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Islamic Republic of Iran: Selected Issues

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ISLAMIC REPUBLIC OF IRAN

Selected Issues

Prepared by Vitaliy Kramarenko, Leo Bonato,
and Roman Zytek (all MCD)

Approved by the Middle East and Central Asia Department

June 26, 2008

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I. Forecasting Inflation in the Islamic Republic of Iran[1]

The recent rise of inflation in Iran and the need to implement policies to counter it highlight the importance of reliable inflation forecasts, which are particularly challenging when structural changes affect the economy. Using a robust procedure based on forecast combinations, this chapter shows that a monetary model provides the best forecasting performance. Although recent evidence of money demand instability may undermine the model's forecasting ability, the robust procedure ensures the model will adjust rapidly to change.

A. Introduction

1. Iran has a history of relatively high inflation. Since the 1979 revolution, annual CPI inflation has averaged more than 19 percent. Following the high and variable inflation that characterized the two decades after the revolution, Iran experienced a decline in inflation, particularly after the 2002 exchange rate unification. However, this favorable trend was reversed recently. After reaching a low of 7 percent in the first quarter of 2006/07, inflation rose sharply, well exceeding 20 percent at the end of 2007/08.[2]

2. Available evidence supports the view that monetary factors are the main determinants of inflation in Iran. Government spending out of oil revenues leads to large liquidity injections that the central bank accommodates due to its efforts to prevent a significant nominal appreciation of the rial and the lack of effective sterilization instruments. The growing discontent with inflation, however, has compelled policy makers to focus on this issue, bringing it to the forefront of the policy agenda. In this context, reliable inflation forecasts are increasingly becoming an important input for monetary policy.

3. Although the literature on inflation determinants in Iran is quite rich, to our knowledge no serious attempt has been made yet to assess the forecasting properties of different models. The aim of this paper is to make this assessment by looking at the forecasting ability of a monetary model of inflation against the benchmark provided by a simple univariate forecast. To assess the predictive ability of nonmonetary factors, the paper also examines the performance of an alternative model, such as the Phillips curve.

4. Visual observation of key macroeconomic variables points to the existence of structural breaks whose timing and nature may not be obvious, making them difficult to identify and model.[3] Moreover, the recent slowdown in bank deposits points at possible

[1] This chapter was prepared by Leo Bonato based on information available as of March 31, 2008.

[2] The Iranian year ends on March 20.

[3] Previous research could not detect any structural change in an inflation equation for Iran (Bonato, 2008).

instability in money demand. These changes present a distinctive challenge for forecasting, which this paper addresses by proposing a methodology that is robust to structural change. Drawing from the literature on forecast combination, the proposed methodology rests on the optimal combination of forecasts in two stages. First, after the initial model selection based on in-sample methods, forecasts for each model are derived by combinations of recursive and rolling forecasts. Second, when warranted by the results of encompassing tests, forecasts from different models are also combined. At each stage, the forecast properties are evaluated based on out-of-sample simulations.

5. The main conclusions are:

- The proposed methodology provides a notable improvement in accuracy, with combinations significantly outperforming individual forecasts at each stage.
- The monetary model provides fairly precise short-term inflation forecasts, outperforming the univariate benchmark significantly.
- Based on simple measures of the output gap, a Phillips curve cannot be fit to the data.
- Although recent evidence of money demand instability makes out-of-sample forecasts unreliable at the moment, the proposed methodology should ensure that structural changes are promptly captured by the monetary model and its forecasting ability more rapidly restored as more information becomes available.

6. Section B briefly surveys the literature on the determinants of inflation in Iran. Section C describes the data and the in-sample model selection procedure. Section D explains the forecast procedure and assesses the outcome of the out-of-sample simulation.

B. A Brief Survey of the Literature

7. In the last two decades, growing evidence of money demand instability has undermined the role of money as a useful operational target for monetary policy in developed countries. At the same time, new theoretical developments, accompanied by the success of inflation targeting in many countries, have led to increasing skepticism about the role of money as a short-term determinant of inflation (Woodford, 2007). Nonetheless, money remains an important predictor of inflation in middle- and low-income countries (Bokil and Schimmelpfennig, 2005; Ramakrishnan and Vamvakidis, 2002; Callen and Chang, 1999).

8. The literature on the determinants of inflation in Iran is relatively extensive. Most studies find a significant role for monetary factors. By focusing directly on the relationship between nominal variables and inflation, Bonato (2008) identifies a long-run relationship between the price level and money, the interest rate, real output, and the exchange rate. Money is found to have a prominent role in driving inflation both in the long and the short run. Other authors reach similar conclusions using a different dataset (Kramarenko, 2004),

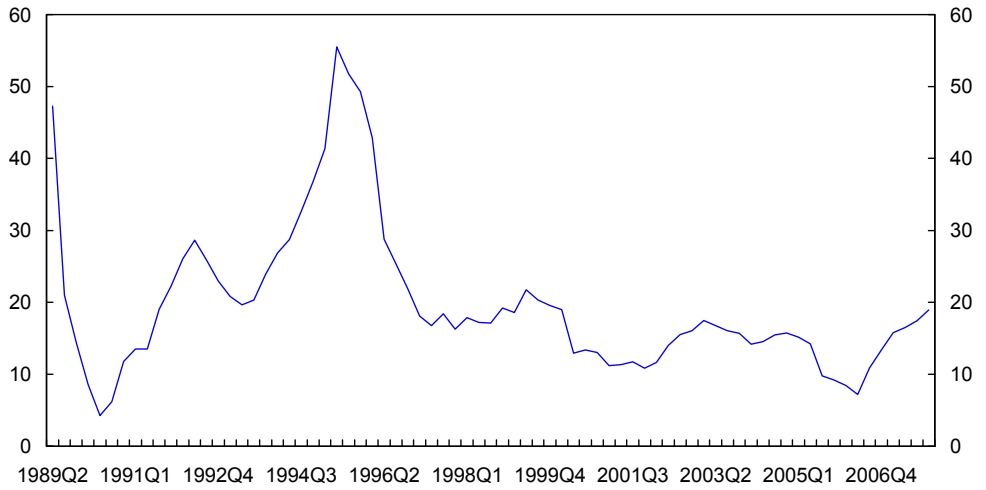
a conventional money demand function (Pesaran, 2000; Celasun and Goswami, 2002) or different modeling approaches (Bahmani-Oskooee, 1995; Becker, 1999; Liu and Adedeji, 2000; Alavirad and Athawale, 2005).

9. The Phillips curve remains a popular inflation forecasting tool in developed countries (Stock and Watson, 1999). However, its success in explaining inflation in middle- and low-income countries has been mixed, partly as a result of the difficulties in measuring trend output and unemployment in economies subject to rapid structural change.

C. Data Description and Model Selection

10. Inflation is defined as the annual (year-on-year) percentage change in the price level, measured by the consumer price index (CPI). Large shifts in mean and variance are evident as we move from high and volatile inflation in the 1980s and 1990s to the more stable—although still relatively high—inflation of the last few years (Figure I.1).

Figure I.1. Islamic Republic of Iran: Inflation, 1989Q2-2007Q4
(year-on-year percentage change in the CPI)



Source: CBI.

Moreover, recent evidence of a slowdown in deposit growth suggests the possibility of a structural change in money demand.[4]

11. These shifts make inflation look nonstationary, and indeed the Augmented Dickey-Fuller test cannot reject the unit root hypothesis. It is well known, however, that standard unit root tests are biased against not rejecting the unit root hypothesis if structural breaks are

[4] Rial time deposits grew only by 27 percent in 2007/08, as opposed to 44 percent in 2006/07, which is likely to reflect higher inflation expectations in a context of declining nominal banking rates of return (interest rates).

present (Reichlin, 1989). To correct for this bias, we conducted a Phillips-Perron test, which is robust to structural breaks. The test confirms that we can consider inflation, as well as the other variables used in the analysis, as stationary (Table I.1).[5]

12. Regular seasonality is removed by seasonal differencing. However, some of the seasonality may be specific to the Iranian calendar**.** To control for this, four dummies for Islamic festivities (Muharram, Ramadan, Shawal, and Dhul-Hijja) are calculated, based on Riazuddin and Khan (2002).[6] Following the introduction of the new CPI in 2005Q2, we also test for the existence of a level shift in the inflation series at the end of the sample.

13. Three different classes of inflation models are estimated:

- Univariate ARMA model. A univariate model is to be used as a benchmark for the multivariate forecasts. An inspection of the autocorrelogram and the partial correlogram does not give a clear guidance as to its specification. Therefore, we estimate all different combinations of ARMA(p,q) models for $0 \leq p, q \leq 4$, with and without a constant term, and the dummies for Islamic festivities. Out of 75 estimated models, we select eight based on the Schwartz Information Criterion (SIC).[7]

- Monetary model. Bonato (2008) estimates an error-correction model of inflation as a function of changes in money, interest rate, real output, and exchange rate. In the presence of structural change, however, the long-term cointegrating restriction may become an important source of forecast error (Clements and Hendry, 2006). Therefore, we removed the cointegrating restriction in this context. Model selection is based on the general-to-specific methodology developed by Hendry, with the original dynamic specification containing 4 lags for inflation and the weakly exogenous variables. Using different combinations of the money (M1 or M2) and exchange rate (NEER or the bilateral exchange rate vis-à-vis the U.S. dollar) measures, we consider four different specifications. For each of them, we estimate two parsimonious equations by ordinary least squares using, alternatively, the "liberal" and the "conservative" strategies embedded in the *PcGets* automated encompassing procedure (Hendry and Krolzig, 2001). As the two strategies yield the same model on two occasions, our final selection consists of six models.

[5] Data sources are described in the Appendix.

[6] This approach is only partially effective because the Iranian calendar contains important festivities that are not included here (we owe this observation to the Iranian authorities).

[7] The SIC is a useful criterion in this context because of its asymptotic property of correctly selecting the model with minimum out-of-sample mean square error (Inoue and Kilian, 2006).

Table I.1. Islamic Republic of Iran: Unit Root Tests, 1989Q2-2007Q4 1/

	Auxiliary regression 2/	Augmented Dickey-Fuller *t* statistics 3/		Phillips-Perron *t* statistics 3/	
		Level	1st diff.	Level	1st diff.
	No intercept, no trend	-0.81	-4.94***	-2.04**	-7.94***
π	Intercept, no trend	-2.18	-4.90***	-3.55***	-7.85***
	Intercept, trend	-2.71	-4.87***	-3.50**	-7.71***
	No intercept, no trend	-2.94***	-11.52***	-2.94***	-19.17***
y	Intercept, no trend	-4.42***	-11.44***	-4.42***	-19.10***
	Intercept, trend	-4.43***	-11.35***	-4.43***	-19.89***
	No intercept, no trend	-1.54	-9.68***	-3.29***	-7.56***
r	Intercept, no trend	-1.52	-9.62***	-3.33**	-7.50***
	Intercept, trend	-2.63	-9.61***	-3.65**	-7.45***
	No intercept, no trend	-0.29	-6.80***	-0.34	-8.46***
m_1	Intercept, no trend	-2.92**	-6.80***	-3.01**	-8.42***
	Intercept, trend	-2.89	-6.75***	-2.99	-8.36***
	No intercept, no trend	0.04	-9.35***	0.13	-9.35***
m_2	Intercept, no trend	-2.28	-9.32***	-2.36	-9.32***
	Intercept, trend	-2.39	-9.31***	-2.47	-9.32***
	No intercept, no trend	-3.11***	-6.62***	-2.29**	-6.81***
s_1	Intercept, no trend	-3.79***	-6.57***	-2.86*	-6.76***
	Intercept, trend	-4.37***	-6.52***	-3.44*	-6.70***
	No intercept, no trend	-2.60**	-6.10***	-2.14**	-6.15***
s_2	Intercept, no trend	-3.35**	-6.06***	-2.58	-6.11***
	Intercept, trend	-3.78**	-6.06***	-2.79	-6.12***

Source: Fund staff estimates.

1/ All variables are expressed as year-on-year percentage change, with the exception of the interest rate (year-on-year change).
π is prices; y is output; r is interest rate; m1 is M1; m2 is M2; s1 is NEER; s2 is the USD exchange rate (see Appendix).

2/ The lag length of the regression, not reported in this table, has been chosen based on the Schwarz information criterion.

3/ * indicates a p-value of 0.10 or less. ** indicates a p-value of 0.05 or less. *** indicates a p-value of 0.01 or less.

- Phillips curve. We tried to estimate a Phillips curve based on a measure of activity (output gap, calculated by applying the Hodrick-Prescott filter to, alternatively, GDP and non-oil GDP) and import prices. However, it was not possible to fit a meaningful Phillips curve. The output gap was selected only once by the *PcGets* procedure, but with the wrong (i.e., negative) sign.

14. Results for the ARMA and the monetary models are reported in Tables I.2 and I.3. All models exhibit a good fit, but residuals in most cases are serially correlated and heteroskedastic, and nonnormal for ARMA models.[8] In most cases, the Chow test does not indicate the presence of structural breaks. Moreover, the dummy for the new CPI never turned out significant and was dropped.

D. Forecast Combination and Evaluation

15. The forecast performance of different models was assessed based on simulated (or pseudo) out-of-sample forecasts. Since the seminal work on the exchange rate by Meese and Rogoff (1983), this has been the preferred method to evaluate forecasts, as it replicates the conditions under which forecasters operate, predicting events based on the limited set of information available at each particular moment.[9]

16. There are three different schemes used in the forecasting literature to generate out-of-sample predictions:

- Fixed: parameters are estimated only once over the portion of the sample set aside for estimation.

- Recursive: parameters are reestimated each period from the beginning of the sample, with the sample size growing continuously.

- Rolling: parameters are reestimated each period for a fixed-size moving window.

17. The latter two schemes enjoy an obvious advantage in that they use the additional information that becomes available each period. As in real life, models are reestimated each period to incorporate the newly-accrued information. In general, the recursive scheme is difficult to beat as it uses all the available information at each point in time. If the data-

[8] Nonnormality and heteroskedasticity should be expected given the characteristics of the data-generating process, which is partly driven by dramatic episodes like the 1995/96 surge in inflation. Serial correlation could be a symptom of misspecification of the monetary model arising from the omission of the error correction term.

[9] Some authors, however, have pointed out the low power of out-of-sample tests, particularly if structural breaks are present (Clark and McCracken, 2005; Inoue and Kilian, 2004, 2006). The pre-selection procedure based on in-sample criteria (as described in the previous section) can be considered as one way to mitigate this problem.

Table I.2. Islamic Republic of Iran: ARMA Model of Inflation, 1989Q3-2007Q4 1/

	Model 1 1,3	Model 2 1,4	Model 3 2,3	Model 4 2,3	Model 5 2,4	Model 6 4,3	Model 7 4,4	Model 8 4,4
Constant	19.23***	18.79***	19.87***	20.97***	20.19***	20.28***	21.76***	21.18***
	(2.95)	(3.72)	(4.39)	(5.00)	(4.80)	(3.66)	(3.36)	(2.66)
AR(1)	0.57**	0.80***	0.41*	0.47	0.90*	0.42	1.14***	0.93***
	(0.22)	(0.15)	(0.22)	(0.41)	(0.48)	(0.29)	(0.13)	(0.19)
AR(2)	…	…	0.30***	0.24	-0.06	0.39***	-0.62***	-0.26
	…	…	(0.08)	(0.23)	(0.35)	(0.12)	(0.23)	(0.26)
AR(3)	…	…	…	…	…	0.02	0.64***	0.40***
	…	…	…	…	…	(0.14)	(0.18)	(0.13)
AR(4)	…	…	…	…	…	-0.14	-0.34***	-0.34***
	…	…	…	…	…	(0.11)	(0.05)	(0.07)
MA(1)	0.99***	0.68***	1.03***	0.96***	0.58	0.97***	0.21	0.44*
	(0.02)	(0.22)	(0.09)	(0.04)	(0.49)	(0.12)	(0.31)	(0.24)
MA(2)	0.96***	0.64***	0.91***	0.94***	0.56	0.80***	1.06	1.00**
	(0.02)	(0.23)	(0.09)	(0.03)	(0.46)	(0.14)	(0.66)	(0.50)
MA(3)	0.96***	0.61***	0.88***	0.95***	0.59	0.82***	0.27	0.64
	(0.02)	(0.23)	(0.11)	(0.03)	(0.48)	(0.13)	(0.60)	(0.65)
MA(4)	…	-0.35	…	…	-0.38	…	-0.52*	-0.63**
	…	(0.22)	…	…	(0.47)	…	(0.31)	(0.31)
Dummy for Muharram	…	…	…	-0.61**	…	…	…	-0.76
	…	…	…	(0.23)	…	…	…	(0.70)
Dummy for Ramadhan	…	…	…	0.10	…	…	…	-0.09
	…	…	…	(0.24)	…	…	…	(0.51)
Dummy for Shawal	…	…	…	-0.24	…	…	…	-0.43
	…	…	…	(0.34)	…	…	…	(0.63)
Dummy for Dhul Hijja	…	…	…	0.46	…	…	…	0.41
	…	…	…	(0.28)	…	…	…	(0.48)
Adjusted R^2	0.93	0.93	0.94	0.94	0.94	0.94	0.96	0.96
Schwarz Information Criterion	4.99	5.00	4.95	4.73	5.00	5.05	4.72	4.84
Serial correlation 2/	0.03	0.13	0.28	0.12	0.06	0.23	0.00	0.00
Heteroskedasticity 3/	0.00	0.04	0.01	0.00	0.00	0.00	0.05	0.00
Normality 4/	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stability 5/	0.06	0.61	0.15	0.78	0.12	0.71	1.00	…
No. Observations	74	74	73	73	73	71	71	71

Source: Fund staff estimates.

1/ * indicates a p-value of 0.10 or less. ** indicates a p-value of 0.05 or less. *** indicates a p-value of 0.01 or less. White heteroskedasticity-consistent standard errors in parentheses.

2/ p-value for the Breusch-Godfrey (Godfrey, 1978) test under the null hypothesis that there is no serial correlation in the residuals up to the 4th order.

3/ p-value for the test under the null hypothesis that there is no autoregressive conditional heteroskedasticity in the residuals (Engle, 1982).

4/ p-value for the Jarque-Bera (1980) test under the null hypothesis that the residuals are normally distributed.

5/ p-value for the Chow (1960) test under the null hypothesis of no structural break at 2000Q1.

Table I.3. Islamic Republic of Iran: Monetary Model of Inflation, 1990Q2-2007Q4 1/

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	m=M1; s=NEER	m=M1; s=USD		m=M2; s=NEER	m=M2; s=USD	
	Lib.&Cons. 2/ 3/	Liberal 2/	Conservative /3	Lib.&Cons. 2/ 3/	Liberal 2/	Conservative /3
Constant	4.44***	1.99**	...	6.93***	...	...
	(1.06)	(0.94)	...	(0.97)	...	...
π_{-1}	0.82***	0.85***	0.85***	0.95***	0.87***	0.95***
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)
π_{-4}	-0.25***	-0.22***	-0.18***	-0.26***	-0.25***	-0.20***
	(0.03)	(0.03)	(0.02)	(0.04)	(0.03)	(0.03)
y	...	0.10**	0.09**	...	0.16***	0.13***
	...	(0.04)	(0.04)	...	(0.04)	(0.04)
y_{-4}	-0.19***	-0.09**	...	-0.24***	...	...
	(0.05)	(0.04)	...	(0.05)	...	...
r	4.11***	3.17***	2.21***	3.69***	2.92***	1.85***
	(0.50)	(0.46)	(0.38)	(0.55)	(0.47)	(0.44)
r_{-1}	-2.50***	-1.85***	-1.28***	-2.77***	-2.00***	-1.34***
	(0.46)	(0.40)	(0.38)	(0.51)	(0.40)	(0.45)
r_{-4}	1.80***	1.06***	...	1.72***	1.15***	...
	(0.38)	(0.34)	...	(0.42)	(0.35)	...
m_{-2}	0.18***	0.18***	0.19***	...	0.18***	...
	(0.04)	(0.04)	(0.03)	...	(0.03)	...
m_{-3}	...	...	...	...	...	0.12***
	...	...	...	...	...	(0.03)
s_{-1}	...	0.14***	0.20***	...	0.21***	0.20***
	...	(0.03)	(0.025)	...	(0.03)	(0.03)
s_{-2}	...	-0.09***	-0.14***	...	-0.15***	-0.11***
	...	(0.03)	(0.03)	...	(0.03)	(0.03)
s_{-4}	...	...	0.03	...	0.06***	...
	...	...	(0.02)	...	(0.02)	...
Adjusted R^2	0.96	0.97	0.97	0.95	0.97	0.96
Schwarz Information Criterion	4.58	4.27	4.29	4.76	4.35	4.55
Serial correlation 4/	0.05	0.01	0.14	0.05	0.03	0.02
Heteroskedasticity 5/	0.46	0.13	0.01	0.71	0.04	0.01
Normality 6/	0.95	0.93	0.95	0.61	0.11	0.14
Stability 7/	0.19	0.26	0.53	0.45	0.63	0.88
No. Observations	71	71	71	71	71	71

Source: Fund staff estimates.

1/ NEER is the nominal effective exchange rate. USD is the rial/U.S. dollar exchange rate. * indicates a p-value of 0.10 or less. ** indicates a p-value of 0.05 or less. *** indicates a p-value of 0.01 or less. White heteroskedasticity-consistent standard errors in parentheses.

2/ Selected by *PCGets* (Hendry and Krolzig, 2001) based on the "liberal" strategy, i.e. the strategy that maximizes the retention probability of relevant variables.

3/ Selected by *PCGets* (Hendry and Krolzig, 2001) based on the "conservative" strategy, i.e. the strategy that minimizes the retention probability of irrelevant variables.

4/ p-value for the Breusch-Godfrey (Godfrey, 1978) test under the null hypothesis that there is no serial correlation in the residuals up to the 4th order.

5/ p-value for the White (1980) test under the null hypothesis that there is no unconditional heteroskedasticity in the residuals.

6/ p-value for the Jarque-Bera (1980) test under the null hypothesis that the residuals are normally distributed.

7/ p-value for the Chow (1960) test under the null hypothesis of no structural break at mid-sample.

generating process is unchanged, the recursive forecast is the optimal forecast. In the presence of structural breaks, however, the rolling scheme adapts to change more rapidly, reducing the forecast bias induced by outdated coefficient estimates. On the downside, by discarding past information, the variance of parameter estimates increases, which is reflected in larger forecast errors. In sum, when estimating model parameters under structural change, there is a balance between how much information one should use and how much of it should be discarded. In other words, there is a bias-variance tradeoff that can be exploited.

18. If the sample size is large enough, as it is typically in financial applications or in macroeconomic data available for advanced countries, one way to exploit the bias-variance tradeoff is to vary the size of the rolling regression window (Pesaran and Timmerman, 2007). If the length of the time series is limited, however, this may not be a viable approach. An alternative is to use a combination of recursive and rolling forecasts, as suggested by Clark and McCracken (2004), with a fixed-size window.

19. To combine forecasts, we use optimal weights (i.e., weights that minimize the mean squared forecast error) estimated by standard least squares from the following regression:

$$y_{t+h} = \omega_{0h} + \omega_h' \hat{y}_{t+h,t} + \varepsilon_{t+h} \quad (1)$$

where y_{t+h} is the inflation realization, $\hat{y}_{t+h,t}$ is the vector of h-step-ahead forecasts, ε_{t+h} is the error term, ω_{0h} is an intercept term, and ω_h is the vector of weights.[10]

20. The limited size of our sample indicates that estimating a variable-size window for the rolling regression would be problematic. Our quarterly CPI series (1988Q2─2007Q4) has 79 observations, which become 71 when the yearly change transformation and lags are considered. Assuming we want to forecast inflation over the period 2008Q1─2009Q1, we need to simulate one-to-five-step-ahead forecasts.

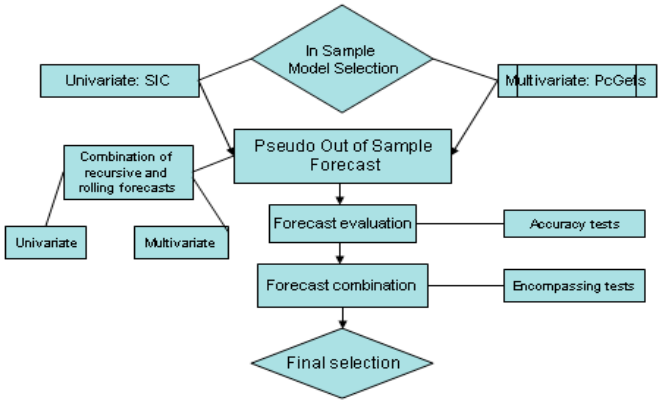
21. The first part of the simulation exercise can be summarized as follows:[11]

- Produce an initial set of estimates based on a fixed-size window of 28, which can be seen as the minimum needed to obtain reliable parameter estimates.

[10] This is one of the regressions suggested by Granger and Ramanathan (1984). It is important to note that the weights are not constrained to sum to unity because, as Min and Zellner (1993) have shown, the adding-up constraint leads to suboptimal weights if one or more of the forecasts are biased. Moreover, the intercept term corrects for bias in the individual forecasts.

[11] The entire procedure is summarized in a flow chart in Fig. I.2.

Figure I.2. Forecasting Procedure



- Construct recursive and rolling forecasts based on the same fixed-size window for the rest of the sample. The set of pseudo out-of-sample forecasts so created includes 39 (five-step-ahead) to 43 (one-step-ahead) data points.

- For each step, combine the two sets of recursive and rolling forecasts using optimal weights.

22. The results of the simulation show that the combination of recursive and rolling forecasts is significantly more accurate—in terms of root mean squared error (RMSE)— than either the recursive or the rolling forecast alone for all ARMA and monetary models at every forecast horizon (Tables I.4 and I.5).[12]

23. In general, combining forecasts from different models can be particularly useful in this context, as it provides insurance against structural change (Timmermann, 2006).[13] Therefore, in the second part of the exercise, we combine the individual models in each class. Based on accuracy alone, we cannot find a clear prevalence of any model within each class (Tables I.6 and I.7).

[12] Inference is complicated by the fact that the asymptotic distribution of the test statistics vary according to whether the forecasts are recursive or rolling, and whether the models are nested or nonnested (West, 2006). Therefore, for all the tests used in this paper, standard errors are obtained by bootstrapping.

[13] There are many examples in the literature corroborating the hedging properties of forecast combination under structural change (Stock and Watson, 2004). The reason for these findings is that individual forecasts may be differently affected by structural change. Although it would be possible, in theory, to incorporate the change in the individual models used for forecasting, it is typically difficult to detect structural change in 'real time' (Timmermann, 2006).

Table I.4. Islamic Republic of Iran: ARMA Model, Accuracy of the Combination of Rolling and Recursive Forecasts 1/

Model 1/		Pseudo out of sample h-step-ahead forecast				
		h=1	h=2	h=3	h=4	h=5
		(Root mean squared error as a ratio of the combined) 2/				
1	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.38**	**1.83**	**1.99**	**2.17**	**2.39**
	Rolling	**1.12**	**1.29**	**1.49**	**1.65**	**1.83**
2	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.16**	**1.38**	**1.56**	**1.76**	**1.95**
	Rolling	**1.13**	**1.30**	**1.53**	**1.64**	**1.79**
3	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.35**	**1.51**	**1.61**	**1.77**	**2.03**
	Rolling	1.07	**1.16**	**1.32**	**1.46**	**1.64**
4	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.33**	**1.60**	**1.84**	**1.99**	**2.31**
	Rolling	**1.16**	**1.37**	**1.61**	**1.74**	**2.01**
5	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.31**	**1.66**	**2.14**	**2.47**	**2.80**
	Rolling	**1.13**	**1.36**	**1.77**	**1.97**	**2.18**
6	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.20**	**1.48**	**1.72**	**1.95**	**2.21**
	Rolling	**1.33**	**1.43**	**1.68**	**1.88**	**2.09**
7	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.30**	**1.69**	**2.05**	**2.31**	**2.65**
	Rolling	**1.25**	**1.48**	**1.82**	**2.16**	**2.64**
8	Combined	1.00	1.00	1.00	1.00	1.00
	Recursive	**1.34**	**1.88**	**2.30**	**2.57**	**2.93**
	Rolling	**1.75**	**1.78**	**2.34**	**2.42**	**2.88**

Source: Fund staff estimates.

1/ See Table I.2 for the model specifications.

2/ Ratios are bolded when the difference of the RMSE from the benchmark is significant at the 5-percent level.

Table I.5. Islamic Republic of Iran: Monetary Model, Accuracy of the Combination of Rolling and Recursive Forecasts 1/

Model 1/		Pseudo out of sample h-step-ahead forecast				
		h=1	h=2	h=3	h=4	h=5
		(Root mean squared error as a ratio of the combined) 2/				
	Combined	1.00	1.00	1.00	1.00	1.00
1	Recursive	**1.33**	**1.57**	**1.86**	**2.03**	**2.04**
	Rolling	**1.24**	**1.49**	**1.84**	**2.07**	**2.00**
	Combined	1.00	1.00	1.00	1.00	1.00
2	Recursive	**1.17**	**1.34**	**1.52**	**1.64**	**1.71**
	Rolling	**1.18**	**1.31**	**1.41**	**1.51**	**1.52**
	Combined	1.00	1.00	1.00	1.00	1.00
3	Recursive	**1.28**	**1.57**	**1.87**	**2.10**	**2.22**
	Rolling	**1.33**	**1.70**	**2.00**	**2.34**	**2.47**
	Combined	1.00	1.00	1.00	1.00	1.00
4	Recursive	**1.40**	**1.74**	**2.04**	**2.34**	**2.76**
	Rolling	**1.26**	**1.56**	**1.89**	**2.19**	**2.52**
	Combined	1.00	1.00	1.00	1.00	1.00
5	Recursive	**1.23**	**1.54**	**1.87**	**2.05**	**2.21**
	Rolling	**1.26**	**1.49**	**1.80**	**2.09**	**2.38**
	Combined	1.00	1.00	1.00	1.00	1.00
6	Recursive	**1.30**	**1.73**	**2.24**	**2.61**	**2.92**
	Rolling	**1.35**	**1.73**	**2.21**	**2.64**	**2.96**

Source: Fund staff estimates.

1/ See Table I.3 for the model specifications.

2/ Ratios are bolded when the difference of the RMSE from the benchmark is significant at the 5-percent level.

Table I.6. Islamic Republic of Iran: ARMA Model, Relative Forecasting Accuracy

	Pseudo out of sample h-step-ahead forecast				
Model 1/	h=1	h=2	h=3	h=4	h=5
	(Root mean squared error)				
Benchmark	1.45	2.14	2.63	3.14	3.17
	(Root mean squared error, ratio of the benchmark) 2/				
1	**1.12**	1.01	1.00	0.99	1.02
2	**1.09**	1.06	1.05	1.03	1.04
3	1.00	1.00	1.00	1.00	1.00
4	**1.34**	1.09	1.05	0.97	0.97
5	1.08	1.01	0.93	0.93	0.98
6	1.08	1.03	0.97	0.98	1.00
7	1.02	0.95	0.96	0.99	1.03
8	**1.32**	1.04	0.99	0.98	1.02

Source: Fund staff estimates.

1/ See Table I.2 for the model specifications.

2/ Ratios are bolded when the difference of the RMSE from the benchmark is significant at the 5-percent level.

Table I.7. Islamic Republic of Iran: Monetary Model, Relative Forecasting Accuracy

	Pseudo out of sample h-step-ahead forecast				
Model 1/	h=1	h=2	h=3	h=4	h=5
	(Root mean squared error)				
Benchmark	1.45	1.83	1.92	1.99	1.89
	(Root mean squared error, ratio of the benchmark) 2/				
1	1.17	1.20	**1.26**	**1.30**	**1.41**
2	1.06	1.03	**1.11**	**1.18**	**1.20**
3	1.01	0.95	0.99	1.01	1.04
4	**1.18**	**1.22**	**1.35**	**1.44**	**1.44**
5	1.00	1.00	1.00	1.00	1.00
6	1.10	**1.15**	**1.17**	**1.18**	**1.21**

Source: Fund staff estimates.

1/ See Table I.3 for the model specifications.

2/ Ratios are bolded when the difference of the RMSE from the benchmark is significant at the 5-percent level.

24. Candidates for combinations are chosen based on the independent information they provide as detected by encompassing tests.[14] The final selection includes only one ARMA model (Model 3 or the ARMA (2,3) model) and four monetary models (Model 1, Model 3, Model 4, and Model 5: see Table I.3). The weights are estimated as in equation (1). The combination shows a clear improvement in accuracy for the monetary model (Table I.8).

Table I.8. Islamic Republic of Iran: Monetary Combination, Relative Forecasting Accuracy

	Pseudo out of sample h-step-ahead forecast				
Model 1/	h=1	h=2	h=3	h=4	h=5
	(Root mean squared error)				
Combination	1.34	1.58	1.52	1.58	1.65
	(Root mean squared error, ratio of the benchmark) 2/				
1	**1.26**	**1.39**	**1.59**	**1.63**	**1.61**
3	**1.10**	1.10	**1.26**	**1.27**	**1.19**
4	**1.28**	**1.41**	**1.70**	**1.81**	**1.65**
5	1.08	**1.16**	**1.26**	**1.26**	1.15

Source: Fund staff estimates.

1/ See Table I.3 for the model specifications.

2/ Ratios are bolded when the difference of the RMSE from the benchmark is significant at the 5-percent level.

25. Comparing the two final models, we can see that the monetary model has by far the best forecasting performance (Table I.9). Its forecasts are, like those from the ARMA(2,3) model, free of bias and efficient, and its forecast errors are serially uncorrelated. But the accuracy of the monetary model is far superior, with a relative gain of up to 98 percent in terms of root mean squared error (RMSE) over the univariate forecasts. The superiority of the monetary model becomes more evident as the forecast horizon lengthens, as shown by the relative accuracy and encompassing tests. The forecasts track fairly well actual inflation over the simulation period (Figures I.3 and I.4).

[14] A model's forecast encompasses another if there is no information contained in the alternative model's prediction that can be exploited to improve its forecasts. More specifically, we estimate a *t*-statistic for the null hypothesis of no correlation between its prediction errors and the other model's forecasts (West, 2006) and follow the procedure suggested by Kişinbay (2007), in which models ranked based on their one-step-ahead RMSE are sequentially tested against all other models until no further elimination is possible.

Table I.9 Islamic Republic of Iran: Forecast Performance Evaluation 1/

(Pseudo Out-of-Sample h-Step-Ahead Forecasts)

	ARMA(2,3)				
	h=1	h=2	h=3	h=4	h=5
Root Mean Squared Error	1.45	2.13	2.63	3.14	3.17
Mean Absolute Error	1.16	1.78	2.17	2.58	2.64
Mean Absolute Percentage Error	8.43	13.33	16.68	20.15	20.57
Bias 1/	1.00	1.00	1.00	1.00	1.00
Efficiency 2/	1.00	1.00	1.00	1.00	1.00
Serial Correlation 3/	0.45	...	...	...	...
	Combined Monetary				
	h=1	h=2	h=3	h=4	h=5
Root Mean Squared Error	1.34	1.58	1.53	1.58	1.65
Mean Absolute Error	1.07	1.25	1.24	1.26	1.28
Mean Absolute Percentage Error	7.90	9.56	9.45	9.81	10.28
Percentage Gain (RMSE) over ARMA	8.21	34.81	71.90	98.73	92.12
Bias 1/	1.00	1.00	1.00	1.00	1.00
Efficiency 2/	1.00	1.00	1.00	1.00	1.00
Serial Correlation 3/	0.45	...	...	...	...
Relative RMSE Accuracy 4/	0.28	0.00	0.00	0.00	0.00
Encompassing 5/	0.82	0.87	0.98	0.97	0.98

Source: Fund staff estimates.

1/ p-value of the test under the null hypothesis of zero mean prediction error.

2/ p-value of the test under the null hypothesis of no correlation between prediction error and prediction.

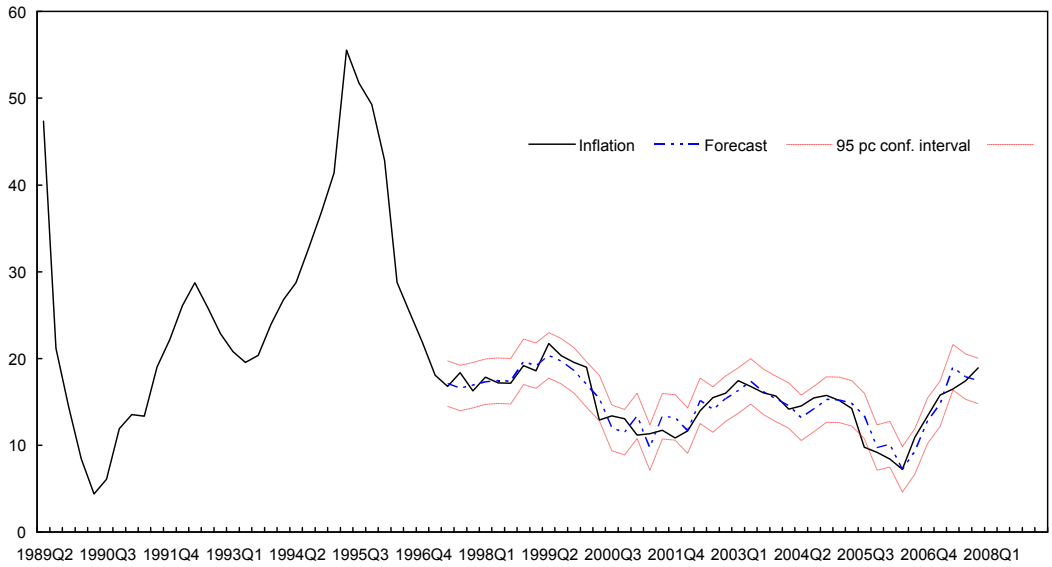
3/ p-value of the test under the null hypothesis of no serial correlation of the prediction error.

4/ p-value of the test under the null hypothesis of equal RMSE.

5/ p-value of the test under the null hypothesis of no correlation between model 1's prediction error and model 2's prediction.

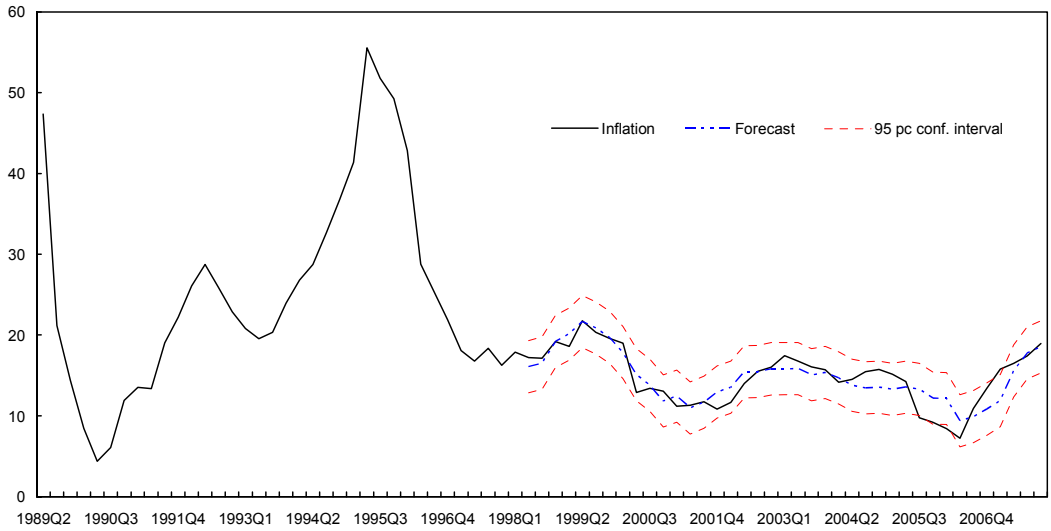
26. Recent evidence of money demand instability suggests that inflation forecasts based on the monetary model may be unreliable in the short run. In particular, if a structural change in inflation expectations reduces money demand, the impact of a given change in money supply is likely to be higher than in the past. Therefore, the monetary model may tend to underestimate inflation. Nonetheless, the proposed methodology should ensure that the structural change in the parameters is reflected promptly in updated model estimates, readily restoring the model's forecasting ability.

Figure I.3. Islamic Republic of Iran: Combined Monetary Model of Inflation, Pseudo Out-of-Sample One-Step-Ahead Forecasts, 1997Q2-2007Q4
(year-on-year percentage change in the CPI)



Sources: CBI; and Fund staff estimates.

Figure I.4. Islamic Republic of Iran: Combined Monetary Model of Inflation, Pseudo Out-of-Sample Five-Step-Ahead Forecasts, 1998Q2-2007Q4
(year-on-year percentage change in the CPI)



Sources: CBI; and Fund staff estimates.

Appendix. Data Sources and Definitions

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

Money supply is, alternatively, M1 or M2 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 1988Q2-2005Q1 from the database on the CBI website (http://www.cbi.ir); the second one, for the period 2005Q1-2007Q1, reported by the CBI in its quarterly publication Economic Trends, also available on http://www.cbi.ir.

The output gap is obtained by applying a Hodrick-Prescott filter (λ=1,600) to the series of GDP at constant factor cost obtained as above. Two series, one for GDP and one for non-oil GDP, are calculated.

The interest rate is the rate of return on one-year deposits in state-owned banks, as reported by the CBI on its quarterly publication Economic Trends, available on http://www.cbi.ir.

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

The rial/dollar exchange rate is obtained by splicing the parallel market rate series used in Celasun and Goswami (2002), which ends in 2002Q1 just before the exchange rate unification, with the official market rate series for the rest of the sample from the IMF IFS database.

Import prices are calculated as the average of the import unit value for manufacturers (MUV), the petroleum price (APSP), and the nonfuel commodity price, weighted by the 2003─05 composition of trade, taken from the IMF WEO database, adjusted with the nominal effective exchange rate index.

The dummies for Islamic festivities are those calculated by Riazuddin and Khan (2002), corrected for the differences between the Persian calendar and the Gregorian calendar and extended to the end of the sample.

Missing observations for M1, M2, and GDP at the end of the sample have been replaced by extrapolation.

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II. Subsidies in the Islamic Republic of Iran[15]

This chapter estimates explicit and implicit subsidies in Iran with a view to evaluating their size and the potential benefits from their elimination. Overall subsidies are estimated at about 27 percent of GDP in 2007/08. Phasing them out would help improve the population's welfare, provide room for growth and employment-generating public expenditure, and strengthen the public finances.

A. Introduction

27. Iran is endowed with large hydrocarbon energy resources. The government has a number of options to ensure that citizens share the benefits accruing from these resources. In Iran, as in some other resource-rich countries, the government has chosen to distribute a significant portion of natural resource wealth in the most direct way: by setting domestic prices for hydrocarbon-based energy products at about the cost of bringing them to users and consumers, irrespective of their international market value.[16] Moreover, Iran maintains relatively large explicit subsidies for first necessities (e.g., food and medicine) and some producers.

28. This chapter analyzes the fiscal and macroeconomic implications of explicit subsidies (i.e., direct subsidies included in the budget) and implicit (indirect) subsidies in Iran, and recommends phasing them out. The chapter is organized as follows. Section B presents estimates of the size of explicit and implicit subsidies in Iran. Drawing on this information, Section C analyzes fiscal and economic costs of subsidies in Iran. Section D concludes by making a case for a gradual elimination of subsidies and by providing a brief review of reform options.

B. The Size of Subsidies in Iran

29. Subsidies usually take two forms: explicit (often referred to as direct or fiscal) or implicit (referred to as indirect or quasi-fiscal). Iran's budget classification framework provides detailed information on explicit subsidies facilitating their analysis. However, the information on implicit subsidies needs to be pieced together from various sources.

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[15] This chapter was prepared by Roman Zytek.

[16] Zamani (2007) reviews energy use in Iran. Petri, Taube, and Tsyvinski (2002) provide an in-depth discussion of energy sector subsidies in several energy-rich countries of the Former Soviet Union in the 1990s. Hossain (2003) discusses taxation and pricing of petroleum products in developing countries.

Explicit subsidies

30. *Explicit subsidies* are paid directly from the budget (central, sub-national, or local) to the beneficiaries—consumers or producers. In most cases, their objective is to reduce the price of a good or service to the consumer. The price reduction is often justified as a means of promoting social equity, or consumption of certain goods and services because of their perceived benefits to individuals or the society. Explicit subsidies are typically implemented by providing suppliers of goods or services with direct co-payments from the budget. The subsidy can be calculated and paid per unit of output sold (per liter of milk, per apartment built or rented, per education unit, etc.), per unit of input purchased to produce a desirable product (subsidy to a baker for wheat purchased to produce bread), or as a lump sum paid to producers to lower overall production costs (including research and development costs). Explicit subsidies are usually transparent and easy to identify and calculate. In many countries, market liberalization, fiscal pressures, and strong growth in per capita income, as well as the broad political agreement on the suboptimal nature of explicit subsidies compared to direct targeted cash transfers to consumers, have made explicit subsidies increasingly difficult to justify and maintain.

31. In Iran, explicit subsidies, excluding imported gasoline subsidies, have remained relatively stable in recent years. They mainly include financial support for agriculture and subsidies to imported food, and their level is comparable to that of many other oil-producing countries (Tables II.1–3).

Table II.1. Islamic Republic of Iran: Central Government Expenditure on Subsidies in Selected Oil-Producing Countries, 2001–07

(In percent of GDP)

	2001	2002	2003	2004	2005	2006	2007
Azerbaijan	6.5	6.6	6.6	6.2	5.3	4.9	5.6
Bahrain	2.2	2.9	2.6	2.6	2.9	2.7	3.2
Iran 1/	n.a.	2.8	3.0	3.0	4.7	5.1	4.9
Of which : excluding gasoline imports	n.a.	2.8	3.0	3.0	3.1	3.0	2.7
Kuwait	10.9	10.6	9.3	10.0	8.2	13.9	12.9
Libya	1.5	2.0	2.4	2.4	2.7	2.4	2.9
Oman	1.2	1.0	1.4	1.7	2.2	2.0	2.1
Saudi Arabia	n.a.	0.9	1.3	1.7	1.3	1.6	1.4
Syria	5.6	5.2	4.7	5.2	5.0	5.5	6.0

Sources: National fiscal and statistical agencies; and Fund staff estimates.

1/ Includes government expenditure on gasoline imports during 2005-07. Fiscal years begin on March 21.

Table II.2. Islamic Republic of Iran: Central Government Expenditure on Subsidies in Selected Oil-Producing Countries, 2001–07

(In percent of central government expenditure)

	2001	2002	2003	2004	2005	2006	2007
Azerbaijan	35.1	24.0	23.1	24.0	23.5	18.0	18.1
Bahrain	8.1	8.9	8.8	9.9	11.4	10.2	12.5
Iran 1/	n.a.	12.4	13.3	13.3	15.5	15.8	16.8
Kuwait	25.7	25.3	25.0	28.9	30.3	44.1	38.0
Libya	3.5	4.4	6.0	5.9	7.1	7.2	6.7
Oman	3.0	2.6	3.5	4.2	6.3	5.4	6.0
Saudi Arabia	n.a.	2.6	4.0	5.2	4.5	5.3	4.4
Syria	20.2	18.1	15.1	16.6	17.5	19.8	22.5

Sources: National fiscal and statistical agencies; and Fund staff estimates.

1/ Includes government expenditure on gasoline imports during 2005-07. Fiscal years begin on March 21.

Table II.3. Islamic Republic of Iran: Subsidies Paid Through the Consumer and Producer Protection Organization, and Other Subsidies, 2000/01–2006/07

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
				(In billions of rials)			
Fertilizer	531	528	650	670	1,800	7,025	...
Sugar	434	439	488	916	2,438	3,429	...
Wheat	5,835	6,819	10,061	11,788	14,049	24,578	...
Milk and cheese	623	809	665	1,280	2,258	3,287	...
Rice and vegetable oil	-274	0	-252	0	1,185	3,556	...
Other food subsidies	771	1,416	1,365	1,845	3,202	6,703	...
Total food subsidies	7,920	10,011	12,977	16,499	24,931	48,578	57,800
Other subsidies	...	...	12,702	17,117	17,532	4,614	2,800
Total subsidies	...	...	25,679	33,616	42,463	53,192	60,600
				(In percent of GDP)			
Fertilizer	0.1	0.1	0.1	0.1	0.1	0.4	...
Sugar	0.1	0.1	0.1	0.1	0.2	0.2	...
Wheat	1.0	1.0	1.1	1.1	1.0	1.4	...
Milk and cheese	0.1	0.1	0.1	0.1	0.2	0.2	...
Rice and vegetable oil	0.0	0.0	0.0	0.0	0.1	0.2	...
Other food subsidies	0.1	0.2	0.1	0.2	0.2	0.4	...
Total food subsidies	1.4	1.5	1.4	1.5	1.8	2.9	2.8
Other subsidies	...	...	1.4	1.5	1.2	0.3	0.1
Total subsidies	...	...	2.8	3.0	3.0	3.1	3.0

Sources: CBI; and the Consumer and Producer Protection Organization.

32. In 2004, the government made subsidies on imported gasoline explicit by compensating the National Iranian Oil Company (NIOC) for the difference between the gasoline import cost and domestic gasoline prices.[17] During 2004/05–2006/07, international gasoline prices increased sharply, but domestic prices were not adjusted. As a result, explicit gasoline subsidies increased from 1.6 percent of GDP in 2004/05 to 2.2 percent in 2006/07. To contain the increase in subsidies for imported gasoline, the government decided to raise gasoline prices to Rls 1,000 (or $0.11) per liter and to introduce rationing starting in June 2007. Since then gasoline consumption and imports have fallen, though subsidies to imported gasoline have declined by less than initially expected as international gasoline prices have risen sharply. Also, a black market for gasoline has emerged as the rationed amount has not been sufficient for many motorists. In response, the authorities increased the rationed amount and allowed gasoline sales above it at a higher price (Rls 4,000 or $0.45 per liter) in March 2008.

[17] Iran's refining capacity is insufficient to satisfy domestic demand for gasoline.

Estimates of implicit subsidies (quasi-fiscal expenditure) in the energy sector

33. *Implicit subsidies* do not involve cash transfers. They arise when an unfunded mandate is imposed by the government (central, sub-national, or local) on producers to provide goods or services at prices that are below their opportunity cost, usually a free market level. Administrative controls, such as price, interest rate, and exchange rate controls, and certain regulations, such as production quotas and service delivery requirements, are the most widely used mechanisms giving rise to implicit subsidies. For example, price controls take the form of administrative requirements imposed on producers to provide unremunerated or under-remunerated goods or services to the general public or specific target groups (such as cheap loans for housing construction for young families). Implicit subsidies are more difficult to estimate, less transparent, and harder to eliminate.

34. Implicit subsidies in Iran dwarf explicit subsidies. Implicit subsidies are heavily concentrated in Iran's energy sector, and they have increased rapidly in the past few years, reflecting the growing discrepancy between administratively controlled domestic energy prices and their international benchmarks.

Implicit subsidies for petroleum products

35. Consumers of petroleum products (e.g., gasoline, diesel, fuel oil, kerosene, and petrochemicals) benefit from large implicit subsidies. To simplify the estimates of the implicit subsidies arising from the underpricing of the petroleum products, this paper calculates the difference between the export border crude oil price and the assumed transfer crude oil price in the domestic production chain (Table II.4).[18] While these estimates are less precise than product-by-product price comparisons, they do not require detailed information on volumes and prices of each product. Equally important, the suggested methodology focuses mainly on the foregone resource rent rather than costs and margins in oil refining and petrochemical companies. Based on this methodology, the government lost an estimated $32 billion (11 percent of GDP) by under-pricing crude oil and its derivatives in the domestic market in 2007/08. The loss may exceed $60 billion (17 percent of GDP) should the average price for Iranian crude in 2008/09 remain at current international market levels of about $115 per barrel.

[18] IMF (2002), Saavalainen and Berg (2006), and Tchaidze (2007) provide in-depth reviews of the methodology for estimating implicit subsidies.

Table II.4. Islamic Republic of Iran: Implicit Subsidies in the Oil Sector, 2005/06–2008/09

	2005/06	2006/07	2007/08	2008/09	
				Low	High
				Projection	
International market value (in billions of U.S. dollars)	74	84	108	132	176
Annual production (in millions of barrels)	1,468	1,481	1,498	1,528	1,528
Average international price (in U.S. dollars per barrel)	50.6	57.0	72.2	86.3	115.0
Revenues (in billions of U.S. dollars)	51.8	60.1	76.3	88.1	114.8
From international sales (in billions of U.S. dollars)	48.8	56.8	72.3	83.4	110.0
From domestic sales (in billions of U.S. dollars)	3.0	3.4	4.0	4.8	4.8
Quantity of sales (in millions of barrels)	372.3	372.3	396.4	396.4	396.4
National domestic price for crude sold domestically (in U.S. dollars per barrel)	8.0	9.0	10.0	12.0	12.0
Forgone revenue due to domestic sales (in billions of U.S. dollars)	22.5	24.3	31.9	43.7	60.9
In percent of GDP 1/	11.9	10.9	11.2	11.9	16.6
Per family of four per year (in U.S. dollars)	1,284	1,388	1,822	2,499	3,481

Sources: CBI; and Fund staff estimates.

1/ GDP calculated at current (low) energy prices. An increase in domestic energy prices will raise the contribution of the energy sector to Iran's GDP and the nominal value of GDP.

Implicit subsidies for gas

36. Natural gas users, in particular electricity-generating companies, benefit from large implicit subsidies in Iran. The domestic prices of natural gas varied widely, depending on the buyer category, but all gas users paid prices that are well below the prevailing regional level. Had Iran priced its gas sold domestically at the regional level of $150 per thousand cubic meters (t.c.m.), its revenues from gas would have been $25 billion (9 percent of GDP) higher in 2007/08 (Table II.5). Should regional gas prices remain at their current elevated levels, implicit subsidies in the gas sector may exceed $30 billion (9 percent of GDP) in 2008/09.

Table II.5. Islamic Republic of Iran: Implicit Subsidies in the Gas Sector, 2005/06–2008/09

	2005/06	2006/07	2007/08	Projection 2008/09	
				Low	High
International market value (in billions of U.S. dollars)	16	17	28	35	71
Annual production (in billions of cubic meters)	159	169	185	236	236
Average international price (in U.S. dollars per 1000 cubic meters)	100	100	150	150	300
Revenues (in billions of U.S. dollars)	1.8	1.9	2.3	2.8	3.5
From net exports (in billions of U.S. dollars)	0.5	0.5	0.8	0.8	1.5
From domestic consumption (in billions of U.S. dollars)	1.2	1.3	1.4	1.9	1.8
For electricity production	0.1	0.1	0.1	0.1	0.2
Forgone revenue due to domestic sales (in billions of U.S. dollars)	14.1	15.0	25.4	32.7	67.4
In percent of GDP 1/	7.5	6.8	8.9	8.9	18.3
Per family of four per year (in U.S. dollars)	806	860	1,453	1,866	3,849

Sources: CBI; and Fund staff estimates.

1/ GDP calculated at current (low) energy prices. An increase in domestic energy prices will raise the contribution of the energy sector to Iran's GDP and the nominal value of GDP.

Implicit subsidies for electricity

37. Implicit subsidies are also high in the electricity sector. In 2005/06, electricity tariffs ranged from 1.1 U.S. cents/kwh for residential users to 2.0–2.4 U.S. cents/kwh for public and industrial users, and up to 5 U.S. cents/kwh for other users. The average electricity tariff stood at 1.7 U.S. cents/kwh, which was well below the regional border price. The implicit subsidy is estimated at $4.3 billion (2.3 percent of GDP) in 2005/06, assuming a border price of 5 U.S. cents/kwh (Table II.6). Assuming electricity production grew at an annual rate of 8 percent, the value of implicit subsidies may have exceeded $5 billion (1.8 percent of GDP) in 2007/08.

Table II.6. Islamic Republic of Iran: Implicit Subsidies in the Electricity Sector, 2005/06–2008/09

	2005/06	2006/07	2007/08	2008/09
		Estimates		Proj.
International market value (in billions of U.S. dollars)	6.7	7.2	7.8	8.4
Annual production (in TWh)	133	144	155	168
Average international price (U.S. dollars per kWh)	0.05	0.05	0.05	0.05
Revenues (in billions of U.S. dollars)	2.3	2.5	2.7	2.9
Quantity of sales (in TWh)	133	144	155	168
Price (U.S. dollars per kWh)	0.017	0.017	0.017	0.017
Forgone revenue due to domestic sales (in billions of U.S. dollars)	4.3	4.7	5.1	5.5
In percent of GDP 1/	2.3	2.1	1.8	1.5
Per family of four per year (in U.S. dollars)	247	267	289	312

Sources: CBI; and Fund staff estimates.

1/ GDP calculated at current (low) energy prices. An increase in domestic energy prices will raise the contribution of the energy sector to Iran's GDP and the nominal value of GDP.

Indirect energy taxes

38. In most countries, energy products are subject to indirect taxation on the following four grounds:

- To minimize economic distortions due to taxation, optimal tax policies call for putting the highest tax burden on goods and services that exhibit the lowest price elasticity of demand. As demand for energy is relatively price inelastic, taxing energy through excises makes economic sense.

- Taxing transportation fuels is justified as a fair and efficient way of paying for road construction and maintenance. Therefore, by taxing transportation fuels, governments ensure that heavier road users cover a higher share of expenditure on road construction and maintenance.

- Energy use generates negative externalities, such as pollution and greenhouse gases. Therefore, taxing hydrocarbon-based fuels can be justified as a way of defraying at least some of the costs incurred from burning hydrocarbons.[19]

- Energy products should be also subject to VAT as any other consumption good.

39. In Iran, total indirect taxes on petroleum products are estimated at less than 4 percent of domestic sales. This level does not cover negative externalities associated with energy consumption or the cost of road maintenance (paragraph 41). Thus, an increase in indirect taxation of energy should be considered. For example, a combined indirect energy tax rate (VAT and excises) of 20 percent on the value of energy products estimated at international benchmark prices would have generated an additional $8–9 billion (2.5–3.0 percent of GDP) in budgetary revenues in 2007/08.

C. Economic Costs of Subsidies

40. The low extraction costs and public ownership of natural resources have historically made it politically difficult for governments to sell domestically publicly-owned natural resources at prices significantly higher than the relevant accounting extraction and processing costs. In fact, in Iran, the average extraction cost of oil is less than $5 per barrel compared with the current market price of about $115 per barrel. While other MCD oil-producing countries face similar political pressures, Iran's petroleum product prices are one of the lowest in the region (Table II.7).

41. There is a sound rationale for eliminating implicit energy subsidies based on efficiency, social equity, and fiscal sustainability considerations.[20]

- Forgone revenue from energy products limits the ability of Iranian and potentially foreign companies to invest into oil and gas extraction and processing, as well as electricity generation.

- Lower fiscal revenue curtails the level of the sustainable non-oil primary deficit, reducing Iran's capacity to increase productive expenditure vital to raising its economic growth potential and creating jobs.

[19] See McMorran and Nellor (1994) for a discussion of tax policy and environmental issues.

[20] World Bank (2003) provides a detailed proposal for reforming energy sector pricing to optimize the use of energy wealth for economic development in Iran. World Bank (2007) focused on the benefits of energy price reforms to Iran's electricity sector.

Table II.7. Domestic Oil Prices in Selected Oil-Producing Countries, 2003–07

(In U.S. dollars per liter, end-of-period)

	Regular Gasoline (unleaded)						High Octane Gasoline				Diesel				Kerosene			
	2003	2004	2005	2006	2007		2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
					Q1	Q2												
Algeria	0.28	0.28	0.31	0.31	…	…	0.29	0.31	0.31	0.31	0.16	0.16	0.19	0.19	...	...	…	…
Azerbaijan	0.30	0.35	0.37	0.38	0.39	0.40	0.37	0.41	0.44	0.45	0.16	0.18	0.20	0.40	0.14	0.16	0.17	0.40
Bahrain	0.21	0.21	0.21	0.21	0.21	0.21	0.27	0.27	0.27	0.27	0.19	0.19	0.19	0.19	0.07	0.07	0.07	0.07
Djibouti	...	...	…	…	…	…	0.96	1.07	1.30	1.18	0.56	0.64	0.77	0.79	0.38	0.59	0.70	0.71
Iran	0.09	0.10	0.09	0.09	0.11	0.11	...	...	0.12	0.12	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Iraq	0.01	0.01	0.07	0.19	0.24	0.32	0.03	0.03	0.17	0.26	0.01	0.01	0.06	0.11	0.00	0.00	0.02	0.06
Kazakhstan	0.30	0.39	0.38	0.49	0.52	0.55	0.36	0.45	0.46	0.61	0.24	0.38	0.39	0.47	0.16	0.24	0.24	0.22
Kuwait	0.20	0.20	0.21	0.21	0.21	0.21	0.24	0.24	0.24	0.24	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Libya	0.09	0.09	0.11	0.11	0.11	0.11	0.12	0.12	0.16	0.17	0.09	0.10	0.10	0.10	0.05	0.06	0.05	0.05
Mauritania	0.51	0.82	0.83	0.98	1.08	1.15	...	...	…	…	0.40	0.61	0.70	0.85	0.38	0.62	0.60	0.87
Oman	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.27	0.27	0.27	0.27	0.31	0.31	0.31	0.31
Qatar	0.18	0.18	0.19	0.19	…	…	0.19	0.19	0.22	0.22	0.18	0.18	0.19	0.19	0.11	0.11	0.11	0.11
Saudi Arabia	...	...	…	…	…	…	0.24	0.24	0.24	0.16	0.10	0.10	0.10	0.07	0.12	0.12	0.12	0.12
Syria	0.49	0.48	0.46	0.58	0.58	0.58	0.49	0.49	0.47	0.58	0.15	0.15	0.14	0.14	0.31	0.45	0.44	0.44
Turkmenistan	0.06	0.06	0.06	0.06	0.06	0.06	0.08	0.08	0.08	0.08	0.02	0.02	0.02	0.02	1.92	1.92	1.92	1.92
United Arab Emirates	0.29	0.34	0.45	0.45	0.45	0.45	0.36	0.38	0.50	0.50	0.23	0.23	0.44	0.62	0.21	0.21	0.27	0.27
International markets 1/	0.22	0.30	0.40	0.46	0.41	0.55	...	...	...	...	0.23	0.31	0.45	0.52	0.23	0.32	0.45	0.52

Sources: National statistical agencies; DataStream; and Fund staff estimates.

1/ For gasoline and kerosene prices, Amsterdam ARA FOB; and for Diesel, No. 2 New York Harbor Low Sulfur FOB.

- Cheap energy favors economic development based on energy-intensive technologies, resulting in economic structures that might not fully reflect Iran's competitive advantage and raising the cost of an eventual transition to international energy prices.

- Subsidies to hydrocarbon-based electricity generation reduce the attractiveness of research and development of promising alternative energy-generating technologies, such as wind and solar.

- At the consumer level, implicit subsidies result in over-consumption of energy (through the substitution effect) at the expense of under-consumption of non-energy products and services. For Iran, the deadweight loss[21] from oil under-pricing is estimated at about 1½ percent of GDP in 2007/08.[22]

- Overuse of hydrocarbon-based energy has contributed to significant environmental degradation and related social costs.[23] Several studies attempted to quantify these costs for Iran. The overall health damage from air pollution in 2001 was estimated at about $7 billion (8.4 percent of GDP). The damage cost to the global environment from flaring of natural gas, assessed on the basis of a carbon price of $10 per ton of carbon dioxide, was estimated at 0.6 billion per year. Another study estimated the annual cost of environmental degradation in Iran at 4.8 to 10 percent of GDP, with a mean estimate of 7.4 percent (equivalent to $8.4 billion).[24]

D. Recommended Reforms

42. The elimination of subsidies may need to be spread over several years in Iran. High economic costs of implicit subsidies justify an immediate start of reforms. However, significant transition costs justify some gradualism in price increases.[25]

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[21] A deadweight loss (also known as excess burden or allocative inefficiency) is a loss of economic efficiency that can occur when equilibrium for a good or service is not Pareto optimal. In other words, either people who would have more marginal benefit than marginal cost are not buying the good or service or people who would have more marginal cost than marginal benefit are buying the product.

[22] This estimate is calculated assuming a constant compensated elasticity of the demand function (see Gupta and others, 2003).

[23] For a detailed review of the environmental impact of low energy prices in Iran, see Shafi-Pour and Ardestani, (2007).

[24] World Bank (2004, 2005, 2006).

[25] For a discussion of reform options in countries with high implicit energy subsidies, see UNEP-DTIE, IEA (2002), IMF (2005), Baig and others (2007), and Cosse (2003).

43. A reform package could include a mix of the following measures:

- Streamline explicit subsidies. The effectiveness of financial support for agricultural producers needs to be examined with a view to curtailing wasteful expenditure that results in inefficient production and consumption.

- Gradually increase energy prices. In particular, it is recommended increasing petroleum product prices to their international level (i.e., import border price, given Iran's insufficient refining capacity), gas prices to the prevailing regional level, and electricity tariffs to cost recovery, assuming higher fuel input prices. The pace of the price adjustments should depend on progress in supporting reforms, such as the implementation of targeted social assistance and restructuring of energy-intensive enterprises.

- Review energy sector taxation. The taxation of energy companies, including the NIOC, needs to be reevaluated in light of the expected increase in their revenues. Regarding indirect taxes, externalities warrant higher energy excises, and the VAT that is planned to be implemented in the second half of 2008/09 should be applied to energy products.

44. The impact of energy price adjustment on the CPI depends, to a great extent, on demand management policies. The one-off direct impact on the CPI of the increase in energy prices to the current level of the recommended benchmarks is estimated at 10–13 percentage points, depending on the benchmark oil price ($85–$115 per barrel). The indirect impact will depend on the macroeconomic policy stance. The latter should aim at limiting the pass-through of energy price increases to other prices. The international experience of energy price adjustments suggests that in countries where appropriate demand management policies were pursued, significant energy price increases resulted in a relatively small increase in inflation (Table II.8).[26]

[26] See World Bank (2003), p. 70.

Table II.8. Islamic Republic of Iran: Energy Price Increases and Change in Inflation in Selected Countries

Country	Fuel	Fuel price change (in percent)	Change in inflation 1/	Fiscal revenues impact 2/	Change in GDP growth rate 3/
Malaysia	Diesel	80.0	-3.8	2.0	-3.0
	Kerosene	69.5			
Indonesia	Diesel	21.8	0.8	18.0	-1.9
	Kerosene	23.0			
Zimbabwe	Diesel	39.7	-3.2	6.0	2.0
	Kerosene	0.0			
Turkey	Diesel	33.3	16.0	20.0	1.3
	Kerosene	23.5			

Source: World Bank

1/ Change in the annual inflation rate from two years before the price change to two years after the price change.

2/ Revenue gains of governments due to energy price rises as percentage of total central government revenues.

3/ Change in the annual growth rate from two years before fuel price change to two years after fuel price change.

45. Energy price reform will facilitate the achievement of the government's social and developmental objectives. To ensure political support for the price reform, and in line with the authorities' desire to distribute hydrocarbon wealth to Iranian citizens, the energy price increases should be accompanied by strengthened targeted social assistance and, possibly, some form of cash transfers from oil revenue to households.[27] The additional budget revenue (net of transfers to households) could be channeled to productive expenditure within a sustainable medium-term expenditure envelope, as discussed in Chapter III.

[27] The authorities could use Alaska's Permanent Income Fund as a model by opting to save some of the revenues from higher domestic hydrocarbon prices in a trust fund and use some of the fund's earnings to pay annual dividends to all Iranians into perpetuity.

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III. Operations of the Oil Stabilization Fund[28]

This chapter examines the operations of the Oil Stabilization Fund (OSF) in Iran. It starts with a brief discussion of the role of oil in the Iranian economy. Subsequently, the chapter presents a detailed description of the OSF's design and operations. It concludes with recommendations on how to strengthen the OSF's role in macroeconomic management by focusing on its stabilization objective and integrating its operations with the central government budget in the context of a rolling medium-term fiscal framework.

A. The Design and Operations of the OSF

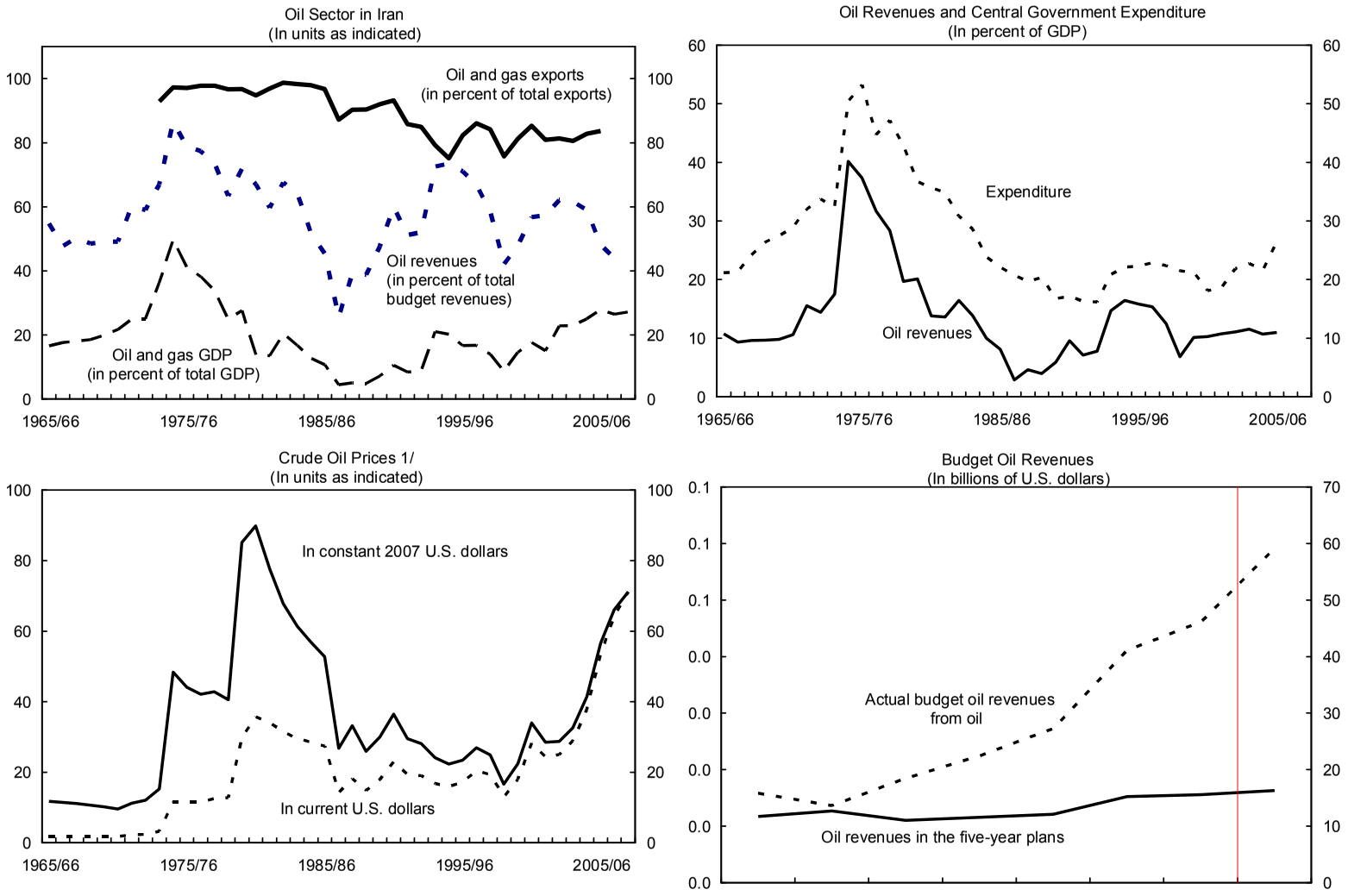
Historical background (1970–99)

46. While the oil sector has played an important role in the Iranian economy, the sector was very volatile during the 1970s–1990s.[29] In the 1970s, oil value added accounted for over 40 percent of GDP due to high oil prices and production volumes. However, following significant declines in oil production, this share shrank to about 10 percent immediately after the 1979 Revolution (Figure III.1). During the war with Iraq (1981–88), the contribution of oil value added to GDP bottomed at 3 percent in 1986, mainly because of war-related damages to oil production facilities and declining oil prices. In the 1990s, the oil sector recovered somewhat, with oil extraction value added fluctuating around 15 percent of GDP, reflecting the volatility of oil prices. As a result of oil sector fluctuations, government oil revenue ranged from 3 percent of GDP (25 percent of government revenues) in 1986 to about 16 percent of GDP (73 percent of government revenues) during 1993–94. This revenue volatility was reflected in large expenditure fluctuations, particularly in capital expenditures. The pro-cyclical fiscal stance exacerbated the variability of output, inflation, and the real effective exchange rate.

[28] This chapter was prepared by Roman Zytek.

[29] For an in-depth analysis of the role of oil and gas in the Iranian economy, see World Bank (2006), Karbassi, Abduli, and Abdollahzadeh (2007), Kia (2006), and Zamani (2007).

Figure III.1. Islamic Republic of Iran: The Role of the Oil Sector in the Economy, 1965/66-2007/08



Sources: CBI; IMF IFS; The Laws of the Third and Fourth Economic, Social, and Cultural Development Plans; and Fund staff estimates.

1/ Average crude oil price; the 2007 constant price calculated based on the U.S. CPI.

OSF objectives

47. To address the shortcomings stemming from expenditure volatility, the Iranian authorities set up an Oil Stabilization Fund (OSF) in 2000 as a separate public sector institution.[30] Article 60 of the Third Five-Year Development Plan (TFYDP, 2000–05) established the following objectives of the OSF:

- Stabilize the government's annual budgets; and
- Provide financial means to commercial banks for on-lending to private and cooperative entities carrying out projects in the priority sectors identified by five-year plans.

OSF accumulation and spending rules

48. The accumulation of OSF deposits was to be driven by the difference between projected and actual oil revenues. Specifically, Article 60 of the TFYDP and Article 1 of the Fourth Five-Year Development Plan (FFYDP) stipulated that annual crude oil export revenue up to a certain limit should be directly drawn by the central government, and that all excess oil revenue should be deposited in the OSF. The oil revenue projections were based on conservative oil price assumptions.

49. The TFYDP and FFYDP envisaged two types of withdrawals from the OSF. First, at the beginning of the plan's third year, the central government could draw from the OSF account if the government's oil export receipts fell short of the budgeted amount for that year. Second, an amendment to the TFYDP law in November 2000 stipulated that up to 50 percent of the OSF's balance should be set aside for lending foreign exchange to domestic private entrepreneurs in priority sectors via commercial banks. Loans were to be repaid in foreign exchange within eight years, with a three-year grace period, at an interest rate of LIBOR+2 percentage points (later capped at 10 percent).

[30] For details on the OSF's history, see Amuzegar (2005). For a general review of the operational aspects of fiscal policy in oil-producing countries, see Davis, Ossowski, and Fedelino (2003), and IMF (2007). In addition, Hunt, Isard, and Laxton (2001), Mehrara and Oskoui (2007), and Shabsigh and Ilahi (2007) present comparative studies of macroeconomic fluctuations in oil-exporting countries.

OSF's institutional arrangements

50. Management and supervision:

- Through mid-May 2008, the OSF was managed by a seven-member Board of Trustees. It comprised the Head of the Management and Planning Organization (MPO),[31] the Minister of Economy and Finance, the Governor of the Central Bank of Iran (CBI), and four representatives who are appointed by the President (of whom at least two are appointed from among the ministers). The Board set the priorities for projects that can use loans from the OSF; determined loans terms and conditions; specified the contractual framework between the MPO and the banks that on-lend OSF resources; and approved banks' charges and commissions for OSF-funded loans.

- In mid-May 2008, the OSF Board of Trustees was dissolved, and the Government Economic Committee was made responsible for OSF oversight.

51. Transparency of operations:

- In practice, members of the OSF's Board of Trustees periodically disclosed information about OSF asset holdings to mass media. In addition, the CBI disseminates information on the accumulated balances and sectoral allocation of OSF loans.[32] Furthermore, aggregated data on OSF cash flows are reported to the Fund during annual Article IV consultation discussions and published in IMF staff reports. However, the OSF itself does not disseminate the information on its operations to the public on a regular basis nor does it have its own website.

- Parliament approves the allocation of oil revenue between the central government budget and the OSF based on implicit oil price assumptions in the context of five-year plans. It also approves additional withdrawals from the OSF, as well as annual limits on OSF lending to domestic companies, in the context of annual budgets and mid-year budget revisions. However, the OSF operations are not consolidated with the central government operations in the budget documents discussed by parliament.

52. Investment management:

- OSF foreign assets are managed as part of the CBI's foreign assets. The Monetary

[31] The MPO has been recently integrated into the presidential administration.

[32] See *Bulletin* and *Economic Trend,* CBI periodic publications.

and Credit Council (MCC)[33] determines the rate of return on OSF foreign currency deposits at the CBI.

- The OSF domestic assets comprise claims related to commercial banks' lending, which it funds. The banks are required to review loan requests to ensure that projects are in conformity with the technical, financial, and economic feasibility criteria approved by the Board of Trustees.

B. OSF's Track Record

53. The creation of the OSF coincided with the on-set of a significant increase in oil prices. After bottoming up at about $9 per barrel in 1999, the oil price trended sharply upward, exceeding $100 per barrel in early 2008. As a result, Iran's annual oil export receipts increased from just under $17 billion in 1999/2000 to an estimated $66 billion in 2007/08.[34] At the same time, consolidated government oil revenues rose from 10 percent of GDP in 1999/2000 to an estimated 21 percent in 2007/08 (Figure III.1).

54. Sizeable oil price increases during 2000/01–2007/08 made it politically difficult to contain expenditure growth within the initial five-year plans' envelopes. In the context of the annual budget deliberations and mid-year budget revisions, parliament approved central government withdrawals from the OSF to finance central government expenditures, with a part earmarked for specific programs or projects, including to cover gasoline imports (Tables III.1–2).

Table III.1. Islamic Republic of Iran: Oil Revenues in the Five-Year Economic, Social, and Cultural Development Plans, 2000/01–2007/08 1/

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08 Est.
	(in billions of U.S. dollars; unless otherwise indicated)							
Plans 2/								
Total planned fiscal oil revenue	11.7	12.7	11.1	11.6	12.1	15.2	15.6	16.3
Outcome								
Fiscal revenues from oil	15.8	13.7	18.5	22.4	27.3	41.1	46.1	59.1
In percent of GDP	16.4	11.8	15.9	16.7	16.9	21.8	20.8	20.7
Additional transfer to the budget and net lending	0.0	0.9	5.7	5.5	11.2	13.7	28.3	29.0
Transfers to the budget	0.0	0.8	5.1	5.4	9.4	11.5	23.0	24.7
Net lending	0.0	0.1	0.6	0.1	1.8	2.1	5.3	4.3
Net transfers to OSF foreign assets	5.9	1.0	0.8	0.4	1.0	1.5	-1.4	9.6

Sources: Iranian authorities; and Fund staff estimates.

1/ The Third FYDP was based on an oil price of $19 per barrel. The Fourth FYDP was based on an oil price of $40 per barrel. The budget was supposed to spend all oil receipts earned at the budget price. Only excess receipts were to be saved in the OSF.

2/ As specified in the Third (2000-04) and Fourth (2005-09) Five-Year Economic, Social, and Cultural Development Plans.

[33] The MCC has been recently integrated into the supreme council for economic planning and management.

[34] The Iranian fiscal year ends on March 20.

Table III.2. Islamic Republic of Iran: Operations of the Oil Stabilization Fund, 2000/01–2007/08

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08 Est.
	(in billion of U.S. dollars)							
Total Inflows	5.9	1.8	5.9	5.8	10.4	13.0	21.6	34.3
Total Outflows	0.0	0.8	5.1	5.4	9.4	11.5	23.0	24.7
Transfers to the budget	0.0	0.4	4.5	5.3	7.5	7.8	17.8	20.3
Net domestic on-lending	0.0	0.1	0.6	0.1	1.8	2.1	5.3	4.3
Valuation adjustments	…	…	…	…	…	…	0.3	2.5
OSF Balance	5.9	1.0	0.8	0.4	1.0	1.5	-1.1	12.1
Memorandum items:								
OSF stock of foreign exchange deposits at the central bank	5.9	7.0	7.8	8.1	9.1	10.7	9.5	21.6
OSF stocks of domestic loans	0.0	0.1	0.7	0.8	2.6	4.8	10.0	14.4

Sources: CBI; and Fund Staff estimates and projections.

55. In contrast to the central government budget overspending, the OSF's domestic loans portfolio remained well below the 50 percent ceiling on the total OSF balance during 2000–05. This was mainly attributable to relatively unattractive terms and the small size of the private sector. Many borrowers viewed dollar-denominated OSF loans as too expensive, considering in particular the rapid rial depreciation during 2000–05. Indeed, the equivalent rial rates of return on OSF loans were estimated to have reached 20 percent, well above the official 15 percent rate charged by the state-owned banks on rial-denominated loans.[35] Equally important, the limited number of private sector companies involved in exporting activities significantly limited the pool of prospective loan applicants.

56. Since 2005, OSF lending rules have been gradually softened to increase loan attractiveness, which has led to approaching the 50 percent ceiling. Projects in "depressed regions" and certain enterprises experiencing financial difficulties saw the maturity of OSF loans extended up to 17 years, and the interest rate reduced to 3 percent. Also, OSF financing was made available to state-owned companies, partly to counter the impact of international sanctions that limited their access to foreign borrowing. In 2007/08, the government converted some of the OSF deposits at selected state-owned commercial banks into equity to strengthen their capital.

[35] The government's attempts to mandate insurance against foreign currency risk failed because the insurance companies were unwilling to provide such services, citing their lack of experience in this field and the overly long coverage periods that made risks difficult to price.

C. Options Going Forward [36]

57. Certain aspects of the OSF could be improved taking into account the lessons learned from its own experience and best international practices.

Objectives

58. Maintaining the OSF's stabilization objective appears appropriate, as the budget is projected to remain vulnerable to oil price declines in the medium term. Precautionary savings are particularly justified in the case of Iran because of lack of access to international financial markets and limited opportunities for domestic non-inflationary financing to ride out a period of lower oil prices.[37]

59. Long-term sustainability and intergenerational fairness considerations do not represent a binding constraint. The non-oil primary fiscal deficit is estimated at 17 percent of GDP and implicit energy subsidies are estimated at 22 percent in 2007/08. Their combined ratio to GDP is well below the sustainable real expenditure from oil wealth, which is estimated at 65 percent of GDP in 2007/08 assuming a conservative oil price of $85 per barrel (at constant U.S. dollar terms). Therefore, there is no compelling need to save more oil revenue than justified by precautionary motives**.**

60. Transferring OSF's domestic lending operations to the budget would facilitate fiscal planning. Should the authorities choose to maintain policy-motivated foreign currency lending, it would be advisable to transfer the administration of this lending to the central government. In this case, lending amounts should be approved by parliament in the context of the central government budget. This approach will de-link the amount of OSF withdrawals from oil price fluctuations, contributing to the fulfillment of the OSF's stabilization objective.

Accumulation and spending rules

61. The existing OSF accumulation and spending rules should become more flexible and responsive to oil price and macroeconomic developments:

- Align OSF accumulation and spending rules with its stabilization objective. Specifically, allocating all oil revenues to the OSF and limiting the use of its

[36] For a comprehensive discussion of the issues related to managing extrabudgetary funds, see Allen and Radev (2006).

[37] Limi (2006), Segura (2006), Carcillo, Leigh, and Villafuerte (2007), and Olters (2007) present country studies of different approaches to fiscal management in oil-producing countries. Bandiera and others (2007) provide a technical manual for using fiscal sustainability analysis in oil-producing countries.

resources to financing the non-oil budget deficit will help focus OSF operations on its stabilization objective and improve expenditure management.

- Implement a rolling medium-term budget framework (MTBF). As a first step in this direction, the existing five-year development plans should be updated annually reflecting the most recent information on oil prices, inflation, and balance of payments developments, as well as shifting government priorities. The authorities may draw on the recent experience of Mexico, the Russian Federation, or Timor-Leste in improving Iran's national MTBF. Mexico and the Russian Federation embarked on ambitious reforms to introduce rolling multi-year budgets that are updated every year to take into account changes in the outlook, including oil price projections. Mexico's Fiscal Responsibility Law requires that budgets aim at a zero balance, and the Russian Federation's framework sets an upper limit on the non-oil fiscal deficit. Timor-Leste adopted a long-term fiscal policy framework that includes rolling three-year projections based on sector investment programs with detailed plans to guide expenditure.

- Review the usefulness of assuming unrealistically low oil prices in the budget planning process. This practice proved ineffective in discouraging pro-cyclical fiscal policy in Iran as well as in other oil-producing countries (IMF, 2007). Instead, it is better to rely on market-based indications of future oil prices and incorporate risk analysis and contingency planning in the MTBF. In particular, the targeted medium-term paths for the non-oil fiscal balance and the accumulation of the OSF deposits under the baseline oil price scenario should take into account possible fluctuations in oil prices. Moreover, contingency plans should describe how the budget would respond to deviations from the budget's oil price assumptions (e.g., draw-down/or increase in the OSF's deposits, and areas of expenditure reductions or increases). The extent of such adjustments could be determined based on judgment on the possible duration of the deviations of oil prices from the budget assumptions, or based on mechanical rules (e.g., a moving average oil price).[38] In addition, a probabilistic approach can be used to determine the optimal size of the OSF's foreign assets and the corresponding fiscal balances to stabilize spending (Bartsch, 2006).

- Check the consistency of the non-oil primary balance with the short-term macroeconomic objectives, including economic growth and inflation. This will require improving the coordination between fiscal and monetary policies.

[38] For an analysis of long-term trends in commodity prices (including oil) see Cashin, Liang, and McDermott (2002); for a review of global demand and supply conditions for petroleum products see National Petroleum Council (2007), and Krichene (2005, 2006, 2007).

Governance structure and transparency

62. The OSF's transparency can be further enhanced.[39] The information that is publicly available (e.g., the key legal documents governing the OSF operations and disseminated elements of OSF financial operations) could be usefully posted on an OSF-dedicated website. In addition, more detailed information, including annual cashflow statements and summary balance sheets, could be disseminated to the public on a regular basis. Websites of a growing number of oil funds, including Norway's Government Pension Fund-Global, can serve as good examples of transparent communication with the general public.[40]

Investment policy and management

63. Going forward, the OSF may benefit from diversifying its foreign exchange asset portfolio to increase long-term returns. The current practice of managing the OSF foreign assets in the same pool as gross official reserves appears justified because the end-2007/08 OSF deposits are estimated to cover only about 22 percent of the budgeted 2008/09 expenditure. If the government decides to build up a larger precautionary balance, which can be used to facilitate expenditure adjustment to prolonged periods of oil price declines, the OSF deposits could be invested in somewhat less liquid and riskier assets.

[39] See IMF (2005) for a detailed discussion of transparency issues related to revenues from natural resources.

[40] For the Alaska Fund, see http://www.apfc.org; and for the Norway's Government Pension Fund-Global, see http://www.regjeringen.no.

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