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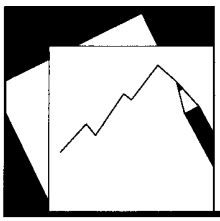

IMF Working Paper

Money and Inflation in the Islamic Republic of Iran

Leo Bonato

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Middle East and Central Asia Department

Money and Inflation in the Islamic Republic of Iran

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Abstract

This paper looks at the determinants of inflation in Iran. Unlike the traditional estimates of the demand function for real money balances, the approach followed here focuses on the relationship between nominal variables and inflation. The model estimates are used to address the questions raised by the decline in inflation that occurred up to the first half of 2006, looking at the structural stability of the estimated relationships and the ability of the model to predict inflation at the end of the sample. The estimates confirm the strong relationship between money and inflation when M1 is used, with no evidence of a structural change.

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Keywords: Money; inflation; monetary policy

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I. INTRODUCTION

Iran has a history of relatively high inflation, with CPI inflation averaging more than 17 percent since the 1979 revolution. Moreover, measured inflation is likely to underestimate "true" inflation owing to price controls and direct and indirect government subsidies. Most of the literature has identified excessive money creation, fueled by government spending out of oil revenues, as the main reason for this phenomenon. More recently, however, from 2002/03[2] up until to the first quarter of 2006/07, inflation has declined despite the continued rapid growth of money, raising questions about the stability of the relationship between money and inflation in Iran.

This paper looks at the determinants of inflation in Iran, both in the short run and in the long run. Unlike the traditional estimates of the demand function for real money balances, the approach followed in this paper looks directly at the relationship between nominal variables and inflation, offering useful insights into the transmission mechanism. Using new national accounts series released by the Central Bank of Iran, a parsimonious error correction model is estimated for the period 1988/89–2005/06. The model estimates are then used to address the questions raised by the recent decline in inflation, looking at the structural stability of the estimated relationships and the ability of the model to predict inflation at the end of the sample.

The main results can be summarized as follows:

- A long-term relationship exists between the price level and money, its rate of return, real output, and the exchange rate. Money has a prominent role in determining the equilibrium price level.

- Money growth drives inflation even in the short-run, with lags of up to four quarters. Moreover, possibly owing to extensive administrative controls on prices, the adjustment to equilibrium takes time, with a half life of about four quarters.

- There is no evidence of a structural change in the relationship between money and inflation. The decline in inflation experienced up until recently is fully predicted by the model, and can be explained almost entirely by the lagged impact of the past deceleration in M1 growth.

- The decline in inflation is unlikely to continue. The model predicts that the recent acceleration of money growth is likely to be reflected in higher inflation after a few quarters.

The paper is organized as follows. Section II provides an overview of the stylized facts about money and inflation in Iran. Section III surveys the literature on the determinants of inflation in

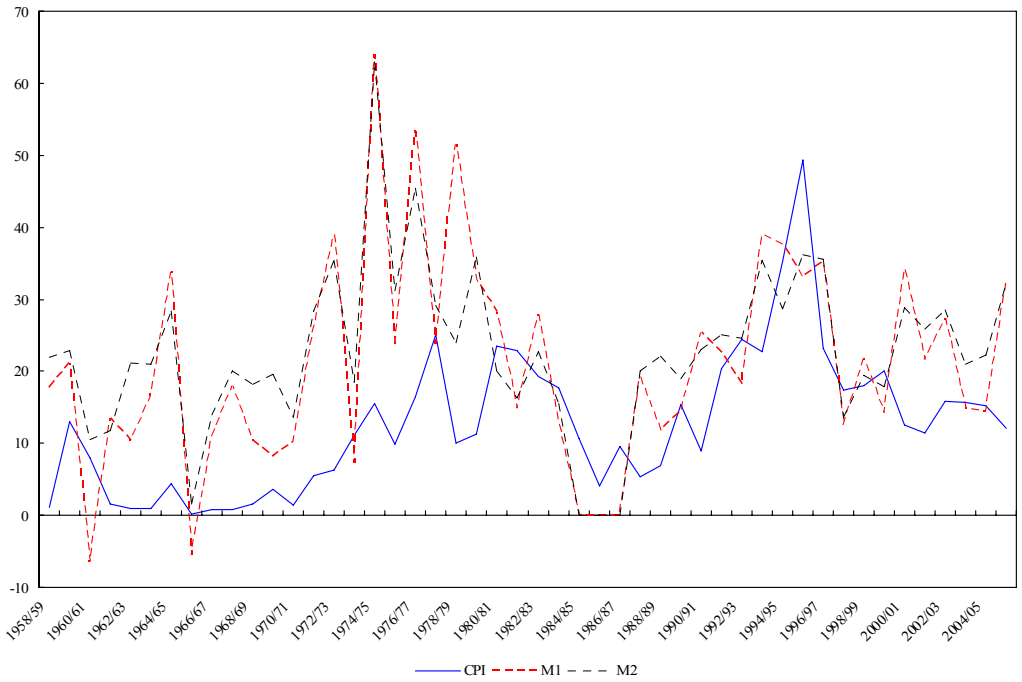
[2] The Iranian year starts March 21.

Iran and describes the model used in the empirical analysis. Section IV presents the empirical results. Section V concludes with some policy implications.

II. The Stylized Facts

Over the last fifty years, the Iranian economy has experienced several events of critical importance, including the 1979 revolution, the 1980–88 war with Iraq, and the 1993 balance of payments crisis; the behavior of the main macroeconomic variables has been strongly influenced by these shocks. Inflation, which experienced sudden bursts in correspondence with these episodes, has been moderately high on average (12.6 percent since 1958/59) and has been generally associated with rapid persistent money growth (24.2 percent for M2) (Figure 1).

Figure 1. Money Growth and Inflation, 1958/59–2005/06
(In percent)



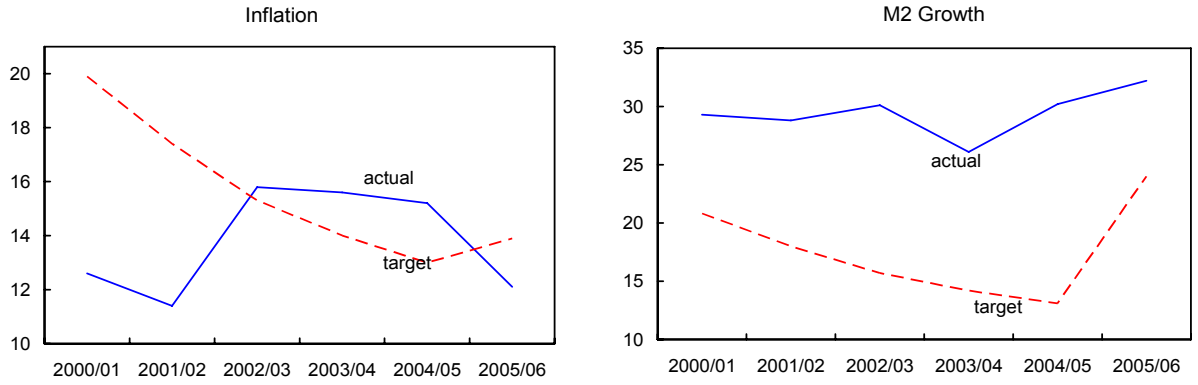
Source: IMF IFS database

The 1979 revolution clearly represents a breaking point in the money-inflation relationship. Inflation increased significantly following the revolution (from 6.6 percent to 17.4 percent on average), but the acceleration in money growth was almost negligible (from 23.8 percent to 24.6 percent on average).[3] After the dramatic increase experienced in the mid-1990s, when it

[3] A plausible explanation has to do with the rapid financial deepening occurring before the revolution. In fact, Pesaran (2000) identifies a structural change in the demand for real money balances, which he finds to be more sensitive to output and more responsive to money market disequilibria in the pre-revolutionary period. The implication of these findings is that the inflationary impact of a given monetary expansion became higher after the revolution.

reached a peak of 50 percent, inflation declined up until the first quarter of 2006/07, though the annual average remained in the double digits. This decline, however, did not reflect an improvement in monetary control, as both M1 and M2 continued to grow quite rapidly. The divergence in the behavior of inflation and monetary growth in recent years is reflected in the performance relative to the inflation target and the money growth target set by the Five-Year Development Plans (FYDPs).[4] Figure 2 shows the evolution of both inflation and money (M2) growth relative to the targets under the Third FYDP (2000/01–2004/05) and the first year of the Fourth FYDP (2005/06–2010/11). While the performance in reaching the inflation target improved somewhat up until 2005/06, the money growth target was consistently missed by a significant margin.[5]

Figure 2. Inflation and M2 Growth, Targets and Outturns, 2000/01–2005/06



Sources: Central Bank of Iran; and IMF staff estimates.

What accounts for this divergence? The trade reforms introduced in the early 2000s resulted in a gradual opening of the economy, which may have exposed it to the effects of international competition. The parallel market appreciation that preceded the 2002 exchange rate unification largely explains the better-than-envisaged inflation performance in the first two years under the Third FYDP. Other factors that may have affected inflation are the impact of favorable weather conditions on agricultural prices, and stricter annual limits to the price increases for goods and services by public sector enterprises (Celasun and Goswami, 2002).

[4] The FYDPs present quantitative annual targets for the main macroeconomic variables, including consumer price inflation and a broad money aggregate. Although these targets are not binding, and there are no consequences for breaching them, they are approved by parliament and are used as benchmarks for formulating monetary programs by the central bank.

[5] The experience under the first two FYDPs was one of systematic underperformance, with inflation exceeding the targets by about 4 percentage points on average under the First FYDP (1989/90–1993/94) and by almost 14 percentage points on average under the Second FYDP (1995/96–1999/2000). The target for M2 growth was missed by almost 16 percentage points on average under the First FYDP, and by 13 percentage points under the Second FYDP (Kramarenko, 2007a).

All these factors, however, may have had only a temporary impact. A more optimistic interpretation would suggest that improved macroeconomic performance and exchange rate stability have increased confidence in the domestic currency, boosting money demand and promoting a resumption of the financial deepening that characterized the years prior to the revolution (Figure 1). Under this interpretation, the authorities should not be overly concerned about the inflationary impact of money growth because that would be, at least partially, defused by an increase in the demand for real money balances. Indeed, if this were the case, the relationship between money growth and inflation should have changed in recent years.

III. A Model of Inflation in Iran

The literature on inflation in Iran is relatively extensive. Part of the literature focuses on conventional money demand functions. Pesaran (2000) estimates a demand equation for real money balances on annual data before (1960/61–1978/79) and after the revolution (1979/80–1998/99) and finds evidence of structural change, with slower adjustment to disequilibrium in the post-revolutionary period.[6] He also finds that the expansion of credit to both the public sector and the private sector largely explains the growth of M2 over the same period. Celasun and Goswami (2002) estimate a similar function on quarterly data over the period 1990:Q2–2002:Q1, where inflation and depreciation of the parallel market exchange rate proxy the opportunity costs of holding money. After identifying a long-run equilibrium condition in the money market, they find a strong impact of money and the exchange rate in the short-run inflation equation.

Other papers propose different approaches. Bahmani-Oskooee (1995) applies cointegration analysis to a sample of annual data over the period 1959–1990, and identifies two cointegrating vectors, one for the price level, and the other for the exchange rate. The former identifies money, real output, the exchange rate, and import prices as the determinants of the equilibrium price level. Becker (1999) uses a common trend model to study the behavior of prices, the exchange rate, and real output over a sample of annual data for the period 1959/60 to 1996/97. Monetary shocks are found to have short-run effects on output, but permanent effects on the price level and the exchange rate. Using quarterly data over the period 1989:Q2–1999:Q4, Liu and Adedeji (2000) estimate long-term equilibrium conditions for the money market, the balance of payments, and the goods market. They find a strong impact of monetary factors on inflation, while the exchange rate effect is weak and transient. Alavirad and Athawale (2005) identify a long-term relationship between prices and the budget deficit. In the short-run, money, as well as the budget deficit, affect inflation, and adjustment to equilibrium is slow.

This paper follows the approach proposed by Kramarenko (2004), where the money demand function is inverted to obtain the price level as a function of nominal money supply. The basic framework for a small open economy is a simple IS-LM model augmented with Purchasing Power Parity (PPP) and Uncovered Interest Parity (UIP) conditions. Despite the progress achieved in recent years in reducing barriers to trade and capital movements, PPP and UIP are unlikely to hold for Iran over the sample period (1988:Q2–2006:Q1). High tariffs and

[6] See footnote 2.

substantial implicit and explicit subsidies to tradable goods distort trade considerably, while impediments to capital mobility and controls on rates of return (interest rates) continue to be pervasive (Kramarenko, 2007b). Even if PPP and UIP do not hold, the exchange rate is still likely to play an important role in the inflation process via its impact on the opportunity cost of holding domestic money.

As PPP and UIP do not hold, the domestic price level can be derived simply by inverting the real money demand equation:

$$p_t = m_t - \theta_1 y_t + \theta_2 r_t - \theta_3 s_t \qquad (1)$$

where:

p_t is the log of the domestic price level (consumer price index)

m_t is the log of the money supply (M1)[7]

y_t is the log of income (GDP at constant market prices)

r_t is the nominal rate of return on time deposits (3-month deposit rate)

s_t is the log of the nominal effective exchange rate.[8]

IV. Empirical Results

A visual inspection of the variables suggests that all are trended over the sample period (Figure 3). Unit root tests indicate that all variables are indeed nonstationary (Appendix II, Table AII.1a).[9]

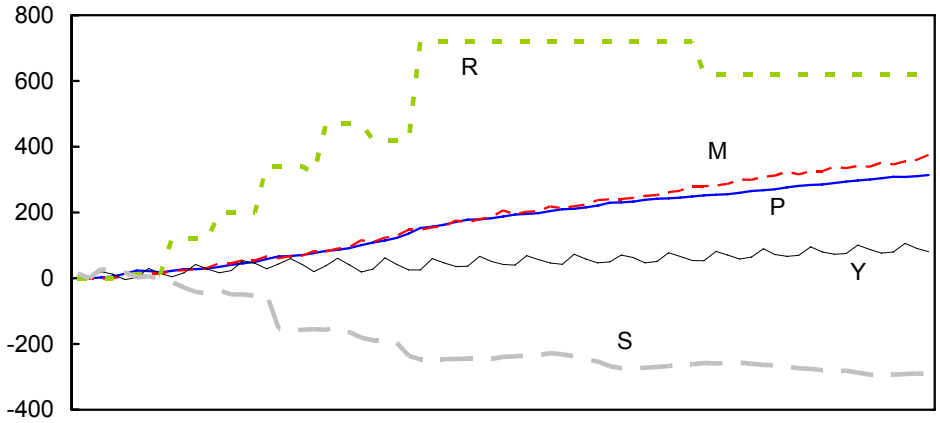
Another characteristic of the data is seasonality, which is particularly evident in GDP. The HEGY test (Hylleberg, Engle, Granger and Yoo, 1990) detects the presence of unit roots at seasonal frequencies for *y* (Appendix II, Table AII.2), invalidating the interpretation of the unit root tests, which are based on the assumption of a single unit root at the zero frequency. To avoid this problem, seasonal components are filtered out of all variables using X-12-Arima. Once the data are seasonally adjusted, unit root tests clearly suggest that all variables are I(1) (Appendix II, Table AII.1b).

[7] Although M2 is the definition of money preferred by the authorities, the relationship between M1 and inflation has been more stable. Another argument for choosing M1 is that the statistical tests reject weak exogeneity for M2 (see footnote 9).

[8] Statistical sources and definitions are provided in Appendix I.

[9] The tests seem to suggest that all variables are I(1), although the Augmented Dickey-Fuller test points at the possibility of *p* and *m* being I(2).

Figure 3. *p, m, y, s*, and *r*, 1988:Q2–2006:Q1
(X_t=100*[log(X_t)-log($X_{1988:Q2}$)])



Sources: IMF IFS database; Central Bank of Iran; and IMF staff estimates.

Given the nonstationarity of the variables, cointegration analysis is used to identify the long-run relationships among them. The selection of the VAR dynamic specification is driven by the need to eliminate serial correlation in the residuals.[10] As some of the seasonality may be specific to the Iranian calendar, four dummy variables for Islamic festivities (Muharram, Ramadan, Shawal, and Thul-Hujia), as calculated by Riazuddin and Khan (2005), are included. Both the trace and maximum eigenvalue Johansen statistics indicate one cointegrating vector at the 5 percent confidence level (Appendix III). The signs of the estimated long-run cointegrating vector are consistent with the predictions from equation (1) (standard errors in parentheses):

$$p = \underset{(0.02)}{0.83}m - \underset{(0.10)}{0.63}y + \underset{(0.01)}{0.03}r - \underset{(0.03)}{0.13}s \qquad (2)$$

Money is by far the most important determinant of changes in the long-run price level. The coefficient of money differs from unity (as would be required by the homogeneity condition), but is reasonably close. The difference is likely to reflect extensive price controls, which prevent full adjustment in many goods markets. A more appreciated nominal effective exchange rate and a higher income level are associated with a lower equilibrium price level, while higher rates of return on deposits reduce demand for real money balances (M1), raising the equilibrium price.

[10] Although the Schwarz information criterion and the Hannan-Quinn information criterion argued for the inclusion of one lag only, it was decided to include two lags to reduce residual autocorrelation. The estimated VAR satisfies the stability condition, with all roots inside the unit circle, and residuals are free of serial correlation, with the exception of some fourth order serial correlation. The residuals are normal and homoskedastic for all variables, with the exception of the exchange rate, which exhibits some large infrequent shocks.

Weak exogeneity tests indicate that money, output, the rate of return, and the nominal effective exchange rate are weakly exogenous to the cointegrating vector. In other words, deviations from the long-term equilibrium price level bring about adjustments only in the price level itself.[11] A single error correction equation can then be estimated for the first difference of p_t. Model selection is based on the general-to-specific methodology developed by Hendry, with the original dynamic specification containing four lags for all the endogenous variables. Using the *PcGets* automated encompassing procedure (Hendry and Krolzig, 2001), a parsimonious model is estimated by ordinary least squares. The following specification is selected (standard errors in parentheses):

$$\underset{}{dp_t} = \underset{(0.08)}{0.27}dp_{t-1} + \underset{(0.05)}{0.31}dm_{t-1} + \underset{(0.06)}{0.16}dm_{t-4} - \underset{(0.04)}{0.10}dy_t + \underset{(0.004)}{0.02}dr_t - \underset{(0.01)}{0.05}ds_t + \underset{(0.003)}{0.01}DM - \underset{(0.03)}{0.16}EC_{t-1}$$

RSS=0.01
R^2=0.75
Adj. R^2=0.72
T=67

where:

dp is the change in the log of CPI

dm is the change in the log of M1

dy is change in the log of real GDP

dr is the change in the rate of return on 3-month deposits

ds is the change in the log of nominal effective exchange rate

DM is the dummy for the Muharram festivity

EC is the error correction term.

Table 1. Specification Tests

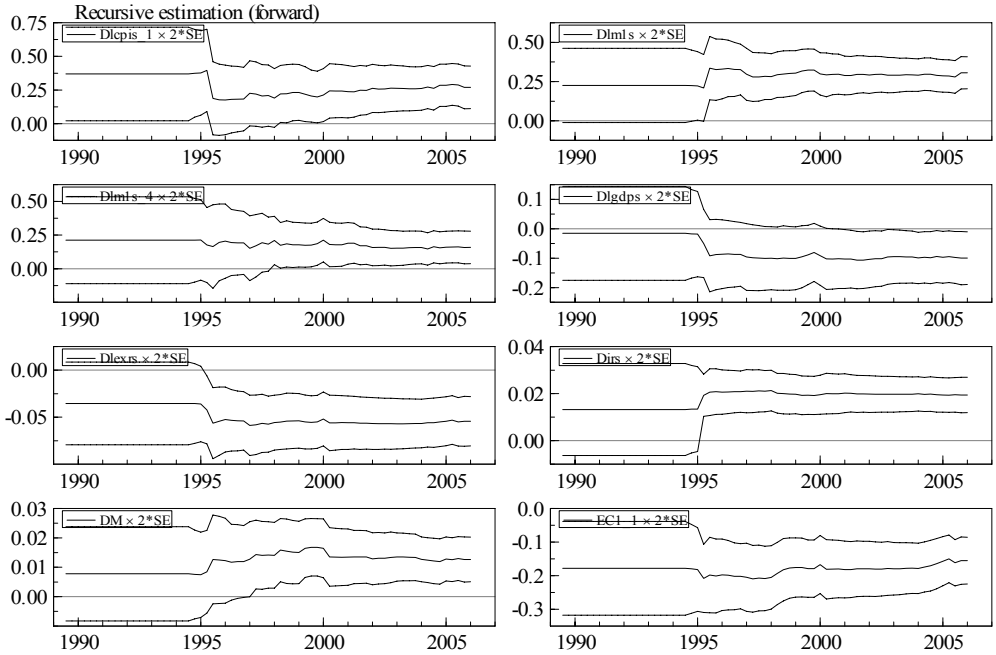
	Value	Prob.
Chow (1997:4)	0.82	0.71
Chow (2004:3)	1.44	0.22
Normality test	0.06	0.97
AR 1–4 test	0.80	0.53
ARCH 1–4 test	0.57	0.69
Heteroskedasticity test	17.28	0.37

Source: IMF staff estimates.

[11] A joint restriction that the adjustment coefficients that multiply the cointegrating vector in the equations for money, output, the rate of return, and the nominal effective exchange rate are equal to zero could not be rejected with $\chi(4)=5.88$ and p-value=0.21. The same restriction could be rejected when M2 was used instead of M1.

The estimated model fits the data well and passes all the specification tests. The residuals appear to be normally distributed with no evidence of autocorrelation or heteroskedasticity. Stability tests suggest an absence of structural breaks in the model, although parameter instability can be rejected more clearly when the breakpoint is in the middle of the sample period (1997:Q4) than towards the end (2004:Q3) (Table 1). Results from recursive estimation suggest that the coefficient estimates have remained stable since 1995 (Figure 4).

Figure 4. Inflation Equation: Recursive Estimates of Short-Run Coefficients*

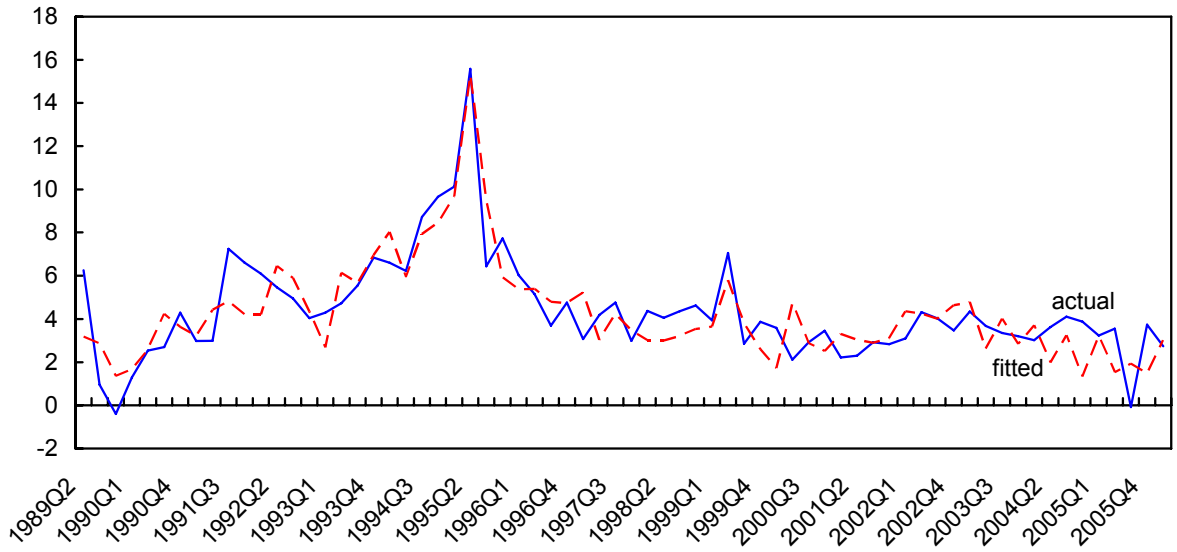


* For each coefficient, the chart report the recursive estimate and the 2-standard error confidence band.

Overall, the model provides a reasonable description of the short-run dynamics of inflation in Iran. Inflation shows some persistence, as indicated by its positive lagged coefficient, but is mostly driven by money, although its impact takes time to feed through, with lags of up to four quarters. Income and rates of return only have contemporaneous effects of the expected sign. The pass-through of the exchange rate to inflation appears relatively small, but feeding through rapidly. Of the Islamic festivities, only Muharram seems to have an impact on inflation. The mean half life of adjustment of inflation to a unit shock is estimated at about four quarters, which is rather long and is likely a consequence of extensive price controls.

How does the model predict the recent decline in inflation? A comparison of actual with fitted values of inflation indicates that the model has mostly underpredicted inflation since mid-2004, with the notable exception of the third quarter of 2005, when actual (quarterly) inflation dropped to zero (Figure 5).

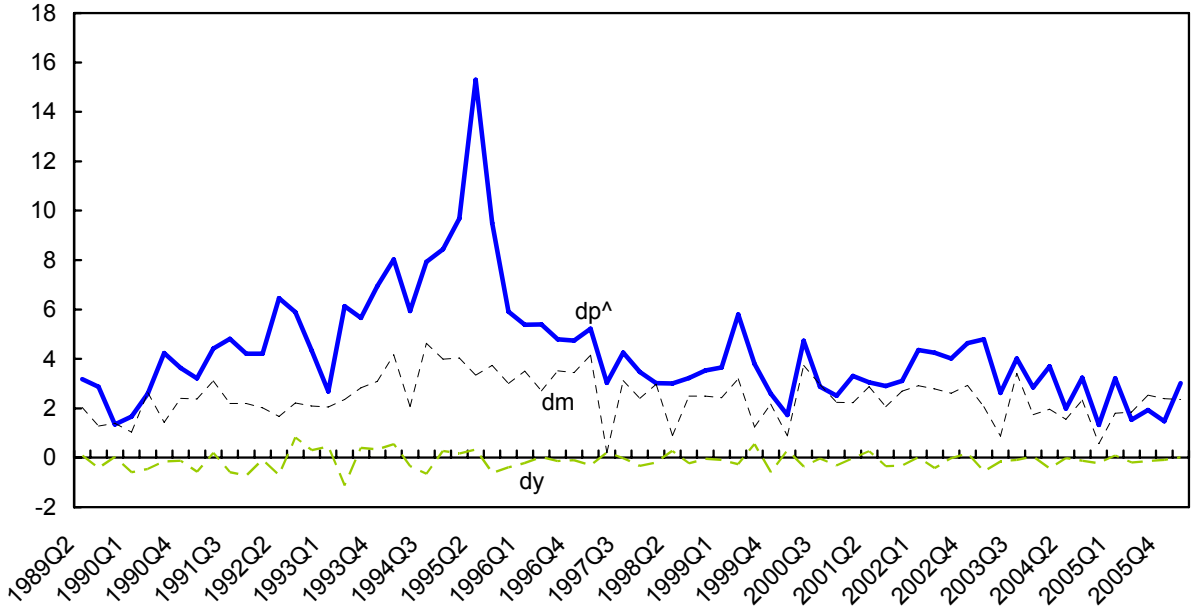
Figure 5. Inflation Equation: Actual and Fitted Values



Sources: IMF IFS database; and IMF staff estimates.

Figure 6 shows the fitted values for inflation, together with the cumulate contributions (including all lags) of the two most important determinants, money and output, calculated using the estimated short-run coefficients. According to the model, the decline in inflation that occurred up until recently can be explained almost exclusively by a slowdown in M1 growth in previous quarters. The contribution of other factors—rapid GDP growth and exchange rate appreciation (not shown in the figure)—to the decline in inflation has been almost negligible.

Figure 6. Predicted Inflation and Contributions of its Determinants, 1989:Q2–2006:Q1



Sources: IMF IFS database; and IMF staff estimates.

V. CONCLUSIONS

Monetary policy in Iran has not been successful in meeting the inflation and monetary targets set in the Five-Year Development Plans, owing mainly to the monetary impact of government spending out of oil revenue. Although the attainment of the inflation targets has improved somewhat recently, the objective of a gradual disinflation to single-digit levels has not been achieved. Moreover, the implicit intermediate target of monetary policy, money growth, has been systematically missed.

This paper shows that the problems encountered in adhering to the monetary targets are the main reasons for the persistence of double-digit inflation in Iran. This conclusion is supported by the finding of a long-run relationship between the price level, money, output, the rate of return on money, and the exchange rate. The role of money is prevalent in determining the price level in the long run. The paper also presents estimates of a parsimonious error correction model of inflation, which explains the short-run inflation dynamics in terms of deviations from the long-run price level, current and lagged money growth, current output growth and exchange rate depreciation, and changes in the rate of return on deposits. The model provides reasonably accurate in-sample estimates of inflation for the period 1988–2006, and does not detect any evidence of a structural change. According to the model, the decline in inflation experienced up until the first quarter of 2006/07 is mostly due to a slowdown in M1 growth in previous quarters, and is likely to be reversed once the current acceleration in money growth feeds through to inflation.

These results suggest that controlling money growth is key to the success of the disinflation effort in Iran. The stability of the relationship between money and inflation also seems to indicate that money growth can be a useful intermediate target. The challenge, however, seems to be how to achieve that target. The history of systematic underperformance vis-à-vis the monetary targets calls for improving the coordination of fiscal policy with monetary policy and clearly subordinating exchange rate objectives to achieving the inflation targets.

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Appendix I. Data Sources and Definitions

Prices are measured by the Consumer Price Index (CPI) for urban areas from the IMF IFS database.

Money supply is M1 from the IMF IFS database.

The output series is obtained by splicing two series of GDP at constant market prices: the first one, available for the period 1988:Q2–2005:Q1 from the database on the Central Bank of Iran website (www.cbi.ir); the second one, for the period 2005:Q1–2006:Q1, reported by the Central Bank of Iran on its quarterly publication *Economic Trends*, also available on www.cbi.ir.

The interest rate is the rate of return on 3-month deposits in state-owned banks reported by the Central Bank of Iran on its quarterly publication *Economic Trends* available on www.cbi.ir.

The nominal effective exchange rate is the trade-weighted index from the IMF's INS database.

The dummy variables for Islamic festivities are those calculated by Riazuddin and Khan (2005).

Appendix II. Unit Root Tests

Table AII.1. Unit Root Tests, Iran, 1998Q2-2006Q1

	Auxiliary regression	Augmented Dickey-Fuller *t* statistics 1/			Phillips-Perron *t* statistics 1/		
		Level	1st diff.	2nd diff.	Level	1st diff.	2nd diff.
				a) Unadjusted data			
	No intercept, no trend	1.18	-0.98	-4.77***	5.89	-3.59***	-18.72***
p	Intercept, no trend	2.09	2.82*	-4.72***	1.33	5.80***	-18.49***
	Intercept, trend	-1.08	-3.35*	-4.82***	-0.39	-6.12***	-18.77***
	No intercept, no trend	2.40	-0.46	-19.85***	9.44	-9.24***	-58.16***
m	Intercept, no trend	-0.64	-2.80*	-19.72***	0.34	-15.43***	-58.18***
	Intercept, trend	-2.20	-2.81	-19.56***	-3.92**	-15.27***	-57.80***
	No intercept, no trend	2.75	-2.84***	-55.33***	1.69	-15.19***	-24.42***
y	Intercept, no trend	-1.23	-4.08***	-54.89***	-4.05***	-18.00***	-24.14***
	Intercept, trend	-2.85	-4.10***	-10.38***	-8.48***	-17.80***	-23.93***
	No intercept, no trend	1.10	-8.52***	-7.29***	1.15	-8.52***	-56.65***
r	Intercept, no trend	-2.00	-8.76***	-7.23***	-2.11	-8.77***	-56.11***
	Intercept, trend	-1.10	-9.10***	-7.15***	-0.87	-9.75***	-56.49***
	No intercept, no trend	-2.87***	-7.55***	-8.87***	-2.96***	-7.56***	-41.61***
s	Intercept, no trend	-1.89	-8.08***	-8.80***	-1.98	-8.08***	-41.81***
	Intercept, trend	-1.16	-8.25***	-8.74***	-1.11	-8.28***	-48.74***
				b) Seasonally adjusted data			
	No intercept, no trend	1.53	-1.31	-12.18***	5.67	-1.56	-12.25***
p	Intercept, no trend	-1.04	2.62*	-12.09***	-1.34	-3.78***	-12.17***
	Intercept, trend	-1.34	-2.75*	-12.00***	-0.58	-3.98**	-12.08***
	No intercept, no trend	16.08	-0.13	-15.99***	12.25	-2.14**	-25.47***
m	Intercept, no trend	0.02	-7.15***	-15.88***	-0.02	-7.28***	-25.47***
	Intercept, trend	-1.42	-7.10***	-15.77***	-1.77	-7.24***	-25.98***
	No intercept, no trend	2.77	-9.18***	-10.27***	5.44	-9.18***	-42.93***
y	Intercept, no trend	-1.02	-10.45***	-10.19***	-0.98	-10.90***	-42.84***
	Intercept, trend	-2.98	-10.42***	-10.11***	-2.96	-11.04***	-42.61***
	No intercept, no trend	1.21	-8.67***	-6.90***	1.26	-8.66***	-40.35***
r	Intercept, no trend	-2.16	-8.96***	-6.85***	-2.20	-8.96***	-40.12***
	Intercept, trend	-1.09	-9.40***	-6.78***	-1.02	-9.42***	-39.77***
	No intercept, no trend	-3.08	-6.82***	-13.96***	-3.08***	-6.86***	-27.52***
s	Intercept, no trend	-1.91	-7.38***	-13.86***	-1.87	-7.38***	-27.11***
	Intercept, trend	-0.97	-7.61***	-13.78***	-1.04	-7.59***	-27.45***

1/ * indicates a p-value of 0.90 or more. ** indicates a p-value of 0.95 or more. *** indicates a p-value of 0.99 or more.

Table AII.2. HEGY Seasonal Unit Root Tests, Iran, 1998Q2-2006Q1

		t statistics 1/				*F* statistics 1/
	Auxiliary regression	zero frequency	biannual	annual	π_4	$\pi_3=\pi_4=0$
	No intercept, no trend, no seasonal dummies	1.83	-9.17**	-2.84**	-4.10**	15.05**
	Intercept, no trend, no seasonal dummies	-1.13	-8.49**	-2.81**	-3.90**	13.85**
p	Intercept, no trend, seasonal dummies	-0.93	-5.54**	-2.93	-5.93**	29.15**
	Intercept, trend, no seasonal dummies	-0.79	-8.48**	-2.85**	-3.87**	13.85**
	Intercept, trend, seasonal dummies	-1.17	-5.58**	-3.08	-5.77**	29.32**
	No intercept, no trend, no seasonal dummies	7.54	-1.73*	-4.46**	-4.16**	26.14**
	Intercept, no trend, no seasonal dummies	-0.43	-1.63*	-4.33**	-3.88**	23.01**
m	Intercept, no trend, seasonal dummies	-0.60	-2.99*	-5.39**	-5.78**	60.25**
	Intercept, trend, no seasonal dummies	-0.81	-1.64*	-4.36**	-3.83**	23.01**
	Intercept, trend, seasonal dummies	-1.25	-3.04**	-5.53**	-5.53**	60.67**
	No intercept, no trend, no seasonal dummies	6.83	-1.50	-0.92	-0.95	0.88
	Intercept, no trend, no seasonal dummies	-1.28	-1.45	-0.94	-0.99	0.95
y	Intercept, no trend, seasonal dummies	-1.05	-2.94*	-3.24*	-3.94**	16.53**
	Intercept, trend, no seasonal dummies	-1.84	-1.44	-0.98	-1.00	1.00
	Intercept, trend, seasonal dummies	-1.99	-2.99*	-3.42*	-3.77**	16.63**
	No intercept, no trend, no seasonal dummies	1.14	-4.55**	-4.64**	-4.51**	30.81**
	Intercept, no trend, no seasonal dummies	-2.37	-4.40**	-4.67**	-4.16**	28.03**
r	Intercept, no trend, seasonal dummies	-2.26	-4.22**	-4.66**	-4.14**	28.39**
	Intercept, trend, no seasonal dummies	-0.99	-4.30**	-4.49**	-4.11**	26.22**
	Intercept, trend, seasonal dummies	-0.96	-4.13**	-4.48**	-4.09**	26.54**
	No intercept, no trend, no seasonal dummies	-2.94**	-4.52**	-4.07**	-5.37**	33.84**
	Intercept, no trend, no seasonal dummies	-2.54	-4.39**	-4.24**	-5.20**	33.78**
s	Intercept, no trend, seasonal dummies	-2.41	-4.41**	-4.17**	-5.01**	31.97**
	Intercept, trend, no seasonal dummies	-1.32	-4.36**	-4.20**	-5.15**	33.20**
	Intercept, trend, seasonal dummies	-1.34	-4.39**	-4.14**	-4.96**	31.50**

1/ * indicates a p-value of 0.90 or more. ** indicates a p-value of 0.95 or more.

Appendix III. Cointegration Tests

Sample (adjusted): 1988:Q4 2006:Q1
Included observations: 70 after adjustments
Trend assumption: Linear deterministic trend
Series: *p m y r s*
Exogenous series: DH DM DR DS
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.407090	80.32418	69.81889	0.0057
At most 1	0.288632	43.73432	47.85613	0.1157
At most 2	0.136823	19.89471	29.79707	0.4300
At most 3	0.118694	9.595243	15.49471	0.3132
At most 4	0.010667	0.750692	3.841466	0.3863

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.407090	36.58987	33.87687	0.0231
At most 1	0.288632	23.83961	27.58434	0.1404
At most 2	0.136823	10.29946	21.13162	0.7161
At most 3	0.118694	8.844551	14.26460	0.2993
At most 4	0.010667	0.750692	3.841466	0.3863

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values