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EXCHANGE RATE PASS-THROUGH INTO IMPORT PRICES: EVIDENCE FROM CENTRAL ASIA

Gulnara Moldasheva

KIMEP University/Bang College of Business

mgulnara@kimep.kz

-Abstract-

This paper estimates the degree of exchange rate pass-through (ERPT) into import prices for Central Asia countries over period 1995q11-2012q11 years. The additional study was done for Kazakhstan to determine the impact of money regulating policy into short-run and long-run ERPT. The study of ERPT was done by employing cointegration analysis across five central Asia countries: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan. The paper analyzes three opportunities of the transmission of the export cost into ERPT using production price indices (PPI) of three major trading partners of Central Asia countries: PPI of Russia, PPI of Turkey and PPI of China. In case with PPI of Russia the results showed, that ERPT is extended beyond of 1 for Kazakhstan and Kyrgyzstan. Incomplete ERPT is indicated for Tajikistan and Turkmenistan, and zero ERPT is indicated for Uzbekistan. In case with PPI of Turkey, the elasticities of extent ERPT into import prices are more higher then in case with PPI of Russia, and elasticities for all Central Asia countries are negative and significant. In case with PPI of China, incomplete ERPT is indicated for all Central Asia countries, except the Kyrgyzstan, which has extended ERPT. In all cases this study showed the significance of ERPT, except only two cases for Kazakhstan and Tajikistan with PPI of China. Also interesting, those elasticities of ERPT with PPI of China are lower comparing with other cases. In the special study of money regulation policy only for Kazakhstan the short-run and long-run elasticities of ERPT are incomplete with PPI of Russia and PPI of Turkey, and they are extended with PPI of China.

Key Words: Exchange Rate Pass Trough, import prices, inflation

JEL Classification: E31, F31, G15

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1. Introduction

According to the theory, exchange rate pass through (ERPT) measures the percentage change in domestic prices of goods resulting from one percentage change in the exchange rate. If 1 percentage change in exchange rate results in 1 percentage change in domestic goods prices, then pass through is 100% or a complete pass through. Less than one-to-one change in domestic price compared to exchange rate is an incomplete or partial pass through. A complete exchange rate pass through indicates that PPP holds, i.e. that the prices of tradable goods when expressed in the same currency are same across countries. Many empirical studies have focused on understating the degree of these pass through and came to the conclusion that complete pass through never occurs, though incomplete pass though occurs with varying degree – thus refuting the purchasing parity hypothesis. More recently, the empirical analysis on exchange rate transmission broadly relates the pass-through estimates to the efficiency of monetary policy, stability of economic environment, optimization of exchange rate regime and inflation performance. Based on previous researches' studies, this paper examines both ERPT into import prices and estimates whether pass-through rates are endogenous to inflation performance for the economy of Central Asia countries. The primary objective of this paper is to estimate the degree of ERPT across Central Asia countries. From the countries perspectives we provided the cointegration analysis of ERPT in the short run and in the long run using the quarterly data from 1995 to 2012. A widely known hypothesis posed by John Taylor (2000) is that the degree of pass-through is determined by inflation performance, a country with relatively lower and more stable inflation rate experiences relatively lower pass-through elasticity. We analyzed three opportunities of the transmission of export cost into ERPT using production price indices (PPI) of three major trading partners of Central Asia countries: PPI of Russia, PPI of Turkey and PPI of China. In case with PPI of Russia the results showed, that ERPT is extended beyond of 1 for Kazakhstan and Kyrgyzstan. Incomplete ERPT is indicated for Tajikistan and Turkmenistan, and zero ERPT is indicated for Uzbekistan, or no ERPT into import prices is indicated for Uzbekistan. This result is new, since ERPT was not studied in the literature for Tajikistan, Turkmenistan and Uzbekistan due to lack of information even in international and local data bases. In case with PPI of Turkey the elasticities of extent ERPT into import prices are higher then those with PPI of Russia , and elasticities for all Central Asia countries are negative and significant. The

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negative elasticities can be explained by decreasing demand for Turkish goods, reflecting to decrease of prices for Turkish goods, and therefore, to negative transmission onto ERPT. In case with PPI of China, incomplete ERPT was indicated for all Central Asia countries, except the Kyrgyzstan, which has extended ERPT. Concerning the statistical significance of ERPT, in all cases we had significant ERPT, except only two cases for Kazakhstan and Tajikistan with PPI of China. Also interesting, those elasticities of ERPT with PPI of China are lower comparing with other cases.
Special cointegration analysis and dynamic OLS was done for ERPT of Kazakhstan in short run and in long-run reflecting the impact of money regulating policy into ERPT. The short-run and long-run elasticities of ERPT showed that ERPT is incomplete with PPI of Russia and PPI if Turkey, and is extended in case with PPI of China. The long-run elasticity of ERPT with PPI of China is almost complete and close to 1.
The paper is organized by next stricture: in section 2 we present the literature review, in section 3 we present our econometric model, in section 4 we present the data description and methodology, in section 5 we show our empirical results of the cointegaration analysis of ERPT elasticities, and in section 6 we present our conclusions.

2. The Literature Review

The phrase "pass-through" was first used in economics literature by Steve Magee (1973) in explaining the impact of currency depreciation. Since then the concept has been widely used in the literature. Dourbusch (1987) has considered the Dixit-Stiglitz' (1977) and the Salop' (1979) model of competition to confine the effects of imperfect substitutability and product differentiation on price response to the changes in the exchange rates. He concluded that the degree of pass-through is directly related to the degree of substitution between the imported goods and domestic produced goods. Next concern relates to the presence of foreign firms in the domestic market in an open economy, which also affects the degree of pass-through .The existence of foreign firms in the domestic market leads to the role of multinational corporations (MNC) and intra-firm trade in influencing the degree of pass-through. The intra-corporate exchange rate may deviate significantly from the pass-trough for a long period, as this is used as a clearing mechanism for intra-firm trade. Shapiro (2003) showed that the MNCs use this sort of pricing mechanism to optimize profit in their global operations. According to the

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theory of absolute purchasing power parity, the price levels should be equal worldwide when expressed in a common currency. Relative purchasing power parity is the extension of absolute purchasing power parity, which uses nominal exchange rate to adjust the difference of inflationary level among the countries and maintain law of one price worldwide. Krugman (1987) and Dornbusch (1987) suggested that one motivation for deviations from law of one price is pricing-to-market. Feenstra and Kendall (1997) also found the empirical evidences that pricing-to-market contributes the big portion of incomplete pass-through and deviation from law of one price. Devereux and Engel (1998) and Devereux and Yetman (2008) investigated the optimal choice of the exchange rate regime and it's relation to currency price setting. They found that when prices are set in local currency (LCP), adopting floating exchange rate is always better than fixed exchange rate because it makes the variance of domestic consumption is not influenced by foreign monetary shocks. When prices are set in producer currency (PCP), there is a tradeoff between floating exchange rate and fixed exchange rate. Under this circumstance, floating exchange rate allows for lower variance of consumption. Campa and Goldberg (2002) studied the exchange rate pass-through into import prices of 25 OECD countries. They found that there is empirical evidence of incomplete exchange rate pass-through in the short run rejecting both PCP and LCP. Over the long run, the degrees of pass-through are closer to one, so PCP is more prevalent for many types of imported goods. These results are consistent also with the result of Campa, Goldberg, and Gonzalz-Minguez (2005). Devereux, Engel and Storgaard (2004) argued that the degree of pass-through is related to stability of monetary policy. Countries with low volatility of money growth will have relatively low rates of exchange rate pass-through, while countries with relatively high volatility of money growth will have relatively high pass-through rate. Frankel, Parsley and Wei (2005), Mumtaz, Oomen and Wang (2005), Ihrig, Marazzi and Rothenberg (2006) found empirical support that developing countries experienced a rapid downward trend in recent years in the degree of short run pass-through, and in the adjustment speed. Stulz (2006) , Korhonen and Wachtel (2005) studied pass-through of exchange rate and import price using VAR framework instead of traditional OLS or ECM model to estimate elasticity of exchange rate pass-through. The degree of pass-through under their framework is estimated by means of impulse response function from VAR model that is highly depending on the specification of the empirical model. Eike (2011) and Boug, Cappelen

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and Erika (2012) found that magnitude of pass-through at all stages has decreased during 1990s by using sub-sample analysis. Ghosh and Rajan (2008) examined the extent and evolution of exchange rate pass-through (ERPT) into Korea's and Thailand's import prices at the aggregate level for the period over the last two decades. They found that ERPT appears to be consistently higher for Thailand compared to Korea; while for both nations ERPT of their respective bilateral rates with respect to the US dollar is higher than with respect to the Japanese yen. Bhattacharya, Karayalcin and Thomakos (2004) explored the extent of exchange rate pass-through for the USA, UK and Japan using a post-Bretton Woods industry-level dataset. Their results were suggestive of two channels of transmission and they found considerable variation in the extent of pass-through across industries and countries.
From presented literature review, it can be concluded that the incomplete ERPT into import prices is prevalent in the short run; while the pass-through elasticity is higher and close to one over the long run. Moreover, there is strong statistical evidence that the downward trend of pass-through exists in many countries and industries through past decades although the explanation of this phenomenon is till controversial. However, most of these studies only focus on cross country analysis of large and developed economies. This paper investigates the degree of ERPT into import prices in Central Asia countries considering them as small open economies with the emerging markets.

3. The Model.

We examined ERPT into the aggregate import prices of Central Asia countries with regard to their bilateral nominal exchange rate with the US dollar (USD), using the estimating equation in our empirical specification for the exchange rates:

$$(1) \qquad \ln(P^{imp})_t = \beta_0 + \beta_1 \ln(S)_t + \beta_2 \ln(GDP)_t + \beta_3 \ln(MS)_t + \beta_4 \ln(PPI_{country})_t + \varepsilon_t$$

Here S denotes the nominal exchange rate for each nation. A rise in S denotes a depreciation of the currency. PPI $_{country}$ denotes the producer price index (PPI) either of the Russia, Turkey or China, respectively. We take these countries as main trader partners of five CA countries in almost balk values of trade. Money supply (MS) variable was introduced in the equation as a proxy for money regulation policy trough exchange rate. If $\beta_1 = 0$, there is no ERPT into import prices, while if $\beta_1 = 1$ there is complete ERPT. If the coefficient lies anywhere in between 0 and 1 there is partial or incomplete ERPT. In

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estimating equation (1) we controlled for possible shifts in domestic demand and costs changes in the exporting nations. A rise in income implies an increase in demand for imported goods, thereby raising the import price. Thus β_1 are generally expected to be positive. However, a rise in output could also imply less demand for imported goods and a decline in the import prices. So it is plausible that β_1 might be negative as well.

4. Data and Methodology

4.1 Description of the Data

The data for imported prices, nominal exchange rates, gross domestic product, money supply and production price index were used in this study from ADB, NB of RK, IFS, IMF and WB data bases on Quarterly base from 1995Q1 to 2012Q3. Except for Kazakhstan, if data on money supply were not available for other CA countries, then this variable was excluded from the analysis. We used import prices (P^{imp}) to measure the price level for import goods in domestic market and use the aggregated production price index (PPI) to measure exporter's costs. As an exchange rate variable, we used nominal exchange rate vise a vise to USD. The nominal GDP in USD for all central

Table 1. Testing for Integration Order

countries was used as a control variable to influence pass-through elasticity.

4.2 Methodology

Since all variables have time series properties, Augmented Dickey-Fuller Test (ADF) and Phillips-Perron (PP) tests were applied to test the existence of unit root. For example, the results only for import prices are reported in Table 1. The results of testing of unit root for GDP, nominal ER, and three PPIs are available upon request from the author. Both tests failed to reject the null hypothesis of unit root in the variables in their level form, suggesting that they are stationary in their first differenced form. Given that, the variables are I (1).

Variable	**ADF**		**PP**	
Import prices (lpimp=log(Prices of import)	Level	First Difference	Level	First Difference
Kazakhstan	-1.482834	-10.01191	-1.331394	-10.65029*
Kyrgystan	0.427775	-8.893749*	0.948431	-8.911089*

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Tadjikistan	-1.413525	-7.438374*	-2.875206	-10.55357*
Turkmenistan	-0.559605	-13.23901*	-0.8011140	-13.70291*
Uzbekistan	-0.175182	-13.56740*	-0.385742	-13.89712*
* Significance at the 5% level				

Next, we performed cointegration analysis among the variables in equation (1) using the methodology developed by Engle-Granger (E-G) and Phillip-Ouliaris (P-Q) (1990). Cointegration analysis was done four each of five countries

separately, and the results of only with PPI of Russia are presented in Table 2. To obtain the long-run exchange rate pass-through elasticities, we used a recent methodology developed by Stock and Watson (1993). The dynamic OLS (DOLS) procedure involves the regressing any variable with the regressors itself but also the leads and lags of the first differences of the regressors.

Table 2. Testing for Cointegration with PPI of Russia

	Kazakhstan		Kyrgyzstan		Tajikistan		Turkmenistan		Uzbekistan	
β_0	-0.304 (0.482)		-0.390 (0.366)		-1.705 (0.561)		0.186 (0.078)		-0.049 (0.163)	
β_1	1.279 (0.209)		-1.168 (0.400)		-0.589 (0.244)		-0.283 (0.046)		0.000 (0.00)	
β_2	0.734 (0.285)		-0.537 (0.195)		-0.100 (0.219)		-0.055 (0.047)		1.083 (0.123)	
β_3	0.984 (0.156)		1.299 (0.166)		0.983 (0.312)		0.768 (0.086)		-0.410741 (0.095)	
t(β0=0)	-0.630		-1.063		-3.038*		2.374*		-0.301*	
t(β1=0)	-6.103*		-2.917*		-2.407		-6.092*		5.244*	
t(β2=0)	2.574*		-2.749*		-0.456		-1.163		8.791*	
t(β3=0)	6.302*		7.821*		3.146*		8.911*		-4.310*	
	E-G	P-Q	E-G	P-Q	E-G	P-Q	E-G	P-Q	E-G	P-Q
$\hat{Z}_t$	-4.00	-3.955	-1.874	-2.252	-2.183	-4.55**	-5.40**	-5.42**	-4.21**	-4.309**
$\hat{Z}_\alpha$	-29.35**	-28.50**	-11.37	-14.95	-16.29	-33.73**	-38.59**	-39.08**	-29.93**	-31.651**

* Significant at the 5% level, **MacKinnon (1996) one-sided p-values

The empirical estimation of (1) for the long-run ERPT is given by equation (2).

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The results, referred only for Kazakhstan with one period leads and lags of the regressors, are presented in section 5.

$$\ln(P^{imp})_t = B'X_t + \sum_{k=-1}^{k=+1}\eta_k \Delta\ln(S)_{t-k} + \sum_{k=-1}^{k=+1}\lambda_k \Delta\ln(GDP)_{t-k} + \sum_{k=-1}^{k=+1}\gamma_k \Delta\ln(PPI)_{t-k} + \zeta_t \quad \textbf{(2)}$$

where

$$B = [\beta_0, \beta_1, \beta_2, \beta_3]', X = [1, \ln(S_t), \ln(GDP_t), \ln(PPI_t)]$$

5. Empirical Results: Exchange rate pass trough into import prices

We tested the cointagration regression (3) for all five countries with three PPIs: PPI of Russia, PPI of Turkey and PPI of China. The results are shown in sections 5.1.

$$\ln(P^{imp})_t = \beta_0 + \beta_1 \ln(S)_t + \beta_2 \ln(GDP)_t + \beta_3 \ln(PPI_{country})_t + \varepsilon_t \quad (3)$$

In all cases, including the PPI of Turkey and China, the H_o of no cointegration was rejected, and therefore, import prices have long- run relationship with the underlined explained the ERPT variables except only one case with PPI of China for Kyrgyzstan. The summarizing elasticizes of exchange rate pass trough into import prices are shown in Table 3. With PPI of Russia the ERPT is extended beyond of 1 for Kazakhstan and Kyrgyzstan. The extent of ERPT in these countries can be explained by very tough integration in economy with Russia. Negative sign for ERPT in Kyrgyzstan might be explained by lower demand for imported goods from Russia because of increasing national output, and therefore the decline in import prices. Incomplete ERPT is indicated for Tajikistan and Turkmenistan, and zero ERPT is for Uzbekistan. This result is also consistent for Uzbekistan, since this country, from all of CA, is more close

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Table 3. Elasticity of ERPT into import prices

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
with PPI of Russia					
Elasticity of ERPT (β1)	1.279*	-1.168*	-0.589*	-0.283*	0.000*
Elasticity of PPI (β3)	0.984*	1.299*	0.983*	0.768*	-0.410*
with PPI of turkey					
Elasticity of ERPT (β1)	-4.550*	-3.611*	-0.569*	-0.174*	0.000*
Elasticity of PPI(β3)	0.684*	1.191*	0.894*	0.438*	-0.317*
with PPI of China					
Elasticity of ERPT (β1)	-0.286	1.884*	0.408	0.265*	0.000
Elasticity of PPI(β3)	1.826	8.427*	4.202	2.591	4.069*
*) significance at 5%					

to international trade due to specific government restrictions in trade policy. With PPI of Turkey we have negative signs, except for Uzbekistan, where ERPT is almost zero. Comparing with case of PPI of Russia, the increasing values of ERPT rate for Kazakhstan and Kyrgyzstan might be explained by greater influence of demand for Turkish goods, than for Russian goods. But elasticities of PPI, comparing with PPI Russia, were declined. With PPI of China, only for Kyrgyzstan and Turkmenistan the elasticities of ERPT are significant, and they were not increased, even the PPI elasticities became much higher than in previous cases with PPI of Russia and PPI of Turkey.

Special cointgartion analysis of equations (1) was done using money supply reflection for Kazakhstan with three PPIs. In all cases the H_o of no cointegration was rejected, and, therefore, import prices have long-run relationship with underlined explained the ERPT variables. The summarized elasticities of exchange rate pass trough into import prices are shown in Table 4. As we can see from Table 4, the incomplete ERPT Kazakhstan has with Russia and Turkey's PPI, but coefficients are insignificant. Complete and significant ERPT Kazakhstan has with China PPI. Money supply is positively related to imported prices, and with PPI of China almost 100% transferred to ERPT. As shown in Table 4, elasticity of PPI of China, export costs of China

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four times transferred into ERPT of Kazakhstan trough import prices. Since we have complete ERPT with PPI China, finally, we run the Dynamic Ordinary Least Squares (DOLS) for the cointegrated regression (2), including one lag and one lead into equation (2) . These results of summarized elasticities are shown in last column of Table 4.

Table 4. Elasticity of ERPT into import prices of Kazakhstan in short-run and in long-run

	PPI of Russia	PPI of Turkey	PPI of China	
			Short-run	Long-run
Elasticity of ERPT (β_1)	-0.316840	-0.299552	1.044731*	0.989289
Elasticity of MS(β_3)	0.535023*	0.667675*	1.042301*	1.042301*
Elasticity of PPI (β_4)	0.486965*	0.309089*	4.430528*	4.430528*

*) significance at 5%

6. Conclusion

This paper estimated the degree of ERPT across CA. Were analyzed three opportunities of the transmission of export cost into ERPT, using PPI of three major trading partners of CA: Russia, Turkey, and China. The results showed that ERPT with PPI of Russia is extended beyond of 1 for Kazakhstan and Kyrgyzstan. Incomplete ERPT was indicated for Tajikistan and Turkmenistan, and zero ERPT was indicated for Uzbekistan. The elasticities of extent ERPT into import prices with PPI of Turkey are higher then those with PPI of Russia and these elasticities are negative and significant. This can be explained by decreasing demand for Turkish goods, reflecting to decrease of prices for Turkish goods, and therefore, to negative transmission onto ERPT. Incomplete ERPT with PPI of China, were indicated for all CA, except the Kyrgyzstan, which has extended ERPT. All cases showed the significant ERPT, except only two cases for Kazakhstan and Tajikistan with PPI of China. Also interesting, those elasticities of ERPT with PPI of China are lower comparing with other cases. Short-run and long-run elasticities of ERPT with the reflection of money supply for Kazakhstan showed that ERPT is incomplete with PPI of Russia and PPI of Turkey, and is extent in case with PPI of China. The long-run elasticity of ERPT in case with PPI of China is almost complete.

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