“Interest rate liberalization and inflation in developing countries: a theoretical analysis”

AUTHORS	Hassan M. Shirvani Sidika Gulfem Bayram

ARTICLE INFO	Hassan M. Shirvani and Sidika Gulfem Bayram (2013). Interest rate liberalization and inflation in developing countries: a theoretical analysis. *Banks and Bank Systems*, *8*(3)
RELEASED ON	Wednesday, 16 October 2013
JOURNAL	"Banks and Bank Systems"
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES	NUMBER OF FIGURES	NUMBER OF TABLES
0	0	0

Hassan M. Shirvani (USA), Sidika Gulfem Bayram (USA)

Interest rate liberalization and inflation in developing countries: a theoretical analysis

Abstract

Interest rate liberalization is often recommended as an effective measure to curb inflation in developing countries. It is particularly asserted that higher interest rates on deposits can reduce inflation by lowering the velocity of circulation of money. This assertion, however, ignores the adverse effects of higher interest rates on money supplies, as governments create new money to help their banks deal with losses from higher deposit costs. Indeed, in the context of a simple model, this paper shows that such increases in money supplies can dominate reductions in money velocities, thus exacerbating inflationary pressures. The paper also shows that the use of government bonds instead of money to finance higher deposit costs may prove ineffective, as such bonds are often perfect substitutes for money as a result of governmental bond price support programs.

Keywords: interest rate liberalization, developing countries, inflation.
JEL Classification: E42, E43, O11.

Introduction

Interest rate liberalization, interpreted to include a significant increase in interest rates on bank deposits and loans, is widely recommended as a powerful tool to simultaneously fight inflation and boost growth in developing countries (Gurley et al., 1965; Chandravakar, 1971; McKinnon, 1973; Shaw, 1973; Fry, 1995, 1997; Levine, 2001; Bekaert et al., 2004; Ang and McKibbin, 2007; and Klein and Olivei, 2008). It is asserted that higher interest rates will curb inflationary pressures by reducing the velocity of circulation of the broad money in the economy. While this assertion can be largely true, it ignores the unintended consequences of higher interest rates for the supply of money. To compensate for higher costs of their deposits, banks are forced to elevate their lending rates, which can reduce the demand for bank loans, thus resulting in bank losses and failures (Corbo and de Melo, 1985; Diaz-Alejandro, 1985; Dornbusch and Reynoso, 1989; Burkett and Dutt, 1991; Singh, 1997; and Kaminsky and Reinhart, 1999; Eichengreen and Arteta, 2002; and Noy, 2004). Since the banking systems in many developing countries rely directly, if they are nationalized, or indirectly, if they are bailed out in emergencies, on government funds, the escalated bank losses will ultimately impose additional burdens on government budgets. To address the resulting budget deficits in the face of widespread tax evasion in their economies, many developing countries tend to resort to the printing presses, thus boosting the money supplies in their economies. The increased money supplies can, in turn, offset the effects of reduced velocities, with overall deleterious effects on inflation rates. Clearly, governments can partly finance their deficits by issuing bonds instead of money, thus somewhat moderating the effects of money creation on inflation. However, the undeveloped nature of the government bond market in many developing countries, which often necessitates the institution of governmental bond support programs in these countries, often renders government bonds as perfect substitutes for local monies. Under these conditions, there will be no real difference between bonds and money, as both will tend to exacerbate inflationary pressures. In addition, to the extent that government bonds often pay higher interest rates than deposits, using bonds can aggravate budgetary shortfalls and, hence, prove more inflationary than issuing money.

This paper addresses some of the above issues within the framework of a simple monetary model of a developing economy. While the basic model itself is not new (e.g., Christ, 1968 and 1979; Smithies, 1976), the present paper aims at advancing the model in new directions. This task is motivated by the fact that some of the issues addressed by the model are still quite timely for many developing countries, where interest rate reform is still widely heralded as an effective measure against inflation. This has been particularly true in the context of many Eastern European countries in the 1990s, as well as some of the industrial countries in Southern Europe in the 2000s (Corbett and Mayer, 1991; Riboud et al., 2002, Tornell et al., 2004, Bekaert et al., 2005; and McGee and Preobragenskaya, 2006). In fact, it can be argued that financial liberalization, instead of promoting growth and stability, may have inadvertently contributed to the recent global financial crisis.

The rest of the paper is organized as follows. Section 1 presents the basic theoretical model underlying the paper. Section 2 discusses the implications of the model for interest rate reform. The final section concludes.

1. Model

The analysis presented in this paper is based on a simple model of a small closed economy as represented by the following equations:

$$Y = Py, \quad (1)$$

where Y is the nominal national output, P is the price level, and y is the real national output. By taking logarithms of both sides of the above equation and differentiating them with respect to time, we will obtain:

$$(dY / dt) / Y = (dP / dt)/ P + (dy / dt)/ y = i + g, \quad (2)$$

where i = rate of inflation and g = rate of economic growth. The model will initially assume that the rate of economic growth will remain constant, regardless of what happens to the rate of interest. In reality, of course, changes in the interest rate can affect the distribution of output between consumption and investment, thus resulting in changes in the rate of economic growth. This rather restrictive assumption, however, will be relaxed later in the paper. The next equation in the model is simply a statement of the condition for equilibrium in the goods market:

$$Y = A + G, \quad (3)$$

where A are the private expenditures, and G are the government expenditures. In addition, we assume that:

$$A = aY, 0 < a < 1. \quad (4)$$

Turning next to the government sector, we assume that government expenditures are financed either through tax revenues or through the creation of new monetary base. For simplicity, we also assume that the banking system is faced with a 100% reserve requirement ratio, so that the model makes no distinction between the levels of monetary base and money supply in the economy. As stated earlier, the model further posits that the ultimate responsibility for the payment of interest on the money supply (bank deposits) will rest with the government. Under these conditions, the government budget can be summarized as:

$$D = G + rM^D - T, \quad (5)$$

where D is the budget deficit, r is the interest rate, M^D is the demand for money, and T is the tax revenues. In addition, it is clear that:

$$dM^S / dt = D, \quad (6)$$

where M^S is the money supply. Thus, as stated earlier, changes in money supply are determined by the deficit in government budget. To complete the model, we additionally make the following institutional and behavioral assumptions:

$$T = tY, 0 < t < 1 \quad (7)$$

that is, tax revenues are proportional to national income. And,

$$M^D = Yf(r - i), f' > 0 \quad (8)$$

indicating that the demand for money depends positively on both the level of income and the real rate of interest. Finally, the equilibrium condition in the money market requires that:

$$M^D = MS. \quad (9)$$

Clearly, equations (1) through (9) form a complete model of the economy, which by appropriate substitutions can be reduced to a single differential equation in terms of the rate of inflation only. More specifically, differentiating both sides of (9) results in:

$$d(M^D) / dt = d(M^S) / dt. \quad (10)$$

Likewise, differentiating both sides of (8) yields:

$$d(M^D) / dt = (dY / dt) f - (di / dt) f'.$$

In addition, appropriate substitutions results in:

$$(dM^S) / dt = Y - aY - tY + rYf.$$

Thus, the equilibrium condition in the money market, equation (10), can be written alternatively as:

$$(dY / dt) f - (di / dt) Yf' = Y - aY - tY + rYf.$$

Dividing both sides of the above equation by Y, and using equation (2), yields:

$$(i + g) f - (di / dt) f' = 1 - a - t + rf$$

or

$$(i + g - r) f(r - i) - (di / dt) f' \times$$
$$\times (r - i) = 1 - a - t. \quad (11)$$

Thus, equation (11) expresses the equilibrium condition in the money market (per unit of nominal output) in terms of a differential equation for the rate of inflation. By solving the above differential equation, the dynamic path of the rate of inflation over time can be determined. However, since the model is only interested in the long run equilibrium rate of inflation, i^*, it is assumed that that, in equilibrium: $di^* / dt = 0$.

This means that the steady state equilibrium value of the rate of inflation is the solution to the following equation:

$$(i^* + g - r) f(r - i^*) = 1 - a - t. \quad (12)$$

Furthermore, it bears repeating that equation (12) is simply the equilibrium condition in the money market, with the left hand side representing the change in the (portfolio) demand for money, while the right hand side denotes the change in the supply of money. Under these conditions, the stability of the equilibrium rate of inflation requires that:

$$d / [(i^* + g - r) f(r - i^*) - 1 + a + t] / di^* > 0$$

that is, any increase in the equilibrium rate of inflation should increase the excess demand for money, as given by the bracketed statement. More specifically, higher inflation will increase the transactions

demand for money and reduce the portfolio demand for money, with the former dominating the latter, so that the demand for money as a whole should increase. In other words, the stability of the equilibrium requires that:

$$f(r - i^*) - (i^* + g - r) f'(r - i^*) > 0. \quad (13)$$

2. Implications of the model

The simple model presented in the previous section can now be used to examine some implications of interest rate liberalization for inflation in developing countries. In particular, differentiating both sides of (12) with respect to the rate of interest results in:

$$(di^* / dr - 1) f(r - i^*) + (i^* + g - r) \times \times (1 - di^* / dr) f'(r - i^*) = 0,$$

or

$$(di^* / dr - 1) [f(r - i^*) - (i^* + g - r) f' \times \times (r - i^*)] = 0. \quad (14)$$

Since the bracketed statement in (14) is positive by virtue of (13), it follows that:

$$(di^* / dr - 1) = 0, \text{ or } di^* / dr = 1. \quad (15)$$

In other words, any increase in the rate of interest will increase the rate of inflation by exactly the same amount, i.e., point for point. Thus, it seems that any favorable effect of higher interest rate policy on the velocity of money will be more than offset by the unfavorable effect of such a policy on the faster money supply growth needed to finance the increased cost of bank deposits.

The foregoing analysis has so far assumed that the growth rate of the economy will not be affected by any increase in the rate of interest. There is a voluminous literature on financial repression in developing countries which asserts that any interest rate liberalization will in fact positively impact the pace of economic growth in such countries (see Fry, 1995, for an excellent review of this literature; however, also see Stiglitz, 1994, for a contrary view). The comparative static result presented in (15) can be modified to take account of the existing liberalization literature. Differentiating both sides of (12) again, and this time allowing for an endogenous growth rate, yields:

$$di^* / dr = 1 - (dg / dr) / [f(r - i^*) - (i^* + g - r) \times \times f'(r - i^*)]. \quad (16)$$

Thus, should higher interest rates boost economic growth through increased efficiency of the financial system ($dg / dr > 0$), and given the positive sign of the denominator on the right hand side of the above due to (13), an increase in interest rate will fail to increase inflation point for point. Indeed, should the resulting boost to growth be sufficiently significant, the inflation rate can even be slowed down. In contrast, should higher interest rate exercise a deleterious effect on growth, the rate of inflation may increase by more than the increase in the rate of interest. Given the ambiguity surrounding the effect of interest rate reform on economic growth, in the rest of this paper it is assumed that the rate of economic growth will remain constant.

Next, it is assumed that instead of funding the additional cost of higher deposit rates by money creation, governments resort to higher taxation. Under this scenario, tax revenues are increased by the amount of interest payments on deposits, so that the total budget deficit will equal the goods deficit, that is:

$$D = G + rM^D - (T + rM^D) = G - T.$$

Reworking the model under this new assumption, the equilibrium relationship will now take the form:

$$(i^* + g) f(r - i^*) = 1 - a - t. \quad (17)$$

Differentiating both sides of the above equation will now yield:

$$(di^* / dr) f(r - i^*) + (1 - di^* / dr) (i^* + g) \times \times f'(r - i^*) = 0, \quad (18)$$

or

$$di^* / dr = - (i^* + g) f' (r - i^*) / [f(r - i^*) - - (i^* + g) f'(r - i^*)], \quad (19)$$

where the fraction on the right hand side is negative (the numerator is negative because f' is positive, and the denominator is positive because of the stability condition). Thus,

$$di^* / dr < 0. \quad (20)$$

In other words, should governments use additional tax revenues instead of new money creation to pay interest on deposits, any increase in the rate of interest on deposits will indeed reduce the pace of inflation. The reason for this is simply that the higher interest rate will decrease the velocity of money without, at the same time, offsetting the positive effects of the lower velocity by the negative effects of a faster monetary expansion.

On the other hand, the question may arise as to whether the use of higher tax revenues to directly reduce the budget deficit, instead of using them to finance higher interest payments on deposits, may be a more optimal application of such revenues. Indeed, under this arrangement, it is easy to show that the moderation in the pace of inflation will be even more dramatic. Specifically, it can be shown that the budget deficit can now be rewritten as:

$$D = G - (T + rM^D) = G - T - rM^D.$$

Reworking the model under this new assumption, the equilibrium relationship will now take the form:

$$(i^* + g + r) f(r - i^*) = 1 - a - T. \quad (21)$$

Differentiating both sides of the above equation will now yield:

$$(di^*/dr + 1) f(r - i^*) + (1 - di^*/dr)(i^* + g + r) \times \times f'(r - i^*) = 0, \quad (22)$$

or

$$di^*/dr = -[f(r - i^*) + (i^* + g + r) f'(r - i^*)] / [f(r - i^*) - (i^* + g + r) f'(r - i^*)], \quad (23)$$

where, the fraction on the right hand side is negative (the numerator is negative because f and f' are both positive, and the denominator is positive because of the stability condition). Thus,

$$di^*/dr < 0. \quad (24)$$

In other words, using tax revenues to reduce the budget deficit instead of paying higher interest on deposits will also reduce the rate of inflation. In fact, as stated earlier, this latter policy will have a more drastic effect in terms of reducing the rate of inflation. This can be seen by reproducing below the two equilibrium relationships (17) and (21), corresponding to the two cases in which higher tax revenues are used to, respectively, finance the higher interest payments and reduce budget deficits. To distinguish between the two cases, the solutions to the two equilibrium conditions are denoted, respectively, as i_1^* and i_2^*:

$$(i_1^* + g) f(r - i_1^*) = 1 - a - t. \quad (17R)$$

$$(i_2^* + g + r) \text{ f } (r - i_2^*) = 1 - a - t. \quad (21R)$$

Since the right hand sides of the above equations are equal, so do the left hand sides. Thus,

$$(i_1^* + g) f(r - i_1^*) = (i_2^* + g + r) f(r - i_2^*) \quad (25)$$

or

$$(i_1^* + g) \text{ f } (r - i_1^*) - (i_2^* + g) f \times \times (r - i_2^*) = rf(r - i_2^*) > 0. \quad (26)$$

or

$$(i^* + g) f(r - i^*) + (i^* + g - r) h(r - i^*) = 1 - a - t.$$

with the stability condition now taking the form:

$$f - (i^* + g) f'(r - i^*) + h - (i^* + g - r) h'(r - i^*) > 0. \quad (33)$$

Finally, differentiating both sides of (32) yields:

$$di^*/dr = 1 - f/[f - (i^* + g) f'(r - i^*) + h - (i^* + g - r) h'(r - i^*)]. \quad (34)$$

A close examination of (34) reveals that the inflationary effect of an increase in the rate of interest on bonds, while less than point for point, is nevertheless ambiguous (the second term on the right hand side of the above equation is positive due to the positive stability condition). In other words, if the interest rate on bonds increases, say, by one percentage point, the rate of inflation can increase by at most one percentage point. In fact, it is possible for the rate of inflation to fall, all depending on the properties of the demand functions for money and bonds, and the ways in which governments combine money and debt to finance their operations. To elaborate this point further, it is assumed that governments finance a fixed fraction (α) of their deficits by issuing money and the rest by issuing bonds. Thus,

$$dB^S/dt = \alpha (G + rB^D - T),$$

$$0 \leq \alpha \leq 1$$

$$(i_1^* + g) f(r - i_1^*) > (i_2^* + g) \text{ f } (r - i_2^*) \quad (27)$$

Since the stability condition for i_1^* requires $(i^* + g) f(r - i^*)$ to be an increasing function of i^*, it is clear from the above inequality that:

$$i_1^* > i_2^*. \quad (28)$$

which proves the earlier assertion in the paper.

Before concluding this paper, it is of interest to also examine the effects of interest rate liberalization on inflation under the assumption that governments use a combination of money creation (which pays no interest) and bonds (which offer a fixed interest rate) to finance their budget deficits. To this end, the new government budget deficit can now be written as follows:

$$D = G + rB^D - T,$$

where B^D is the demand for government bonds, and r are the interest on bonds. Now, as stated earlier, it is assumed that budget deficits are financed by the issuance of money and bonds. Thus,

$$dM^S/dt + dB^S/dt = D, \quad (29)$$

where B^S is the supply of bonds. Under the new conditions, the private sector demand for money and bonds are as follows:

$$M^D = Yf(r - i), f' < 0. \quad (30)$$

and

$$B^D = Yh(r - i), h' > 0. \quad (31)$$

It is important to note that higher real interest rates on bonds, while having a positive effect on the demand for bonds, will have a negative effect on the demand for money due to the increased opportunity cost of holding idle money balances. Once again, appropriate substitutions will result in the following relationship for the steady state rate of inflation:

$$(i^* + g) f(r - i^*) + (i^* + g - r) h(r - i^*) = 1 - a - t. \quad (32)$$

and $dM^S/dt = (1-\alpha)(G + rB^D - T)\ 0 \le \alpha \le 1$.

Again after appropriate substitutions, the new equilibrium relationship for the long run value of the inflation rate becomes:

$$(i^* + g - \alpha r)\, h\, (r - i^*) = \alpha\, (1 - a - t). \quad (35)$$

With the stability condition of:

$$h - (i^* + g - \alpha r)\, h'\, (r - i^*) > 0. \quad (36)$$

To determine the effects of rising interest rates on bonds on the rate of inflation, both sides of (35) are differentiated to yield:

$$di^*/dr = 1 - (1-\alpha)\, h / [h - (i^* + g - \alpha r)\, h'\, (r - i^*)],$$
$$i^*/dr = 1 - (1-\alpha)\, h / [h - (i^* + g - \alpha r) \times$$
$$\times\, h'\, (r - i^*)]. \quad (37)$$

In general, the sign of (37) is indeterminate, but the sign is unambiguous for the following two special cases:

Case 1: $\alpha = 1$,

$$di^*/dr = 1$$

so that, if the budget deficits are completely financed by bonds, any increase in interest rate on bonds will increase the rate of inflation by the same amount.

Case 2: $\alpha = 0$,

$$di^*/dr = -(i^* + g)\, h'/[h - (i^* + g)\, h'\, (r - i^*)] < 0$$

that is, if budget deficits are financed exclusively by new money, any increase in interest rate on bonds will actually reduce the rate of inflation. This result may seem surprising, given that monetary expansion is often deemed more inflationary than government borrowing. However, in the present model, given that governments support bond prices by offering fixed interest rates on them, there is really no difference between money and bonds. That is, government bonds can effectively trade as monetary base, a situation quite familiar from the recent financial crisis in the United States. In addition, unlike money, in the present model government bonds offer interest, thus rendering them more expensive.

Conclusions

Using a simple model of a closed economy, this paper has questioned the assertion often made in the development literature that interest rate liberalization can serve as an effective measure to curb inflation in developing countries. While higher interest rates on deposits can reduce inflation by lowering the velocity of money, it can also increase inflation by adding to the supply of money. The additional supply of money is often used by governments to help banks cope with the adverse effect of higher deposit costs on their earnings. Indeed, the paper has shown that such increases in money supplies can dominate reductions in money velocities, resulting in higher inflation rates. The paper has also shown that if higher deposit costs are financed by higher taxes instead of new money creation, interest rate liberalization can lower inflation rates. Finally, the paper has shown that using government bonds instead of money will not constitute much of an improvement, if governments provide bond price support programs; as such bonds will be perfect substitutes for their bonds.

References

1. Ang, J.B., McKibbin, W.J. (2007). Financial Liberalization, Financial Sector Development andGrowth: Evidence from Malaysia, *Journal of Development Economics*, 84, pp. 215-233.
2. Bekaert, G., Harvey, C.R. & Lundblad, C. (2005). Does Financial Liberalization Spur Growth? *Journal of Financial Economics*, 77 (1), pp. 3-56.
3. Burkett, P., Dutt, A. (1991). Interest Rate Policy, Effective Demand, and Growth in LDCs, *International Review of Applied Economics*, Vol. 5, No. 2, pp. 127-253.
4. Chandavarkar, A.G. (1971). Some Aspects of Interest Rate Policies in Less Developed Economies: The Experience of Selected Asian Countries, *Staff Papers – International Monetary Fund*, Vol. 18, No. 1, pp. 48-112.
5. Christ, C.F. (1968). A Simple Macroeconomic Model with a Government Budget Restraint, *Journal of Political Economy*, Vol. 76, No. 1, pp. 53-67.
6. Christ, C.F. (1979). On Fiscal and Monetary Policies and the Government Budget Restraint. *The American Economic Review*, Vol. 69, No. 4, pp. 526-538.
7. Corbett, J., Mayer, C. (1991). Financial Reform in Eastern Europe: Progress with the Wrong Model, *Oxford Review of Economic Policy*, Vol. 7, No. 4, pp. 57-75.
8. Corbo, V., de Melo, J. (1985). Overview and Summary: Liberalization with Stabilization in the Southern Cone of Latin America, *World Development*, 13 (8), pp. 863-66.
9. Diaz-Alejandro, C.F.(1985). Good-bye Financial Repression, Hello Financial Crash, *Journal of Development Economics*, 19, reprinted. In: Velasco, A. (ed.), Trade, Development and the World Economy. Selected essays of Carlos DõÁaz-Alejandro, Blackwell, Oxford, UK.
10. Dornbusch, R., Reynoso, A. (1989). Financial Factors in Economic Development. *American Economic Review*, 79, pp. 204-209.
11. Eichengreen, B., Arteta, C. (2002). Banking Crises in Emerging Markets: Presumptions and Evidence. In Mario Blejer and Marko Skreb (eds.), *Financial Policies in Emerging Markets*, MIT Press, Cambridge, Massachusetts.

12. Fry, M.J. (1995). *Money, Interest and Banking in Economic Development*, London: John Hopkins University Press.
13. Fry, M.J. (1997). In Favour of Financial Liberalisation, *Economic Journal*, 107 (442), pp. 754-770.
14. Gurley, J.G., Hugh, T.P., Shaw, E.S. (1965). The Financial Structure of Korea, Reprinted by Research Department, the Bank of Korea, Seoul.
15. Kaminsky, G.L., Reinhart, C.M. (1999). The Twin Crises: The Causes of Banking and Balance-of-Payments Problems, *The American Economic Review*, Vol. 89, No. 3, pp. 473-500.
16. Klein, M.W., Olivei, G.P. (2001). Capital Account Liberalization, Financial Depth and Economic Growth, *Manuscript*, *Fletcher School of Law and Diplomacy*.
17. Levine, R. (2001). International Financial Liberalization and Economic Growth, *Review of International Economics*, 9, pp. 668-702.
18. McGee, R.W., Preobragenskaya, G.G. (2006). *Accounting and Financial System Reform in Eastern Europe and Asia*. New York, NY: Springer.
19. McKinnon, R.I. (1973). *Money and Capital in Economic Development*, Washington, DC: Brookings Institution.
20. Noy, I. (2004). Financial Liberalization, Prudential Supervision, and the Onset of Banking Crises, *Emerging Markets Review*, Vol. 5, pp. 341-59.
21. Riboud, M. Sanchez-Paramo, C. Silva-Jauregui, C. (2002). Does Eurosclerosis Matter? Institutional Reform and Labour Market Performance in Central and Eastern European Countries. In B. Funck and L. Pizzati (eds.), *Labour, Employment and Social Policies in the EU Enlargement Process*, Washington, DC: World Bank, pp. 243-311.
22. Shaw, E.S. (1973). *Financial Deepening in Economic Development*, Oxford University Press, New York.
23. Singh, A. (1997). Financial Liberalisation, Stockmarkets and Economic Development, *The Economic Journal*, Vol. 107, No. 442, pp. 771-782.
24. Smithies, A. (1976). Interest Rate Reform and Inflation. Paper presented at the Economic Development Seminar at Harvard University.
25. Stiglitz, J.E. (1994). *Whither Socialism*? *The Wicksell Lectures, 1990*. Cambridge, Mass: MIT Press.
26. Tornell, A., Westermann, F. Martinez, L. (2004). The Positive Link between Financial Liberalization, Growth and Crises, National Bureau of Economic Research Working Paper No. 10293.