REAL EXCHANGE RATES DETERMINATION: PURCHASING POWER PARITY (PPP) AND BALASSA-SAMUELSON HYPOTHESIS

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ABSTRACT

The Balassa and Samuelson hypothesis -- BS -- (Balassa, 1964, Samuelson, 1964), which natural point of departure is the Salter-Swan (dependent economy) model is analysed. It offers general theoretical justification of the long run trends in real exchange rates in relation to productivities and prices. This is to say, that taking into consideration the important real world feature of having both tradable and non-tradable goods BS states that if a given country's productivity in producing tradable goods compared to its productivity in making non-tradable goods and services rises more rapidly than in a (certain) foreign country, then the home country real exchange rate will experience appreciation. Thus if productivity of factors of production grows faster in the home country tradable sector, then relative price in the non-tradable sector should rise. Furthermore, we provide supporting illustrative evidence by empirically assessing the BS effect for Azerbaijan.

Keywords: Balassa-Samuelson hypothesis, Salter-Swan Model, PPP, Dutch disease.

DOI: http://dx.doi.org/10.15549/jeecar.v4i1.147

INTRODUCTION

The PPP was the simple, apparently easy to figure out and easier to spread idea articulated by the Swedish economist Gustav Cassel (fundamentally developed by David Ricardo). The modern form of the PPP appeared just on time, when it was needed; after the world currencies were debased from gold (following the World War I) a mechanism was needed to determine their (previously gold content based) exchange rates. The suggested straightforward definition would sound like this: the exchange rate between two currencies is determined by the ratio of their purchasing powers (command over goods and services) in their respective country. "I propose to call this parity "the purchasing power parity". As long as anything like free movement of merchandise and a somewhat comprehensive trade between two countries take place, the actual rate of exchange cannot deviate very much from this purchasing power parity (Cassel, 1918)."

Three corollary points to be made: i) PPP imply convergence between market rates of exchange (MER) and PPPs; who converges to whom? This question should be treated very carefully. While it is easy to reply that the market rate of exchange should be moving towards the "equilibrium" (PPP) exchange rate, this would confuse the names and the substances of these concepts. In fact the PPP is time-varying; hence adjustment towards "equilibrium" can be attained by changes in MER, PPP or mutually; ii) PPP depends on the law of one price, which derive from expected work of market forces driven by arbitrage, i.e., if the PPP and MER are too far from each other there would exist a profit opportunity, which will be covered by international trade; and, iii) Cassel's PPP hypothesis and the widely used technical conversion factors – PPPs – for comparative analysis among countries are different concepts. The former is a theoretical paradigm and the latter is statistical index providing a general basis for comparison of the strength of two monetary units in common currency.

However, empirically the evidence fails to sustain the PPP hypothesis. The large empirical literature endeavouring to deal with these issues is attaining diverse conclusions. Rogoff (1996) provides a useful overview of the extensive research in this area and gives the name of "purchasing power parity puzzle" to the frustrating empirical results obtained regularly ("remarkable consensus") when testing the Purchasing Power Parity (PPP) doctrine. These results imply a too long time -- three to five years (HL: half-life) -- needed to convergence despite the high volatility of real exchange rate. This is to say that, at most, the real exchange rates very slowly tend to return to their means. Moreover, recent research (e.g., Lopez et al, 2013 and Gadea and Mayoral, 2013) questions if thus estimated very long adjustment period is not indeed too low "The probability that the HL lies in the so-called Rogoff's puzzle interval (3-5 years) is quite small (around 21%), (Gadea and Mayoral, 2013)" One potential road to finding a solution to this puzzle is the Balassa-Samuelson hypothesis.

The Balassa and Samuelson hypothesis -- BS -- (Balassa, 1964, Samuelson, 1964) offers in general a theoretical justification of the long run trends in real exchange rates in relation to productivities and prices. Their natural point of departure is the Salter-Swan (dependent economy) model, i.e., taking into consideration the important real world feature of having both tradable and non-tradable goods. BS states that if a given country's productivity in producing tradable goods compared to its productivity in making non-tradable goods and services rises more rapidly than in a (certain) foreign country, then the home country real exchange rate will experience appreciation. Thus if productivity of factors of production grows faster in the home country tradable sector, then relative price in the non-tradable sector should rise. Evidently, this would cause a faster rate of domestic inflation relative to the country with the slower rate of productivity growth and as a result the real exchange rate would appreciate. Or seen from the perspective of the income terms of trade approach the booming sector (e.g., high oil premiums) originate larger spending on both tradable and non-tradable goods and services. Given that the tradable products are linked to the international market by the price taker (small country) supposition, the increased demand would generate higher imports. However, the prices of the non-traded goods would have to rise as they are determined by the interaction of domestic supply and demand, resulting in higher inflation. Consequently, the real exchange rate of the country under consideration would appreciate.

The existence of the BS effect is corroborated by substantial empirical support, though its strength is commonly found to be quite smaller in comparison to the theoretically expected one. While notionally, it may well be expected the magnitude of the effect of relative productivity to be similar (at least) to the share of non-tradables in the GDP (generally found to be higher than 0.5), Ricci et al (2008), using a sample of 48 countries (containing both industrialised and emerging markets countries) over the period 1980-2004 estimate coefficient of domestic productivity of 0.2 "[o]n the low side with respect to the theory, but in line with other studies."

The net barter terms of trade (included as well into their regression analysis) is estimated to have significant, positive effect of about 0.55, enhancing the BS effect. This represents an uncharacteristic result, as the standard outcome in the international macroeconomics literature tends to advocate that increase in productivity of domestic tradable goods is expected to lead to decline of the terms of trade, e.g., Obstfeld and Rogoff (1996). As well, Nahuis and Geurts (2004) -- using a sample of 25 OECD countries covering the 1971-2002 time span -- provide support to the existence of such negative effect from productivity expansion via competition forces to lower prices. However, other studies, e.g., Corsetti et al. (2005) support this (reverse) conclusion: "Following a shock that increases permanently U.S. labour productivity in manufacturing (our measure of tradables) relative to the rest of the world, U.S. relative output and consumption increase, while the real exchange rate appreciates. Second, the same increase in productivity improves the terms of trade, as suggested by our model under the negative transmission."

Still, further recent study by Bordo et al (2014) after solving a version of the conventional BS model, offers an interesting calibrating exercise by "correcting" the productivity effect for elasticity of substitution of home and foreign tradables (Armington elasticity) and for home bias (share of home goods in the domestically traded goods basket, minus the share of the home goods in the foreign goods basket of traded goods). Substituting for values of Armington elasticity in-between 1 and 2; home bias values ranging from 0.4 to 0.8; and share of nontraded goods in GDP of 0.65, they conclude that "The Balassa-Samuelson theory modified to account for the terms of trade effect has the potential to explain the observed variation in the productivity effect over a long period."

Another proposed solution is sought in a combination of the three factors: TFP differential; real interest rate differential and, the real price of gold, "[r]epresenting real shocks, monetary shocks, and shocks to the global financial system (Kakkar and Yan, 2014). Collecting data for 15 OECD countries plus China, they utilise cointegration procedure and conclude that "[t]he evidence […] is quite favourable to the augmented Balassa-Samuelson model. […] The visual evidence […] shows a close link between actual and fitted values of the real exchange rates for most countries"

These are general theoretical observations and they should be examined carefully within any historic and country context.

EMPIRICAL ASSESSMENT OF THE REAL EXCHANGE RATE OF AZERBAIJAN

We implement empirical analysis for Azerbaijan based on the Balassa – Samuelson model. Among other indicators, real exchange rate misalignments play a prominent role in defining competitiveness or the potential ability of Azerbaijan to produce goods and services of international quality standards at least as effectively as its trading partners.

The derivation of the Balassa–Samuelson effect endures different logical and empirical specifications that may have important economic implications. One essential issue associated with Purchasing Power Parity (PPP) doctrine is the question of causality. In general, all economic variables are mutually dependent, so it is difficult to establish unilateral causation. Still for practical purposes, it is feasible to argue and empirically determine the prevailing causation, i.e., that prices determine exchange rates or that exchange rates determine prices (P → ER; ER → P). This is an essential but difficult question to answer.

Given that the exchange rate moves because of differential inflation in two countries -- causality from P to E -- we have arrived at a theory of exchange rate determination. In this case, home and foreign prices are the driving force. If home prices are changing due to exchange rate "undervaluation" or "overvaluation" -- causality from E to P -- we have a theory of price determination. In this case, the independent behaviour of the exchange rate is the cause and the inflation or deflation is the result.

The two alternatives have very different policy implications. Under the first option, the exchange rate is an adjusting variable and its movement is accepted as equilibrating force. If the second view dominates, the exchange rate movement would be seen conventionally as a destabilizing factor for the domestic economy. This passive movement of domestic prices in response to an exchange rate shock is called the "pass-through" effect. In large and relatively balanced national economies, pass-through may be rather small, e.g., Powers and Riker, (2013), estimate median pass-through for the US economy import prices of 0.44); hence domestic inflation is no more than affected by exchange rate movement. But for small open economies, particularly with fixed exchange rates, it may be quite high. Beirne and Bijsterbosch, (2009) utilising monthly data (January 1995 to April 2008) for the (then) nine central and eastern European EU members and applying both cointegrated VAR and impulse responses based on VECM, conclude that the exchange rate pass-through is around 0.6 on average based on cointegrated VAR and around 0.5 based on the impulse response. More interestingly their cointegration results on exchange rates pass-through illustrate that "[f]or the four fixed exchange rate regime countries (Bulgaria, Estonia, Latvia, and Lithuania) it averages 0.758. Moreover, for each of these countries, a hypothesis test for full pass-through cannot be rejected."

The pass-through effect is in the main larger for primary commodities, e.g., oil and minerals, than for manufactured products. Also, pass-through is smaller for regulated goods and countries with various trade restrictions than for free trade products and open economies.

It should be noted that there is certain bewilderment within the realm of exchange rates and relative prices interrelations which could be illustrated by the following assertions:

1) Higher inflation countries should experience a high rate of real exchange rate depreciation -- no, under (the absolute form of) PPP the real exchange rate is one (or constant under the relative version). Thus any differences in inflation rates would not affect real exchange rates, but would be precisely matched by corresponding changes in the nominal exchange rate (through arbitrage). This to say:

$$eq.1 - -PPP = \frac{p^* e}{p} = 1$$

$$eq.2 - -RER = \frac{p^* e}{p}$$

where,

p^* -- foreign currency price level

p -- domestic currency price level

e -- nominal exchange rate

RER – Real exchange rate (in terms of domestic price of foreign currency)

2) Higher general price level relative to other countries, *ceteris paribus*, means an appreciation of the real exchange rate – yes, under BS hypothesis. This to say:

--Poorer countries have lower price level;

--Improvement in productivity in tradable sector relative to foreign country appreciates the RER; and,

--Improvement in productivity in non-tradable sector relative to foreign country depreciates the RER.

However, the subtle nature of this theory has been well understood and fully acknowledged by both authors credited with its formulation. As Balassa (1964) points out "Interest in the doctrine arose whenever existing exchange rates were considered unrealistic and the search began for the elusive concept of equilibrium rates." Additional clarification is provided by the statement of Samuelson (1964) "PPP is misleading, pretentious doctrine, promising us what is rare in economics, detailed, numerical predictions."

METHODOLOGY

We begin the empirical analysis by looking into the various sources of the real exchange rates (PPPs) data in particular. The real exchange rate (RER) is calculated as the nominal exchange rate adjusted for relative price movements. Different alternatives for calculating RER are available, depending on which prices are being used – consumer prices, product prices, wholesale prices or unit labour costs – and also depending on whether bilateral or multilateral measures are used. The most widely used measure of RER is the CPI based one.

Figure 1, below depicts the data series available from various sources, including: the three different editions of the Penn World Tables (PWT 61; 71; and, 80), one from the World Development Indicators (WDI, World Bank), and one based on direct estimates by the author. Plus, we present the partial, but important data of the real effective exchange rate (REER) provided by an IMF analytical paper to inform our judgement. It is obvious that while there is a distinct difference between the three versions of the PWTs and the WDI, these series seem to exhibit more or less common profile, but all of them diverge significantly from the direct estimate and the IMF REER. The difficulties with the quality of data and its availability for the former centrally planned economies, especially during the earlier years of transition is well known. On the positive side, it appears that from the year 2008 forward all data sources begin to move on the whole in parallel.

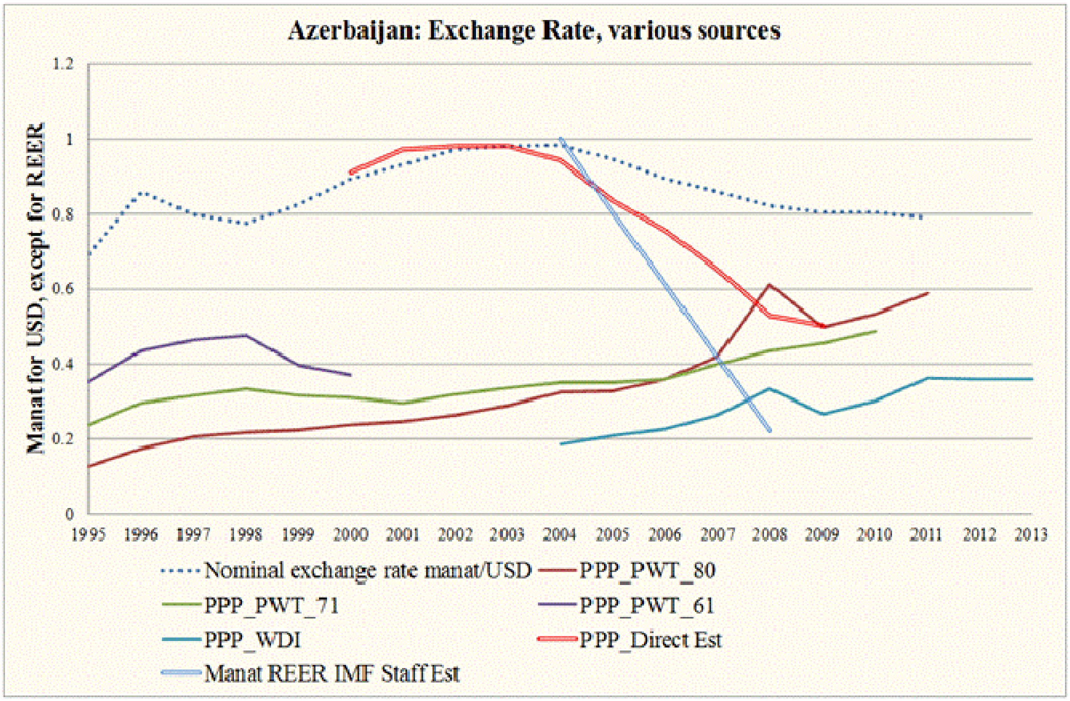

Figure 1. Azerbaijan, nominal and PPPs exchange rates data

In continuing our analysis, first we test whether the time-series of the exchange rates and productivities are co-integrated, this is to say share the same trend. Our analysis follows directly in the footsteps of the econometric procedure developed and employed in Pesaran and Shin (1995).

Problems related to spurious regression could arise from potentially mixed order of integration of the employed series and from the lack of long run stable relationship among the variables of the model. Hence, stationarity of variables is a major concern in time series analysis since non-stationary variables are not mean preserving leading to invalid standard errors and related problems with hypothesis testing and other standard inferential techniques. We use unit root test – The Augmented Dickey Fuller test (ADF) – to check the data generating process statistically for trend stationarity against difference stationarity. The test (ADF) when performed as follows is a simple t-test but with different critical values from the standard normal distribution:

$$\Delta Y = \alpha + Y_{t-1} + \sum_{i=1}^{k} \Delta Y_{t-k} + u_{1t}$$

eq. 3

The lagged first difference terms are added to remove any serial correlation in the error term. First we test the real exchange rate series (RERSM). The test cannot reject the null hypothesis of a unit root. The ADF statistic in absolute value is below its 95 per cent critical values of -3.2197 for up to the third order of augmentation. The values are reported in Table 1 below. Three of the model selection criteria (AIC, SBC, and HQC) suggest that the correct order of the ADF regression is around one, with the maximum log-likelihood (LL) selecting a higher order.

Next we test for a unit root in the first-difference of same time series (differencing a non-stationary variable is commonly expected to result in a stationary variable). However, all values of the ADF statistics are below the 95 per cent critical value. The model selection criteria suggest that the proper order of the regression is between two and three. Based on the outcome of the test, we cannot reject the hypothesis that the first difference of the real exchange rate between the US Dollar and the Manat has a unit root. Simultaneously the ADF test seems to suggest that RERSM is neither level nor first difference stationary, in other words, the order of integration is not an integer, signifying that the "standard" choice between unit root I(1) and level stationary I(0) process is in doubt.

Table 1. Unit root test for the variable real exchange rate (RERSM) and for the first difference of the variable real exchange rate (DRERSM)

The Dickey-Fuller regressions include an intercept but not a trend

	Test Statistic	LL	AIC	SBC	HQC
DF	.48060	4.2381	2.2381	1.9355	2.5700
ADF(1)	-.96710	9.4388	6.4388	5.9849	6.9367
ADF(2)	-.53537	9.4892	5.4892	4.8840	6.1531
ADF(3)	-.36369	9.4907	4.4907	3.7342	5.3205

95% critical value for the augmented Dickey-Fuller statistic = -3.2197
LL – Maximized log-likelihood AIC – Akaike Information Criterion
SBC – Schwarz Bayesian Criterion HQC – Hannan-Quinn Criterion

DRERSM -- The Dickey-Fuller regressions include an intercept but not a trend

	Test Statistic	LL	AIC	SBC	HQC
DF	-.13622	16.9574	14.9574	14.7602	15.3830
ADF(1)	.96637	18.8029	15.8029	15.5070	16.4413
ADF(2)	2.7331	23.0605	19.0605	18.6660	19.9117
ADF(3)	2.2835	23.2794	18.2794	17.7863	19.3434

95% critical value for the augmented Dickey-Fuller statistic = -3.2698

Next we test for unit root in relative productivity time-series (RPR), i.e. the ratio between GDP and employment of Azerbaijan and United States. The null hypothesis that this variable is difference stationary (unit root) against the alternative that it is trend stationary cannot be rejected for all orders of expansion. All model selection criteria are suggesting that the suitable order of augmentation is between one and three. Further we test for unit root in the first difference of RPR. In this case for all orders of augmentation (three) the absolute values of the ADF statistics are well below the 95 per cent critical value of the test and thus the hypothesis (unit root) cannot be rejected again.

In the following section we discuss the theoretical basis of our modeling approach.

Above we discerned two main factors relating to real exchange rates, prices and productivities. The first relates to the PPP concept and characterises RER dynamics as a mean reverting, stationary process where shocks and cyclical movements do not have strong permanent effect. Consequently the RER must tend to revert to its long run equilibrium level rather quickly. The second is associated with the notion of Balassa-Samuelson effect, claiming that productivity fluctuations have rather permanent effects on the RER and, therefore RER could appropriately be characterized as a non-stationary, long memory, non mean reverting process. It should be born in mind that it can be problematic to distinguish small trends from "spurious" local trends as a stationary time series under strong dependence can easily look a lot like the former but be essentially the latter and vice versa.

Essentially the evidence strongly suggests that the variables are mean reverting, nonstationary: their order of integration is not an integer. To inspect the relationship between the real exchange rate and relative productivity, therefore, we need to address the general problem of defining a cointegrating relationship between series that do not have the same order of integration. The standard cointegration tests (e.g., Johansen's ML) are inappropriate as the ADF tests for stationarity indicate that the variables are characterised by different orders of integration.

Table 2. Unit root test for the level (RPR) and first difference (DRPR) of the variable relative productivity

RPR -- The Dickey-Fuller regressions include an intercept but not a trend

	Test Statistic	LL	AIC	SBC	HQC
DF	2.3104	4.3893	2.3893	2.0868	2.7213
ADF(1)	.22155	4.7960	1.7960	1.3421	2.2939
ADF(2)	1.3145	6.6338	2.6338	2.0287	3.2977
ADF(3)	1.3535	7.0685	2.0685	1.3121	2.8984

95% critical value for the augmented Dickey-Fuller statistic = -3.2197

DRPR -- The Dickey-Fuller regressions include an intercept but not a trend

	Test Statistic	LL	AIC	SBC	HQC
DF	-1.3488	4.6388	2.6388	2.4415	3.0644
ADF(1)	-2.3593	6.6854	3.6854	3.3896	4.3238
ADF(2)	-2.3554	7.7212	3.7212	3.3268	4.5724
ADF(3)	-1.6575	7.8370	2.8370	2.3440	3.9011

95% critical value for the augmented Dickey-Fuller statistic = -3.2698

Therefore, we turn towards the autoregressive distributed lag (ARDL) testing and estimating procedure developed in Pesaran and Shin (1995) and Pesaran, Shin and Smith (2001). This approach allows the regressors to be I(1), I(0), or even fractionally integrated, testing in fact for the existence of a long-run relation between the variables under investigation irrespective of the order of their integration.

The null hypothesis of non-cointegration is tested against the existence of a long-run relationship by computing the statistics (F-statistics) for the joint significance of the lagged levels of the variables in the ARDL model. The asymptotic distribution of this F-statistic is non-standard, but the critical value bounds are tabulated by Pesaran et al. (1996). If the estimated F-statistic exceeds the upper bound of the critical value band, we can reject the null hypothesis of no long-run relationship between the real exchange rate (RERSM) and the ratio of respective countries productivity (RPR).

The test for a long-run relationship between RERSM and RPR is performed using the following version of the ARDL model:

$$\Delta DRERSM_t = \alpha + \sum_{i-1}^{3} \beta_i DRERSM_{t-1} + \sum_{i=1}^{3} \delta DRPR_{t-1} + \lambda_1 RERSM_{t-1} + \lambda_2 RPR_{t-1} + \varepsilon_t$$

eq. 4

The null hypothesis of "no long-run relationship" is defined by $H_0 : \lambda_1 = \lambda_2 = 0$

against, $H_1 : \lambda_1 \neq 0, \lambda_2 \neq 0$ where the relevant statistics is the F-statistics for the joint significance of λ_1 and λ_2.

We estimate (eq. 4) by OLS and then calculate the F-statistic for the joint null hypothesis that the level variables coefficients are all equal to zero.

The results are reported in Table 3 below. Following Pesaran et al. (2001) bounds testing approach, and given that our sample test statistic exceeds the associated upper critical value (at the 99 per cent level the values are 10.040 and 12.011 respectively) we reject the null in favour of the alternative that there exists a long-run relationship between RERSM and RPR. Note that the least square estimator of a cointegrating regression is "super" consistent, i.e., converging faster to the true parameter.

Table 3. Variable addition test (OLS case)

Dependent variable is DRERSM
List of the variables added to the regression:
RERSM(-1) RPR(-1)

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
DRERSM(-1)	.080277	.22002	.36486 [.750]
DRERSM(-2)	-.21859	.33477	-.65294 [.581]
DRERSM(-3)	.24296	.19991	1.2154 [.348]
DRPR(-1)	-.19379	.18563	-1.0440 [.406]
DRPR(-2)	.032049	.16916	.18946 [.867]
DRPR(-3)	-.14217	.28697	-.49543 [.669]
RERSM(-1)	-.40990	.083967	-4.8817 [.039]
RPR(-1)	.34164	.087640	3.8982 [.060]

Joint test of zero restrictions on the coefficients of additional variables:
Lagrange Multiplier Statistic CHSQ(2) = 9.4381[.009]
Likelihood Ratio Statistic CHSQ(2) = 28.7909[.000]
F statistic F(2, 2) = 16.7980[.056]

In what follows we estimate the coefficient based as obtainable by the equation (4) above. The long-run coefficients and error correction model (ECM) are estimated by the ARDL specification, where the ECM is estimated by OLS and the lag structure for the ARDL specification of the short-run dynamics is determined by the AIC, SBC, and HQC information criteria.

Table 4. Autoregressive distributes lag estimates (ARDL (2,0) selected based on the Schwarz Bayesian Criterion

Dependent variable is RERSM

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
RERSM(-1)	1.2293	.19730	6.2308[.000]
RERSM(-2)	-.41254	.17501	-2.3572[.046]
RPR	.13583	.027407	4.9560[.001]

R-Squared	.95826	R-Bar-Squared	.94782
S.E. of Regression	.061084	F-stat. F(2, 8)	91.8206[.000]
Mean of Dependent Variable	1.2736	S.D. of Dependent Variable	.26741
Residual Sum of Squares	.029850	Equation Log-likelihood	16.8938
Akaike Info. Criterion	13.8938	Schwarz Bayesian Criterion	13.2969
DW-statistic	2.7124		

We begin by choosing the maximum order of lags present in the ARDL model to be three, allowing for lags between RERSM and RPR. The Akaike and the Schwartz Bayesian information criteria select the ARDL(2,0), while the Hannan-Quin criterion selects ARDL(2,3). The estimated long-run coefficients from the two models selected on the bases of the above criteria are given in the table below.

Table 5. Estimates of the long-run coefficients -- ARDL approach

1995-2008	Estimation results	
Model Selection Criteria	AIC and SBC- ARDL(2,0)	HQC--ARDL(2,3)
Long-run Coefficient -- RPR	**0.74143**	**0.82482**
t-statistics	[12.0092]	[3.3612]
R-Bar-Squared	0.94782	0.85586
F-satistics	91.8206	30.6877

The point estimates are comparable, though the standard errors obtained using the model selected by AIC / SBC are considerably smaller than those obtained using the model selected by HQC.

The coefficients of mutual determination are very high suggesting that the regressor explains most of the variation in the dependent variable. Further, to obtain an approximation of the speed of convergence to equilibrium, we estimate the error correction model associated with the long-run estimate.

Table 6. Error correction representation for the selected ARDL model

Dependent variable is dRERSM

Regressor	Coefficient	Standard Error	T-Ratio[Prob]
dRERSM1	.41254	.17501	2.3572[.046]
dRPR	.13583	.027407	4.9560[.001]
ecm(-1)	-.18320	.042087	-4.3529[.002]

List of additional temporary variables created:
dRERSM = RERSM-RERSM(-1)
dRERSM1 = RERSM(-1)-RERSM(-2)
dRPR = RPR-RPR(-1)
ecm = RERSM -.74143*RPR

R-Squared	.88469	R-Bar-Squared	.85586
S.E. of Regression	.061084	F-stat.	F(2, 8) 30.6877[.000]
Mean of Dependent Variable	.036364	S.D. of Dependent Variable	.16089
Residual Sum of Squares	.029850	Equation Log-likelihood	16.8938
Akaike Info. Criterion	13.8938	Schwarz Bayesian Criterion	13.2969
DW-statistic	2.7124		

The error correction coefficient (AIC and SBC, based model), estimated at -0.18320, has the correct sign, is highly statistically significant and suggests that the economy's half-life return to equilibrium would take around 3.4 years. This is to say that around 18% of the opening between the long-run values of the variables is closed every year. Consequently, it would take a long time for the equation to return to its equilibrium once it has been shocked.

If we are to examine the terms of trade developments of Azerbaijan (in comparison with other CCE countries) over recent past (see Figure 2, below), in fact, they clearly strengthen the productivity effect.

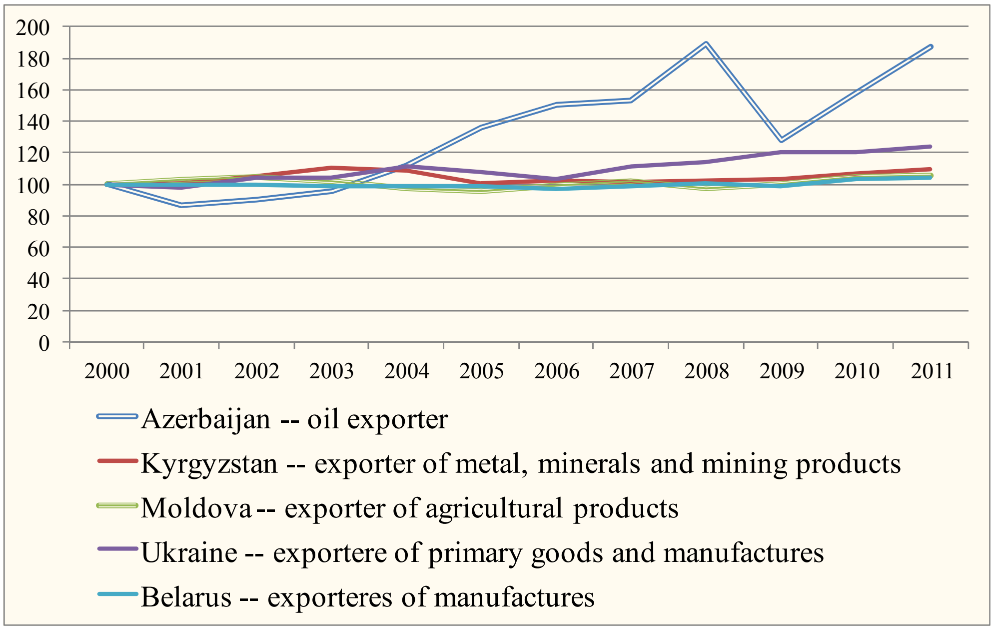

Figure 2. Net barter terms of trade of selected CCE countries (2000-2011)

CONCLUDING REMARKS

Our finding confirms the validity of B-S effect for Azerbaijan: i) poorer countries have lower price levels; and, ii) improvement in productivity in the tradable sector (relative to foreign country) appreciates exchange rate.

As Azerbaijan economic growth (and, it appears, productivity) is largely driven by the value of oil exports our results are a clear sign of Dutch Disease -- huge oil revenues cause swift real exchange rate appreciation, leaving the non-oil tradable sector (including manufacturing) unable to compete, consequently its output (as a share of GDP) declines and the country is *de facto* on the path to deindustrialisation.

Furthermore, it should be noted that: i) the changes in the terms of trade diverge significantly across CCE countries; ii) This difference depends to a great extent on the product composition of their respective exports and imports; and, iii) the difference in the impact of the terms of trade changes on the evolution of the purchasing power of exports depends on the speed of export volume growth.

REFERENCES

Balassa, B., (1964). The Purchasing Power Parity Doctrine: A Reappraisal, *Journal of Political Economy*, vol. 72, December, pp. 584-596

Beirne, J., Bijsterbosch, M. (2009). Exchange rate pass-through in central and eastern European member states. *Working Paper European Central Bank* 1120, Euro System.

Bordo, M., Eh. Choudhri, G., Fazio, and R., MacDonald, (2014). The Real Exchange Rate in the Long Run: Balassa-Samuelson Effects Reconsidered, *NBER Working Papers*, Working Paper 20228, http://www.nber.org/papers/w20228

Cassel, G., (1918). Abnormal deviations in international exchanges, *The Economic Journal*, vol. 28, pp. 413-415.

Corsetti, G., Ph., Martin, and P. Pesenti, (2005). Productivity Spillovers, Terms of Trade, and the Home Market Effect, *Federal Reserve Bank of New York Staff Reports*, no. 201,February 2005

Gadea, M., and L. Mayoral, (2013). Uncertainty, model selection and the PPP puzzle, Working Paper, University of Zaragoza, October 2013

Kakkar V., and I. Yan, (2014). Determinants of real exchange rates: An empirical investigation *BOFIT Discussion Papers*, Bank of Finland, BOFIT, Institute for Economies in Transition, 1, 2014

Leon, J. and Soto, R. (1997), Structural Breaks and Long-Run Trends in Commodity Prices. Journal of International Development, 9: p. 347

Lopez, C., Ch., Murray, and D., Papell, (2011). Median-Unbiased Estimation in DF-GLS Regressions and the PPP Puzzle, Applied Economics, Vol. 45, pp. 455-464

Nahuis, N., and B. Geurts, (2004). *Helping thy neighbour: productivity, welfare and international trade* , General Financial and Economic Policy Directorate, Ministry of Finance, The Netherlands

Obstfelt, M., and K. Rogoff, (1996). *Foundations of International Macroeconomics*, The MIT Press, Cambridge Massachusetts, London England.

Pesaran, M. H. and Y. Shin, (1995). An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis, *DAE Working Paper* No.9514, Department of Applied Economics, University of Cambridge.

Pesaran, M. H., Y. Shin and R. J. Smith, (1996). Testing for the Existence of Long-Run Relationship, *DAE Working Paper* No. 9622, Department of Applied Economics, University of Cambridge.

Pesaran, M. H., Y. Shin and R. J. Smith (2001). Bounds testing approaches to the analysis of level relationships, *Journal of Applied Econometrics, special issue in honour of J. D. Sargan on the theme "Studies in Empirical Macroeconometrics"*, D.F. Hendry and M.H. Pesaran (eds),Vol.16, pp. 289–326.

Rogoff, K, (1996). The Purchasing Power Parity Puzzle, Journal of Economic Literature, Vol. 34, No. 2, June, 1996, pp. 647- 668.

Samuelson, P., (1964). Theoretical Notes on Trade Problems, *Review of Economics and Statistics*, vol. 23, pp. 1-60.

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