Purchasing Power Parity: Reasons for Deviations of the Ruble from PPP

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Abstract

This paper aims at testing of the PPP relationship for the Russian Ruble and modeling deviations from that relation. It contains a literature review and a discussion of features specific for Russia. A large part of the work is devoted to construction of appropriate indicators based on the slender data available. Subsequent emprical tests show satisfactory correspondence between the theoretical models and the data. Some relationships obtained could be used for long-lun real exchange rate forecasting.

Keywords: PPP; Balassa-Samuelson effect; Productivity; Unit Roots; Russia; Ruble

JEL classification: C32; C33; F31

The PPP theory is one the main approaches to the analisys of exchange rate dynamics. The underlying idea is that in the long run the exchange rate is determined by the proportion between the price indeces. The main empirical result of testing the PPP theory so far is that the relative version of the theory holds. It asserts that the rates of devaluation of the currency are cointegrated with the rates of inflation in two countries.

There are a lot of reasons why a permanent and absolute relationship between the exchange rate and the prices does not hold. Among these one can recall transport and information costs, all kinds of trade barriers as well as monopoly power of firms. But the most important reason is the existence of nontraded goods. As many goods are not traded at the international level, their prices are not driven by the arbitrage mechanism. As a result, a lot of factors, such as

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income, productivity and fiscal policy, influence those prices, causing deviations from absolute PPP in the long run.

Empirically income growth has the strongest impact on the relative prices. The mechanism behind this relationship is described by the Balassa-Samuelson effect[1]. Relative productivity growth in the tradables sector causes an increase in real wages all over the economy, which means higher cost of labor inputs for the nontradables sector. As a result, the relative price of non-tradables in terms of tradables grows, which means real appreciation of the currency. One of the implications of this effict is the positive relationship between per capita income and the price level over a cross-section of countries.

Figure 1 illustrates this relationship and shows the position of Russia in the price level-income coordinates. One can see that Russia has a relatively low income as well as a relatively low price level, which well fits into the emprical relationship.

An important fact is that Russian data satisfies the relationship quite well not only for a cross-section, but also for time-series. Figure 2 illustrates this point. During the period 1991-1994 the sharp decline in output was accompanied with a corresponding depreciation. Despite the transition from centralized regulation to market pricing the movements were well predictable according to the Balassa-Samuelson model. In 1995 the Central Bank started fighting inflation using an exchange rate band as a nominal anchor. This caused a severe appreciation of the ruble during the period 1995-1997. The inability to maintain a balanced budget and supply the government bond pyramid caused the financial cricis in August 1998, which forced the Central Bank to devalue the ruble and turn to managed float. Devaluation resulted in a large swing towards the average relationship, while the overshooting effect could be attributed to rigid prices as in the Dornbusch

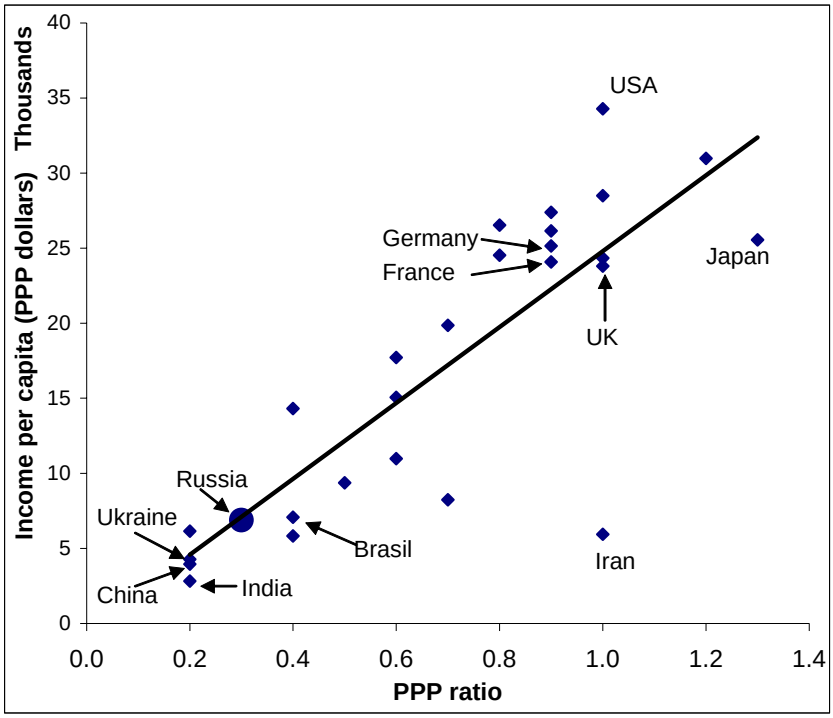

Figure 1: Relationship between Income per capita and PPP ratio for a cross-section of countries (source: Worldbank Development Indicators, 2001).

model. Devaluation also caused an increase in import prices and hence a burst in the demand for home goods, which became one of the main sources of consequent economic growth.

During the period 1999-2003 Russia moved along the new path parallel to the average. One possible explanation to the shift could be a strengthening of the trade barriers, which occured between 1996 and 1999. It could be a result of both better administration and an increase in the average tariffs during the period of interest.

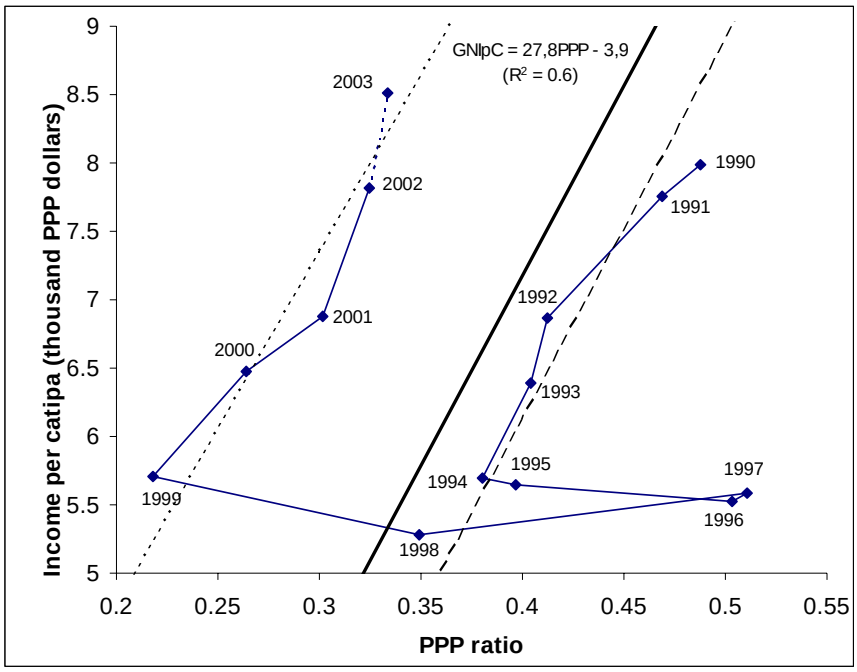

Figure 2: Path of Russia in price level-income coordinates (source: World Development Indicators 1991-2004, author's calculations)

The resulting empirical relationship after taking differences is given by:

$$g - n + e + \pi^* = \pi - e - \pi^*,$$

where g denotes output growth, n - population growth, e - currency depreciation rate, π - home inflation, π^* - inflation abroad.

When using the relationship one should take into account that it is attributable only to periods of stable trade policy as well as no dramatical changes in the economy in general. Changes could cause a shift in the level and temporarily break the relationship.

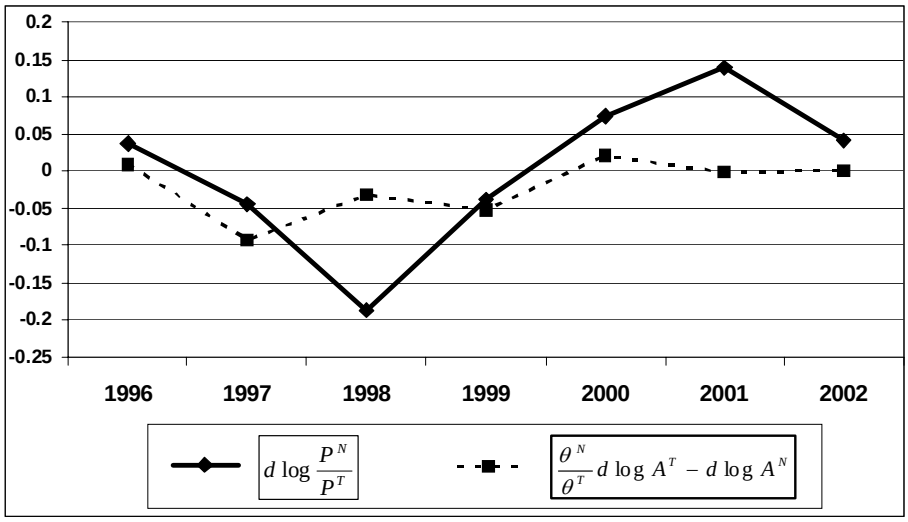

Figure 3: Right- and left-hand sides of the relationship between the price level and the productivity difference (source: Rosstat, Bessonov (2002), author's calculations)

To claim that this relationship has something to do with Balassa-Samuelson effect, namely that the change in the price level is concerned with the differences in productivity growth between sectors, one should test the following theoretical clause empirically:

$$(p^N - p^T)_t = \alpha + \beta(\tfrac{\theta^N}{\theta^T} a^T - a^N)_t$$

From Figure 3 one can see, that periods of positive values of the right- and left-hand sides coincide. Correlation between them appears to be quite high as well (*0.56*), which draws us to the conclusion that Balassa-Samuelson effect is one of the main determinants of changes in the relative prices, and hence, the real exchange rate.

Use of monthly data on the real exchange rate enables testing the PPP theory

using standard OLS and unit root techniques. The first stage of tests[2] gives coefficients quite near to unitiy:

$$s_t = -0.62 + 0.79(p_t - p_t^*) + \varepsilon_t$$
$$p_t - p_t^* = 1.0 + 1.21 s_t + \varepsilon_t$$
$$(t\text{-}stat = 53 \ for \ both)$$

However second-stage tests give unbiguous results, forcing us to allow for the random-walk hypothesis:

	ADF	P-value	DF-GLS	P-P	KPSS	ERS	Ng-P
p	+(4.95)´	0.0001	–	+	–	–	–
p^*	+(-3.27)†	0.0764	+	–	–	–	–
$p - p^*$	+(-4.95)´	0.0001	–	+	–	–	–
s	+(-4.23)´	0.0009	–	+	–	–	–
RER	+(-2.08)	0.0368	–	+	–	–	–
$REER$	+(-2.12)	0.0335	+	+	+	+	+

+ means no unit root, ´means a specification with a constant,

† means a specification with both a constant and a trend

Allowing for a random walk in time series means cointegration tests should be performed to test the relationship. Third-stage tests applied using Johansen's method give the following stationary linear combinations:

$$(p_t - p_t^*) - 0.63 s_t \qquad\qquad p_t - 0.96 s_t$$
$$(t\text{-}stat = 6.4 \ and \ 6.7 \ respectively)$$

Thus, taking into account specifics of Russia as a transitional economy with high inflation, we have veryfied that the real-exchange rate is mean reverting and

that long-run swings are in part due to the Balassa-Samuelson effect. Besides, unit root tests imply a half-life of deviations of the real exchange rate of approximately 22 months, which is much lower than usual[3]. Panel tests of the PPP hypothesis for the CIS countries give half-lives, which lie in between. They are generally more than 2 years but less than 3 years. One of the explanations to this is better integration of Russia into the world economy than other CIS countries.

References

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Notes

[1] *Balassa (1964)* and *Samuelson (1964)* were the first to propose the explanation.

[2] See *Froot and Rogoff (1994)* for description of stages of PPP testing.

[3] The common interval for developed countries is from 3 to 5 years.