Inflation Targeting and Exchange Rate Regimes; Evidence from the Financial Markets

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Abstract

Inflation targeting is gaining popularity as a framework for conducting monetary policy. At the same time many countries employ some sort of foreign exchange intervention policy assuming that these two policies can coexist. This paper attempts to show that both policies are not sustainable. The potential conflict between the two policies is costly to the economy and will eventually result in the abandonment of one of these policies. Israel is a classic test case for two reasons. First, in the mid to late 90s Israel has struggled to maintain both policies. Second, it has a variety of financial instruments which provide a rich source of information. We test our hypothesis about the conflict using information from the financial markets. The results support the hypothesis that both policies cannot be sustained in the long run. The conclusion is that a credible monetary policy aimed at inflation targets should be conducted in a free floating exchange rate regime.

Keywords: Derivatives, Monetary Policy, Crawling Band
JEL Classification: G13, E52, E58, F31

I. Introduction

In recent years inflation targeting (IT) is gaining popularity in both developed and emerging market countries as a framework for conducting monetary policy. The success of inflation targeting depends critically on the credibility of monetary policy to achieve the inflation targets over the relevant horizon[1].

It is generally agreed that a credible IT regime requires a considerable degree of exchange rate flexibility (see, for example, Masson, Savastano and Sharma (1997) and Fischer (2001)). Indeed, almost all the countries that adopted inflation targeting have floated their currency or have moved to more flexible exchange rate regimes. However, as pointed out in an article in the Economist (2000) and in a study by Calvo and Reinhart (2000) "labels mean little". Many countries, including inflation targeters, use interest rates or currency intervention to influence their exchange rates[2].

Central banks in inflation targeting countries face the following questions: How strong is the conflict between active exchange rate management and inflation targeting? What are the consequences of maintaining an exchange rate band in an IT regime?

The purpose of this paper is to test the extent to which an IT framework is sustainable along with an exchange rate band regime using the Israeli experience. Israel is an interesting case study for two reasons: One, it has adopted inflation targeting since

1992 and at the same time has an official exchange rate band whose lower limit (the appreciating one) had to be defended in the past. Two, policy makers have at their disposal a set of unique forward-looking data which is useful in assessing the effectiveness of monetary policy. The data includes: professional inflation forecasts, nominal and real yields obtained from nominal bonds and from bonds linked to the Consumer Price Index (CPI) as well as option premiums obtained from currency options.

The plan of the paper is as follows: section II provides a brief background of the Israeli institutional setup and the data. Section III uses inflation forecasts, the real yield on the CPI linked bonds and the yields on nominal bonds to show that: a) monetary policy is effective and credible since June 1997 when the Bank Of Israel (BOI) stopped intervening in the FX market. b) Monetary policy was ineffective and not credible prior to June 1997 when the

BOI had to engage in FX sterilized intervention to defend the band's lower official limit. Section IV provides additional evidence, using two sets of FX options data, to show that inflation targeting is not sustainable in an FX band regime. Section V provides a summary and offers some general lessons based on the Israeli experience.

II. The Institutional Setup and Data

a. Background

In 1992 Israel adopted an inflation targeting policy together with a crawling exchange rate band regime[3]. At first, monetary policy was aimed at the inflation target while the BOI was intervening directly in the FX market in an attempt to keep the exchange rate near the midpoint of the FX band. This joint effort failed and in February 1996 the BOI changed its FX policy and declared a policy of non-intervention within the official limits of the band. This change in policy did not stop the ongoing appreciation of the Israeli currency (Shekel) and eventually the exchange rate reached the lower edge of the band and got stuck there for more than six months. The massive FX purchases during the periods Feb. 1996 to June 1997 were sterilized by the BOI. When it was realized that the policy is not sustainable, the width of the band was increased considerably. Consequently, on June 17 1997 the purchases have stopped [4]. The BOI has not intervened in the FX market since June 1997.

This short history, which is divided into two periods, the heavy FX intervention period (Feb. 1996 to June 1997) and the non-intervention period (June 1997 to June. 2001), provides an opportunity to examine empirically the extent of the conflict between inflation targeting and FX direct intervention.

b. Data

Monetary authorities nowadays use various types of forward looking data such as inflation forecasts by professionals, forecasts derived from the bond markets, risk premiums derived from currency options and other market derived forecasts [5].

Such data add valuable information to monetary policy makers because it contains information which is useful in assessing the credibility of the commitment of monetary policy to inflation targeting, with and without FX intervention.

In Israel such data play an important role in the monthly monetary decision process. Due to Israel's long experience with high inflation, government bonds linked to the CPI with maturities up to 15 years are traded regularly on the Tel-Aviv Stock Exchange (TASE). Non-linked nominal bonds are also available, for up to 10 years. The difference between the nominal and real rates is used as an estimate of inflation expectations for horizons up to ten years [6]. The one-year ahead market derived inflation expectations measure [7] is among the most important gauges of the credibility of the BOI monetary policy.

There are also inflation forecasts by professional forecasters which include banks as well as other firms and in the past few years have become another source used by policymakers.

In this study we also use two types of FX currency options. The first type is traded daily on the TASE and includes European call and put options with maturities up to six months. The second type is FX options offered in weekly auctions by the BI.

Since 1993, the BOI has offered At-The-Money-Forward (ATMF) options for three and six months respectively. Since these options have no intrinsic value their price reflects only the uncertainty regarding the FX rate. Table 1 provides summary statistics of inflation forecasts, actual inflation, the exchange rate and implied volatility.

The data is used in three ways. First, the information derived from the real and nominal bonds is used to assess their influence on inflation forecasts with and without FX intervention. Second, the traded FX currency options are used to construct an effective exchange rate band, which turns out to be much narrower than the official one and is more relevant to the participants in the FX market. Third, the effective band is then used to demonstrate the conflict between an IT regime and a crawling FX band regime.

III. Credibility of Monetary Policy and FX intervention

In countries with inflation targeting the central bank steers the short-term interest rate (the *key* rate) under its control to achieve its goal. Changes in the *key* rate affect, to a large extent, future inflation through their effect on inflation expectations and as stated in (Svensson (2001), and stressed by Woodford (1999), "…to the extent to which private sector expectations, take into account the conduct of monetary policy". Thus a key feature of the IT regime is its forward-looking nature [8]. Since expected inflation should, assuming rational expectations, embody all the relevant information regarding the future path of inflation it depends on the current and future levels of the *key* interest rate, the current and expected states of economic activity and the exchange rate.

Table 1

Summary of Statistics of Rates of Inflation and Exchange Rates

Using Monthly Observations For the Period 2/96 – 6/01

	Mean	***SD***	***Min***	***Max***
π	5.85	4.01	-0.12	12.93
π^e	6.40	3.54	0.76	13.72
S	6.01	5.58	-4.90	19.62
IV	6.79	**-**	4.70	11.00

π	*The rate of inflation during the last 12 months*
π^e	*The one year ahead expected rate of inflation*
S	*The rate of change of the Shekel Dollar exchange rate in the last 12 months*
IV	*The implied volatility of the six months BI option*

The way that inflation expectations respond to changes in the key rate depends on the credibility of the IT regime. The more credible the regime, the stronger the response of the inflation expectations to an expected change in the key rate. In reality, however, there never is full credibility and inflation expectations are never fully and permanently anchored at the desired inflation target. Rather, inflation expectations are affected by various shocks and are conditional, among other factors, on the way monetary policy responds to shocks.

Credibility may be adversely affected by various constraints placed on the transmission process of monetary policy. One such impeding constraint may be the FX regime. Specifically, the existence of an official exchange rate band in a small-open inflation targeting economy is a case in point. In such an economy, the exchange rate is an important channel through which monetary policy affects inflation (see Svensson (2000) and Haldane and Batini (1998)). This channel is shut-off when the exchange rate is not allowed to appreciate beyond a certain arbitrary rate determined by the lower limit of an exchange rate band. When the limit is reached the central bank is forced to engage in

sterilization operations which are problematic for well known reasons such as the "quasi-fiscal" costs of sterilization [see, for example, Calvo (1991) and Kletzer and Spiegel (2000)] and the accumulation of national debt which sterilization generates. Moreover, by shutting off the exchange rate channel which is the fastest transmission channel, the other main channel which affects inflation, the real interest rate – aggregate demand channel, must "work harder" (e.g., meaning a higher unemployment than in a full floating regime). In other words, the effectiveness of monetary policy is impaired when the central bank is forced to defend the limits of an exchange rate band. The issue is how sustainable is an IT regime when exchange rate movements are restricted by an effective band.

The effect of an FX band in an inflation targeting regime is tested next. As stated above, inflation expectations are affected by the monetary policy and also by economic activity. The hypothesis which we test is that the FX band severely hampers the effectiveness of monetary policy. When the exchange rate is at the lower limit of the exchange rate band, inflation expectations react differently to the expected changes in the *key* rate than when the exchange rate is freely floating inside the band. Figure 1 depicts the evolution of the exchange rate within the official band.

To minimize the effect of autocorrelation, present in our time-series data, we test the hypothesis using first differences in the following equation

$$\Delta E_t \pi_{t+1} = b_o - b_1 \Delta i_t - b_2 \Delta RS_t + e_t \qquad (1)$$

where $\Delta E_t \pi_{t+1}$ is the change in the 12-month ahead average inflation forecast, Δi is the change in the difference between the daily *key* interest rate and the one year nominal rate on a zero coupon Treasury note. A fall in the one year rate relative to the *key* rate, according to the pure expectations hypothesis, means that future *key* rates are expected to fall. Such a change means that the current tight monetary stance is expected to loosen. If the commitment to inflation targeting is credible and expectations take into account the conduct of monetary policy then $b_1 < 0$.

The variable ΔRS is the change in the difference between the real yields to maturity on CPI linked bonds for 1 and 15 years respectively. A rise in the one year real rate relative to the 15 years rate is a signal of an expected slow down in economic activity which decelerates inflation forecasts. The inclusion of a variable representing the expected state of economic

activity is important because an expected slowdown, lowers, *cetirus paribus,* both inflationary pressures and inflation expectations for any given key rate.

We are fully aware that equation 1 is an incomplete model of inflation expectations. Its only purpose, however, is to test the impediment that an FX regime imposes on the monetary transmission mechanism, the link between the key rate and inflation expectations.[9] The conventional approach includes the rate of inflation or lagged inflation in the regressions and the coefficients are used as a test of credibility of the regime. See, for example, Gurkaynak, Levin and Swanson (2005) or Ball and Sheridan (2004) who use OECD forecasts.

There are numerous empirical studies[10] which use the slope of the nominal yield curve as a predictor of economic activity. Here we use the slope of the *real* yield curve which should be even a better proxy of economic activity.

To test our hypothesis we focus on the difference between two periods. The first is from February 1996 to June 1997. During this period the exchange rate was stuck at the lower edge of the band for forty percent of the time. During the rest of the time it was very close to the lower limit (never more than 5.7 percent from the lower limit). The central bank was forced to buy dollars to defend the lower limit. Since the BOI was committed to the inflation target, it had no choice but to engage in sterilizing the effects of its intervention. In the first six months of 1997 alone the BOI purchased and sterilized more than 7 billion dollars. The second period is from June 1997 to June 2001. During this period the BOI did not intervene directly in the FX market, including the Russian default crisis and the Long Term Capital Management (LTCM) debacle (fall of 1998) during which the exchange rate rose about 15 percent above the lower limit. We tested the difference in the two periods using the following regressions: a regression for the whole period and for the two sub periods; the intervention period and the non-intervention period. To test the sensitivity of the results to the unusual events, the Russian/LTCM crises that took place in October and November of 1998, we have introduced a dummy variable in the second period regression. The results are presented in Table 2.

Table 2

The Effect of Monetary Policy on Inflation Expectations in an FX Band Regime*

Periods	b_0	b_1	b_2	Dummy	R^2	D.W.
2-1996 to 6-2001	-0.09	-0.37	-0.52		0.33	1.81
	(-1.39)	(-2.20)	(-1.86)			
2-1996 to 6-1997	-0.04	0.11	0.01		0.02	2.03
	(-0.36)	(0.42)	(0.02)			
7-1997 to 6-2001	-0.14	-0.67	-0.43		0.54	1.55
	(-1.82)	(-3.65)	(-1.49)			
7-1997 to 6-2001 (Dummy)	-0.19	-0.54	-0.33	2.00	0.74	1.82
	(-3.21)	(-3.78)	(-1.49)	(5.22)		

**The statistics in Table 2 are obtained from the regression given in equation 1. The numbers in parentheses are t-values. The dummy variable is for the October and November 1998 period to test the effect of this unusual period.*

The message of the results is clear. First, for the period as whole, Feb. 1996 to June. 2001, the results are consistent with our expectation $b_1 < 0 \ \ and \ \ b_2 < 0$. Tighter monetary policy, increasing the key rate, reduces inflation expectations and an increase in the slack in the economy, as proxied by the real interest rate gap, also reduces expected inflation. Second, there is a significant difference between the two periods. During the Feb. 1996 to June 1997 period, when the exchange rate was at, or very close to, the lower limit of the band and the BOI intervened heavily in the FX market, changes in inflation expectations were not related either to Δi or to ΔRS. That is, they responded neither to changes in the monetary stance nor to changes in the variable representing the output gap.

In sharp contrast to the first period, in the July 1997 to June 2001 period, the non-intervention period, both b_1 and b_2 are negative as expected and the R^2 of the regression

indicates that overall our simple model is a good representation of the relationship between inflation expectations and the BOI policies. The difference between the two periods can be explained by the difference in the credibility of the commitment to inflation targeting. This commitment was not very credible in the first period when the BOI had to defend the exchange rate and had to sterilize its purchases of foreign currency. Monetary policy at that time was in effect facing the situation described by Sargent and Wallace (1981) as "unpleasant monetarist arithmetic". In the second period, however, there was no FX intervention and the commitment to inflation targeting was much more credible.

To test the robustness of the results, given the special circumstances in the fall of 1998, we have introduced a dummy variable for this period. The results in row 4 show that although the dummy variable is positive and significant, it does not change the nature of the earlier results. In particular the coefficient of b_1, the effect of the monetary stance, remains negative and significant. The coefficient b_2 remains negative but not significant, as before. Moreover, the exclusion of this period has improved the total fit of the relationships presented in equation (1).

The above results show that in circumstances like the ones described here, monetary policy is ineffective and the transmission mechanism is hampered by the exchange rate policy.

IV. Sustainability of Inflation Targeting and an Exchange Rate Band

This section provides further evidence of the conflict between inflation targeting and the exchange rate policy. Many countries, in the past, have followed such policies in an attempt to strike a balance between the exchange rate and inflation[11]. Maintaining such a balance is rather problematic in countries with a long history of high inflation and a high pass-through from the exchange rate to consumer prices. In such countries, the efforts to reduce inflation through a tight monetary policy requires a consistent fiscal policy framework.

Pursuing a policy of sterilized FX intervention, with its "quasi fiscal costs", whose burden is not internalized in a transparent[12] way by the fiscal authorities, is clearly inconsistent with a tight monetary policy stance. The *key* rate deemed appropriate for achieving the inflation target may also affect the equilibrium FX rate, causing the domestic currency to appreciate. Since, however, the exchange rate is not allowed to appreciate below the lower limit of the

FX band, maintaining the band simultaneously with the IT regime may prove to be unsustainable. Simply put, the commitment to fight inflation may result in the abandonment of the FX regime.

One way to detect in advance the conflict between the two policies is to examine the relationship between a tight monetary policy and expected FX uncertainty. If raising

the *key* rate results in greater expected exchange rate uncertainty which means a higher probability of either a large appreciation or depreciation, it would point to a potential breakup of the twin policies. A higher probability of a large appreciation means that breaching the lower limit of the FX band is more likely and a higher probability of a large depreciation means that the inflation target may be violated because of the pass through from the exchange rates to consumer prices[13].

To test the relationship between the *key* rate and expected FX volatility we introduce a straight forward simple regression

$$PRM = a_0 + a_1 KR + v \qquad (2)$$

Expected exchange rate volatility is represented by the dependent variable PRM, which is the option premium[14] of the six months at-the-money-forward (ATMF) calls offered in weakly tenders by the BOI. The variable KR stands for the *key* rate and v is an error term. The data, PRM and KR, consists of weekly observations, which corresponds to the day (normally a Tuesday) on which the option is auctioned off by the BOI.

The above relationship is tested for the whole period Feb 1996 to June 2001 and for the two sub-periods: I. the period when the exchange rate was inside the band and sub-period II when the exchange rate was stuck at the lower limit of the band.

Table3

Test of the Sustainability of Inflation Targeting and the FX Band*

	a_o	a_1	R^2	DW
Period I: 7-1997 to 6-2001	1.17	0.03	0.58	2.42
	(2.72)	(2.67)		
Period II: 2-1996 to 6-1997	- 1.98	0.25	0.66	1.93
	(-3.75)	(6.92)		
Total Period: 2/1996 – 6/2001	1.37	0.05	0.66	2.47
	(4.27)	(1.83)		

** The regressions in rows 1 and 2 were estimated using the AR procedure. The coefficients of AR were respectively 0.72 and 0.76. This procedure was applied because of high serial correlation of the error terms. There was no serial correlation present in the second period regression. The numbers in parenthesis are t-values.*

The results in Table 3 confirm our hypothesis that tighter monetary policy is associated with greater FX uncertainty when the exchange rate is restricted by a band, $a_1 > 0$ and is statistically significant in all three periods examined. This result is particularly strong during the BOI intervention period (period II), when the exchange rate was stuck at the lower edge of the band. During that period, a one percentage point rise in the *key* rate (KR) resulted in a 0.25 percentage point increase in FX uncertainty as measured by the premium on the FX call option (PRM). Not surprisingly the conflict between inflation targeting and

the FX band regime was particularly strong in the second period. Even when the exchange rate was inside the band, in period I, and no FX intervention took place the evidence points to this conflict, a significant positive coefficient, a_1, though its magnitude is much smaller. The mere existence of an FX band is enough to potentially create a conflict.

Though these results are significant they may understate the extent of the conflict described above. To see this consider the effect on FX uncertainty of narrowing the band while

holding the key rate unchanged. A narrower band implies, ceteris paribus, a higher probability of violating the band's limits which should result in higher expected volatility of the exchange rate. A narrower band does not necessarily involve narrowing the official limits of the band. Instead, the band could effectively get narrower as a result of monetary policy. For the purpose at hand, the lower limit of the effective band is the official one, but the upper limit is **effectively** determined by the credibility of the policy to achieve the inflation target and the existing pass- through from the exchange rate to consumer prices. The upper effective limit, which is much lower than the official upper limit, reflects the public's perception regarding the ability of BOI to attain the inflation targets specified by the government. This perception takes into account high pass-through, from the exchange rate to prices in Israel, which could interfere with the attainment of the inflation target. Thus, given this pass through, and as long as the exchange rate is inside the band, the more credible monetary policy becomes in reducing inflation the lower is the probability of a depreciation of the currency. I.e. the lower is the effective upper limit of the band.

We next construct the upper effective limit which we need as a basis for our extended test of the sustainability of the twin policies. To construct the "effective" upper limit we used FX currency options with varying strike prices traded on the TASE. On any given trading day we searched for an **out-of-the-money** call option with the highest available strike price for which some minimal positive premium has been paid[15]. We mark the exchange rate corresponding to the strike price of this option as a point on the effective upper limit. This procedure is repeated for each trading day starting in February 1996 to June 2001. The result is an effective upper edge, which is depicted in Figure 2.

The effective FX band provides interesting information. First, from February 1996 to November 1998, just after the Russian/LTCM crises the effective band was only 4.4 percent wide with a standard deviation of 1.6 percent. As was mentioned earlier, during this period the parameters of the official band changed twice. These changes had little effect on the **width** of the effective band, which we use in our next test and is represented by VK. The following test expands the test of equation (2), by adding the **width** of the FX band, VK, as an explanatory variable in the following equation.

$$PRM = a_o + a_1 KR + a_2 VK, \qquad (3)$$

FX expected volatility, PRM, should be also affected, for a given key rate (KR), by the width of the exchange rate band.

The results, presented in Table 4, are interesting in several respects. First, we find once again, as in Table 3, that a rise in the *key* rate results in greater FX uncertainty.

This is true when the exchange rate was inside band (first row second column) and particularly so when the exchange rate is stuck at the lower band's limit (second row second column).

Table 4

Tests of the Sustainability of Inflation Targeting With an Effective FX Band*

	a_o	a_1	a_2	R^2	DW
Period I: 7/1997 - 6/2001	**0.94**	**0.026**	**3.96**	**0.64**	**2.30**
	(4.80)	**(3.50)**	**(7.70)**		
Period II: 2/1996 - 6/1997	**-0.80**	**0.15**	**8.41**	**0.68**	**2.18**
	(-0.88)	**(2.12)**	**(1.57)**		
Total Period: 2/1996 - 6/2001	**1.00**	**0.05**	**4.26**	**0.65**	**2.30**
	(5.30)	**(3.19)**	**(8.60)**		

***** *These regressions, for the total period and period I, are estimated using the RA procedure. The coefficients of AR were 0.57 and 0.6 respectively. This procedure was applied because of high serial correlation in the OLS version. The numbers in parentheses are t-values.*

Second, when the exchange rate is inside the band, a wider effective band is associated, as expected, with larger FX uncertainty (first row third column). However, when the exchange rate is stuck at the band's lower limit the width of the effective band does not seem to affect exchange rate uncertainty.

Third, adding VK improves somewhat the overall fit of the period I regression, but not the one for period II. That is, when the exchange rate is stuck at the lower limit of the band, not only is an increase in the *key* rate ineffective in reducing inflation expectations but it also points to an increase in exchange rate volatility. That is, a tighter monetary policy

leads in this case to a higher probability of either, a large appreciation of the exchange rate (possibly breaching the lower limit of the band.). Or, a large depreciation of the exchange rate which might, via the pass through, cause inflation to be higher than the target[16].

V. Summary and Conclusions

The main question addressed here is the following, could a country simultaneously commit itself to an inflation target and an exchange rate band. The inherent conflict between the two remained even after the band was widened considerably.

Is the Israeli experience relevant for inflation targeting countries with no official band but with direct currency intervention. Could the case be made, for inflation targeting countries, that intervention could be useful "so long as they are not perceived as trying to defend a particular rate" as stated by Fischer (2001). We doubt that it is possible to maintain an intervention policy in an inflation targeting regime. The fact that very few central banks disclose information regarding their FX intervention means, in our judgment, that they themselves cannot clearly distinguish between intervention to keep "orderly markets" and intervention aimed to affect the exchange rate because it is "clearly away from fundamentals."

Even an implicit exchange rate band might lead to conflicts such as in Israel. In the last decade there has been a range of exchange rate regimes with straight dollarization or currency board on the one hand and various degrees of floating on the other hand.

The results of this study suggest that maintaining a credible inflation targeting regime is sustainable only if we view the exchange rate as a financial asset whose value is determined by market forces.

Endnotes

1. Inflation targets differ from country to country. The specification involves target horizons, the price index used, target range or points, escape clauses and who sets the target (the government or the central banks). Though the U.S. does not have an explicit inflation target, Ben Bernanke, the current Fed chairmanis a long time proponent of explicit inflation targets.
2. An example of such a policy was the international concerted effort to support the Euro in Sept. 2000.
3. The FX band is vis-à-vis a currency basket which is based on the currencies of Israel's main trading partners where the dollar has about 60 percent of the weight and the Euro's weight is about 25 percent.
4. On that day, an asymmetric change in the slopes of the band was introduced; six percent for the upper limit and four percent for the lower limit. An additional decrease to a slope of two percent of the lower limit was introduced in June 1998. The band was finally eliminated in May 2005.
5. For example, the Bank of England is routinely engaged in extracting data from financial markets to assess its monetary stance. Information from FX currency options has been used to assess the credibility of official exchange rate target zones (e.g. Campa and Chang (1996)).
6. This estimate may be biased upwards since it may include a premium for inflation uncertainty. Since, in recent years, inflation has declined considerably so did the uncertainty surrounding it. We believe, therefore, that the risk premium is minuscule, and that the estimate of inflation expectations is only slightly biased.
7. For the details on the derivation of inflation expectations in Israel see Yariv (1990).
8. See for example, the survey by Clarida, Gali and Gertler (1999).
9. There is a compelling reason why equation (1) was specified as a first difference rather than a level equation. During the period under consideration, there was a world-wide

downtrend of inflation, inflation expectations, and interest rates. This was also true for many previously high inflation countries such as Israel. Thus, if (1) were specified as a level equation, a valid criticisim might be that any result pointing to the expected negative effect of the expected key rate on expected inflation does not reflect credibility but rather is a spurious result hiding the true international pressures which were the driving force behind the decline in both. The same argument cannot be claimed for a first difference specification. There are two additional reasons for specifying (1) as a first difference equation: a) to reduce the effects that persistent shocks might have on inflation expectations and b) to reduce the effects that gradual policy responses to shocks (interest rate smoothing) might have on inflation expectations.

10. Among related studies are Estrella and Mishkin (1997) and Smets and Tsatsaronis (1997) where the test is for more than one country. A recent study by Neiss and Nelson (2001) argues that the interest rate gap (the difference between the current and the natural rate of interest) might be a better predictor of future inflation than the output gap.
11. This possible trade-off is pointed out by Fischer (2001) who considers it to be analogues to the Phillips curve tradeoff.
12. The cost of sterilization is internalized by the fiscal authorities in a transparent way if there are explicit arrangements where the Treasury covers Central Bank's losses stemming from sterilization operations. Such an arrangement is provided in the New Zealand Reserve Bank Act of 1984. This is not the case in Israel and in many other countries.
13. Bufman and Leiderman (2001) estimated an average pass-through coefficient of 40 percent over the first 10 quarters after the shock while Elkayam (2001) reports an immediate pass through of 25 percent.
14. For ATMF options the premium is mainly determined by volatility. In the Black-Scholes model there is a one to one correspondence between option premiums and implied volatility.
15. To control for the changing time to maturity of the option we decided to use a constant 75 days to maturity. Since only on few occasions the maturity is of 75 days we have used options which originally had 60 days and 90 days to maturity and constructed a weighted average price of these two options.

16. It should be mentioned that the results presented in tables (3) and (4) may be affected by omitted variables in equations (2) and (3). We do not believe, however, that the bias, if there is one is different in the two periods that we have tested.

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FIGURE 1

EXCHANGE RATE BAND AND CONSUMER PRICE LEVEL (1/1/95-6/30/01)

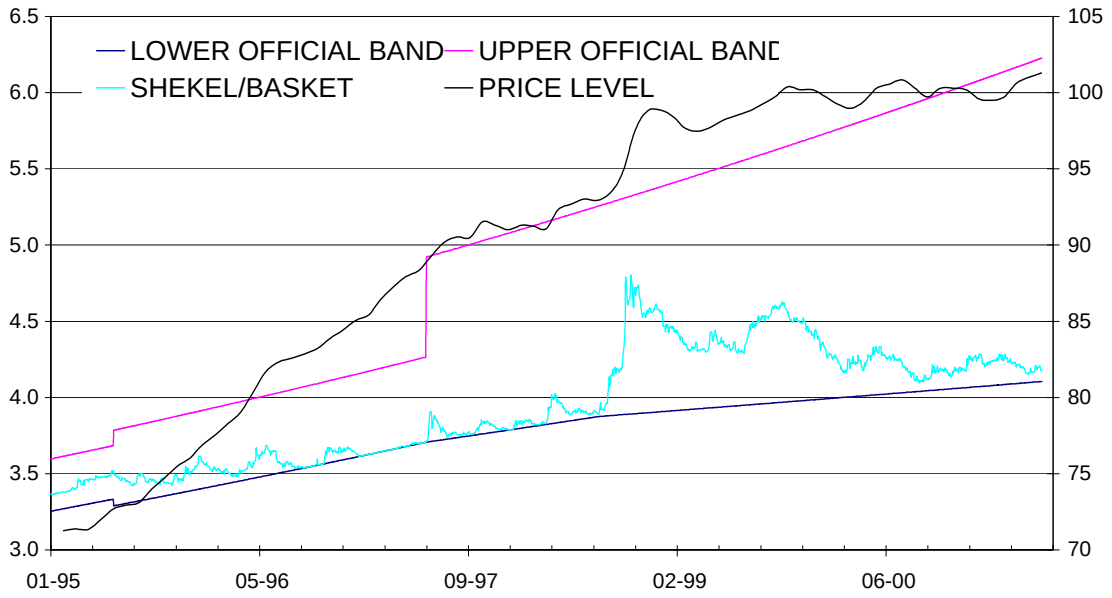

FIGURE 2

THE EFFECTIVE UPPER EXCHANGE RATE BAND, THE OFFICIAL LOWER BAND

AND THE ACTUAL EXCHANGE RATE 2/1/96-) (6/30/01