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Abstract

This paper studies determinants of inflation in Iran. The buildup of international reserves has accelerated in response to the higher oil price. Further, the associated increase in government spending has limited contribution to capacity building and pronounced inflationary pressures, which appears to have been accelerated at the beginning of the Iran-Iraq war in 1980, and eased at the end of the war in 1988. Accommodating monetary stance has proven to be an important determinant of inflation, both in the long and short-run. In the long-run, depreciation of the rial increases the cost of intermediate goods, increasing inflationary pressures with limited significant effect on output supply in light of inelastic demand for imports. In contrast, depreciation could boost competitiveness of non-energy exports, in support of higher demand and output growth in the short-run. For policy implications, priorities should be in place to direct both public and private resources towards relaxing binding capacity constraints, capitalizing on the added windfall of abundant oil resources in Iran. Aligning the effective exchange rate with underlying fundamentals will help boost competitiveness and stem inflationary pressures that could prove detrimental to non-energy export competitiveness, hampering efforts to diversify resources and expand capacity to sustain output growth over time.

JEL Classifications: E3, F3

Keywords: inflation, import price, domestic policies, oil wealth, exchange rate.

ملخص

تدرس هذه الورقة محددات التضخم في إيران. وقد تسارعت وتيرة تراكم الاحتياطيات الدولية ردا على ارتفاع أسعار النفط. وعلاوة على ذلك، فإن الزيادة في الإنفاق الحكومي المرتبط له مساهمة محدودة لبناء القدرات والضغوط التضخمية ، والذي يبدو أنه قد تسارع في بداية الحرب العراقية الإيرانية في عام 1980، وتراجعت في نهاية الحرب في عام 1988. وقد ثبت ان موقف استيعاب النقد هو من العوامل الهامة للتضخم، سواء على المدى القصير أوالطويل. وفي المدى الطويل، فان انخفاض قيمة الريال يزيد من تكلفة السلع الوسيطة، وزيادة الضغوط التضخمية مع تأثير كبير على إمدادات محدودة الانتاج في ضوء الطلب الغير مرن بالنسبة للواردات. في المقابل، يمكن أن يعزز الاستهلاك القدرة التنافسية للصادرات غير النفطية، وذلك دعما لارتفاع الطلب ونمو الإنتاج في المدى القصير. وعن الآثار السياسة، فيجب أن تكون الأولويات في المكان المناسب لتوجيه الموارد العامة والخاصة نحو تخفيف القيود المفروضة على القدرات ملزمة، والاستفادة من المفاجئة المضافة لموارد النفط في إيران. والتوفيق بين سعر الصرف الفعلي وذلك يؤكد ان العوامل الاساسية تساهم في زيادة القدرة التنافسية وكبح الضغوط التضخمية التي يمكن أن تكون ضارة على القدرة التنافسية للصادرات غير النفطية، مما يعوق الجهود المبذولة لتنويع الموارد وتوسيع القدرة على الحفاظ على نمو الناتج مع مرور الوقت.

1. Introduction

Iran's inflation has been surging, the highest in decades. Following a peak of inflation to 50 percent in 1995, anti-inflationary policies paid off to reduce inflation in subsequent years. However, again, in recent years the inflation rate has begun to soar. According to Iran's Central Bank the value of Iran's inflation is recorded at 40.4 percent in September 2013, compared to the same month a year earlier. The election of a new government in June 2013 has sparked a debate on the appropriate policy response to stem inflationary pressures while fighting the current high unemployment.[1] Past Iran's experience showed success when inflation heightened in mid 90s. However, a lower inflation era was not long lasting.

The Iranian economy is characterized by dependency on oil. Before the tightening of international sanctions, Iran has been enjoying a windfall of oil revenues. Two factors are widely emphasized in connection to the recent surge of inflation. Iran, like other oil-producing countries, experienced high flow of oil revenues on the back of record crude prices.[2] While the surge in revenues had boosted economic growth, it has left the country awash in cash. Higher liquidity resulted in massive expansion in credit and aggregate demand that faces binding capacity constraints in light of the structural bottlenecks that exist on the supply side, particularly in the real estate and food production (See Table 1).[3]

In the face of recent financial sanctions by the west, the price of imported goods was kept low by keeping the exchange rate of the domestic currency appreciated. However, the tightening of sanctions, reduced the central Bank's access to foreign currency reserves to continue defend the currency value and led to a drastic depreciation of the rial, pushing not only the price of imported goods higher but also inflationary expectations by the public. Moreover, following many years of low price of imported goods, domestic production capacity has been severely undermined on account of higher cost of intermediate imported goods, increasing domestic supply constraints and further creating higher inflationary pressures.

In this paper, we aim to study the underlying determinants of inflation in Iran, in order to evaluate appropriate policy responses to curb inflationary pressures, both in the short term and long terms given internal and external constraints. Iran had traditionally pegged the domestic currency to the US dollar, the currency of international oil transactions. By doing so, Iran had sought to insulate oil revenues in the budget from exchange rate volatility. Subsequently, the wealth of oil funds have been largely invested in dollar-denominated assets that further reinforced the desire to stabilize the value of the domestic currency relative to the US dollar. Starting in 1992, Iran has officially switched to a floating exchange rate system. Nonetheless, the Iranian central bank has been able to keep the exchange rate pretty stable against the value of the dollar through both capital control and frequent intervention using its foreign currency reserves until recently. Absent flexibility in the exchange rate for several

[1] The unemployment rate is reported at 12.2 percent in 2012. However, actual unemployment is likely to be higher on account of underemployment, particularly in the public sector, and high concentration of unemployment among the young generation, ages 18-26 years. The unemployment rate for ages 15-24 is reported at 26.9 percent in 2012.

[2] Oil accounts for 80percent of Iran's exports. Recently, rising oil prices have increased government revenues and reduced the budget deficit. However, the rising revenues were absorbed by higher spending. After President Ahmadinejad came to power in 2005, the government embarked on an initiative to boost employment by establishing a system of "quick-impact loans". Specifically, substantial loans were made available to individuals and companies that submitted economic plans to create jobs. In reality, the majority of these loans were diverted to the housing market due to inadequate other private and public investment opportunities.

[3] Qumarsi (2005) notes that housing prices have surged on account of high concentration of developments in Tehran and large cities, as well as high construction costs. During the last few years, 120 million square meters of housing have been added in Tehran, forcing an increase in demand for building materials. The surge in construction activity increased pressures on input prices, including wages and cement price. Moreover, higher cost of construction spilled over to the cost of existing homes. Rising cost of urban homes is considered a major determinant of higher inflation in Iran.

years, the burden of adjustment to rising oil prices had fallen on domestic prices (see Figure 1).

In practice, targeting a stable exchange rate relative to the US dollar substantially reduced the scope for independent monetary policy.[4] Nonetheless, fluctuations in the oil price presented another constraint on monetary policy. The buildup of reserves with the surge in the oil price forced monetary easing, exacerbated by abundant liquidity conditions.

Faced with high international prices of food and fuel, attention has once again focused on the flexibility of the exchange rate to weather the spillover effects of imported prices.[5] The managed depreciation of the exchange rate may have increased the pass-through of higher international prices, contributing to additional inflationary pressures in Iran.

The recent surge of inflation has sparked a debate on the appropriate policy response to stem inflationary pressures by introducing more flexibility in the exchange rate, and/or aligning domestic policies to restrain demand growth. An appreciation of the rial when the oil price is rising would block the pass-through of imported inflation into domestic prices in Iran. On the other hand, a depreciation of the rial when oil price is decreasing could boost non-energy export competitiveness and domestic non-oil production. Moreover, containing credit growth and government spending would limit excess demand, in light of structural binding capacity constraints.

This paper studies determinants of inflation in Iran, using an empirical model that includes domestic and external factors. Higher oil price is likely to increase government revenues and domestic liquidity, resulting in demand expansion and higher inflation. An increase in government spending could further reinforce the inflationary effects of higher oil price through higher demand for goods.[6] An increase in foreign reserves is likely to increase liquidity, resulting in credit expansion and, therefore, price inflation. Depreciation of the nominal exchange rate, relative to major trading partners, is likely to increase the price of imports and accelerate price inflation. In addition, higher price of imports is likely to spillover additional inflationary pressures in light of Iran's high dependency on imports for consumption and production.[7]

2. Literature Review

The existing literature on determinants of inflation has considered demand and supply pressures in advanced and developing countries. In general, researchers have distinguished

[4] Moreover, interest rate determination in Iran plays a political role for a government that subscribes to the rules of Islam, prohibiting a fixed rate on loans and deposits. The central bank announces a range for the interest rate to banks based on predictions of capital profitability. The range applies to loans, assuming money is invested in production and the interest rate on loans represents lenders' share of the profit on investment. Moreover, the government occasionally intervenes to force a reduction in the interest rate, beyond the guidelines established by the central bank.

[5] While rising oil price has increased Iran's national income, it has also increased the cost of imported refined oil due to capacity limitation of domestic refineries.

[6] Government spending accounts for 11 percent of GDP in 2010. At the same time, the shares of private consumption and gross fixed capital formation of GDP are 41, and 11, respectively. The government size has fluctuated with the oil price, booming during periods of higher oil revenues and shrinking during economic stagnation. The greatest size of government was during the boom period of oil revenues (1973/74-1978/79). During the war with Iraq (1979/80-1988/89) there were massive cuts in government spending in a recessionary environment. Nonetheless, the relationship may not be proportional, mitigating the pro-cyclical stance of government spending (see Figure 2) due to the high share of oil in GDP. For example, during the stagnation of late nineties, the ratio of government spending to GDP increased, despite expenditure cuts. Similarly, during boom periods, e.g., 2000/01-2004/05, the ratio of government spending to GDP did not increase, despite expansionary fiscal stance. Bazmo hammadi and Cheshmi (2006) study the size of government in Iran. They note significant increase in government spending during the booming oil period of 1973-79, and the booming period 2000-05.

[7] In 2012, imports account for 20 percent of GDP, while exports account for a larger share, 27.5 percent of GDP. Oil GDP accounted for only 17.7 percent and non-oil GDP accounted for 82.3 percent of total GDP. Iranian economy has become more of a service economy as services account for 51.5 percent of GDP in the same year.

between supply side constraints, demand pressures, and the spillover of external factors. To analyze the effects of these factors on persistent inflation, researchers have considered the role of second-round effects and entrenched expectations on prolonged price adjustments.[8]

More recently, higher inflation in oil-producing countries has attracted a wave of research to unveil sources of underlying pressures. A number of shortcomings exist, however, in the existing literature. Most of the studies have considered inflation in individual countries, without a comprehensive approach that integrates developments in the global economy into country-specific framework. Moreover, the focus of the analysis, in general, has been on short-run inflationary pressures, neglecting determinants of inflation in the long-run.[9]

A number of studies have analyzed developments of inflation in Iran. Alavirad (2003) studies the effect of inflation on fiscal revenues and expenditures in Iran. He concludes that the budget deficit increases with higher inflation, necessitating an accommodating monetary stance that further accelerates price inflation. Alavirad and Athawale (2005) analyze the impact of the budget deficit on inflation in Iran in the long- and short-run, using data from 1964-99. They support significant positive effect of higher budget deficit on price inflation in the long-run. They also support the role of higher liquidity in increasing inflationary pressures, reflecting an accommodating monetary stance to higher government spending. Bonato (2008) finds a strong relationship between monetary growth, using M1, and price inflation. Gholibeglou (2008) studies the impact of inflation uncertainty on relative prices between 1981 and 2006. Unexpected inflation raises relative price dispersion and inflationary pressures have varying effects across economic sectors. The Dutch disease has pushed prices higher in the services sector, particularly in medical care and housing.

The analysis provides a thorough evaluation of determinants of inflation in Iran. The analysis of the underlying determinants will shed some light on sources of inflationary pressures and the effects of fluctuations in the nominal effective exchange rate to weather external shocks. In addition, the work departs from previous investigations above, by considering the impact of public spending and the money supply on inflation. Higher government spending on subsidies, wages and salaries, as well as on goods and services is likely to exert persistent inflationary pressures due to prolonged second round effects. In contrast, spending aimed at relaxing capacity constraints will ease structural bottlenecks and mitigate inflationary pressures. Similarly, growth of international reserves, on account of higher oil price, is likely to avail resources for private activity. Higher private consumption is inflationary. In contrast, private investment, particularly in construction and the real estate sector could relax capacity constraints and ease inflationary pressures.

3. Econometric Methodology

Inflation in Iran is likely to vary with specific underlying pressures. Like many developing commodity-producing countries, Iran shares high dependency on oil exports and exposure to external shocks. Moreover, Iran is highly dependent on imports and with exception of the

[8] Researchers have employed various techniques to study inflation in various countries. De Brower and Ericsson (1998) model inflation in Australia using a mark-up model. Juselius (1992) investigates spillover effects of German shocks on inflation in Denmark, via interest rate and exchange rate channels. The analysis in Lim and Papi (1997) highlights the roles of money and exchange rate in determining inflation in Turkey. Along the same line, Leo (2007) finds a strong relation between money and inflation in Iran. Mohaddes and Williams (2013) find the oil cycle as the most influential factor on inflation in GCC countries. In addition to common inflationary sources, some studies have zeroed in on country-specific determinants of inflation (see, e.g., Sekine (2001; Japan), Khan and Schimmelpfennig (2006; Pakistan), Diouf (2007; Mali), and Hosny (2013; Egypt).

[9] The specifics of the analysis have varied across existing studies. Darrat (1985) analyzes the effect of monetary growth on higher inflation and lower growth in Libya, Nigeria and Saudi Arabia. Keran and Al Malik (1979) contrast the effects of monetary growth and imported inflation on domestic inflation in Saudi Arabia. Other studies have analyzed the effect of exchange rate pass-through on domestic inflation (see, e.g., Pattanaik (2003)).

time of currency crisis[10]; it has maintained an informal relatively stable target of the rial to the US dollar to insulate oil resources from currency fluctuations. Nonetheless, fluctuations of the US dollar have exposed Iran to imported inflation and reduced its competitiveness to diversify non-oil exports.[11]

To capture the effect of currency fluctuations on price inflation, we include the nominal effective exchange rate in the model, a weighted average of bilateral fluctuations in the domestic currency with respect to major trading partners. While the rial may fluctuate moderately with respect to the US dollar, it is likely to exhibit massive fluctuations on account of bilateral exchange rate movements in the US dollar relative to the currencies of Iran's major trading partners, particularly in the euro area, see table 2. An appreciation in the nominal effective exchange rate would decrease demand for the rial (money demand channel) on account of expected future depreciation, reduce the cost of imported intermediate goods (supply-side channel) and reduce demand for non-energy exports (demand-side channel). The latter two channels would work to ease inflationary pressures. Similarly depreciation of the nominal effective exchange rate would increase the cost of imported goods and increase demand for Iran's non-energy exports, but reduce velocity of the domestic currency in anticipation of future appreciation. The former two channels would increase inflationary pressures and the net effect would depend on the relative strengths of these channels compared to the effect of depreciation on money demand.[12]

In general, researchers have distinguished between supply side constraints, demand pressures, and the spillover of external factors. To analyze the effects of these factors on persistent inflation, researchers have considered the role of second-round effects and entrenched expectations on prolonged price adjustments.

We use an empirical model that includes domestic and external factors and combines the determinants of inflation in the long-run with short-term dynamics. The proposed analysis departs from previous investigations, by considering the impact of public spending and the money supply on inflation. Higher government spending on subsidies, wages and salaries, as well as on goods and services is likely to exert persistent inflationary pressures due to prolonged second round effects. In contrast, government spending on investment with a goal to relax capacity constraints will ease structural bottlenecks and mitigate inflationary pressures. Similarly, growth of international reserves, on account of higher oil price, is likely to avail resources for private activity. Subsequent increase in aggregate demand will exert inflationary pressures.

Structural bottlenecks on the supply side could further escalate price inflation in the face of demand pressures. To formalize this channel, we introduce a measure of excess demand (*excd)* into the empirical model, defined as follows:

$$excd_t = RGDP - \overline{RGDP}$$

[10] After years of multi-tier currency exchange rates, Iran unified the rate by letting the value of the rial to be devaluated in 1992. The exchange rate changed from 67.8 rials to 1458.5 rials per the U.S. dollar, a devaluation of more than 2000 percentage points. This value was kept stable until 2002 when the rial gradually depreciated against the U.S. dollars until the currency crisis of 2013 when the rate dropped from 12260 rials to 24798 rials per dollar. As we see in figure 3, all official adjustments took place after a period of depreciation of the rial in the unofficial market against the backdrop of dwindling international reserves at the central bank.

[11] Iran has taken serious steps to diversify and promote non-oil exports. Non-oil exports, as a percent of total exports, was little over 3 percent when the Iranian revolution took place in 1979. This percent has increased over time; non-oil exports represented 18.4% of total exports in 2012.

[12] For detailed theoretical illustration, see Kandil and Mirzaie (2002). For an empirical investigation across a sample of developing countries, see Kandil and Mirzaie (2005).

Here, *RGDP* is a measure of real income, the real value of gross domestic product and $\overline{RGDP}$ is its potential, approximated by its de-trended value using an hp-filter. An error correction model is specified as follows:

$$\Delta p_t = c + \delta(p_{t-1} - \alpha_1 neer_{t-1} - \alpha_3 m_{t-1} - \alpha_4 g_{t-1}) + \sum_{i=1}^{k} b_{1i}\Delta p_{t-i} + \sum_{i=1}^{k} b_{2i}\Delta neer_{t-i} + \sum_{i=1}^{k} b_{4i}\Delta m_{t-i} + \sum_{i=1}^{k} b_{5i}\Delta g_{t-i} + \sum_{i=1}^{k} b_{8i} excd_{t-i}$$

where P is the domestic price level, neer[13] is the nominal effective exchange rate, *M* is broad money, and *G* is government spending. When testing, all variables are introduced in log forms. Finally, *k* is the number of lags defining short-run dynamics. We will substitute real effective exchange rate for nominal effective exchange rate to test the effects of relative competitiveness, including relative price inflation, on developments in domestic price inflation.

The empirical model will be augmented with dummy variables, as necessary, to capture the start of the Iran/Iraq war in 1980 and the end of the war and subsequent spending on reconstruction. Further, a proxy for inflationary expectations will be introduced into the empirical model which determines the public's demand for domestic currency, given their expectations of future inflation and the exchange rate of the rial. Less demand for money would increase dollarization, depreciating the rial and creating further inflationary pressures.

4. Data and Estimation

Following evidence of non-stationarity (Appendix Table A1), estimation results identify determinants of inflation and real growth in the long-run and short-run dynamics. The results will reflect vulnerability in the face of external shocks, pass-through channel, demand pressures, and supply-side bottlenecks.

4.1 Inflation

Two models are estimated to alternate sources of inflation in the short run (see Table 3), alternating the real and nominal effective exchange rates in the model. Across the two models, the long-run specification includes the money supply and government spending. The short-run dynamics varies across models.

The main driving force of inflation in the long-run is the growth of money supply and government spending. Higher spending increases aggregate demand and increases inflationary pressures. Equally important to inflation in the long-run is depreciation of the effective exchange rate. Depreciation increases the cost of imports and intermediate goods, which has a long-lasting effect on price inflation. The speed of adjustment, judged by the coefficient on the error correction terms in the empirical model, appears relatively in support of fast movement to eliminate deviation from long-run equilibrium.[14]

[13] Nominal Effective Exchange Rate is defined as how much domestic currency can buy one unit of a weighted average of foreign currencies for major trading partners and Real Effective Exchange Rate is defined as a weighted average of relative prices, including movements in bilateral exchange rates, at home relative to major trading partners (see Figure 3). An Increase in the exchange rate indicates depreciation of the currency in effective terms.

[14] The speed of adjustment is the number of periods (years) required to reduce one-half of a deviation from the long-run equilibrium. It is calculated as log (-0.5)/log (1+δ), see Rogoff (1996).

Growth of government spending is a major determinant of price inflation in the short-run, although with a lag. The significant evidence further confirms the effect of government spending on inflationary pressures.

Accommodating monetary policy fuels price inflation in the short-run. The evidence spells out significant lagged and persistent effects of monetary policy. Monetary growth escalates price inflation, although with a lag, reflecting the duration of the transmission mechanism that supports high entrenched inflationary expectations.

Higher price of imports is passed through to domestic price inflation. Across both models, there is evidence of a significant increase in price inflation in response to higher price of imports. Despite price controls and subsidies, the spillover effects of international prices on domestic inflation are quite pronounced.[15] Appreciation of the exchange rate relative to non-dollarized trading partners, particularly in mid-nineties, did not prove to be effective to block the pass-through of international prices to domestic price inflation.

Real exchange rate depreciation does not appear to have significant inflationary effect on price inflation in the short-run. However, the inflationary effect of depreciation in the nominal effective exchange rate is significant in the short-run in model 2. The pass-through of nominal depreciation to domestic price inflation is evident by the significant positive response as depreciation increases the cost of imports, further increasing inflationary pressures. As the rial is managed to maintain a stable exchange rate with respect to the US dollar, a downward trend of the US dollar resulted in a depreciation of the nominal effective exchange rate of the Rial relative to non-dollarized trading partners, which is passed through to price inflation.[16] Revaluation of the currency, departing from close management to stabilize the rial relative to the US dollar, would appreciate the nominal effective exchange rate relative to non-dollarized partners and stem inflationary pressures. Alternatively, switching to a basket peg with weights that reflect trading shares with major partners may provide a more transparent approach of managing the exchange rate and avoid discretionary revaluation in response to bilateral adjustments in the currencies of major trading partners to stem potential severe under- or over-valuation.

Determinants of inflation in the short run include the energy price and deviation in demand, relative to potential output, i.e., the output gap. An increase in the energy price has a negative and significant effect on price inflation. Higher energy price increases spending on infrastructure and capacity building, easing inflationary pressures. Indeed, there is no positive effect of the output gap on price inflation in parallel, indicating that the demand cycle is more closely attached to fluctuations in the energy price with offsetting effects on price inflation.

4.2 Real growth

Two models are estimated to illustrate determinants of real growth, alternating the real and nominal effective exchange rate in the model (see Table 4). Across the two models, the long-run specification includes the money supply and government spending. The short-run dynamics include lagged values of the money supply, government spending, the exchange rate, and the current values of the output gap, the energy price and the price of imports.

The main driving force of real growth in the long-run is the growth of government spending which has a positive significant effect, further affirming its contribution to capacity building. Monetary growth increases liquidity and credit availability, contributing to demand increase with a positive effect on output growth in the long run. Despite positive effects on real

[15] It could be argued that the government kept inflation below its true value due to price controls and subsidies.

[16] The management of the exchange rate was mostly aligned to the US dollar value.

growth, the inflationary effects of growth in government spending and the money supply are pronouncedly large, indicating a relatively steep supply curve in the long-run. Depreciation of the exchange rate has no significant effect on real growth in the long run as it is mostly absorbed in price inflation, limiting its effect on capacity in the long-run. The speed of adjustment, measured by the adjustment coefficient, appears relatively high to eliminate deviation from long-run equilibrium.

There is no flexibility to extend output growth in response to the first lag of monetary growth in the short-run, as evident by the negative and significant effect on real growth Monetary growth appears to be absorbed mostly in inflation in the short-run, with no stimulating effect on real growth. However, persistent growth of the money supply stimulates output growth, as evident by the positive and significant response to the second lag of monetary growth in the empirical model.

Fiscal spending exhibits significant stimulus effects in the short-run. Consistent with the stimulus effect of government spending in the long-run, the positive effects of the growth of government spending appear significant on real growth in the short-run.

Higher price of imports impact output growth positively and significantly, ruling out the adverse effect of higher cost of imports on the cost of intermediate goods and the output supplied. Despite inflationary pressures, limited substitution forces producers to endure the higher cost of imports which is passed through to price inflation, with no evidence of output contraction (see Figure 4). Deviation in demand around capacity limit, the output gap, has a positive significant effect on output growth. Hence, demand mobilization is an important determinant of growth. In contrast, higher energy price does not have a direct positive effect on real growth in the short-run. Hence, the stimulus direct effects of the energy price boom do not induce higher growth of the output supplied in the short-run, given the larger share of non-energy GDP in the economy.

Exchange rate depreciation stimulates real growth in the short run. Depreciation increases non-oil export competitiveness and output production. This channel is in contrast to the long-run evidence. While depreciation is not significant to stimulate output growth in the long-run in light of its strong inflationary effects, it helps stimulate non-oil export growth and competitiveness in support of higher output growth in the short-run.

5. Testing for Structural Break

The Iranian economy experienced a declining growth from 1976 that became negative after the revolution in 1979. When the Iran-Iraq war started in 1980, economic activities picked up initially and then went down because of the devastating effect of the war. In 1988 when the war ended, it had a positive effect on economic growth in 1989 (see Figure 5).

To capture the structural breaks in 1980 and 1988, we introduce two dummy variables in the empirical models. The first takes zero values before 1980 and one thereafter. The second takes zero values before 1988 and one thereafter.

We augment the models above with the dummy variables as constants and interactive dummies to test structural break in economic variables and the associated responses to the variables in the models, alternating the interactive dummy with each variable one at a time. The results are presented in Tables 5 and 6.

There is evidence of a pickup in growth in 1980 and 1988, supporting the above hypotheses. However, the significant structural increase in price inflation is only evident after 1980. Ending the war may have helped to revive growth by devoting more attention to domestic spending. However, tight supply side constraints, following many years of the war and

resource depletion, continued to push inflationary pressures upward at the end of the war in 1988, further affirming tight resources in the face of higher demand and currency depreciation. The analysis of the role of the interactive dummies in association with each explanatory variable in the empirical models follows.

5.1 Inflation

Interacting the dummy variables with each of the variables in the model that explain price inflation illustrates the effects of structural breaks on inflationary pressures associated with each variable in the model.

The long-run inflationary effect of monetary growth has increased following the structural break in 1980. Higher cost of the Iran-Iraq war and associated supply shortages have further increased inflationary pressures attributed to monetary growth.

However, inflationary pressures appear to have eased at the end of the war. This is evident by the negative and significant long-run coefficient of the interactive dummy. The evidence suggests that supply shortages have eased at the end of the war, moderating the long-run inflationary effect of an increase in the money supply. However, the inflationary pressures associated with cyclicality in monetary growth have increased in the short-run at the end of the Iran-Iraq war. Monetary growth continued to be a source of inflation, absent ability to expand capacity and cope with higher demand in the short-run.

The effect of the growth in government spending in easing capacity constraints and moderating inflationary pressures in the long-run has become more pronounced starting in 1980. This evidence attests to the availability of resources and targeted government spending to enhance capacity and ease structural constraints at the beginning of the Iran-Iraq war.

However, persistent increase in the cost of the war has tightened resources and the ability of the government to maintain spending for capacity building. Indeed, the evidence indicates that at the end of the war, further government spending has been associated with higher inflationary pressures in the long-run. Higher government spending, against the backdrop of tight financial resources, has increased crowding out and forced an increase in the cost of borrowing and higher inflation. Further, limited capacity has become a more binding constraint in the face of higher spending by the government, accelerating price inflation further.

The interactive dummy on the exchange rate variable indicates higher inflationary pressure in the long-run in the face of exchange rate depreciation following structural break in 1980.[17] Depreciation increases competitiveness and the demand for exports. In parallel, depreciation increases the cost of intermediate and consumption imports. Both channels seem to have been reinforced following structural break in 1980, and again at the end of Iran-Iraq war in 1988.

5.2 Real growth

The interactive structural break dummies with variables in the model illustrate their effects on the response of real growth to explanatory variables, both in the short and long-run.

There is evidence of significant increase in the expansionary effect of monetary growth in the long-run, following the structural break in 1980. The evidence is also supported by significant increase in the short run. That is, output expansion is significantly more marked in response to monetary growth, following the structural break in 1980, attesting to more effective monetary policy.

[17] We illustrate the evidence using real effective exchange rate. The results using nominal effective exchange rate support the reported evidence and are available upon request.

However, the evidence further supports significant decrease in output growth in response to monetary growth, only in the long-run, following the structural break in 1988.

The evidence suggests that continued monetary expansion was primarily used to finance growing expenses related to the prolonged Iran-war, forcing contraction in domestic capacity building with a negative effect on real growth in 1988.

The interactive dummy variables with government spending in the empirical model for real growth produce the following evidence. The negative effect of the increase in government on real growth is further reinforced following the structural break in 1980, only in the long run. The evidence confirms that binding constraints have had a negative effect on real growth in the face of higher government spending, which has become more acute in the face of the rising war cost.

It is interesting, however, to observe the varying results for the interactive dummy with government spending, marking the structural break in 1988. At the end of the 1988 war, growth has become positively responsive to the increase in government spending, in the long-run. The evidence indicates that easing financing constraints at the end of the war helped increase available resources in support of higher growth in response to government spending.

The interactive dummy on the exchange rate variable indicates significant increase in the expansionary effect of exchange rate depreciation, following the structural break in 1980, both in the long- and short-run. Depreciation helps boost non-oil export competitiveness, in support of higher output growth. This channel is significantly reinforced, in the early eighties, attesting to available capacity that could be mobilized in support of higher non-energy export and output growth.

In contrast, the interactive dummy for structural break in 1988 indicates significant reduction of real growth in response to exchange rate depreciation at the end of the Iran-Iraq war. Significant depletion of resources increased capacity constraints at the end of the war. Hence, exchange rate depreciation did not help to boost non-energy export competitiveness and real growth. Instead, exchange rate depreciation pushed the cost of intermediate imports higher and further reinforced tight capacity constraints with a negative effect on real growth.

6. Conclusion

Economic activity in Iran is exposed to fluctuations in the global economy. In light of the high share of imports to GDP at more than 20 percent, domestic prices have reflected external pressures fully. Therefore, higher import prices exhibit significant inflationary effects in Iran, in general. However, higher price of imports does not appear to exhibit direct negative effect on the output supply, attesting to inelastic demand for imports and limited capacity of substitution that forced higher cost and accelerated inflationary pressures.

Domestic factors have reinforced inflationary pressures in response to external shocks. Specifically, the buildup of international reserves has accelerated in response to the higher oil price. Further, the associated increase in government spending has limited contribution to capacity building and pronounced inflationary pressures, which appears to have been accelerated at the beginning of the Iran-Iraq war in 1980, and eased at the end of the war in 1988. Accommodating monetary stance has proven to be an important determinant of inflation, both in the long and short-run. The inflationary channel of higher monetary growth picked up significantly at the beginning of the Iran-Iraq war. However, the end of the war helped ease inflationary pressures associated with this channel, attesting to less binding capacity constraints. Higher energy price has provided the channel to sustain monetary expansion, in support of higher demand growth, which has supported output growth in the short-run.

The effect of exchange rate adjustment varies with its effects on the output supply and aggregate demand. In the long-run, depreciation increases the cost of intermediate goods, increasing inflationary pressures with limited significant effect on output supply in light of inelastic demand for imports. In contrast, depreciation could boost competitiveness of non-energy exports, in support of higher demand and output growth in the short-run.

The effect of exchange rate fluctuations has varied with structural break in the long-run. At the start of the Iran-Iraq war, the positive effect of depreciation on output growth and price inflation has become more pronounced, attesting to flexible scope to mobilize competitiveness and export growth. However, the supply-side channel was more pronounced at the end of the war, reflecting depletion of resources and more binding capacity constraints. Accordingly, the effect of exchange rate depreciation has become negative on output growth in the long-run, attesting to higher cost of imported intermediate goods. Consistently, the long-run inflationary pressures of depreciation have increased in 1988, attesting to higher cost of imports for consumption and production.

Introducing more flexibility in managing he exchange rate to stem depreciation pressures with respect to major trading partners could mitigate the risk of persistent inflation in economies, like Iran, that are undergoing a spending spiral, triggered by the oil price boom and accompanying domestic policies expansionary stance. Further, addressing supply-side bottlenecks remain crucial, which have become more acute during marked periods of structural breaks spanning a prolonged war with Iraq. Where the evidence supports the stimulus effect of fiscal spending in the short-run, the government has successfully targeted supply-side constraints and helped support output growth.

For policy implications, priorities should be in place to direct both public and private resources towards relaxing binding capacity constraints, capitalizing on the added windfall of abundant oil resources in Iran. Aligning the effective exchange rate with underlying fundamentals will help boost competitiveness and stem inflationary pressures that could prove detrimental to non-energy export competitiveness, hampering efforts to diversify resources and expand capacity to sustain output growth over time.

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Table 1: Components of Consumer and Wholesale Price in 2012

Average Percentage change over previous year	
Consumer Price Inflation	
General Index	30.5
Food, Beverages, and Tobacco	44.6
Tobacco	82.5
Clothing and Footwear	47.8
Housing, Water, Fuel, and Power	12.9
Household Furnishings and Operation	50.9
Transportation and Communication	29.5
Medical Care	24.7
Recreation, Reading and Education	41
Education	14.1
Restaurants & Hotels	38.7
Producer Price Inflation	
General Index	29.6
Agriculture, Hunting, Forestry, Fishing	38.2
Manufacturing	29.6
Services	22.6
Hotels & Restaurants	32.7
Transport, Storage, & Communication	20.3
Education	14
Health & Social Work	28.6

Table 2: Iran's Major Trading Partners

Country	**Exports from Iran/Iran's total Export (Percentage)**		**Imports to Iran/Iran's Total Import (Percentage)**	
	2000	**2010**	**2000**	**2010**
China	5	17.8	8.1	9.1
Iraq	3	17.7	4	-
UAE	13.2	13	8.1	33.1
India	4.5	7.7	1.8	2
Afghanistan	1.2	5.4	-	-
Germany	10.5	1.4	10.6	7.2
Turkey	4.9	4.2	1.6	6.2
Switzerland	-	-	2.3	5.9
South Korea	-	-	5.2	5.7
France	-	-	4.3	3.2
Italy	5.7	1.3	6	2.7
Japan	3.8	1.7	4.8	2.5
Europe	36.9	9.5	50.1	30.3
Asia	67.4	90.7	35.1	67.3

Source: Iran's Central Bank, Economics Times Series Database

Table 3: Alternative Models of Price Inflation in Iran

	Model 1	Model 2
Long Run Equation:		
P(-1)	1	1
M (-1)	- 6.35E-14**	-3.42E-01
	(-3.10)	(-0.81)
G (-1)	-2.54E-14**	-2.47E-13*
	(-6.53)	(-1.71)
REER (-1)	-0.01**	
	(-2.28)	
NEER (-1)		0.001
		-2.65
C	-6.8	-17.2
Adjustment Coefficient	-0.27**	-0.23**
	(-5.12)	(-4.67)
Short Run Dynamic		
D (P (-1))	0.21	0.03
	-1.38	-0.19
D (P (-2))	-0.39**	-0.48**
	(-3.06)	(-3.71)
D (M (-1))	1.56E-14	3.89E-14*
	-0.76	-1.87
D (M (-2))	1.34E-14**	1.41E-13**
	-3.53	-3.55
D (G (-1))	1.10E-14	5.96E-14
	-0.25	-1.17
D (G (-2))	1.01E-13*	5.05E-14
	-1.96	-0.87
D (REER (-1))	-0.001	
	(-0.56)	
D (NEER (-1))		0.003
		-0.92
D (REER (-2))	-0.0003	
	(-0.21)	
D (NEER (-2))		0.001*
		-1.91
Constant	-2.24**	-2.88*
	(-2.26)	(-1.98)
Oil Price	-0.1**	-.05**
	(-5.67)	(-2.04)
Excess Demand	-7.57E+06	-9.57E-0.6
	(-0.66)	(-0.75)
Import Price	0.09**	0.08**
		-5.63
R-squared	0.99	0.99
Adj. R-squared	0.99	0.99
Log Likelihood	-1908.7	-11.17
Akaike AIC	135.5	1.86

Notes: Sample period: 1976-2011, t-statistics are in brackets. ** 5 percent significant. * 10 percent significant

Table 4: Alternative Models of Real Growth in Iran

	Model 1	Model 2
Long Run Equation:		
y (-1)	1	1
M (-1)	-2.45E-10	-13.942
	(-1.26)	(-1.96)
G (-1)	5.16E-10*	-1.05E-10
	(-1.77)	(-1.33)
REER (-1)	18.87	
	-0.99	
NEER (-1)		1.79
		-0.8
C	-261563.8	-176974.5
Adjustment Coefficient	-0.89**	-0.88**
	(-7.34)	(-3.24)
Short Run Dynamic		
D(y (-1))	0.19	0.47
	-1.33	-1.91
D(y (-2))	-0.004	-0.02
	(-0.03)	-0.07
D (M (-1))	-8.50E-10**	-1.05E-09**
	(-4.10)	(-2.82)
D (M (-2))	8.39E-10**	3.89E-10**
	-2.44	-0.91
D (G (-1))	9.23E-10*	2.40E-10
	-1.72	-1.83
D (G (-2))	1.37E09*	1.57E-09
	-2.2	-1.83
D (REER (-1))	-1.25	
	(-0.07)	
D (NEER (-1))		7.58*
		-1.92
D (REER (-2))	-3.89	
	(-0.22)	
D (NEER (-2))		-5.46
		(-1.06)
Constant	-14036.9**	16671.1*
	(-2.27)	-1.76
Oil Price	-262.9	-735*
	(-1.26)	(-1.72)
Excess Demand	0.65**	0.58*
	-3.29	-1.86
Import Price	477.87**	405**
	-6.43	2.82
R-squared	0.92	0.85
Adj. R-squared	0.86	0.71
Log Likelihood	-285.4	-259.5
Akaike AIC	2.58	20.96

Notes: Sample period: 1976-2011. t-statistics are in brackets. ** 5 percent significant. * 10 percent significant

Table 5: Alternative Models of Price Inflation in Iran, Interactive Dummies

Long Run Equation:	
Dummy80*M (-1)	-2.18E-11**
	(-8.08)
Dummy88*M (-1)	1.34E-12**
	-7.48
Dummy80*G (-1)	3.77E-12**
	-20.14
Dummy88*G (-1)	-8.96E-13**
	(-4.28)
Dummy80*REER (-1)	-0.57*
	(-26.04)
Dummy88*REER (-1)	-0.12**
	(-14.72)
Short Run Dynamic	
D (Dummy80 (-1)*M (-1))	1.88E-13
	-0.57
D (Dummy80 (-1)*M (-2))	-5.07E-13
	(-0.17)
D (Dummy88 (-1)*M (-1))	2.07E-13**
	-3.19
D (Dummy88 (-1)*M (-2))	2.07E-13**
	-2.49
D (Dummy80 (-1)*G (-1))	2.27E-14
	-0.98
D (Dummy80 (-1)*G (-2))	8.72E-16
	-0.04
D (Dummy88 (-1)*G (-1))	1.48E-14
	-0.36
D (Dummy80 (-1)*G (-2))	6.02E-14
	-0.04
D (Dummy80*REER (-1))	0.003
	-0.87
D (Dummy80*REER (-2))	-0.0003
	(-0.09)
D (Dummy88*REER (-1))	-0.001
	-0.29
D (Dummy88*REER (-2))	0.004
	-1.34

Notes: Sample period: 1976-2011. t-statistics are in brackets. ** 5 percent significant. * 10 percent significant

Table 6: Alternative Models of Output Growth in Iran, Interactions

Long Run Equation:	
Dummy80*M (-1)	-2.11E-07**
	(-27.03)
Dummy88*M (-1)	1.43E-08**
	-8.8
Dummy80*G (-1)	1.50E-08**
	-62.15
Dummy88*G (-1)	-7.12E-10**
	(-2.83)
Dummy80*REER (-1)	-25337
	(-51.44)
Dummy88*REER (-1)	93.55**
	-4.42
Short Run Dynamic	
D (Dummy80 (-1)*M (-1))	7.25E-09*
	-1.77
D (Dummy80 (-1)*M (-2))	4.55E-09
	-1.22
D (Dummy88 (-1)*M (-1))	-9.64E-11
	-0.06
D (Dummy88 (-1)*M (-2))	8.21E-11
	-0.06
D (Dummy80 (-1)*G (-1))	4.08E-10
	-1.39
D (Dummy80 (-1)*G (-2))	3.76E-10
	-1.14
D (Dummy88 (-1)*G (-1))	6.01E-10
	-1.26
D (Dummy80 (-1)*G (-2))	6.98E-10
	-1.55
D (Dummy80*REER (-1))	76.71*
	-1.71
D (Dummy80*REER (-2))	47.14
	-1.01
D (Dummy88*REER (-1))	33.81
	-0.86
D (Dummy88*REER (-2))	46.9
	-1.31

Notes: Sample period: 1976-2011. t-statistics are in brackets. ** 5 percent significant. * 10 percent significant

Data Appendix

Data Span: 1971– 2011

Sources:

International Financial Statistics:

Real and Effective Exchange Rate of Rial

Energy Information Administration of Iran:

Iranian Light, US Dollars per Barrel

Central Bank of Iran:

Historical values of all other variables are taken from Iran's Central Bank's *Economic Time Series Database*. For the most recent numbers, different issues of *Economic Trends and Annual Review* published by Iran's Central Bank are used.

Table A1: The KPSS Statistics for Null of Level Stationary. (The 5% critical value is 0.463)

LM Statistic (Bandwidth) +	
Consumer Price Index	0.60*(5)
Real GDP	0.62* (5)
Real Government Spending	0.21 (4)
Money Supply	0.53* (5)
Import Price	0.67* (4)
Nominal Effective Exchange Rate	0.59* (4)

Test description:

The KPSS (Kwiatowski, Phillips, Schmidt, and Shin) stationarity test procedure examines the null hypothesis of stationarity of a univariate time series. The KPSS test assumes that a time series variable X_t could be decomposed into the sum of a deterministic trend, a random walk, and a stationary error. Then the random walk term is assumed to have two components: an anticipated component and an error term. The stationarity of the error term is established by testing if the variance of the error is zero.

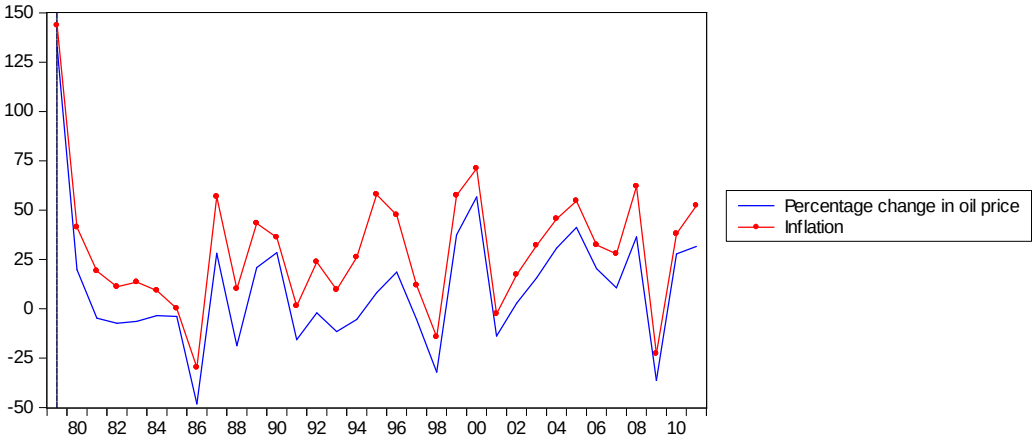
If the calculated lag truncation variable is greater than 0.463, we reject the null hypothesis of stationarity.

+ Bandwidth is specified using Newey-West using Bartlett Kernel. For detail see Newey-West (1994).

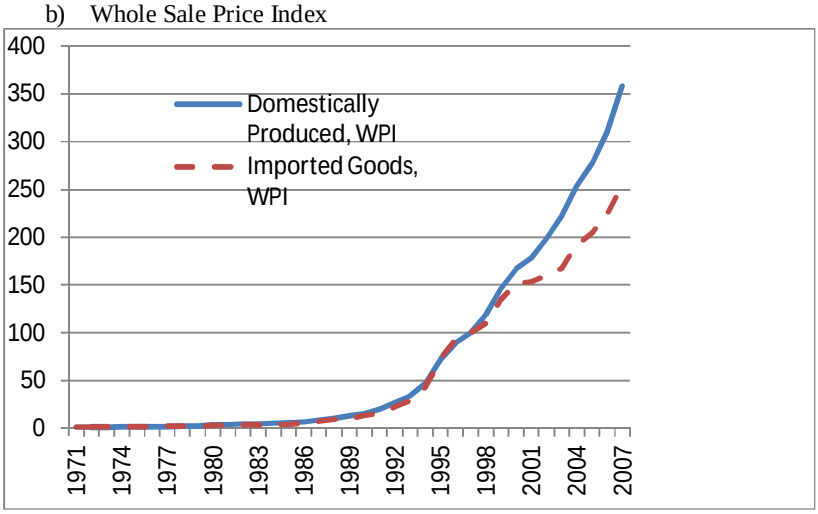
* The variable has a unit root.

Figure 1: Price indices and Inflation in Iran

a) Oil Price Change and Average CPI Inflation



b) Whole Sale Price Index



c) Producer Price Index

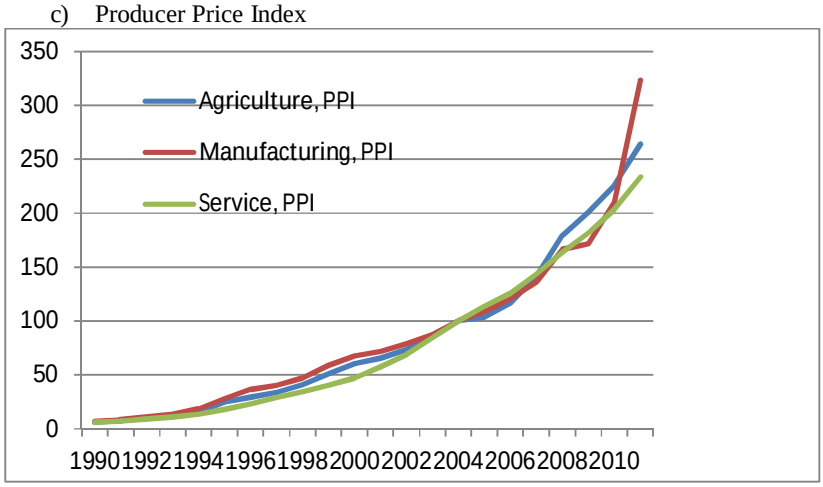


Figure 2: Gross Domestic Product

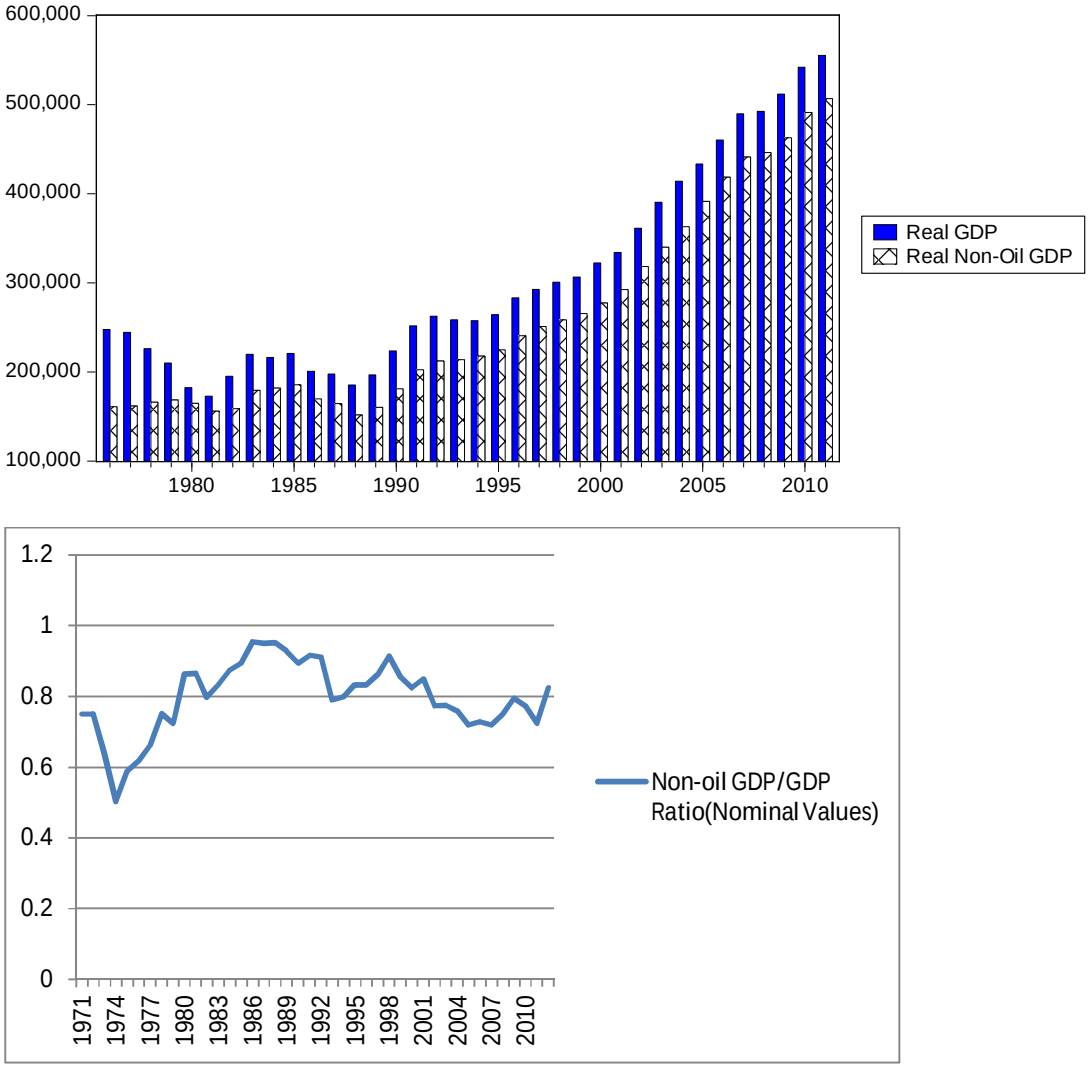
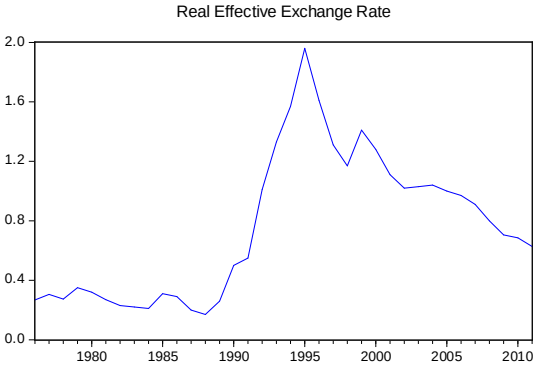
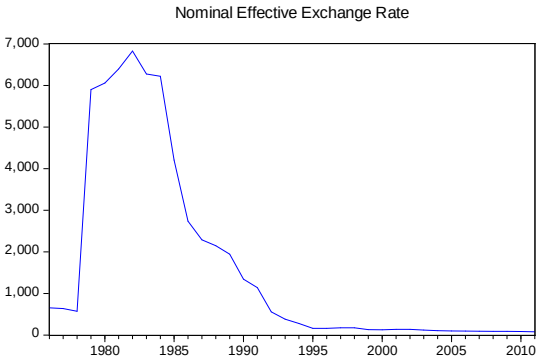
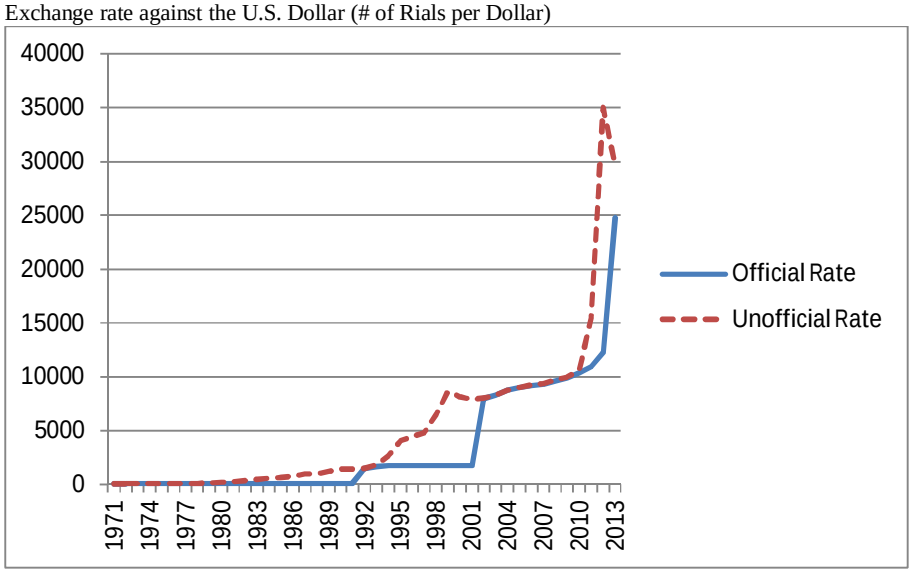


Figure 3: Exchange Rates of Iranian Rial[18]





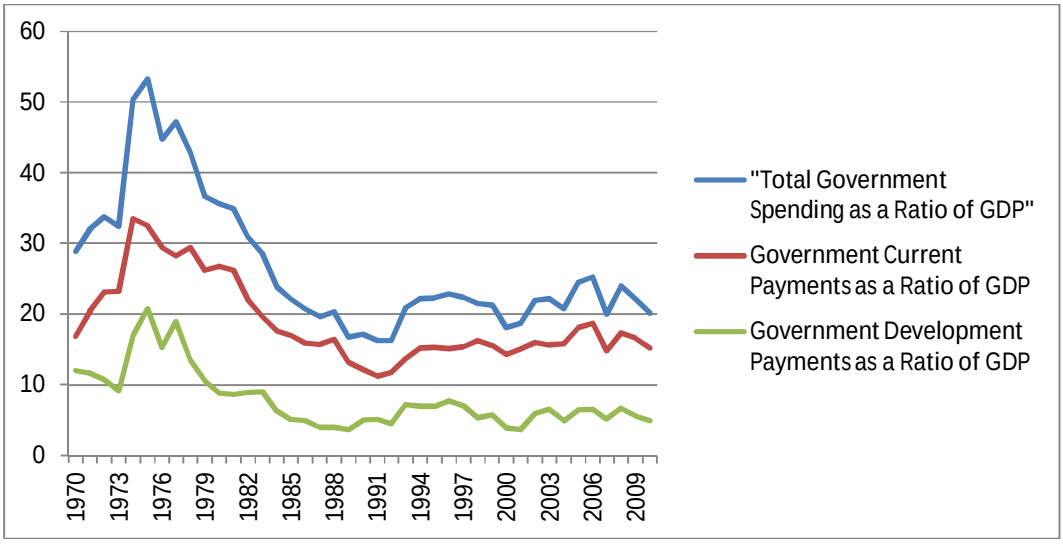
Exchange rate against the U.S. Dollar (# of Rials per Dollar)



[18] Higher value represents depreciation of rial.

Figure 4: Government Spending in Iran

a) Government Expenditure as a Share of GDP



b) Government Development Payments as a Ratio of Total Government Spending