	(1.87)*	(1.02)	(0.83)	(-2.01)*
-0.03	-0.64			0.08	-0.24	0.16	-0.01	-0.3
(1.97)*	(3.69)*			(1.08)	(4.07)*	(2.40)*	(-0.26)	(2.69)*
-0.07	-0.08			0.08	-0.08		0.03	-0.01
(2.46)*	(1.27)			(1.2)	(-3.36)*		(1.52)	(3.72)*
	-0.15			0.04				-0.11
	(2.66)*			(0.86)				(1.41)
-0.29	-2.20	NA	-0.41	-0.43	-1.48	-0.15	-1.46	-1.25
(1.53)*	(-2.3)*		(2.54)*	(2.10)*	(3.93)*	(4.51)*	(3.52)*	(3.36)*

Note: *- indicates statistical significance at the 5% level

TABLE 6: CUSUM, CUSUMSQ STABILITY AND DIAGNOSTIC TESTS RESULTS

Industry	CUSUM	CUSUMSQ	χ^2_{sc}	χ^2_{ff}	χ^2_{n}	χ^2_{h}
Plants and vegetables	Stable	Stable	9.60**	1.27	.57	1.71
Semi-precious metals	Stable	Unstable	10.91**	16.75**	.78	.26
Transport facilities	Stable	Stable	7.89*	.79	.06	5.07**
Food Products and Beverages	Stable	Stable	7.83*	.86	1.92	1.21
Chemical products	Stable	Stable	13.06**	.42	.97	3.53**
Polymer, rubber, plastics	Stable	Stable	2.85	19.64**	1.91	.49
Animal and Plant oils	Stable	Stable	1.13	8.25**	.11	.05
Weaving products/materials	Stable	Stable	27.17**	.06	1.06	.17
Machines and equipment	Stable	Stable	6.87	7.61**	.04	2.93**
Instruments and apparatus	Stable	Stable	23.11**	6.68**	8.79**	1.11

Note: χ^2_{sc}, χ^2_{ff}, χ^2_{n}, χ^2_{h} are the Lagrange multiplier statistics for tests of serial correlation, Ramsey's test of functional misspecification, normality, and heteroskedasticity, respectively, and are distributed as Chi-squared variables. *,**- indicate statistical significance at the 10% and 5% levels, respectively.

Figure 4: Plot of CUSUM for Transport Facilities

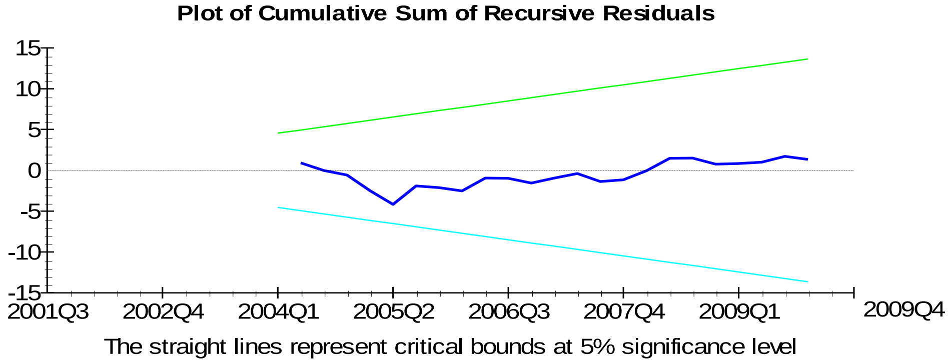

Figure 5: Plot of CUSUMSQ for Transport Facilities