Exchange Market Pressure and Monetary Policy in Ethiopia

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I. Introduction

The level and movements in the exchange rate have been a matter of policy concern for central banks of most countries, including that of Ethiopia, as erratic changes in the exchange rate not only undermine the goal of price stability but also reduce real output, trade, capital flows and investment (IMF, 1984). These considerations often prompt central banks to intervene in the foreign exchange market so as to influence exchange rate developments.

In a free floating exchange rate regime, the total pressure in the foreign exchange market is reflected in observed changes in exchange rate. At the other extreme, in a fixed exchange rate regime, foreign exchange market conditions are completely captured by changes in reserves. But, in mixed exchange rate regimes such as in a managed floating, a part of the pressure is absorbed by a change in exchange rate and a part by changes in reserves. Under such circumstances, neither the reserve changes nor the exchange rate movements capture the extent or nature of the exchange market disequilibrium. This calls for the precise measurement of pressures in the foreign exchange market. The pressure in the foreign exchange market is measured by an exchange market pressure (EMP). It is simply the sum of the percentage changes of international reserves and nominal exchange rate depreciation.

A recent study that estimated an index of the EMP for Ethiopia over the period November, 2001 to December, 2005 reveals that in majority of the cases (in 42 months out of 49 months considered) the Ethiopian foreign exchange market was characterized by depreciation pressures (Abebe, 2006). A critical issue under such circumstances is the policy measures to be undertaken by Monetary Authority (central bank) when the economy faces such external strains.

For a country adopting a managed floating exchange rate regime and faced with exchange rate pressures, policy options in the short run are only limited to monetary policy as certain fundamental domestic remedies, like fiscal adjustment and financial sector reform, may require time to implement (often under political stress).To assuage the pressures and reduce EMP, the central bank should react by embracing contractionary monetary policy. Interest rate defense is recently emphasized by the literature as possible venue to defend the currency and contend the attack. A more traditional way is via controlling domestic credit (Kamaly and Erbil, 2000, Tanner, 2001).

The policy response to an exchange market pressure to a large extent depends on the stance of monetary policy as well as the degree of monetary autonomy. When EMP builds up, the central bank decides whether to use domestic credit or interest rate or a combination of both to contend such pressures.

A simple monetary model of exchange market pressure states that for a given rate of growth of world prices, real income and the money multiplier, an increase in domestic credit (expansionary monetary policy) will result in an equi-proportionate loss in foreign reserves, or an equi-proportionate depreciation of the exchange rate, or some combination of the two (Kim, 1985).

The objective of this study is, therefore, to examine empirically the impact of monetary policy on exchange market pressure (EMP) in Ethiopia. More specifically, this study examines whether contractionary monetary policy reduces EMP or not. The study also tests empirically how the National Bank of Ethiopia absorbs the pressures in the foreign exchange market. It also addresses whether the stance of monetary policy itself is a function of EMP. In this study, EMP is measured as the sum of the percentage change of international reserves scaled by the monetary base and the percentage change of nominal exchange rate depreciation. Domestic credit, the domestic component of monetary base, which is considered the variable directly controlled by policy makers, is used as measure of monetary policy.

As the exchange rate regime of Ethiopia is characterized as managed floating (the simultaneous adjustment of both exchange rates and reserves), EMP is the appropriate concept for analysis. To the best of my knowledge, there has been no study conducted so far analyzing the interaction between EMP and monetary policy in Ethiopia. As a result, this study differs from previous studies in that it investigates the relationship between EMP and monetary policy instead of the relationship between exchange rate and monetary policy or the relationship between reserves and monetary policy alone.

The remainder of this paper is organized as follows. The next chapter provides a brief overview of the conduct of exchange and monetary policy in Ethiopia. Chapter III briefly describes a theoretical model of EMP and reviews an empirical work on exchange market pressure and monetary policy focusing in particular on the Griton-Roper's model of exchange market pressure. Chapter IV specifies an empirical EMP model for Ethiopia and presents main results. Chapter V presents conclusions and policy implications.

II. An Overview of the Conduct of Exchange and Monetary Policy in Ethiopia

As the central bank of the country, the National Bank of Ethiopia (NBE) is obviously entrusted with the responsibility of maintaining the stability of the exchange rate of the Birr, the country's legal tender currency against other currencies.

Accordingly, during 1970s and 1980s, when the Ethiopian Birr was pegged to the US dollar at a fixed rate, the NBE used to maintain exchange rate stability of the Birr by making available foreign currency to the market at the fixed rate.

Following the introduction of the auction system on May 1, 1993 and the subsequent replacement of the auction system by the daily inter-bank foreign exchange market in October, 2001, demand and supply factors were given more latitude in the determination of the exchange rate. As a result, the NBE acts as a buffer between forces of demand and supply through intervention. Indeed, the NBE has attempted to stabilize the exchange rate through official interventions mainly by varying the amount of foreign exchange it supplied to the market. In effect, pressures in the foreign exchange market are reflected by changes in both exchange rate and reserve holdings of the NBE.

The objectives of monetary policy in Ethiopia are, among others, maintenance of price and exchange rate stability and ensuring the safety and soundness of the financial system, within the broader macroeconomic policy of attaining high level of economic growth. The responsibility of formulation and implementation of monetary policy in Ethiopia is vested in the National Bank of Ethiopia (NBE).

Monetary control mechanism in Ethiopia mainly follows the financial programming approach applied by the International Monetary Fund (IMF). This involves establishing a ceiling for the growth rate of money supply on the basis of projected growth rate of GDP and targeted inflation, establishing a floor for international reserves and ceilings for net domestic assets of the National Bank of Ethiopia and net domestic government financing.

In short, the National Bank of Ethiopia controls the supply of and demand for money largely by using the mix of both direct and indirect monetary policy instruments. These include setting a floor rate for saving and time deposits, credit ceilings on government borrowings from the banking system, reserve requirements and open market operations mainly sale of Treasury Bills.

III. Literature Review

3.1 The Relationship Between Exchange Rate and Monetary Policy

An exchange rate policy implies a systematic effort on the part of the monetary authorities to influence the level or rate of change of the exchange rate. A variety of policy instruments are potentially available to influence the exchange rate, including foreign exchange market intervention, domestic monetary policy, various forms of controls on international trade and capital flows, and official announcements of future policies (Glick and Hutchison, 1989).

The exchange rate is often a signal of the stance of monetary policy. For example, in the absence of any other changes in economic circumstances, a weakening of the exchange rate (or upward pressure) may suggest that monetary policy is too loose, relative to policy in the country of the reference foreign currency. On the other hand, a strengthening of the exchange rate, or downward pressure, may suggest that monetary policy is tight.

3.2 Monetary Model of EMP

The exchange market pressure model draws on the combination of the monetary approach to the balance of payments and the monetary approach to the exchange rate determination (Younus, 2005).

Following the work of Girton-Roper(1977), different authors (for instance, Kim (1985), Thornton(1995), and Younus(2005)) have developed a simple monetary model of exchange market pressure as follows:-

$$M^d = kPY \qquad (1)$$

$$M^s = A(R+D) \qquad (2)$$

$$P = EP^* \qquad (3)$$

$$M^d = M^s \qquad (4)$$

Substituting (1) and (2) into (4) we get

$kPY = A(R+D)$ (5)

Replacing P by EP*, we get

$k(EP^*)Y = A(R+D)$ (6)

In terms of percentage change and rearranging terms, equation (6) can be rewritten as:

$r-e = -d+ p^* + y-a$ (7)

Where, r=the percentage change in international reserves;

e= the percentage change in the nominal exchange rate depreciation;

d=the percentage change in domestic credit;

p*=the percentage change in the foreign price level;

y=the percentage change in domestic real income; and

a=the percentage change in the money multiplier; money multiplier is calculated as the ratio of broad money to the monetary base

Kim (1985) and Thornton (1995) citing the works of Connolly and Silveira (1979), and Shiva and Bahmani-Oskooee (1998) included a variable Q= (e-1/r-1) on the right hand side of the equation to see whether the monetary authority responds to absorb exchange market pressure either by the exchange rate depreciation or reserve depletion or not. The variable Q is a measure of the way a central bank absorbs exchange market pressure. A significant and positive coefficient of Q implies that the monetary authority absorbs more pressure by the exchange rate depreciation, while a significant and negative Q implies that more pressure is absorbed by reserve losses (Younus, 2005). An insignificant coefficient implies that the monetary authority is not sensitive to components of EMP.

3.3 Review of Empirical Literature

Empirical studies on the interrelations between exchange market pressure and monetary policy can be broadly divided into two categories: single-equation econometric methods and vector autoregressive (VAR) models. Earlier studies mostly used single-equation econometric methods, while a number of recent studies have applied VAR models.

Most of the empirical studies that applied Girton-Roper model of exchange market pressure(Kim 1985, Hallwood and Marsh, 2003, Thornton, 1995) found that there is a strong evidence of a negative relationship between the rate of domestic credit creation and the rates of changes in the exchange market pressure.

Many current works prefer to apply a VAR technique in order to account for the many possible interactions between the variables in monetary models. Tanner (2001) uses a VAR technique to unravel the interrelations between EMP and monetary policy (observable in changes in domestic credit and the interest rate differential) for the cases of Brazil, Chile, Mexico, Indonesia, Korea, and Thailand in 1990-98. He found that monetary policy affects EMP as generally expected: contractionary monetary policy helps to reduce EMP.

Kamaly and Erbil (2000) applied a VAR technique to Turkey, Egypt and Tunisia. Their results are somewhat more mixed. They found a strong link between domestic credit and EMP for Turkey. Egypt and Tunisia have used domestic credit and interest rate changes, respectively, as a policy tool in response to EMP shock, but the direction of the response is not clear from the results.

Empirical literatures on Ethiopia mainly focused on the determinants of the real exchange rate (Andualem, 1996, Teferi, 2005, Melesse, 2001). The real exchange rate is hypothesized to be determined by terms of trade, fiscal and monetary policy variables and trade variables. The rate of growth of domestic credit less the lagged rate of growth of

real GDP, a proxy for excess supply of credits, was among the monetary variables frequently used in empirical analysis.

An excess supply of credits is found to have a depreciating impact on the real exchange rate (Andualem, 1996, Teferi, 2005) contrary to the expectations of appreciating the real exchange rate. On the contrary, Melesse(2001) found that high level of excess credit would result in the appreciation of the real exchange rate.

Another study on Ethiopia investigated monetary approach to the balance of payments (Haile, 2001). The main objective of the paper was to test the hypothesis that an increase in domestic credit creation will cause an opposite and equal change in international reserves. The coefficients of money multiplier and domestic credit are expected to be negative. The empirical result indicates that a one percent increase in domestic credit will lead to 1.3 percent deterioration in net foreign assets, which is a proxy for balance of payments.

IV. An Application of the EMP Model to Ethiopia

4.1 Sources of the Data

The main sources of the data for this study are NBE's Quarterly Bulletin (various issues) and International Financial Statistics (IFS) data base. The data used in empirical analysis are monthly data spanning from August 1993/94 to December 2005/06.

4.2 Econometric Methodology

In order to gauge the impact of monetary policy on the exchange rate, this study estimates two sets of econometric models-single equation regressions and Vector auto regressions (VARs)

4.2.1 Single Equation Model.

Following the works of Kim (1985), Thornton(1995), and Younus(2005), the empirical formulation of the model is given by the following form:-

$$\ln EMP_t = \beta 0 + \beta 1 \ln DC_t + \beta 2 \ln FP_t + \beta 3 \ln mm_t + \beta 4 \ln SP_t + \beta 5 \ln Q_t$$

Where EMP is exchange market pressure, DC is the percentage change in domestic credit, FP is US inflation (a proxy for foreign inflation), mm is the change in money multiplier, SP is the spread and Q is Q= (e-1/r-1). The variable Q is added to the model to see whether the monetary authority in Ethiopia, namely, NBE responds to absorb exchange market pressure either by the exchange rate depreciation or reserve draw down or both. In other words, it shows the sensitivity of the NBE to the components of the EMP. A significant and positive coefficient of Q implies that the NBE absorbs more pressure by the exchange rate depreciation, while a significant and negative Q implies that more pressure is absorbed by reserves losses. An insignificant coefficient implies that the monetary authority is not sensitive to components of EMP.

The expected sign of β1 is positive as an increase in domestic credit creation is assumed to increase the exchange market pressure through depreciating the domestic currency or reserve losses. For similar reason, the expected signs of β3 and β4 are also positive. On the other hand, the expected sign of β2 is negative, implying that an increase in foreign prices increases the foreign reserves or appreciates the domestic currency, thereby reducing EMP.

4.2.2 Vector Auto Regression (VAR)

Following Tanner (2001), this study uses a VAR methodology and focuses on EMP. A key feature of this framework is how monetary policy is modeled. In most recent research works a monetary aggregate and the interest differential are considered as the policy variable. However, in this study, the domestic credit is considered as the stance of monetary policy.

4.3 Unit Root Tests of the Variables

As this study employs time series data, an analysis of the statistical properties of each variable is essential before proceeding to the estimation of the model. This procedure helps to identify the problem of spurious regression. A series of Dickey-Fuller unit root tests are conducted to test for the presence of unit root using log level data.

The augmented Dickey-Fuller (ADF) unit root tests suggest that the logs of all the variables are stationary. Consequently, tests for co integration among the variables were not conducted.

4.4 Interpretation of Results

4.4.1 Single Equation Results

This study estimated the exchange market pressure using two approaches. In the first approach, the EMP is calculated as the sum of exchange rate depreciation and the net sales of foreign exchange by NBE and is designated as EMP1. In the second approach, the EMP is calculated as the sum of exchange rate depreciation and the change in reserve holdings of the NBE. It is designated as EMP2.

The coefficients of the growth rate of the domestic credit and foreign prices appear to be statistically significant with the expected positive and negative signs, respectively. A significant and negative coefficient of foreign inflation implies that an increase in foreign prices decreases foreign exchange market pressure in Ethiopia, either through increase in reserves or appreciating the currency, or both.

The coefficients of money multiplier and spread are not statistically significant implying that these variables do not have an impact on EMP in Ethiopia. The inclusion of an additional variable, Q, improves the overall fits of the model. The coefficient of Q is negative and statistically significant implying that more of the pressure is absorbed by drawdown of reserves.

Table 1: OLS Estimation Results:- Final Output

Independent Variables	Dependent Variables		Q	R^2	Ad.R^2	D-W
	LNDC	LNFP				
LNEMP1	0.931	-0.84		0.13	0.13	1.98
	(5.85)	(-2.66)				
	2.562		-1.656	0.31	0.30	2.1
	(8.48)		(-6.81)			
LNEMP2	0.93	-0.84		0.13	0.13	1.99
	(5.83)	(-2.66)				
	2.564		-1.658	0.31	0.30	2.1
	(8.49)		(-6.81)			

Note: T-statistics in parentheses

4.4.2 VAR Estimation Results

Table 2 presents the summary results of the VAR test. The Table depicts that 24 percent of the variations in EMP are explained by the VAR system, together with its exogenous variables. It is worth mentioning here that the signs of the estimated coefficients of DC and MM are positive (though insignificant) indicating that increases in both domestic credit and money multiplier raises the exchange market pressure. The coefficient of FP is with the correct sign reflecting the fact that increase in foreign prices would decrease the exchange market pressure largely by increasing foreign reserves. On the other hand, the coefficient of SP was with the wrong sign presumably reflecting the ex-post result of the shift in foreign exchange demand from the official market to the parallel market.

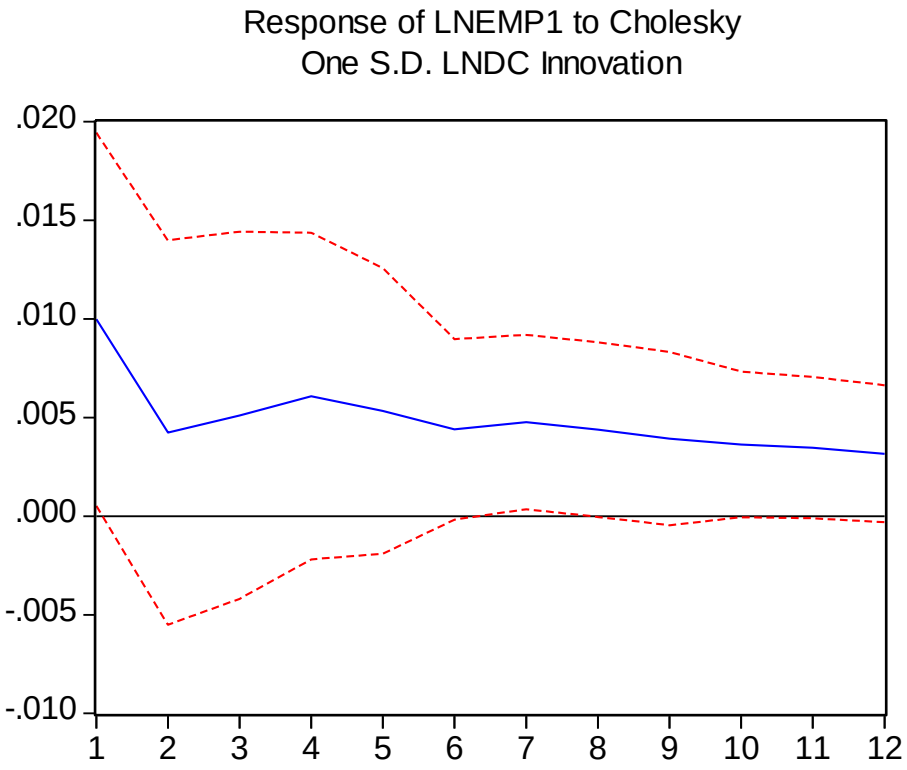
Table 2. VAR Estimation Results

Dependent Variable	EMP1	DC	EMP2	DC
R-squared	0.24	0.01	0.24	0.01
Adj.R-squared	0.18	-0.06	0.18	-0.06
F-Statistics	4.23	0.15	4.15	0.16
FP Coefficient	-0.03	0.08	-0.03	0.09
t-statistics	-0.18	1.18	-0.15	1.19
MM Coefficient	0.02	0.02	0.01	0.02
t-statistics	0.77	2.01	0.76	2.01
SP Coefficient	-0.04	0.09	-0.06	0.09
t-statistics	-0.31	1.66	-0.43	1.63

Source: Appendix 1A and 1B.

Domestic credit shocks affect EMP positively as depicted in Fig 1. The positive response of EMP to domestic credit shocks is supportive of the conventional wisdom, where an expansionary shock to domestic credit builds up pressure on EMP, either by reducing reserves, depreciating the currency or some combination thereof.

Fig 1. Response of Exchange Market Pressure to Domestic Credit

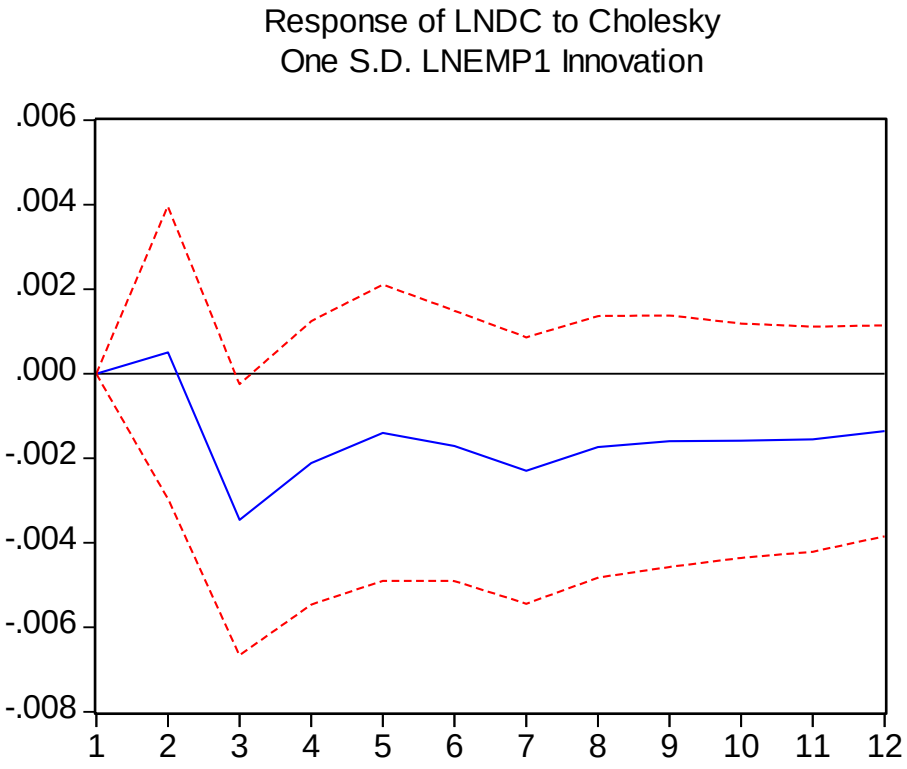


On the other hand, the domestic credit equation suffers from a low level of overall significance, with F-statistics of 0.15, R-squared of 0.01 and Adj. R-squared of -0.06. This presumably was due to the exclusion of major explanatory variables, such as economic growth and budget deficit.

As a policy reaction function, except in the initial cases, EMP shocks affect domestic credit negatively (though the coefficients are insignificant)(see Appendix 3 and Fig 2). This result suggests that the NBE responds to increased EMP by withdrawing liquidity

from the banking system (i.e by contracting money supply). This finding seems plausible given the un-sterilized nature of NBE's intervention in the foreign exchange market.

Fig.2 Responses of Domestic Credit to Exchange Market Pressure



V. Conclusion and Policy Implications

5.1 Conclusion

A recent study that estimated an index of the EMP for Ethiopia over the period November, 2001 to December, 2005 found that in majority of the cases (in 42 months out of 49 months considered) the Ethiopian foreign exchange market was characterized by depreciation pressures (Abebe, 2006). A critical issue under such circumstances is the policy measures to be undertaken by Monetary Authority when the economy faces such external strains.

Theoretical literature suggests that for a country adopting a managed floating exchange rate regime and faced with exchange rate pressures, policy options in the short run are only limited to monetary policy. To assuage the pressures and reduce EMP, the authority should react by embracing contractionary monetary policy, via controlling domestic credit (Kamaly and Erbil, 2000).

The objective of this study is, therefore, to examine empirically the impact of monetary policy on exchange market pressure (EMP) in Ethiopia using monthly data from August 1993 to December 2005 by applying the Griton-Roper(1977) model of exchange market pressure.

The results of the single equation model reveal that measure of the stance of monetary policy, i.e domestic credit growth, has powerful impact on *EMP*. Domestic credit has a significant and positive impact on EMP. The coefficient of domestic credit was 0.93 implying that as the domestic credit increases by 10 percent, foreign reserves decrease by 9.3 percent or exchange rate depreciates by the same amount, or a combination thereof. The result also shows that the coefficient of foreign prices is negative (0.83) and significant indicating that an increase in foreign prices increases the foreign reserves or appreciates the domestic currency. On the other hand, the coefficient of money multiplier was positive in line with theoretical expectations (though insignificant). The study also indicated that the

monetary authority tends to absorb more of the exchange market pressure by drawing down reserves as the variable Q is statistically significant with a negative sign.

The VAR test provides further evidence supporting the claim that domestic credit has a positive impact on exchange market pressure. The estimated IRF as well indicate a positive response of EMP due to a shock in domestic credit, implying that a contractionary monetary policy reduces EMP in line with traditional theory.

The paper also provides evidences of the fact that the NBE responds to increases of EMP by contracting domestic credit. This finding largely reflects the un-sterilized nature of NBE's intervention in the foreign exchange market.

Finally, the low level of R-square and adjusted R-square indicates that the amount of EMP that could be explained by macroeconomic variables is minimal. One possible explanation is the existence of omitted set of variable(s) such as real income(owing to lack of monthly data) and devaluation expectations.

5.2 Policy Implications

The main policy implications of the findings of this study are the following:-

1. The NBE can reduce EMP by contracting the pace of domestic credit expansion. This proposal is consistent with standard IMF's policy prescription that is, using contractionary monetary policy to counter depreciation pressures.

2. The main implication of the findings of small values of R-square and adjusted R-square is that disciplined management of fundamentals may not be enough to maintain exchange rate stability or contain exchange market pressures.

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Appendix 1A. VAR Estimation Results

Sample (adjusted): 1993M12 2005M12
Included observations: 145 after adjustments
Standard errors & t-statistics in parentheses

	LNEMP1	LNDC
LNEMP1(-1)	0.294547	0.008936
	(0.07270)	(0.03058)
	(4.05154)	(0.29227)
LNEMP1(-2)	-0.094671	-0.065531
	(0.05618)	(0.02363)
	(-1.68509)	(-2.77335)
LNEMP1(-3)	0.166234	-0.008706
	(0.05233)	(0.02201)
	(3.17673)	(-0.39558)
LNEMP1(-4)	0.028716	0.000285
	(0.05341)	(0.02246)
	(0.53767)	(0.01271)
LNDC(-1)	0.053679	0.195348
	(0.19790)	(0.08323)
	(0.27125)	(2.34703)
LNDC(-2)	0.188404	0.296200
	(0.19852)	(0.08349)
	(0.94903)	(3.54753)
LNDC(-3)	0.083243	0.141646
	(0.19658)	(0.08268)
	(0.42346)	(1.71326)
LNDC(-4)	0.037272	0.230689
	(0.19794)	(0.08325)
	(0.18830)	(2.77103)
LNFP	-0.030676	0.086926
	(0.17441)	(0.07335)
	(-0.17588)	(1.18503)
LNMM	0.015076	0.016522
	(0.01948)	(0.00819)
	(0.77375)	(2.01620)
LNSP	-0.044323	0.097407
	(0.13968)	(0.05874)
	(-0.31733)	(1.65815)
R-squared	0.239924	0.010895
Adj. R-squared	0.183202	-0.062919
F-statistic	4.229809	0.147602

Appendix 1B. VAR Estimation Results

Sample (adjusted): 1993M12 2005M12
Included observations: 145 after adjustments
Standard errors & t-statistics in parentheses

	LNEMP2	LNDC
LNEMP2(-1)	0.287629	0.006741
	(0.07282)	(0.03078)
	(3.94961)	(0.21900)
LNEMP2(-2)	-0.105854	-0.066769
	(0.05643)	(0.02385)
	(-1.87573)	(-2.79925)
LNEMP2(-3)	0.159937	-0.010263
	(0.05249)	(0.02218)
	(3.04712)	(-0.46262)
LNEMP2(-4)	0.023393	-0.000429
	(0.05338)	(0.02256)
	(0.43827)	(-0.01904)
LNDC(-1)	0.056533	0.194770
	(0.19695)	(0.08324)
	(0.28704)	(2.33976)
LNDC(-2)	0.196590	0.296919
	(0.19755)	(0.08350)
	(0.99514)	(3.55604)
LNDC(-3)	0.095469	0.143978
	(0.19594)	(0.08282)
	(0.48724)	(1.73853)
LNDC(-4)	0.045422	0.232570
	(0.19740)	(0.08343)
	(0.23010)	(2.78749)
LNFP	-0.026453	0.087178
	(0.17340)	(0.07329)
	(-0.15255)	(1.18950)
LNMM	0.014633	0.016491
	(0.01938)	(0.00819)
	(0.75518)	(2.01367)
LNSP	-0.060342	0.096017
	(0.13910)	(0.05879)
	(-0.43379)	(1.63313)
R-squared	0.236572	0.011933
Adj. R-squared	0.179599	-0.061804
F-statistic	4.152400	0.161827