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PRODUCT, MONEY, AND FOREIGN EXCHANGE MARKET DISEQUILIBRIA AND INFLATION IN UZBEKISTAN DURING THE PERIOD 1994–2000

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In this study a macroeconomic framework is developed and applied ascertaining the influence of domestic disequilibria and external shocks on inflation dynamics in Uzbekistan. Using quarterly data for the period 1994:Q1 to 2000:Q3, several long-run relationships are estimated for goods, money, and foreign exchange markets of Uzbekistan, which are characterised by multiple exchange rates, import restrictions, and other domestic administrative controls. The empirical estimates, which use error-correction mechanisms for different markets, show that domestic monetary and output developments, and changes in the official exchange rate vis-à-vis the parallel market rate have had a significant influence on the short-run behaviour of the foreign exchange market in Uzbekistan. Furthermore, disequilibria in the product and money markets are the major forces driving short-run inflation dynamics. It should be noted that the study has been constrained by both the quantity and the quality of quarterly data available on the Uzbek economy.

Keywords: inflation dynamics, demand for money, output gaps, Uzbekistan

JEL classification index: E31, E43, E5, P24

The objective of the study is to develop and apply a macroeconomic framework to explain inflation dynamics in Uzbekistan. The main approach underlying the study is to determine the relative roles that domestic disequilibria and external shocks played on the behaviour of inflation. Given this background, using quarterly data for the period 1994:Q1 to 2000:Q3, the study estimates several "long-run" relationships for the goods, foreign exchange, and money markets of Uzbekistan. In this context, it is noteworthy that the foreign exchange markets of the country are characterised by multiple exchange rates, import restrictions, and other domestic administrative controls. The empirical estimates, which rely on error-correction mechanisms for different markets, show that domestic monetary and output developments, and changes in the relationship between the curb market and official exchange rates have had a significant influence on the foreign

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exchange market dynamics in Uzbekistan. Furthermore, the results of the study suggest that disequilibria in the product and money markets are the major forces driving inflation dynamics in Uzbekistan. While disequilibria in the parallel market themselves do not seem to be a factor in price increase, the ratio of the curb market exchange rate to the official rate seems to exert a significant influence. One can infer that an important consideration here is the speed and the magnitude of adjustment of the official exchange rate in the face of disequilibria in the parallel market for foreign exchange.

The macroeconomic framework underlying the analysis assumes that Uzbekistan economy is "small" relative to the rest of the world.[1] Thus terms of trade shocks and effects of international financial flows pass through to the economy mainly via the exchange rate, especially the parallel market rate. The financial system is dominated by state-owned banks, which are operating under fixed interest rates, administratively determined exchange rates (both the official and commercial bank rates, until May 2000), and have limited access to financial assets for investment. Given these considerations, we specify a model that attempts to capture the long-run behaviour of money, foreign exchange and goods markets. We then use the long-run equations to analyse the impact of market disequilibria on the dynamic behaviour of money, exchange rate and prices.[2]

The paper is organised as follows. Section 1 starts with a comparative analysis of the inflation and stabilisation experiences of a number of transition economies. Providing the setting for the economic relationships considered in the study, section 2 gives a brief description of the recent developments in Uzbekistan's economy. Section 3 is devoted to the presentation of the long-run relationships for each of the markets: money market, foreign exchange market, and goods market. Time series properties of the variables used in the study are presented in section 4 followed by empirical estimates of the equations in section 5. Section 6 contains a number of concluding remarks. *Tables* and *Figures* are included at the end of the paper.

1. INFLATION AND STABILISATION IN TRANSITION ECONOMIES

A comparative study of inflation and stabilisation in Eastern Europe (Fischer and Sahay 2000) revealed that most countries entered the transition process with a monetary overhang and the urgent need for price liberalisation. Stabilisation packages were introduced in 25 countries by the year 1995. The extent of the mon-

[1] This is the familiar small-country assumption.
[2] For this purpose, an error-correction formulation is used.

etary overhang and the timing (delays) of the initiation of a stabilisation programme had an effect on the extent of pre-stabilisation inflation, which varied from 57 000% per annum in Georgia to 26% in Hungary (*Table 1*).

It appears that inflation stabilisation was one of the key successes of the transition process. At the time of liberalising prices, countries were concerned with possibilities of inflation spirals and ever-rising wage demands. Taking these concerns into account, most stabilisation programmes included tight monetary and credit policies, wage controls, and policies for non-inflationary sources of financing the budget deficits.

By the year 2001, inflation had been brought down to single digits, except in the cases of Belarus, Romania, Russia, Tajikistan, Turkmenistan, and Uzbekistan. An important consideration in the initial stabilisation strategy was the choice of exchange rate regime. The Central and Eastern European Countries (CEECs) and the Baltics chose a mix of fixed regimes (Croatia, the Czech Republic, Estonia, Hungary, Poland, and Slovakia) or flexible regimes (Albania, Bulgaria, Macedonia FYR, Latvia, Lithuania, Romania, and Slovenia). Apparently, countries with a currency board (i.e., Bulgaria, Estonia, and Lithuania) have had impressive inflation control performances.

Although many former Soviet Union countries (FSU) had announced their regimes as flexible, most were actually pegged to the US dollar or the Deutsche Mark after the commencement of the stabilisation programme. Several countries introduced monetary reforms and new currencies. With the exchange rates explicitly or implicitly fixed, there was a rapid decline in inflation towards the later part of the 1990s.

In recent times, most countries have moved to a flexible exchange rate regime. The move from pegs to more flexible regimes had been prompted, among other things, by considerations of easing the pressure on exchange rates. The case of Russia demonstrates the dangers of not exiting to a more flexible regime in time in the backdrop of unsustainable fiscal policies and high capital mobility.

Uzbekistan launched a comprehensive stabilisation and structural reform programme in late 1994. However, the country seems to have adopted a somewhat different approach than most FSU countries. In early 1997, the progress in liberalising the foreign exchange and trade regime was reversed and a system of multiple exchange rates and restrictions on current account transactions was introduced with the objective of promoting import-substituting industries and conserving foreign exchange reserves. In the current study, we give explicit consideration to the exchange rate regime, the money market conditions, and the output gaps that jointly determined the inflation experience of Uzbekistan. In the following section, we begin with a brief analysis of the overall developments and policy approaches of Uzbekistan.

2. RECENT DEVELOPMENTS IN THE UZBEK ECONOMY

Since its independence in 1991, Uzbekistan, a successor state of the FSU in Central Asia, has followed a unique path to economic transition. At the time of independence, the country's relatively rich resource endowment, low degree of over-industrialisation and trade dependence, large share of agriculture in aggregate output, and the predominance of cotton and other raw materials in exports indicated a transition path to a market-based system relatively smoother than for other FSU countries. However, rather than emphasising economic growth, the government has sought to promote stability. This goal was pursued by subsidising employment, controlling prices on essential items, privatising large enterprises gradually, and attempting to attain self-sufficiency in energy and food supplies. Although no clear characterisation of this strategy exists, it could be broadly considered as some form of gradualism to economic transition.

The transition process in Uzbekistan has so far been rather uneven (Alam and Banerji 2000; Spechler 2000; World Bank 1999) and can be described as a case of stop-go on transition reforms. In this respect, beginning in early 1992, Uzbekistan has evolved through *three different transition phases*, varying in terms of macroeconomic policies followed by the government, progress made in the implementation of market-oriented reforms, and stability of the macroeconomic situation:

– During the first phase, from 1992 to 1993, the government seemed to have followed rather loose macroeconomic policies, the implementation of market-oriented reforms was slow and limited in scope, and macroeconomic imbalances inherited from the FSU deteriorated markedly.
– During the second phase, from early 1994 to the 3rd quarter of 1996, macroeconomic performance improved considerably, perhaps as a result of tightening financial policies and the acceleration of many market-oriented reforms.
– The third phase, from the 4th quarter of 1996 to the present, is characterised by occasional loosening of macroeconomic policies, a reversal of some key reforms while maintaining sustained progress in others, and the worsening of external imbalances. The macroeconomic situation continued to be difficult during the year 2000 as a result of low gold prices, large debt-service payments, and the overvalued exchange rate system. Nevertheless, on 1 May 2000, the official and commercial bank's foreign exchange rates against the US dollar were unified at the level of the commercial bank rate, which reduced the spread between the new official rate and the curb market rate. In the year 2000, high interest payments led to a marginal deterioration in current account of balance of payments in spite of a marginal improvement in trade balance. A drop in tax revenues and an increase in current expenditures led to a deterioration in the budget deficit.

3. LONG-RUN RELATIONSHIPS

The long-run relationships in the product, money, and foreign exchange markets are considered in the backdrop of the "gradualist" transition path followed by Uzbekistan, the country essentially remaining a rather "controlled" economy.

3.1. The money market

The money market equation attempts to incorporate a number of important characteristics of Uzbekistan's financial system: i.e., severely limited scope of markets, instruments confined to money, real assets, and foreign exchange, fixed nominal interest rates under high inflation conditions, and substantial influence exerted on the degree of asset substitution by parallel market exchange rate. The long-run money demand for Uzbekistan can be specified as follows:[3]

$$M = a * y^b * PAR^c * P^d \tag{1}$$

where M is nominal money supply; y is real GDP; PAR is parallel market exchange rate; and P is domestic price level. The parameters $a, b, c, d > 0$.

Taking logarithms, we can write the real demand for money as[4]

$$M–P = a + b * y – c * PAR \tag{2}$$

3.2. Foreign exchange market

To develop a market-clearing model for foreign exchange, two equations related to supply and demand are postulated. On the supply side, exports, foreign borrowing and changes in external reserves are important elements. On the demand side, the important components are imports and currency substitution. Imports depend on the level of domestic expenditures (absorption) and the real exchange rate, while the demand for currency substitution can be depicted as a function of excess money supply.

Assuming that the long-run excess money supply is equal to zero (that is, $M^s – M^d = 0$), the equilibrium condition for the foreign exchange market can be written as follows:

[3] In the empirical work of this study, the parallel market exchange rate is expressed in terms of local currency units per USD.

[4] This specification assumes homogeneity between money and prices ($d = 1$).

$$fex = a_1 - b_1 * rer + b_2 * rde \quad (3)$$

where the parameters $b_1, b_2 > 0$; *fex* is foreign exchange supply (demand); *rer* is real exchange rate; and *rde* is real domestic expenditures.

In principle, this equation can be written in terms of the logarithm of the nominal exchange rate by incorporating appropriate relative price terms (as proxies for the real exchange rate). Thus, with all lower case variables in logarithms, we have:

$$par = a_2 - b_3 * fex + b_4 * rde + b_5 * pd - b_6 * pm \quad (4)$$

where *pd* is domestic price level; and *pm* is international prices (proxied by the import price index). Coefficients $b_3, b_4, b_5, b_6 > 0$.

During the period of analysis (1994–2000), Uzbekistan maintained extensive foreign exchange and trade controls that aimed at preserving foreign exchange for servicing the country's external debt obligations. The multiple official exchange rates (official and commercial bank rates) remained at substantially appreciated levels, as a consequence of which demand for foreign exchange at the official rate exceeded supply considerably. The unmet demand for foreign exchange for both current and capital transactions was channelled to the parallel market, exerting considerable pressure on the parallel market premium. Since the public sector is officially barred from utilising the parallel market, it is clear that the parallel market premium does not reflect the unmet foreign exchange demands of the public sector. The gap between the observed parallel market exchange rate and the unrestricted equilibrium exchange rate (which is unobserved in the present case) can be considered as a measure of the degree of restrictions on public sector import demand that is excluded from the parallel market in the current administrative set-up.

3.3. The goods market

Following the expectations-augmented version of the Phillips curve, inflationary expectations and the departure of output from its potential level determine the inflation rate. In this formulation, if output (demand) is higher than the potential level, inflation will tend to rise, and if actual output is below potential, inflation will tend to fall[5]. One implication of the formulation is that in the steady state

[5] It is probably correct to say that the Phillips-curve approach is a central element in most models of inflation (Nickell 1988; Masson, Symansky, and Meredith 1990; Chadha, Masson, and Meredith 1992).

inflation (where the output gap is zero) will tend to remain constant.[6] In addition, taking explicit note of imbalances in the money and foreign exchange markets, the basic model can be written as follows:

$$\Delta\Pi_t = a_4 + \sum_{i=0}^{\Omega} \beta_{4i}{}^{*} YGAP_{t-1} + \sum_{i=0}^{\Omega} \lambda_{4i}{}^{*} MGAP_{t-1} + \sum_{i=0}^{\Omega} \gamma_{4i}{}^{*} ERGAP_{t-1} + e_{4t} \qquad (5)$$

where $\Pi_t = (CPI/CPI_{(t-1)}-1)$ – change in the Consumer Price Index;
$YGAP_t = (RGDP_t - TRGDP_t) / TRGDP_t$;
TRGDP – Potential real GDP;
RGDP – Real GDP;
$MGAP = (M_t - TM_t) / TM_t$;
MGAP – money market gap in terms of deviations from an "equilibrium" money supply (*TM*);
$ERGAP = (ER_t - TER_t) / TER_t$;
ERGAP – the exchange rate gap in terms of a deviation from an "equilibrium" rate (*TER*); and
e_t – a stochastic disturbance term.

Note that the parameters β_{1i} indicate the percentage change in inflation that can be attributable to a one-percent change in the output gap (i.e. the semi-elasticity of inflation with respect to the output gap for various past years).

4. CHARACTERISTICS OF THE TIME SERIES USED

All data used in the study were assembled from various official publications. These include publications of the State Committee for Statistics, IMF (including International Financial Statistics), EBRD, UNDP, and the World Bank.

The properties of the time series included in the study are investigated using the Phillips–Perron (1988) (PP) and ADF tests. Both the PP and ADF tests indi-

[6] In standard macroeconomics (for example, see Dornbusch and Fischer 1994) the inflation rate and the level of output are determined by the interaction of aggregate demand and supply. In the long-run, i.e., in the steady state (where the growth rate of money is assumed to be constant, expectations have adjusted to actual inflation, and where output and inflation are constant, and output is at full-employment level), the inflation rate is determined only by the growth rate of money. In the real world, an economy probably never reaches a steady state with internal and external shocks to both supply and demand moving it in unexpected directions. In the short-run, changes in the growth of money, government spending and/or taxes could cause changes in both aggregate demand and inflation. In the dynamic case, aggregate demand also depends on lagged output.

cated that all the series were non-stationary in "levels" (for saving space, these results were not reported, but are available on request) irrespective of whether raw data or logarithms of the data were considered. However, almost all the variables proved to be difference stationary, except for the quarterly series on the official exchange rate, which turned out to be stationary after the second difference.

The PP and ADF tests for the first differences of the data are reported in *Table 2*.[7]

5. EMPIRICAL ESTIMATES[8]

For empirical validation of the model, following the Engle–Granger (1987) two-step procedure, long-run behavioural equations for the money, foreign exchange, and product markets are estimated first. Cointegrating vectors identified in this process are then used to formulate error-correction models (ECM) for estimating the short-run dynamics in each of the markets. Finally, the short-run adjustments in the different markets are put together to explain inflation dynamics.

5.1. Demand for money

The results of estimation of one of several variants of the long-run demand for money using quarterly data for the period 1994:Q1 to 2000:Q3 are given in *Figure 1*, which shows the actual and fitted values of the dependent variable (log of real money balances) and the distribution of the residuals. These results suggest that production has a positive effect on the demand for real balances and that the coefficient is significant at the 1% level, the real output variable being approximated by a Hodrick–Prescott filter. The currency substitution effect is captured more appropriately by the ratio of the curb market rate to the official exchange rate. The higher the curb market rate in relation to the official rate (that is, the higher the parallel market premium), the lower the demand for domestic real balances, as the agents are shifting away from the relatively lower returns associated with domestic money (i.e., negative real interest rates). These results are not substantially affected by the inclusion or exclusion of dummy variables that are intended to capture seasonal factors.[9]

[7] Unit root tests for the levels of variables have not been reported here to save space. These are available directly from the author.

[8] The results are reported in graphical form at the end of this paper. The detailed results are available from the author.

[9] The equation including the seasonal dummies is available on request directly from the author.

5.2. "Equilibrium" exchange rate

Due to the lack of national accounts expenditure data on a quarterly basis for the entire period of the study, a variable for domestic demand (absorption) could not be included in the analysis. The closest proxy was conceived to be gross domestic expenditure (equivalent to GDP). While domestic demand (absorption) would be expected to exert an upward pressure on the parallel market exchange rate, GDP (or its expenditure version) could be expected to have a negative effect – a supply-side effect.

The results for estimates of equation (4) are shown in *Figure 2,* suggesting a fairly strong relationship among the parallel market exchange rate, CPI (the proxy for domestic prices), production, and foreign exchange availability. Domestic production (expenditure) seems to have had a strong negative influence on the curb market exchange rate. This suggests that domestic production of import substitutes may have dampened the demand for imports, thus reducing relatively the pressure on the curb market exchange rate. At the same time, domestic prices (as proxied by CPI) seems to have exerted a strong upward pressure on the curb market exchange rate with the current level of the CPI being highly significant in explaining the variations in the ratio of curb market to official exchange rate. Foreign exchange supply *(LTFESUP)* has the correct sign in the equation. However, it is not a significant variable that explains the variations in the parallel market exchange rate in relation to the official rate.

Figure 2 is also quite revealing in other ways. Periods of relative "over-valuation" seems to have been followed by "overshooting" as authorities grapple with the multiple exchange rate and import controls, and other policy reforms. Thus, the parallel market rate seems to have been "over-valued" during the period 1997:Q4 to 1999:Q2. However, with the rapid adjustment of the parallel market rate since then (and perhaps, with insufficient adjustment of the official rate), it seems to have "overshot".

5.3. The output gap

Several empirical studies for developed countries have attempted to show the validity of the gap model and the magnitude of the impact of outputs gaps on inflation (IMF 1991; de Masi 1997; Singh 1996). In their study Coe and McDermott (IMF 1997), presented evidence of 13 developing countries suggesting that the gap model works well in almost all Asian economies, and the output gap is a significant determinant of the change in inflation in 11 of the 13 countries studied.

The Hodrick–Prescott (1997) filter has been widely used to separate the "potential" part of GDP from the "cyclical" component. An estimate of the output gap is obtained by calculating the difference between the estimate of the HP trend and the actual output.[10] The results of the estimates are shown in *Figure 3*. It appears that since 1998:Q3, actual output is well below potential output, while the opposite seems to be the case for the earlier period 1994 to 1996. While most FSU countries experienced a significant output collapse after the disintegration of the USSR, it has been found that the output collapse in Uzbekistan was much less severe than in other FSU countries (Zettelmeyer 1999; Zettelmeyer and Taube 1998).[11]

5.4. Dynamic equations

Dynamic versions of each of the equations for goods, money and foreign exchange markets are formulated following the two-step procedure of Engle–Granger (1987). First, the long-run equations are tested for cointegration (Johansen 1988; Johansen and Juselius 1990). If the variables in each of the equations are found to be cointegrated, error-correction models are formulated using the respective cointegrated equations.

5.5. Demand for money

The long-run equation for money demand is found to be cointegrated. *Table 3* reports the results of estimating the dynamic model for money demand following the Engle–Granger (1987) two-step procedure. The error-correction term has the right sign and is significant at the 10% level. In the short-run, money demand appears to be adjusting towards a long-run equilibrium in little over one quarter.

[10] Several criticism has been leveled at the HP filter method. It has been argued that the HP method removes potentially valuable information from time series data (King and Rebelo 1993) and that it may impart spurious cyclical patterns to the data (Cogley and Nason 1995). Another major concern is the rather arbitrary choice of smoothing parameters. However, in the absence of the information to estimate production functions, the HP filter offers a convenient (but mechanical) way to estimate trend output.

[11] The mildness of Uzbekistan's recession are attributed to a combination of (a) a low degree of initial industrialisation; (b) its cotton production; and (c) its self-sufficiency in energy. While evidence suggested no positive role of public investment, it was thought that a set of policies which failed in most other transition countries, i.e., supporting the industrial sector through credits and direct subsidies, was relatively successful in sustaining output during Uzbekistan's early transition years.

The error-correction mechanism in the foreign exchange market does not seem to have a significant effect on short-run money demand, except when a three-quarter lag is considered. In this case, the ECM term is significant at the 10% level. Neither the output gap nor any price variables are significant in the estimated equations despite carrying the expected signs.

5.6. Exchange rates

Several different estimates of the short-run parallel market foreign exchange rate were made but only one result is reported in *Table 4*. It is clear that a relatively good fit is obtained for the error-correction model when the logarithm of the change in the ratio of the curb market rate to the official rate is considered to be the dependent variable. The estimates yield relatively inferior results when the change in the logarithm of the curb market rate is considered the dependent variable.

The error-correction term for the ratio of the parallel market to the official rate in this equation is highly significant, has the right sign, and indicates an almost full adjustment of disequilibria in the foreign exchange market (as represented by the ratio) in one quarter. Furthermore, the change in the level of the ratio itself seems to be exerting an important short-run effect. The adjustments to disequilibria in the money market during at least the preceding two quarters seem to exert a strong influence on the relationship between the curb and official market exchange rates, with the relatively stronger impact coming two quarters ahead. The disequilibria in the product market also influence the parallel market exchange rate with the relevant coefficient being significant at the 10% level. However, in the short-run model, the foreign exchange supply variable is not significant, indicating that factors other than the flow of foreign exchange resources probably play a more significant role in the foreign exchange market.

5.7. Inflation in the short run

One of the objectives of the study was to explain short-run inflationary behaviour in the Uzbek economy in terms of the disequilibria in the money, foreign exchange, and product markets. With this in mind, we use the error-correction terms for each of the equations in the formulation of the dynamic version of the inflation equation.

In the short-run dynamic inflation equation, except for the error-correction term relating to the parallel market for foreign exchange, all error-correction terms

are highly significant *(Table 5)*. At the same time, the change in the ratio of the parallel market to the official rate has a very significant effect on the change in inflation rate. If the curb market rate increases due to disequilibria in the foreign exchange market or the authorities fail to adjust the official rate in line with those disequilibria, inflation is likely to increase substantially. Furthermore, product market disequilibria are seen to exert a strong influence on the change in inflation. The coefficients for money market adjustment as well as the change in the level of money supply are highly significant indicating the predominance of monetary phenomena in the inflation process in Uzbekistan.

6. SOME CONCLUSIONS

Using quarterly data, the study has estimated several long-run relationships for the goods, money, and foreign exchange markets of Uzbekistan for the period 1994:Q1 to 2000:Q3, in an environment of multiple exchange rates, administrative controls, and import restrictions. It was found that the variables describing the behaviour of each of the different markets were cointegrated. Using this property to incorporate the error-correction mechanisms in different markets, the study developed a framework to ascertain the influence of domestic disequilibria and external shocks on inflation dynamics in Uzbekistan.

The empirical estimates show that domestic monetary and output developments, and changes in the relationship between the curb market and official exchange rates have a significant influence on the foreign exchange market dynamics in the country. However, the currently measured level of foreign exchange supply does not seem to have a substantial impact on the parallel exchange rate market.

The results suggest that disequilibria in the product and money markets are the major forces driving inflation dynamics in Uzbekistan. While disequilibria in the parallel market themselves do not seem to be a factor in price increases, the ratio of the curb market to the official exchange rate seems to exert a significant influence. One can infer that an important consideration is the speed and the magnitude of adjustment of the official exchange rate in the face of disequilibria in the parallel market for foreign exchange.

The study has been rather constrained by the limited availability of quarterly data on many important variables. It had to make do with a number of proxies for the variables under focus. A further investigation into improving both the quality and the quantity of data required for econometric and other investigations of the Uzbek economy would be a highly beneficial future step for economic research.

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REFERENCES

Alam, A., and Banerji, A. (2000): Uzbekistan and Kazakhstan, a Tale of two Transition Paths, Europe and Central Asia Region. Working Paper, Poverty Reduction and Economic Management Sector Unit, The World Bank.

Chadha, B., Masson, P. R., and Meredith, G. (1992): Models of Inflation and the Costs of Disinflation. Staff Papers, IMF, 39: 395–431.

Coe, D. T. and McDermott (1997): Does the Gap Model Work in Asia? Staff Papers, IMF, 44: 59–80.

Cogley, T., and Nason, J. M. (1995): Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycles Research. *Journal of Economic Dynamics and Control*, 19: 253–278.

De Masi, P. (1997): IMF Estimate of Potential Output: Theory and Practice. IMF Working Paper WP/1997/177.

Dornbusch, R., and Fischer, S. (1994): *Macroeconomics*. 6th Edition, New York: McGraw Hill.

Engle, R.F., and Granger, C.W. (1987): Cointegration and Error Correction Representation, Estimation and Testing. *Econometrica*, 55: 251–276.

Fischer, S., and Sahay, R. (2000): The Transition Economies after ten Years. IMF Working Paper, WP/2000/30, February.

Hodrick, R. J., and Prescott, E. C. (1997): Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit, and Banking,* 29: 1–16.

Johansen, S. (1988): Statistical Analysis of Cointegrated Vectors. *Journal of Economic Dynamics and Control,* 12: 577–638.

Johansen, S., and Juselius, K. (1990): Maximum Likelihood Estimation and Inference on Cointegration with Applications to the Demand for Money. *Oxford Bulletin of Economics and Statistics,* 52: 169–210.

King, R. G., and Rebelo, S. (1993): Low Frequency Filtering and Real Business Cycles. *Journal of Economic Dynamics and Control,* 17: 207–231.

Masson, P. R., Symansky, S. A., and Meredith, G. (1990): MULTIMOD Mark II: A Revised and Extended Model. IMF Occasional Paper, No. 71, Washington, D.C.

Nickell, S. (1988): The Supply Side and Macroeconomic Modeling. In: Bryant, R. C., *et al*.: *Empirical Macroeconomics for Interdependent Economies.* Washington, D.C.: Brookings Institution: 202–221.

Phillips, P., and Perron, P. (1988): Testing for a Unit Root in Time Series Regression. *Biometrica,* No. 75: 335–346.

Singh, A. (1996): Rapid Growth in Asian Economies: A Review of Some Issues and Evidence. Paper presented at the South East Asian Central Banks – IMF Seminar, Singapore, May.

Spechler, M. C. (2000): Uzbekistan: Silk Road to Nowhere? *Contemporary Economic Policy,* 18: 295–303.

World Bank (1999): Uzbekistan Social and Structural Policy Review. Grey Cover Report, No. 19626.

Zettelmeyer, J. (1999): The Uzbek Growth Puzzle. Staff Papers, IMF, 46(2).

Zettelmeyer, J., and Taube, G. (1998): Output Decline and Recovery in Uzbekistan – Past Performance and Future Prospects. IMF Working Paper WP/1998/132.

Table 1

Transition economies: stabilisation programmes and inflation performance (1989–1998 and 2001)

Country	Stabilisation programme date	Pre-programme inflation	Exchange regime adopted	Maximum annual inflation	Year in which		Exchange regime in 2000	Inflation in 1998	Inflation in 2001
					inflation was highest	inflation fell below 50%			
Albania	August 1992	293	Flexible	237	1992	1993	Flexible	8.7	3.1
Armenia	December 1994	1885	Flexible/Fixed	10896	1993	1995	Flexible	–1.2	3.1
Azerbaijan	January 1995	1651	Flexible/Fixed	1787	1994	1996	Flexible	–7.6	1.5
Belarus	November 1994	2180	Flexible/Fixed	1997	1993	1996	Flexible	181.7	61.1
Bulgaria	February 1991	245	Flexible	579	1997	1998	Fixed	1.0	7.4
Croatia	October 1993	1903	Fixed	2585	1989	1994	Flexible	5.3	4.8
Czech Republic	January 1991	46	Fixed	52	1991	1992	Flexible	6.8	4.7
Estonia	June 1992	1086	FixedS	947	1992	1993	Fixed	4.5	5.7
Georgia	September 1994	56476	Flexible/Fixed	7486	1993	1996	Flexible	10.6	4.6
Hungary	March 1990	26	Fixed	35	1990	NA	Flexible	10.6	9.1
Kazakhstan	January 1994	2315	Flexible/Fixed	2961	1992	1996	Flexible	1.9	8.4
Kyrgyz Republic	May 1993	934	Flexible/Fixcd	958	1992	1993	Flexible	18.3	6.9
Latvia	June 1992	818	Flexible/Fixed	1162	1992	1993	Fixed	2.8	2.5
Lithuania	June 1992	709	Flexible/Fixed	1162	1992	1994	Fixed	2.4	1.2
Macedonia, FYR	January 1994	248	Fixed	1780	1992	1995	Flexible	–2.4	5.5
Moldova	September 1993	1090	Flexible	2198	1992	1995	Flexible	18.2	9.8
Poland	January 1990	1096	Fixed	640	1989	1992	Flexible	8.5	5.5
Romania	October 1993	314	Flexible	295	1993	1995	Flexible	40.6	34.5
Russia	April 1995	218	Flexible/Fixed	2510	1992	1996	Flexible	84.4	21.5
Slovak Republic	January 1991	46	Fixed	58	1991	1990	Flexible	5.6	7.3
Slovenia	February 1992	288	Flexible	247	1991	1993	Flexible	7.5	8.4
Tajikistan	February 1995	73	Flexible	7344	1993	1994	Flexible	2.7	12.1
Turkmenistan	Not Started	20	Not applicable	9743	1993	1997	Flexible	19.8	11.4
Ukraine	November 1994	645	Flexible/Fixed	10155	1993	1990	Flexible	20.0	6.1
Uzbekistan	November 1994	1555	Flexible	1281	1994	1996	Flexible	26.1	27.2

Table 1 (cont.)

Country	Stabilisation programme date	Pre-programme inflation	Exchange regime adopted	Maximum annual inflation	Year in which inflation was highest	Year in which inflation fell below 50%	Exchange regime in 2000	Inflation in 1998	Inflation in 2001
Memorandum items:									
All transition countries		820		2764	1992	1996		19.1	
All CEECs		450		651	1991	1993		9.2	
CEEC: early reformers		567		603	1991	1992		7.4	
CEEC: late reformers		275		723	1992	1995		12.0	
Baltics		871		1091	1992	1993		3.2	
Other Former Soviet Union		1142		4943	1993	1996		31.2	

Sources: For years 1989–1998, data adapted from IMF Working Paper (2000) authored by Fischer and Sahay.
For other years, IMF, International Financial Statistics.

Notes:

Pre-programme inflation is inflation in the 12th months previous to the month of the stabilisation programme.
Inflation is calculated from December to December.
Fixed regimes are those that have a currency board, pegged (explicitly or implicitly) at a fixed rate or have a narrow crawling band.
Flexible regimes include those that are free or managed floating.
Lithuania adopted a currency board in April 1994 and Bulgaria adopted one in July 1997.
The Latvian currency was pegged to the SDR in February 1994.
Russia announced an exchange rate corridor in July 1995. Both Latvia and Russia had flexible exchange rate regimes prior to these dates.
CEE early reformers refers to Croatia, the Czech Republic, Hungary, Poland, Slovak Republic and Slovenia.
CEE later reformers refers to Albania, Bulgaria, Macedonia FYR and Romania.
Baltics refers to Estonia, Latvia and Lithuania.
Other former Soviet Union refers to Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Turkmenistan, Ukraine and Uzbekistan.

Table 2

Unit root tests for first differences of data

Variables	ADF-test statistic	Phillips–Perron test statistic
LQACUR	–3.5219	–8.2687
LQAOFI	–6.8312	–3.1457
LQBLKP	–4.3122	–5.6972
LQCP93	–2.7341	–5.3979
LQNFRD	–2.8680	–3.2815
LQPRDIN	–7.9336	–7.3586
LQRM2	–5.2409	–4.0856
LQRRM	–7.9472	–4.8400
QACURR	–3.0714	–3.6439
QAOFIR	–1.2796	
*QAOFIR**	–3.7626	–4.6643
QBLKPRM	–3.0555	–3.5903
QNFRESD	–2.2263	–2.9432
QOFCPI93	–6.2136	–3.9662
QPRDIND	–7.1755	–6.6740
QRM2	–2.6765	–2.8656
QRRM	–4.3910	–3.7246

Notes:
* indicates second difference of series.

Variable names:
QACURR quarterly average curb market exchange rate
QAOFIR quarterly average official exchange rate
QBLKPRM quarterly average curb market exchange rate premium
QNFRESD quarterly net foreign reserves in US dollars
QOFCPI93 quarterly official consumer price index (1993 = 100)
QPRDIND quarterly production index
QRM2 quarterly real broad money supply
QRRM quarterly real reserve money
Variables names beginning with L indicate logarithm of the series.
Variables names beginning with Q indicate quarterly series.
Variables names beginning with QA indicate quarterly averages of series.

Table 3

The dynamic demand for money equation

Dependent variable: *DLQRM2*
Method: Least Squares

Sample (adjusted): 1996:3 2000:3
Included observations: 17 after adjusting endpoints

Variable	Coefficient	Std. error	*t*-statistic
RSEQLRM2C(–1)	–0.7544	0.3577	–2.1089
LYGAP/LQPRDIN(–1)	0.0072	0.0264	0.2722
DLNWCP93(–1)	–0.1417	0.2756	–0.5142
RSEQLCUR1(–3)	0.1849	0.1000	1.8485
C	0.0247	0.0340	0.7249
SD2	0.0110	0.0292	0.3779
SD3	0.0207	0.0362	0.5707
SD4	0.0631	0.0450	1.4040
R-squared	0.7438	Mean dependent var.	0.0396
Adjusted *R*-squared	0.5445	S.D. dependent var.	0.0697
S.E. of regression	0.0471	Akaike info criterion	–2.9692
Sum squared resid.	0.0199	Schwarz criterion	–2.5771
Log likelihood	33.2378	*F*-statistic	3.7319
Durbin–Watson stat.	2.3579	Prob (*F*-statistic)	0.0353

Symbols:

DLQRM2	change in log of quarterly broad money
RSEQLRM2C(–1)	error-correction term for money demand equation
LYGAP/LQPRDIN(–1)	ratio of log of output gap to log of production lagged one quarter
DLNWCP93(–1)	change in log of CPI lagged one quarter
RSEQLCUR1(–3)	error-correction term for exchange rate equation

Table 4

Equation for the change in ratio of curb market to official exchange rate

Dependent variable: *DLRQCUROFI*
Method: least squares

Sample (adjusted): 1996:2 2000:3
Included observations: 18 after adjusting endpoints

Variable	Coefficient	Std. error	*t*-statistic
RSEQLCUROFI2(–1)	–0.9933	0.3272	–3.0360
RSEQLRM2C(–1)	–0.2629	0.8423	–0.3121
RSEQLRM2C(–2)	–3.0518	0.8429	–3.6204
LYGAP/LQPRDIN(–1)	0.1194	0.0657	1.8178
DLTFESUP(–1)	0.0940	0.4075	0.2307
DLRQCUROFI(–1)	0.5977	0.2312	2.5848
C	–0.0068	0.0411	–0.1645

R-squared	0.6378	Mean dependent var.	0.0407
Adjusted *R*-squared	0.4403	S.D. dependent var.	0.1973
S.E. of regression	0.1476	Akaike info criterion	–0.7027
Sum squared resid.	0.2398	Schwarz criterion	–0.3565
Log likelihood	13.3247	*F*-statistic	3.2289
Durbin–Watson stat.	1.9269	Prob (*F*-statistic)	0.0442

Symbols:

DLRQCUROFI	change in log of ratio of curb market to official exchange rate
RSEQLCUROFI2(–1)	error-correction term from foreign exchange market equation
RSEQLRM2C(–1)	error-correction term from demand for money equation
RSEQLRM2C(–2)	error-correction term from money demand lagged 2 quarters
LYGAP/LQPRDIN(–1)	ratio of log of output gap to log of production index lagged one quarter
DLTFESUP(–1)	change in log of foreign exchange supply lagged one quarter
DLRQCUROFI(–1)	change in log of ratio of curb to official exchange rate lagged one quarter

Table 5

Dynamic inflation equation

Dependent variable: *DLNWCP93*
Method: least squares

Sample (adjusted): 1996:1 2000:3
Included observations: 19 after adjusting endpoints

Variable	Coefficient	Std. error	*t*-statistic
LYGAP/LQPRDIN(–1)	–0.0442	0.0159	–2.7841
RSEQLRM2C(–1)	1.1761	0.2793	4.2103
RSEQLCUROFI2(–1)	0.0330	0.0970	0.3398
DRCUROFI	1.3600	0.3454	3.9371
DLQRM2	0.8555	0.2467	3.4678
C	0.0404	0.0200	2.0235
SD2	0.0206	0.0316	0.6509
SD3	–0.0040	0.0310	–0.1287
SD4	–0.0075	0.0359	–0.2092
R-squared	0.8355	Mean dependent var.	0.0716
Adjusted *R*-squared	0.7039	S.D. dependent var.	0.0663
S.E. of regression	0.0361	Akaike info criterion	–3.4994
Sum squared resid.	0.0130	Schwarz criterion	–3.0521
Log likelihood	42.2447	*F*-statistic	6.3476
Durbin–Watson stat.	1.9873	Prob (*F*-statistic)	0.0043

Symbols:

DLNWCP93	change in log of CPI
LYGAP/LQPRDIN(–1)	ratio of log of output gap to log of production index lagged one quarter
RSEQLRM2C(–1)	error-correction term for money demand equation
RSEQLCUROFI2(–1)	error-correction term for foreign exchange market equation
DRCUROFI	change in ratio of curb market to official exchange rate
DLQRM2	change in log of quarterly broad money

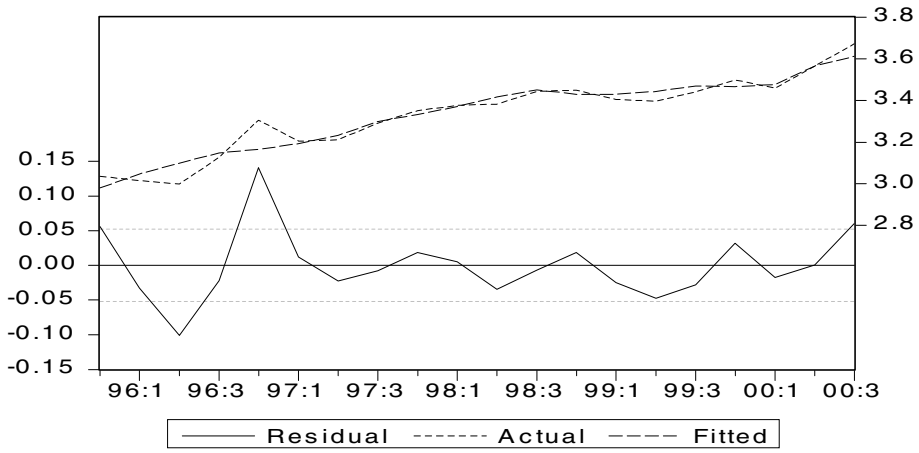

Figure 1. The demand for money equation

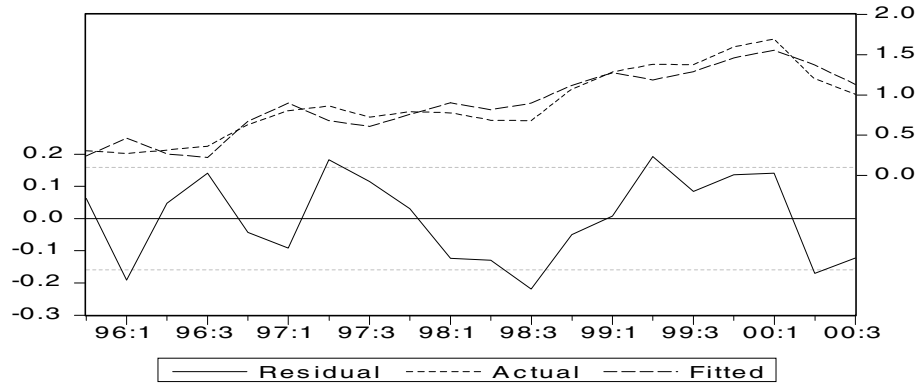

Figure 2. Equation for the ratio of curb market to official exchange rate

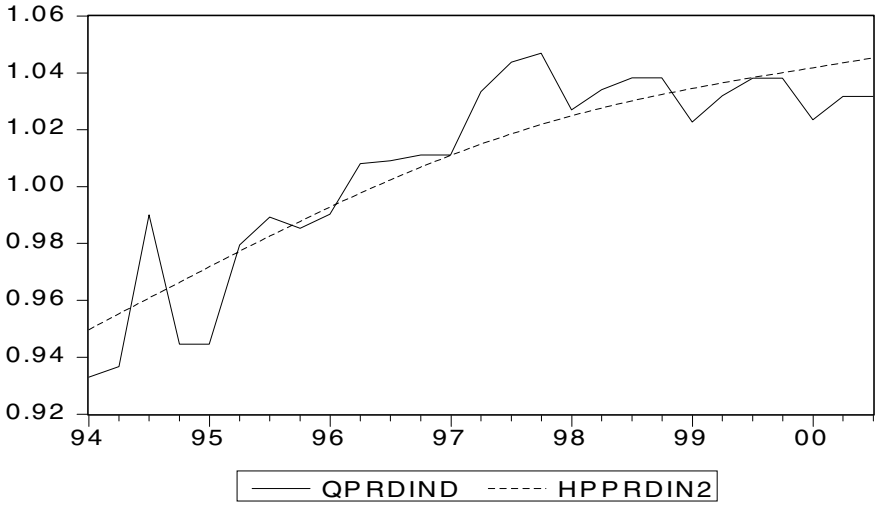

Figure 3. Uzbekistan: Estimates of output gaps

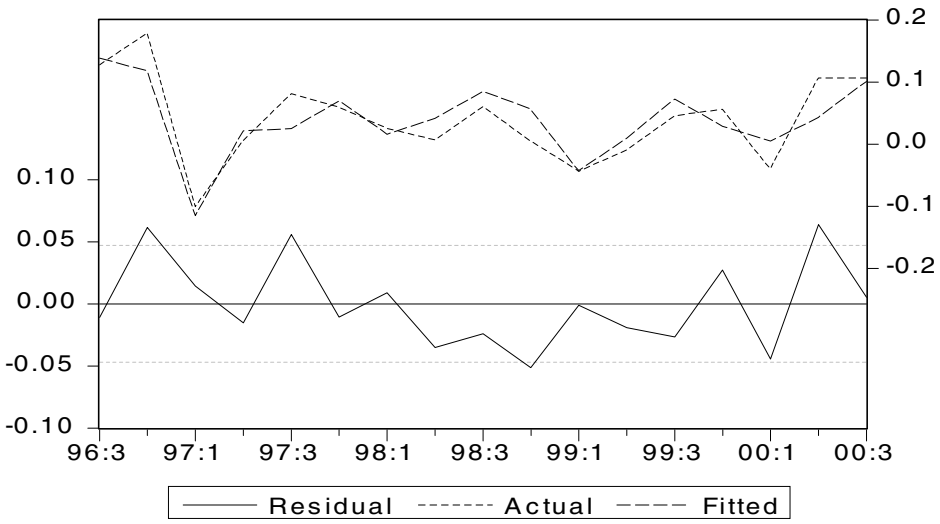

Figure 4. Dynamic demand for money equation

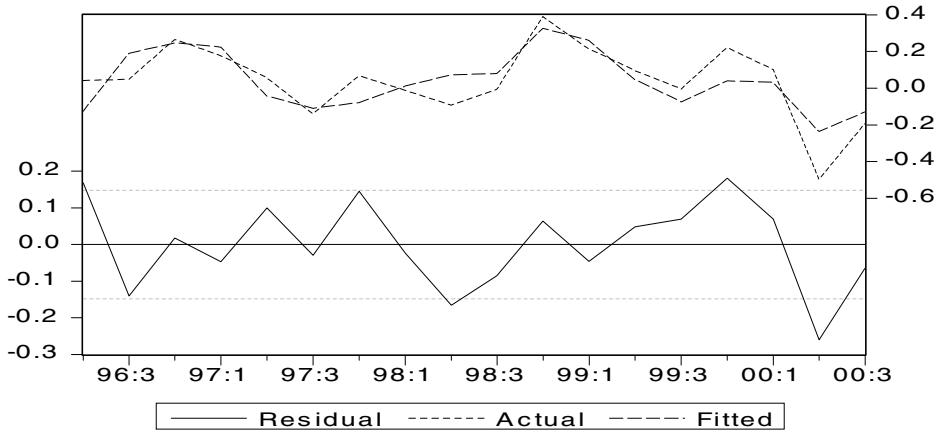

Figure 5. Dynamic equation for the ratio of curb market to official exchange rate

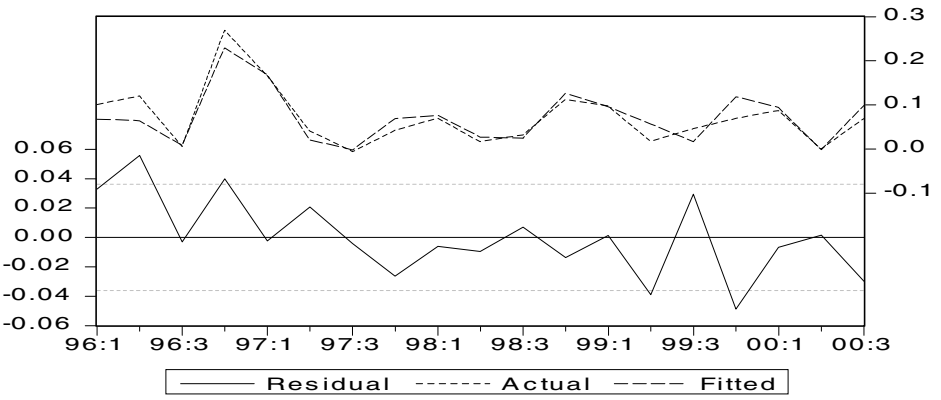

Figure 6. Dynamic inflation equation