Inflation Stabilization, Fiscal Deficits and Public Debt Management in Poland

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Abstract:

Poland edged towards hyperinflation towards the latter half of 1989, but inflation fell dramatically after drastic reforms were enacted in January of 1990. We analyse the consistency between fiscal deficits and inflation targets and assess Poland's domestic and foreign debt management policies and the impact of the Brady debt reduction agreement on the relationship between fiscal deficits and inflation. We also assess the impact of financial sector measures on seigniorage revenue and the sustainability of the low inflation strategy. Such policies are shown to have a direct impact on the sustainability of inflation targets.

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1 Introduction

Poland threatened to slide into hyperinflation in the second half of 1989, but the hyperinflation process was stopped abruptly during the first quarter of 1990. The inflation rate has since then been reduced to moderate levels. Inflation fell significantly from over 600 percent in 1989 to below 20 percent in 1996. This success has been sustained in later years.

Debt-management policies have played an important role in the macroeconomic stabilization package. The Polish debt rescheduling deal at the beginning of the 1990s successfully decreased the foreign debt burden and, together with the implementation of restrictive monetary policies, has removed the obstacles to achieving a sustainable fiscal balance. This process was supported by a substantial reduction in the non-interest fiscal deficit, mainly achieved through tax reform and the reduction of subsidies. All of this occurred while the link between monetary policy, exchange rates and inflation was shifting due to a process of financial sector reform implemented concurrently with the stabilization package. Many of these issues are familiar from other countries, thus making an analysis of the Polish case of wider interest.

In order to analyze this experience, we outline a simple framework which links inflation, fiscal deficits and public debt management and apply it to Poland. The framework is designed for environments that have sparse data and are undergoing structural change. It focuses on the interplay between interest rates, growth rates, and primary deficits in determining fiscal sustainability for different inflation targets. We pay special attention to the role of debt management and exchange rate policy and to the impact of financial sector reform on the relationship between asset demands, seigniorage and inflation.

The framework draws on the public finance approach to inflation pioneered by E. Phelps in the early 1970s (Phelps (1973)); his approach is also followed in the well-known analysis of the relationship between debt management, monetary policy and inflation of Sargent and Wallace (1981). This paper extends that approach by explicitly incorporating a commercial banking sector, which is a crucial factor in the understanding of the link between fiscal policy, money growth and inflation in many developing countries.

Section 2 describes the analytical framework and presents the calculations of the Polish real quasi-fiscal deficit for the consolidated government and Central Bank accounts. Section 3 presents the econometric estimates for financial assets demands. In section 4, the model underlying our analysis is assembled. It is then used for a detailed empirical analysis of the revenue

from seigniorage and its inflation dependence, and for an assessment of the fiscal stance in 1992, prior to the restructuring of external debt. Section 5 shows the impact of domestic and foreign debt management policies on the trade-off between inflation and fiscal deficits. It also describes the Polish foreign debt reduction agreement and assesses its impact on the inflation-fiscal deficits trade-off. Section 6 tackles a different issue, the impact of financial sector policies on the consistency between fiscal and monetary policies. Section 7 examines the situation in 1995/6 in comparison to 1992, the year before the debt and financial market reforms took hold. The last section pulls the results from the various sections together and concludes that fiscal and financial policies in Poland, supported by two effective international debt renegotiations, have succeeded in providing a sustainable low inflation environment. The relative ease with which Poland seems to have weathered the crisis engulfing many emerging market economies since the onset of the Asia crisis in1997 and the subsequent crash in Russia mid 1998 supports that finding.

2 Fiscal Deficits and Inflation

2.1 A methodological framework

This section presents a simple quantitative framework that links debt, deficits and inflation, incorporating enough details of the financial sector to assess the impact of financial sector policies on the link between those variables[1]. The focus is on medium term consistency, not on short term dynamics.

A starting point for the analysis is the government budget constraint:

$$D + iB + i^* B^* E = \dot{B} + \dot{B}^* E + \dot{C}_g \qquad (1)$$

A dot above a variable indicates absolute changes in that variable. i (i^*) is the interest rate on domestic (foreign) debt B (B^*). B^* is in foreign currency terms and E is the exchange rate (local currency units per foreign currency unit). D is the primary (non-interest) government deficit before consolidation of government and Central Bank accounts. C_g is (net) domestic credit of the Central Bank to the Government. On the left of the equation are the funding requirements: the

public sector primary deficit (D) plus the interest payments on the domestic (iB) and foreign debt ($i^*.B^*.E$). On the right are the different sources of financing: domestic debt issue (changes in B), foreign borrowing (changes in B^* expressed in local currency terms) and domestic credit to the government (changes in C_g). For presentational purposes we will assume that D is a policy parameter; in reality of course the government can control such variables only indirectly.

To establish the link between credit growth and base money creation, it is necessary to integrate the Central Bank (CB) with the fiscal authorities (Anand and van Wijnbergen,1989). For the sake of simplicity, consider a CB that extends only zero interest credit to the government (C_g) and holds net foreign assets (NFA^*) earning interest i^*. On the liability side of the balance sheet of this hypothetical CB, there is only the CB s net worth (NW) and base money M, which equals currency in circulation plus commercial bank deposits at the CB. Profits of such a simplified CB will consist of interest earnings on its foreign assets only. In reality, of course, the Central Bank will have other expenses and sources of income.

If one differentiates the CB s balance sheet and substitutes out the change in NW by using the fact that, in the absence of capital gains, current profits equal the CB s change in net worth, the budget constraint can be rewritten in the following way:

$$D + iB + i^*(B^* - NFA^*)E = \dot{B} + (\dot{B}^* - N\dot{F}A^*)E + \dot{M} \qquad (2)$$

Equation 2 represents the integrated budget constraint of the CB and the government. The equation indicates that integration of the Central Bank into the public sector requires a switch to a net concept of foreign debt, that is foreign debt B^* minus net foreign assets NFA^* of the Central Bank. The equation shows the three sources of financing open to the integrated public sector: domestic debt issue, net foreign debt financing and nominal base money growth.

Solvency considerations or other debt management objectives, and macroeconomic policy objectives such as targets for inflation and real growth lead to restrictions on these three sources of financing. The *financeable deficit* equals the maximum obtainable from these three sources given the restrictions just mentioned.

The precise point where debt levels begin to threaten solvency is of course difficult to determine, and anyhow *willingness to pay* may cut in earlier: (political) willingness to pay may be less than ability to pay. A conservative approach would take current debt-output ratios as a

benchmark: if at current levels the government still has access to capital markets, then at least the market's assessment is that at current levels the debt is within the limits set by ability and willingness to pay. It is moreover reasonable to take debt-output levels rather than absolute levels of debt as a benchmark since capacity to generate tax revenue is clearly closely related to the aggregate level of output. In this view, domestic and (net) foreign debt should not grow faster than the real resources available for its financing. Equation 3 indicates the restrictions on debt issue if this conservative approach is chosen and debt-output ratios should be kept constant (the model can accommodate different debt management strategies).

$$\Delta (B / P) = n (B / P)$$

$$\Delta(\frac{(B^* - NFA) E}{P}) = n (\frac{(B^* - NFA) E}{P}) \qquad (3)$$

With debt policy defined in terms of target debt output ratios, debt should in real terms not grow faster than real GDP, the growth rate of which is defined as *n*. Δ indicates the absolute change in the expression that follows (like a dot above a single variable). *P* is a price deflator.

Instead of using the limits on financing (the financeable deficit) to derive the primary deficit compatible with the targets and policies that underlie the funding restrictions, the actual value of *D* (or rather *d* , the primary deficit expressed as share of GDP) can be inserted into the budget constraint. In general the resulting funding requirement will then not be equal to the financeable deficit. We label the difference, expressed as a percentage of the GDP, *rdr*, for required deficit reduction. By using standard identities linking nominal changes in variables to corresponding real changes and inflation, expressing deficit and debt variables as a share of real income Y, and collecting terms, *rdr* equals:

$$rdr = [d + rb + (r^* + \hat{e})(b^* - nfa^*)e] - [nb + n(b^* - nfa^*)e + nm + pm] \qquad (4)$$

r and r^* stand for domestic and foreign real interest rates respectively, and e is the real exchange rate $P/(EP^*)$. Lower case variants of variables already defined as upper case indicate the corresponding ratios to the GDP. For example, b is the ratio of domestic debt to GDP, B/(PY); m is the monetary base expressed as a percentage of GDP; and so forth. π equals the inflation rate. A "^" above a variable indicates a percentage change.

The first term between square brackets on the righthandside of equation (4) stands for the actual public sector deficit and includes real interest payments on domestic and (net) foreign debt. The second term represents the financeable deficit using the two constraints for the growth rate of the domestic and foreign debt (it should not grow faster than the growth of the real resources available for its servicing) plus the resources collected through the increase in the monetary base (seigniorage). $(n+\pi)m$ equals the real value of the nominal increase in base money, $\Delta M/(PY)$.

Seigniorage revenues $(n + p)m$ in turn are a function of the inflation rate, reserve requirements, liquidity requirements, and asset demands. Under a fractional reserve system, demand for monetary base equals:

$$m = cu + \sum_i RR_i\, a_i \qquad (5)$$

The first component of the monetary base m is currency in circulation, cu. The second component represents commercial bank reserves held at the CB. If we ignore free reserves (reserves that commercial banks hold at the CB in excess of what they are required to), we can express reserves held at the CB as the product of the deposits held at the commercial banks times the required reserve ratios applying to those deposits. a_i are commercial bank deposits against which reserves have to be held at the Central Bank, again expressed as a share of GDP. RR_i are the respective reserve requirement ratios against these deposits.

To evaluate the relation between the monetary base and variables like inflation through use of equation (5), we have used a portfolio choice model of the demand for currency (cu), demand deposits (dd), time and savings deposits (sd), and foreign currency deposits (fd). In standard portfolio theory fashion, these asset demands are assumed to depend on the interest rates on the various deposits and inflation[2]:

$$a_i = f(p, i_{TD}, i_{FD}) \qquad (6)$$

The total demand for base money is then equal to:

$$m = f^{cu}(p, i_{TD}, i_{FD}) + \sum_i RR_i \quad f_i^a (p, i_{TD}, i_{FD}) \qquad (7)$$

The demand for base money as calculated through (7) is subsequently used to obtain seigniorage revenues for different inflation rates, real output growth rates, interest rates, and different regulatory policies. Seigniorage revenues *sr* are derived as:

$$sr = (p + n).m(p, i_{TD}, i_{FD}, RR_{D_i}, i_{RR_{Di}}) \qquad (8)$$

Base money growth and thus seigniorage is, for any inflation target, endogenously determined by the path of the primary deficit, debt policy, the real rate of interest, the financial structure (asset demands and the regulatory rules under which the banking system operates), and the growth rate of GDP. This framework is designed to indicate whether any given inflation target is consistent with the other policy parameters and structural characteristics of the economy. Alternatively, consistency can be imposed and, if done so, yields the inflation rate consistent with the current fiscal stance of the government, other policy variables, and the financial structure of the economy.

2.2 Calculation of the Polish real quasi-fiscal deficit

Table 1 presents calculations of the Polish quasi-fiscal deficit consolidating the government and CB accounts for 1992, 1995 and 1996.[3] Deficits were calculated from the financing side by calculating the increases in liabilities of the institutions involved. As far as interest rates on foreign debt were concerned, the only data available were actual interest payments. We have therefore calculated the implicit average interest rate on foreign debt derived from those actual payments.

Real domestic debt equaled 18, 14, and 16 percent of GDP[4] in 1992, 1995 and 1996, respectively. For 1992 we obtained a very negative (*ex post*) real interest rate on domestic debt, -22 percent; whereas for 1995 and 1996, the ex-post real interest rate became positive.[5]

.<insert table 1 here>

Table 1 shows a primary deficit to GDP ratio of 3.5 percent, and a 3.2 and 1.4 percent surplus in 1995 and 1996, respectively. The consolidated real fiscal balance amounts to a deficit of 0.72 percent of GDP in 1992, a surplus of 1.5 percent of GDP in 1995, and a deficit of 0.27 percent of GDP in 1996

3 Estimation of Asset Demands

Through the fractional reserve system, base money depends on demand for the various assets offered by the banking system and on demand for cash balances. We therefore begin with an econometric estimation of the demand functions for currency in circulation, demand deposits, time and savings deposits, and foreign currency deposits.

The sample period includes quarterly data from the fourth quarter of 1988 until the second quarter of 1997[6]. We have applied the one-step error correction method by regressing the first difference of each dependent variable on lagged dependent and independent variables, on differenced independent variables, and on constants, dummies and time trends in some cases[7] .

$$\Delta y_{i,t} = \lambda_i \, y_{i,\,t-1} + \delta_{i,j} \, z_{i,j,t-1} + \gamma_{i,j} \Delta z_{i,j,t} + \eta_{i,t} \; + \text{Dummies} \qquad (9)$$

In eq. 9 $y_{\,i,t}$ represents the vector of dependent variables (in our case these are various asset demands to GDP ratios); whereas $z_{\,,j,t}$ is the vector of explanatory variables (opportunity costs variables such as 3-month time deposit rate or domestic to foreign interest rate differential, inflation or nominal exchange rate depreciation), and dummy variables account for the price and foreign exchange liberalization at the beginning of 1990, and seasonal effects at the end of each year for the currency in circulation and demand deposits. We have four equations for all the financial asset demands (demand for currency, demand deposits, time and savings deposits, and foreign currency deposits), i=1,..,4, and j is the number of independent variables in each equation. Table 2 presents the results from the one-step error correction method for the aforementioned asset demands expressed as ratios to GDP. For a detailed description of the variables used in the regressions, see Annex 2.

<table 2 here>

The estimated parameters of the interest variables have the expected signs: a negative impact of time deposit interest rates on demand deposits, foreign currency deposits and currency in circulation, and a positive impact on time and savings deposits of the differential between interest rates on domestic time deposits and foreign interest rates. We also find a very significant and negative impact of changes in inflation on all domestic asset demands (currency, demand, time and savings deposits). Exchange rate depreciation enters positively in the demand for foreign currency deposits, which reflects currency substitution at play in response to nominal depreciation.

The second step in our analysis was to perform unit root tests for the estimated equations. To test for co-integration we performed the Wald test for the joined hypothesis that the coefficients of all lagged variables on the RHS are equal to zero[8].

The last step of our econometric analysis was to estimate the long-run parameters for the four equations. The estimates of long-run parameters are calculated as minus the coefficients of the lagged independent variables over the coefficient of the lagged dependent variables in every equation. Annex 2 shows the coefficients of the long run demands.

In the next section we use the estimated long-run coefficients of the explanatory variables (interest rates, inflation and exchange rate depreciation) to compute base money, seigniorage revenues and financeable deficits as a function of the rate of inflation.

4 Fiscal Consistency in 1992

In this section we discuss the impact of the inflation rate on financial asset demands, the monetary base, and revenue from seigniorage. Seigniorage revenues are derived as a function of the inflation rate, reserve requirements, liquidity requirements and estimated financial asset demands. The monetary base equals all interest-free- net public sector liabilities to the private sector. These liabilities are currency in circulation and commercial bank reserves held in the Central Bank, minus any claim the bank has on the non-government sector.

<table 3 here>

Table 3 shows the Laffer curve shape of seigniorage revenues and the inflation tax. The first five columns of Table 3 present the inflation rate and the corresponding demand for currency, demand deposits, time and savings deposits, and foreign currency deposits. The sixth column shows the monetary base for different inflation rates, given the minimum reserve requirements for various deposits in base year 1992, which were as follows: 23 percent for demand deposits, 10 percent for time and savings deposits, and 0 percent for foreign currency deposits. The final two columns present inflation tax and the revenue from seigniorage. The inflation tax is the product of the inflation rate and the monetary base; to obtain seigniorage, one adds the increase in demand for base money due to real growth to the inflation tax Interest paid on mandatory reserves should of course be subtracted from the total revenue from seigniorage. In 1992, however, mandatory reserves did not earn any interest.

In our simulations we have used an inflation range of 0 to 700 percent. . Any rise in the inflation rate (the inflation tax "rate") causes the real monetary base (the inflation tax "base") to fall. According to our econometric results, inflation tax and seigniorage revenue reach their maximum of 5.1 and 5.3 percent of GDP respectively at an inflation rate of 200 percent in Poland. For higher inflation rates, the negative impact of rising inflation on base money more than offsets the direct effect of the higher inflation rate itself on seigniorage. These estimates are in line with empirical estimates of the inflation dependence of inflation tax and seigniorage revenues for Latin American high-inflation countries. Clearly a real possibility exists for the government to use this revenue for deficit financing. However, inflation in Poland shows a pronounced downward trend from 1990 onwards. In 1992, our base year, the end-of year inflation rate was approximately 40 percent. Thus for 40 percent, the inflation tax and revenue from seigniorage is estimated at a still high 2.7 and 2.95 percent. These numbers are in line with the experience of other middle income countries, but are very high by the standards of countries with more advanced financial systems. Thus Poland should expect seigniorage revenues to fall for all levels of inflation as its financial sector progresses towards EU standards.

The fiscal situation as of 1992

In the late 1980s and early 1990s, Poland underwent a deep economic recession. Large fiscal deficits, financed mainly through direct CB lending, propelled the money printing process before stabilization of the economy was attempted in 1990. Table 4 assesses the fiscal stance in

the Polish economy for 1992. The underlying assumptions in our analysis are the following: a real GDP growth rate of 2.6 percent, a 44 percent base year inflation rate, an actual real deficit of 0.70 percent of the GDP, a -22 percent (*ex post*) real interest rate on domestic debt, a domestic debt to GDP ratio of 18 percent, a 2.3 percent interest rate on foreign debt, and a net foreign debt to GDP ratio of 55.7 percent.

<Table 4 here>

As discussed in the previous section, whenever the *rdr* is equal to zero, no fiscal correction is necessary; whereas if the *rdr* is positive, there is a gap between funding requirements and funding sources and a corresponding need for fiscal correction. We have calculated the financeable deficit and the *rdr* for an inflation range from 0 to 700 percent. For a 40 percent inflation rate in base year 1992, the *rdr* is already negative, in fact very much so; this means that the funding sources more than cover cover funding requirements; there are seemingly no fiscal inconsistencies at least with the actual inflation rate of that year (figure 1 below).

<insert figure 1>

The results thus seem to suggest that consistency between fiscal and monetary policy targets is achieved as of 1992. The actual situation was, however, less rosy. At issue is the fact that in 1992 both the domestic and the foreign debt carried interest rates far below market rates. Thus far, we have assumed that all debt coming due can be refinanced at the same below-market rate paid on average and *ex post* in 1992. For medium-term sustainability, however, an analysis which assumes full market interest rates on all debt is more plausible. We pursue this below.

5 Domestic and Foreign Debt Management

The impact of switching to full market interest rates on domestic debt

Obviously, the government cannot continue to issue new debt at the same below-market interest rates for an indefinite period: a sustainability analysis should assume that in the long run debt is refinanced at market terms. Therefore, we assess the impact of a transition to market

interest rates on foreign and domestic debt. Figure 2 outlines the step-by-step effect of raising the *real* interest rates on domestic and foreign debt to market levels which we assumed to be 5 percent (in real terms).

<figure 2 here>

<Table 5 here>

Table 5 presents step-by-step the impact of the transition to market interest rates on foreign and domestic debt on the *rdr*. The first column of the table shows the base case, using the *ex post* interest rates on domestic and foreign debt for 1992: -22 and 2.3 percent respectively. The second column starts calculating the impact of the transition to market rates by assuming a 5% real rate on the domestic debt while keeping the 2.3 percent interest rate on foreign debt.

At the base year inflation rate of 40 percent, the *rdr* measure rises from -6.9 to -1.95 percent. Thus such an increase in the real interest rate on domestic debt would reduce the financeable deficit significantly, but not enough to make the base year inflation rate unsustainable. This relative insensitivity to such large interest rate increases reflects the low level of domestic debt in that year.

The last column of Table 5 presents the *rdr* assuming a real interest rate of 5% on both foreign and domestic debt. A comparison between the two columns indicates a further increase of the *rdr* to -0.46 percent of GDP for the base year inflation rate of 40 percent. With these numbers, the equilibrium inflation rate from the point of view of achieving medium-term fiscal consistency turns out to be about 30 percent annually; at that inflation rate, the *rdr* equals zero. This may well be one reason why inflation in Poland has been so difficult to reduce to single digit levels.

Assessing the impact of the Polish Brady debt reduction agreement

On 21 April 1991 the Polish government reached an agreement with its Paris Club creditors to reduce their claims by 50 percent in net present value terms. This was to occur in two stages: 30 percent at the beginning of stage one, on 1 April 1991, and 20 percent on 1 April, 1994 upon successful completion of an IMF program. An additional precondition for stage 2 was the conclusion of a similar agreement with private creditors (the so called London club). In fact even the benefits of stage 1 were to be withdrawn unless 50% debt reduction would be achieved

in the London club negotiations. Part of the 30 percent reduction in the first stage would be achieved through an 80 percent reduction of interest payments due by Poland to all participating creditor countries before any reduction in principal.

To assess the impact of the first step of the debt reduction on *rdr* and sustainable inflation, we proceed in a two-step fashion[9]. Of course one should realize that the deal not only reduced the amount of outstanding debt, but also implied a switch to market interest rates for the remaining debt. The impact of that switch, unavoidable but obviously detrimental to the fiscal stabilization effort, is analyzed in the first step. Second, we calculate the impact on *rdr* of reducing the debt from its ratio prior to the debt deal, 82% of GDP, to the 1992 ratio, 55.7%.

<Table 6 here>

The first column of Table 6 presents the *rdr*, for different inflation rates, based on the foreign debt to GDP ratio of 82 percent that prevailed prior to the debt deal.. The column thus represents the situation prior to the debt deal. The second column presents the *rdr* ratio using the pre-deal value for the foreign debt to GDP but assuming a switch to market rates (taken to be 5%). The third column presents the *rdr* using (A) a foreign debt to GDP ratio of 55.7 percent, and (B) a market interest rate of 5 percent on what remains owed. If we compare the last two columns we can assess the pure debt reduction part of the debt deal: the macroeconomic impact is of course strongly favorable, the *rdr* becomes negative for all (positive) inflation rates.

Comparison of the first and the third columns reveals the <u>total impact</u> of the debt deal. For example, for the base year 40 percent inflation, the net benefit of the debt reduction is a <u>decline</u> in the *rdr* from 1.8 to -0.46 percent of GDP. This decline will bring fiscal consistency. At 10 percent inflation, the *rdr* also falls, from 3.5 to 1.3 percent of GDP.

Figure 3 presents the impact of the debt reduction achieved under the deal graphically.

<Figure 3 here>

Overall we can conclude that the upfront debt reduction agreed with the Paris club of creditors has had a direct positive impact on inflation - fiscal deficit trade-offs and that it has removed the fiscal imbalances within the Polish economy, at least for inflation rates above 20 percent.

The impact of real exchange rate changes

Real exchange rate developments have a major impact on the cost of servicing the foreign debt and ultimately on financeable deficits and the *rdr*. In 1990 Poland fixed the exchange rate against a basket of the dollar and the DM; one year later in 1991, it switched to a crawling peg against the same basket. In 1992, Poland experienced a real exchange rate appreciation of 5.6 percent.[10] In 1995, the exchange rate system was modified once again by the introduction of an exchange rate band of plus and minus 7 percent around a central peg, which itself continued to crawl. These adjustments of the exchange rate system were made to prevent further appreciation of the domestic currency and avoid harmful effects on external competitiveness. However, taking into account the high foreign debt burden, we show that the initial exchange rate appreciation did have positive effects on the fiscal effort because it decreased the necessary fiscal adjustment for any given inflation rate.

<Table 7 here>

The table shows the impact on the *rdr* measure of different rates of real exchange rate depreciation, starting with an appreciation of 5.6 percent (the base case) down to 0 percent and further down to a 5 percent real depreciation. It is clear from the table that real exchange rate depreciation raises the required deficit measure for all inflation rates by a substantial measure and thus exacerbates any consistency problem that may exist. The capital losses on foreign debt associated with real exchange rate depreciation thus complicate stabilization policy.

The impact of delayed fiscal adjustment

What would the effect on the *rdr* be if the government would decide to finance the gap between financeable and actual deficits through debt accumulation rather than closing it through fiscal adjustment? Table 8 presents the impact of delayed fiscal adjustment at the 1992 growth rate (2.6 %), and at the 1995 real GDP growth rate (6%).

The comparison illustrates that the debt accumulation process depends crucially on the difference between the real interest rate and the real growth rate. Whenever the real interest exceeds the growth rate, delaying fiscal adjustment creates a greater adjustment problem later, as the first two columns of Table 8 show. Thus, at a 0% inflation target (third and fourth column), postponing the fiscal adjustment necessary to reach that target leads to a rise in the cumulative

measure of the *rdr* for this six-year period, be it marginally, from 2.2 to 2.55 percent of the GDP at the end of that period.

<Table 8 here>

The first and third columns indicate the impact of a real growth rate increase from 2.6 to 6 percent growth in the base year on the cumulative *rdr*. First, higher GDP growth increases seigniorage revenues and will therefore decrease the *rdr* at 0 percent inflation from 2.2 to 0.6 percent of GDP. Second, higher real GDP growth will decrease the cumulative measure of the *rdr* after six years from 2.6 to 0.5 percent of GDP; this may seem anomalous at first sight. However, the high growth rate of 6% actually exceeds the real interest rate on domestic and foreign debt; thus postponing adjustment actually creates more rather than less borrowing room (compare columns three and four in the table). Of course this somewhat mechanical analysis depends crucially on the assumption that delaying fiscal adjustment will not lead foreign lenders to charge higher interest rates.

6 The impact of financial sector measures on the Fiscal Policy Stance

Changes in (the regulation of) the financial sector have an impact on money demand and thus on seigniorage; and from there on the *rdr* measure. In 1993 minimum reserve requirements of 1 percent on foreign currency deposits were introduced. Further changes have been a decrease of the reserve requirements for demand deposits from 23 to 20, and for savings zloty deposits from 10 to 9 percent. The channel through which such measures affect the financeable deficit and the *rdr* measure is through their impact on the demand for reserve money and from there on seigniorage revenues for any given inflation rate.

<Table 9 here>

Table 9 portrays the impact of a change in minimum reserve requirements on seigniorage revenue. A comparison between the second and third columns shows the effect of introducing a 1 percent minimum reserve requirement against foreign currency deposits. In this case, the changes in the *rdr* do not depend on inflation. This is due to the fact that these reserves are held in foreign currency themselves; reserves held in foreign currency yield an implicit tax proportional to foreign inflation only, which we assume to be 2 percent and independent of domestic inflation.

A decrease of reserve requirements against demand deposits from 23 to 20 percent, and of savings deposits from 10 to 9 percent, does affect the inflation dependency of signiorage

revenues: for example the maximum seigniorage falls from 4.6 to 4.3 percent of GDP. For the 1992 inflation rate of 22 percent, seigniorage revenue falls from 2.95 to 2.85 percent of GDP. Table 10 shows the impact of a change in minimum reserve requirements and of paying interest on the mandatory reserves on the *rdr* for various inflation rates.

<Table 10 here>

A comparison of the second and third columns shows the impact of introducing an 11 percent interest rate on mandatory reserves on the *rdr* ratio. The effect of this policy is straightforward: the revenues from seigniorage remain unchanged, but a part is used to pay interest on the mandatory reserves. This implies that for the same inflation rate and the same minimum reserve requirements, there are fewer resources available for deficit financing. At a 0 percent inflation rate, the *rdr* rises from 2.2 to 2.55 percent of the GDP. If we compare the third and fourth columns of Table 10, we see the impact of a decrease of minimum reserve requirements on domestic currency deposits on the required deficit reduction: the *rdr* increases slightly.

7 The Consistency of Fiscal Policy, Debt Management and Inflation Targets in 1995-1996

Foreign debt reduction contributed to the process of inflation stabilization and has provided alternative sources for deficit financing by opening up foreign capital markets again. In addition, a gradual decrease in the primary deficit, resulting in a surplus from 1993 onward was the other important component of the stabilization package that helped to contain inflationary pressures and gradually led to lower inflation.

In this section we evaluate the success of these measures by comparing the *rdr* measure for 1992, 1995 and 1996 (see Table 11). We have constructed this table as follows. The first column lists inflation rates from 0 to 500 percent. The second column presents the model results for the base year 1992. The third column recalculates the model using 1995 as a base year, and the last column uses 1996 as a base year.

<Table 11 here>

Annex 1 lists the assumptions under which we construct the model for each base year. The most important year-to-year changes are (a) a switch from a 3.5 percent primary deficit in 1992 to a 3.2 and 1.4 percent primary surplus in 1995 and 1996 respectively; Poland was very successful both in reducing expenditures (especially subsidies) and maintaining fiscal revenues.[11]

(b) the remarkable increase in the real GDP growth rate from 2.6 percent in 1992 to 6.5 percent in 1995 and 5 percent in 1996, and (c) a relatively low interest rate burden due to external debt renegotiation and capable domestic macroeconomic policies.

Falling primary deficits, together with the reduction of interest costs on foreign debt, and the successful development of domestic debt markets, allowed for a relatively quick drop in inflation rates from triple digits down to moderate levels. Renewed access to international capital markets, coupled with the successful development of a domestic debt market and permanent cuts in the primary deficit, allowed Poland to substantially reduce its reliance on money creation for deficit financing. Poland has achieved fiscal sustainability and has been relatively successful in stabilizing inflation; inflation is now (1998) approaching single digit levels.

8 Conclusions

Poland was on the brink of hyperinflation at the end of 1989, but was able to abruptly halt the process after the price liberalization in January of 1990. Since early 1990 inflation has been reduced to close to single digit levels in 1998. As in most countries where debt markets are non-existent or are in their infancy, fiscal deficits broadly defined have played an important role in the monetary process that has fuelled inflation. Therefore the consistency between fiscal and monetary policies is critical to the effectiveness of any anti-inflation strategy. Moreover, Sargent and Wallace (1981) demonstrated that in the presence of borrowing constraints, the failure to establish such a consistent set of fiscal and monetary policies may have an impact on inflation long before any such borrowing constraint becomes binding.

We construct a simple model that links inflation, fiscal deficits and public debt management. This model may be used in two ways: (a) to derive financeable deficits and the *rdr* (required deficit reduction) necessary for consistency between given output growth rates, inflation targets and target debt-output ratios, or (b) to obtain the equilibrium inflation rate for which no fiscal adjustment need occur. It has been designed to be applicable in environments with sparse data; in fact, like the famous monetary approach model used routinely by the IMF, it requires only money demand functions for the various components of M2. A careful econometric analysis showed that stable long-term relationships could be extracted from Polish data despite the turbulent period over which data were available.

The application of the model to the budget situation of 1992 showed consistency between inflation targets and fiscal policy in that year, but only because the interest rates paid on the external debt were far below market rates. This indicated that the fiscal balance achieved at that time was unsustainable since new debt would not be available at such terms. We then indicate how the external debt restructuring in the following years and various measures concerning the banking system contributed towards bringing the fiscal policy in line with inflation targets on a more sustainable basis.

This analysis is of interest in its own right, beyond the specific application to Poland, as an application of a framework explicitly incorporating the commercial banking system into an analysis of the relation between fiscal deficits and inflation. The discussion also contains relevant lessons for other countries that are in similar stages of reform and stabilization.

For example the Polish debt rescheduling deal initiated at the beginning of the 1990s successfully decreased the foreign debt burden (the ratio of foreign debt to GDP fell from 83% in 1990 to 33% in 1996). We show that this has played an important role in making the Polish anti-inflation drive sustainable. Because runaway inflation is a major factor hampering economic growth, the impact of debt restructuring on the fiscal sustainability of low inflation targets is a key channel through which debt reduction has contributed to the restoration of economic growth in Poland.

The analysis also indicates the importance of financial sector measures for the structure of money demand and consequently for the basis of the inflation tax and the revenues it will yield. An important lesson is that every major financial reform effort should be accompanied by a macroeconomic analysis focusing on the consequences for fiscal policy of the reform measures under consideration.

Another noteworthy point revealed by the analysis is the high cost of postponing fiscal adjustment in an environment of high interest rates and low economic growth. Delays in making fiscal adjustments under such circumstances will lead to a rapidly escalating debt burden and eventually to much higher inflation rates. A final warning concerns Polands relatively high level of seigniorage and inflation tax revenues for any given inflation rate; these are in line with the experience of other middle income countries, but are very high by the standards of countries with more advanced financial systems. Thus Poland should expect seigniorage revenues to fall for all levels of inflation as its financial sector progresses towards EU standards.

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Annex 1. Calculation of the base year parameters

<insert the table about here>

Annex 2. Data and Variables Definitions and Stationarity Tests

List of abbreviations:

D - nominal primary deficit

B (B^*) - domestic (foreign) government debt

i (i^*) - nominal interest rate on domestic (foreign) debt

r (r^*) - real interest rate on domestic (foreign) debt, accounting for domestic (foreign) inflation

E (e) - nominal (real) exchange rate, Polish zloty per 1 USD

DC_g - direct CB credit to the government

NFA^* - net foreign assets, in USD

M - base money (currency outside banks and commercial banks' obligatory reserves)

P - domestic price level

n - real output (GDP) growth rate

π - domestic inflation rate

Y - the real output (GDP)

NW - net worth of the CB

e – hat - real exchange rate depreciation

d - real primary deficit to GDP ratio

b (b*) - real domestic (foreign) debt t GDP ratio

nfa^* - real net foreign assets to GDP ratio

m - real base money to GDP ratio

Cu - currency in circulation

Di - commercial bank deposits against which obligatory reserves are required by the CB

RR_{Di} - mandatory reserve requirements of the CB against various commercial banks' deposits

A_i - demands for various financial assets

Variables definition: Sample period: 1989:1 - 1997.2; possible break at 1990:1

NBP - National Bank of Poland;

RDR - required deficit reduction

CU-currency in circulation

DD- demand deposits

HD - time and saving deposits in Zloty

FD - foreign currency deposits

itd3 - three month time deposits rate of the commercial banks

AP - annualized inflation rate

AE - annualized nominal exchange rate depreciation

FI - London offer rate on one month dollar deposits

Y88- index of real industrial production

LCUY=log(CU/CPI)-log(Y88); LDDY=log(DD/CPI)-log(Y88);

LHDY=log(HD/CPI) -log(Y88); LFDY=log(FD/CPI) - log(Y88);

LITD3=log(1+itd3/100); LFI=log(1+fi/100)+ae

ae=4*log(exr/exr(-1)); ap=4*log(cpi/cpi(-1)); FID3=LITD3-LFI

Dummies:

d901=1 after the first quarter of 1990, price liberalization

q901 =1 for the first quarter of 1990, price and foreign exchange liberalization

D4 =1 for the last quarter each year; measures some seasonal effects in currency in circulation and demand deposits

Q951 = 1 for the first quarter of 1995

Table A.3 presents unit root tests performed on the dependent and independent variables in **(1)**, using the Augmented Dickey-Fuller test on stationarity (a) with and (b) without constant, using four lags in both cases. If the estimated ADF statistic is smaller than the critical value, we reject the presence of a unit-root and conclude that the variable has been stationary. The critical values at the three significance levels of 10%, 5% and 1% were considered.

Annex 3: Coëfficiënt Stability and the Use of Pre-Transition Data

To assess whether we can include pre-transition data in our sample period, we first check if there is a long-run relationship between the variables including the pre-transition data. All the series are integrated of order one, which means that their first differences are stationary. Table A.3 presents the results from the ADF tests on the individual variables used in our regression. Since all the variables are integrated of the same order, this is an indication that a long run relationship between them does exist.

We then perform a one-step error correction estimation of the demand for various financial assets. Merely running the regression in first differences would imply omitting a potentially important explanatory variable, the error correction term. These terms are presented by lagged dependent and independent variables. We have estimated the portfolio model for the total sample, including pre-transition data. However, we have used dummy variables to properly account for the impact of the price and foreign exchange liberalization.

We also check whether this is indeed the long-run relationship, or if the variables are co-integrated. Boswijk and van Dijk (1996) propose the use of the F statistics from a Wald test on the coefficients of the lagged variables in levels, which are included in the long-run co-integrating relationship times the number of the coefficients.

All the estimated equations except the demand deposits equation passed the test for stationarity. This can be seen immediately from their p-values. Small sample size could be an explanation for accepting the unit root hypothesis in the case of the demand for demand deposits. Stationarity tests tend to be biased towards acceptance of the unit root in small samples.

Next we estimate of demand for various financial assets using post-transition data only. Table A.6 shows the results. These are reasonable: we obtain a negative impact of inflation on the demand for currency and demand for savings deposits, a negative impact of the time deposits interest rate on the demand for demand deposits, a positive coefficient of domestic to foreign interest differential on the demand for savings deposits, and a positive coefficient of the nominal currency depreciation rate on the demand for foreign currency deposits.

We also show the tests for stationarity of the residuals performed on the post-transition data. Table A.7 shows the Wald test on the long-run coefficients and the statistics suggested by Boswijk and van Dijk (1996). We also provide critical values of these statistics. As shown in the table, we cannot reject the unit root for all the equations. Of course the small sample bias towards accepting unit roots is even more of issue here since the sample size is even smaller now.

Finally we compare the long-run coefficients obtained from both the total and the shorter sample periods. The results are presented in table A.8. As shown in the table, the results for the long-run coefficients obtained from using the total sample accounting for price and foreign trade liberalization are very similar to the coefficients obtained by using only post-liberalization data. Since the co-integration hypothesis applies to the results obtained using the longer time period, and the relevant long run results are anyhow similar under both approaches, we have chosen to work with the results obtained using the entire sample period.

Figure 1 Financeable Deficit and Inflation for 1992

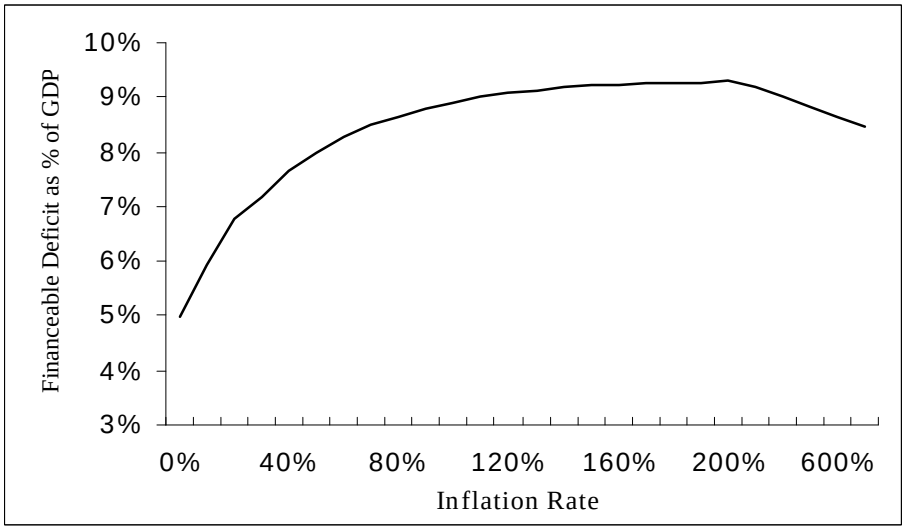


Figure 2 The impact of switching to market interest rates on public sector debt

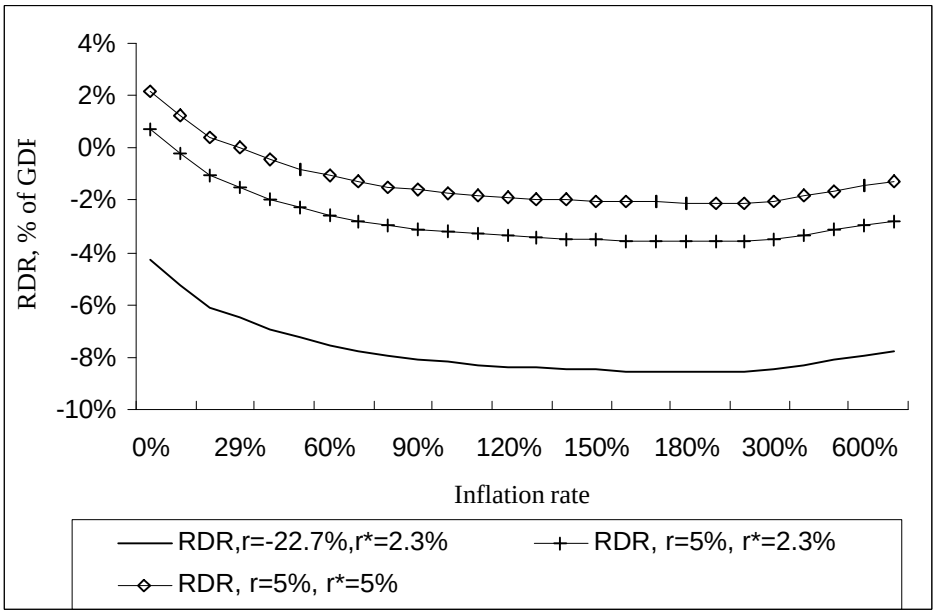
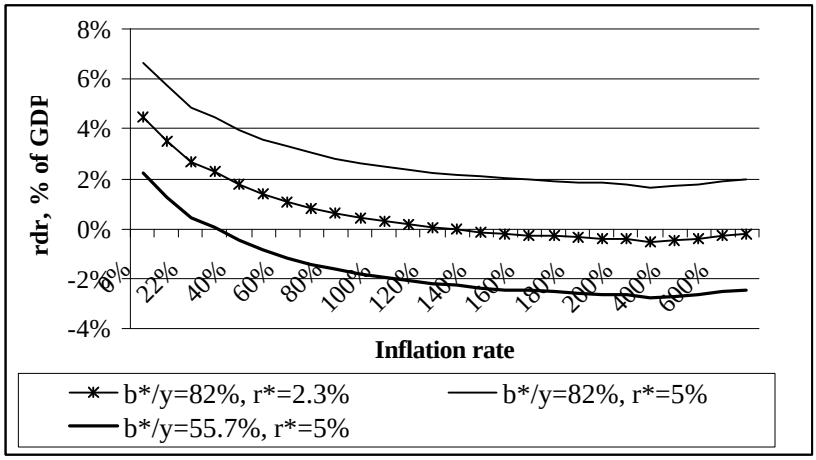


Figure 3 The impact of foreign debt reduction on *RDR*



Tables

Table 1
Real quasi-fiscal deficit to GDP ratios for 1992, 1995 and 1996

	1992	1995	1996
Primary deficit to GDP	3.5%	-3.2%	-1.40%
Public debt to GDP	73.7%	51.7%	50.1%
Real b/y	18%	14.35%	16.35%
πb/y	7.9%	3.2%	3.02%
r, real int on b/y	-22.7%	4.28%	0.90%
b*/y	55.74%	37.39%	33.75%
r* on b*/y	2.33%	2.72%	4.52%
Operational deficit to GDP	0.72%	-1.5%	0.27%

Sources: NBP Monthly Bulletins, World Bank data

Table 2 Estimates of the financial sector portfolio model for the Polish Economy

D(LCUY) = -0.44 + 0.56*Q901 - 0.24*LCUY(-1) - 0.20*AP(-1) - 0.007*T - 0.25*(D901*D(AP)) - 0.03*D4 + 0.15*Q951

(- 1.1) (2.87) (- 1.46) (- 3.6) (- 2.45) (- 3.93) (- 0.72) (1.56)

R^2 = 0.61 DW = 1.68

D(LDDY) = -0.74 + 0.07*D901 - 0.31*LDDY(-1) - 0.32*LITD3(-1) - 0.006*T - 0.49*D(LITD3) + 0.14*D4

(- 1.87) (0.83) (- 2.06) (- 0.97) (- 1.47) (- 1.84) (2.46)

R^2 = 0.38 DW = 1.57

D(LHDY) = -0.51 - 0.29*LHDY(-1) - 0.18*AP(-1) + 0.065*FID3(-1) - 0.18*D(AP) - 3.39*(Q901*D(AP))

(- 3.01) (- 3.15) (- 1.79) (0.86) (- 3.02) (- 3.29)

R^2 = 0.74 DW = 1.54

D(LFDY) = - 0.37 - 0.13*LFDY(-1) + 0.096*AE(-1) + 0.29*D(AE) - 0.18*(D901*D(AE)) - 0.46*(D901*D(LITD3))

(- 2.34) (- 1.98) (4.13) (15.23) (- 4.58) (- 1.93)

R^2 = 0.90 DW = 2.11

Table 3 Asset demands, inflation tax and seigniorage revenue (as % of GDP) for various inflation rates

Inflation	Demand for:				M_0	πM_0	$(\pi+n)M_0$
	Currency	Deposits					
		Demand	Savings	Foreign Currency			
0%	7,48%	7,27%	14,13%	5,77%	10,56%	0,00%	0,27%
22%	6,34%	5,96%	12,54%	6,67%	8,96%	1,78%	2,04%
40%	5,65%	5,19%	11,55%	7,38%	8,00%	2,70%	2,95%
60%	5,06%	4,54%	10,66%	8,14%	7,17%	3,40%	3,63%
80%	4,58%	4,04%	9,93%	8,87%	6,50%	3,88%	4,11%
100%	4,20%	3,63%	9,32%	9,57%	5,97%	4,22%	4,44%
150%	3,49%	2,91%	8,16%	11,27%	4,97%	4,71%	4,92%
200%	2,99%	2,42%	7,31%	12,87%	4,28%	4,95%	5,14%
300%	2,36%	1,82%	6,15%	15,88%	3,39%	5,08%	5,26%
500%	1,68%	1,21%	4,82%	21,35%	2,44%	4,98%	5,14%
700%	1,32%	0,91%	4,06%	26,34%	1,94%	4,80%	4,94%

Table 4 Financeable deficit, actual deficit and *RDR* to GDP ratios for various inflation rates

Inflation rate	Financeable Deficit	Actual Deficit	Required Deficit Reduction
0%	4,98%	0,72%	-4,26%
10%	5,90%	0,72%	-5,18%
22%	6,74%	0,72%	-6,02%
29%	7,16%	0,72%	-6,44%
40%	7,65%	0,72%	-6,93%
80%	8,81%	0,72%	-8,09%
150%	9,62%	0,72%	-8,90%
300%	9,96%	0,72%	-9,24%
500%	9,84%	0,72%	-9,12%

Table 5 Switching to market interest rates on domestic debt and RDR to GDP ratios

Inflation rate	Required Deficit Reduction		
	rr= -22% rr*=2.3%	rr=5% rr*=2.3%	rr= 5% rr*=5%
0%	-4,26%	0,72%	2,21%
10%	-5,18%	-0,20%	1,29%
22%	-6,02%	-1,04%	0,44%
29%	-6,44%	-1,46%	0,03%
40%	-6,93%	-1,95%	-0,46%
80%	-8,09%	-3,11%	-1,62%
150%	-8,90%	-3,92%	-2,43%
300%	-9,24%	-4,26%	-2,77%
500%	-9,12%	-4,14%	-2,65%

Table 6 Assessing the impact of foreign debt reduction

Inflation rate	Required Deficit Reduction		
	b*/y=82% rr=5% rr*=2.3%	b*/y=82% rr=5% rr*=5%	b*/y=55.7% rr= 5% rr*=5%
0%	4,46%	6.65%	2,21%
10%	3,53%	5.72%	1,29%
22%	2,69%	4.88%	0,44%
29%	2,27%	4.46%	0,03%
40%	1,78%	3.97%	-0,46%
80%	0,63%	2.82%	-1,62%
150%	-0,19%	2.00%	-2,43%
300%	-0,53%	1.66%	-2,77%
500%	-0,41%	1.78%	-2,65%

Table 7 The impact of real exchange rate depreciation

Inflation rate	Required Deficit Reduction		
	e= -5.6 % (Base case)	e=0 %	e=5 %
0%	2,21%	4,40%	7,17%
22%	0,44%	2,65%	5,42%
40%	-0,46%	1,75%	4,52%
150%	-2,43%	-0,19%	2,59%
300%	-2,77%	-0,50%	2,27%
500%	-2,65%	-0,36%	2,41%

Table 8 The impact of higher output growth and a delayed fiscal adjustment

Inflation rate	Required Deficit Reduction			
	n=6.5 %		n=2.6 % (Base case, 1992)	
	now	after 6 years	Now	after 6 years
0%	0,58%	0,53%	2,21%	2,55%
22%	-1,16%	-1,06%	0,44%	0,51%
40%	-2,06%	-1,88%	-0,46%	-0,53%
150%	-3,96%	-3,62%	-2,43%	-2,80%
300%	-4,26%	-3,89%	-2,77%	-3,20%
500%	-4,11%	-3,75%	-2,65%	-3,06%

Table 9 The impact of financial sector reform on the seigniorage revenue

Inflation rate	Seigniorage Revenue		
	RR_{DD}=23%RR_{TD}=10% RR_{FD}=1%	RR_{DD}=20%RR_{TD}=9% RR_{FD}=1%	RR_{DD}=23%RR_{TD}=10% RR_{FD}=0% (base case)
0%	0,28%	0,27%	0,27%
22%	2,05%	1,98%	2,04%
40%	2,95%	2,85%	2,95%
150%	4,93%	4,76%	4,92%
200%	5,15%	4,97%	5,14%
300%	5,27%	5,09%	5,26%
500%	5,16%	4,98%	5,14%

Table 10 The impact of financial sector reforms on *RDR*

Inflation rate	Required Deficit Reduction			
	RR_{DD}=23% RR_{TD}=10% RR_{FD}=1% iRR=0%	RR_{DD}=23% RR_{TD}=10% RR_{FD}=1% IRR=11%	RR_{DD}=20% RR_{TD}=9% RR_{FD}=1% iRR=11%	RR_{DD}=23% RR_{TD}=10% RR_{FD}=0% iRR=0% (base case)
0%	2,21%	2,55%	2,52%	2,21%
22%	0,44%	0,73%	0,77%	0,44%
40%	-0,47%	-0,21%	-0,14%	-0,46%
150%	-2,44%	-2,28%	-2,13%	-2,43%
300%	-2,79%	-2,67%	-2,50%	-2,77%
500%	-2,67%	-2,59%	-2,42%	-2,65%

Table 11 The Required Deficit Reduction and Inflation rate for 1992, 1995 and 1996

Inflation rate	Required Deficit Reduction		
	1992	1995	1996
0%	2,21%	-2,75%	-0,72%
22%	0,43%	-4,46%	-2,29%
29%	0,02%	-4,87%	-2,66%
150%	-2,27%	-7,08%	-4,71%
200%	-2,43%	-7,24%	-4,85%
300%	-2,46%	-7,26%	-4,88%
500%	-2,21%	-7,02%	-4,68%

Tables from Annexes

Table A.1 Monetary base, inflation tax and seigniorage

Poland	1992	1995	1996
π, inflation rate, %	44,4	22	18,5
N, Real GDP growth rate, %	2,6	6,5	5
μ, base money growth rate, %	30,6	34,1	18,4
M0/y, adjusted for end of year inflation, %	8	9,05	7,85
πM0/Y, inflation tax, %	2,7	2,15	1,5
SR/Y, Gross seigniorage, % of GDP	3,4	2,91	1,6

This table is based on authors' calculations of data from IFS statistics.

Table A.2 Base year parameters calculation

	1992	1995	1996
Real CU/GDP	5.65%	6.18%	6.01%
Real DD/GDP	5.19%	5.64%	6.56%
Real HD/GDP	11.55%	14.44%	15.88%
Real FD/GDP	7.38%	6.74%	5.97%
Time deposits' interest rate	43%	22%	20%
Forex deposits' interest rate	5%	5%	5%
Interest on reserves in Zloty	0%	11%	11%
Reserve requirements on demand deposits	23%	20%	17%
Reserve requirements on time and savings deposits	10%	9%	9%
Reserve requirements on forex deposits	0%	1%	2%
Primary deficit to GDP ratio	3.5%	-3.2%	-1.40%
Foreign debt interest rate	2.3%	2.7%	4.52%
Real foreign debt to GDP ratio	55.7%	37.4%	33.7%
Real interest rate on domestic debt	-22%	4.28%	0.90%
Real domestic debt to GDP ratio	18%	14.35%	16.35%
Total Public Sector Deficit (OD/P*Y)	0.72%	-1.4%	0.27%

This table is obtained by authors calculations from data from Polish National Bank bulletins and Annual reports, as well as IFS and World Bank data.

Table A.3 Determination of the order of integration of the individual time series

ADF tests	***LCUY***	***LDDY***	***LSDY***	***LFDY***	Log(1+ i)	FID	π	E
Levels	0.62	0.33	-0.92	0.91	-0.57	-3.16	-2.73	-3.27*
First	-	-	-4.35***	-6.49***	-6.05***	-	-	-
Differences	3.66***	3.10***				8.85***	5.87***	9.88***

Test Augmented Dickey-Fuller test statistic using 4 lags of a variable, or including a constant, or including a constant and trend. *, ** and *** imply rejection of H0 that the variable contains a unit root at significance levels of 10%, 5% and 1%, respectively.

Table A.4 Estimates of the financial sector portfolio model for the Polish Economy

D(LCUY) = -0.44 + 0.56*Q901 - 0.24*LCUY(-1) - 0.20*AP(-1) - 0.007*T –

(- 1.1) (2.87) (- 1.46) (- 3.6) (- 2.45)

-0.25*(D901*D(AP)) - 0.03*D4 + 0.15*Q951

(- 3.93) (- 0.72) (1.56)

R^2 = 0.61 DW = 1.68

D(LDDY) = -0.74 + 0.07*D901 - 0.32*LDDY(-1) - 0.32*LITD3(-1) - 0.006*T - 0.49*D(LITD3)

(- 1.87) (0.83) (- 2.06) (- 0.97) (- 1.47) (- 1.84)

+ 0.14*D4

(2.46)

R^2 = 0.38 DW = 1.57

D(LHDY) = -0.51 - 0.29*LHDY(-1) - 0.18*AP(-1) + 0.065*FID3(-1) - 0.18*D(AP) –

(- 3.01) (- 3.15) (- 1.79) (0.86) (- 3.02)

-3.39*(Q901*D(AP))

(- 3.29)

R^2 = 0.74 DW = 1.54

D(LFDY) = - 0.37 - 0.13*LFDY(-1) + 0.096*AE(-1) + 0.29*D(AE) - 0.18*(D901*D(AE)) –

(- 2.34) (- 1.98) (4.13) (15.23) (- 4.58)

-0.46*(D901*D(LITD3))

(- 1.93)

R^2 = 0.90 DW = 2.11

Table A.5 Wald tests for H_0 being no-cointegration hypothesis for the total sample

	D(LCUY)	D(LDDY)	D(LTDY)	D(LFDY)
n, # restrictions	2	2	3	2
F-Statistics**	7.29	2.6	13.6	10.1
ξ =nF	14.5	5.2	40.8	20.2
Critical values*	ξ = 14.91	ξ = 14.91	ξ = 14.93	ξ = 12.22

*The critical values are taken from Boswijk and van Dijk (1996) and are for a 0.10 level of significance.

Table A.6 Estimates of the financial sector portfolio model for the Polish Economy for the post-transition period, 1990.IIQ- 1997.IIQ

D(LCUY) = - 0.60 - 0.32459762*LCUY(-1) - 0.24*AP(-1) - 0.28*D(AP) - 0.02*D4 –

(-1.63) (-2.21) (-1.46) (-1.67) (-0.53)

0.0089*T

(-2.24)

R^2 = 0.43 DW = 1.68

D(LDDY) = - 1.39 - 0.50*LDDY(-1) - 0.42*LITD3(-1) + 0.19*D4

(-2.50) (-2.75) (-0.78) (4.2)

R^2 = 0.67 DW = 1.3

D(LHDY) = - 0.52 - 0.304*LHDY(-1) - 0.21*AP(-1) + 0.08*FID3(-1) -- 0.21*D(AP)

(- 2.58) (-2.52) (-1.04) (0.83) (-1.09)

R^2 = 0.38 DW = 1.52

D(LFDY) = - 0.35 - 0.12*LFDY(-1) + 0.10*AE(-1) + 0.11*D(AE) - 0.44*D(LITD3)

(- 2.16) (-1.82) (1.013) (1.60) (- 1.65)

R^2 = 0.34 DW = 2.16

Table A.7 Wald tests for H_0 being no-cointegration hypothesis for the post-transition sample

	D(LCUY)	D(LDDY)	D(LTDY)	D(LFDY)
n, # restrictions	2	2	3	2
F-Statistics**	3.32	4.53	3.65	2.1
ξ =nF	6.64	9.06	10.95	4.2
Critical values*	ξ = 14.91	ξ = 14.91	ξ = 14.93	ξ = 12.22

*The critical values are taken from Boswijk and van Dijk (1996) and are for a 0.10 level of significance.

Table A.8 Long-run money demand estimates obtained from the total sample, including pre-transition data and the shorter sample, excluding the pre-transition data

	π Inflation rate	**$(1 + i_{TD})$** Domestic int. rate on time deposits	**FID**(domestic minus foreign int. rate difference)	**E**, Exchange rate depreciation
LCUY total Sample	- 0.83			
Post-transit. Sample	- 0.73			
LDDY total s Sample		- 1		
Post-transit. Sample		- 0.82 (-1.12)		
LHDY total Sample	- 0.62		0.22	
Post-transit. Sample	- 0.68		0.26	
LFDY total Sample				0.74
Post-transit. Sample				0.83

Total sample includes 1989.IQ 1997.IIQ (except for Demand deposits and Savings deposits, which were available only until 1996.IVQ).

Post-transition sample includes 1990.IIQ 1997.IIQ for Currency in circulation and Foreign currency deposits; 1992.IIQ 1996.IVQ for Demand deposits, and 1990.IIQ 1996.IVQ for Savings deposits.

Endnotes

1. See Anand and van Wijnbergen (1987) and Budina and van Wijnbergen (1996) for related work.

2. In our case, however, we have used only two interest rates: interest rates on one-month time deposits and interest rates on foreign currency deposits, approximated by the official London interest rate on one-month dollar time deposits. For a detailed description of all the variables, see Annex 2.

3. The quasi-fiscal deficit is obtained as a sum of the primary fiscal deficit and all the interest payments on domestic debt and foreign debt net of Central Bank foreign assets, minus all interest payments accruing to the Central Bank from credit to the private sector.

4. The domestic debt to GDP ratio was adjusted by the square root of one plus inflation in order to properly match an end-of-year stock (B) with an (approximation of an) end-of-year price.

5. The average nominal interest rate on domestic debt is derived from actual interest payments on domestic debt.

6. Our estimates for the demand for demand and savings deposits are based on the period 1989.IIQ until 1996.IVQ, because data on the amount of these deposits in 1997 were not available.

7. Boswijk and van Dijk (1996) suggested the following algorithm:

i. Choose the proper lagged structure of the variables

ii. Specify the following equation:

$\Delta y_t = \lambda\, y_{t-1} + \delta z_{t-1} + \delta_0 \Delta z_t + \eta_t$

iii. The unit root test is equivalent to a Wald test on $\lambda=0$ and $\delta=0$

iv. The above equation is equivalent to:

$\Delta y_t = \lambda (y_{t-1} - \theta z_{t-1}) + \delta_0 \Delta z_t + \eta_t$

Where $\theta = -\delta/\lambda$ and is interpreted as the long-run value of the variable coefficient, and the t-statistics of δ can be used as a test for its significance. This basic equation can be extended by adding a constant, linear trend and lagged differences of dependent or independent variables.

8. The results of 'no-cointegration' hypothesis are presented in Annex 2.

9. For a more complete analysis of this debt reduction package and the subsequent agreement reached with the commercial creditors (the so called "London club"), see van Wijnbergen and Budina (1999).

10. Source: World Bank data.

11. See Budina and van Wijnbergen (1997) and Dabrowski (1997)