DOMESTIC DEBT, INFLATION AND ECONOMIC CRISES: A PANEL COINTEGRATION APPLICATION TO EMERGING AND DEVELOPED ECONOMIES

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Abstract
The paper aims to investigate the economic relationship between inflation and domestic debt. In countries that experience high inflation, the inflationary process fed on increasing costs of domestic debt. As a result, the increasing debt to GDP ratios led these countries to borrow at higher interest rates and with lower maturity rates. The paper aims to divide countries into three groups. First group consists of Mexico, Turkey and Brazil; countries with high inflation experiences which result in increasing costs of domestic debt. Second group consists of Belgium, Canada and Japan, low inflation rates, low costs of borrowing. Third group consists of Portugal, Greece and Spain, countries with low inflation, high borrowing with low costs of borrowing and fiscal discipline. It is observed that, increasing costs of borrowing is epidemic to those with Non-Ricardian fiscal policies. As a result, it is not the rate of domestic debt/GDP ratio but the cost of borrowing and active fiscal regimes that lessens the immunity of emerging economies to the economic crises. Another important result that cannot be avoided is the fact that, FMOLS and DOLS methods followed in the study resulted in similar estimates for some countries, whereas we also observe very different estimates for others.

JEL Classification: C220, E310, E600, H600
Keywords: FTPL, Ricardian Equivalence, inflation and public debt, Panel Cointegration, Panel VAR, Panel VEC, FMOLS, DOLS.

1. Introduction

The independence of Central Bank and the policies regarding monetary aggregates plays a crucial role in the process of price level determination and the achievement of price stability. Recent studies show that, active monetary policies may fail to success maintaining price stability unless these policies had been backed by correct fiscal measures. On the other hand, active monetary policies followed by political authorities can result in deflationary or inflationary disequilibria in Non-Ricardian regimes. In economies, where fiscal policies are dominant, price level is explained by the FTPL whereas prices are determined by public debt and current and future primary surpluses. FTPL theory has been developed after the "Unpleasant Monetarist Aritmetics" by Sargent-Wallace (1981), where monetary policy is under the fiscal pressures; after a point has been reached, central banks should monetize the budget deficits which lead prices to increase; whereas, the inflationary effects of deficits developed by Sargent-Wallace are still a monetary phenomenon.

In FTPL theory, developed by Leeper (1991), Woodford (1994, 1995) and Sims (1994), fiscal policies bear important roles in the determination of prices. As prices are

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determined in Quantity Theory by money supply and monetary aggregates, in the new theory of price level prices are determined by the public debt (Woodford, M.: 2000: 19). According to the new theory, in economies where Ricardian equivalence does not hold, the dominance of fiscal policies cause price level to be determined by intertemporal budget constraint. Furthermore, monetary aggregates and seignorage revenues have no effects on the deviations in price level. Thus, an independent central bank following activist policies may lead to indeterminacy in the price level and inflationary or deflationary spirals (Wodford, M.: 1995: 1). As a result, monetary policy has important implications on the real debt stock, bond prices and real debt service through fiscal policies in the non-Ricardian regimes.

Recent studies suggest that, under rational expectations, non-Ricardian equilibria could occur in a way that, fiscal shocks effect price level through the aggregate demand. In economies, where Ricardian equivalence and rational expectations are prevalent and there are no frictions in financial markets, the budget equivalence relation leads current and the future primary surpluses to adjust in accordance with the increases in the current debt so that the wealth effects on aggregate demand become neutralized. Conversely, in non-Ricardian regimes this condition becomes obsolete; as a result, rational agents expect that current debt would not be financed by future primary surpluses (Woodford, M.: 1998: 671). In these regimes, the intertemporal budget constraint is not satisfied until the prices increase to balance the equivalence by decreasing net wealth. In such an economy, households observe an increase in their net wealth, which is not expected to be financed by future taxes that would decrease their future disposable income. If budget deficits resulting from the policies followed by fiscal policies are even partially subject to open positioning and Ponzi schemes, in full employment, the wealth effects that result in increases in prices become inevitable. Furthermore, expectations regarding future decreases in the primary surpluses, given current public debt, would lead the price level to increase. In conclusion, in fiscal dominant regimes, non-Ricardian policies lead to inflationary pressures, hence anti-inflationary monetary policies followed by independent Central Banks may result in even higher inflation rates.

In economies, where chronic budget deficits take place, monetary policy is under the pressure of these deficits and fiscal policy shocks (Uygur, E.: 2001: 10). These regimes are discussed in the literature as Non-Ricardian (Woodford 1994, Sims 1994), fiscal dominant (Sargent-Wallace 1981), Polar Ricardian or active fiscal policy (Leeper 1991). The regimes that Ricardian policies loose their validity can be seen commonly in the emerging markets as well as most periods in the developed economies. Favero-Giavazzi (2003) discuss that, in economies with fiscal dominant regimes where public debt is subject to indexation and speculation, active anti-inflationary monetary policies result in hyperinflation. Consequently, monetary policy is under fiscal pressures; an active policy such as Taylor rule lead nominal interest rates to increase in response to inflation, which in turn lead the nominal debt to grow faster; the increasing debt result prices to rise further. Loyo (1999) discusses the Brazilian hyperinflationary period and concludes that the tight money policy causes prices to fall eventually into an inflationary process under non-Ricardian policies. (Loyo, E.: 1999: 17)

In FTPL, the results of fiscal and monetary policies depend on the dominant characteristics of fiscal and monetary policies; moreover, the consequences of policies differ depending on the active and passive characteristics of the policy which follows the

active policy. (Leeper, 1991). Furthermore, the implementation of active and passive policy combinations create random multiple equilibria, thus central banks that maintain an active monetary policy stance near a given inflation target are more likely to lead the economy into inflationary or deflationary spiral and liquidity traps (Benhabib, J., S. S. Grohe, M. Uribe: 1998: 3).

In the determination of price level function, at least one of the authorities should choose its control variable independently. During this process, intertemporal budget constraint to be satisfied, at least one of the political authorities is obliged to determine its control variable passively. On the other hand, in a case where both of the authorities maintain the active or both follow passive policy rules, price level becomes indeterminate; whereas the indeterminacy leads intertemporal budget constraint to become unsatisfied (Leeper, E.: 1991: 3). If the policy combination is defined as *monetary policy active-fiscal policy passive,* fiscal policy accommodates monetary policies. These policies are defined as "Polar-Ricardian" by Aijagari-Gertler (1985), "accommodative fiscal policy" by Sims (1994, 1997), "dominant monetary policy" by Sargent-Wallace (1981) and "Ricardian regime" by Woodford (1994, 1995) and Cochrane (1999, 2005). In this policy combination, fiscal detoriation fails to effect interest rate and real balances. On the other hand, in *monetary policy passive-fiscal policy active* policies, monetary policy accommodates fiscal policy by considering budget deficits as a constraint in the political decision process. This policy combination represents Sargent-Wallace's "dominant fiscal policy" and Woodford's (1994, 1995) and Cochrane's (1999, 2005) "non-Ricardian policy" definitions.

Leeper's policy definitions correspond to the "Rules or Discretionary Policy" proposal suggested by Simons (1936) and Friedman (1948). Further, Benhabib, Schmitt-Grohe ve Uribe (1998, 2001) discuss nominal interest rate rules under fiscal dominant regimes and conclude that Taylor rules are destabilizing and cause to multiplicity of steady-state equilibrium, hence price level stability can only be achieved by an active monetary policy that shifts towards discretionary policies in response to the price level changes. The efficiency of these policies depends mainly on the passive backing by fiscal policies (Benhabib *et al.*: 1998: 2). Consequently, an anti-inflation policy followed independently by the Central Bank could result in deflationary or inflationary spirals depending on the active and passive characteristics of fiscal policies. Loyo (1999) and Blanchard (2004) discuss Brazilian hyperinflations with analogous approaches, whereas Loyo concludes that Brazilian Economy is subject to non-Ricardian policies combined by active monetary policy rules resulting in hyperinflations in late 1980's.

Cochrane (1999) and Woodford (1998) state that, since the early 1960's, inflation had been progressed proportional to the changes in fiscal balance, hence as the cashless limit is reached resulting from rapid innovations in financial markets, which grounds the intertemporal budget constraint and FTPL theory to hold. On the other hand, the collective movement of inflation, nominal interest rates and primary surpluses also hold in Ricardian regimes as well as non-Ricardian regimes (Woodford, M.: 2001: 705). The most striking dilemma that had been faced in both regimes is the fact that, in either of the regimes intertemporal budget constraint must hold just like the quantity theory of money relation (Cochrane, J.: 1999: 28). Although the positive relation between public debt and primary surpluses seems to hold in Ricardian regimes, there is a positive relation between surpluses and debt in non-Ricardian regimes, but the causality operates in the opposite

direction. In fiscal dominant regimes, the ratio of public debt to GDP is determined by the current value of current and future primary surpluses (Canzoneri, M. *et al.*: 2001: 1223).

Canzoneri *et al.* (2001), investigate the accessibility of Ricardian equivalence in accordance with the FTPL theory for United States for the period after WW II and reach to similar results to those of Bohn (1998) using VAR estimates. They conclude that, a positive shock in budget surpluses result in a decrease in current debt and an increase in future budget surpluses which is expected to be in accordance with Ricardian regimes. On the other hand, the similar results reached by Bohn (1998) are criticized that, Bohn's model fails to include an adequate amount of lags which is expected to increase the explanatory power of the model that demonstrates households with rational expectations and altruistic behavior. Even though Bohn's model includes only one lag of the debt and surplus variables, a positive value of the parameter of the debt to GDP ratio should be considered seriously as a sign of Ricardian policies (Woodford, M.: 2000: 28). Thus, Erdogdu (2001), Creel (2002) and Mikek (2001) obtained similar Ricardian results for the US economy by using VAR approaches that aim to analyze the responses of primary surpluses to public debt and they concluded that the dominant monetary policy had been accommodated by Ricardian policies in America. On the other hand, Ersin (2005) follows Engle Granger two stage cointagration methodology in accordance with the FTPL theory followed by VEC regression methods to access short run and long run dynamics of the characteristics of fiscal policies in Turkey following Cochrane (1998) VAR approach. For the period of 1989-2004, a period of financial liberalization and combined with two economic crises in 1994, and 2000-2001, Turkish political authorities are concluded to be following non-Ricardian fiscal rules for the period.

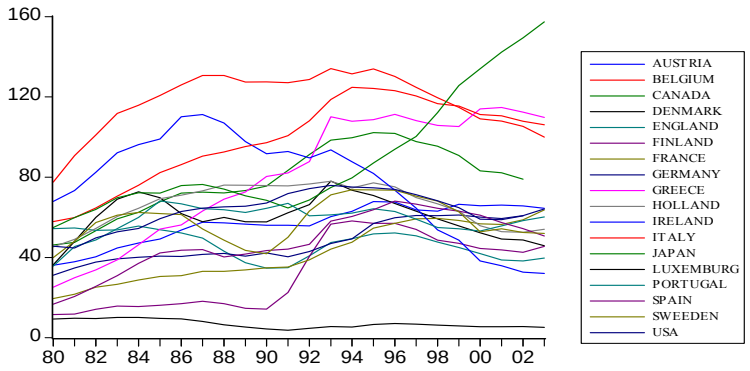
2. Domestic debt, fiscal dominance and inflation

In FTPL theory, domestic debt is an important ingredient of inflation. We observed that, in developed and emerging countries the problem is not the domestic debt but the cost of domestic debt in the determination of the inflation rate. Domestic debt with low interest rates is an important factor in the determination of price level through the intertemporal budget valuation. On the other hand, high interest rates have a strong impact on high or hyper inflationary periods in emerging countries.

The inflationary spirals which had been experienced by many emerging countries could be explained by the cost of domestic debt. Countries experiencing inflationary periods follow interest rate policies resulting from tight money policies, which increase domestic borrowing even further; decreasing maturity and increasing budget deficits. During the process, further rises in interest payments amplify domestic debt stock. The fact that, refinancing of debt by borrowing more lead budget constraint to deteriorate which resulted from continuing Ponzi game in fiscal policies. Furthermore, following the increases in domestic debt and decreasing maturity rates, an inflationary process becomes unavoidable through the wealth effects. If rational agents expect that the primary surpluses response inefficiently to the domestic debt, the only equilibrium in the price level follows an increasing inflationary path. The increases in price level lead further increases in nominal interest rates and decreases seignorage. As a result, it is inevitable that rising domestic debt will result in an economic through the same channels.

Increasing domestic debt to GNP ratio is not a special case of emerging countries. Among OECD countries, though the debt/GDP ratio is around 100 percent in Belgium, Spain and Greece, the ratio of net interest payments over GDP is around 8 percent,

whereas the same ratio corresponds to ~25% of GDP in some emerging countries that the debt/GDP ratio is around 65 percent.

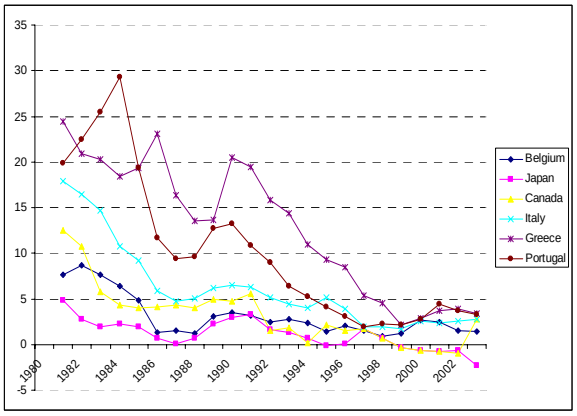


Source: IMF, International Financial Statistics, 2005.
Figure 1. Domestic Debt/GNP for Selected OECD Countries

After 1980's, all countries experienced increased domestic debt whereas, increasing domestic debt could not be considered an epidemic phenomenon of the rising economies. Ratios for certain developed countries are given in the figure above. Among the countries mentioned, many had experienced 100 percent or more domestic debt. Furthermore, debt/GNP ratios had been above 100% for Belgium, Japan, France and Spain. However, these countries did not experience high or hyper inflationary periods. It is argued that, low interest rates and high maturity rates of domestic debt are the main safety belt to avoid accelerated inflation. Countries such as Turkey, Brazil and Mexico have high costs of domestic borrowing and are more likely to experience hyper/or high inflationary periods as a result of fiscal dominance.

The main hypothesis of the study is that high costs of domestic borrowing are an important source of inflation. The study aims to analyze the inflationary effects of domestic debt in accordance with 3 groups of countries. First group consists of *Mexico, Turkey and Brazil*; countries with high inflation experiences which result in increasing costs of domestic debt. Second group consists of *Belgium, Canada and Japan*, low inflation rates, low costs of borrowing. Third group consists of *Portugal, Greece and Spain*, countries with low inflation, high borrowing with low costs of borrowing and fiscal discipline. Countries are selected such that; even though domestic debt is high because of low cost of borrowing, second and third group countries haven't experienced hyperinflationary periods. It is noted that, though the domestic debt in the first group is comparatively lower than the third group, high valuation of costs of domestic debt increase inflation rates accordingly and cause to crisis. Even though all selected countries had a strong domestic debt/GDP, those in the first group had experienced economic crises and a strong inflationary impact of domestic debt in accordance with the high costs of domestic debt. The evidence show that, the main problems regarding public policies in Turkey, Brazil and Mexico are not the domestic debt but domestic debt stock in context of the cost of borrowing in these countries. After 1980's, Turkey, Mexico and Brazil experienced either hyperinflationary periods or high inflation rates. On the other hand, the common characteristics of these economies are high cost of domestic debt and high

interest rates, decreasing seignorage revenues and money demand as a result of high inflation rate, and refinancing through incapable public revenues followed by missmanaged tax reforms a process that results in economic crisis. In these countries, the avoidance of the importance of FTPL theory had serious impacts on economic stability. As given in the figures below, the main problems regarding domestic debt cannot be considered as the level of the domestic debt but the relative significance of terms of borrowing as compared to the countries in the groups II and III.



Source: Worldbank GDF, 2005.
Figure 3. Yearly Inflation Rates, Group 2 & 3 Countries, (CPI, 1993=100)

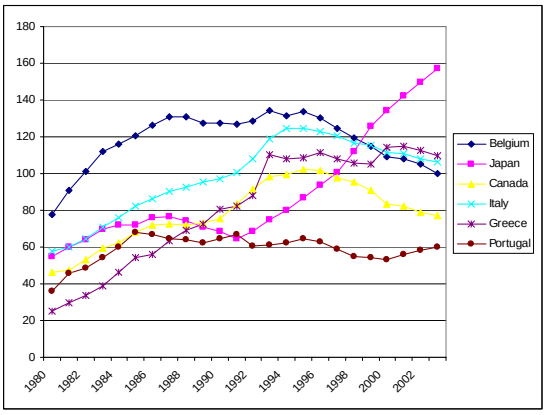


Figure 4. Yearly Domestic Debt/GDP, Group 2 & 3 Countries

As an important factor of terms of borrowing, average maturity rates for Brazil and Turkey are given in Figure 6. It is commonly observed that, periods of an increase in maturity are followed by a sharp decrease after corresponding economic crisis' years of 1994 and 1998. Although average maturity tend to decline after 2001 crisis, the negative trend in maturity kinked upwards in 2003.

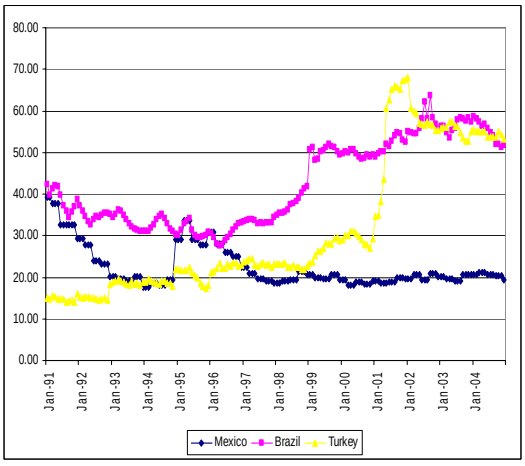


Figure 5. Mexico, Brazil and Turkey, Net Domestic Debt/GDP, Monthly

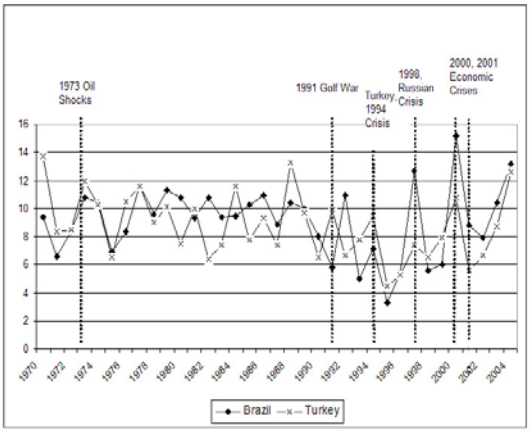


Figure 6. Mexico, Brazil and Turkey, Average maturity Years of Public Debt

Sources: Bank of Mexico; Banco Central do Brazil; Central Bank of Turkey; IFS,2005.

In emerging countries, the active monetary policies based on the Taylor rule lead to high domestic debt stock in the result of higher interest rates and increasing costs of borrowing and rising budget deficits. Thus the process produces higher inflation rates and economic crises resulting from non-Ricardian fiscal and active monetary policy combinations. In Favero, C, F. Giavazzi (2003), the increases in the interest rates are considered as an increase in the country risk by the investors hence the cost of borrowing increases as a result of increasing interest payments and decreasing maturity rates (Favero, C, F. Giavazzi: 2003: 1). In Benhabib, *et.al.* (2001), monetary policy affects interest rates and interest bearing government bonds that increase the net assets of the private agents. Thus, lower future primary surpluses are anticipated, tight monetary policies lead debt stock to increase even further. (Benhabib, *et.al.:*2001: 13).

In Brazil after the early 1980's; in Turkey after the early 1990's; in accordance with the fast increase in the debt stock, an ingredient that lead policies to depart from conventional results, an important shift in monetary policy had been taken place. As a result, both countries experienced a shift from price stability to chronic and high inflation rates. As Loyo (1998) suggested, in early 1980's, Brazilian central bank followed a tight monetary policy based on an active interest rate rule, and seignorage revenues had been maintained in a stable rate for the period. On the other hand, the increases in inflation rates had occurred independent of monetary policy speculatively. Even though inflation had been under the control of tight money policy before 1980's, the process had become a self-fulfilling inflationary spiral after 1980's. The fact that after this period stabilization left its place to accelerating inflation can be explained by the increases in rapid supply side shocks. The *tight money paradox* occurred in Brazil was mainly caused by the shift towards aggressive nominal interest rate policy after 1980's accompanied by active fiscal policies that led to an inflationary process (Loyo, E.: 1998: 4).

In Turkey, the stabilization policies followed by the policymakers fail to recognize the fact that, increasing domestic borrowing is a self-fulfilling phenomenon. Hence, inflationary processes fed on increasing interest payments on domestic borrowings, the inflation inertia could not be broken with the policies followed after 1990's until program that aim to achieve fiscal stability accompanied with independent monetary policies.

3. Data and econometric methodology

Data. In the study, the relationship between the domestic debt stock and inflation is aimed to be analyzed. Domestic debt stock / GDP ratio is taken as measure of the cost of the domestic debt. The study covers nine countries, namely; Brazil, Mexico and Turkey (1. group), Japan, Belgium, Canada (3. group), Greece, Portugal, Spain (3. group). The inflationary effects of public debt are analyzed within the econometric methodology covering cointegration framework based on Johansen cointegration tests and expended to Vector Error Correction models and panel cointegration models. Our analysis covers 1980-2004 period. Data for Brazil included in the study is taken from electronic data system of Central Bank of Brazil; for Mexico, the sources of public debt statistics and consumer price indices are taken from public debt statistics which are gathered by Ministry of Finance and Public Credit and Central Bank of Mexico. For Turkey, The data are taken from Central Bank of Turkey Electronic Data Transfer System and the Ministry of Treasury of Turkey, *Financial Statistics, 2001.* Data covering 1980-2004 period for Belgium, Japan, Canada, Spain, Greece and Portugal are gathered from World Bank,

International Financial Statistics, 2005 and consumer price indices for all countries are transformed to 2000=100 basis.

Unit Root Tests and Cointegration Results: Unit root tests are presented in the Annex

In Table 4, the result of panel cointegration tests are given. The results had been attained by Fisher χ^2 test and given in table 4. The results in the presence of one cointegrating vector is supported with Fisher's test and the hypothesis of a cointegrating relation is determined with HT and LL tests. Both time series and panel-based tests support that there is a cointegrating vector. Fully modified OLS (FMOLS) estimates of the cointegrating relationship are showed in Table 5. For the panel, the coefficient of *lib* is 2.54 for the first group; 0.28 for the second group and 0.56 for the third group and is statistically significant. On a per country basis, *lib* has a strong impact on *lenf* and the relation is statistically significant in these countries.

Table 4. Fisher χ^2 Results

	(Bel, Jap, Can)		(Ita, Gre, Por)		*(Tur, Bre, Mex)*	
	R=0	r≤1	r=0	r≤1	*r=0*	*r≤1*
Fisher χ^2 Cointegration Test	*31.40*	*3.12*	*31.28*	*5.14*	*170.25*	*7.45*

Furthermore, it is observed that, although FMOLS and DOLS estimation methods delivered very similar results for most of the countries, we achieved different estimates for Belgium, Mexico, Portugal and Greece. According to the results, the FMOLS, DOLS estimation may coincide and diverge in an important manner, thus the study points out an important finding for the ongoing FMOLS-DOLS debate.

VAR-VEC Results. Canzoneri, M. *et al*. (1998) suggests a VAR approach followed by impulse response functions in order to analyze the causal relationship between primary surpluses and government debt. (Canzoneri *et al:* 2001: 3). A similar approach suggested by J. Creel (2001), who focuses on fiscal policy rules, concludes that FTPL does not hold for France and U.S. since debt follow a decreasing and negative response to positive surplus shocks (Creel, J.: 2001: 1). Both studies show VAR approach. Canzoneri *et.al* (1998) approach using VAR models are severely criticized by Cochrane (1998), who points out the fact that, FTPL deals with off-equilibrium prices, thus a VAR approach leads to inconclusive results, since intertemporal budget constraint holds for both regimes just like the quantity theory relation. (Cochrane, J.: 1998: 18). Furthermore, Sims (2002) clearly shows that both intertemporal budget constraint and MV=PT equation holds in both Ricardian and Non-Ricardian regimes; both relations propose two equations and one independent variable *p*, as a result, monetary and fiscal policies act according to the "who moves first" characteristics and active and passive policy rules suggested by Leeper (1991). To overcome the "observational equivalence" problem proposed by Cochrane (1998, 2005), off-equilibria relations between the inflation and domestic debt stock are undertaken further by Vector Error Correction mechanism developed by Johansen and Juselius (1991). The following VEC regressions are estimated to analize the inflationary effects of domestic debt variables which are integrated of order one I[1]. Equilibrium error and/or deviations from the long run are $enf_{i,t-1} - lib_{i,t-1}$. Important problem is whether $\gamma \neq 0$ and whether $H_0 : \beta_i = 0$ can be rejected. γ is the estimate of error

correction mechanism and ε_{1t} and ε_{2t} stand for residuals of VEC regression estimates. The coefficient of domestic debt stock ϕ_i, is expected to be statistically significant and to range between $0 < \phi_i \leq 1$. On the other hand, the domestic debt stock should follow a decreasing path in Ricardian regimes since low inflation and low interest rate reduces the real value of domestic debt, which results in the satisfaction of intertemporal budget valuation equation. Furthermore, in Ricardian regimes, estimate of φ_i is expected to be statistically significant and φ_i<1. The χ^2 test for VEC model is given in Table 7.

Table 7. Short Run Causality Between *lenf* and *lib* Variables

Countries	**Lags of *lib***	γ **p-value**
TURKEY	1.13(0.006)	0.005
MEXICO	2.98(0.04)	0.02
BRAZIL	2.76(0.04)	0.04
BELGIUM	-0.14(0.45)	0.009
JAPAN	-0.206(0.14)	0.005
CANADA	-11.58(0.01)	0.01
SPAIN	2.27(0.04)	0.032
GREECE	1.64(0.12)	0.035
PORTUGAL	0.98(0.04)	0.028
Panel Fisher Test (1.group) 69.98 (2.group) 87.34 (3.group) 76.56		

Panel Fisher test is computed, basing on individual tests. All values have statistical significance. The short run causality can not be rejected for all countries. Estimates and diagnostic statistics for the VEC model are presented in Table 8. VEC model for panel data is estimated with instrumental variables. An instrumental variable estimator must be used to deal with the correlation between the error term and lagged dependent variables. Diagnostic statistics for the VEC model and panel error correction model estimates for the three groups are given at the Table 9.

Table 8. Diagnostic Tests for the Vector Error Correction (VEC) Model

Countries	*JB Test*	*LM Test p-value*
TURKEY	7.90(0.001)	5.22(0.26)
MEXICO	9.76(0.0)	9.42(0.051)
BRAZIL	7.068(0.006)	8.30(0.08)
BELGIUM	1.91(0.38)	5.008(0.01)
JAPAN	2.42(0.29)	4.89(0.29)
CANADA	3.43(0.179)	1.23(0.37)
SPAIN	1.64(0.43)	5.008(0.01)
GREECE	1.75(0.41)	4.89(0.29)
PORTUGAL	3.43(0.179)	1.23(0.37)

*Jarque-Berra(JB) show the Jarque-Bera normality test of errors. Lagrange Multiplier Test(LM) tests the null hypothesis hat there is no second order autocorrelation.

Table 9.Panel Error Correction Model(According to Groups)

.Panel Error Correction Model(1.Group Countries)

Variable	*Estimate*	*Variable*	*Estimate*
$\Delta lenf_{t-1}$	3.36	Δlib_{t-1}	5.41
$\Delta lenf_{t-2}$	6.46	Δlib_{t-2}	6.78
Error Cor Ter-0.18	*LR(2)* 8.86	*JB* 11.98	

.Panel Error Correction Model(3.Group Countries)

Variable	*Estimate*	*Variable*	*Estimate*
$\Delta lenf_{t-1}$	-4.6	Δlib_{t-1}	-3.17
$\Delta lenf_{t-2}$	-1.23	Δlib_{t-2}	-7.8
Error Cor Ter -0.38	*LR(2)* 7.566	*JB* 10.01	

.Panel Error Correction Model(2.Group Countries)

Variable	*Estimate*	*Variable*	*Estimate*
$\Delta lenf_{t-1}$	1.78	Δlib_{t-1}	3.98
$\Delta lenf_{t-2}$	1.87	Δlib_{t-2}	2.25
Error Cor Ter -0.086	*LR(2)* 9.98	*JB* 21.98	

It is observed that, all estimates are significantly positive except for the second group. As our results suggest, inflationary impacts of domestic debt stock is significantly stronger for those countries with higher costs of domestic debt burden.

Furthermore, we estimated the following impulse response functions from VAR models estimated for Turkey, Brazil and Mexico. Further, a CRISES dummy representing 1994-1998-2001 crises for Turkey; 1994 crisis and pre-Real Plan period for Brazil; for Mexico's 1982 crisis; and for negative effects of 1997 Asian Crisis. The first part of the Figure 7 represents the response followed by *lenf* resulting from an innovation in *lib.* As can be seen in the figure, an expansionary domestic debt shock leads price level to rise steadily in Turkey in the long run. At the bottom of Figure 7.a, the response of domestic borrowing is positive as a result of an impulse in the price level. Further, increases in the domestic debt has a significant positive impact on the *Crises.* On the other hand, after a positive shock resulting from economic crises implies a positive response followed by increasing domestic debt.

Similar results are obtained in Figure 7.b. for Mexico and in Figure 7.c. for Brazil (see Annex). According to the results, a positive impulse in domestic debt (*lib*) leads the inflation (*lenf*) to follow an increasing path in Mexico and Brazil. Further, an increase in the price level fails to lower the real debt stock and a positive shock in *lenf* results in a positive response in *lib* accordingly. Consequently, we analyzed the impulse-response functions between *lenf, lib* and economic crises (*crises*) and given in Figure 7. It is observed that, a positive impulse in domestic debt leads to a positive response in economic crises. The positive impact of *lib* on *crises* shows the increasing vulnerability to economic crisis as a result of worsening cost of domestic debt in these countries. On the other hand, a positive shock in *crises* leads *lenf* to follow a positive path. According to the results, cost of domestic debt has strong impacts on the countries analyzed.

4. Conclusion

In emerging economies, higher price levels in accordance with higher costs of borrowing is an important phenomenon that differentiates emerging economies. These countries have fiscal policies, which are less immune to open positioning and Ponzi game. The study divides analyzed countries into three groups. First group consists of Mexico, Turkey and Brazil; countries with high inflation experiences which result in increasing costs of domestic debt. Second group consists of Belgium, Canada and Japan, low inflation rates, low costs of borrowing. Third group consists of Portugal, Greece and Spain, countries with low inflation, high domestic debt/GDP ratios with low costs of borrowing. It is observed that, the hypothesis that the countries with less immunity to economic crises are inadequately affected from high costs of domestic debt cannot be avoided. In developed countries analyzed in group 2 and 3, Ricardian characteristics of fiscal policies improved the credibility of fiscal authorities even though a considerable exercise of domestic borrowing for deficit financing. In these countries, credibility and fiscal stability play a crucial role in achieving price stability. Even though there had been a strong fiscal commitment in the light of important stability programs in the third group, the vulnerability to crises had been increased in accordance with high costs of domestic debt; worsening maturity and sharp increases in interest rates.

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On line Annex at the journal web site: http://www.usc.es/economet/aeid.htm

Annex

a. Unit Root Tests and Cointegration Results:

In time series and panel unit root test for the cointegration analysis, we used four statistics and in second step it was tested for cointegration in panel data with Johansen, Pedroni test, FMOLS and DOLS methods. And to represent the dynamics of the system, the model is extended to vector error correction model (VEC).

In order to analyze the order of integration of corresponding variables, three unit root tests are applied to the data. The null hypotheses for ADF and PP tests are that the variable has a unit root, whereas the null hypothesis for KPSS test is that the variable is trend stationary. The ADF and PP test results are given in Table 1. *lenf* and *lib* variables have a unit root in levels for all countries. KPSS test is applied as a third test for corresponding variables. According to the test results given in Table 1, *lenf* and *lib* variables have a unit root in levels, however they become trend stationary in their first differences, thus all variables are integrated of I(1).

Table 1. Unit Root Test for the Variables

Variables	***ADF(F. Dif.)***	***PP(F. Dif.)***	***KPSS(F. Dif.)***
Δlenf (Mexico) (Group I)	-4.27**	-3.89**	0.097**
Δlib	-3.34**	-19.68**	0.098**
Δlenf(Brazil)	-4.58**	-4.58**	0.21**
Δlib	-10.41**	-10.39**	0.87
Δlenf (Turkey)	-7.75**	-7.82**	0.011**
Δlib	-11.38**	-11.82	0.204**
Δlenf Jap. (Group III)	-2.02**	2.066**	0.417**
Δlib	-2.43**	-2.43**	0.256**
Δlenf Can.	-3.21**	-3.23**	0.61**
Δlib	-2.75*	-2.70*	0.33**
Δlenf Bel.	-2.638*	-2.68*	0.38**
Δlib	-2.56**	-2.59**	0.44**
Δlenf Spa. (Group II)	-2.61**	-2.09	0.40*
Δlib	-2.40**	-2.66**	0.31**
Δlenf Gre.	-2.28	-2.41	0.19**
Δlib	-3.14**	-3.14**	0.43**
Δlenf Por.	-1.87*	-1.50*	0.21**
Δlib	-3.63**	-3.63**	0.30**

* (**) 10%, **5%, *F.Dif. is first difference. All unit root tests are based on Andrews band with and no intercept and trend included except the KPSS test which included intercept without trend.*

In Table 2, the result of panel unit root tests are given. The results support the hypothesis of a unit root in all variables across countries.

Table 2. Panel Unit Root Tests (F.DF is first difference)

	MW(F.DF)	*HT(F.DF)*	*LLC (F.DF)*	*BR (F.DF)*	*HARDRILM (F.DF)*	*IPS (F.DF)*
lenf(I.group)	241.09	-99.56	-30.42	-2.14	1.48	-24.08
Lib	241.78	-100.1	-30.48	-22.08	-0.09	-24.13
Lenf(III.group)	97.9	-77.9	-9.84	-5.48	-0.43	-8.19
Lib	76.12	-67.45	-8.99	-5.83	-0.82	-7.56
lenf(II.group)	65.89	-82.89	-7.65	-9.48	-0.73	-7.78
Lib	87.34	-56.09	-9.48	-7.82	-0.54	-7.77

*Levin-Lin-Chu (LLC), Breitung (BR), Im-Pesaran-Shin (IPS), Maddala-Wu (MW) and Choi, Hadri (HARDRILM).

To prove the robutness of the cointegration results, Johansen estimation procedure is carried out which uses full information maximum likelihood framework. First, the long term relationship between inflation and domestic debt will be tested. Table 3 shows the result of the cointegration analysis. Testing the restriction of no more than r cointegration vectors against the alternative of r+1 such vectors, the trace statistics test restriction of no more than r cointegration vectors against the alternative of r=0. The hypothesis must not be rejected by both the maximum eigen value and the trace statistic values at the 95 % level. Cointegration test results obtained for all countries indicate one cointegration vector. Based on the results obtained from the Johansen's and the Engle-Granger's two stage cointegration method, we can now conclude that inflation and the cost of domestic debt are cointegrated. This shows that, under the hypothesis of cointegration, the series are tied together by some long-run equilibrium relationship. Further, we used error correction model to search a long-run relationship between inflation and domestic debt.

Country by country, Johansen maximum likelihood cointegration results are reported in Table 3**.** While the hypothesis of no cointegration is rejected for all countries, the hypothesis of one cointegrating vector are accepted.

Table 3. Johansen Cointegration Result

Countries	Max.Eigenvalue Statictic Ho: rank=r	
	r=0	r≤1
Spain	32.11	0.52
Greece	54.93	1.72
Portugal	26.07	2.51
Brazil	*250.15*	0.01
Turkey	54.90	1.03
Mexico	211.69	1.53
Belgium	36.27	0.43
Japan	36.18	0.04
Canada	46.86	0.41

Notes: r shows the number of cointegrating vectors. The optimal lag length VARs were selected by AIC. Results denote rejection of the null hypothesis of no-cointegration at 5% level of significance.

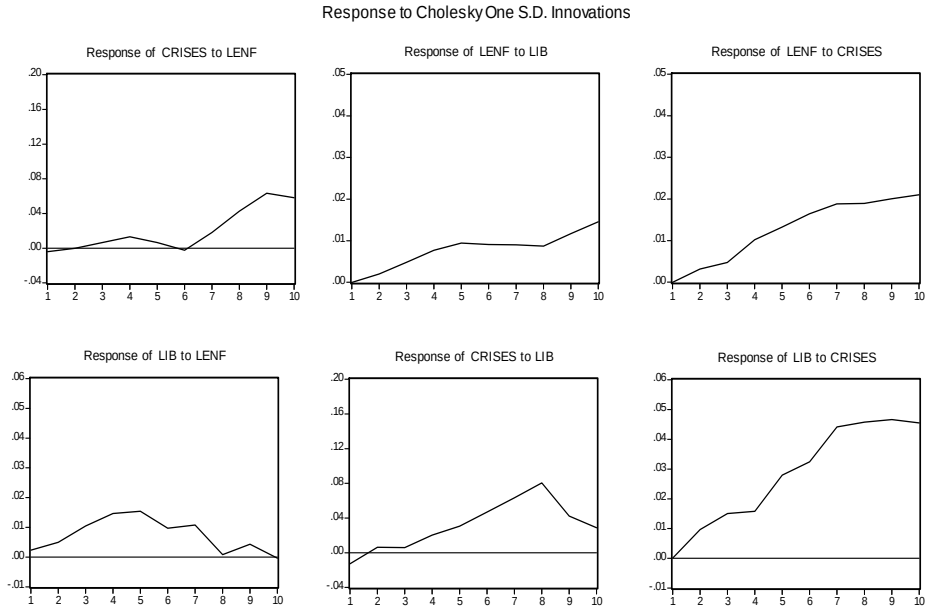
Table 5. FMOLS and DOLS Estimates (lenf is dependent variable)

Lib	*Lib(DOLS)**	
0.73(15.01))	0.71(15.011)	*TURKEY*
1.04(35.27)	1.56(33.10)	*MEXICO*
0.87(14.893)	0.86(14.891)	*BRAZIL*
0.09 (0.9)	1.01(2.15)	*BELGIUM*
0.89(9.5)	0.89(9.499)	*CANADA*
0.17(4.08)	0.178(4.09)	*JAPAN*
1.24(10.68)	1.35(10.9)	*PORTUGAL*
0.86(18.35)	1.59(10.12)	*GREECE*
0.81(30.49)	0.81(30.50)	*SPAIN*
2.54(3.14)		***FMOLS (Turkey,Mexico,Brazil)***
0.28 (2.54)		***FMOLS (Belgium,Canada, Japan)***
0.56(5.89)		***FMOLS(Portugal, Greece, Spain)***

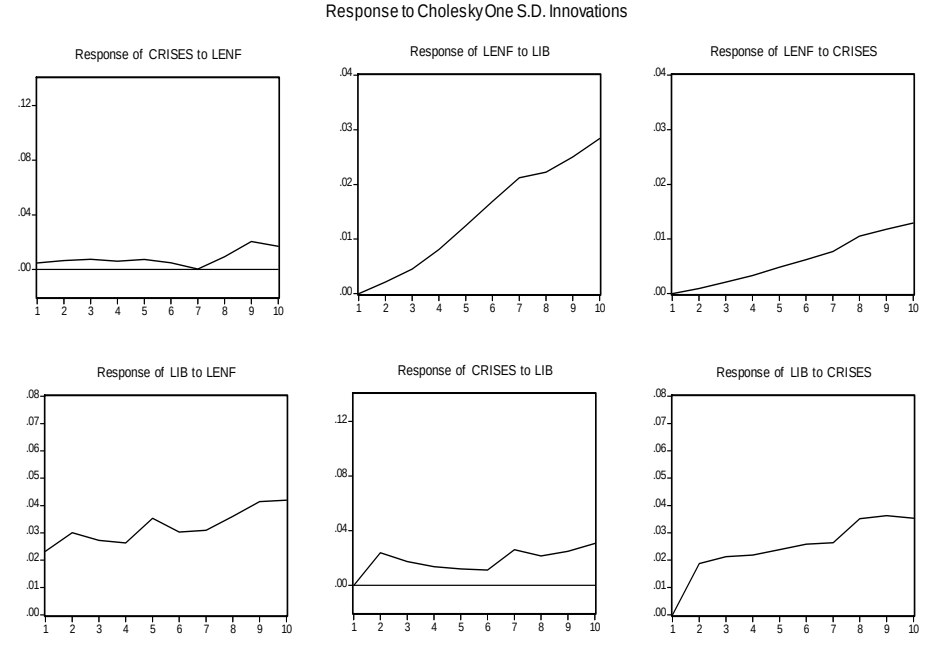
* FMOLS and DOLS estimate differences and very identical estimates are achieved for different series, suggesting an important finding in FMOLS-DOLS debate. *(t-stats in parentheses)*

The hypothesis of short run causality can not be rejected for all countries. One point that cannot be overlooked is the fact that, given the significant high value of the estimate for the first group, the cost of domestic debt has the highest impact among all groups. For country specific estimates, Portugal, Greece, Spain and Canada also have highly positive results. It must be noted that, all countries have very high domestic debt/GDP ratios as given in figure 1. On the other hand, Countries with higher costs of debt with high interest rates and low maturities experience inflationary impact of debt in a significant manner.

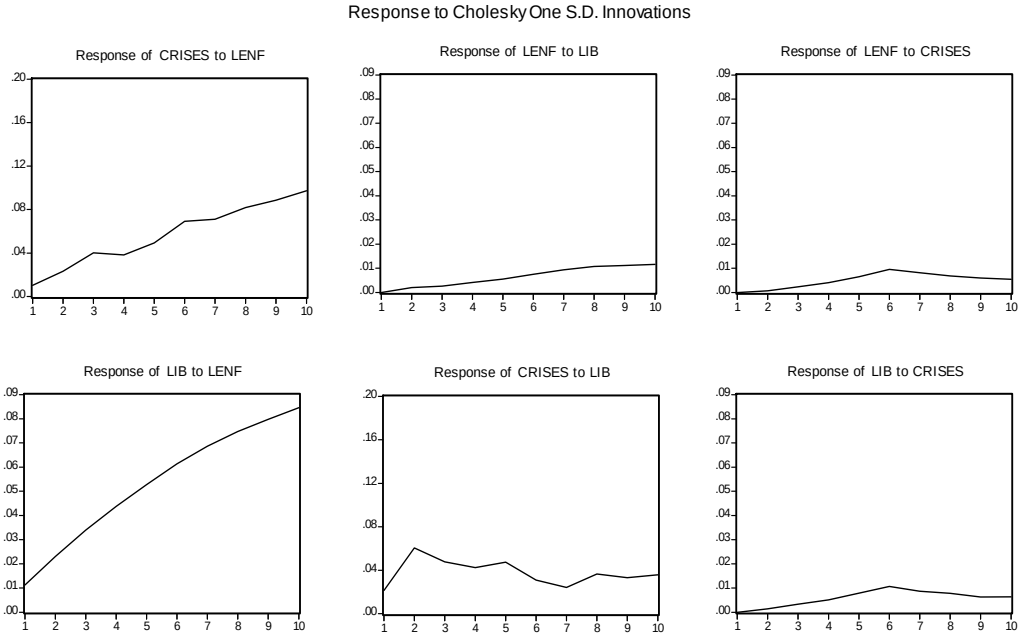
Figure 7. Impulse Response Functions



a. Turkey



b. Mexico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c. Brazil