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Dealing with Dramatic Appreciation: Is the Armenian Dram Still Competitive?

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IMF Working Paper

Middle East and Central Asia Department

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PRELIMINARY DRAFT; COMMENTS WELCOME

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Abstract

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This paper assesses the domestic and external competitiveness of the Armenian economy following the recent dramatic appreciation of the Armenian dram. We find that this appreciation has reduced the previously existing undervaluation and has brought the real exchange rate near or possibly slightly above equilibrium. We also find that import prices tend to be sticky downwards in response to appreciations, suggesting that there may be insufficient domestic competition between importers.

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I. INTRODUCTION

In recent years, Armenia’s widening trade deficits and the significant appreciation of the dram—both in nominal and real terms—have raised concerns about the competitiveness of the Armenian economy. While a certain extent of appreciation is expected to occur as incomes in Armenia rise, large foreign exchange inflows have led to concerns about a possible overvaluation of the dram, which would have adverse effects on export performance as well as on households who receive remittances in dollars. Since the outlook for official transfers, FDI, and remittances remains positive, pressures on the real exchange rate are likely to persist for the foreseeable future. Against this background, the main policy challenge is to maintain competitiveness.

This paper assesses the degree of competitiveness of the Armenian economy. Because there is no single measure of competitiveness that can properly summarize the competitiveness of a country, we follow the approach typically found in the literature of examining a range of estimations and indicators (e.g., Di Bella and others, 2007).

The paper is organized as follows. In Section II, we assess the equilibrium real exchange rate level through three different methods: the purchasing power parity (PPP) approach, the behavioral equilibrium exchange rate (BEER) approach, and the external sustainability approach.¹ In Section III, we then estimate the degree of exchange rate pass-through to import prices, which can be considered a measure of the degree of domestic competitiveness in Armenia. Section IV concludes.

We have two main findings. First, all three approaches for estimating the equilibrium real exchange rate suggest that the recent dramatic appreciation has reduced the previously existing undervaluation and has brought the real exchange rate near or possibly slightly above equilibrium. Second, our pass-through estimates suggested that there is significant downward rigidity in import prices in response to exchange rate movements, suggesting that there may be insufficient domestic competition between importers. We conclude that an acceleration of structural reforms is needed to maintain competitiveness in Armenia.

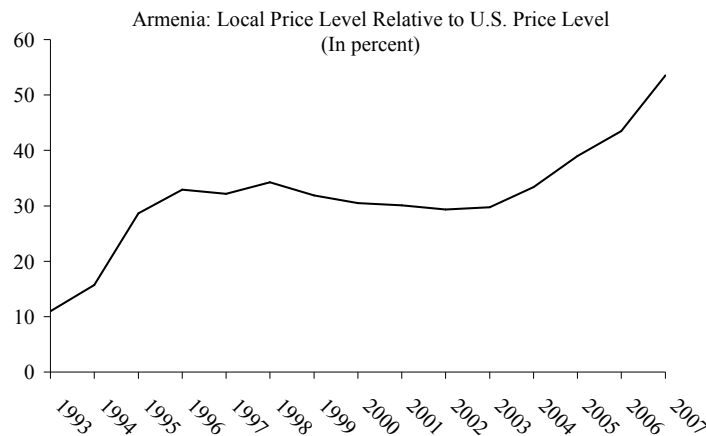
¹ Other equilibrium real exchange rate models not used in this paper include the Fundamental Equilibrium Exchange Rate (FEER) approach, the Desired Equilibrium Exchange Rate approach (DEER), and the Natural Rate of Exchange (NATREX) approach. For a survey, see Égert (2003).

II. EXCHANGE RATE ASSESSMENT

A. Purchasing Power Parity (PPP) Approach

One approach for estimating the equilibrium real exchange rate is by defining it as an equilibrium distance to Purchasing Power Parity (PPP). Armenia's PPP exchange rate is defined as the nominal exchange rate E at which the Armenian price level P equals the foreign price level P^* , that is, $PE=P^*$. Since the real exchange rate is defined as PE/P^* , the condition for PPP implies that the real exchange rate should equal one. While few people would want to maintain that the PPP real exchange rate itself is an "equilibrium" rate, it is nevertheless a useful benchmark.

The latest PPP estimates for Armenia (based on 2005 weights) suggest that Armenian prices in U.S. dollar terms have increased recently from about one third to more than one half of U.S. prices. In 1993, the Armenian price level was only about 10 percent of the U.S. price level. However, between 1993 and 1996, this relative price level increased gradually from roughly 10 to 30 percent, after which it remained approximately constant for almost 10 years. In recent years, however, the price level has increased significantly, to more than 50 percent in 2007, mostly reflecting rapid nominal appreciation.



Sources: WEO (April 2008); IFS; and IMF staff estimates.

If a relative price of 100 percent (PPP exchange rate of one) were defined as the equilibrium real exchange rate, the above PPP estimates would suggest that the dram is undervalued by about 50 percent, which seems unrealistic. Moreover, the same would then be true for almost all developing countries, which typically have exchange rates far below PPP. As explained below, an important reason for this divergence from PPP is that countries with lower incomes and lower productivity have lower prices for nontradable goods and services, which do not converge to nontradables prices in partner countries precisely because of the absence of trade. It is more natural, therefore, to think of the equilibrium real exchange rate as an "equilibrium distance to PPP."

To estimate the “equilibrium distance to PPP,” we need to correct for the fact that prices are generally lower in countries with lower incomes and lower productivity.² This hypothesis goes back to Balassa (1964) and Samuelson (1964), and is therefore referred to as the Balassa-Samuelson hypothesis. It is based on the following argument. First, lower productivity in the tradables sector implies lower wages in the tradables sector (under the assumption that wages depend on productivity). Second, lower wages in the tradables sector imply lower wages in the nontradables sector (under the assumption that labor and capital are sufficiently mobile). Third, lower wages in the nontradables sector imply lower prices of nontradables, both for supply-side reasons (lower input costs) and demand-side reasons (lower incomes, hence lower effective demand).³ These nontradables prices are unlikely to converge to nontradables prices in neighboring countries because nontradables, by definition, cannot be easily traded.⁴

Strictly speaking, the Balassa-Samuelson hypothesis implies that the real exchange rate should appreciate in line with the “relative productivity differential”. If Armenia experiences “relative productivity growth,” this means that productivity growth in the tradables sector exceeds productivity growth in its nontradables sector. In other words, prices of Armenian nontradables will then rise over time, while prices of Armenian tradables, in theory, will not (assuming they are determined by PPP), implying a rise in the overall Armenian price level. This does not necessarily imply real appreciation: for example, if Armenia’s trade partners were to experience the same relative productivity growth, trade partner prices would rise at the same rate as Armenian prices, and the real exchange rate would be unaffected. However, if trade partners experienced less relative productivity growth than Armenia, then Armenian prices would rise faster than trade partner prices, and the real exchange rate would appreciate. That is why what matters is the “relative productivity differential”: Armenian relative productivity minus relative productivity growth in trade partner countries.

In the absence of reliable data on sectoral productivity, the Balassa-Samuelson hypothesis is usually tested by regressing the real exchange rate (or the relative price level) on the overall productivity differential.⁵ Output and employment data for tradables and nontradables sectors tend to be unavailable for most developing countries and are of mixed quality for others, and

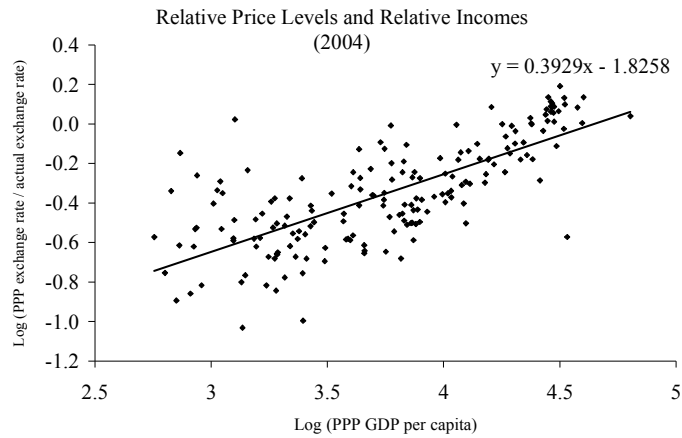
² Technically, what matters for the Balassa-Samuelson hypothesis is not absolute productivity, but *relative productivity*: the difference between productivity in the tradables sector and productivity in the nontradables sector. We will expand on this distinction further below.

³ The argument here is that lower effective demand in Armenia reduces nontradables prices in Armenia, but does not necessarily reduce tradables prices to the extent that the latter are determined by global supply and demand.

⁴ For example, even though haircuts may be cheaper in Armenia than in the US, it generally does not pay for Americans to travel to Armenia just to get a haircut, because of the high transportation costs and because haircuts cannot be stored. In addition, labor market restrictions prevent Armenian hairdressers from moving to the US, implying that wage differences will persist. Finally, even if education and health care are cheaper in Armenia than in the US, such public non-market services are typically not available to non-citizens.

⁵ See, e.g., De Gregorio and others (1994), Rogoff (1996), Kravis and Lipsey (1988), or Frankel (2005).

in any case are difficult to compare across countries. In the absence of better data, a common proxy is, therefore, to regress relative price levels on the overall productivity differential, i.e., on relative GDP per capita.⁶



Source: IMF (World Economic Outlook).

As predicted by the Balassa-Samuelson hypothesis, there exists indeed a clear positive relationship between the real exchange rate and productivity. As before, the real exchange rate is measured as the relative price level PE / P^* , and productivity is measured as PPP GDP per capita.⁷ The sample is taken from the IMF's World Economic Outlook database, and covers 180 countries (virtually the entire world). Based on a simple loglinear regression, we find the following equilibrium real exchange rate relationship:

$$\text{Log (real exchange rate)} = -1.83 + 0.39 * \text{Log (PPP GDP per capita)}.$$

This loglinear relationship, along with the 180 data points, is plotted in the chart above.

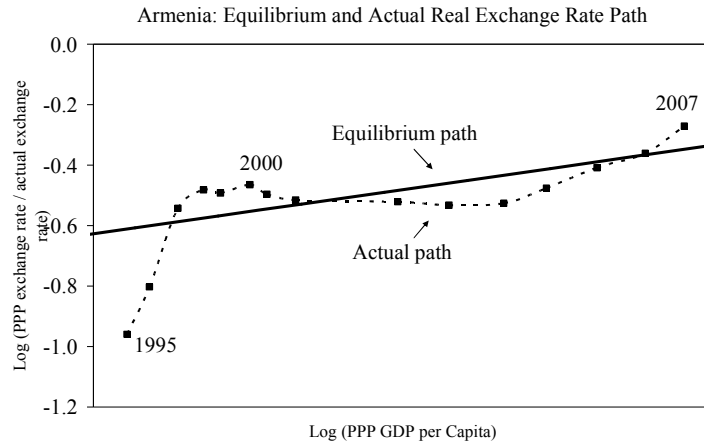
Our estimates suggests that, on average, every 1 percent increase in PPP GDP per capita is associated with a real appreciation of 0.39 percent, which is surprisingly close to similar estimates conducted by others, and seems robust over time. For example, in his classic paper, Rogoff (1996) found a slope of 0.37 for a sample of 100 countries in 1990. De Broeck and Slok (2001) repeated this estimate for a sample of 149 countries in 1999, and found a slope of 0.41. Most recently, Frankel (2005) found a slope of 0.38 for a sample of 118 countries in 2000.⁸

⁶ Another approach is to use the overall productivity differential as a proxy for the relative productivity differential, which amounts to assuming that productivity growth in both the tradables and the nontradables sector are approximately a constant fraction of overall productivity growth.

⁷ It is common to measure productivity as GDP per capita in PPP terms, because measuring it at actual exchange rates would imply that nominal exchange rate appreciation is equivalent to an increase in GDP per capita in U.S. dollar terms (i.e., this would implicitly assume that PPP holds).

⁸ Note that, since the data are in logs, a value of 0 on the y-axis corresponds to full PPP.

Based on the estimated equilibrium relationship between relative price levels and productivity differentials, we can obtain an estimate of the extent to which the dram has been undervalued or overvalued. The solid line indicates our estimated equilibrium relationship between relative price levels (or the real exchange rate) and productivity, while the dashed line plots the actual evolution of Armenia's relative price level against Armenia's GDP per capita. The difference between the dashed and dotted lines can thus be interpreted as a measure of real exchange rate misalignment.



The results suggest that the Armenian real exchange rate has been converging back to equilibrium, and may currently be slightly overvalued. We plot the percentage difference between the actual and expected real exchange rate (i.e., the difference between the dashed and dotted lines), which we interpret as a measure of real exchange rate misalignment. These estimates suggest that the dram was highly undervalued in 1993, then converged quickly to equilibrium in 1995 and stayed around equilibrium until 1998. Between 1998 and 2003, however, the dram became undervalued again, as the equilibrium real exchange rate appreciated while the actual real exchange rate remained constant. Since 2003, the dram has been converging back towards its equilibrium real exchange rate, and may have become overvalued in 2007, but probably not statistically significantly so.

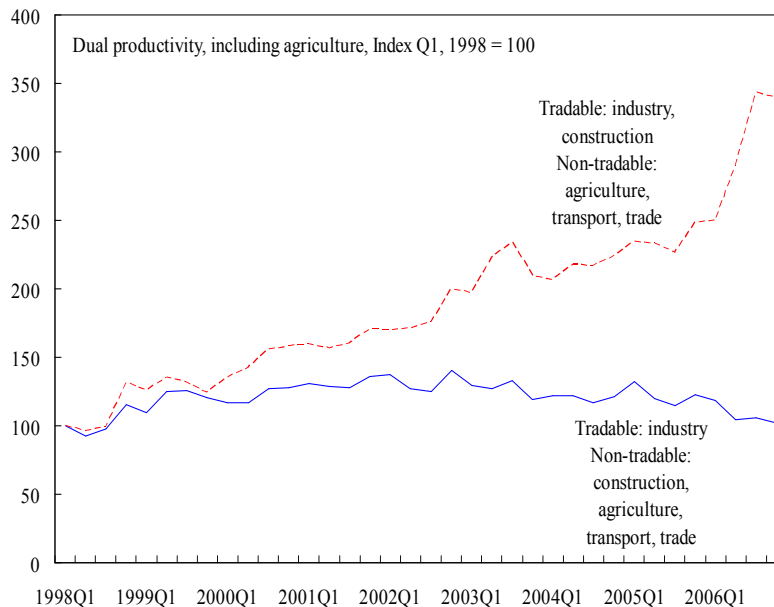
The PPP approach is subject to a number of shortcomings. First, it only looks at the relationship between the real exchange and productivity, and does not look at other equilibrium exchange rate determinants. Second, the estimated equilibrium relationship between the real exchange rate and productivity is based on a large cross-section of countries that may not necessarily be representative of Armenia. Third, the estimated equilibrium relationship is a historical average for a large number of countries, which implicitly assumes that all exchange rates are on average in equilibrium. Finally, GDP per capita is a very rough proxy for the relative productivity differential variable suggested by Balassa-Samuelson.

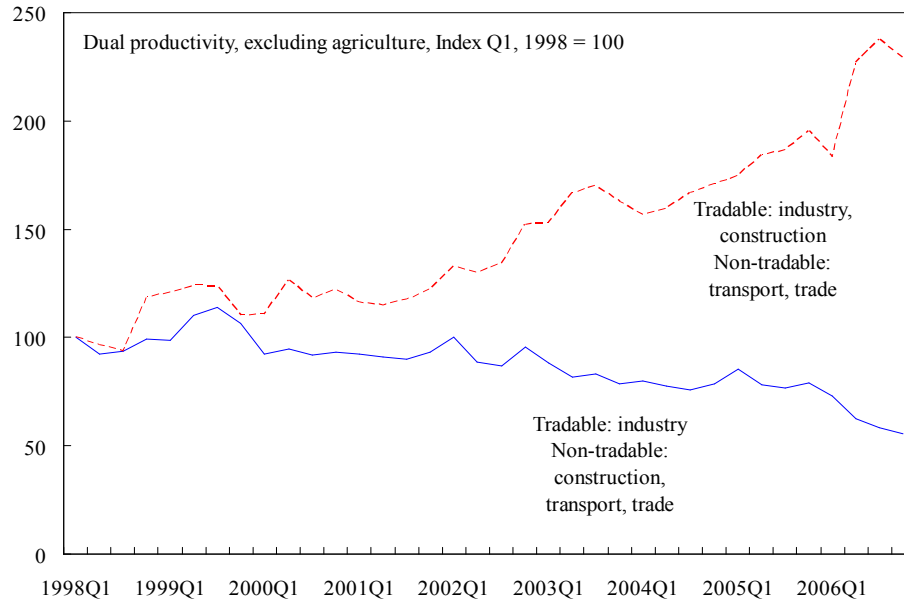
B. Behavioral Equilibrium Real Exchange Rate (BEER) Approach

The next approach, the so-called Behavioral Equilibrium Exchange Rate or “BEER” approach, avoids some of the shortcomings of the PPP approach because it uses more precise definitions of productivity, includes other variables besides productivity, and is based on time-series data for Armenia alone. The methodology involves estimating the statistical long-run relationship between the real exchange rate and its fundamentals. In addition to the productivity differential, we also include net international reserves and government consumption in GDP as potential exchange rate determinants.

Productivity measures

The definition of the “relative productivity differential” for Armenia depends on which sectors are classified as tradable and which as nontradable As explained above, “relative productivity” (also called “dual productivity”) is the difference between productivity in the tradable sector and productivity in the nontradable sector, and the “relative productivity differential” is the difference between relative productivity in Armenia and relative productivity in Armenia’s trade partners. While industrial production is traditionally considered as tradable, and services as nontradable, the classification of other sectors, in particular construction and agriculture, is not straightforward.





Since construction could be considered as either nontradable or tradable, we use both approaches in our analysis. Construction is typically considered as nontradable because the goods involved (particularly, real estate) cannot be physically moved across the border, while goods arbitrage is the main mechanism that ensures PPP (Egert, 2003). However, there are several arguments why one may wish to consider the construction sector in Armenia as largely tradable. First, the recent residential construction boom in Armenia is largely believed to be fueled by external demand, with anecdotal evidence suggesting that more than half of all real estate purchases (including corporate construction) are made by foreigners, mostly diasporan Armenians from Russia and the Middle East. Second, Armenian construction workers are very mobile and many of them find temporary jobs in Russia, where wages are higher, which in turn drives up Armenian construction wages. Third, the Armenian construction sector in Armenia appears to have experienced significant productivity growth recently.⁹ For these and other reasons, several other authors (e.g., De Broek and Slok 2001; Coricelli and Jazbec 2001) have also treated construction as a tradable sector in their panel analyses of Central and Eastern European economies. Nevertheless, since our productivity measures are quite sensitive to the treatment of construction (see chart), we run our regressions treating construction alternately as tradable and as nontradable.

Since the classification of agriculture is unclear, we exclude agriculture from our analysis. One rule of thumb suggested by the literature is to include agriculture in the tradable sector if the export share exceeds 10 percent, and include it in the nontradable sector otherwise. In Armenia, the export share of agriculture is significantly less than 10 percent, and has, in fact, been below two percent in the last 5 years. However, agriculture in Armenia—as in many other countries—is characterized by relatively high state intervention,

⁹ However, there are indications that official statistics underestimate construction prices and wages, and therefore are likely to overestimate real output growth and real productivity growth in construction.

while the Balassa-Samuelson effect is essentially a market mechanism. Moreover, the data on agricultural output and employment are believed to be of particularly poor quality, as employment in agriculture is estimated based on land ownership by the household (all adult family members owing land are considered full-time employed, while only some of them may be working seasonally). Following other authors, we therefore exclude agriculture from our analysis altogether.

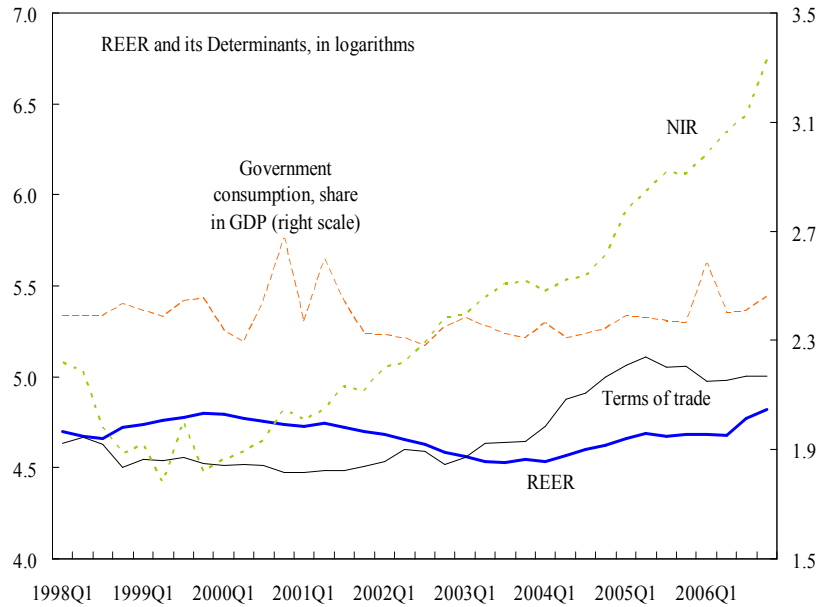
To compute the relative productivity differential, we compare Armenia's relative productivity to that of the European Union (EU), using the same sectoral classification for the EU as for Armenia. We focus on the differential with the EU because the EU is Armenia's largest trade partner, accounting for 37 percent of Armenia's external trade. The next largest trade partner is Russia, accounting for 22 percent, followed by the United States, with 13 percent. While it would be preferable to take the relative productivity differential based on a weighted average of all or the major trade partners, this was not possible due to limited data availability and the fact that the sectoral classifications used by Russia and the U.S. are not comparable with that of Armenia and the EU. We therefore decided to focus on the productivity differential with the EU only.

Other equilibrium exchange rate determinants

In addition to the productivity variables, we also include government consumption and net international reserves (NIR) as potential equilibrium exchange rate determinants. We also tried including other variables, such as the terms of trade, but ended up excluding them because we could not find any robust results using these variables.

An increase in government consumption (in percent of GDP) is expected to give rise to real appreciation. This is because government consumption tends to be biased towards nontradables, so that an increase in government consumption is likely to lead to a rise in the price of nontradables relative to tradables, which is another measure of real appreciation. Using a Ricardian equivalence argument, one could argue that government spending will eventually have to be financed through higher taxes, which would offset the effect on real appreciation through a decline in disposable income and therefore to a fall in the relative price of nontradables, assuming that the demand for nontradables increases with disposable income. However, as Edwards (1989) has argued, the first effect is likely to dominate the second effect, and this is generally confirmed by empirical studies.¹⁰

¹⁰ In an important cross-country study, Froot and Rogoff (1991) found that the real exchange rate appreciates more in countries with a high growth rate of government consumption. Égert, Halpern, and MacDonald (2004), Table 5, list ten more papers that find a positive effect of government consumption on the real exchange rate, and only two papers that find a negative effect.



While the relationship between NIR and the real exchange rate is generally ambiguous, it is likely to be positive for Armenia. As Egert (2003) has argued, transition countries that are still in the catch-up process are likely to have a negative steady-state NIR position, as they finance their growth via foreign capital.¹¹ An increase in NIR by means of foreign borrowing is therefore likely to be associated with real exchange rate appreciation in this phase of development. Conversely, countries in a later phase of development that have already reached their desired long-term foreign liability position will need to start servicing their debt, in which case additional increases in NIR would be associated with a real depreciation.

While the terms of trade is also often included in BEER models for small open economies, we did not include it in our regressions for several reasons. The terms of trade is typically measured as the export price index divided by the import price index. Using the Balassa-Samuelson framework, this can also serve as proxy for the difference in tradable prices at home and abroad. Theoretically, the Balassa-Samuelson effect should account for real exchange rate movements that are not explained by shifts in tradables prices. However, in cases of relatively less diversified exports (as in Armenia), the terms of trade is driven by only a few commodity prices, and, therefore, tends to be extremely volatile. Another problem is that it is highly correlated with NIR and therefore distorts the estimation results. Both problems imply that it is very difficult to obtain robust results when the terms of trade is included as a variable. One could argue that the effect of changes in the terms of trade is already captured by the NIR variable.

¹¹ While Egert's arguments are for Net Foreign Assets (NFA), NFA of the Central Bank in Armenia is equivalent to NIR.

Results

Unit root and cointegration tests give evidence of nonstationarity and uniqueness of the estimated cointegrating vectors. Augmented Dickey-Fuller (ADF) unit root tests, presented in Table 1, show that all series are nonstationary in levels and stationary in first differences, implying that it is legitimate to test for cointegration between these variables. Table 2 indicates that a unique cointegrating vector exists between the real exchange rate, the various relative productivity measures, government consumption and NIR.

The estimated cointegration vectors show that all variables are statistically significantly associated with the real effective exchange rate (REER), with the correct expected signs. Various estimated cointegration vectors are shown in Table 3, for different definitions of the relative productivity variable. In all cases, the coefficient sign for NIR is negative, while the signs for government consumption and productivity are positive, as expected.

Like the PPP approach, the results from the BEER approach suggest that the real exchange rate is currently near or possibly slightly above equilibrium. The actual and estimated equilibrium exchange rates are shown in Figure 1, where the error correction term is interpreted as misalignment, i.e., deviation from the long-run equilibrium.

[description of results to be elaborated]

Our BEER results are broadly in line with results for other countries. Reviewing a number of time series and panel studies, Egert (2003) finds that an increase in relative productivity, or the relative productivity differential, is always associated with an appreciation of the real exchange rate. The ratio of government consumption to GDP also appears to be usually positively connected to the real exchange rate, although the evidence on this is less robust. The effect of NIR (or NFA) is more controversial, probably because it depends on the level of development of the country, as argued above.

Just as the PPP-based approach for estimating the equilibrium exchange rate has a number of shortcomings, the BEER approach is subject to various shortcomings as well. First, the sample is quite short. Second, cointegration techniques assume by definition that misalignment is zero on average, because the extent of misalignment is measured by the residual, which is zero by construction. This could be a problem particularly in a short sample. Third, as we have shown, the results depend significantly on whether construction is considered as tradable or nontradable. Finally, even though the results are statistically significant, the standard errors are quite large, implying that the estimated misalignment is not significantly different from zero.¹²

¹² For a discussion of other shortcomings to this approach, see also Maeso-Fernandez, Chiara Osbat, and Bernd Schnatz, 2005, "Pitfalls in estimating equilibrium exchange rates for transition economies," *Economic Systems* 29, p. 130-143.

Table 1. Augmented Dickey-Fuller Unit Root Tests

	Levels		First differences	
	t-statistic	Prob.*	t-statistic	Prob.*
Real effective exchange rate Exogenous: Constant, Linear Trend	0.48	1.00	-3.27	0.09
Real effective exchange rate based on PPI Exogenous: Constant, Linear Trend	-1.14	0.91	-5.56	0.00
Terms of trade Exogenous: Constant, Linear Trend	-2.50	0.33	-4.50	0.01
Net International Reserves Exogenous: Constant, Linear Trend	-2.81	0.20	-3.86	0.03
Government consumption in GDP Exogenous: None	0.06	0.70	-9.38	0.00
Relative productivity (construction in the non-tradable sector) Exogenous: Constant, Linear Trend	-1.69	0.73	-5.41	0.00
Relative productivity (construction in the tradable sector) Exogenous: Constant, Linear Trend	-2.84	0.19	-6.58	0.00
Relative productivity differential (construction in the non-tradable sector) Exogenous: Constant, Linear Trend	-1.62	0.77	-5.39	0.00
Relative productivity differential (construction in the tradable sector) Exogenous: Constant, Linear Trend	-2.89	0.18	-6.57	0.00

*MacKinnon (1996) one-sided p-values.

Table 2. Johansen Cointegration Tests

Sample (adjusted): 1999Q1 2006Q4
 Trend assumption: Linear deterministic trend
 Lags interval (in first differences): 1 to 2
 Unrestricted Cointegration Rank Test (Trace)

Hypothesized number of cointegration equations	Eigenvalue	Trace Statistic	Critical Value	Prob.**
Equation 1				
None *	0.539	57.328	51.873	0.005
At most 1	0.423	32.581	33.116	0.023
At most 2	0.355	14.982	18.071	0.060
At most 3	0.030	0.967	5.412	0.325
Equation 2				
None *	0.531	55.844	51.873	0.007
At most 1	0.431	31.625	33.116	0.031
At most 2	0.326	13.554	18.071	0.096
At most 3	0.029	0.943	5.412	0.331
Equation 3				
None	0.518	47.163	51.873	0.058
At most 1	0.359	23.797	33.116	0.209
At most 2	0.243	9.581	18.071	0.314
At most 3	0.021	0.671	5.412	0.413
Equation 4				
None	0.541	47.094	51.873	0.059
At most 1	0.320	22.179	33.116	0.289
At most 2	0.243	9.821	18.071	0.295
At most 3	0.028	0.901	5.412	0.343

* denotes rejection of the hypothesis at the 0.02 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 2. Johansen Cointegration Tests (continued)

Sample (adjusted): 1999Q1 2006Q4

Trend assumption: Linear deterministic trend

Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized number of cointegration equations	Eigenvalue	Trace Statistic	Critical Value	Prob.**
Equation 5				
None *	0.76	109.00	69.82	0.00
At most 1 *	0.60	62.78	47.86	0.00
At most 2 *	0.54	33.38	29.80	0.02
At most 3	0.23	8.68	15.49	0.40
At most 4	0.00	0.12	3.84	0.73
Equation 6				
None *	0.80	113.28	69.82	0.00
At most 1 *	0.60	62.17	47.86	0.00
At most 2 *	0.53	33.03	29.80	0.02
At most 3	0.24	9.00	15.49	0.37
At most 4	0.01	0.21	3.84	0.65
Equation 7				
None *	0.81	110.19	69.82	0.00
At most 1 *	0.61	57.64	47.86	0.00
At most 2	0.48	27.14	29.80	0.10
At most 3	0.17	6.19	15.49	0.67
At most 4	0.01	0.27	3.84	0.60
Equation 8				
None *	0.79	106.18	69.82	0.00
At most 1 *	0.60	56.34	47.86	0.01
At most 2	0.48	27.28	29.80	0.10
At most 3	0.17	6.60	15.49	0.63
At most 4	0.02	0.78	3.84	0.38

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Table 3. Estimated Cointegration Vectors

Sample: 1999Q1 2006Q4

Number of lags: 2

All variables are in logarithms

Included observations: 32 after adjustments

t-statistics in ()

Dependent variable: Real effective exchange rate

Equation	(1)	(2)	(3)	(4)
Net international reserves	-0.86 (-4.01)	-0.75 (-4.12)	-0.03 (-0.46)	-0.004 (-0.06)
Government consumption in GDP	2.26 (4.58)	2.14 (4.56)	1.07 (5.52)	1.09 (5.89)
Relative productivity (construction in the tradable sector)	2.59 (4.10)			
Relative productivity differential (construction in the tradable sector)		2.47 (4.00)		
Relative productivity (construction in the non-tradable sector)			0.37 (1.35)	
Relative productivity differential (construction in the non-tradable sector)				0.34 (1.56)
Log likelihood	210.77	210.67	207.75	207.58
Akaike information criterion	-10.42	-10.42	-10.23	-10.22
Schwarz criterion	-8.41	-8.40	-8.22	-8.21
Jarque-Bera normality joint test	0.08	0.08	0.13	0.10
Residual serial correlation LM test, 2 lags	0.64	0.60	0.95	0.95

Table 3. Estimated Cointegration Vectors (continued)

Sample: 1999Q1 2006Q4

Number of lags: 3

All variables are in logarithms

Included observations: 32 after adjustments

t-statistics in ()

Dependent variable: Real effective exchange rate

Equation	(5)	(6)	(7)	(8)
PPI-based REER	1.02 (29.68)	1.04 (33.10)	1.02 (16.29)	1.00 (22.19)
Net international reserves	-0.24 (-13.81)	-0.24 (-15.70)	-0.07 (-3.96)	-0.08 (-6.09)
Government consumption in GDP	0.38 (10.91)	0.39 (12.06)	0.30 (4.60)	0.26 (5.55)
Relative productivity (construction in the tradable sector)	0.35 (7.31)			
Relative productivity differential (construction in the tradable sector)		0.40 (8.28)		
Relative productivity (construction in the non-tradable sector)			0.50 (5.91)	
Relative productivity differential (construction in the non-tradable sector)				0.26 (5.43)
Log likelihood	325.13	328.72	322.46	319.88
Akaike information criterion	-14.70	-14.92	-14.53	-14.37
Schwarz criterion	-10.57	-10.80	-10.41	-10.25
Jarque-Bera normality joint test	0.00	0.00	0.00	0.00
Residual serial correlation LM test, 2 lags	0.44	0.37	0.77	0.77

Figure 1. Estimated Misalignment

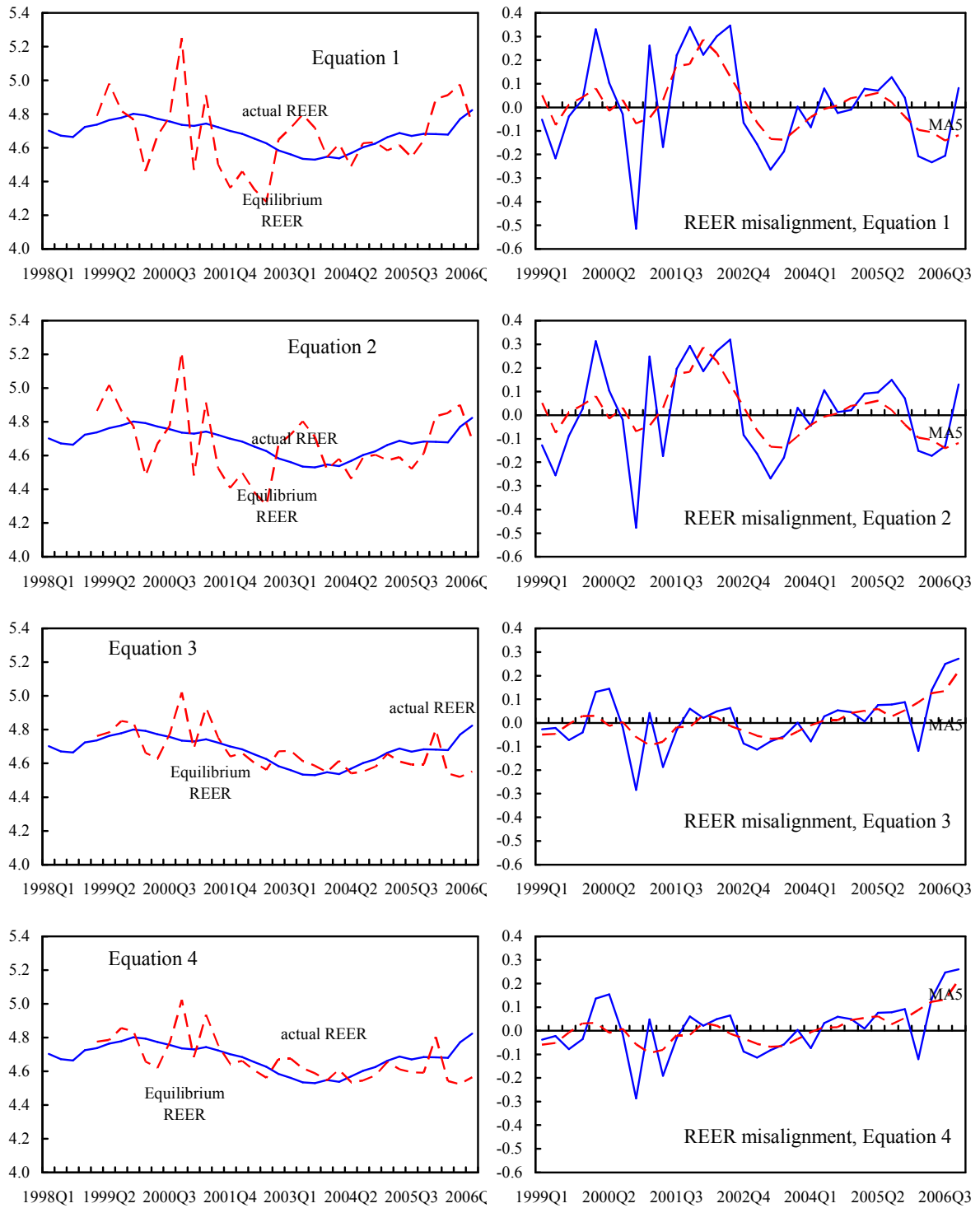
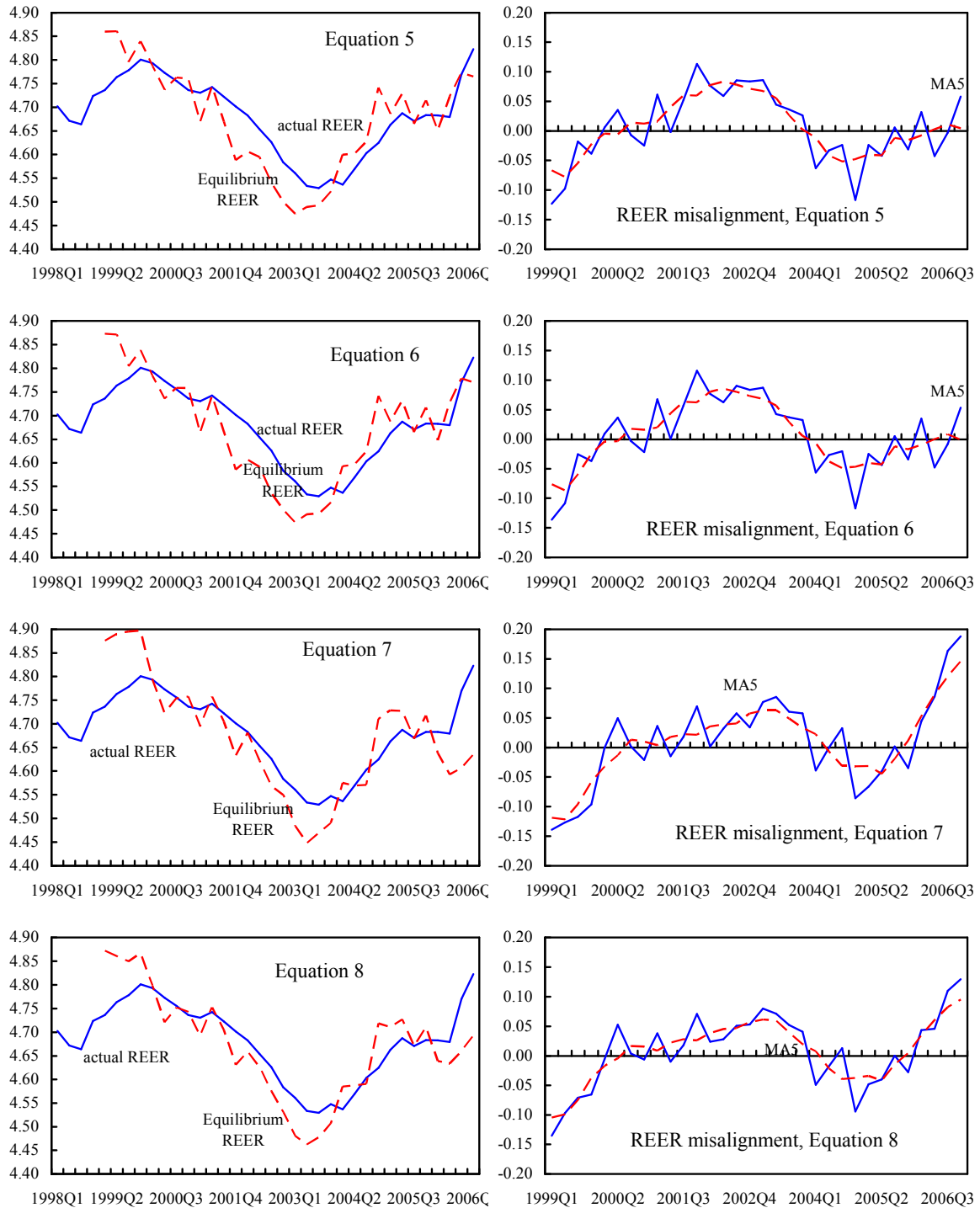


Figure 1. Estimated Misalignment (continued)



C. External Sustainability (ES) Approach

The ES approach focuses on the relation between the sustainability of a country's external stock position, its current account position, and the real exchange rate. The approach consists of a simple calibration exercise that requires only a few assumptions about the economy's potential growth rate, inflation rate, and rates of return on external assets and liabilities.

The ES approach consists of three steps:

1. Determine the trade or current account balance as ratios to GDP that stabilize the net foreign asset position at a given benchmark level;
2. Compare these NFA-stabilizing trade or current account balance ratios with the level of a country's trade or current account balance expected to prevail over the medium term;
3. Assess the adjustment in the real effective exchange rate that is needed to close the gap between medium-term balances and the NFA-stabilizing balances.

The external sustainability of an open economy requires that the intertemporal budget constraint of that economy is satisfied—i.e., the present value of future trade surpluses has to be sufficient to pay back all the outstanding external liabilities of the economy as a whole. One simple way to satisfy the intertemporal budget constraint is to have a stable ratio between net foreign assets and the size of the economy. This is analogous to approaches to debt sustainability which require the stabilization of the public debt-to-GDP ratio at a certain level.

To determine what is required to stabilize the NFA-to-GDP ratio at a benchmark level, the accumulation equation for NFA can be used:

$$(1) \ NFA_t - NFA_{t-1} = CA_t + KG_t + KT_t + E_t,$$

where CA_t is the current account balance, KG_t are capital gains from valuation changes, KT_t are capital transfers, and E_t errors and omissions. Denoting ratios to GDP by lower-case letters, equation (1) above becomes:

$$nfa_t - nfa_{t-1} = ca_t + kg_t + kt_t + e_t - \frac{g_t + \pi_t}{(1 + g_t)(1 + \pi_t)} nfa_{t-1},$$

where g_t is the growth rate of real GDP and π_t is the inflation rate of net foreign assets. Assuming that capital gains and errors and omissions have average zero over long periods, the stabilization of the NFA ratio to GDP at a benchmark level nfa^s implies

$$(2) \ ca^s = \frac{g + \pi}{(1 + g)(1 + \pi)} nfa^s - kt^s$$

Equation (2) determines the current account balance as a ratio of GDP that stabilizes the NFA position. It is analogous to the determination of the primary surplus that stabilizes the public debt-to-GDP ratio.

Some important implications of the ES approach can be seen from equation (2). First, the faster a debtor economy ($nfa < 0$) grows the larger the current account deficit it can run without increasing the ratio of NFA to GDP. This observation is specially important for Armenia, which has been growing at double digits in recent years and therefore can afford having large current account deficits while keeping the sustainability of its external position.

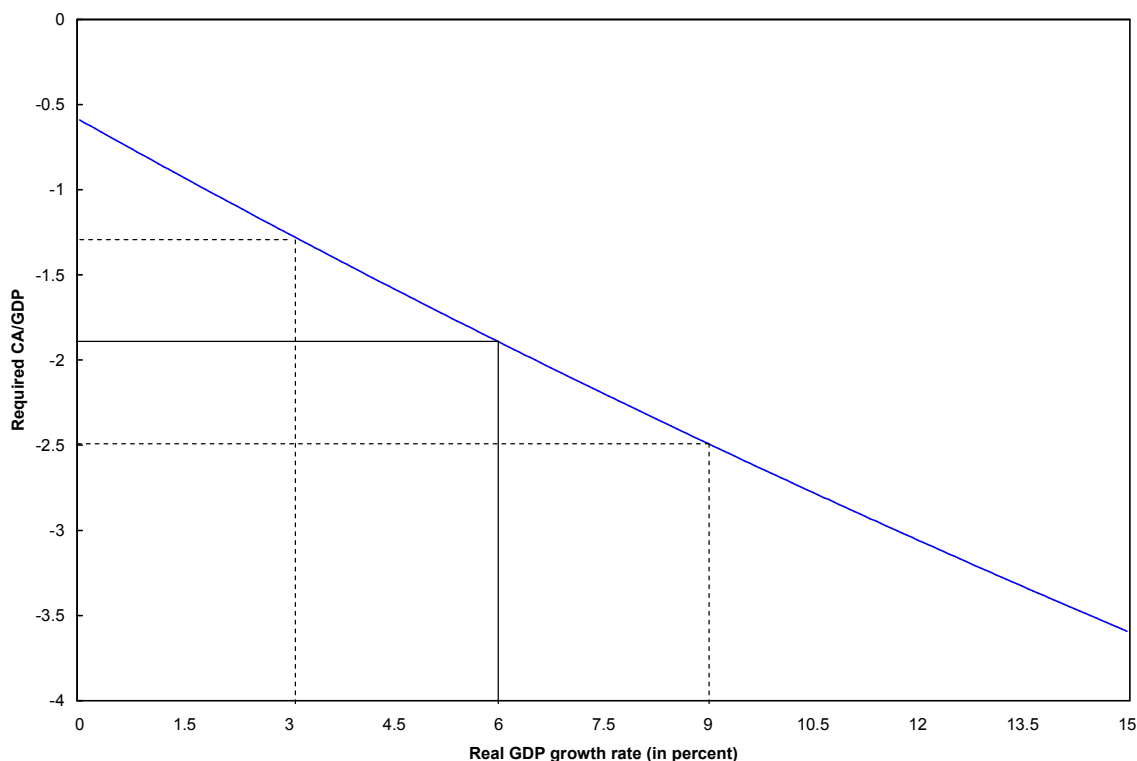
Second, larger capital transfers imply that further current account deficits can occur with a stable NFA-to-GDP ratio. The typical approach found in the literature is to assume that capital transfers as shares of GDP are null ($kt^s = 0$). Indeed, it is natural to assume that capital transfers will eventually converge to zero. But this convergence may be very slow implying that it is realistic to assume that current account deficits will be partly financed by capital transfers for the foreseeable future. In this paper we calibrate equation (2) first assuming $kt^s = 0$, and then assuming a value for kt^s that is consistent with medium term forecasts for capital transfers.

The choice of the NFA-to-GDP ratio benchmark is a key element of the ES approach but is, to some extent, arbitrary. One possibility use the most recent NFA position (provided this can be considered a sustainable external position). A more elaborate approach could consider econometric evidence of the long-run relation between NFA and underlying fundamentals such as the relative level of development, fiscal policy and demographics (Lane and Milesi-Ferretti, 2005). For now, we use the NFA-to-GDP position as of end-2006: -24.2 percent.

The inflation rate of NFA is assumed to be 2.5 percent, consistent with the latest IMF projections for the U.S. inflation rate [note: this may have been revised]. Armenia's potential GDP growth rate was calibrated at 6 percent, consistent with IMF's medium-term growth projections. However, because results are somewhat sensitive to the growth rate assumption, we also assumed two alternative scenarios: low growth, with a growth rate of 3 percent (close to that observed in 1999); and high growth, with growth rate of 9 percent (close to the 2 digit growth rates of recent years). For each of the scenarios, the current account deficit required to stabilize the NFA-to-GDP ratio is shown below:

- Benchmark growth scenario ($g=6\%$) $\Rightarrow ca^s = -1.9\%$
- Low growth scenario ($g=3\%$) $\Rightarrow ca^s = -1.3\%$
- High growth scenario ($g=9\%$) $\Rightarrow ca^s = -2.5\%$

The figure below shows the results in a graph, which also depicts what would be the required current account deficit for each possible GDP growth rate in the range 0-15%.



The last step of the ES approach is to derive the required medium-term real effective exchange rate adjustment that is needed to bring the current account balance to the NFA-stabilizing current account balance. The magnitude of the required exchange rate adjustment is obtained by first computing the elasticity of the current account balance to the real exchange rate,

$$\varepsilon_{CA} = \varepsilon_X \frac{X}{GDP} + (\varepsilon_M - 1) \frac{M}{GDP},$$

where ε_X and ε_M are the elasticities of exports and imports to the real exchange, and X/GDP and M/GDP are the ratios of exports and imports to GDP, respectively. Once ε_{CA} is computed, the required real exchange rate adjustment can be obtained as follows.

$$\varepsilon_{CA} = \frac{\Delta CA/CA}{\Delta RER/RER} \Rightarrow \frac{\Delta RER}{RER} = \frac{\Delta CA}{CA} \frac{1}{\varepsilon_{CA}}$$

The trade elasticities were calibrated at $\varepsilon_X = -0.71$ and $\varepsilon_M = 0.92$, following the values used by the Consultative Group on Exchange Rate Issues (CGER). [Note: CBA estimates of those elasticities to be obtained] The export and import ratios to GDP were calibrated with both end-2006 and end-2007 figures. The result is depicted in the table below.

Required REER adjustment		
	2006	2007
Benchmark growth ($g = 6\%$)	-0.6	10.7
Low growth scenario ($g = 3\%$)	3.1	12.0
High growth scenario ($g = 9\%$)	-4.3	9.5

Like the other two approaches, the ES approach indicates that the real exchange rate is no longer undervalued, and may possibly even have been overvalued in 2007. In 2006, the benchmark growth and high growth scenarios indicate undervaluation, while the low growth scenario indicates overvaluation. In 2007, however, all three scenarios suggest an exchange rate overvaluation of around 10 percent. While the exact numbers of overvaluation and undervaluation may be questioned on the grounds of their sensitivity to parameter choice, the trend is undeniable and is not affected by the exact calibration choice.

Like the other two approaches, the ES approach has shortcomings as well. First, the choice of parameter values, including the NFA-to-GDP ratio benchmark, is mostly subjective. Second, the results are quite sensitive to these parametric assumptions.

III. EXCHANGE RATE PASS-THROUGH AND DOMESTIC COMPETITION

Domestic competition can encourage innovation and enhance productivity, thereby strengthening competitiveness and promoting growth. When tradables goods markets are competitive, one would expect that changes in international prices would pass-through to domestic prices. Therefore, the degree of exchange rate pass-through to domestic prices can serve as an indicator of the degree of competitiveness.

In Armenia, there is widespread anecdotal evidence of monopolistic practices in some key import sectors, such as sugar, fuel, and cement. If monopolistic practices are indeed significant, the pass-through of movements in the nominal exchange rate to import prices should be affected—in particular, an exchange rate appreciation is not expected to translate into a decrease in import price as much in monopolistic markets as it would in competitive markets. This section studies the pass-through of exchange rate movements to import prices in Armenia. In order to assess whether exchange rate appreciations have a different impact on import prices than depreciations, the estimation will take into account the possibility of asymmetric responses.

The estimations also permit an assessment of the extent to which the prolonged appreciation of the dram in recent years has helped reduce domestic inflation. From a policy perspective, understanding the price impact of movements in the exchange rate is critical to determine the proper monetary policy response. This issue is particularly important for Armenia given the intention to move towards a full-fledge inflation targeting regime, which would involve transparent communication with the public on the determinants and dynamics of inflation.

A. Methodology

The methodology employed loosely follows the vector autoregressive (VAR) model by McCarthy (2007).¹³ Monthly data is used for 2000:5-2007:8 so as to focus on the post-stabilization and post-Russia crisis years. The VAR specification has five endogenous variables: price of oil in domestic currency (p_t^{oil}), output gap¹⁴ (y_t^{gap}), nominal effective exchange rate (e_t), and import prices (pm_t). Variables are expressed in first differences to guarantee stationarity and are expressed in natural logs (except for the output gap which is already stationary and can be negative). The VAR representation is given by

$$X_t = A(L)X_{t-1} + \varepsilon_t,$$

where $A(L)$ is the matrix of coefficients, ε_t is the vector of innovations, and X_t is the vector of endogenous variables, which is ordered as follows:

$$X_t = \left[\Delta p_t^{oil} \quad y_t^{gap} \quad \Delta e_t^+ \quad \Delta e_t^- \quad \Delta pm_t \right]'$$

To assess whether appreciations and depreciations have different effects on imports, instead of considering the vector of exchange rate changes we split exchange rate movements in two vectors, one with exchange rate depreciations and the other with exchange rate appreciations, as follows:

For each period t ,

- (1) if $\Delta e_t \geq 0$ then $\Delta e_t^+ = \Delta e_t$ and $\Delta e_t^- = 0$;
- (2) if instead $\Delta e_t < 0$ then $\Delta e_t^+ = 0$ and $\Delta e_t^- = \Delta e_t$.

In words, shocks to the vector Δe_t^+ capture the effect of depreciations on import prices, while shocks to Δe_t^- capture the effect of appreciations.¹⁵ Therefore, any differences in the estimated coefficients of these variables in the import price equation of the VAR will indicate

¹³ An extended, working paper version was issued as McCarthy (1999). Variations of the methodology have been extensively used in the pass-through literature. See, for instance, Ca' Zorzi et al. (2007) for estimations for 12 emerging markets, Rabanal (2005) for the case of Egypt, Belaisch (2003) for Brazil, Billmeier and Bonato (2002) for Croatia, Bhundia (2002) for South Africa, and Leigh and Rossi (2002) for Turkey.

¹⁴ The output gap is created by taking the deviations of the log of real GDP (approximated by the industrial production index) from the series smoothed by the Hodrick-Prescott filter.

¹⁵ Results are robust to the change in the ordering of Δe_t^+ and Δe_t^- .

that import prices respond asymmetrically to positive and negative shocks on the exchange rate.

The rationale for the other variables in the model and their ordering is the following. Oil price identifies supply shocks, while output gap identifies demand shocks. The exchange rate is therefore allowed to respond contemporaneously to supply and demand shocks. The import price index responds contemporaneously not only to supply and demand shocks, but also to exchange rate shocks.

Once this system of equations is estimated, the pass-through level is measured as the ratio of cumulative responses of the price level and the exchange rate j periods after the exchange rate shock:

$$PT_j = P_j / E_j,$$

where P_j and E_j are the cumulative responses of the price level and the exchange rate j periods after the shock, respectively. For example, if 3 months after the shocks the nominal exchange rate has depreciated by 5 percent and the price level has increased 2 percent, the pass-through level at $j=3$ is 40 percent. Note that, given the structure of our VAR, the pass-through to import prices of both exchange depreciations and appreciations can be computed separately.

In order to assess the time the effect of exchange rate shocks takes to build up in import prices, the pass-through speed is computed as the ratio between the pass-through level at horizon j and the long-run pass-through level, which is assumed to be the level of pass-through 24 months after the shock:

$$SPEED_j = P_j / P_{24}.$$

B. Results

Figure XX shows the estimated impulse responses of import prices to both an appreciation and a depreciation of the nominal effective exchange rate. It is clear that the magnitude of import price responses is much larger for exchange rate depreciations than for appreciations. Furthermore, only the responses to exchange rate depreciations are statistically significant.

Figures XXX and XXXX show, respectively, the exchange rate pass-through and its speed, which are computed from the accumulated responses of the import price. The first figure clearly shows that the exchange rate pass-through is much larger for depreciations than for appreciations: the passthrough for depreciations is about three times larger than that for appreciations. In terms of speed, the adjustment in import prices to both appreciation and depreciation last about 3 months.

Figure XX. Impulse Responses of Import Prices to NEER Shocks

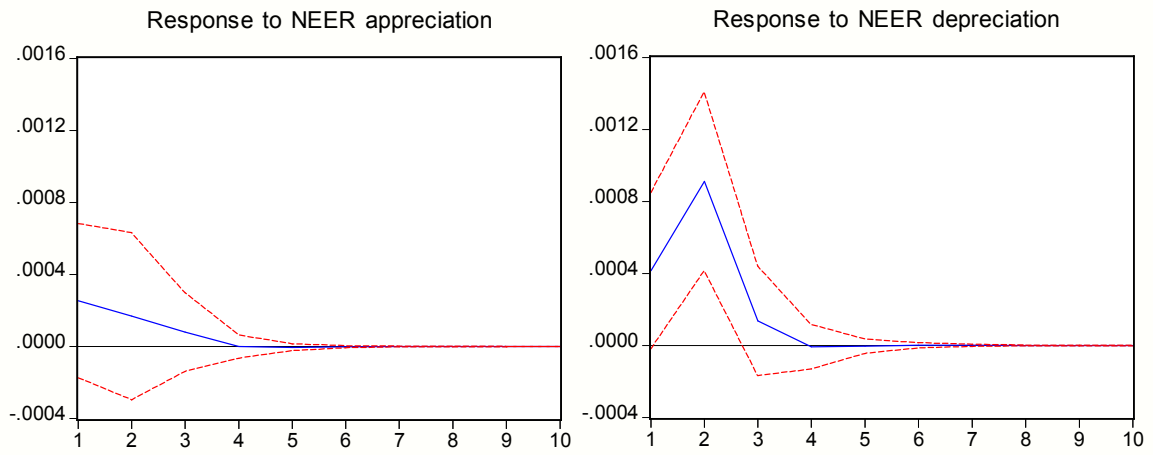
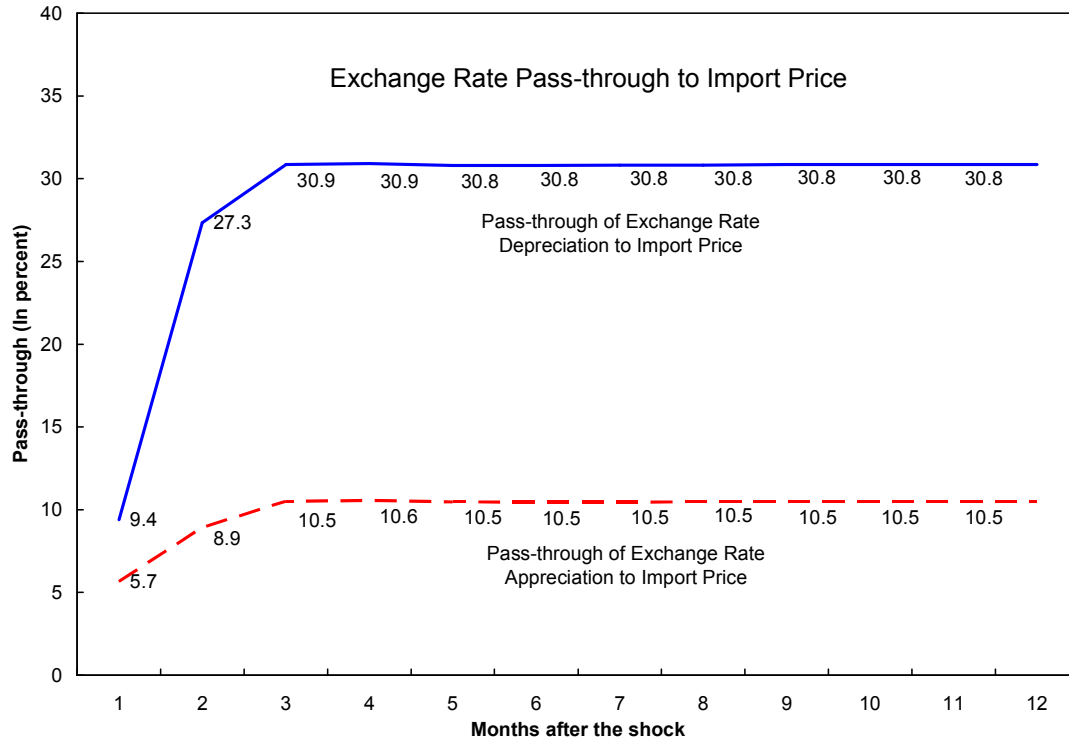
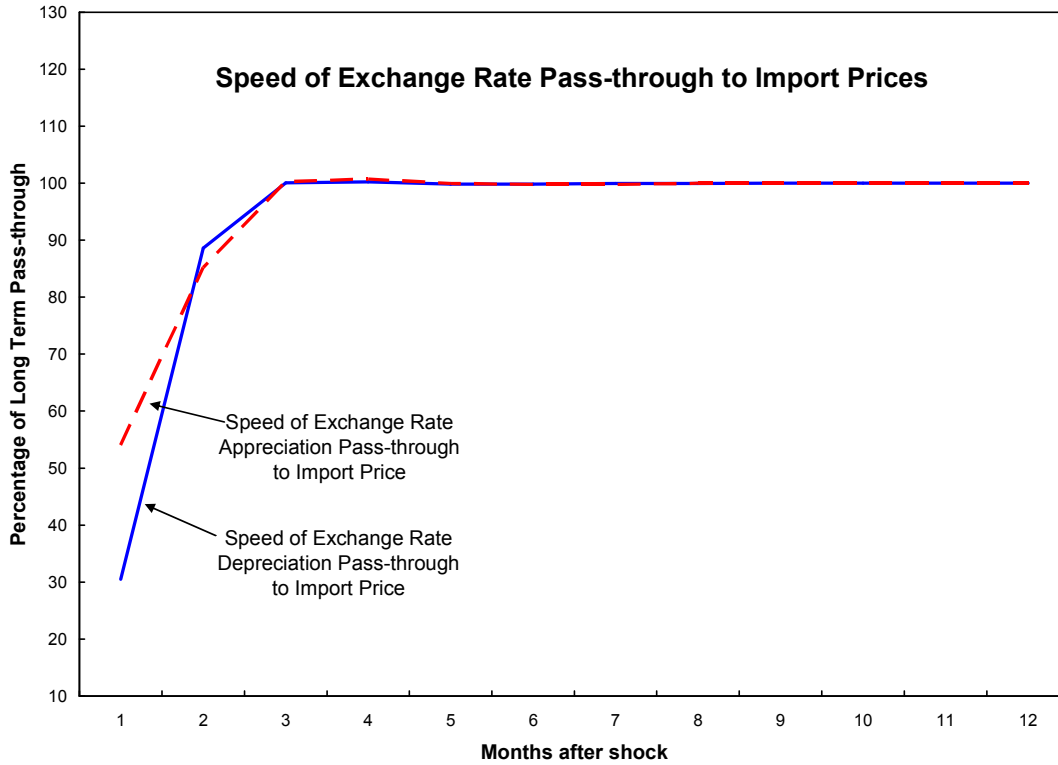
Response to Cholesky One S.D. Innovations ± 2 S.E.

Figure XXX. Exchange Rate Pass-through to Import Prices



Source: Author's calculations

Figure XXXX. Speed of Exchange Rate Pass-through to Import Prices



Source: Author's calculations

Importantly, the asymmetric pass-through uncovered by our estimations above suggest that there is significant downward rigidity in import prices in response to exchange rate movements. The asymmetry cannot be reasonably explained by transportation costs. A more coherent explanation is that it results from monopolistic practices in the import sector in Armenia, which is able to increase prices as the exchange rate depreciates and maintain prices high when the exchange rate appreciates. In particular, the results imply that appreciations have a limited role in helping contain inflationary pressures, and that innovation, productivity and growth are limited by lack of competition.

IV. CONCLUSIONS

This paper has evaluated the competitiveness of the Armenian economy following the recent dramatic appreciation of the Armenian dram. We first assessed the equilibrium real exchange rate level by means of three different methods: the purchasing power parity (PPP) approach, the behavioral equilibrium exchange rate (BEER) approach, and the external sustainability approach. We then estimated the degree of exchange rate pass-through to import prices, allowing for possible asymmetric effects.

All three assessments of the equilibrium exchange rate indicate that the real exchange rate is no longer undervalued, and may possibly even have become overvalued in 2007. Recent rapid nominal appreciation has clearly reduced or removed any existing most or all of this undervaluation and has brought the real exchange rate near or just above equilibrium.

Our pass-through estimates suggested that there is significant downward rigidity in import prices in response to exchange rate movements, indicating a possible lack of competition between importers. In particular, we find a significantly higher pass-through for exchange rate depreciations (about 31 percent) than for appreciations (10 percent), suggesting that prices are raised more easily in response to depreciations than they are lowered in response to appreciations. Such asymmetric rigidities indicate that there is insufficient competition between importers.

We conclude that safeguarding competitiveness in the context of dramatic dram appreciation calls for a more determined approach to structural reforms so as to improve the business environment, raise productivity, and contain inflationary pressures. Securing productivity gains will require further improving tax and customs administration, deepening financial intermediation, reducing corruption, and, more generally, ensuring that there is fair and equal treatment for all businesses. Policies to boost domestic competition and remove barriers to entry would raise the pass-through and could enhance productivity as well, by encouraging innovation. In addition, discontinuing monopolistic practices in the import sector would allow consumers to benefit from dram appreciation in the form of lower import prices.

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