Macroeconomic Policies and the Iranian Economy in The Era of Sanctions

by[1]

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Abstract

This paper examines the impact of macroeconomic policies in the era of sanctions on the Iranian economy. The results illustrate the role of the money supply and government spending in supporting growth, but contributing to inflationary pressures in the long run, attesting to supply-side constraints. In the short-run, policies have aimed to provide support to the economy in the face of continued fluctuations with the oil price and spillovers from the geopolitical tensions attributed to sanctions. The exchange rate has played a key role in absorbing, but at times magnifying the adverse effects of these tensions. Continued deterioration of the fundamentals of the Iranian economy forced an official devaluation as the exchange rate proved to be misaligned with the fundamentals of the economy against the backdrop of the limited ability of the Central Bank to continue to intervene to defend it. In the meantime, a parallel exchange rate market has been flourishing to satisfy the market's needs for foreign exchange as culminated in the spread between the market exchange rate and the official exchange rate. A wider spread has been a major source of inflationary pressures and have forced an official devaluation of the exchange rate, further increasing inflationary pressures with negative effects on the output supply given high dependency on imports for consumption and investment. As the Iranian economy continues to be challenged by the effects of the sanctions, policy priorities should be focused on easing structural bottlenecks and enhancing domestic production capacity to reduce the adverse effects of the exchange rate devaluation on output supply and inflationary pressures.

Key words: inflation, output growth, exchange rate, sanctions.

JEL Classification: E61, E62, E63, E32, E21

Introduction

The Iranian economy has suffered from a series of economic sanctions since 1978. However, the impacts of the sanctions increased drastically in 2012, as the U.S. led a coalition to impose sanctions on Iran in connection to the nuclear program. The sanctions embraced measures to limit the access of the Iranian central bank to the payments system to settle transactions in US dollar and the European Union banned Iranian oil exports, and tightened sanctions on banking, trade and energy sectors. As a result of the financial sanctions of 2012, the Iranian rial fell to a record low, see Graph 1. Historically, the depreciation of the rial has fueled price inflation and stagnation in Iran as illustrated in Graph 2. For example, more recently in 2018, the severe depreciation of the rial in anticipation of another round of sanctions increased dollarization and resulted in more than 30 percent inflation rate. Absent policies to arrest continued depreciation of the rial, more inflationary pressures could be in the pipelines at a much higher rate with further stagnation in economic conditions.

In normal circumstances, the depreciation of the rial could have been welcome news to boost the competitiveness of Iran's non-oil export sector and reduce the country's increased reliance on oil exports. Ideally, improved competitiveness could help Iran to diversify the export structure, which could ease the effects of the sanctions on the Iranian economy. More importantly, such diversification would circumvent the effects of the sanctions on the payments systems in US dollar denomination which are most applicable to oil exports, allowing the country to diversify the payments structure and currency denomination for other non-energy exports, reducing the impact of the failure to sell oil on the international market.

However, depreciation is a double edge sword in a country that has high dependency on imports for consumption and intermediate goods. Given this high dependency, the benefits of

cheaper exports on account of nominal depreciation could be easily eroded by the higher cost of imports that could fuel price inflation and appreciate the real effective exchange rate despite nominal depreciation. Depreciation increases the cost of imported goods for consumption and production and, therefore, it fuels inflationary expectations and increases the cost of output produced eroding competitiveness and shrinking the output supply. Given the limited capacity of the Central Bank to defend the exchange rate through proper interventions, depreciation could start a wave of dollarization, magnifying the adverse effects of depreciation on the economy and economic activity. As illustrated in Graphs 3 and 4, while Iran's non-oil output and non-oil export have increased over the years, the increases have not been sufficient enough to reduce Iran's economic dependency on oil.

Against this backdrop and the most recent wave of economic sanctions imposed by the US Administration on the Iranian economy, this paper aims to investigate the current economic conditions in Iran and the impact of the currency depreciation on real growth and price inflation. Given the lagged effect of the sanctions on the Central Bank's decision to devalue the official exchange rate following multiple attempts to defend the exchange rate, the analysis captures the impact of the spread, the difference between the parallel market rate and the official exchange rate, on growth and inflation. To capture the channels through which fluctuations in the exchange rate determine the economy, the analysis captures the impacts of the exchange rate fluctuations, both official and parallel market rates, on non-oil exports and imports. In all empirical models, the analysis includes real government spending and the money supply as domestic policy variables and the oil price as the major source of foreign income receipts for the Iranian economy.

The aim is to study the role of macroeconomic policies in sheltering the economy from potential exogenous shocks that may include additional sanctions and further depreciation of the exchange rate, triggering further price inflation and output contraction. The results will be timely for the Iranian economy as it continues to struggle with a challenging external environment that has been inflamed recently by growing geopolitical tensions that could prove to be formidable for the prospects of the Iranian economy under additional sanctions.

2. Methodology and Analysis:

Building on the study by Kandil and Mirzaie (2017), domestic macroeconomic policies should be tailored to mitigate the effects of a challenging external environment on the Iranian economy. This paper aims to investigate the effects of the sanctions on exchange rate depreciation in Iran, both the official rate and the parallel market rate, and the prospects of monetary and fiscal policies to contain the risks of further capital outflows, increased dollarization and loss of investors' confidence that would collectively further widen the spread between the official and black market exchange rates in Iran.

The choices are limited in such a challenging environment. Imposing capital controls could also work to increase speculation and dollarization, widening the spread between the official and black market exchange rates and fueling further speculative attacks. Hence, domestic policies should aim to foster confidence in the capacity of the economy to weather the shocks to ease structural bottlenecks and increase investors' confidence by controlling inflation and reducing dependency on hot capital inflows as a major source of financing domestic credit and infrastructure projects.

To that end, the analysis employs annual data from 1978–2017 to examine the impact of the official and non-official currency (market rate) value gap along with macroeconomic policies on price inflation, output growth, non-oil export growth, and import growth. The analysis will establish the relationships between the domestic and external macroeconomic environment and supporting macroeconomic policies, fiscal and monetary, on the spread between the official and black market exchange rates. The impact of the latter on the macroeconomic environment will also be studied to assess bilateral causality and the role of pro-active macroeconomic policy management to arrest the risks of the vicious cycles of depreciation and inflation.

First, we use an empirical model that includes domestic and external factors and combines the determinants of inflation and economic growth in the long-run with short-term dynamics. Endogeneity is commonly a concern when analyzing policy implications. Hence, variables in the estimated error correction model are predetermined (entered with a lag) and as such are assumed "weakly" exogenous.

An error correction model is specified as follows:

$$\Delta p_t = c + \delta(p_{t-1} - \alpha_1 m_{t-1} - \alpha_2 g_{t-1} - \alpha_3 exch_{t-1} - \alpha_4 spread_{t-1}) + \sum_{i=1}^{k} b_{1i}\Delta p_{t-i} + \sum_{i=1}^{k} b_{2i}\Delta exch_{t-i} + \sum_{i=1}^{k} b_{3i}\Delta m_{t-i} + \sum_{i=1}^{k} b_{4i}\Delta spread_{t-i} + \sum_{i=1}^{k} b_{5i}\Delta g_{t-i} + \sum_{i=1}^{k} b_{6i}\Delta oilp_{t-i}$$

where P is the domestic price level, *exch*[2] is the value of rial in terms of the U.S. dollar, *Spread* is the difference between the non-official exchange rate and the official rate, *M* is broad money, and *G* is real government spending. When testing, all variables are introduced in log forms. Finally, *k* is the number of lags defining short-run dynamics.

[2] An Increase in the exchange rate indicates depreciation of the rial against the U.S. dollar.

The empirical model will be augmented with dummy variables, as necessary, to capture the end of the war in 1988 and subsequent spending on reconstruction, a 2012[3] dummy, marking the start of financial sanctions against Iran's central bank and its banking system, and finally a dummy variable in 2015 to capture the nuclear agreement between Iran and the Group of 7, China, France, Germany, European Union, Russia, the United Kingdom, and the United States.

Then, we repeat the above model to examine the factors determining decisions by the Iranian Central Bank regarding the official exchange rate. The results of the estimations are reported in Tables 1, and 2 and discussed in the next section.

3. Data and Estimation

The details of the data and its sources are reported in Appendix A. Our empirical tests confirm the existence of unit roots in variables while the first difference of variables is stationary, see the test result in Appendix Table A1.

Following evidence of non-stationarity, we run the Johnsen co-integration test. The tests confirm at least one co-integration vector. Then, we run vector error correction models and the estimation results identify determinants of inflation, real growth, real non-oil output growth, non-oil export growth, imports, the official exchange rate, and the spread between the parallel market rate and the official rates in the long-run and short-run dynamics. Autocorrelation tests confirm that there ae no serial correlations in our models. VEC lag exclusion Wald tests confirm that the

[3] In 2012, the International Community led by the US tightened sanctions on the banking and energy sectors of Iran. As a result, Iranian rial fell by 80 percent from its 2011 value.

inclusion of two lags is jointly significant and they should be included in the estimates (Appendix Table A2). Tables 1 and 2 report the results.

Inflation:

The long-run specification in the model includes the money supply and government spending, the official value of the rial against the US dollar, and the spread between the non-official and the official exchange rate. The short-run dynamics also includes the oil price, a major source of determining foreign exchange receipts and economic conditions in Iran, and dummy variables to mark the end of the 1988 war, imposing sanctions in 2012 and easing these sanctions in 2015.

The price level increases in the long-run with the money supply, depreciation of the official exchange rate, and the spread, i.e., higher market rate relative to official rate of the rial. Government spending decreases inflation in the long run, signifying the importance of government spending to capacity building and easing supply-side constraints. Monetary growth increases inflation in the long-run, indicating capacity constraints that force higher inflation with continued increase in liquidity over time. Depreciation of the official exchange rate fuels price inflation in the long-run, attesting to higher cost of inflation and limited domestic capacity to compensate for imported inflation. Similarly, an increase in the spread, i.e., depreciation of the market rate relative to the official exchange rate, has fueled price inflation over time, attesting to higher cost of imports and domestic supply constraints.

In the short-run, price inflation is not persistent, as evident by the lack of significant response of price inflation to its lag. Monetary growth increases inflation in the short run, solidifying the evidence regarding capacity constraints. The depreciation of the market exchange

rate, captured by an increase in the spread relative to the official exchange rate, has an inflationary impact on the economy in the short run as depreciation of the rial in the market increases inflationary expectations and leads to increased dollarization, speculative attacks and further price inflation. While devaluation of the official rate of the rial has a positive effect on inflation in in the short run, the signs are positive but not significant. The 2015 nuclear agreement captured by the dummy15 signifies that the agreement helped to reduce inflation expectation and thereby the rate of inflation in anticipation of easing constraints on foreign exchange and inflationary pressures.

Output Growth:

In the long-run, output growth increases with the money supply, government spending, and decreases with the spread, i.e., depreciation of the market rate relative to the official rate. The evidence attests to the importance of government spending and supporting liquidity to ease capacity constraints and contribute to long-term growth of the economy. However, depreciation increases the cost of imports and raises the cost of production, shrinking the output supply and real growth over time. At the same time, Iran's government faces restrictions in its access to the global financial market because of sanctions, Graph 5 illustrates the amount of Iranian government's external debt for more than two decades. As it is shown, the level of external borrowing has declined in recent years because of financial sanctions.

In the short-run, real output growth appears to be persistent as evident by the positive and statistically significant response to its lag. However, neither monetary growth nor government spending stimulate growth, establishing the limitation of stabilization policies to mobilize growth and counter the adverse implications of sanctions and rising uncertainty on the Iranian economy.

Depreciation of the official or market exchange rate also do not have any significant impact on output growth, indicating binding supply-side constraints that limit the scope of mobilizing non-energy exports capitalizing on nominal depreciation to enhance competitiveness. None of the structural break dummies has a significant impact on output growth.

Non-oil Output Growth:

For an economy that is positioning itself towards further diversification, the analysis should consider the determinants of non-energy growth, in the long and short-term to establish determinants of competitiveness and the role of stabilization policies to counter the adverse effects of external shocks on the economy.

Non-oil growth increases with the money supply and government spending in the long-run. The evidence further affirms the importance of fiscal and monetary policies in boosting non-energy growth over time. Depreciation of the rial does not have any long run effect on non-oil output growth, further affirming limitations on the supply side to mobilize nominal depreciation towards boosting competitiveness and expanding non-energy growth.

In the short-run, non-oil growth appears to be persistent as evident by the positive and statistically significant response to its lag. Monetary growth does stimulate non-oil growth with a lag in the short run. The evidence attests to the importance of monetary growth, albeit with a lag, to avail necessary liquidity in support of diversification and boosting non-energy growth. In contrast, higher government spending or depreciation of the official exchange rate or the market parallel exchange rate of the rial do not affect non-oil growth in the short run. Once again, the evidence attests to supply side constraints and failure to mobilize currency depreciation towards boosting competitiveness and mobilizing non-energy growth. Higher oil price has a positive

impact on non-oil growth in the short-run. The evidence attests to the supporting role of energy price to domestic resources, which helps relax constraints on financing and supports capacity building and non-energy growth. The nuclear agreement of 2015 had a positive impact in fostering confidence and boosting non-oil output growth.

Non-Energy Export Growth:

Non-energy export growth increases in the long-run with the money supply. The evidence specifically identifies the channel through which monetary growth has supported non-energy growth. On one hand, monetary growth supports depreciation of the exchange rate and higher competitiveness of non-energy exports. On the other hand, higher monetary growth eases liquidity constraints in support of non-energy growth and capacity building. Further, depreciation of both the official rate and the market exchange rate of the rial has a positive impact on non-energy export growth. Despite the fact that depreciation does not mobilize growth in the long run, when it comes to non-energy export growth, the evidence suggests a positive effect on competitiveness and further diversification of the export structure in the long-run. An increase in government spending does not have a significant impact on non-energy export growth in the long-run. The evidence indicates failure to target additional spending by the government towards mobilizing support to the non-energy export sector.

In the short-run, export growth appears to be persistent as evident by the positive and statistically significant response to its lag. An increase in monetary growth, increases export growth with a lag in the short run, further affirming the importance of monetary growth to boosting non-energy export competitiveness and availing supporting liquidity. In contrast, growth in government spending does not provide support towards supporting non-energy export

growth, signifying failure to prioritize government spending towards supporting further diversification of the economy. Devaluation of the official exchange rate stimulates non-energy export growth, signifying the importance of the nominal exchange rate to support competitiveness. In addition, depreciation of the market parallel exchange rate relative to the official exchange rate stimulates non-energy export growth in further testimony of the positive impact of nominal depreciation on competitiveness. However, an increase in the oil price has a negative effect on non-energy export growth, in testimony of the Dutch disease where higher oil exports reduce incentives to mobilize non-energy growth and appreciate the exchange rate, eroding competitiveness. The end of the Iraq/Iran war in 1988, captured by dummy88, had a positive effect on non-energy export growth as it fostered confidence and stability to build the economy and invest in infrastructures.

Import Growth

In the long-run, import growth increases with the money supply. As growth increases in response to higher money supply, imports grow over time, signifying the dependency of the economy on imports. However, depreciation of the market rate of the rial relative to its official rate, as captured by the spread, increases the cost of imports and decreases imports in the long-run.

In the short-run, import growth does not appear to be persistent as evident by the insignificant response to its lag. None of the remaining variables has significant effects on import growth in the short run, signifying failure to curb imports based on policy interventions or depreciation of the exchange rate, given high dependency on imports for consumption and investment.

Finally, we use the same technique to investigate the long run and short run factors behind fluctuations in the official exchange rate. The long-run specification in this model includes the money supply and government spending, non-energy exports and imports, and the spread between the parallel market and official exchange rates. The short-run dynamics also includes oil price and dummy variables. The test results are posted in Table 2.

Official Exchange Rate

The exchange rate depreciates in the long-run with an increase in the money supply. Higher monetary growth increases domestic liquidity, forcing depreciation of the official rate over time. Moreover, higher government spending depreciates the official exchange in the long-run, signifying the high import content of government spending. Indeed, higher imports depreciate the exchange rate in the long-run. Further, depreciation of the parallel market exchange rate, relative to the official rate, signifies that the official rate is overvalued, resulting in nominal devaluation of the official exchange rate[4] in the long run. On the other hand, the official rate also appreciates in the long-run with an increase in non-oil exports and further foreign exchange receipts.

In the short run, the official exchange rate depreciates with an increase in government spending. The evidence further signifies the high import content of government spending. On the other hand, an increase in the oil price leads to appreciation of the official exchange rate. Higher oil price translates to higher foreign exchange receipts in support of exchange rate appreciation. The nuclear agreement of 2015 also boosted confidence in the capacity of the Iranian economy

[4] Granger causality test, reported in Table 3, also confirms a significant impact of spread on the official exchange rate.

to mobilize further foreign exchange receipts, resulting in an appreciation of official exchange rate of the rial.

4. Conclusion and Policy Implications:

Exchange rate depreciation reflects the demand for the rial relative to foreign currencies that are needed for imports and settling external debt services and other foreign liabilities. On the other hand, the available supply of foreign exchange increases with higher demand for the rial by foreigners through higher Iranian exports and more financial inflows to Iran's economy for investments. Building the capacity of the central bank through higher international reserves and fostering confidence in the stability of the exchange rate will stabilize the demand to hold rial by the citizens of Iran, compared to alternative instruments to store wealth, and stem the risks of dollarization.

Against this backdrop, Iran has been facing up mounting challenges to external stability that have been more formidable under the sanctions imposed by the International Community on the country. In the wake of these sanctions, the natural inflows of foreign income receipts have considerably declined, while the demand for foreign currency by locals has increased to keep up with the need to import and service the outstanding external debt. The situation has become worse due to loss of confidence in the stability of the exchange rate that increased speculative demand and dollarization given further expectations of depreciating rial and additional sanctions. Many agents have opted to hoard dollar savings in anticipation of further depreciation of the rial against the backdrop of lingering shortages of foreign exchange that could become worse under renewed waves of sanctions, restrictions to sell Iranian exports on the international market and

loss of access to the US dollar clearing system for settlements of payments' transactions through correspondent banks.[5]

For policy implications, priorities should be in place to reach an agreement with the international community to ease sanctions and resume natural inflows of trade and investment to the Iranian economy. In parallel, and given the prospects of more challenging and continued volatility of the external environment, both public and private resources should be focused on relaxing binding domestic capacity constraints, capitalizing on oil resources in Iran (assuming resumption of oil exports on the international market) towards further diversification of the economy and less dependency on oil resources and continued fluctuations in the oil price that have proven to be a difficult political weapon.[6]

Faced with the continued prospects of a challenging environment, aligning the official exchange rate with the underlying fundamentals will help boost the competitiveness of non-energy exports, as the evidence attests. Blocking the channel from exchange rate depreciation to inflation would be facilitated by easing capacity constraints to reduce dependency on imported inflation. Absent this capacity, inflationary pressures, as the evidence attests, could prove detrimental to the non-energy export competitiveness, hampering efforts to diversify resources and expanding capacity to sustain non-energy output growth. Diversification will also help shore up non-oil revenues in the government budget, reducing increasing reliance on government spending against the backdrop of continued fluctuations in budgetary oil revenues with the oil price that has been made more volatile by the international sanctions on Iran's oil exports.

[5] Recently, swift has announced cutting Iranian banks from the swift system to avoid sanctions by the US.
[6] Despite recent evidence of significant drop in Iranian exports in anticipation of the new wave of sanctions, the US Administration granted a temporary waiver to eight countries to continue to import oil from Iran, which led to an increase in the supply of oil in the international market and the recent reduction in the oil price.

Switching to a transparent exchange rate management regime would help to employ a basket peg with weights that reflect the trading shares of major trading partners. A more diversified structure of trading partners on the Import side or for non-oil exports could help ease the impact of economic sanctions as some major partners may be willing to trade rial directly in exchange for their currencies. Alternatively, the exchange rate could be aligned with the price of oil, although at a higher risk of continuing to settle oil receipts in dollar denomination, which could be targeted for further international sanctions if Iranian banks continue to face restrictions on dollar clearance for international settlements.

Regardless of the exchange rate system, more transparency in managing the exchange rate would anchor expectations and solidify external stability. Such transparency would also foster confidence to stem continued speculative pressures on the rial and increase agents' confidence in rial holdings. Boosting confidence in the exchange rate and its alignment with the underlying fundamentals of the economy would reduce the need for trading in the parallel market. Priorities of the Central Bank should be focused on containing the risks of abrupt discretionary devaluation of the rial in response to long episodes of pronounced over-valuation and foreign exchange shortages that may not be sustained against the backdrop of increasingly challenging external environment and finite holdings of international reserves. Arresting exchange rate risks and boosting confidence in the management and transparency of the exchange rate system would pave the way for macroeconomic stabilization, focusing domestic policy priorities on hedging against global spillovers in the short-term and building capacity in the long-term for sustainable growth and more diversified structure of the Iranian economy.

References

Alavinasab, S. M. 2014, "Determinants of Inflation: The Case of Iran," *International Journal of Social Science and Management,* 1 (1), pp. 71-77.

Bahmani, Mohsen and Magda Kandil (2010), "Exchange Rate Fluctuations and Oil in Oil-Producing Countries: The Case of Iran," *Emerging Markets Finance and Trade,* May-June, Vol. 46, No. 3, pp. 23-45.

Bleaney, Michael, 1999, "Price and Monetary Dynamics under alternative exchange rate regimes", *IMF Working Paper WP*/99/67.

Bonato, Leo, 2008, Money and Inflation in the Islamic Republic of Iran, *Review of Middle East* Economics and Finance, Volume 4, Issue 1, Article 3.

Dastgerdi, G. HamidReza, Zarinah Binti Yusof, and Muhammad Shahbaz, 2018, "Nexus between economic sanctions and inflation: a case study in Iran," Applied Economics, July.

Frankel, Jeffrey, 2017, "The Currency-Plus-Commodity Basket: A Proposal for Exchange Rates in Oil-Exporting Countries to Accommodate Trade Shocks Automatically" forthcoming in: Macroeconomic Institutions and Management in Resource-Rich Arab Economies (Oxford: Oxford University Press), a project for the Economic Research Forum, Cairo. CID WP no 333, March.

Gholibeglou, Mohammareza, 2008, "Inflation, Inflation Uncertainty, and Relative Price Dispersion," Economic Research Department, *Central Bank of the Islamic Republic of Iran,* no. 31.

Ghosh, Atish, Jonathan Ostry, Anne-Marie Gulde and Holger Wolf. 1996, "Does the Exchange Rate Regime Matter for Inflation and Growth?" *Economic Issues* n. 2.

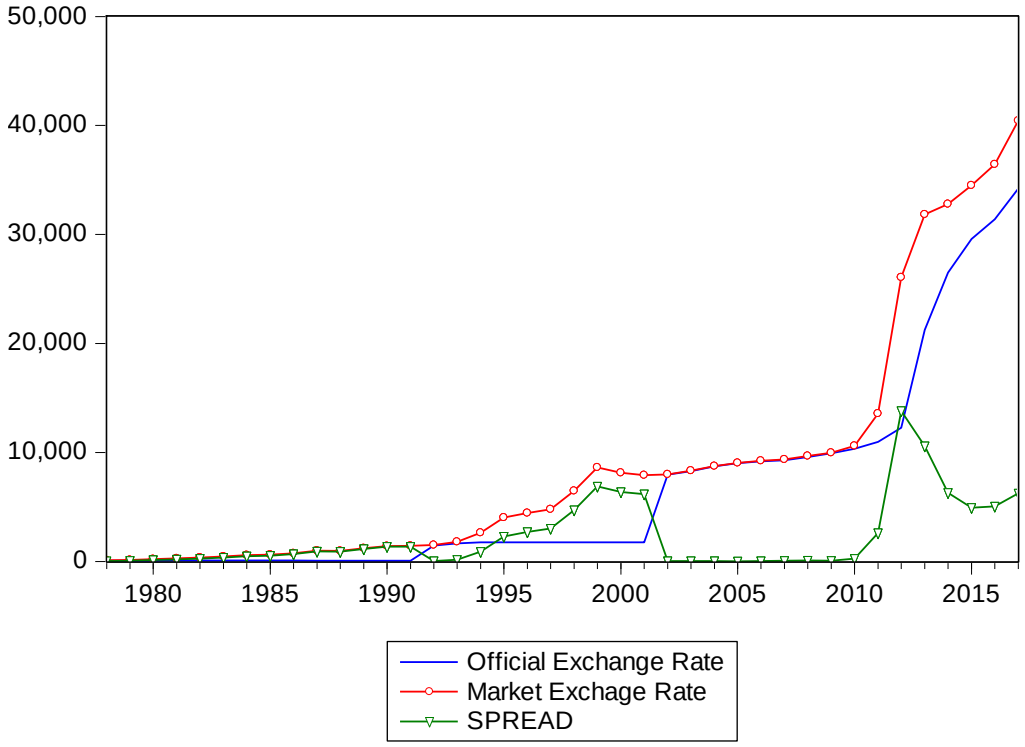
Kandil, Magda and Ida Mirzaie, 2017, "Iran's Inflationary Experience: Demand Pressures, External Shocks, and Supply Constraints," Review of Middle East Economics and Finance, De Gruyter, vol. 13(2), pages 1-19

Khandan, A. and S. M. Hosseini, 2016, "Determinants of Inflation: A Case Study of Iran," *Applied Economics and Finance,* 3 (4), pp. 95-102.

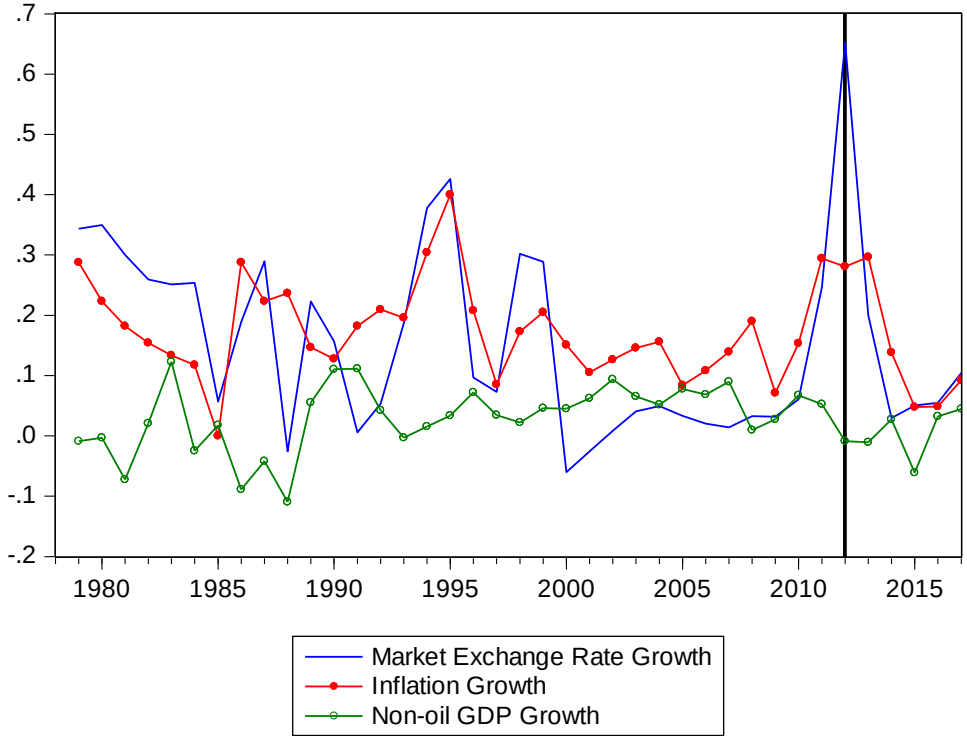
Leo Bonato, 2007, "Money and Inflation in the Islamic Republic of Iran," *IMF Working Paper*, 07/119

Pratt Stephen and Valiollah Alizadeh, 2017, "The economic impact of the lifting of sanctions on tourism in Iran: a computable general equilibrium analysis, Current Issues in Tourism," Current Issues in Tourism.

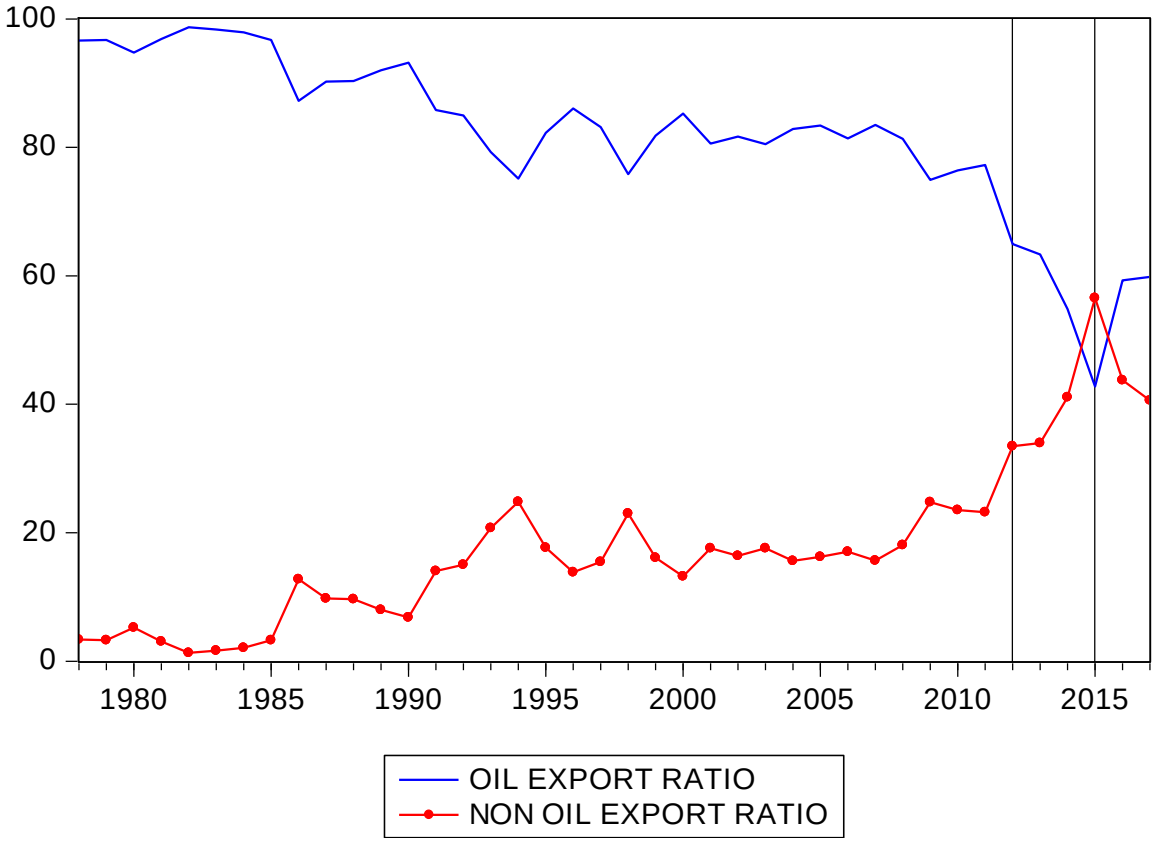
Graph 1: The Official and Non-official Exchange Rates and the Spread, 1978 - 2017



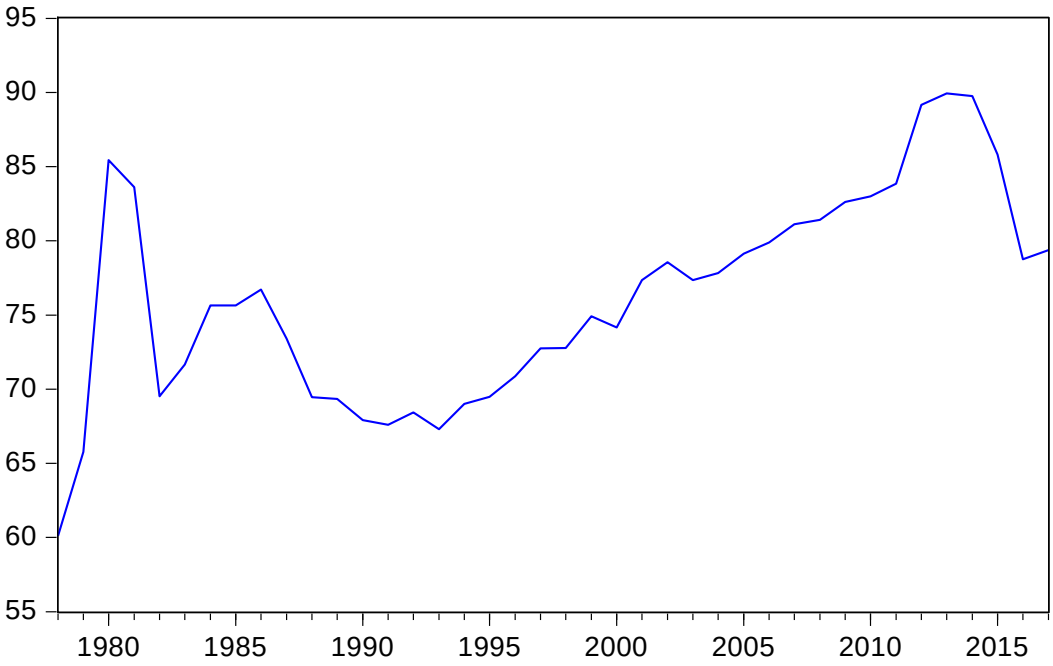
Graph 2: Market Exchange rate depreciation, Inflation & Non-oil GDP Growth, 1978 - 2017



Graph 3: Oil and Non-oil Export Ratios to Total Export, 1978 - 2017



Graph 4: Ratio of Non-oil Output to Total Output, 1978 - 2017



Graph 5: Iran's Government Total External Debt (million dollars), 1993-2017

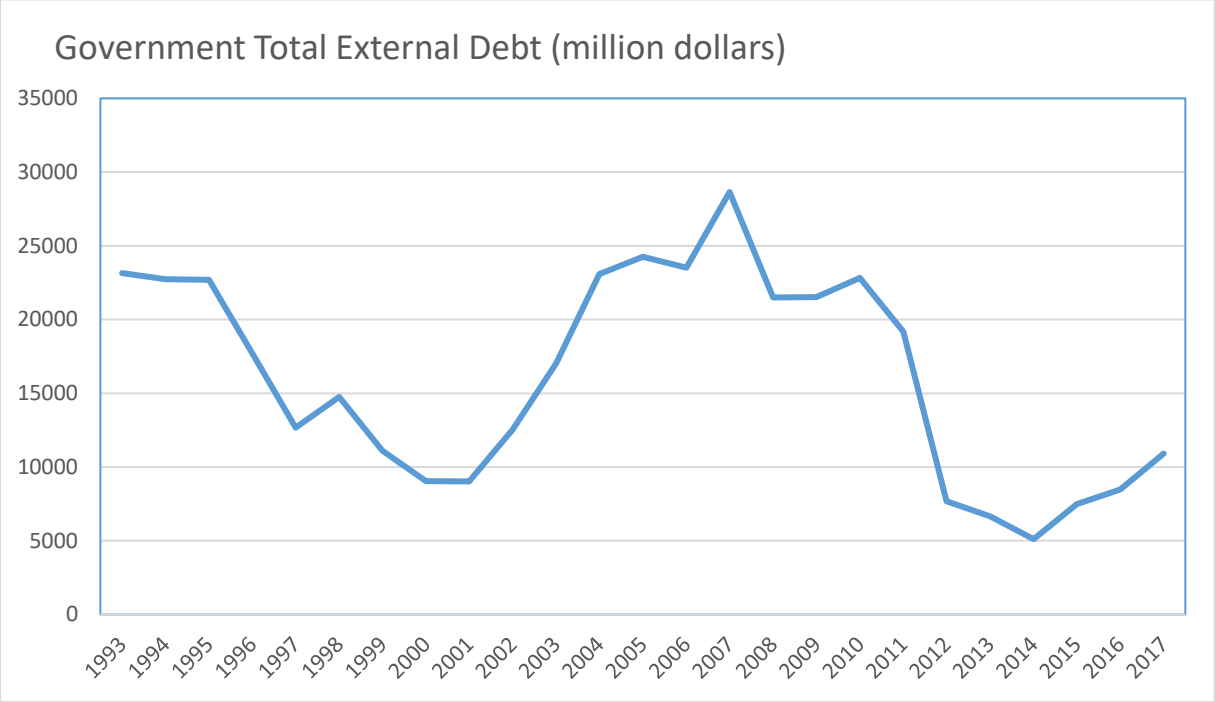


Table 1: Vector Error Correction Estimates[7]

	Model 1 PRICE	Model 2 Real GDP	Model 3 Non-oil Real GDP	Model 4 Export	Model 5 Import
Long Run Equation					
Log(M (-1))	0.50**	0.12**	0.15**	1.06**	0.36**
	(27.87)	(9.82)	(12.92)	(8.62)	(6.83)
Log(G (-1))	-1.40**	0.32**	0.46	0.22	-0.54
	(-9.18)	(2.70)	(4.31)	(0.28)	(-1.15)
Log(EXCH (-1))	0.33**	0.01	-0.01	-0.41**	-0.03
	(18.48)	(1.19)	(-1.21)	(-4.38)	(-0.56)
Log(SPREAD (-1))	0.06**	-0.01**	0.005	-0.13**	-0.17**
	(10.70)	(-2.79)	(1.19)	(-3.86)	(-8.24)
C	10.40	8.7	6.53	- 3.87	-13.32
Adjustment Coefficient	-0.26	-0.95**	-1.26**	-0.76**	-0.20
	(-1.06)	(-2.81)	(-6.93)	(-4.54)	(-0.63)
Short Run Dynamic					
D(Log((P (-1)))	-0.14				
	(-0.53)				
D(Log((P (-2)))	-0,58**				
	(-2.33)				
D(Log(((Y(-1))		0.45**			
		(2.50)			
D(Log((Y (-2)))		-0.04			
		(-0.21)			
D(Log((NON-OIL GDP(-1)))			0.42**		
			(3.18)		
D(Log((NON-OIL GDP(-2)))			0.36**		
			(2.84)		
D(Log((EXPORT(-1)))				0.31**	
				(2.37)	
D(Log((EXPORT(-2)))				0.04	
				(0.28)	
D(Log((IMPORT(-1)))					0.28
					(0.75)
D(Log((IMPORT(-2))					0.20
					(0.73)
D(Log((M (-1)))	0.58*	-0.17	-0.12	0.77	1.35
	(1.93)	(-0.87)	(-1.53)	(1.29)	(1.59)
D(Log((M (-2)))	-0.14	-0.21	-0.29**	-1.23**	-0.61
	(-0.58)	(-1.31)	(-3.31)	(-2.43)	(-0.79)
D(Log((G (-1)))	-0.09	-0.09	-0.14	-0.52	-0.64
	(-0.26)	(-0.49)	(-1.24)	(-0.96)	(0.81)

[7] The signs of long run equation has been reversed to reflect the actual impact.

D(Log((G (-2)))	-0.30	0.16	0.07	0.14	0.16
	(-1.18)	(0.93)	(0.80)	(0.30)	0.23()

Table 1: Vector Error Correction Estimates, continued

	Model 1 PRICE	Model 2 Real GDP	Model 3 Non-oil	Model 4 Export	Model 5 Import
D(Log((EXCH (-1)))	0.04	0.02	0.02	0.37**	-0.17
	(0.54)	(0.58)	(1.17)	(3.10)	(-1.08)
D(Log((EXCH (-2)))	0.01	-0.01	0.01	0,35**	-0.15
	(1.56)	(-0.29)	(0.67)	(3.05)	(-0.85)
D(Log((SPRED (-1)))	0.04*	0.01	-0.01	0.11**	-0.005
	(1.86)	(0.65)	(-1.06)	(2.22)	(-0.06)
D(Log((SPREAD (-2)))	0.01	0.003	-0.001	0.13**	-0.02
	(0.65)	(0.23)	(-0.29)	(2.59)	(-0.19)
Constant	0.23	00.02	-0.32**	1.37**	0.08
	(1.66)	(0.41)	(-6.31)	(4.79)	(0.19)
Log(Oil Price)	-0.2	0.02	0.13**	-0.41**	-0.05
	(-0.58)	(1.04)	(6.97)	(-3.53)	(-0.65)
DUMMY88	0.06	0.03	-0.02	0.16**	0.02
	(1.26)	(1.13)	(-0.94)	(1.99)	(0.12)
DUMMY12	0.01	-0.02	-0.005	-0.15	0.0002
	(0.18)	(-0.42)	(-0.21)	(-1.36)	(0.001)
DUMMY15	-0.17*	-0.01	-0.66**	-0.19	0.08
	(-1.82)	(-0.11)	(-2.31)	(-1.23)	(0.36)
R-squared	0.61	0.62	0.86	0.79	0.52
Adj. R-squared	0.33	0.35	0.77	0.64	0.17
Log Likelihood	57.27	69.32	92.78	29.97	16.29
Akaike AIC	-2.23	-2.88	-4.15	-0.75	-0.02

t-statistics are in brackets

** 5 percent significant, * 10 percent significant.

Table 2: Vector Error Correction Estimates[8]

	Model 6 Exchange Rate	Model 7 Exchange Rate	Model 8 Exchange Rate
Long Run Equation			
Log(M (-1))	0.79**	0.57**	0.46
	(6.26)	(2.94)	(1.17)
Log(G (-1))	3.39**	3.55**	6.47**
	(2.12)	(1.60)	(2.21)
Log(SPREAD (-1))		0.28**	0.51**
		(2.64)	(3.33)
Log(EXPORT (-1))			-2.57**
			(-3.39)
Log(IMPORT(-1))			5.46**
			(4.64)
C	43.07	44.15	112.66
Adjustment Coefficient	-0.94**	-0.65**	-0.17
	(-3.88)	(-3.73)	(-1.21)
Short Run Dynamic			
D(Log((EXCH (-1)))	0.35*	0.32	-0.28
	(1.78)	(1.19)	(-0.87)
D(Log((EXCH (-2)))	0.14	0.08	0.01
	(0.76)	(0.24)	(0.01)
D(Log((SPRED (-1)))		-0.06	-0.01
		(-0.48)	(-0.06)
D(Log((SPRED (-2)))		-0.07	0.01
		(-0.57)	(0.26)
D(Log((M (-1)))	2.11	1.86	2.77
	(1.19)	(0.99)	(1.22)
D(Log((M (-2)))	1.16	1.36	0.37
	(0.75)	(0.84)	(0.17)
D(Log((G (-1)))	-0.33	1.14	-0.62
	(-0.19)	(0.67)	(-0.26)
D(Log((G (-2)))	2.61*	2.93**	1.57
	(1.87)	(1.98)	(0.75)
Log(EXPORT (-1))			0.42
			(0.87)
Log(EXPORT (-2))			0.72
			(1.51)
Log(IMPORT(-1))			0.33
			(0.34)
Log(IMPORT(-2))			0.35
			(0.48)
Constant	1.61**	-0.78	0.42
	(2.72)	(-1.55)	(0.47)

[8] The signs of long run equation have been reversed to reflect the actual impact. t-statistics are in brackets
** 5 percent significant, * 10 percent significant.

Table 2: Vector Error Correction Estimates[9], continued

Log(Oil Price)	-0.71**	0.001	-0.45**
	(-3.44)	(0.28)	(-2.39)
DUMMY88	0.33	0.28	0.61
	(1.15)	(0.93)	(0.85)
DUMMY12	0.17	-0.33	0.49
	(0.49)	(-0.75)	(1.07)
DUMMY15	-0.89*	-0.43	-0.20
	(-1.88)	(0.80)	(-0.35)
R-squared	0.49	0.49	0.54
Adj. R-squared	0.26	0.20	0.13
Log Likelihood	-18.03	-17.99	-15.91
Akaike AIC	1.62	1.73	1.83

[9] t-statistics are in brackets

** 5 percent significant, * 10 percent significant.

Table 3: Pairwise Granger Causality Tests

Sample: 1978- 2017
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
EXCH does not Granger Cause SPREAD	38	1.42786	0.2543
SPREAD does not Granger Cause EXCH		27.7291	9.E-08

Data Appendix

Data Span: 1978– 2017

Sources:

Central Bank of Iran:

Historical values of all most of the 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.

International Financial Statistics and Central Bank of Iran:

Export and Import in the U.S. Dollars

> Export includes agricultural & traditional goods, mineral and metallic ores, and industrial products.

OPEC, IEA:

OPEC price of Crude, U.S. Dollars per Barrel, Annual, Not Seasonally Adjusted

Table A1: The Augmented Dicky Fuller Test Results

(The 5% critical value is -2.94)

	Level	1st difference
Price	-0.78	-3.99**
Output	-0.29	-4.51**
Non-oil Output	0.04	-4.19**
Exchange rate	-0.59	-6.14**
Spread	-2.11	-5.44**
Money *Sup*ply	1.52	-3.86**
Government Spending	-1.42	-5.39**
Export	-0.15	-4.95**
Import	-1.38	-4.42**

Table A2: Wald Test

VEC Lag Exclusion Wald Tests

Sample period: 1978 2017

Chi-squared test statistics for lag exclusion:
Numbers in [ ] are p-values

	D(LOG(P))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXCH))	D(LOG(SPREAD))	Joint
DLag 1	10.42096 [0.064149]	5.335295 [0.376344]	9.502085 [0.090637]	16.63174 [0.005254]	14.26951 [0.013985]	98.73080 [1.03e-10]
DLag 2	8.822270 [0.116367]	3.265536 [0.659122]	11.35416 [0.044793]	8.185555 [0.146301]	12.50587 [0.028477]	78.83551 [1.74e-07]
df	5	5	5	5	5	25

	D(LOG(RY))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXCH))	D(LOG(SPREAD))	Joint
DLag 1	6.987395 [0.221579]	2.814568 [0.728548]	6.225481 [0.284893]	8.170354 [0.147094]	6.318965 [0.276408]	50.82932 [0.001682]
DLag 2	3.330922 [0.649111]	3.581781 [0.611051]	3.832609 [0.573759]	6.790993 [0.236654]	5.291112 [0.381395]	44.14385 [0.010450]

	D(LOG(NONOILRY))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXCH))	D(LOG(SPREAD))	Joint
DLag 1	16.64152 [0.005232]	4.571338 [0.470396]	16.46330 [0.005639]	2.970858 [0.704479]	3.747358 [0.586332]	50.99949 [0.001602]
DLag 2	21.18637 [0.000747]	2.428993 [0.787149]	12.20649 [0.032065]	3.638287 [0.602574]	5.585589 [0.348652]	50.23439 [0.001994]

	D(LOG(EXPORT))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXCH))	D(LOG(SPREAD))	Joint
DLag 1	12.96974 [0.023664]	4.728400 [0.449917]	5.902411 [0.315831]	5.228065 [0.388686]	2.929162 [0.710906]	39.66910 [0.031529]
DLag 2	20.76457 [0.000897]	8.613463 [0.125511]	4.095896 [0.535694]	3.348240 [0.646465]	4.528956 [0.476019]	44.37795 [0.009836]

Table A2: Wald Test, Continued

Chi-squared test statistics for lag exclusion:

Numbers in [ ] are p-values

	D(LOG(IMPORT))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXCH))	D(LOG(SPREAD))	Joint
DLag 1	9.208326	8.039716	11.89691	7.015843	9.363809	64.45724
	[0.101038]	[0.154060]	[0.036228]	[0.219465]	[0.095404]	[2.47e-05]
DLag 2	3.769115	5.819018	18.07126	3.844582	4.961222	50.70476
	[0.583113]	[0.324230]	[0.002858]	[0.572002]	[0.420631]	[0.001743]

	D(LOG(EXCH))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXPORT))	D(LOG(IMPORT))	Joint
DLag 1	4.976209	14.56831	13.62057	5.390684	9.732741	67.46591
	[0.418791]	[0.012375]	[0.018208]	[0.370082]	[0.083172]	[9.09e-06]
DLag 2	4.072688	17.19532	22.06539	9.594287	1.884109	69.48427
	[0.538999]	[0.004144]	[0.000509]	[0.087582]	[0.864937]	[4.59e-06]

	D(LOG(SPREAD))	D(LOG(M2))	D(LOG(RG))	D(LOG(EXPORT))	D(LOG(IMPORT))	Joint
DLag 1	10.24338	6.877131	8.552715	4.355988	14.45358	53.77190
	[0.068626]	[0.229940]	[0.128291]	[0.499380]	[0.012971]	[0.000711]
DLag 2	5.773375	10.53797	14.52606	12.66294	12.20300	57.25339
	[0.328899]	[0.061351]	[0.012591]	[0.026751]	[0.032110]	[0.000247]
df	5	5	5	5	5	25