7-1-2011

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February 2008*

Abstract

From 1970 to 1985, Israel experienced high inflation. It rose in three jumps to new plateaus and eventually exceeded 400% per annum. This paper claims that anticipated monetary and fiscal effects of a massive government bailout of owners of fallen bank shares caused the last big jump in inflation that occurred in October 1983. Bank shares had just collapsed after a scandal in which it was revealed that banks had long manipulated their share prices. The government promised to reimburse innocent owners for the diminished value of their bank shares, but only after four or five years. The public believed that promise and public debt therefore implicitly increased by a large amount. That implied future monetary expansions. Because that was foreseen, inflation immediately rose as predicted by the unpleasant monetarist arithmetic of Sargent and Wallace (1981).

Keywords: Inflation, Rational Expectations, Inflation Tax, Public Debt.
JEL Classification:

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* We would like to thank Karnit Flug, Avissar Cohen, Nissan Liviatan and Dani Yariv for very helpful comments. We are also grateful to Michal Abramovitz, Michael Ritov, and Sarit Weissbrod for excellent research assistance.

Israel 1983:

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1. Introduction

From an average level of 130%, around which it had hovered during the previous five years, inflation in Israel suddenly jumped to 400% in October 1983. It fluctuated around that new level for slightly less than two years, when it was suddenly and drastically reduced by a comprehensive fiscal reform in July 1985. That reform could not have been foreseen in October 1983, but other fiscal events could, and it is those that we feature in our explanation of the 1983 explosion of inflation.[1]

The sudden upward jump of inflation in October 1983 has puzzled economists because it was not accompanied by any significant contemporaneous rise in the government deficit or in government expenditures. Although the Israeli inflation had been ignited by fiscal and monetary actions strongly associated with an intensification of the Israeli-Arab conflict after 1967 and especially after 1973, the October 1983 jump in inflation did not seem to be related directly to any intensification in the conflict. The Lebanon war, which began in June 1982, was much less costly than previous wars, and

[1] Among the reasons that we believe that the stabilization of 1985 was not foreseen by market participants in October 1983 is our doubt that the altered political landscape that eventually facilitated the 1985 reform could have been forecast in October 1983. The reform was managed by the unity government of Likud and Labor that came to power in September 1984 after elections held one year earlier than anticipated. The elections were moved up in response to a gradual worsening of the military situation in Lebanon and higher inflation. In October 1983, Begin resigned the premiership and Shamir assumed it, but the Likud government looked weak and unlikely to carry out major fiscal reforms. In those days, few foresaw the emergence of the broad coalition of September 1984 (97 seats in the Knesset out of 120). Even after September 1984, there were some failed attempts to reduce inflation by fostering deals with the labor unions without fiscal restraint.

the defense budget, overall expenditures, and the public deficit did not change much during it.

This paper claims that the October 1983 jump in inflation was caused by another event in October 1983: a massive bailout of bank shares by the government of Israel. The banks had manipulated the prices of their shares for some years prior to 1983. By 1983, the shares were significantly overvalued, the banks could no longer support them, and share values fell precipitously. In a dramatic move in October 1983, the government promised to bail out banks' shareholders. That increased the government debt overnight by almost 7 billion dollars, more than a quarter of GDP. Because the banks still had some intrinsic value, not all of this increase in government debt was net debt. But the public appropriately viewed it as a very large increase in net debt.[2] Even if the public had anticipated some chance of a bailout earlier, the announcement of the bailout in October 1983 significantly increased the probability that such a bailout would actually occur. The government promised to reimburse shareholders for the high value their shares had fallen from, but only after four or five years. We claim that the public's anticipation of this increase of public payments in 1987 and 1988 caused an immediate jump in inflation.[3]

The episode presents a particularly clear example of the 'unpleasant monetarist arithmetic' of Sargent and Wallace (1981), according to which an anticipated future monetary expansion triggers an immediate rise in inflation coming from rational expectations and a negative dependence of money demand on expected inflation. What George Eliot called the "dim lights and tangled circumstances" of the real world often

[2] The commitment to pay the public the value of the bank shares was not formally written as public debt until the shares were actually purchased by the government.

[3] In a recent history of monetary policy in Israel Barkai and Liviatan (2007, p. 167) mention the bank shares bailout as one of the possible explanations for the jump in inflation in 1983, but dismiss this explanation in favor of other explanations.

obscure the workings of unpleasant monetarist arithmetic. The 1983 Israeli episode is an unusually clear example because the anticipated jump in the future deficit was so large.

The paper begins with a brief history of the Israeli inflation and tries to account for its dynamics by using the standard inflation tax model. This is done in Section 2. Section 3 tells the story of the bank shares bailout. Section 4 presents a simple monetary model that shows how the bailout announcement could trigger a jump in inflation of the same magnitude as observed in the data. Section 5 briefly and critically surveys some of the alternative explanations to the jump in inflation in 1983. Section 6 concludes.

2. The Story of the Israeli Inflation

2.1. The dynamics of Inflation

Before the 1967 War between Israel and its neighbors, Egypt, Jordan and Syria, inflation in Israel was less than 10% per annum. See figure 1.[4] After 1967, inflation rose. After 1973, when Israel experienced an even more costly war with two neighbors, Egypt and Syria, inflation rose further and fluctuated around 40% until 1978. In that year inflation jumped again and settled in at about 120% annually. That remained the average rate of inflation until October 1983. Then inflation jumped again and for a while fluctuated around a very high rate of 400%.

In July 1985, the pressure of very high and unstable inflation, a deep decline in tax revenues as a result of inflation (a manifestation of the Tanzi-Olivera effect), and rising foreign debt, all led the government to implement a drastic stabilization plan whose

[4] All the data, except for government debt below, is taken from the publications of the Bank of Israel and Israel's Central Bureau of Statistics.

central feature was renewed fiscal discipline. The stabilization plan quickly reduced the rate of inflation to around 20% annually. During the 90s, inflation further declined.

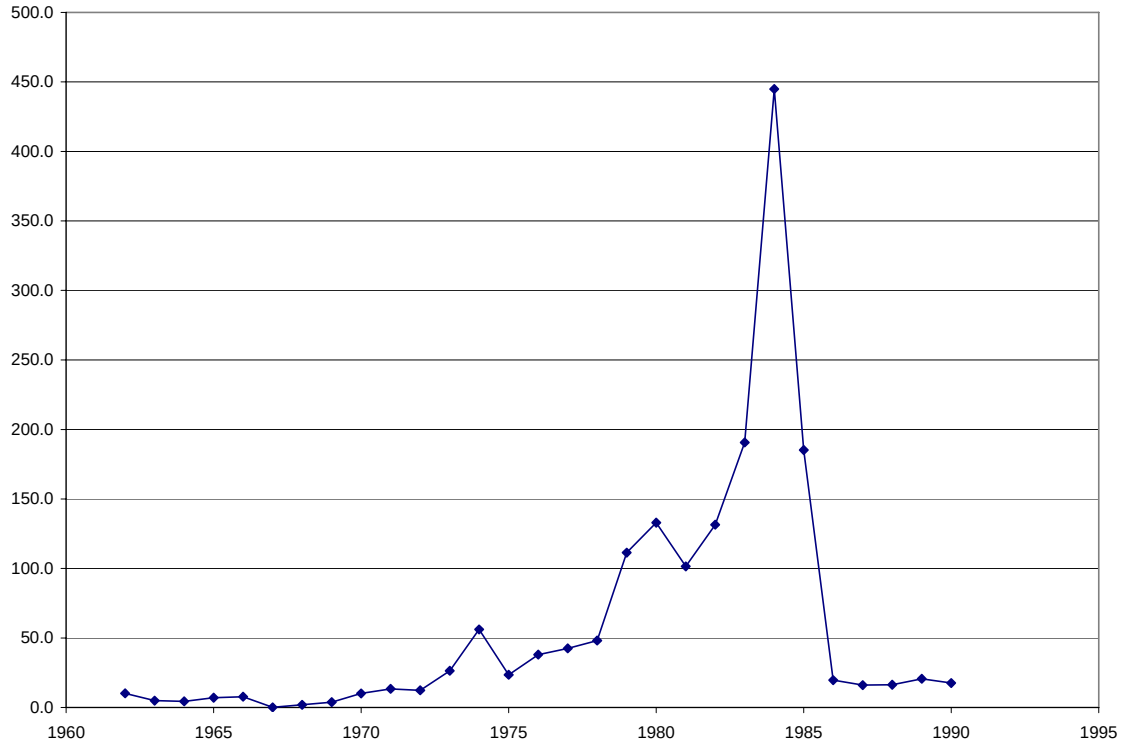

Figure 1: Annual Rate of Inflation: 1960 – 1990

Figure 1, which presents annual rates of inflation, includes years when inflation changed significantly in midyear, for example, 1983 and 1985. Figure 2 presents the monthly rate of inflation, which is much more volatile, but also better shows the timing of jumps from one inflation plateau to another. Evidently, the highest plateau began in October 1983. Actually, the inflation in the last three months of 1983 was even higher than in 1984. In these three months the monthly rate of inflation was 16%, which means an annual rate of almost 600%.

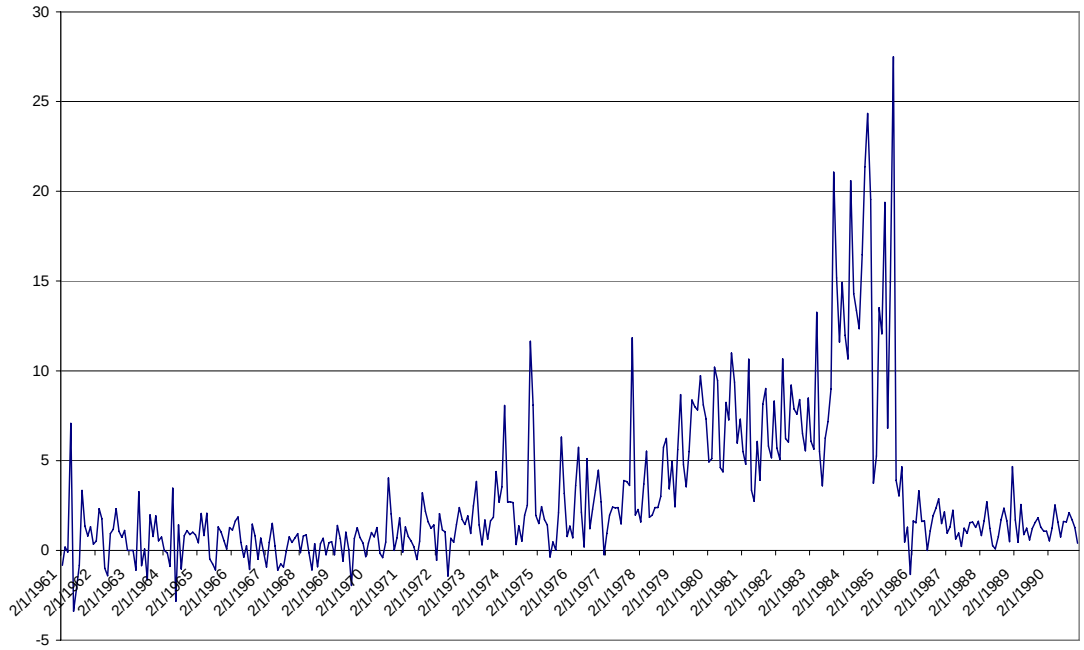

Figure 2: Monthly Rate of Inflation, 1960-1990.

2.2. Money and Prices

Figure 3 shows the annual rates of change of M1 -- cash and demand deposits - and the annual rates of change of M0 -- high powered money. The two monetary aggregates rise with prices. High powered money increased by more during the high period of inflation. One possible explanation for that could be a reduction of required reserve ratios that occurred at the time.

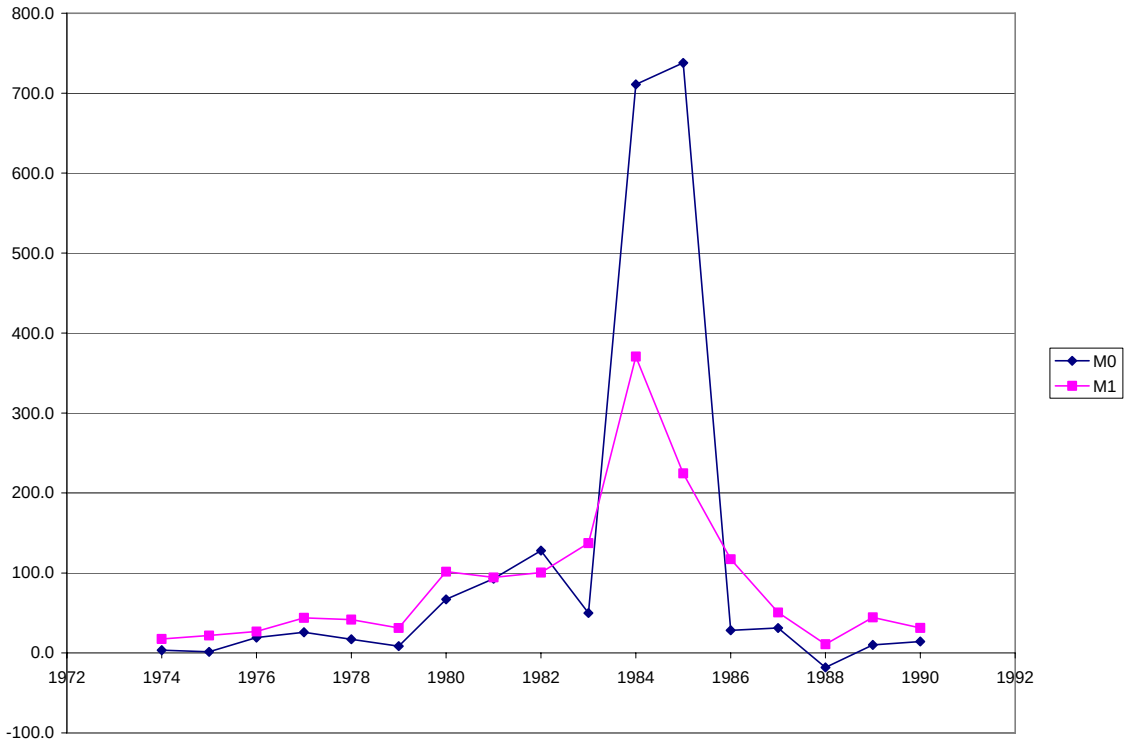

Figure 3: Rates of Change of M0 and M1 – 1973-1990

Figure 4 describes the dynamics of M1 together with the dynamics of inflation. The rate of growth of money was lower than the rate of change of prices so long as inflation is rising, while it was higher than that of prices so long as inflation was on the way down, after 1985. This was exactly what we would anticipate from monetary theory because the demand for money is inversely related to the expected rate of inflation. When expected inflation rises, real balances should decline, through prices rising faster than money, and the opposite should happen when expected inflation is in decline. Hence, this basic prediction of monetary theory holds in the case of the Israeli inflation. But figures 3 and 4 also raise the question: why was so much money printed during these years? The usual suspect in such cases is of course a large fiscal deficit that is financed at least

partially by an inflation tax. That was indeed the case in Israel during these years, as we show next.

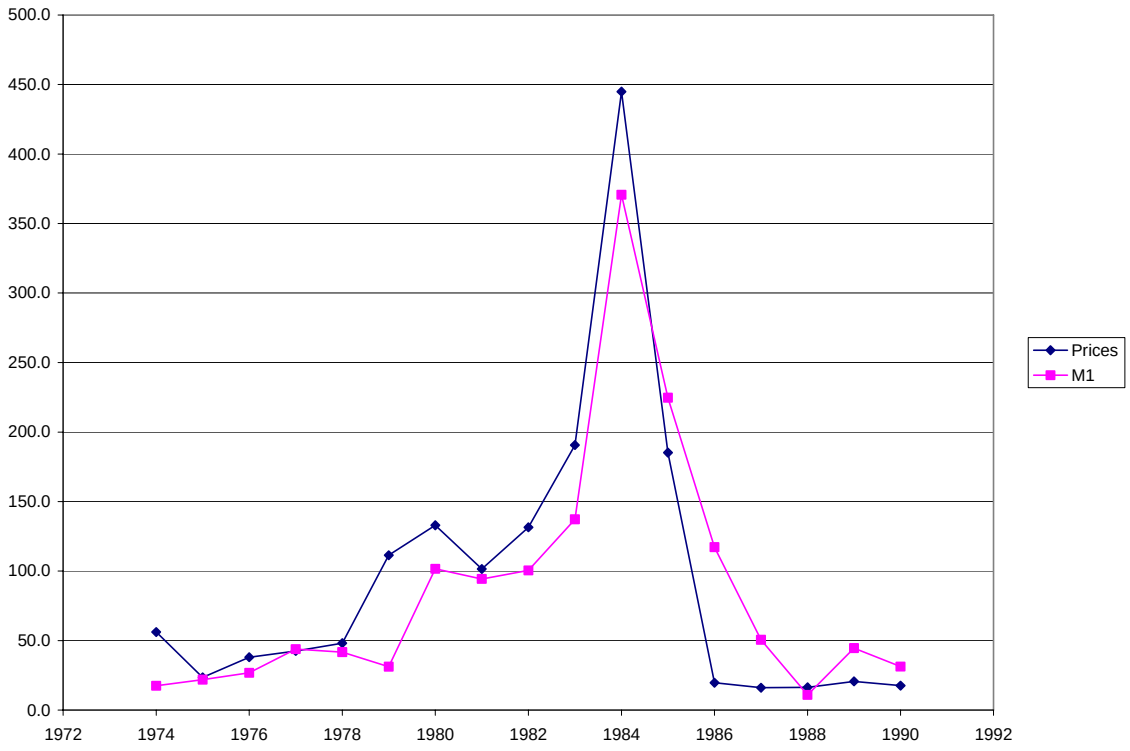

Figure 4: Inflation and M1 Growth in Israel – 1973-1990

2.3. Fiscal Policy

In the early 60s, the public sector share of GDP reached an average of 35%, including defense costs that were around 6-7% of GDP. The public sector was in surplus.[5] That ended in 1967. Public costs began to rise, mainly because of rising defense costs. After 1967, Israel fought wars of attrition with Egypt, Syria, and the Palestinians. Also, the French embargo of 1967 caused Israel to allocate resources to a construct a domestic

[5] The public sector in Israel includes the central government, social security (the National Insurance Institute), local municipalities, hospitals and universities, and the Jewish Agency.

weapons industry. As a result defense costs rose to a level of around 20% of GDP even before 1973. After the Yom Kippur War in October 1973, against Egypt and Syria, which was more costly than the 1967 War in all aspects, defense costs went up to more than 30% of GDP.[6] These were just the defense costs in the budget of the ministry of defense; costs in other parts of the budget increased as well.[7] The rise in the deficit led to higher debt. The associated higher interest payments further increased public expenditures.

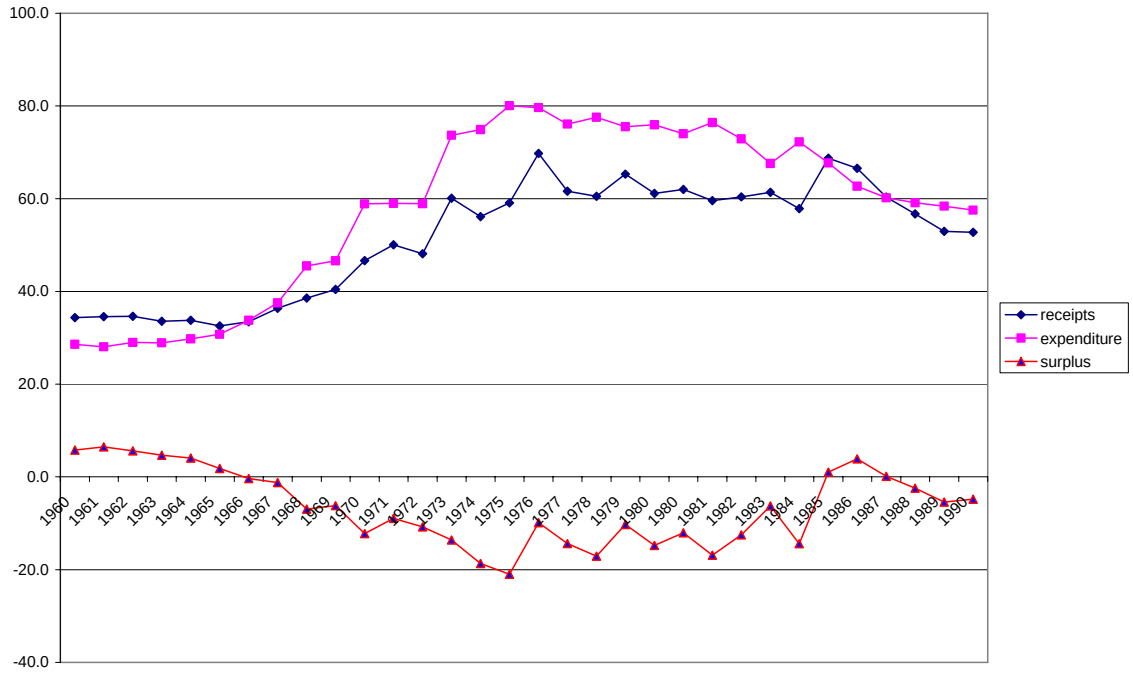

Figure 5: Public Sector Expenditures, Receipts and Deficits (% of GDP) – 1960-1990

Figure 5 shows that public expenditures kept on rising until they reached a level of 75% percent of GDP after the 1973 war. In the years after the war, defense costs reached a level of 33% of GDP. Public revenues increased too during this period, partly due to US transfers to Israel after 1968, but the rise in expenditures was even larger. As a

[6] The war lasted three weeks, but reserve soldiers remained in service for months afterward. Israel suffered more than 2500 casualties in 1973 while less than 700 in 1967.
[7] Berglas (1986) has shown that the additional defense costs were quite significant.

result, the deficit increased as well, and between 1973 and 1985 it was around 15% of GDP. Note that public expenditure remained around 75% of GDP until 1985, despite the decline of defense costs after the completion of the big arms build-up of the mid 70s and the Peace Agreement with Egypt in 1979. Defense expenditures went down to around 20% of GDP in the early 80s, but overall expenditures remained high because of increases in other public expenditure like interest payments and various subsidies to subsistence goods that were intended to alleviate the burden of inflation.

The rise in the public deficit between 1967 and 1973 can explain the initial rise of inflation from close to zero to around 50%. We can estimate the share of the deficit that was financed by money issuing.[8] According to the inflation tax model, the monetized deficit in an inflationary steady state is

$$DEF_{monetized} = \frac{M_t - M_{t-1}}{P_t^a} = \frac{M_t}{P_t}\frac{\hat{P}_t P_{t-1}}{P_t^a}, \tag{1}$$

where M_t is high powered money at the end of period t, P_t is the price level at the end of period t, P_t^a is the average price during period t, and $\hat{P}_t$ is the rate of inflation during period t. We take 1976-1978 as the years in which inflation reached one plateau, which we interpret as a steady state. In those years high-powered money relative to GDP was on average 16%, the average rate of inflation was 43%, and hence we can calculate from the above equation that the deficit financed by printing money was on average 5.6% of GDP. We therefore deduce that around a third of the deficit in the period following 1973, which was on average 15% of GDP, was financed by printing money.[9]

[8] Part of the deficit was financed by increasing debt and part was financed by sale of foreign reserves.
[9] As shown below, in later years the part of deficit financed by money decreased. Indeed, calculations made over the whole period by Bental and Eckstein (1988) came out with lower estimates of the amount financed by inflation tax.

To shed further light on government finances, what can be said about the part of the deficit that was financed by issuing interest bearing government debt? Official data on public debt goes back only to the year 1983. To learn about earlier periods, we constructed estimates of government debt for the years 1976 – 1986. The central government is only one part of the public sector in Israel, but it is the main player and especially the main debtor, as other public institutions find it harder to borrow outside and usually finance their deficits by borrowing from the central government.

The data are taken from the annual publications of the General Accountant of the Ministry of Finance, who reports the balance sheet of the government at the end of each fiscal year, in March 31.[10] The debt data are in nominal terms. Since Israel used three types of coins during this period, Israeli Pounds, Shekels, and New Israeli Shekels, we converted all figures to New Israeli Shekels (NIS). We made another adjustment for bank shares. After the bailout in 1984, the government included the value of the banks on the asset side of its balance sheet, but it did not include on the debt side the future bailout obligations to the public. We therefore subtracted the reported value of the banks from the balance sheet.

Since inflation during this period was quite high, nominal values of the debt are not so informative, as can be seen from the first column in Table 1. We therefore calculated the real value of debt using the CPI at March 31 in each year. We did not use the GDP deflator because it can be calculated only annually and inflation at the time was quite high. The real value of government debt in 2000 prices is described in Table 1 in the second column.

[Insert Table 1 here]

[10] Only in the 90s fiscal years were shifted to December 31.

We next calculate the ratio of debt to GDP. While a fiscal year at the time was from April 1 to March 31, annual GDP was measured from January to December. Israel has quarterly data only after 1980. Hence, we calculated the debt to output ratio by dividing real debt at March 31 1976 by real GDP in the year 1975, and so on. These figures appear in Table 1 in the third column.

These figures indicate the following pattersns. The government debt increased throughout the period, but not in every year. Thus, for example, debt decreased in 1980 and 1983. In the nine inflationary years from March 1976 to March 1985 (inflation was reduced by the July 1985 fiscal stabilization plan) debt increased accumulatively by 76% of GDP. This is an average increase of 6.7% of GDP annually. Accounting for GDP growth of an average rate of 3.3% during these years, we get that debt financed a deficit of an average of 11% of GDP annually during the years 1976-1985. Hence debt financed around two thirds of the budget deficit, while money issuing financed most of the remaining third.[11]

There is one sharp decline in real debt in March 1983. This seems to be partly an artifact of the exchange rate policy at the time, since from September 1982 till September 1983 the government made an attempt to curb inflation by reducing the rate of depreciation to a monthly rate of 5%, significantly less than the rate of inflation. Such a policy was used in several Latin American countries during the 1970s where it always failed miserably. It thus gained the notorious name "Southern Cone Disinflation." It also failed in Israel, ending in big devaluations in August and in October 1983. Meanwhile it created a real appreciation, which reduced foreign debt relative to domestic debt and since foreign debt was quite large, it reduced debt significantly. This real appreciation

[11] A third way to finance the deficit was sale of foreign exchange, mainly in the early 80s.

cannot explain the entire decline of debt by 36% of GDP from March 1982 to March 1983, but accounting for it reduces this decline significantly.

2.4. The Second Jump of Inflation

After having explained the initial rise in inflation by the inflation tax, we are left with two bigger puzzles, namely how to explain the two next jumps in inflation, at 1978 and at 1983. Sussman (1992) uses an inflation tax model to explain the rise in inflation in 1978. He relates the jump in inflation to the liberalization of foreign currency in October 1977 in Israel. The new access to foreign currency led to a reduction in the demand for money, causing a reduction of the base of inflation tax and therefore a rise in the inflation tax rate, meaning that inflation had to rise. It is important to note that although the liberalization was canceled after one year due to a huge currency flight, the effect on the demand for money remained, because the government introduced a new financial asset, called PATAM, that was denominated in domestic currency but indexed to the dollar. Hence, the financial liberalization, which came when the fiscal deficit was already large, contributed to a hike in inflation from about 50% to about 130%. Indeed, studies have shown that there was a shift in the demand for money in the years 1978 and 1979, as described by Offenbacher (1986). This gives additional support to the explanation offered by Sussman. The remaining puzzle is the second jump in inflation that occurred in October 1983. This is where we think the bailout of bank shareholders comes in.

3. The Banks' Shares Debacle

During the 70s the main Israeli banks manipulated the prices of their own equity by executing trades through various subsidiaries such as mutual funds and provident funds.[12] Initially, they seemed to have manipulated their share prices mainly to reduce their volatility in order to make them more attractive to cautious investors. The main reason that the banks offered for manipulating share prices was that during the seventies the banks increased the scale of their operations significantly when inflation rose and so needed to increase their capital to satisfy international capital adequacy requirements. Therefore, they sought ways to make their stocks more attractive to the public. The illegal methods they employed finally led to their disgrace in 1986 before an investigating committee, the Baisky Committee.[13] Later on, some bankers faced criminal charges and some were convicted. Although the government eventually became aware of the banks' share-price manipulations, aside from mild protests, it did almost nothing to stop them.[14]

The banks were eventually trapped by their web of manipulation. They marketed their shares as almost risk-free assets and the demand for banks shares increased significantly. But the early 80s were also booming years for the Tel-Aviv Stock Exchange in general. This put extra pressure on the banks to raise their share prices further. The real rate of return of the bank shares, which had been 9.7% between 1975 and 1979, rose to 40.6% in 1980, 32.5% in 1981, and 28.3% in 1982. In January 1983 the Tel Aviv Stock Exchange (TASE) crashed, but the banks kept their shares from crashing. Now the competition from other shares was less fierce, but the competition from other

[12] The Israeli banks controlled most of the channels of financial intermediation in Israel: mutual funds, provident funds, investment banking, etc.
[13] Most of the information in this section is taken from the Baisky Report, Investigation Committee (1986). This also includes the above justification the banks gave for manipulation their shares.
[14] Interestingly the two main banks were mostly public. Bank Leumi belonged mainly to the Jewish Agency. Bank Hapoalim belonged to the Histadrut, the national labor union.

assets, like foreign currency, became intense. The net investment of Israelis abroad was 359 million dollars in 1983, while it was much lower in previous years, 156 in 1981 and 193 in 1982. In the first nine months of 1983 the banks succeeded in maintaining a real rate of return of 9% on their shares, but it began to cost them. The value of banks shares held by the banks increased sharply. From around 200 million dollar during 1982, bank owned shares increased to more than 400 million dollars in May 1983, more than 600 million dollars in the beginning of October, and in October 6 they reached 920 million dollars. That was around 10 percent of the outstanding amount of bank shares altogether. The banks had already been borrowing abroad for some time in order to finance purchases of their own shares in the market, but now the required amounts became too large to sustain.

In early October 1983 the banks realized they face a crisis and turned to the government for support.[15] Through the mediation of MK Avraham Shapira, they reached an agreement.[16] On October 6, 1983 the Tel-Aviv Stock Exchange closed and opened again only after a bailout agreement was finalized 18 days later. It was called "The Bank Shares Arrangement" (Hesder Hamenayot Habankayot), or in short, the "Hesder" (Arrangement).

The main elements of the Hesder were that the manipulation of bank shares would stop and the government would be responsible for the shares of the manipulating banks that were then held by the public, excluding shares held by bank executives. The Hesder offered share holders two main options. The first was to keep the shares tradable, but to

[15] This of course was not surprising. Much of the main banks was under public ownership already. Also the main banks were very large and they believed that they were 'too big to fail.'
[16] Shapira has been head of the finance committee in the Knesset, a representative of the Ultra Orthodox party and a very rich industrialist himself.

be able to sell them to the government in October 1988 at their value of October 6th, 1983, indexed to the US dollar with an interest of a cumulative rate of 4% over the 5 years. The second option was to hold the shares non-tradable and sell them to the government in 1987, at the value of October 6th, 1983, indexed to the US dollar and with interest of a cumulative rate of 12% over the whole 4 years.[17] The government promised that those who would continue to hold the bank shares for 6 or 8 years would get even higher interest rates. Pensioners could redeem their shares after only 2 years.

Most of the public chose the option of holding the shares tradable for 5 years, which indicates that people did not fully trust the ability that the government would be able to bail out the shares. As we show below in this section, these doubts were not too big, and the public expected that the bailout would be implemented with a probability of more than 50%. We also show in Section 4 that this probability was sufficient to increase the rate of inflation by 300%. Despite holding most of the shares tradable, the public finally sold most of them to the special holding company that was founded by the government. In July 1985 inflation was stabilized, and in the following years the government financed the bailout by issuing bonds.[18] It purchased shares from the public at 1 billion New Israeli Shekels (NIS) in October 1985 (from pensioners), 2 billion NIS in October 1987, 5.6 billion NIS in October 1988, .85 billion NIS in October 1989 and finally 3.4 billion NIS in October 1991.

The economic implications of the bank shares bailout agreement were far-reaching. The government of Israel became the owner of 7 banks, among them the largest four banks, Leumi, Poalim, Discount and Mizrahi. Privatizing these banks took a long

[17] Actually the government calculated the value of the shares at the exchange rate that prevailed after October 6th, namely at 25% less, as there was a large devaluation on the night of the 6th.
[18] See Bank of Israel (1989).

time, and even today, in 2008, one of the largest banks, Bank Leumi, has not yet been fully privatized. But the main focus of our paper is not the implications for the banking sector but rather for fiscal and monetary policy. By committing to purchase the shares in a specific future date, the government, albeit implicitly, increased its debt overnight. The putative value of the shares being bailed out was 6.8 billion dollar. Even after the erosion of their dollar value due to the 25% exchange rate devaluation on October 6, the government increased its obligations by a huge amount of 5.44 billion dollars. GDP in 1983 was about 24 billion dollars.

By 1991, when the bailout finally ended, its cumulative cost was 16 billion NIS at 1991 prices.[19] This is equivalent to $6.9 billion in 1991 prices. Formally the government increased its obligations but also its assets, as it became owner of the banks shares. But the public knew that the market value of the bank shares was truly much lower than their value on the eve of the scandal. The market value of the shares dropped significantly following the bailout arrangement. By the end of 1983 it declined to 48% of its September value. Note, that this value is still upward biased, due to the positive probability of bailout. Another way to estimate the intrinsic value of the banks shares at the time is to examine the actual future sales of the banks. Up to July 2005 the government had received only 5.13 billion dollars from the privatizations of the banks. The present value of these sales, in 1983, discounted by the constant maturity interest rate, is 1.98 billion dollars. Hence, we estimate that ex-post the net cost of the bailout was about $3.46 billion in 1983 prices, which is 14.4% of GDP.[20]

[19] See Bank of Israel (1992).
[20] This is clearly an underestimate of the net cost of the bailout, since future sales of the banks benefited from future economic developments in Israel, like the Russian immigration, which could not be anticipated at the time.

It is important to note that while the bailout was announced in October 1983, it might have been anticipated ahead of time and it could still have been doubted by the public after the arrangement had been announced. Interestingly, we can learn about those expectations from rates of return on bank shares after the arrangement. The ex post rate of return of these banks shares, which were like dollar indexed bonds, was quite high. The average rate of return from December 1983 to the end of 1984 was 17%.[21] Alternative safe dollar denominated assets had a rate of return of 8.8%. A simple calculation shows that if we ignore the risk premium, the imputed probability that the bailout would be implemented by the government was 43% by the end of 1983 and during 1984. If we take into consideration a risk premium on these risky dollar denominated bonds, the probability of a bailout after the announcement was probably 50% or even more.

We claim that the rise of inflation in October 1983 was a result of this sudden increase in anticipated financial obligations of the government. We claim that the announcement in October 1983 increased the probability of a bailout enough to cause inflation to jump to a high annual rate of 400% and more.

4. A Model and Calibration

In this section we calibrate a simple model of a monetary economy that indicates that the increase in public debt associated with the banks' shares settlement was sufficient to raise inflation by as much as occurred in 1983. We calculate probability of a bailout that is required to account for the higher inflation. Consider a closed Ramsey economy with a

[21] The rate of return was 12.4% in November 1983 and reached 17% at December 1983. During 1984 it remained approximately at that level. See the Bank of Israel Annual Report 1984 (1985).

single physical good that is produced by labor only. The population consists of a continuum of size 1 of consumers with infinite horizons. Each individual produces an amount Y in each period. There are two assets, bonds and money. Bonds are one period indexed loans that pay a real interest rate r_t.[22] The government issues high powered money.[23] Continuation utility of a consumer at time t is

$$U_t = E_t \sum_{s=t}^{\infty} \frac{\log c_s + \gamma \log(m_s / P_s)}{(1+\rho)^{s-t}}, \tag{2}$$

where c_t is consumption in period t, m_t is the consumer's stock of money at the end of the period, and P_t is the price of the physical good in terms of money in period t.

The government purchases an amount G of the good in each period. The government collects no taxes. It issues new money to finance G.[24] For the sake of simplicity assume that public debt is zero. Following our basic story assume that the public foresees a possibility of a bailout in period T. In particular, there is a positive probability q that in period T the government will pay the public an amount of real size B. This is the net burden of the shares bailout. There are various ways to model how the government will finance this future payment, but it is assumed here that it will ultimately be paid by printing money. We assume that the bailout is financed by a single monetary expansion in period T.[25] We can therefore summarize monetary policy as follows. In all periods other than T:

$$M_t - M_{t-1} = P_t G. \tag{3}$$

[22] Indexed bonds have been the most common asset at the time in Israel. The model could be solved with nominal bonds just as well, with the same results.
[23] Ironically, there are no banks in this model.
[24] This assumption reflects the limitation on borrowing by the government that we described above. Alternatively, we can assume that the government has a deficit as it already exhausted its tax base.
[25] Another possibility is to finance the payment by debt, and then finance the interest on this debt by money issuing. This alternative financing yields the same results.

If there is a bailout in period T monetary policy will be:

(4) $$M_T - M_{T-1} = P_T G + P_T B.$$

If the bailout does not occur, the monetary policy is described by (3) in period T as well.

We next turn to describe the equilibrium. We first present the consumer's budget constraint in each period, where b denotes the amount of indexed loans:

(5) $$b_{t-1}(1+r_t) + \frac{m_{t-1}}{P_{t-1}}\frac{P_{t-1}}{P_t} + Y - c_t - \frac{m_t}{P_t} - b_t = 0.$$

If in period T the government bails out the banks, the budget constraint also includes a windfall of size B:

(6) $$b_{T-1}(1+r_T) + \frac{m_{T-1}}{P_{T-1}}\frac{P_{T-1}}{P_T} + Y + B - c_T - \frac{m_T}{P_T} - b_T = 0.$$

Maximizing expected utility (2) subject to the budget constraints (5) and (6) we get first order conditions that take the form of the Euler condition

(7) $$\frac{1+\rho}{c_t} = (1+r_{t+1})E_t\left(\frac{1}{c_{t+1}}\right).$$

and the portfolio condition

(8) $$\frac{\gamma P_t}{m_t} = \frac{1}{c_t} - \frac{1}{1+\rho}E_t\left(\frac{\frac{P_t}{P_{t+1}}}{c_{t+1}}\right).$$

The equilibrium condition in the money market each period is $m_t = M_t$ and the equilibrium condition in the bonds market is $b_t = 0$ in each period. Together with the budget constraints and the printing money conditions it follows that in each period:

$c_t = Y - G$. As a result (7) implies that the real interest rate is equal to ρ in each period. From (8) we get that the monetary equilibrium is described by:

$$\frac{\gamma P_t}{M_t} = \frac{1}{Y-G}\left[1 - \frac{1}{1+\rho} E_t\left(\frac{P_t}{P_{t+1}}\right)\right]. \tag{9}$$

Note that this condition is deterministic for all t except for T-1.

To describe the dynamics of the model, denote real balances by $L_t = M_t / P_t$. From the monetary policy rule (3) we get that for every $t \neq T-1$, real balances satisfy:

$$L_{t+1} = G + L_t \frac{P_t}{P_{t+1}}.$$

Substituting the monetary equilibrium condition (9) we get that for all $t \neq T-1$:

$$L_{t+1} = L_t(1+\rho) + G - \gamma(1+\rho)(Y-G). \tag{10}$$

This equation describes how real balances and inflation evolve over time.

Note that from period T on, after it is realized whether or not there is a bailout, there is full certainty and monetary policy is fixed. Hence real balances and the rate of inflation are fixed as well and it can be shown that:

$$L^* = \gamma \frac{1+\rho}{\rho}(Y-G) - \frac{G}{\rho}, \tag{11}$$

and:

$$\pi^* = \frac{G}{L^* - G}. \tag{12}$$

We next find the rate of inflation in period T in the case of bailout and in the case of no bailout. Note that in both cases real balances in period T are L^*. Using (3) we find that if there is no bailout inflation in T is given by:

$$\frac{P_{T-1}}{P_T} = \frac{L^* - G}{M_{T-1}/P_{T-1}}.$$

Using (4) we find that in case of bailout inflation in T is:

$$\frac{P_{T-1}}{P_T} = \frac{L^* - G - B}{M_{T-1}/P_{T-1}}.$$

Calculating the ex-ante expectations of inflation $E_{T-1}(P_{T-1}/P_T)$ and substituting in equation (9), we get after some manipulation:

(13) $$L_{T-1} = L^* - \frac{qB}{1+\rho}.$$

The dynamic condition (10) can be rewritten by use of (11) as

(14) $$L_t = \frac{\rho L^* + L_{t+1}}{1+\rho}.$$

Applying this dynamic condition to the size of real balances prior to the possible bailout, given by equation (13), we can calculate the size of real balances in every period. Thus, real balances N periods before the possible bailout are:

(15) $$L_{T-N} = L^* - \frac{qB}{(1+\rho)^N}.$$

Hence, the rate of inflation N periods prior to T is:

(16) $$\pi_{T-N} = \frac{G + \rho qB(1+\rho)^{-N-1}}{L^* - G - qB(1+\rho)^{-N}}.$$

Assume now that in period 0, namely T periods before the possible bailout, the ex-ante probability of the bailout increases due to an exogenous event, from q_a to q_b. As a result the rate of inflation jumps because people assign a higher probability to a monetary expansion in the future. The rate of inflation before this change, in period -1, is described by (16), where $N = T+1$, namely:

(17) $$\pi_{-1} = \frac{G + \rho q_a B(1+\rho)^{-T-2}}{L^* - G - q_a B(1+\rho)^{-T-1}}.$$

Inflation jumps already in period 0, since real balances are reduced. Calculation of this inflation rate yields:

(18) $$\pi_0 = \frac{G + q_b B(1+\rho)^{-T} - q_a B(1+\rho)^{-T-1}}{L^* - G - q_b B(1+\rho)^{-T}}.$$

After inflation stabilizes at the new dynamic path its rate is again described by (16), but at a higher probability of bailout. Hence:

(19) $$\pi_1 = \frac{G + \rho q_b B(1+\rho)^{-T}}{L^* - G - q_b B(1+\rho)^{-T+1}}.$$

We next calibrate this model in order to examine whether the rise in probability of bailout due to the "arrangement" was sufficiently large to create a jump in inflation from 120% to around 400%. We calibrate the following parameters: the rate of discount ρ, the size of monetized deficit prior to the announcement G, the rate of inflation prior to the announcement π_{-1}, real balances L, and the net cost of the bailout in 1988, namely B.[26] First we assume that the subjective annual discount rate ρ is 0.05, although the real interest rates in Israel at the time were higher than usual, due to a high risk premium caused by the high public debt. The average rate of inflation prior to the shares bailout, in the years 1980-1982 was 122%, hence $\pi_{-1} = 1.22$. The ratio of high powered money to output prior to 1983, in the years 1980-1982, was on average 4.4%. Hence we set $L_{-1} = .044$.

We next estimate the net cost of the bailout predicted for 1988. As mentioned above, the value of the bailout was 5.44 billion dollars in 1983. Since it was indexed to

[26] Thus we do not need to calibrate the liquidity preference coefficient γ.

the dollar with an accumulated interest of 4% over the 5 years, its value in 1988, the year of the bailout, was supposed to be 5.66 billion dollars. We estimate the value of the bank shares to the government by their future sale value, discounted by the constant maturity's rate to 1988, which is 3.2 billion dollars. Hence, the net cost of bailout anticipated in 1988 is 2.46 billion dollars. Since Israel's GDP in 1988 was 44 billion dollars, B should be 5.59% of GDP, or 0.056.

Next, we turn to estimate the size of the monetized deficit G. According to Bank of Israel (1984) its size was 2% on average in the years 1980-1982. Bental and Eckstein (1988) estimate it to be higher, around 2.5%. Interestingly we are able to calibrate G by use of our model. Note that from equations (15) and (17) we can derive the following equation:

$$L_{-1}\pi_{-1} - G(1+\pi_{-1}) = \rho q_a B(1+\rho)^{-T-2}. \tag{20}$$

This equation enables to calculate for any G the probability of bailout prior to the "arrangement," q_a. It appears that the probability is very sensitive to small changes in G (mainly due to multiplication by ρ). If G is 2.3% of GDP, this probability is larger than 1, which is not plausible. If G is 2.5%, this probability is negative, which is implausible as well. We are left with 2.4%, and for this G the probability prior to 1983 is 19%, which is quite reasonable. Evidently, the public had anticipated a bailout of the banks shares even before the "Hesder," though at a lower probability, since the probability of the bailout after the "Hesder" was more than 50%, as shown in Section 3 above. Hence, we set G = .024, which is quite close the the estimate of Bental and Eckstein (1988).

We can now simulate the change in inflation rate as a result of the rise in probability of the bailout. Before that we calculate the long-run real balances L^* by use of

equation (15) and the estimated value of q_a. We get that $L^* = 0.0524$. The following table presents the simulated rates of inflation.

Table 2: Simulated Inflation Rates[27]

q_B	π_0	π_1
.30	247%	169%
.35	302%	202%
.40	383%	259%
.45	505%	326%
.50	711%	468%
.55	1128%	824%
.60	2447%	3343%

The results of the simulation show that the probability of bailout needed to cause inflation to jumps to more than 400% was around 50%.[28] This fits our estimation of this probability from the rate of return differential between the bank shares and other dollar indexed assets after the "Hesder," during 1983-1984. Hence, both the size of the bailout and the rise in the probability that the public assigned to the bailout were sufficient to cause the significant jump in the rate of inflation.

5. Alternative Stories

[27] The rates of inflation π_0 and π_1 are simulated by use of equations (18) and (19) respectively.
[28] Note that after October 1983 the monthly rate of inflation until the end of 1983 was 16%, which is an annual rate of 600%. Hence, the estimate of $\pi_0 = 711\%$ in Table 2 is not far from reality.

There have been a number of other explanations for the jump in inflation in Israel in 1983. Liviatan and Pitterman (1985) claimed that it was caused by the combination of a price shock and an accommodating monetary policy. The price shocks were caused by balance of payments crises that occasionally required large devaluations. This explanation has many supporters in Israel but its theoretical basis is problematic. Zeira (1987) showed that even if inflation is inertial due to wage-price stickiness, in the long run it reverts to a unique long-run rate. That long-run rate is not altered by temporary price shocks, only by real permanent changes in real costs of production. Bruno and Fischer (1990) offered another explanation. They noted that an inflation tax model has two equilibria, one high, one low, both of which could be stable under some kinds of dynamics. They posited that a shock could push the economy from a low-inflation equilibrium to a high-inflation one.

There are two more explanations that like ours are based on the standard theory of inflation tax and rational expectations and allude to unpleasant monetarist arithmetic. One was hinted by Drazen and Helpman (1987) in a theoretical paper that refers to the same inflationary jump that we study.[29] During the year 1983 the Israeli government followed a policy of reducing the rate of depreciation of the dollar, namely a version of the infamous "Southern Cone Disinflation." The policy restricted the rate of devaluation to a monthly rate of 5%, while prior rates of devaluation were around 7%. This policy was supported by increasing the public debt, which increased anticipation of future monetary expansions and thus caused inflation to rise at the present. We next show that this explanation does not fit the facts of 1983.

[29] The reference to the Israeli episode was stronger in earlier versions of the paper.

First, according to this explanation, net public debt increased mainly through a reduction of foreign reserves held by the central bank, which were used to reduce the depreciation rate. But this did not happen. By the end of 1982 the reserves were 14.5% of GDP, while at the end of 1983 the bank's reserves were 14.8% of GDP, almost no change. Second, although we do not have data on total public debt prior to 1983, we were able to construct estimates of government debt for the years 1976 – 1986, as shown in Table 1. Indeed this table shows that there was no significant increase in official public debt in 1983. Third, the policy of reducing devaluation rates should have caused inflation to jump much earlier, in 1982, when it was implemented, and not in October 1983, after it collapsed two months earlier.

A second explanation based on future expectations is offered by Bental and Eckstein (1990), who study the theoretical case of an inflationary economy with constant public deficits, which anticipates a future stabilization of inflation. They show that conditions under which inflation tends to rise prior to stabilization. Indeed, the Israeli inflation was stabilized in July 1985. But the Bental and Eckstein result holds only if the post-stabilization demand for real balances is smaller than before. The Israeli data shows that real balances increased significantly after the stabilization, from 3.6% of GDP in 1985 to 6.3% in 1989. Hence this also has trouble fitting the Israeli case.

5. Conclusions

This paper does two things. First, it provides a new explanation for the dramatic October 1983 rise in inflation in Israel that has been difficult to account for previously. Inflation jumped in October 1983 without any observable rise in public expenditures or the

government deficit. We claim that the reason for this rise in inflation could not be seen in the fiscal accounts of the time but loomed in the future. The government bailout of the banks' shares, consisting of its promise to compensate the public four and five years hence, created expectations of future deficits financed by a future money expansion. That raised inflation immediately.

A second thing this paper does is to supply a good example of a situation when a rise in future government expenditures seems to have raised inflation immediately. The example is sharp because the government pre-announced an increase in its expenditures at a specific future date. And this increase was massive, around 10% of GDP. We view this as a 'natural experiment'. The economy reacted as the theory of rational expectations indeed predicts, by running away from money immediately, raising inflation immediately by almost 300%. It is too bad that this neat illustration of unpleasant monetarist arithmetic was associated with a bank share scandal that disrupted many lives.

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Table 1: Government Debt in Israel: 1976 – 1986

Year	Nominal Net Debt (Millions NIS)	Real Debt (Millions NIS, 2000 prices)	Debt / GDP
1976	10.64	159,641.3	0.9556
1977	15.61	174,860.7	1.0304
1978	32.28	241,652.4	1.3957
1979	52.45	251,565.0	1.3956
1980	108.22	235,526.2	1.2477
1981	333.78	311,103.9	1.5915
1982	825.94	376,838.2	1.8408
1983	1,581.02	308,325.4	1.4850
1984	6,954.84	398,298.1	1.8699
1985	33,435.32	373,748.0	1.7167
1986	71,430.10	368,167.3	1.6190