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The Fiscal Effects of Monetary Policy

Prepared by Momi Dahan[1]

Authorized for distribution by Mario I. Blejer

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Abstract

This paper develops a simple framework to examine the budgetary implications of monetary policy measures. It further outlines, using this framework, the various channels of influence that tight monetary policy may have on the budget deficit. The cumulative effect might be quantitatively large although each effect might be small. Most of the effects tend to increase the budget deficit as result of tight monetary policy, but tight monetary policy causes a short-run decrease in the government debt. Thus, macroeconomic policy coordination should be considered.

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[1]Momi Dahan is an economist in the Research Department of the Bank of Israel and was a research scholar in the Monetary and Exchange Affairs Department.

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SUMMARY

A common feature of recent experience of several countries (both industrial and developing) is that most of the burden of inflation stabilization and macroeconomic adjustment in the short run falls on monetary policy. Although the main purpose of monetary policy under these circumstances is to control inflation and contribute to financial stability, in the short run such policy can have an expansionary impact on the government budget deficit.

This paper develops a simple framework to examine the budgetary implications of monetary policy. The paper outlines, using this framework, the various channels of influence that tight monetary policy, and consequent higher interest rate, may have on the budget deficit: price, expenditure, revenue, debt, seigniorage, sterilization, and swapping effects.

Most of these effects tend to increase the budget deficit as result of tight monetary policy. The worsening of the fiscal deficit, however, may well be accompanied by improving the public debt in the short run. A higher interest rate implies a lower market value of the central government debt (excluding the net assets held by the central bank). Thus, the change in the overall fiscal position (budget deficit and public debt) may well be mixed as result of tight monetary policy. Consequently, macroeconomic policy coordination should be considered because of the (potential) importance of the budgetary impact of tight monetary policy. In addition, the reaction of the government to recession might be an increase of the budget deficit that may affect the overall policies' credibility. Also, the reaction function of the government regarding the debt management may impair the monetary policy.

I. INTRODUCTION

A common feature of recent experience of several countries (both, industrial and developing) is that most of the burden of inflation stabilization and macroeconomic adjustment in the short run falls in the territory of monetary policy. In some cases, tight monetary policies are required not only to control inflation, but also to prevent sharp rises in balance of payments' deficits and to maintain financial stability. If fiscal policy discipline is not maintained at the same time, then the monetary policy quickly becomes overburded.

Although the main purpose of monetary policy under these circumstances is to control inflation and contribute to financial stability, it turns out, somewhat paradoxically, that in the short run such policy can have a short run expansionary impact on the government budget deficit. Thus, even though the central bank actions are intended to restore overall macroeconomic discipline, a proper evaluation of the policies should consider these temporary consequences.

The possible effects of monetary policy on output and employment tend to introduce a wedge between policy makers because the fiscal authority may consider employment considerations to be more important than the monetary authority. Another cause of tension between the two authorities is the effect of contractionary monetary policy measures on the government budget deficit. Further, an increase in a budget deficit due to tight monetary policy might work as a signal of loss of fiscal discipline, which in turn could cause inflation expectations to increase rather than decrease.

The main objective of this work will be to discuss the various channels through which overburdened central bank operations might affect the government budget and to elaborate on the possible policy implications of these effects. The paper outlines, using a simple model and accounting, the various (short-run) channels of influence that tight monetary policy measures can have on the budget deficit. It deals with the various effects such as the revenue effect, the debt effect, the seigniorage effect and the sterilization effect. In the course of the analysis, the role of the accounting practices that relate the central bank profits or losses to the budget of the public sector will be emphasized. Some of the characteristics of these practices are country specific, which carry with them various possible implications.

This paper may prove useful in putting together most of the effects of monetary policy measures on the budget into a simple framework. Earlier papers covering this subject usually emphasized one particular influence of monetary policy on the budget deficit while neglecting other effects.[2] Because of the interrelationship between various channels of influence, a unified framework should be considered. This approach has two additional benefits. First, every specific effect might be small or even negligible, yet the overall effect could be large. Though

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[2]For example, Calvo, Leiderman and Reinhart (1996) and Frenkel (1994) emphasize the fiscal cost of sterilization and Tobin (1987) focus on the debt effect.

in some countries, the quasi-fiscal costs of sterilization effect alone have approached figures of nearly 1 percent of GDP. Second, this framework provides a checklist of the factors that determine the quantitative effect of monetary policy on fiscal deficits.

II. A SIMPLE FRAMEWORK

The methodology of this paper is consisted of two steps. The first step is differentiating the government budget deficit with respect to the interest rate that is influenced directly by monetary policy measures. The second step is to sign the various derivatives. The issue of fiscal effects of monetary policy is more relevant in the short run and therefore the chosen economic model should include short run effects. Thus, most of the discussion in this paper is based on the IS-LM framework. Most of the results are not sensitive (qualitatively) to the chosen economic model as long as it includes some kind of nominal rigidity and that framework is used mainly because of its tractability. There will be some ad-hoc deviations from that simple framework wherever necessary. Recall that this framework deals only with flows variables like output, government expenditure, consumption and others. Nevertheless, we will discuss (briefly) also the effects of monetary policy on stock variables such as the domestic public debt and external public debt.

Consider a small economy in which capital is either perfectly mobile between the domestic and international markets so that domestic and foreign interest rates are equal or completely immobile. In both cases it is assumed that the central bank controls the quantity of money but with a clear interest rate target. The exchange rate is fixed (or relies on a predetermined crawling peg regime). It is assumed that monetary policy has a short-run impact on output because of temporary price and wage stickiness. These could be due to "menu cost" (Mankiw, 1985) or long-term nominal contracts (Fischer, 1977). The effect of monetary policy on budget deficits is more profound if there is at least one kind of nominal rigidity and therefore money is non-neutral in the short run.[3]

A change in monetary policy is defined here as a change in one particular interest rate. Using the conventional definition of a budget deficit along with a simple model one can understand the overall effect of monetary policy. The consolidated public sector budget deficit, D, is defined as:

$$(1) \quad D = G - T(Y) + (\frac{1}{P}) \sum_{m=1}^{M} i_m B_m{}^P + \sum_{x=1}^{X} (i_x + \frac{\Delta E}{E}) B_x{}^P e - (i_X + \frac{\Delta E}{E}) A_X e$$

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[3]Blanchard and Fischer (1989, Ch. 4) reviewed channels other than nominal rigidities through which changes in money could have real effects and concluded that those channels are likely to be quantitatively unimportant.

where P is the price level and G is the real government expenditure that includes public consumption, public investment, transfer payments and subsidies.[4] T stands for taxes that most of them closely related to the overall economic activity, Y. The nominal interest payments are composed of two groups:[5] interest payments on domestic debt held by the private sector, $B_m{}^P$, where i_m is the nominal domestic interest rate on bonds of type m. The second group is the interest payments on foreign debt (or indexed to foreign currency), B_x where i_x is the international interest rate on the bond of type x. To use the minimum of notations, assume that there is one nominal foreign exchange rate which is denoted by E, e is the real exchange rate and the central bank holds one type of reserve only, A_X. The ex-post nominal exchange rate depreciation is denoted by $\Delta E/E$. Within each group there are various types of government bonds: long-run, short-run, marketable, nonmarketable, fixed interest rates, floating interest rates, indexed, unindexed and some other types. The central bank holds one type of government bond only, B_M. Note, that the interest payments to the private sector appear in the definition of the public sector deficit. That is the case if the central bank gives the interest (on government bonds held by the central bank) back to government.

For expositional purposes it is worth separating the discussion into two parts: a case of lack of capital mobility and a case of an economy which is characterized by complete capital mobility. It is important especially because some of the effects of monetary policy on the budget deficit are more profound than others (in particular the sterilization effect) in an economy with large degree of capital inflows and outflows.

A. A Case of Lack of Capital Mobility

Assume momentarily that the public sector (including the central bank) has no foreign debt or assets and that the public sector cannot borrow or lend in the international capital markets. This is a simple way to capture the lack of capital mobility. The monetary policy is represented here by changes in the interest rate of one particular type of Treasury bills, i_M. A change in the fiscal deficit as a result of monetary policy can be inferred by looking at the derivative of the fiscal deficit with respect to that particular interest rate:[6]

$$(2) \quad \frac{\partial D^{CC}}{\partial i_M} = \frac{\partial G}{\partial i_M} - \frac{\partial T}{\partial Y}\frac{\partial Y}{\partial i_M} + (\frac{1}{P})\sum_{m=1}^{M}\frac{\partial i_m}{\partial i_M}B_m{}^P + (\frac{1}{P})\frac{\partial B_M{}^P}{\partial i_M}i_M - \frac{\partial P}{\partial i_M}[\frac{1}{P^2}\sum_{m=1}^{M}i_m B_m]$$

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[4] A common price index has been used in order to save notation although the price index may differ for each component of the budget deficit.

[5] Where indexed bonds of type m could be define as $B_m = P * b_m$.

[6] It is easy to see that the derivative of the fiscal deficit with respect to B_M is equal to Eq. 2 divided by $\partial i_M / \partial B_M$, however the terms look less transparent.

where $\partial D^{CC}/\partial i_M$ is the derivative of a budget deficit with respect to the interest rate that is affected directly by monetary policy in an economy without capital mobility.

The first term (the *expenditure effect*) is likely to be with a positive sign if the government has a counter-cyclical reaction function. The government may try to smooth out output and employment fluctuations by increasing government expenditures whenever the level of output is below its trend. The economy might be in the down side of the business cycle as result of tight monetary measures and high interest rate which may lead the government to respond in increasing the budget deficit. An offsetting factor could be at work if the public investment depends negatively, among other things, on the interest rate.

The second term is the *revenue effect*. In the short run, as mentioned before, tight monetary policy measures may lead to slower (short-run) growth in output and national income than otherwise. If that is the case, income tax and other tax revenues might be reduced, thus leading to a rise in the recorded government budget deficit.[7] The more important the nominal short-run rigidity is, the higher the magnitude of this effect becomes. It also depends positively on the elasticity of the overall tax revenues with respect to output. The existence and the extent of automatic stabilizers (reaction function) have a lot to do with the size of the revenue effect. The automatic stabilizers are aimed to smooth out output fluctuations by imposing a nonlinear income tax rate that grow faster than the national income during times of economic boom and decline faster (or grow less faster) than the national income during times of recession. Thus, the presence of automatic stabilizers implies that the revenue effect is even larger than the output change.

In many countries there exist estimates of the cyclicly adjusted budget deficit that should not be changed by the revenue effect. But, the public is usually skeptical to count on the cyclicly adjusted budget deficit as the only indicator that reflects the fiscal discipline because of the unstable nature of the elasticity of the taxes with respect to output.

The third term is the *debt effect*. A tight monetary policy typically results in higher short-term nominal interest rates than otherwise. In the short-run, higher short-term rates may affect medium and long-term rates through the whole term structure of interest rates. As a result, servicing a constant level of public debt may become more expensive, and these costs may increase the public sector deficit. However, a full evaluation of this effect would require taking into account the impact of central bank operations on the public's expectations of inflation and the impact of the latter on interest rates as well.

The way economic agents formulate their expectations and the degree of credibility of monetary policy are crucial factors here. There are two extreme possibilities that span the whole range: (1) the public expects that the monetary authority will fail to achieve the inflation target and eventually abandon the tight policy; (2) The tight monetary policy will bring down

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[7]A lower output increase may also result in a rise of public debt-to-GDP ratio.

inflation (and inflation expectations) once the policy is announced. In the first scenario, the tight monetary policy may lead to higher inflation and higher nominal interest rates.[8] Thus the sign of the debt effect is unchanged (qualitatively). In the second scenario, the expected reduction of the inflation rate tends to decrease the nominal interest rate thus the debt effect is ambiguous.

The sign of the debt effect is positive if the government is a net borrower and negative if the government is a net lender. The magnitude of the debt effect depends on the level of the public debt, the maturity distribution of government bonds, the share of flexible interest rate bonds in the overall public debt and on the sensitivity of various interest rates with respect to i_M. Tight monetary policy has a more profound effect on the fiscal position whenever the level of public debt is high and composed of a large share of a short-term bond and/or a large share of flexible interest rate bonds.

A natural assumption is that all of the quantities of government bonds are exogenous and fixed except the one that is the instrument of monetary policy—bonds of type M.[9] Technically, it means that all the derivatives of the government bonds held by the private sector (other than B_M^P) with respect to the instrument interest rate, i_M, equal zero. Note that the real value of government bonds is higher than otherwise if the inflation rate is lower as result of tight monetary policy. That reflects a lower erosion rate of the nominal public debt as result of a lower inflation rate.

The fourth term is the *seigniorage effect*. Assuming a constant budget deficit, a deceleration in the rate of money creation (through open market operations) leads to an increase in debt creation, which in turn may result in higher budget deficits in subsequent periods. This effect is at work depending on the government-central bank relationship. One interpretation of the set up that is outlined above could be that the central bank is nothing other than an agent of the government. This institutional arrangement allows the government to borrow from the central bank (e.g., The government has an unlimited access to fiat money). Thus, the central bank sells government bonds to the private sector has to be replaced by other source of financing the budget deficit.

That argument is consistent also with a distinct institutional arrangement in which the government is not allowed to borrow from the central bank, yet the central bank has to transfer (usually, at the end of period) the net gains to the treasury. However, if the central

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[8]This point was made more than decade ago by Sargent and Wallace (1985). In addition, a change of inflation expectations tends to change the debt composition (for instance, the share of the indexed bonds may change).

[9]It could be the case that the business sector is not allowed to borrow or lend from the rest of the world yet the public sector has an access to the foreign capital market. This point will be discussed below.

bank only transfers the net gains on its foreign-exchange holdings, then this is not valid anymore. In that case, the interest payments on government bonds are automatically used by the central bank to reduce money creation.[10] Thus, tight monetary policy that is conduct by a more independent central bank may have a lower seigniorage impact on the budget deficit.

Unlike the case of open market operations, increasing the quantity of money supply by way of "helicopter drop"means that there is simultaneous rise in transfer payments from the public sector to the private sector and in the stock of high power money following the conventional national accounts rules. Note that in that case the government budget deficit becomes endogenous. A tight monetary policy by reducing the "helicopter drop" rate is associated with a lower budget deficit and therefore does not to be replaced by other source of financing. Thus the "helicopter drop" case has a similar budgetary implication as in the last case.

A tight monetary policy can be also carried out by raising the required reserve-to-deposit-ratio. So the quantity of money supply may change without any change in the high power money. In that case a tight monetary policy has a lower seigniorage impact on the budget deficit. Monetary measure may include also a quasi-fiscal activities that can be used to affect the interest rate. In the rest of the paper, it is assumed that monetary policy carried out only through open market operations.

The fifth term (the *price effect*) in the last equation is positive given that the price level (or the inflation rate) depends negatively on the interest rate and positively related to the quantity of money. A lower rate of inflation causes a lower real rate of erosion of the nominal interest payments. The presence of the price effect is because the budget deficit is defined in real terms. It has another important effect on the real value of the stock of public sector debt. A lower price level (or a lower inflation rate) implies a higher real value of public debt than otherwise to the extent of the share of nonindexed bonds relative to the overall public debt.

It is important to point out that a higher interest rate due to tight monetary policy means a lower price of almost all assets including government bonds. Thus the market value of the public sector debt (including the net debt or assets of the central bank) may increase, decrease or stay constant depending on the elasticity of the demand for government bonds. The market value of the central government debt (e.g., excluding the net debt or assets of the central bank) unambiguously decreases. In a more formal way the net public debt in the current period is the sum of the current fiscal deficit and the previous stock of public debt. Therefore the effect of i_M on the market value of the public debt is:

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[10]An asymmetry is at place if the central bank transfers profits to the government while losses covered by a rise in printing money (Robinson and Stella, 1987). The discussion here consistent with the arrangement in which the central banks which have suffered chronic losses are recapitalized as suggested by Stella (1997).

$$(3) \qquad \frac{\partial (P_t^B Q_t^B)}{\partial i_M} = \frac{\partial D_t}{\partial i_M} + \frac{\partial P_t^B}{\partial i_M} Q_{t-1}^B$$

where P_t^B is the market price of government bonds in period t and Q_t^B is the quantity of government bonds. For simplicity it is assumed (in deriving equation 3 only) that there is one type of government bonds. Thus, the effect of monetary policy on the public debt is composed of two parts: flow effect and stock effect. As can be seen, the stock effect is *negative* given that the market price of government bonds depend negatively on the interest rate.

Eqation 3 shows that while the burden of servicing the debt at the margins may increase it is also possible that an important fiscal variable, the (market value of) public debt, might decrease. This factor reflects the capital gains of a net borrower as a result of an increase in interest rates. The magnitude of these capital gains depends on the same variables as the debt effect but with the opposite result. Following the accounting conventions, the government budget does not include capital gains or losses. One possible way that the government could realize those gains is by imposing (lump sum) taxes and buying part of its outstanding debt. However, the par value of the government bonds held by the private sector (which equal to the public sector debt) must increase because of the government bonds that were transferred from the central bank to the private sector during the open market operations.

B. A Case of Complete Capital Mobility

The world financial integration is more profound today than in the past though the world is still far from a situation of complete capital mobility. The large capital inflows and outflows (especially from and to the developing countries) usually pressure central banks to respond. Hence, it is important to consider the effects of monetary policy on the budget deficit under a regime of fixed exchange rate and high degree of capital mobility.

Assume (momentarily) that monetary policy does not affect foreign exchange rates and the government has a positive amount of domestic and foreign debt (and/or domestic debt in foreign currency). As a result of an open market sale of domestic bonds, an operation that decreases the quantity of money in circulation, economic agents find their portfolios thrown out of equilibrium; that is, at the initial interest rate, they have too many bonds and not enough money. The agents with an excess demand of money try to sell foreign assets. Consider the instant before the central bank has to buy foreign bonds. At this point (point B in figure 2) the tight monetary policy has had the same budgetary effect as in the case of an economy without capital mobility.

Then the central bank has to buy foreign currency and absorb the domestic currency so as to maintain a fixed exchange rate that shifts the economy back to point C. At point C, the

change in the government's budget deficit as a result of monetary policy can be seen according to this equation:[11]

$$(4) \quad \frac{\partial D^{CMI}}{\partial i_M} = \frac{\partial D^{CC}}{\partial i_M} + \frac{1}{P}\frac{\partial B_M^P}{\partial i_M}[i_M - (i_X + \frac{\Delta E}{E})] - \frac{1}{P}\frac{\partial B_M^P}{\partial i_M}i_M$$

where $\partial D^{CMI}/\partial i_M$ is the derivative of a budget deficit with respect to the interest rate in an economy with complete capital mobility. Note that the domestic interest rate in the new equilibrium is the same as before the monetary disturbance. Equation 4 captures the temporary high domestic interest rate before the convergence to the new equilibrium. As can be seen from equation (4), there are two additional effects compare with an economy without capital mobility. On the one hand the quantity of money supply does not change at point C which means that there is no seigniorage effect. On the other hand the central bank sells the government bonds for a lower price compare to the market price before the open market operations which is associated with a higher domestic interest rate though for a very short period of time. From the public sector point of view it is equivalent to issuing a new bond with a higher interest rate and trade it for holding an additional foreign bond. The fiscal costs (or gains) of monetary policy (at point C) might be less than is the case of an economy without capital mobility because the seigniorage effect may outweigh the additional cost because of the temporary gap between domestic and foreign nominal interest rates.

The second term in this equation reflects the cost of monetary disturbance which is the *sterilization effect*. Note that the central bank does not sterilize (in the usual sense), yet a change in the quantity of money that eventually fully offsets has the same effect as sterilization does (an automatic sterilization). In an open economy with an important degree of nominal exchange rate targeting (e.g., an extreme example would be a fixed exchange rate), a rise in the short-term central bank interest rate can be associated with an increase in the short-term capital inflows which may contribute to strengthening the value of the domestic currency. To the extent that the authorities would like to avoid some of the implied nominal exchange rate appreciation, they might intervene in the foreign exchange market in order to ensure that tight money indeed prevails.[12]

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[11] One can arrive at this equation by adding and subtracting $(\partial B_M^P/\partial i_M)i_M$ and recall that the rise of foreign exchange holdings is equal to reduction in the government bonds held by the public.

[12] It is important to note that in the short-run the central bank has realized expenses and non-realized revenues because the capital inflows cause the central bank to keep buying. Thus there might be "accounting overshooting" where the central bank losses are overstated.

To sterilize the rise in the money supply due to capital inflows, the central bank must undertake open market operations repeatedly which provoke continuous capital inflows, an increase in a foreign exchange holdings and a decrease in the domestic bonds held by the central bank (to arrive at point B). After the first iteration, which reflects the seigniorage effect, the fall in domestic bond holdings is equal to the rise in foreign exchange holdings. The overall change in fiscal cost due to tight monetary policy in that case (point B) can be seen in this equation:

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(5) \qquad \frac{\partial D^{CM2}}{\partial i_M} = \frac{\partial D^{CM1}}{\partial i_M} + \frac{1}{P}\frac{\partial B_M^{P}}{\partial i_M}i_M + \frac{1}{P}\sum_{m=1}^{M-1}\frac{\partial B_m^{P}}{\partial i_M}i_m + \sum_{x=1}^{X}\frac{\partial B_x^{P}}{\partial i_M}(i_x + \frac{\Delta E}{E})e
$$

The effect of monetary policy measures on the budget deficit of ceaseless sterilization (at point B) could be higher or lower than in the last case (point C). The quantity of money does fall at point B which implies that, for a given budget deficit, the public debt must go up to replace that source of budget finance. As a result the interest payments of the public sector in the following periods go up as well (i.e., the seigniorage effect).

The cost of sterilization depends on combination of the persistent of the tight monetary policy and the degree of openness to capital flows. The monetary authority may conduct a contractionary monetary policy for a relatively long period of time and thus the cost may be very large. That cost is equal to the rise of the level of domestic government debt (or the fall in foreign public debt) multiply by the difference between domestic and foreign interest rates. Note that the last equation captures only the cost of temporary (and small) sterilization and accordingly the sterilization effect has to be multiplied by the magnitude of the open market operations.

However, the cost for the public sector might be smaller if the domestic interest rate is high for a relatively long period of time. Under these conditions, in order to reduce interest payments, the government is likely to change the composition of its debt by reducing its expensive domestic debt and increasing its less expensive foreign debt (the *swapping effect*). The size of the swapping effect depends on the access the government has to international capital markets and on the maturity distribution of the public debt. This effect is captured by the third and fourth terms in the last equation. Such a change in the government debt composition implies a rise in the quantity of money supply that may impair the conduct of monetary policy. Obviously, it will not occur if the monetary and fiscal policies are coordinated.

In the real world, changes in monetary measures may also affect nominal foreign exchange rate expectations.[13] The extent and direction of this relationship depends to a large extent on the credibility of the monetary policy. The economy might move to a new equilibrium by a rise of nominal foreign exchange rate expectations in response to a rise in the nominal domestic interest rate, as can be seen through the Fisher equation ($i_M = i_X + \Delta E/E$), if the monetary policy to a large extent is not credible.[14] One source of lack of credibility could be the fiscal position which might be affected by monetary policy itself. However, if there is macroeconomic policy coordination in achieving a lower inflation rate, the nominal foreign exchange rate expectations are more likely to go down as result of tight monetary policy. Nevertheless, the actual effects of monetary policy measures on the budget deficit are affected by the actual exchange rate depreciation according to:[15]

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(6) \qquad \frac{\partial D^{CM3}}{\partial i_M} = \frac{\partial D^{CM2}}{\partial i_M} + \sum_{x=1}^{X} \frac{\partial (i_x + \frac{\Delta E}{E})(1 + \frac{\Delta E}{E})}{\partial i_M} B_x^P - \frac{\partial (i_x + \frac{\Delta E}{E})(1 + \pi)}{\partial i_M} A_X
$$

As can be seen from equation (6) the nominal exchange rate appreciation has an ambiguous effect on a budget deficit. Suppose that the net effect of a higher interest rate due to tight monetary policy on the ex-post foreign exchange rate is negative (e.g., appreciation of the exchange rate); then the fiscal effect depends on the size of exchange rate holdings of the central bank compared with the overall level of foreign public debt. It is possible that this particular effect might decrease the budget deficit.

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[13]The discussion here refers to periods of (relatively) low inflation and exchange rate depreciation. The budget deficit might be overstated during high inflation periods since interest payments may include a component that compensates for the reduction in the real value of debt (Tanzi, Blejer and Teijeiro, 1993). For example, suppose that the central bank sells government bonds in order to sterilize capital inflows of 1000. The exchange rate is 1, the domestic nominal interest rate is 57.5 percent, the ex-post depreciation rate is 50 percent and the nominal (and real) foreign interest rate is 5 percent. The actual budget deficit in this example would be overstated by 500, yet the real interest rate is the same for the two transactions.

[14] Calvo (1991) suggested a different mechanism under which stabilization programs based on exchange rates accompanied by capital inflow may lead to higher inflation expectations.

[15] Assuming that E equals to one in the begining of the period.

At any point in time, the ex-post nominal foreign exchange rate depreciation might be different from ex-ante depreciation expectations. It could be either because the unit of time is too short or because of the expectations were false. For practical reasons, the conventional budget deficit is based on a cash basis and a year as unit of time and that is more consistent with the ex-post analysis. A change in exchange rate expectations does not induce directly a change in the recorded consolidated public sector deficit unless the authorities decide to revalue the exchange rate or let it, automatically, appreciate as in a regime of an exchange rate band (or a floating exchange regime). However, if the monetary policy measures reduce not only the nominal exchange rate devaluation but also inflation expectations then the domestic nominal interest rate goes up due to increase in the demand for money.

Exchange rate revaluation expectations may increase further the spread between domestic and foreign nominal interest rates. Therefore, the size of capital inflow is larger and so the sterilization cost. So the more successful the tight monetary policy is in reducing the nominal exchange rate expectations the more it cost. Of course, the time period of high interest rates, tight monetary policy, is a decision variable which can be change to reduce the fiscal cost. The fiscal cost is smaller if the monetary policy is adjusted fast enough after the inflation (and exchange rate devaluation) expectations went down.

It is necessary to estimate the ex-ante nominal foreign exchange rate expectations in order to calculate the effect of monetary measures on the budget deficit. This is not an easy task. As mentioned before, the exchange rate expectations could go either way. Calculations of the sterilization effect that incorporates the effect of exchange rate devaluation expectations depend heavily on the chosen time period.

It is important to point out that a higher ex-post revaluation of the exchange rate due to tight monetary policy is associated with a lower (than otherwise) level of foreign public debt in terms of domestic currency and relative to GDP. It has a similar effect as that of a higher domestic interest rate on the stock of government domestic debt. One should take into account those ex-post capital gains in calculating the overall fiscal cost.

High domestic interest rates (relative to foreign interest rates) cannot prevail forever because of budget constraints. The portfolio change toward more domestic assets and more foreign liabilities may increase the risk premium. An increase in the risk premium is one possible way through which the gap of interest rates could be, at least in part, narrowed. If this is the case then the direct effects of tight monetary policy on the budget deficit are smaller.

Sterilization, which is defined here as the operation that central bank has to do so as to keep the quantity of money unchanged, may take place even in economy without capital mobility. Suppose that the central bank undertakes an open market sale that indues an increase in the (domestic) interest rate and decreases the output growth rate. As a result, the current account improves and causes a pressure to increase the quantity of money. To prevent that, the central bank may sterilize the change in money supply. So, the interest rate is higher than

in the point of departure. The effects of sterilization on the government budget in economy without capital mobility are similar, under certain conditions, to a capital mobility economy if the world interest rate is below the domestic interest rate. But, the public sector might even benefit from the rise in foreign exchange holdings if the world interest rate remains sufficiently higher than the one after the monetary measures were taken.

III. MACROECONOMIC POLICY COORDINATION

The degree of the credibility of monetary policy is an important factor that may affect the fiscal position. Almost all of the effects outlined above are affected by the extent of credibility of the macroeconomic policy. For instance, the nominal wage contracts exhibit a lower scale of inertia by incorporating a new information about policy change which result in smaller effect of monetary measure on output and employment. It implies a lower size of revenue effect. The size of the debt effect is also lower, and the sterilization effect might be higher with higher degree of credibility.

As is well-known, credibility is closely related to central bank independence because it prevents, to a large extent, the government from monetizing its debt. In other words, full central bank independence means that the fiscal deficit is more endogenous. Thus the additional budget deficit, which may occur because of tight monetary policy, is less likely to affect the inflationary process. Therefore, a larger degree of central bank independence and as a result a larger degree of macroeconomic policy credibility may be associated with less budgetary impact.

However, there is always some probability that the policy makers will decrease or increase the degree of the central bank independence. In particular, that probability may be higher with a high level of public debt that is accompanied with insufficient political power to cut the budget deficit. Thus, a deterioration of the fiscal deficit because of tight monetary policy might lead to erosion of the credibility macroeconomic policy. Thus credibility affects the size of budgetary effects of monetary policy and also could be affected by that size. A high level of public debt, a large budget deficit and a large share of short-term bonds are conditions under which it is more difficult to accumulate enough credibility to bring down inflation by monetary measures alone. It is possible that a tight monetary policy, under these conditions, leads to higher inflation environment rather than lower inflation.[16]

Nevertheless, it is also possible that a higher interest rate due to a tight monetary policy might work, under those conditions, more as threat and enforce the fiscal authorities to adopt budget discipline. As mentioned above the tight monetary policy has also a positive effect on the fiscal position; the market value of the government (both domestic and foreign)

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[16] Dahan and Strawczyski (1997) show that the level of public debt and size of budget deficit are important factors in the Israeli inflationary process.

debt falls in the short run as a result of a higher interest rate. That short-run positive effect couple with the possibility that a tight monetary policy triggers fiscal adjustment and that may contribute to pressure down inflation.

In addition, the behavior of the government regarding the debt management can reduce the interest payments by changing the composition of its debt. But such a reaction of the government might impair the conduct of monetary policy. For example, if the government responds to tight monetary measure by swapping domestic debt for foreign debt, it would increase the quantity of money. This kind of behavior is possible if the government has an access to the international market. Another example is swapping domestic long-term domestic bonds for short-term domestic bonds. Such a reaction function of the government reflects lack of policy coordination that may reduce the cost of monetary policy but at the same time reduces the effectiveness of monetary policy.[17]

It is likely that the reaction function of the government is influence (among other things) by the level of debt and its composition. Because the fiscal position is more vulnerable to tight monetary policy when the level of debt is relatively high, the government may not cooperate with monetary policy and even it tries to pressure the monetary policy maker(s) to abandon that policy. Obviously, in forming inflation expectations the public takes into account the reaction function of the government. It is not clear whether this kind of reaction which results in a combination of less fiscal expansion (minimization of interest payments) and less monetary contraction leads to higher or lower inflation expectations.

IV. CONCLUSIONS

This paper shows the various channels of influence through which the monetary policy may affect the government budget deficit. That provides a long list of factors that determine the size of the overall effect of monetary policy. These may include the level of public debt, the composition of the public debt, the importance of nominal stickiness, the elasticity of taxes with respect to output, the degree of openness, the sensitivity of the whole term structure of interest rates with respect to the interest rate that is influenced directly by monetary policy, the sensitivity of exchange rate expectations with respect to the nominal interest rate, the degree of credibility and the length of time that tight monetary measures are implemented and their extent.

These factors are organized under seven different effects: price effect, expenditure effect, revenue effect, debt effect, seigniorage effect, sterilization effect and swapping effect. Every single effect could be small yet the overall effect of monetary policy on the budget deficit could be relatively large. The overall impact of monetary policy measures on the budget

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[17]Laurens and de la Piedra (1997) discuss at length the issue of macroeconomic policy coordination.

deficit relies also on the 'political economy game' between the government and the central bank. That game is crucial for the degree of credibility and plays a major role in determining the size of budgetary cost. The revenue effect and the debt effect depend negatively on the degree of credibility whereas the sterilization effect (at least in the short run) depends positively on the degree of credibility.

It is important to point out that the flow effects of monetary policy are accompanied by a stock effect. A higher domestic interest rate may affect the budget deficit through the higher cost of servicing the exiting public debt (the debt effect) though, at the same time it tends to reduce the market value of domestic debt of the central government (excluding the central bank). Similar reasoning is true also for the sterilization effect. In assessing the overall impact of monetary policy measures on the fiscal position these capital gains should not be neglected.

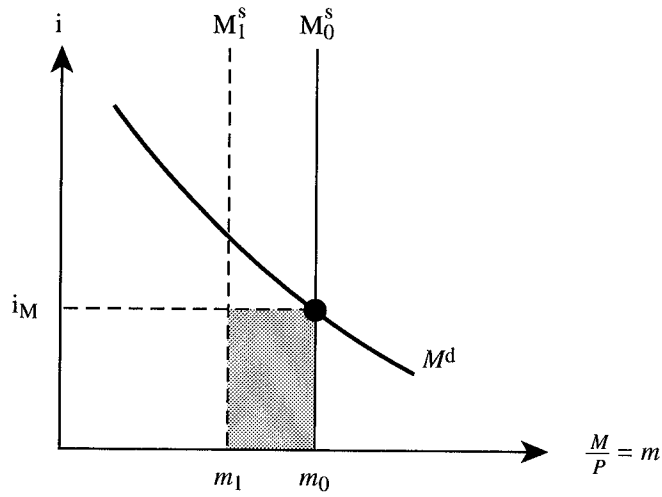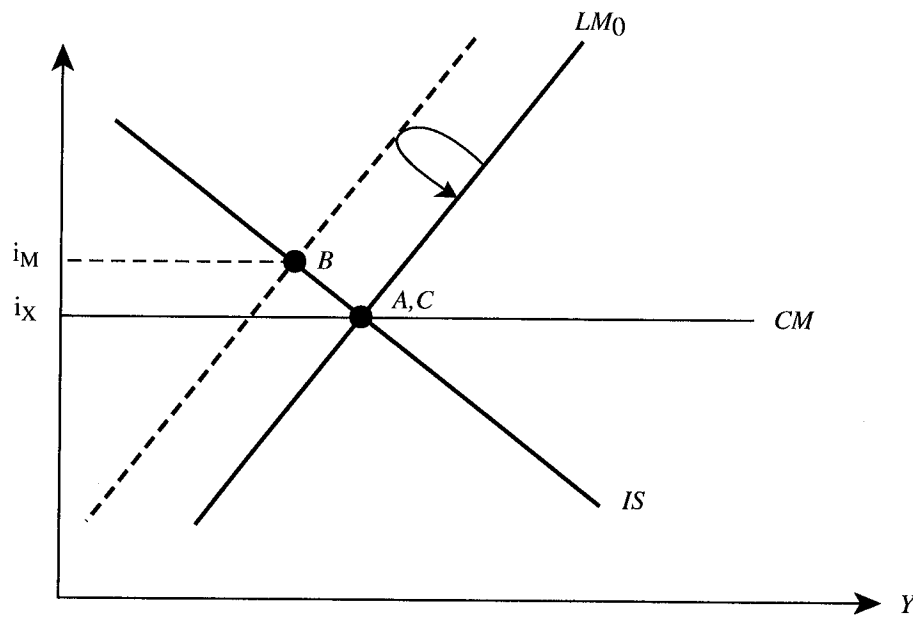## Figure 1: The seigniorage effect

Figure 2: The Sterilization effect

References

Blanchard, Olivier J. and Stanley Fischer, 1989, *Lectures on Macroeconomics*, The MIT Press, Cambridge, Massachusetts.

Calvo, Guillermo A., 1991, "The Perils of Sterilization," International Monetary Fund Staff Papers 38, pp 921-26 (Washington: International Monetary Fund).

_____, Leonardo Leiderman and Carmen M., Reinhart, (1996), "Inflows of Capital to Developing Countries in the 1990s," *Journal of Economic Perspective*, 10(2), Spring, pp. 123-39.

Dahan, Momi, and Michel Strawczynski, 1997, "Fiscal Policy and Inflation," Bank of Israel Discussion Papers No. 97.04.

Fischer Stanley, 1977, "Long Term Contracts, Rational Expectations and the Optimal Money Supply Rule," *Journal of Political Economy*, February.

Frenkel, A., Jeffrey, 1994, "Sterilization of Money Inflows: Difficult (Calvo) or Easy (Reisen)?," IMF Working Paper 94/159. (Washington: International Monetary Fund).

Laurens, Bernard and Enrique G. De la Piedra, 1997, "Coordination of Monetary and Fiscal Policies," IMF Working Paper (Washington: International Monetary Fund).

Mankiw, Gregory, 1985, "Small Menu Cost and Large Business Cycle: A Macroeconomic Model of Monopoly," *Quarterly Journal of Economics*, May.

Robinson, David J., and Peter Stella, 1987, "Amalgamating Central Bank and Fiscal Deficits," IMF Working Paper 87/93 (Washington: International Monetary Fund).

Sargent, J. Thomas and Neil Wallace, 1985, Ünpleasant Monetarist Arithmetic," *Federal Bank of Minneapolis Quarterly Review* 9 (1), Winter.

Stella, Peter, 1997, "Do Central Banks Need Capital?," IMF Working Paper 97/83 (Washington: International Monetary Fund).

Tanzi, Vito, Mario I. Blejer and Mario O. Teijerio, 1993, Effects of Inflation on Measurement of Fiscal Deficits: Conventional versus Operational Measures," in *How to Measure the fiscal Deficit*, ed. By Mario I. Blejer and Adrienne Cheasty (Washington: International Monetary Fund).

Tobin, James, 1987, "An Essay on the Principles of Debt Management," Volume 1: *Essays in Economics: Macroeconomics*, The MIT Press, Cambridge, Masschusetts.