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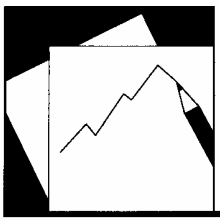

IMF Working Paper

Suppressed Inflation and Money Demand in Zimbabwe

Sònia Muñoz

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Suppressed Inflation and Money Demand in Zimbabwe

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Authorized for distribution by Sharmini Coorey

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Abstract

The paper investigates the divergence between inflation and monetary expansion in Zimbabwe since late 2003. The substantial decline in velocity and increasing levels of real money balances during 2004 are at odds with a record of inflation closely tracking the growth rates of monetary aggregates in the past. Possible explanations for the divergence include an unstable demand for money, a sudden shift in the underlying demand for real balances due to a sharp change in an explanatory variable, and a structural break or aberration in a normally stable money demand relation reflecting some unexplained factor such as repressed inflation (given administered prices) or measurement errors in the consumer price index. The results of the study point to the last possibility as the most likely explanation.

JEL Classification Numbers: C22, E31, E41

Keywords: Inflation, Money Demand, Administered Prices, and Repressed Regime

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I. INTRODUCTION

Financially repressed regimes are characterized by suppressed prices, which lower the rate of real economic growth and retard the development process. Suppressed inflation describes a situation in which, at existing wages and prices, the aggregate demand for current output and labor services exceed the corresponding aggregate supply. Suppressed inflation results from the inability of wages and prices to adjust instantaneously, in response to shifts in aggregate demand or supply, to satisfy the conditions for general market clearing. This inability can result either from effective legal constraints—that is, the imposition of price and wage restrictions—or from natural frictions in the workings of the market mechanism (see Barro and Grossman, 1974).

In this type of regime, nominal income increases occur as a money illusion to minimize social discontent and provide a work incentive. This strategy increases the inflationary overhang—the accumulated and unusable purchasing power in the hands of the population. At the same time, suppressed inflation spurs maladjustments and inequities in the production processes, further reducing the supply of goods.

The underlying economic theory is based on developments in disequilibrium macroeconomics (Muellbauer and Portes, 1978; a particularly relevant example is Barro and Grossman, 1974). The latter finds that too low a price and nominal wage level and the consequent excess demand for consumables and labor services causes employment and output to be below general-market-clearing levels. That is, households react both to their increased real money balances and to the constraint in their consumption by reducing their effective supply of labor supply, and the level of output is constrained by the level of employment, by the production function.

Most of the studies on depressed inflation have been based on centrally planned economies that have suffered chronically from some significant degree of excess demand (repressed inflation), i.e., that buyers have faced quantity constraints (informal or formal rationing) on the markets for goods and labor. Whereas Portes and Winter (1978) use a market approach by supposing no excess demand in the official economy in Poland from 1953 to 1973, Charemza and Ghatak (1990) for instance suggest that shortages in the official sector are of main interest in analyzing money demand. Under shortage, households hold additional money balances. These balances are needed to make purchases at higher prices on the black market. Feltenstein and Ha (1991) went a step further and derived a variable measure of repressed inflation in China based on monetary overhang that is the excess of consumer money holdings over the nominal value of retail goods.

The aim of the paper is to explore explanations for the substantial decrease in velocity and increasing levels of real money balances that has led to a divergence between inflation and monetary expansion since late 2003 in Zimbabwe—an economy whose real GDP declined by almost 30 percent from 1997 to 2003, while inflation soared from about 20 percent in December 1997 to a peak of 623 percent in January 2004. Agricultural production—the mainstay of the economy—collapsed with the disruption caused by the violent implementation of fast-track land reform. With the official exchange held at a highly overvalued level and

declining exports and foreign financing, the supply of foreign exchange to the official market shrank, leading to sharp restrictions on imports and the accumulation of external arrears. Investment fell sharply, and shortages of food, fuel, electricity, and other basics became pervasive. Real GDP fell by about 4 percent in 2004, but year-on-year inflation decelerated surprisingly sharply from a peak of 623 percent in January 2004 to around 130 percent at end-2004, while money growth stayed at very high levels.

The paper is structured as follows. Section II presents background information on the evolution of inflation and money aggregates in Zimbabwe. Section III analyzes the demand for money since the late 1990s. Section IV discusses other factors that can lead to diverging paths of inflation and money growth in the short run. Section V concludes.

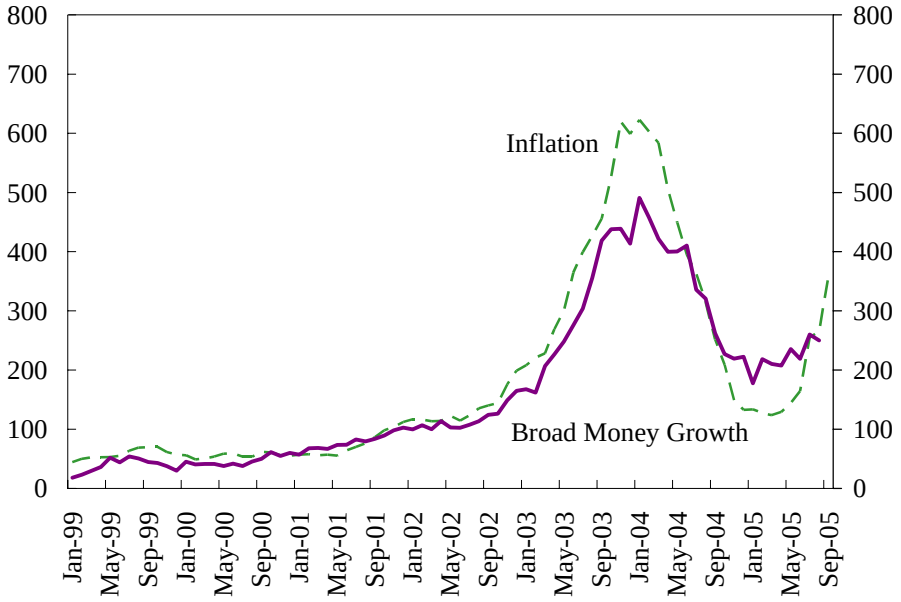
II. STYLIZED FACTS

Money growth[2] and inflation paths started to diverge from late 2003. Inflation soared from about 20 percent in December 1997 to a peak of 623 percent in January 2004, but decelerated sharply from March to around 130 percent at end-2004. Broad money growth, however, started decelerating only in July 2004 from over 400 percent at end-2003 to some 130 percent by end-December 2004.[3] This is contrary to the experience under recent stabilization efforts in most countries, where inflation inertia has been evident. That is, inflation lags—rather than leads—the decline in money growth because price and wage expectations are likely to be based, at least partly, on the past behavior of inflation and because expectations of the future stance of monetary policy are likely to react slowly to shifts in the observed rates of money growth. Accordingly, changes in the rate of monetary expansion would be slow to translate into changes in the rate of inflation. Further, a significant monetary tightening might not be perceived as credible until well into the stabilization program. By contrast, prices in Zimbabwe appear to have responded to factors other than just changes in monetary policy.

[2] All growth rates in the paper are 12-month changes.

[3] Policy interest rates were raised sharply in the first quarter of 2004 (reaching a peak at 5,242 percent in annualized basis in March 2004) and subsequently lowered as inflation declined, but real interest rates were nonetheless maintained at very high levels throughout the year. However, with high real interest rates and an increasingly overvalued official exchange rate putting pressure on domestic producers and exporters, the Reserve Bank of Zimbabwe (RBZ) continued to operate its subsidized credit facility, which provided low-interest loans to selected borrowers.

Figure 1. Inflation and Money Growth since 1999



Source: Zimbabwean authorities and IMF staff estimates.

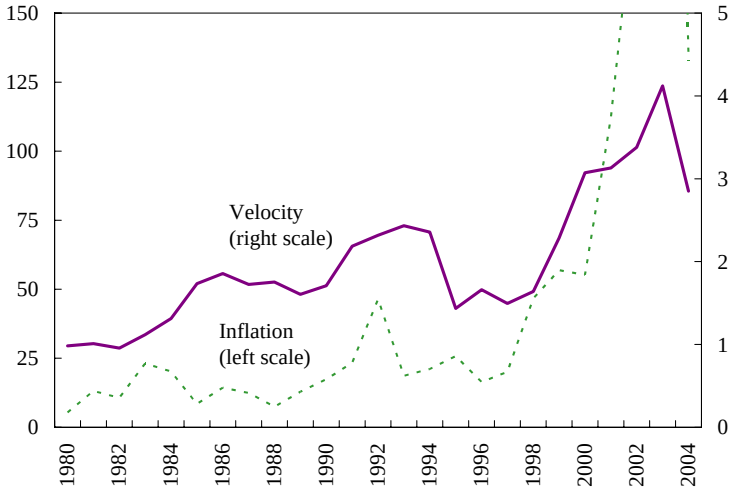
Velocity[4] declined in the same year that inflation started to fall. In 2003, the significant rise in velocity was associated with the sharp acceleration in inflation, but declined quite quickly in 2004. By contrast, a sharp increase in the level of velocity is common during the initial stages of stabilization,[5] followed by a decline when stabilization is achieved.[6]

[4] Estimates for velocity are derived as an implied index from the path of money, prices, and real output following the standard Fisher equation $\left(\pi_t = \left(\frac{(M_t \times v_t)/Y_t}{(M_{t-1} \times v_{t-1})/Y_{t-1}} - 1 \right) \times 100 \right)$ with π equal to the year-on-year change in the consumer price index rebased to the GDP deflator in 2000, M to broad money, V to velocity of broad money and Y to real GDP).

[5] Stabilization is defined as being achieved in the first month when 12-month inflation falls below 40 percent.

[6] See Anderson and Citrin (1995) for details.

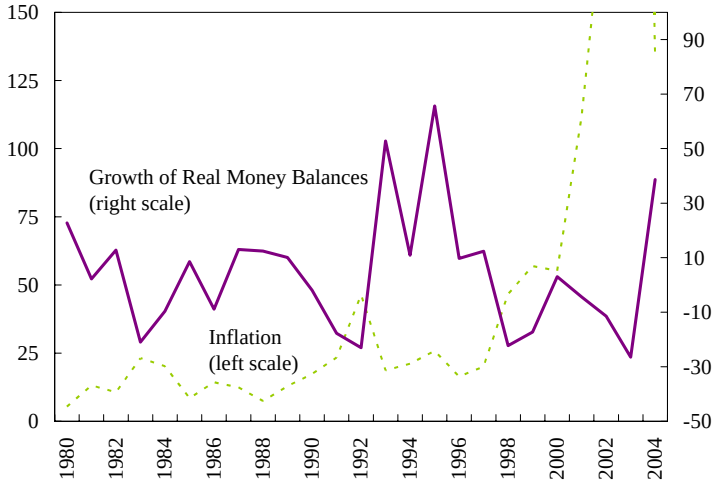
Figure 2. Velocity and Inflation, 1980-2004



Source: Zimbabwean authorities and IMF staff estimates.

Zimbabwe's real money balances started increasing in 2004, while inflation was still very high. This is at odds with the "conventional wisdom" that the evolution of real balances typically exhibits a U-shaped pattern over the course of a stabilization program,[7] with a decline during the initial phases of a program. The period of declining real money balances normally coincides with high but rapidly declining inflation, while the increase in real money balances is accompanied by relatively stable and moderate inflation rates. However, in most cases, the rate of increase in this period of remonetization is smaller than the rate of decrease during the demonetization period, so that the U-shaped pattern is not symmetric.

Figure 3. Growth of Real Money Balances and Inflation, 1980-2004

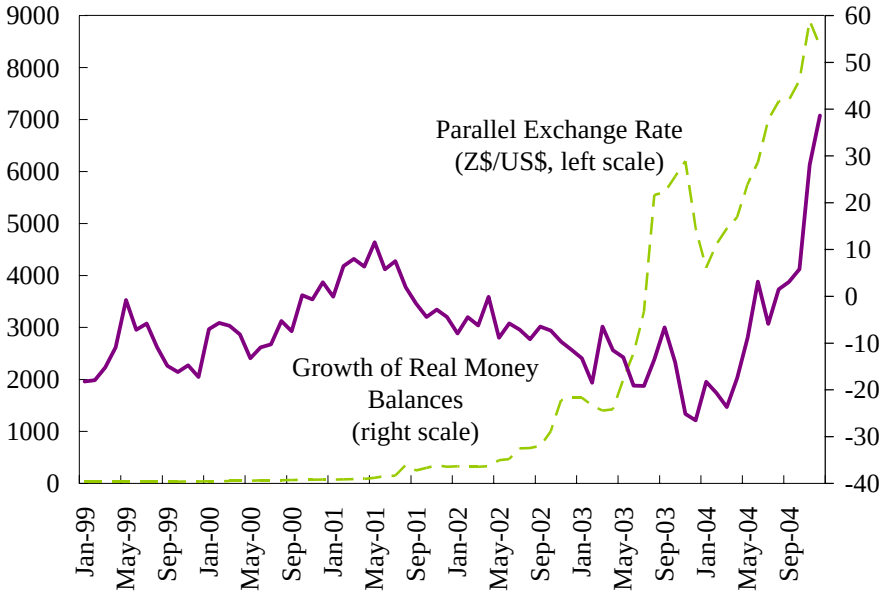


Source: Zimbabwean authorities and IMF staff estimates.

[7] See De Broeck, Krajnyák, and Lorie (1997) for details.

Despite a depreciation of the parallel market exchange rate in 2004, the demand for real balances increased. The parallel exchange rate appreciated in early 2004 as a result of the introduction of a managed foreign exchange tender system and a clamp down on the parallel market, where the bulk of foreign exchange transactions was taking place in 2003. However, the tender rate depreciated only moderately for the rest of the year, despite a growing gap between demand and supply in the tender. As a result, the parallel market resurfaced with a rapidly depreciating exchange rate. Real money balances, however, continued to increase despite the continuous depreciation of the parallel exchange rate.

Figure 4. Growth of Real Money Balances and Parallel Exchange Rate, 1999-2004



Source: Zimbabwean authorities and IMF staff estimates.

III. Estimating a Money Demand Equation

A. Model Specification and Econometric Method

What factors account for the behavior of real money balances and velocity in 2004? The observed outcome could reflect (i) a historically unstable money demand relationship; (ii) a sharp movement in some independent variable within a stable money demand relationship; or (iii) an aberration or structural break within a historically stable money demand relationship. If a plausible specification of money demand does fit very poorly, we might suspect we were not estimating a money demand at all. Conversely, good performance by a money demand function with a priori justification would suggest that the data are generated by this behavioral relation operating in a market not far or often out of equilibrium. However, the pattern of deviations from the fitted functions may reveal that particular years are outliers, and these may be interpreted in the light of the economic history of the period.

Following Portes and Winter (1978), we start by assuming that households are in equilibrium, i.e., they are not constrained in the amounts of goods they can buy or labor they can sell so that money can be modeled with the standard log linear function for desired balances. This is a very strong assumption given the economic situation in Zimbabwe. Given this assumption, the only way we can consider the possibility of disequilibrium behavior—e.g., households holding more money than their "notional" demand, because they cannot buy all the goods they want—is to inspect the results of estimation. If we cannot explain money holdings well, we might suspect that we are not actually observing unconstrained behavior, or that the parameter estimates might suggest excessive money-holding. But this is as far as we can go without explicitly allowing disequilibrium in the maintained hypothesis.

To explore these questions, we employ Friedman's model of demand for money as follows:

$$(M / p)_D = f\left[W, r - (1/r)(dr/dt), (1/p)(dp/dt), h\right] \qquad (1)$$

where $(M/p)_D$ is the demand for money in real terms, r is the interest rate, W is wealth (which is proxied by real income), h is the ratio of human to nonhuman wealth (not used in our empirical work), p is the price level, and $(1/r)(dr/dt)$ and $(1/p)(dp/dt)$ are expected rates of change in interest rates and prices. The stability of the long-run relationship is assessed through the traditional specification (the log-linear form of Equation (1)):[8]

$$(m-p)_t = \gamma_0 + \gamma_1 y_t + \gamma_2 R_t + \gamma_3 \Delta p_t + \gamma_4 \Delta e_t + u_t \qquad (2)$$

The data are broad money, M3 (m), the domestic consumer price index (p), real GDP (y),[9] the three-month time deposit interest rate (R), and the parallel exchange rate (e);[10] and variables in lowercase are in logarithms and Δ is the first difference of natural logarithm of a variable. All data are monthly and seasonally unadjusted from 1998:1-2004:12. R, Δp, and Δe measure returns on M3, goods, and U.S. dollars, respectively. A cointegration system is estimated using the Johansen procedure.

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[8] In the long run, the expected and actual values of the variables determining money demand will coincide, and Equation (1) can therefore be rewritten in terms of the actual rate of inflation, Δp, and the actual rate of depreciation, Δe.

[9] Monthly GDP data were generated by using the cubic spline interpolation method.

[10] The source of the parallel exchange rate is several volumes of the World Currency Yearbook and Techfin.

B. Empirical Results

The empirical results support the stability of the demand for money in contrast with earlier studies. Kovanen (2004) estimated a different set of extensive specifications of long-run money demand for Zimbabwe from 1980 to 2001 using the official exchange rate, inflation, financial innovations, real GDP, and different monetary aggregates (currency, narrow money, and M2). He concluded that a stable relationship could be found during 1980-1995 for currency demand, but was unable to find a stable relationship for the latter period or other monetary aggregates.

The empirical results are described in Table 1 below. The ADF test cannot reject the null hypothesis of the presence of a unit root in all series,[11] therefore a stochastic trend exists in the series of interest.

Table 1. Unit-Root Tests

	Levels	
Variable	t	lags[1]
m-p	-1.914	1
y	-0.191	2
R	-2.179	2
Δp	-2.666	1
Δe	-2.626	3

Note: ADF test with constant.
5% Critical Value: -2.90
Sample period: 1998:1-2004:12.
[1]Lag orders selected by AIC.

The maximal eigenvalue and trace eigenvalue statistics with a degrees of freedom adjustment ($\lambda^{a}_{\max}$ and λ^{a}_{trace}) reject the null hypothesis of no cointegration in favor of one (and possibly more than one) cointegrating relationship (Table 2). This means that the residuals of equation (2) are stationary: broad money, income, interest rate, inflation, and parallel exchange rate are cointegrated despite the hyperinflation at the end of 2003.

[11] Given the short time period considered, the results of any formal unit root test should be considered highly tentative.

Table 2. Cointegrating Tests

Rank	Trace test	T-nm	Max test	T-nm
0	109.13	0.00	56.86	0.00
1	42.27	0.05	30.52	0.02
2	21.75	0.13	17.15	0.17
3	14.61	0.11	12.34	0.10
4	2.26	0.13	2.26	0.13

Table 3 shows the estimation results. They can be summarized as follows:

- The coefficients of inflation and depreciation of the currency[12] are negative and significant, confirming that goods and U.S. dollars are substitutes for money.

- The estimated income elasticity is statistically not different from 0.5 and consistent with the Baumol-Tobin model of transactions demand for money.[13]

- Broad money is composed primarily of interest-bearing deposits; therefore the time deposit interest rate should exert a positive effect on money demand. However, the coefficient is strikingly low and has the wrong sign. It could be that most of the impact from the variation in the nominal interest rate is being captured by the more powerful inflation variable. The lack of variation in the interest rate series could also be a factor.[14]

[12] Following Kremers and Lane (1990), a (nine-month) lag in inflation and the exchange rate was used as independent variables in the estimation.

[13] The low income elasticity might reflect the use of a cubic spline interpolation method, which does not capture seasonal variation that could be important in Zimbabwe. Kovanen (2004) used a monthly manufacturing index and Jenkins (1999) used agricultural output to proxy the seasonal pattern; however, none of these series are available for recent years. Moreover, it is not clear how meaningful the real GDP data is given the large parallel market activity in the country.

[14] There is no time series available on a market-based rate of return on an alternative asset to money.

Table 3. Cointegrating Vector

Dependent Variable: Real Broad Money		
Variables	Estimate[1]	Std. Err.
Real GDP	0.4127***	0.106
Time-deposit interest rate	-0.0007***	0.000
Inflation	-1.2817***	0.326
Depreciation	-0.1214*	0.093
Seasonal dummies	yes	
Constant	yes	
R^2	0.82	
Sample period	1998:1-2004:12	
Frequency of data	Monthly	
Number of lags used in the VAR	6	

[1] *, **, and *** correspond to the 10, 5 and 1 percent significance levels, respectively.

Table 4 shows a series a diagnostic tests were performed: (i) AR 1-5 test: portmanteau test for first-order and first- to fifth-order autoregression of the residuals in the form of an F-test; (ii) Normality test: it amounts to testing whether the skewness and kurtosis of the variable corresponds to that of a normal distribution; (iii) ARCH 1-5 test: an abbreviation for autoregressive conditional heteroscedasticity test in the form of an F-test, since the values of residuals in time series appears to be related to its lagged values; and (iv) Hetero test: test for detecting heteroscedasticity of the explanatory variables due to omitted squares of the variables.

The diagnostic tests show that the estimated residuals are free of autocorrelation and heteroscedasticity. The hypothesis for normality cannot be rejected with the exception of weak non-normality for real GDP and depreciation of the currency. Moreover, Figure 5 shows that the coefficients are constant using recursive estimation.

Figure 5. Recursive Estimation

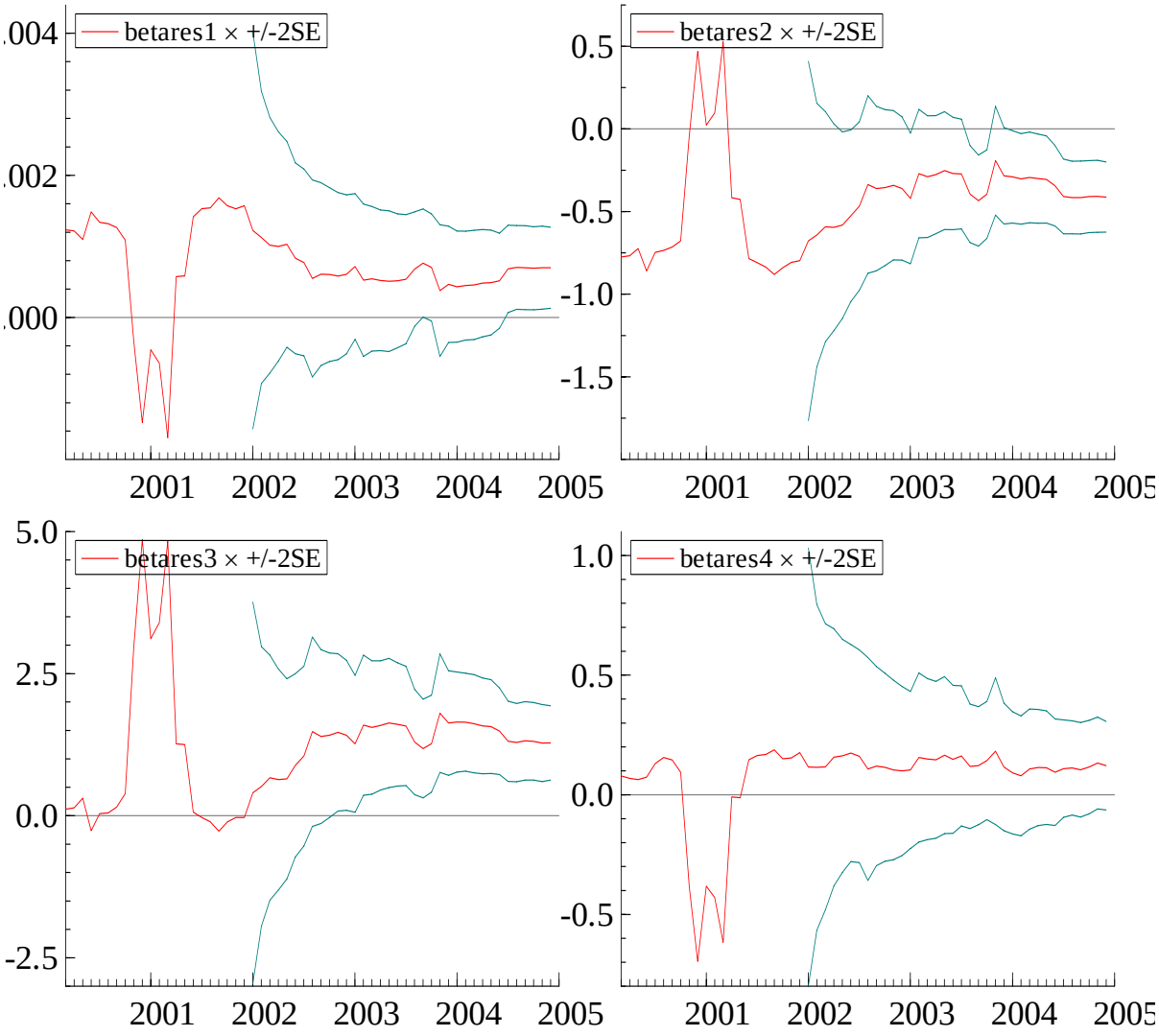


Table 4. Diagnostic Tests

	AR 1-5 test		Normality test		ARCH 1-5 test		Hetero test	
	F(5,27)	Prob	χ^2 (2)	Prob	F(5,22)	Prob	χ^2 (60)	Prob
Real broad money	2.1621	0.0883	3.6296	0.1629	0.0953	0.9920	60.6990	0.4505
Real GDP	1.1470	0.3603	5.4080	0.0431	0.2737	0.9226	52.4850	0.7439
Time-deposit interest rate	0.9679	0.4548	4.4064	0.1105	0.5486	0.7377	70.8250	0.1600
Inflation	0.8252	0.5428	0.5174	0.7720	0.2641	0.9279	62.6390	0.3828
Depreciation	0.5602	0.7294	5.0560	0.0450	0.1523	0.9771	61.8600	0.4095

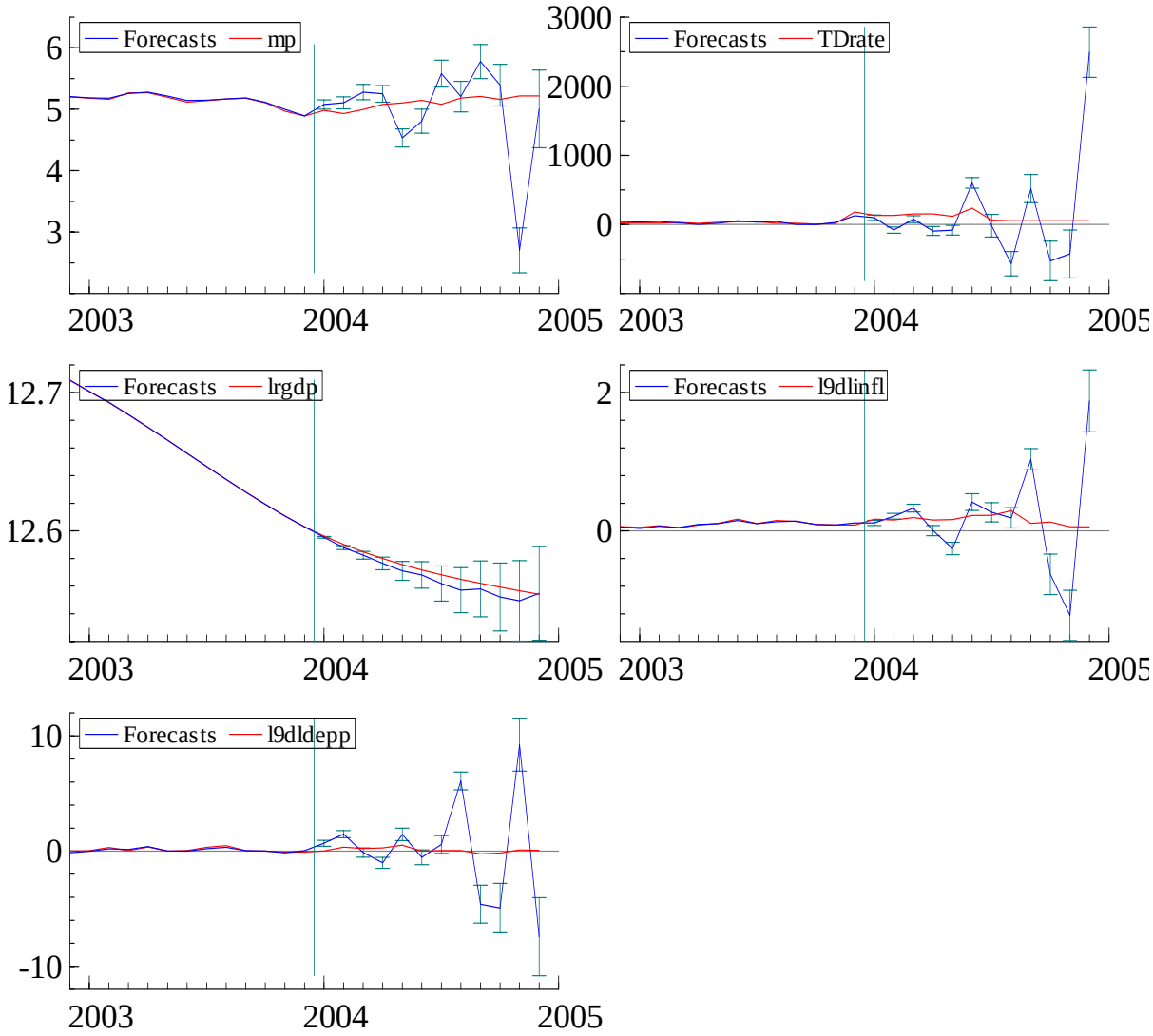
Within-sample forecasts show that real money balances would not have been expected to increase by end-2004 as was the case (Figure 6). Inspection of the residuals from the fitted money demand function reveals as outlying year precisely that which knowledge of the stylized facts would suggest. The Chow test is performed to test for parameter constancy over the ex ante prediction period. Only one spike is found in the test for structural changes in the coefficients of the regression in Figure 7. Interestingly the structural break is in 2004, the year when velocity deviated from the expected path. The residuals suggest that the observed points do lie on or near a true money demand function, supported by the conformity to prior beliefs of the year that do depart significantly from the estimated money demand function.

IV. Influence of Exogenous Factors on Velocity Movements

While inflation is a monetary phenomenon in the long run, in the short run inflation can be influenced by a host of other factors that could lead to fluctuations in real money balances and the velocity of broad money. First, inflation may simply have an inertial component, resulting in a lagged response of prices to changes in monetary expansion. Second, changes in the demand for money due to changes in its underlying determinants (e.g., a rise in inflationary expectations) will be reflected in movements in the velocity of broad money (i.e., short-run deviations in inflation relative to the rate of monetary expansion). Third, factors such as wage policies, exogenous import price increases, and changes in relative domestic prices owing to changes in administered prices can also lead to diverging paths of inflation and money growth in the short run. Finally, observed differences in the paths of inflation and monetary expansion can reflect improper measurement of one or both of the variables.

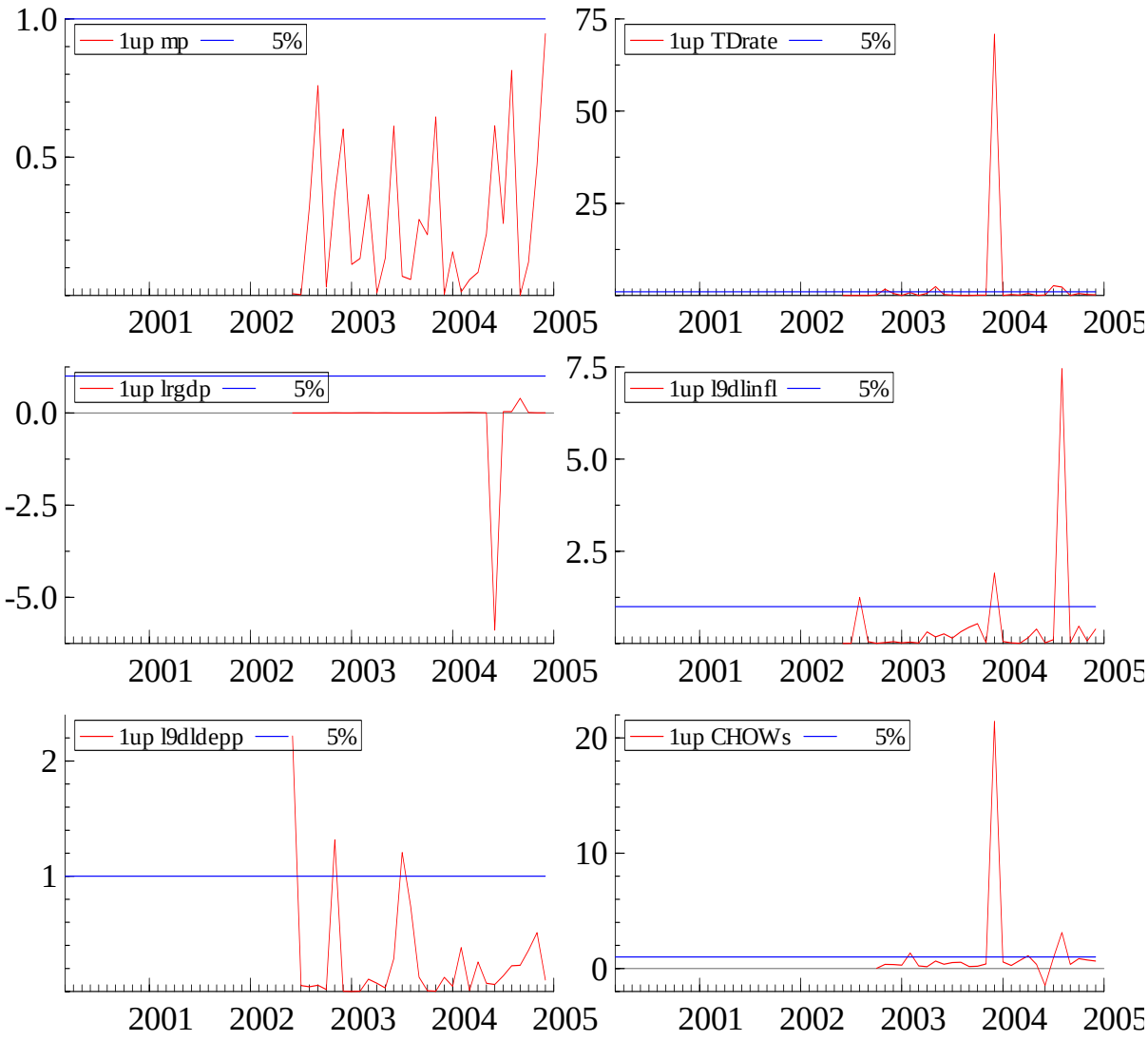
Underestimation of the official inflation could explain the unconventional behavior of velocity. The actual CPI could have increased by more than the measured CPI because the index (i) suffers from inadequacies in the area of coverage (goods traded in the parallel market are not included in the CPI index), (ii) includes controlled and monitored prices, and (iii) uses outdated weights in the CPI basket—from 1997. In particular, Kovanen (2003) estimated that if a full price liberalization would have taken place in April 2003, with administered prices being adjusted to market levels, overall CPI would have adjusted upward by about 47 percent.

Figure 6. Within-Sample Forecast



Note: mp is the log of real broad money, TDrate is the time-deposit interest rate, lrgdp is the real GDP, l9dlinfl is the log of the (9-month) lag of inflation, and l9dldepp is the log of the (9-month) lag of the depreciation of the parallel exchange rate.

Figure 7. Chow Tests



Note: mp is the log of real broad money, TDrate is the time-deposit interest rate, lrgdp is the real GDP, l9dlinfl is the log of the (9-month) lag of inflation, and l9dldepp is the log of the (9-month) lag of the depreciation of the parallel exchange rate.

Moreover, more recently, domestic prices of energy were allowed to remain low in the face of increases in prices of energy imports. In addition, the parallel market premium widened sharply from 13 percent in January 2004 to about 53 percent in December 2004 and, although the pass through to actual market prices may have been relatively rapid (anecdotal evidence suggests that this is normally the case), the increase may not have been fully captured by the measured CPI. Therefore, these factors put together could have understated inflation during the sharp recorded disinflation in 2004 and explain the dramatic fall in velocity.

V. CONCLUSION

The empirical results indicate that, except for 2004, a stable demand for money as a function of parallel market exchange rate, inflation, and real output can be found in Zimbabwe. The paper explores whether the outcome in 2004 can be explained by a sudden sharp shift in some explanatory variable during that period or a breakdown in the demand for money relationship. When controlling for movements in the parallel market exchange rate, inflation, and real output, the analysis shows a structural break in 2004. Despite the depreciation of the parallel exchange rate in 2004, real money balances increased. Although one explanation could be that expected inflation fell quickly, this behavior is not normally observed in disinflation episodes where there is inflation inertia and a lag in the adjustment of expectations. It is therefore difficult to identify the factors that could explain the unconventional behavior of velocity in 2004, although repressed inflation and the mismeasurement of inflation are the most likely possibilities.[15]

Consequently, an important issue in Zimbabwe is how to coordinate monetary policy with managing the current price system. In a market economy, this problem does not arise: prices adjust to achieve an equilibrium in financial and good markets. In Zimbabwe, however, prices are at least to some extent subject to controls. Moreover, the external sector is not open and the exchange rate, like the domestic price system, is subject to distortions. As a result, changes in the money supply that are not accompanied by changes in domestic prices and the exchange rate may lead to repressed market demands and balance of payments disequilibrium. This could lead prices to be stuck at wrong values and raise concern over the magnitude of the overhang of liquidity that was built up in 2004 with M3 exceeding its reference. As Milton Friedman pointed out, price controls do not get at the fundamental source of inflation—excessive expansion of the money supply—and eventually make the problem worse. Controls often result in shortages of goods and the inflationary pressures that have been bottled up artificially tend to explode.

[15] Although we found no evidence of abnormal behavior that might suggest sustained disequilibrium, any final judgment on the question of repressed inflation that began this paper must await the disequilibrium analysis.

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