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The Exchange Rate Volatility and the Trade Balance: Case of Uzbekistan

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In transition economies, exchange rate may fluctuate quite substantially relative to major currencies, and thus, have a strong impact on country's foreign trade dynamics. This study estimates the effect of exchange rate volatility on the international trade in Uzbekistan duringthe 1999-2009 period. Results show that the real exchange rate volatility has a substantial impact on the exports and imports of the country during the given period. Furthermore, using Johansen's cointegration framework, we test for the presence of unique cointegrating vectors linking series such as exports (imports), foreign (domestic) income, relative export (import) prices (proxied by real exchange rate) with the volatility of the real exchange rate in the long run. Results show that increases in the volatility of the real exchange rate have significant negative effects on equations of exports and imports in the long-run dynamics. We also observe that improvements in the terms of trade, as represented by declines in the real exchange rate, positivelyaffectexports. Overall, our findings suggest that trade can be further increased as a result of sound macroeconomic policies directed to achieve and maintain a stable real exchange rate.

Keywords: *Exchange rate volatility, Trade balance, Uzbekistan*

1. Introduction

The real exchange rate is one of the essential indicators of economy's international competitiveness, and therefore, has a strong influence on a country's foreign trade developments. It is commonly believed that the movements of the real exchange rate have a permanent effect on exports and imports. Most empirical studies on the exchange rate volatility on trade focus only on developed countries[2], and the literature on transition economies is limited, mainly due to the lack of good quality data. Transition economies have less developed financial markets, so the cost of adjusting to macroeconomic changes is higher compared to those in developed countries. Therefore, we can conclude that exchange rate volatility may have a major impact on trade.

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[2]For example, Bailey, Tavlas and Ulan (1987) observe seven OECD countries,Koray and Lastrapes (1989) analyze US bilateral trade with five industrialized countries, Aristotelous (2001) examines UK-US exports, and Babecky et al (2010) investigateeuro-area countries.

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In Uzbekistan, there exists a multiple exchange rate policy and the system has been unified to make a more flexible exchange rate regime in recent years. However, the practice of exchange rate policy is considered as a managed floating with no pre-announced path for the exchange rate. Appleyard et al. (2010) defines the policy practiced in Uzbekistan as a "crawling peg" exchange rate system.

After unification of the exchange rate in 2003, macroeconomic policy in Uzbekistan was aimed to promote export activities. To increase the industrialization ratio in domestic gross output and to enhance manufacturing sectors, policy is also promoted to increase the imports of equipment and machinery products into the country. This aim in turn leads to conducting import substitution strategy in other sectors. Therefore, it is crucial for policymakers to analyze the impact of exchange rate volatility to devise exchange rate and trade policies for the promotion of export activities and stabilization of import operations.

Olimov and Sirajiddinov (2008) observe the negative relationship of exchange rate volatility on both the trade outflows and inflows of Uzbekistan. They find high volatility in the exchange rate system after exchange regime reforms of 2001-2003 years. Although this study has significant contribution to the literature, there is some room to be extended. Assessment of volatility measure on the changes of aggregate exports in this study relies on domestic fundamental variables such as a domestic GDP. However, changes in foreign income also create substantial impact on changes of the export activities in the country. Countries such as Russia[3] and Kazakhstan are expanding their economies due to high earnings from their oil-exports. Ukraine also shows decent economic growth thanks to proximity to European markets and better-industrialized sectors. These countries are the largest trading partners of Uzbekistan, which can make greater deal of impact on trade flows of the country.

This paper examines the effects of exchange rate volatility on trade in Uzbekistan and its possible further developments, building upon Olimov and Sirajiddinov (2008). The contribution of this study is twofold. First, we employ the exogenous variable of foreign income in the investigation of the export equation contrary to the choice of solely using domestic GDP as observed in the previous study. Second, we investigate if liberalization processes in the country increased the volatility measure on trade flows. These two extensions enable us to assess whether exchange rate volatility remains in the predicted levels analyzed by previous studies and identify the coherence of current macroeconomic policies with the changes in foreign exchange rates.

We note that there exist less opportunities or lack of risk hedging associated with exchange rate uncertainty expectations for shorter time periods, because of lower degree of developments in the currency forward markets. In order to capture better policy-oriented implications for longer periods, we may need to identify the existence of a long-run relationship between the real exchange rate and the selected explanatory variables. For this purpose, the Johansen cointegration-testing framework is utilized.

The remainder of the paper is organized as follows. Section 2 gives a brief background on exchange rate policy and trade of Uzbekistan for the period of 1999-2009. Section 3 reviews the literature on empirical studies on the subject in industrialized

[3]Russia remains a key trading partner (as regards formal and informal trade) for the Central Asian region (Pastor and Damjanovic, 2003; IMF DoTS, last accessed on April 4, 2011).

economies. Section 4 discusses the trade model and theoretical framework. The empirical results are presented in Section 6. Section 7 concludes.

2. Overview of the Foreign Exchange Rate Regime in Uzbekistan

Structural and stabilizing developments in the exchange rate system of Uzbekistan started in 1994, when the country began to accelerate market-oriented reforms and to relax financial policies. These measures improved macroeconomic performance and the exchange rate system considerably. After 1996, the currency rationing policy measure in the foreign exchange market was implemented to promote import substitution strategy. This measure was taken as a response to results of low export revenues in preceding years.

In 2001, the official and commercial bank foreign exchange rates against the US dollar were unified with the same level of the exchange rate as the one that existed in commercial banks. Contrary to the concept of radical "shock therapy" reforms, Uzbekistan took more cautious steps concerning changes in the exchange rate policy. In this regard, its approach to the new economic transition can be considered to take the form of "gradual transition" choice, where the government prioritizes stability and promotes import-substituting industries to stimulate industrial sectors.

However, these reforms were not implemented completely. The unification of multiple exchange rates by allowing large devaluations of the national currency was needed to resolve difficulties of the national currency's convertibility to foreign currency in exchange markets. After adopting the Article VIII of the IMF in October 2003, Uzbekistan sped up the liberalization process of its foreign exchange market to fulfill its obligations to the IMF regulations. Central bank of Uzbekistan (CBU) has reduced many limitations to the foreign currency market that encouraged the demand for foreign currency operations in the illegal curb market. CBU has increased the supply of foreign currency on the official currency markets by participating more actively in the currency trades of the Republic's Currency Stock Exchange. Figure 1 shows that exchange rate fluctuations were moderate during the period between 2003-2008 years.

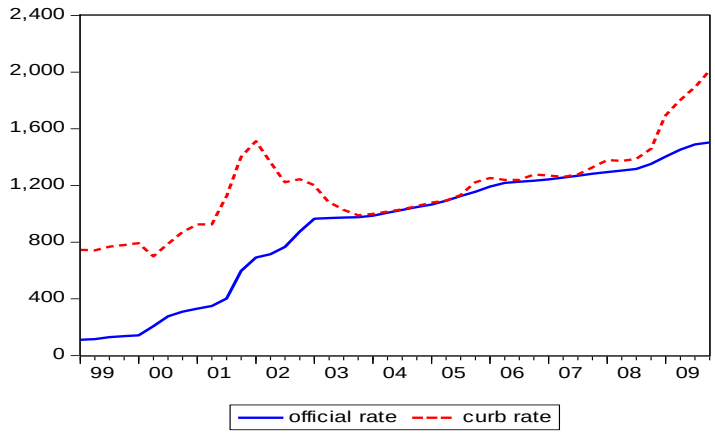

Figure 1: Exchange Rate Dynamics in Uzbekistan, 1999-2009

Note:"Official rate" is the official exchange rate, "curb rate" is the parallel (curb) market exchange rate, both are shown in nominal values of Uzbek sum perUSD. The horizontal axis represents a period from 1999 to 2009.

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The agricultural sector and energy resources remain as a main source of country's revenue generation in trade flows of the country. In the late 1990s, trade opportunities of Uzbekistan were affected by financial turmoil of Asian crisis of 1997-98. The country's export possibilities were diminished, even though the impact of Asian crisis was relatively smoothed due to conditions of the closed capital markets within the country, currency rationing policy in its foreign exchange system, and better trade connections with CIS countries.

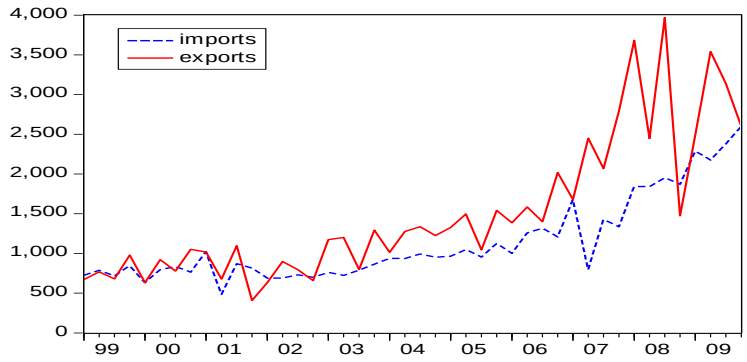

Figure 2: Exports and Imports of Uzbekistan, 1999-2009

Note:Vertical axis values are in million US dollars. The horizontal axis represents a period from 1999 to 2009.

In the recent years after the financial crisis of 2008, world prices started to raise to new historical high points in the markets for raw materials and commodities such as cotton, natural gas, gold, and other ferrous and non-ferrous metals. These favorable conditions helped Uzbekistan to enhance the growth of total exports and regain more trade surplus (Figure 2). Nonetheless, the trade increase with neighboring and other countries has also become volatile to the foreign exchange rate. In this analysis, it is assumed that Uzbekistan's economy is "small" relatively to the rest of the economies in the world. In this respect, terms of trade shocks and the impact of international trade flows will pass to the country with movements in exchange rates. In this regard, we investigate the impact of exchange rate volatility to trade flows of Uzbekistan to find out (1) whether exchange rate volatility has changed significantly after implementation of new system reforms in 2003, and (2) if volatility of real exchange rates has a negative or positive relationship with trade flows.

3. Literature Review

In spite of many empirical studies having been conducted on the subject, the relationship of exchange rate volatility to international trade is ambiguous. Several theoretical modeling studies on the impact of exchange rate volatility evidenced a negative relationship of exchange rate volatility on the levels of international trade. Calderon (2004) investigates the issue of trade openness in a sample containing 79 countries for the 1974-2003 period and concludes on that volatility of real exchange rates have less impact, if a country follows more open trade policies. Aidin (2010) investigates panel data for 182 countries from 1973 to 2008 and finds different dynamics in the impact of macroeconomic fundamentals on the equilibrium real exchange rate of sub-Saharan African economies compared with less advanced economies. Frankel and Wei (1993) observed negative effects of volatility and trade flows in the data constructed with selected Asian countries.

Arize et al. (2000) investigate real exchange rate volatility on the exports of 13 less developed countries with quarterly data series for the period 1973-1996 using Johansen's multivariate procedure for long-run and error correction model to analyze the short-run dynamics. Their study reveals a significant negative impact of volatility on export flows. Broda (2004) examines the panel data of 75 developing countries covering periods between 1973–1996 using the VAR model. He finds that there exists substantial impact of real shocks, such as shocks to terms of trade of a country, on real GDP in the short term. He also suggests that negative shocks lead to larger real exchange rate changes in countries with flexible exchange rate regimes. On the other hand, Wang and Barrett (2002) find no significant relationship between expected exchange rate volatility and trade volumes outside of the agricultural sector in their investigation of Taiwan's exports to the United States between 1989-1998.Aristotelous (2001) also reports an insignificant relationship between exchange rate volatility on the UK-US exports for the 1889-1999 period.

In addition, Qureshi and Tsangarides (2010) investigate on extended database with exchange rate classifications for the impact of fixed exchange rate regimes on bilateral trade, and they find that fixed exchange rate regimes increase trade indifferently to macro-policy announcements in the system or real actions in practice. Akbostanci (2004) examines the short-run and long-run behaviors of the trade balance and real exchange rate in a dynamic model using Turkish data. She suggests that, in the long run, a real depreciation of the Turkish lira improves the Turkish trade balance. Her findings are consistent with the long-run result of earlier study on Turkey by Brada et al. (1997).

Analyzing euro-area countries for exchange rate misalignments, Babecky et al (2010) finds a greater gap in real exchange rate misalignments with mostly pegged exchange rates systems and a closer gap to fundamental equilibrium points in countries with flexible exchange rates. Bailey, Tavlas and Ulan (1987) also observe volatility impact in both nominal and real exchange rates of quarterly data they studied of seven OECD and four other countries.

By summarizing the studies reviewed above, it can be concluded that high volatility in the exchange rate system may have substantial impact on trade and it may reduce foreign trade operations in the export and import operations of the country.

4. Trade Model

The main objective is to investigate the link between real exchange rate volatility and changes in trade flows of a country with abroad. In this respect, we will test the price elasticity functions to measure the responsiveness of export or import values to real exchange rate fluctuations.

A survey of enormous literature on the subject by McKenzie (1999) implies that using the standard model with adequate variables will be sufficient for analysis, in spite of some previous studies that have included in their trade functions a number of different explanatory variables. We follow Olimov and Sirajiddinov (2008) together with Sauer and Bohera (2001) to specify the following trade functions:

$$X = f(Y_{\text{foreign}}, P_x, TOT_x, Vol) \text{ and} \quad (1)$$

$$M = g(Y_{\text{domestic}}, P_m, TOT_m, Vol), \quad (2)$$

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where *X, M* are real aggregate exports and imports, respectively; $Y_{foreign}$ accounts for foreign income of trading countries, $Y_{domestic}$ is domestic income, P_x is relative price of exports *(proxied by the real exchange rate)*, P_m – relative price of imports *(proxied by the real exchange rate), TOT* is terms of trade, *Vol* is real exchange rate volatility.

Fundamental economic theory suggests that foreign income has a substantial impact on domestic exports, so that an increase in real foreign income ($Y_{foreign}$) will result to an increase in the demand for domestic exports. If relative export prices (P_x) fall, it will cause the domestic goods to be more attractive than foreign goods, therefore exports should increase. The effect of exchange rate volatility on exports is, however, ambiguous. De Grauwe (1988) suggests that risk-averse people may export more because of exchange rate uncertainty (volatility) and it may result in increasing overall trade. If traders are risk-neutral, they can feel that exports are less attractive with exchange rate uncertainty. They may decide to perform fewer export activities, and this will result in declining overall trade. So, the impact of exchange rate volatility on exports can be either positive or negative. On the other hand, exchange rate volatility will have a negative relationship on imports. Variables such as domestic activity ($Y_{domestic}$), import prices (P_m), which is proxied by the real exchange rate (RER), and volatility will also have a major impact on the import function.

To investigate this relationship in our model, trade functions in the simplified model will be changed to the following log–linear equation:

$$\log X_t = a_{10} + a_{11}\log rGDP_{t,foreign} + a_{12}\log RER_t + a_{13}Vol_t + \varepsilon_t, \quad (3)$$

$$\log M_t = a_{20} + a_{21}\log rGDP_{t,domestic} + a_{22}\log RER_t + a_{23}Vol_t + \varepsilon_t, \quad (4)$$

where $\log X_t$ is the logarithm of real exports, $\log M_t$ is the logarithm of real imports, $\log rGDP_{t,foreign}$ is the logarithm of real foreign income, $\log rGDP_{t,domestic}$ is the logarithm of real domestic income, $\log RER_t$ is the logarithm of real exchange rate, Vol_t is a measure of exchange rate volatility, and ε_t is a error term.

In the reviewed literature, theoretical studies determine that the volume or total amount of exports to a foreign country should increase as long as the real income of the trading partner rises. For this assumption, we expect $a_{11} > 0$. Total imports to a domestic country is related to the improvements of domestic economy or activities, hence we also expect $a_{21} > 0$. A rise of export prices or depreciation in the real exchange rate will cause the domestic goods to become more competitive than foreign goods, therefore exports will increase. So we expect $a_{12} > 0$. A rise of import prices or depreciation in the real exchange rate will make foreign goods more expensive, thus imports will fall. We expect $a_{22} < 0$. The impact of exchange rate volatility on exports and imports is not clearly defined and empirically investigated, that is why we expect a_{13} and a_{23} to be either positive or negative.

5. Data

This study uses data covering the period from the first quarter of 1999 year to the fourth quarter of 2009 (1999:Q1-2009:Q4). For the real foreign income variable, quarterly data is acquired from the International Financial Statistics website. Thus, real foreign income rGDPforeign is computed as the weighted figures of real values of gross domestic product

(GDP) for the largest trading countries of Uzbekistan, namely for Russia, Ukraine and Kazakhstan.

Real domestic income rGDPdomestic is quarterly real GDP figures for Uzbekistan. Exports and imports of Uzbekistan are quarterly figures expressed in their real value. CPIdomestic is the domestic consumer price index value, adjusted to the base year of 1999. Data on real exports (Xt), real imports (Mt), the domestic consumer price index values (CPI1999,domestic) and the domestic real GDP figures (rGDPdomestic) are obtained from the quarterly publications of Reports of the "Main Macroeconomic and Social Indicators of Uzbekistan" of the Statistics Committee of Uzbekistan. The foreign consumer price index values (CPI1999, foreign) are monthly data for CPI series: CUUR0000SA0 with adjustment for the base year of 1999.They are obtained from the website of Bureau of Labor Statistics, US Department of Labor.

Information regarding official exchange rates (eofficial) is obtained from the weekly data published on the website of Central bank of Uzbekistan and adjusted to quarterly values. Curb market exchange rates (ecurb) are monthly data with adjustment to quarterly periods, which are based on the author's own observations.

6. Empirical Analysis

Based on the theory of purchasing power parity (PPP), we estimate the real exchange rate with the following formula:

$$RER = e_{nominal} * (CPI_{1999,foreign} / CPI_{1999,domestic}),$$

where $e_{nominal}$ is the nominal exchange rate of the domestic currency. Following Ranaweera (2003), who finds significant results for the relationships of official and curb exchange rates to the foreign exchange market dynamics, we use a weighted average of the official and curb market exchange rates for the domestic nominal exchange rate, $e_{nominal} = 0.70*e_{official} + 0.3*e_{curb}$. $CPI_{1999,foreign}$ is the US consumer price index, $CPI_{1999,domestic}$ is the domestic consumer price index of Uzbekistan.

ARCH-type models include the time-varying conditional variance as a parameter generated from a time-series model of the conditional mean and variance of the growth rate. Therefore, they are very efficient in describing volatility clustering. As the real exchange rate volatility is not directly observable, different statistical measurement methods have been used in the literature to determine volatility. We follow Sauer and Bohara (2001) for the volatility estimation using the conditional variance of a first-order ARCH model with the real exchange rate. The equation takes the following form:

$$\log(RER_t) = \alpha_0 + \alpha_1 \log(RER_{t-1}) + u_t, \text{ whereas, } u_t \sim N(0, \boldsymbol{\delta_t}) \quad (5)$$

$$\text{Volatility, } \delta_t = \beta_0 + \beta_1 u^2_{t-1} \quad (6)$$

Estimating equation (6) gives the following result (standard errors are in parenthesis):

$$\text{Volatility, } \delta_t = 0.000197 + 1.412 * u^2_{t-1}$$

(0.0000575) (0.528)

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The result may be interpreted as a prediction of the current period's real exchange rate variance. This variance is measured as a weighted average of a long-term average (the constant term in equation 6) and the ARCH term. Thus, the predicted values of $\delta_t$provide us with a measure of the volatility of the *Uzbeksum's* exchange rate against the US dollar. A graphical representation of the volatility of the real exchange rate is presented in Figure 3.

Figure 3: Real Exchange Rate Volatility Measure, 1999-2009

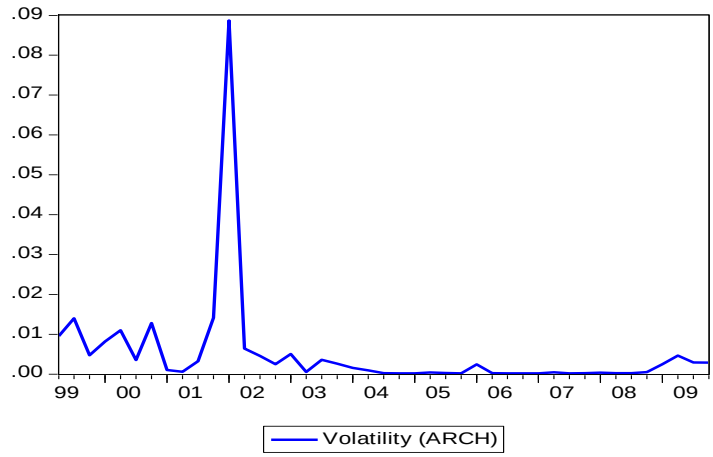

Figure 3: Real Exchange Rate Volatility Measure, 1999-2009

Note:"Volatility" is a trend graph of conditional variance of ARCH, calculated as real exchange rate volatility. Vertical axis is nominal values for volatility measure, and the horizontal axis represents quarterly time intervals for the given period.

Since the analyzed variables are considered as time series variables, this data could change over time and may not have stationary means. The existence of nonstationarity in the data may compromise standard tests used in the final regression, and therefore, it may lead to inaccurate conclusions. To avoid this miscalculation, in the first step, we will examine the property of stationarity in the individual explanatory series by using the augmented Dickey–Fuller (ADF) unit roots test procedure. The results of the ADF unit roots tests (Table 1) show that all variables, except volatility, are nonstationary at their level and we get stationarity after the first difference. Engle and Granger (1991) state that including a stationary variable in the co-integration relationship should *not* affect the other remaining coefficients, if this stationary variable is *not* the dependent variable. Including such a variable should also *not* affect the critical values of the t-statistics.

Table 1 Augmented Dickey-Fuller Statistics for Unit Root Testing

Variable	Levels / First Differences	Test Statistic	Critical Value (at 5% level)
Export, lnexp	Level	-0.3898	-2.9350
	First Diff.	-8.1890*	-2.9350
Import, lnimp	Level	0.4747	-2.9332
	First Diff.	-14.7419*	-2.9332
Foreign GDP, lngdpf	Level	-0.3394	-2.9411
	First Diff.	-3.8275*	-2.9411
Domestic GDP, lngdpd	Level	-1.2816	-2.9411
	First Diff.	-1.3607	-2.9411
Real exchange rate, lnrer	Level	-2.8034	-2.9369
	First Diff.	-2.4260	-2.9369
Volatilityδ, Vol	Level	-5.3124*	-2.9350

Note:* indicates statistical significance at 10% level.

After obtaining the unit-root properties of the variables, we proceed to establish whether there is a long-run equilibrium relationship among the variables of the trade functions. Johansen cointegration test indicates the presence or absence of stable long-term relationships among all test variables. Given the cointegration test results in the following sections, we reject the null hypothesis, which states that "there is no cointegrating equation."

Table 3 Johansen's Cointegration Test for Export Function

Number of Valid Cointegrating Vectors	Max Eigenvalue	Trace
None*	0.5833	66.8152
1	0.3917	32.6743
2	0.1824	13.2852

Notes: * denotes rejection at 5% critical level.

The results of Johansen cointegration test for the export equation are reported in Table 2.The cointegration test shows that the maximum Eigen-value trace statistics reject the null hypothesis of no-cointegration vector at the 5% significance level. The conclusion is that there exist a stationary long-run relationship among series of *X, rGDP*$_{\text{foreign}}$*, RER,* and *Vol*. The parameters of the cointegrating vector, which represents the long-run real export demand equation (3) for the long-run relationship among variables, are obtained by normalizing the estimates of the unconstrained cointegrating vector (standard errors are in parenthesis):

$$\text{Exports, } X_t = -10.068 + 0.571 \log rGDP_{foreign} + 1.946 \log RER - 64.577 Vol$$
$$(4.078) \qquad (0.592) \qquad (0.853) \qquad (30.551)$$

The estimated equation shows that the coefficients of real foreign income and the real exchange rate are positive and sign of the coefficient on the real exchange rate volatility is negative, and they are statistically significant. This implies that increases in real foreign income and the real exchange rate positively affect export demand consistent with our model in the conditions of a long-run relationship. On the other hand, volatility measure hasa negative impact on exports.

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Table 3 Johansen's Cointegration Test for Import Function

Number of Valid Cointegrating Vectors	Max Eigenvalue	Trace
None*	0.7270	113.3531
1	0.6165	61.4282
2	0.3400	23.0905

Notes: * denotes rejection at 5% critical level.

Table 3 presents the cointegration test results for the import equation. The maximum Eigen-value trace statistics reject the null hypothesis of no-cointegration vector (r=0) at the 5% significance level for the long-run relationship of the import equation (4). Normalized estimates of unconstrained cointegrating vector are as follows (standard errors are in parenthesis):

$$\text{Imports, } M_t = 6.688 + 0.865 \log rGDP_{domestic} - 0.985 \log RER - 16.908 Vol$$

$$(0.712) \qquad (0.105) \qquad (0.203) \qquad (3.435)$$

The estimated equation shows that the coefficient on the real domestic income is positive, but coefficients for the real exchange rate and volatility are negatively related to the import function. We can observe that increasing of domestic income positively affects import demand, but depreciation of the real exchange rate and its volatility has adverse impacts in the long-run dynamics of the import equation consistent with the previous findings. It implies that more floating of exchange rates after market reforms had less impact on the direction of volatility movements.

7. Conclusion

This study estimated the impact of real exchange rate volatility on aggregate exports and imports of Uzbekistan with the Johansen cointegration test framework, using quarterly data for periods from 1999 to 2009. The results of the cointegration analysis show that there exists a long-run relationship among the variables of the real exports and imports demand functions. The results of the long-run parameter estimates are consistent with the economic model and theory. An increase in the real foreign and domestic income has a significant and positive impact on trade flows. Increasing in the real exchange rate will lead to depreciation of domestic currency; thus, it was found to encourage exports, while it was found to adversely affect imports demand. An increase in exchange rate volatility was also found to adversely affect demands for both exports and imports.

In addition, we observe that liberalization and economic reform policies implemented between the years 2001-2003 were found to have later contributed significantly to increasing trade flows of Uzbekistan, which was inferred on the basis of forecasted estimates of trade openness policy in a previous study[4]. Empirical results suggest that export and import activities can be improved further, if the following are utilized: (1) macroeconomic policies, which aim to keep a stable competitive real exchange rate, and (2) reasonable policies that avoid overvaluation of the real exchange rate to decrease volatility. Therefore, policymakers should establish coherent policies that lead to a transparent exchange rate system, under which the stability of the real exchange rate will be achieved and maintained to boost the country's overall trade and economic growth strategy.

[4]Olimov and Sirajiddinov (2008)

References

Akbostanci, E. 2004. Dynamics of the Trade Balance: The Turkish J-Curve. *Emerging Markets Finance and Trade*, 40:5, 57-73.

Appleyard, D.R., Field, A., Cobb, S. 2010. *International Economics*, 7th Ed., McGraw-Hill/Irwin, New York

Aristotelous, K., 2001. Exchange Rate Volatility, Exchange Rate Regime, and Trade Volume: Evidence from the UK-US Export Function (1889–1999). *Economic Letters*, 72, 87-94.

Arize, A.C., Osang, T., Slottje, D. 2000. Exchange-Rate Volatility and Foreign Trade: Evidence from Thirteen LDC's. *Journal of Business & Economic Statistics*, 18:1, 10-17.

Aydin, B. 2010. *Exchange Rate Assessment for Sub-Saharan Economies*. IMF, Working Paper 10:162. http://www.imf.org/external/pubs/ft/wp/2010/wp10162.pdf [09/09/2011].

Babecky, J., Bulir, A., Smidkova, K. 2010. *Sustainable Real Exchange Rates in the New EU Member States: What did the Great Recession Change?* IMF, Working Paper 10:198. http://www.imf.org/external/pubs/ft/wp/2010/wp10198.pdf [09/09/2011].

Bailey, M. J., Tavlas, G.,S. Ulan, M. 1987. The Impact of Exchange-Rate Volatility on Export Growth: Some Theoretical Considerations and Empirical Results. *Journal of Policy Modeling* 9, 225-43.

Brada, J.C., Kutan, A.M., Zhou, S. 1997. The Exchange Rate and the Balance of Trade: The Turkish Experience. *Journal of Development Studies* 33:5, 675–692.

Bureau of Labor Statistics, USA http://www.bls.gov/cpi, last accessed on 04.04.2011.

Broda, C. 2004. Terms of Trade and Exchange Rate Regimes in Developing Countries. *Journal of International Economics* 63:1. 31-58.

Calderon, C. 2004. *Trade Openness and Real Exchange Rate Volatility: Panel Data Evidence.* Central Bank of Chile. Working paper 294.

Central Bank of Uzbekistan, http://www.cbu.uz, [04.04.2011].

Chowdhury, A. R. 1993. Does Exchange Rate Volatility Depress Trade Flows? Evidence from error-correction models. *The Review of Economics and Statistics* 75:4, 700-706.

Cushman, D. O. 1986. Has Exchange Risk Depressed International Trade: The impact of third country exchange risk. *Journal of International Money and Finance* 5, 361-79.

De Grauwe, P. 1988. *Exchange Rate Variability and the Slowdown in Growth of International Trade.* IMF Working Papers 35, 65–84. Washington.

Doyle, E. 2001. Exchange Rate Volatility and Irish-UK Trade, 1979–1992. *Applied Economics* 33, 249-265.

 ISSN 1927-033X

Engle, R.F., et al., 1991. *Long-Run Economic Relationships: Readings in Cointegration.* Oxford University Press. New York.

Feenstra, R. C., Kendall, J. D. 1991. *Exchange Rate Volatility and International Prices*. National Bureau of Economic Research, NBER Working Paper No. 3644. Cambridge, MA http://www.nber.org/papers/w3644 [25/12/2011].

Frankel, J. A., Wei, S. J. 1993. *Trade Blocs and Currency Blocs*. National Bureau of Economic Research, NBER Working Paper No. 4335. Cambridge, MA.

International Financial Statistics, http://www.imfstatistics.org, last accessed on 04.04.2011.

International Monetary Fund, Direction of Trade Statistics dataset, last accessed on April4, 2011

Koray, F. Lastrapes, W. D. 1989. Real Exchange Rate Volatility and U.S. Bilateral Trade: A Var Approach. *The Review of Economics and Statistics* 71:4, 708-712.

McKenzie, M. 1999. The Impact of Exchange Rate Volatility on International Trade Flows. *Journal of Economic Surveys* 13:1, 71-106.

McKenzie, M., Brooks, R. 1997. The Impact of Exchange Rate Volatility on German Trade Flows. *Journal of International Financial Markets, Institutions and Money* 7, 73-87.

Olimov, U., Sirajiddinov, N. 2008. *The Effects of the Real Exchange Rate Volatility and Misalignments on Foreign Trade Flows in Uzbekistan*. Economics Discussion Papers, No 2008-29. http://www.economics-ejournal.org/economics/discussionpapers/2008-29 [13/12/201].

Pastor, G., Damjanovic, T. 2003. The Russian Financial Crisis and Its Consequences for Central Asia. *Emerging Markets Finance and Trade* 39:3, 79-104.

Peree, E., Steinherr, A. 1989. Exchange Rate Uncertainty and Foreign Trade. *European Economic Review* 33, 1241-64.

Qian, Y., Varangis, P. 1994. Does Exchange Rate Volatility Hinder Export Growth: Additional Evidence. *Empirical Economics* 19: 3, 371-396.

Qureshi, M. S., Tsangarides, C. 2010. *The Empirics of Exchange Rate Regimes and Trade: Words vs. Deeds*. IMF Working Paper 10/48. http://www.imf.org/external/pubs/ft/wp/2010/wp1048.pdf [11/010/2011]

Sauer, C., Bohara, A. 2001. Exchange Rate Volatility and Exports: Regional Differences between Developing and Industrialized Countries. *Review of International Economics*, 9:1, 133-152.

Statistics Committee of Uzbekistan, http://www.stat.uz, [04.04.2011].

Wang, K-Li., Barrett, C. 2002. A New Look at the Trade Volume Effects of Real Exchange Rate Risk.). Cornell University Applied Economics Management Working Paper No. 2002-41. http://ssrn.com/abstract=430422 or doi:10.2139/ssrn.430422 [05/11/2011].

Appendix

Table A1 Variables Used in Analysis

Variable	Test Statistics
LNEXP	Log of exports for Uzbekistan, State Statistics Committee of Uzbekistan, http://stat.uz/publications/
LNIMP	Log of imports for Uzbekistan, State Statistics Committee of Uzbekistan, http://stat.uz/publications/
LNGDPD	Log of real gross domestic product for domestic income of Uzbekistan, State Statistics Committee of Uzbekistan, http://stat.uz/publications/
LNGDPF	Log of real gross domestic product for foreign income, computed as a weight of three trading partners of Uzbekistan: 75%Russia + 25%Ukraine + 25%Kazakstan = foreign income, *International Financial Statistics*, http://www.imfstatistics.org/imf/
LNNOM	Nominal weighted exchange rate of Uzbekistan, lnnom=0.7*lnoffr+0.3*lncurbr
LNCPID	Log of consumer price index for Uzbekistan, State Statistics Committee of Uzbekistan, http://stat.uz/publications/
LNCPIF	Log of consumer price index for USA, Bureau of Labor Statistics, USA http://www.bls.gov/cpi
LNRER	Calculated as lnrer=lnnom+lncpif - lncpid
LNOFFR	Log of official exchange rate for Uzbekistan, Central bank of Uzbekistan, http://www.cbu.uz
LNCURBR	Log of curb (parallel) market exchange rate
VOL	Nominal value for volatility measure, computed from the ARCH model

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