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ABSTRACT

Inflation Targeting as the New Golden Standard*

Financial globalization has seen the emergence of a new monetary standard based on inflation targeting. At the same time the most financially advanced economies moved away from exchange rate targeting which also characterized the previous era of globalization - the era of the Classical Gold Standard. Does the new financial environment of free capital flows constrain the independence of central banks to conduct monetary policy? We argue, and show empirically, that credible inflation targeting allows central banks to conduct an independent monetary policy as manifested in their ability to deviate from the world (Fed) interest rate. This new regime, with exchange rate flexibility, generates sufficient short term volatility that prevents short term arbitrage against central banks that deviate from the Fed rate. In contrast, during the Gold Standard only limited deviation was possible within the 'gold points'. On the other hand, the credibility of inflation targeting regime is as good as gold in anchoring inflation expectations for the long run as manifested in strong co-movement and similar levels of long term borrowing rates- just as was the case during the gold standard. We conclude that inflation targeting allows more flexibility than the Gold Standard to conduct monetary policy in the short run and has similar benefits for long term stability. We suggest that it is the new golden rule.

JEL Classification: E31, E4, E42, E43, E44, E55, E58, F3 and F33
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1. Introduction

Following three decades of inflation and exchange rate regimes evolution, a new international monetary system is emerging. The former Bretton-Woods system, that prevailed from 1946 until 1971, was based on fixed exchange rates that were modified periodically. The new system is polarized: on the one hand, currency union prevails within the Euro monetary union where it is impossible to change the exchange rate and the same applies to the countries that adopted dolarization. For many of the remaining national currencies, the exchange rate is free to float; most central banks in more developed countries now target the inflation rate, or inflation together with other goals, instead of targeting the exchange rate[1]. In lesser developed countries, exchange rate targeting is still in effect but there is continuous movement towards inflation targeting.

Another fundamental difference with respect to previous systems is the independence from gold in pegging the inflation (price) level. In both the Bretton-Woods and the Gold Standard systems, the intrinsic value of money was anchored by a fixed exchange rate with a precious metal. As of 1971, the value of money is based merely on monetary and fiscal polices. Following the high inflations in the 1970s and stabilizations in the 1980s, a set of rules of behavior, known as fiscal discipline and inflation targeting emerged in the 1990s. The rules for inflation targeting include a well specified range for inflation, usually a band of very low and positive inflation rate that is usually promulgated by the government: 1-3% in many countries. The central bank usually employs a transparent policy and sets the domestic short term interest rate to achieve this goal. Most countries that adopted inflation targeting also practiced floating exchange rates. (See Table A).

In this regime it is common to speak of a reaction function of central banks (Taylor, 1993) in which the central bank's lending rate is adjusted in response to deviation of inflation from target and possibly in response to change in the output gap.[2] Often, the success of the regime is facilitated by increased central bank legal independence[3]. Moreover, a crucial necessary condition for maintaining low inflation is part of the

[1] Inflation targeters include both countries with explicit inflation targets (Canada, New Zealand) and those with implicit targets such as the U.S., the ECB or Switzerland. In the empirical part we limit oursleves to implicit targeters only.

[2] See: IMF inflation targeting (2006) for a comprehensive review of the current state of affairs. Their definition of IT is rather restrictive. For example, the ECB has a well-specified inflation target but is not categorized as inflation targeter and so is Switzerland.

[3] Cukierman (1992).

Washington consensus known as 'fiscal discipline': low budget deficits and reasonably low government debt to GDP ratio. [4] The Maastricht treaty quantified the conditions for joining the Euro: budget deficits are limited to 3 percents of GDP, and government debt is limited to 60 percent of GDP.

Rose (2006) characterizes this new international regime in a very useful way. Unlike the Bretton-Woods system, there is no need for central coordination. It is a stable system: no country that adopted it was forced to leave it and move back to exchange rate targeting; inflation targeters suffer less from sudden stops and reversals of international capital inflows; and the probability of regime change is lower as compared with the Bretton-Woods system. The IMF (2006) also found that leaving exchange rate targeting in favor of inflation targeting is associated with an improvement of macro-economic performance, as measured by a loss function of inflation, output and real exchange rate volatility.[5] It is interesting to note that similarly to inflation targeting, the gold standard system (1870-1914) was also devoid of the need for a central coordinator, and was also based on rules for fiscal and monetary discipline.[6]

Apparently, central banks (and governments) that target inflation have managed to convince economic agents that they can control inflation, and thus inflationary expectations are now anchored by the inflation target. However, in an environment of financial globalization characterized by free capital flows, achieving the inflation targets is not simple: In a world with free capital flows it may be argued that differences between interest rates in various countries will be arbitraged away, making it difficult, if not impossible, for central banks to conduct independent monetary policy. In particular, for a small open economy, setting the interest rate above the FED rate might lead to short term capital inflows which need to be sterilized; setting the rate below the FED rate might lead to capital flight which may undermine financial stability. It is this inherent difficulty that was addressed by Svensson (2000) who argued that small open economies can not behave according to the simple Taylor rule, but have to explicitly incorporate the effect of global financial markets (country risk premium, spreads, etc..) in the central bank's reaction function.

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[4] The term 'Washington consensus' was coined by John Williamson. See: Williamson (2000) for re-appraisal of the term. Some IMF people say that IMF stands for 'Its Mostly Fiscal'.

[5] See: IMF inflation targeting (2006), p.48.

[6] Eichengreen and Flandreau (1997) show that the Bank of England was not 'the conductor of the international orchestra'.

This dilemma was also present under the gold standard (Eichengreen and Flandreau, 1997) when central banks used the lending rate to peg gold reserves and the price of gold. Under a fixed exchange rate and free capital flows, central banks had to worry about the effect of interest rate differentials when conducting their monetary policy.[7]

Following the literature on exchange rate targeting, we contribute to the inflation targeting literature by arguing that in this regime, as during the gold standard, there exists a band inside which short-term interest rates can deviate between countries, allowing for the conduct of independent monetary policy. It has been recently argued (Svensson (1994)), that the gold standard operated much like the modern exchange rate targeting regime. The exchange rate band around the central parity was the result of the cost of shipping gold ('gold points'). Recently, this point was examined empirically by Bordo and MacDonald (2005). Under the inflation targeting regime it is the short term exchange rate volatility that allows this deviation. Inflation targeting is associated with flexible exchange rates and higher volatility. Devereux et. al. (2006) investigated the theoretical basis for this phenomena.[8] Volatility increases exchange rate risk and therefore serves as an additional cost facing those who want to exploit interest rate differentials between two countries. Put differently, higher volatility may deter large volumes of speculation against the domestic currency.[9] Then, as now, central banks exploited this freedom for carrying out their short-run policy: anti-cyclical policy and interest rate smoothing.

In this paper we examine, empirically, the functioning of this new international standard as it is reflected in two key interest rates: the short term central bank rate and the long term bonds' market yields. In particular, we empirically investigate the nature of the central bank reaction function. We distinguish between open economies that commit to inflation targets and those that don't. We investigate whether the former follow a Taylor type rule while the latter peg the FED rate. We then suggest that central banks that pursue an inflation target can take advantage of the high exchange rate volatility to exploit a band around the FED rate within which they may react less to external variables than is implied by the standard Svensson (2000) reaction, (as did Gold Standard central bankers (Svensson 1994)). This band implies non-linearity in the Central Bank's reaction function, which is departure from Svensson (2000). This

[7] See: Svensson (1994).

[8] See: Devereux et al. (2006).

[9] This kind of speculative attack is called 'carry trade'; the most notable recently is against the Japanese Yen.

is reminiscent of Taylor (2001), who found non-linearities in the PPP relationship. As a control we also investigate the uncovered interest parity for the ten year bonds. We hypothesize that short term exchange rate volatility has a lesser impact on long term bonds, and therefore we expect domestic long term bonds to follow U.S bonds more closely than the policy determined short term interest rates.

Using quarterly data for the years 1993 to 2006 from 27 open economies, twenty of them emerging markets and seven open OECD countries, our results show that for the non-inflation targeters, the Svensson (2000) reaction function holds where central banks seem to merely peg the Fed rate. However, for economies that have inflation targets there exists a band of two and a half percentage points above and below the Fed rate in which the reaction function is weaker. [10] Therefore, as shown for the Gold Standard, interest rates of established inflation targeting central banks can deviate quite substantially from each other. However, a central bank that has not yet established its credibility as inflation targeter must follow the world interest rate more closely, because a large discrepancy may lead to a sudden devaluation and to foreign investors' loss of confidence in the currency, leading to further devaluations and a possible vicious cycle. This may be exacerbated by possible pass-through from devaluation to inflation (Svensson (2000)).

The long-term bond markets exhibits, paradoxically, an opposite picture: for credible inflation targeting economies, long-term domestic yields follow the 'world's' long term rate rather closely. [11] Obviously, long-term investors nowadays are subject to much more exchange rate risk, as compared with truly fixed exchange rate regime such as the gold standard. However, if agents believe in the inflation target set by the government, then the difference in inflation targets between home and abroad is - assuming uncovered interest rate parity with constant country risk - , a proxy for interest rate differentials. Most often, economies share the same inflation target, and therefore there is no expectation of a long term trend in the exchange rate and hence no significant difference in long term yields.[12]

Our results echo those of Bordo and MacDonald (2005) who studied monetary independence under the gold standard, for France, Germany and the UK in 1880-

[10] See also: CGG (1998).

[11] This implies co-movement of the long term rates. There could still be a differential risk premium between economies.

[12] Even in models that assume the Samuelson-Balassa effect, we should not expect a long term trend in the exchange rate between the industrialized countries that have very stable productivity growth rates in the long run.

1913. They found that long-term interest rates deviated less than short-term interest rates, and that the central bank had a reaction function to the fundamentals of the economy. Flandreau and Komlos (2006) studied the case of the successful Austro-Hungarian exchange rate band, based on the gold standard, in the period 1896-1914. They emphasize that policy's credibility was the basis for successful monetary conduct in the first era as well. Our findings, therefore, suggest that inflation targeting is a new golden rule.

In Section 2 we present data motivating our more formal analysis, showing that long-term market yields converge more than short-term policy determined discount rates. In section 3 we present the reaction function of central banks, showing the significant difference between inflation targeters and others, taking into account the dynamics of becoming a successful inflation targeter. We show the importance of FDI as a proxy for risk premium for the non-targeters, and also estimate the risk premium equation as a function of FDI. Section 4 presents the econometric findings and section 5 concludes..

2. The international capital market development, interest rate spreads and exchange rate volatility

Figure 1 shows central bank rates spreads versus the U.S and exchange rate volatility for three countries who pioneered inflation targeting: Canada, New Zealand and Australia. Volatility as measured by the daily standard deviation of changes in the exchange rate, seems to have roughly doubled after 1996. In all these countries the central bank was clearly able to operate within a significant spread that was associated with a high and rising volatility of the exchange rate.[13] Canada, which is particularly vulnerable to the effect of capital flows exploiting interest differentials, shows a remarkable correlation between the width of the spread and exchange rate volatility. When we compare this with the Gold Standard period, the movement of exchange rate was limited by the gold points – for example, about ±0.5% in the case of Austro-Hungary, so the volatility was much smaller. (See: Flandreau-Komlos (2006).) This allowed for much smaller spreads and less flexibility than we see today.

It is interesting to note that long-run yield spreads are much smaller than their short-run counterparts and less volatile. In Table 1 we present the data.. In our panel data,

[13] A detailed study by the IMF (2004) also finds changes in the volatility of the exchange rate, but no trend.

that span 27 countries over the years 1993-2006, when restricted to observations with annual inflation of not more than 10 percent and conditional on the country being able to issue long term domestic bonds, the average long spread is 210 basis points over the U.S. 10 year bond rate (which represents a 39 percent spread), while the average short spread is 294 basis over the Fed rate (which represent a 89 percent spread). The standard deviation of the short spread is also higher than that of the long spread. When we restrict our sample to those countries with an inflation target we note that the main effect is to lower the spread and volatility of the ten years bond yields. Furthermore, restricting our data to those countries that achieved inflation rates within a stable target below three percent – we notice a dramatic decline in the long term yield spreads and volatility.

Anticipating the more elaborate econometric analysis in the next sections, we show in Table 2 simple regressions of long- and short-term rates using the same data points as in Table 1. The ten year bond rate of the various countries in our sample follows more closely the U.S. ten year bond rate, with a coefficient closer to 1 and much better fit – R^2 of 0.45 as compared to 0.18 for the correlation of the central banks' rates with the FED lending rate. Again, when we restrict the sample to countries that achieved an inflation rate below a target of three percent, our results become stronger: the coefficient of the long term ten year bond yield is practically one and the coefficient of the short term rate drops below half.

As we alluded above, the seeming paradox that these data present, that the short interest rates are less subjected to the international capital markets discipline than the long rates, emerges from the properties of the inflation targeting regime. We show that it is the freedom to conduct independent monetary policy in the short term, obtained by successful inflation targeting central banks, which is behind the efficiency of the international long term bond markets. Put differently, the flexibility of the short term rates allows central banks to successfully pursue their inflation targets and obtain credibility that convinces market participants that inflation is under control and predictable. Given similar expected inflation rates for the countries operating under this regime, the long term capital market may function smoothly, with relatively small spreads.

3. The determination of interest rates in today's world capital markets and the conduct of monetary policy

A convenient point of departure in analyzing international capital markets with free capital flows and flexible exchange rate is the uncovered interest rate parity condition:

(1) $i = i^{*} + s_{t+1/t} - s_t + \varphi_t + \xi_t$

Where i and i^{*} are domestic and foreign interest rates, respectively; $s_{t+1/t} - s_t$ is the expected devaluation of the nominal exchange rate. This differential is approximated, following relative purchasing power parity, by the expected inflation differential between two countries; φ_t is the risk premium of the sovereign debt – country risk; and ξ_t denotes the sum of exchange rate risk and transaction costs. The term $\varphi_t + \xi_t$ introduces a wedge between the interest rate at home and abroad for a given expected exchange rate change.

Equation (1) holds for both short-term and long-term interest rate parities, However, the relative weight of the wedge is higher for the short-term case. Transaction costs are constant per deal and thus represent a larger fraction of the short-term rate of return. This is similar to the Tobin tax on financial transactions that constitutes a barrier for short-term capital movements but not for long-term ones.[14] The share of the risk premium is also lower in the total value of the long-term yield relative to the short-term one. [15] Thus, the market for long-term securities is more integrated than that of short-term securities whereas, the greater are the volatility and transaction costs, the more costly it is to transact with short-term securities. This creates a band around the world's interest, in which central banks have the freedom to pursue more independent monetary policy.[16]

This band is reminiscent of the exchange rate band in a fixed exchange rate regime. Svensson (1994) shows that this band allows the central bank some freedom in conducting monetary policy. In the gold standard period, the band was defined by the

[14] See discussion in Flandreau and Komlos (2006) for the gold standard era.

[15] In our comparisons of short and long term exchange rate volatility, the volatility increases by the square root of the period length, or by less.

[16] An interesting manifestation of this general principle is the speculative action known as 'carry trading', which has become a center of attention in the first months of 2007. Speculators borrowed in Japanese Yen, whose interest rate was rather low – the Bank of Japan rate was close to zero – and invested in currencies whose rate of return was much higher. The risk of this position depends on the probability of the appreciation of the Yen, because the loan must be repaid in Yen. The higher the volatility of the Yen's exchange rate, the higher is the probability of its appreciation. In the specific case of the Yen, it is its traditional low volatility that allured the speculators.

In a somewhat different vein, Svensson (2000) suggests a very elaborate theoretical framework for conducting inflation targeting policy in a small open economy and solves a calibrated version of it. In Svensson's model, the central bank minimizes a quadratic loss function that represents aversion to both inflation and deviations from equilibrium output. In this model, the real exchange rate is one of the channels for the transmission of monetary policy: a decline in the interest rate causes a depreciation of the currency and thus affects inflation. When the domestic interest rate is lowered by the central bank, the exchange rate depreciates to balance the uncovered interest rate parity condition (the Dornbusch over-shooting effect). This effect allows the central bank to conduct monetary policy despite the fact that international short term capital markets are perfectly competitive. One of the assumptions used in Svenssnon's model is that exchange rate risk follows an auto regressive process with a mean of zero. This is quite different from the finings we report in Figure 1, which shows that for thirteen years it was always positive and non-negligible. This is consistent with our findings that show (Figure 1) that spreads need not converge to zero as in the model, or to any other constant level.[17] Thus, in reality, due to market imperfections, central banks seem to have more freedom to determine their interest rates than the model suggests.

Adopting Svenssons (2000) model, the issue at hand is the value of the coefficient c in Equation (2):

(2) $i=a\pi+b(y-y_p)+ci^*+\varphi$

Where i is the central bank's rate, π is the inflation rate, $y-y_p$ is the output gap, i^* is the world's interest rate and φ is the risk premium.

The optimization carried out by Svensson yields several reaction functions, whose coefficients depends on the weights given to inflation and output gap in the loss function of the central bank and also whether the central banks targets the consumer price level inflation (which includes imported goods) or only the domestic price level. In the specifications that target the CPI inflation, the coefficient on the world interest

[17] In Svensson (2000) Figures 1-3, (pp. 172-174), the impulse response of the domestic interest rate to changes in the world rate converges to zero very quickly.

rate is.0.97 or 1, reflecting the passthrough of exchange arte changes to consumer prices, in other cases, c=0.[18]

From the publications of established open economies central banks, such as Canada, or Sweden (that are included in our sample) it emerges that their reaction function is of the typical Taylor rule, with the addition of expected change in exchange rate:

(3) $i=a\pi+b(y-y_p)+ c(s_{t+1/t} - s_t)$ [19]

The work by Clarida, Gali and Gertler (CGG) lends empirical support to this specification. (CGG, 1998). Note that the world's interest rate is missing.

In the following section we investigate whether, indeed, central banks of open economies that operate in an inflation target regime closely peg the world's interest rate, or whether, our hypothesis regarding of operation of the regime holds: close co-movement of long term rates and possible divergence of the short rates, in the presence of a wedge produced by short term exchange rate volatility and transaction costs.

4. Empirical findings

Data

The variables used in this section are the following: exchange rate, official Central Bank interest rate, domestic 10 year bond yield, EMBI+ index, inflation, FDI (net foreign direct investment), GDP, output gap (the difference between actual output and its trend), unemployment, The detailed list of countries and data sources is provided in the Data Appendix.

We constructed dummy variables for three categories of policy regimes for both countries and periods: inflation targeters, final inflation targeters (a subset of inflation targeters where actual inflation was less than 3 percent or declared target of 3 percent or less), and the rest.

Results

In this section we proceed to test the hypothesis that the reaction function postulated by Svensson (2000) holds differentially for the three categories. In particular our own hypothesis is that credible inflation targeting central banks can deviate from the U.S. Fed rate. We start by showing that the uncovered interest parity holds for long term

[18] See: Svenson (2000), Table 2 on p. 169.

[19] This specification is reaction function no. 6 in Table 2 in Svensson (2000).

bonds but differentially for short term rates: it holds for non-inflation-targeters and does not hold for credible inflation targeting central bank rates.

Table 3 presents the results for the estimation of the uncovered interest rate parity for countries that are not on a fixed exchange rate, vis-à-vis the U.S. interest rate as the international bench-mark [20]. We used panel data estimation methods using FGLS estimation. We first look at the 10 year bond market. The 10 year bond equation performs relatively well: the coefficient on the U.S bond ($i*$) is very close to 1, the `inflation difference PPP that serves as a proxy for long-run expected inflation differential is positive and significant (although less than 1)[21].

We introduced several new variables to the estimation. To capture the risk premium φ that appears in equation (1), in the absence of dollar denominated bonds for most of our sample, we used the ratio of FDI (foreign direct investments) to the GDP as an instrument for the risk premium. Below we show, for a sub-sample sample of countries for which the data is available, that FDI/GDP ratio is strongly correlated with the EMBI spread which is a direct measure of the risk premium. To account for the differences in monetary regimes we also divided the countries in our sample into three categories: non inflation targeters, inflation targeters and a sub-group of final targeters – already enjoying price stability.

Our results show that, indeed, the long term bond market is very well integrated and that economies that have reached inflation stability (final targeters) are significantly different from the other two groups. For this group of economies, the short term PPP coefficient is approximately 0.3, which means that short term inflationary (exchange rate) expectations have a weaker effect on the long term rates. This is suggestive of greater credibility of the monetary authorities. The FDI/GDP ratio is approximately zero, - i.e. there is no significant risk premium associated with these economies. Inflation targeters are somewhere in the middle between non inflation targerters and final inflation targeters. They exhibit a slightly higher coefficient for the U.S bond rate and FDI does affect the long term risk premium. When we introduce a measure of exchange rate risk – the standard deviation of its daily rate of change - we see that it has the expected positive effect but does not change the other coefficients in any significant way.

[20] The interest rate on other alternatives such as the Euro did not perform well.

[21] For the 10 year bond, the expected depreciation should be the difference between the 10 year forecast of domestic and U.S inflation. In the estimation we used the one year difference. This may account for downwards bias in the coefficient.

Next we look at the variables that determine the central bank discount rates. The uncovered interest rate parity equation for this case was estimated for two samples: the first estimation used the same sample as the long term equations –for the purpose of consistency - and the second used the entire data for countries with non fixed exchange rates. In the three specifications, shown in Table 3, the coefficients for the Fed rate are close to 1 for the non-targeters and targeters, with the exception of non targeters in the smaller sample that have a lower coefficient on the U.S Fed. However, these are financially mature economies. For the final targeters we find a coefficient of approximately 0,45 – significantly lower than 1. The importance of the PPP also declines with the success of the inflation targeting regime: For non targeter and targeters the coefficient is close to 1 – as predicted by the theory. For final targeters it ranges from 0.45 to 0.6 which is significantly lower than 1. The effect of the risk premium captured by the FDI/GDP ratio and the exchange rate risk is qualitatively similar to their effect in the long term regressions. Therefore, it seems that short term uncovered interest rate parity specified in term of the central banks interest rate for credible targeters holds to a lesser extent than for other regimes, suggseting that the central bank enjoys more autonomy in determining short term rates when it has achieved a credible inflation targeter status.

To conclude, the discount rate of the central banks that adhere to an inflation target, can deviate from the parity condition. Apparently, in these countries the central bank has gained the independence for fixing the short run interest rates, by following an inflation targeting regime. Hence, for these countries the correct specification is the modified Svensson version where the coefficient on the world interest rate is significantly lower than one. Indeed as we argued above (Table A), most inflation targeting countries choose a flexible exchange rate because on the one hand, they do not need an exchange rate anchor for inflation and on the other hand, they do not want to subordinate their monetary policy to the defense of an exchange rate peg.

In table 3.1 we report results obtained by Bordo and MacDonald for the gold standard period for countries that can be considered as the core of that regime, equivalent to the final targeters in our sample. Their results show that both coefficients for the short and long rates are statistically not different than 1 – we discuss these results further below.

In Table 4 we present estimation results for the central bank reaction function. using FGLS procedure for the panel estimation. We introduce a business cycle measure - the change in unemployment over the preceding four quarters. Again, we use the FDI/GDP as an instrument for the risk premium, and differentiate between non-targeters, targeters and final targeters, as in Table 3 The results show that non-inflation targeters follow closely the world's discount rate with a coefficient of 0.9, they fight inflation and are forced into pro-cyclical policy.[22] They are fortunate if they have large FDI influx, that allows a lower interest rate. Those who are final targeters can deviate from the world's interest rate – a coefficient of 0.2 only, and they need not depend on FDI. Inflation targeters who achieve inflation stability win partial independence in the pursuit of monetary policy. They can engage in interest smoothing because they fight inflation less aggressively. They can also avoid the pro-cyclical policy, and pursue, to a small measure, anti-cyclical policy. We also see that within the group of inflation targeters, those who still did not reach their final target fight inflation more aggressively than any other group, in order to eventually obtain the desired status of final targeters.

The risk premium

We have used long term capital flows that are exogenous to short term monetary response function, or short term variations of the exchange rate, as a measure for the country's risk premium φ. Another variable which may capture the risk premium in emerging economies is Morgan Stanley's emerging market bond index (EMBI+) which serves to capture the global risks associated with emerging economies. The EMBI+ is a *direct measure* of the country's risk. Again, the advantage of this variable is that it is exogenous to short term monetary policy of individual countries.

We estimate the following risk-premium equation:

(3) $\varphi_t = \gamma embi_t + \delta fdi_t$

Where φ is the individual country's risk premium, as measured by its specific component of the EMBI+ index. We decompose the country risk into two components – individual country risk which we capture with *fdi*: foreign direct investment and a global risk for small open economies which we capture using *embi,* the EMBI+ index.

[22] Think of financial stress (with negative FDI) combined with a recession: the international capital markets force the central bank to hold the interest rate high, so as to avoid further flight of capital, and this deepens the recession.

The two specification of the regression, shown in Table 5, indicate that the *fdi* performs well as the measure of the country risk. It would be preferable to use the direct measure for risk, such as the EMBI+ for each country, but this index was available only for a subset of our panel.

Cointegration analysis

A common stochastic property of financial data is that the series have unit roots. Therefore the results obtained by OLS may be spurious. In this section we perform an additional robustness check by performing cointegration tests on all individual countries vis á vis the U.S interest rates[23]. Our analysis is similar to the one done by Bordo and MacDonald (2006), who found that interest rate data during the Gold Standard also suffered from unit root problems. Table 6 presents the cointegration results of testing for uncovered interest rate parity using the Engle-Granger method. The coefficient on the U.S rate is reported as β in Table 7.

We first look at short term rates. The co-integration relationship cannot be rejected but for two countries: Australia and Poland. This increases the degree of confidence we have in our panel results reported above. All the countries where inflation targeting was in place at the beginning of our sample period (e.g. Canada, New Zealand) have coefficients lower than 1 for the FED rate. For most countries, the introduction of inflation targeting lowered the coefficient on the Fed rate, often substantially (e.g. Thailand, Peru). These results are consistent with the findings in the panel estimation reported above.

It is interesting to compare these results with those of Bordo and MacDonald. There the coefficients on the World's (U.K. during the Gold Standards) interest rate are not different significantly from 1, the constant is not different significantly from 0, and the short interest rates are cointegrated with those of the World. In other words, under the Gold Standard, the French or German interest rate had to follow more closely that of the U.K., deviating from it only temporarily, whereas under inflation targeting, the relationship is not so tight. If a business cycles of a country is not synchronized with that of the U.S., its central bank can respond to it more independently of the actions of the Fed as compared with the Gold Standard period.[24]

[23] Since there exist no cointegration methods for panel data, cointegration was tested for pairs of Fed rate- central bank, and 10 year bond rates.
[24] We note that our sample is much shorter than the one for the Gold Standard.

The cointegration analysis of the relationship between pairs of long-run interest rates also yields coefficients that are similar to those found in the panel analysis. These coefficients are close to 1 for most of the developed countries, with either specification – with or without a constant. The R-squared of the regressions was also close to 1. All those indicate an integrated market for long-run debt.

However, cointegration was found only for half of the countries in our sample. It is possible that the length of the period did not allow the cointegration to manifest itself in a statistically significant way – the period is about half of that studied by Bordo and MacDonald, and for some countries in our sample 10 year bonds were available only for a shorter sub-sample. Moreover the error-correction coefficients are smaller, as predicted by the theory.[25] Alternatively, it is possible that the long-term equation is missing the component of the expected change in the exchange rate over the 10 year horizon (owing to the absence of data on such long term expectations). Since not all countries that issued 10 year bonds were in the price stability phase, this missing variable may account for the lack of co-integration. Moreover, the risk premium of some countries in the sample also changed during this period – whereas we assumed a fixed risk premium. The two caveats above hold for Chile, Israel and Korea.

Finally, it could be the case that the finding of no cointegration in the 10 year bond interest rates, especially for the financially mature economies of Australia, Canada, and the Netherlands may suggest that the long term 'world' interest rate is no longer determined by the U.S bond. Rather, it is determined according to the Fisher identity – it is the sum of the real interest rate and expected inflation. Since the advanced economies have similar returns to capital (real interest rate) and since they are credible inflation targeters (similar expected long-term inflation) their nominal interest rates move together. However, idiosyncratic productivity shocks (shocks to the real interest rate) may cause the long term nominal yields to deviate from each other for substantial periods of time such that, given the length of our sample, we fail to find cointegration.

5. The existence of an interest rate band for inflation targeting

As explained earlier, the gold points operated within a band in which the exchange rate could move, allowing for some interest rate flexibility to carry out monetary

[25] The results are available from the authors.

policy. We have hypothesized that exchange rate volatility creates a band for the spread between the domestic central bank's discount rate and the Fed's. In this section we show empirical findings that support this claim. Using techniques borrowed from Threshold Auto Regression (TAR) we show that there exists such band.[26] Within this band, the central bank is less affected by outside variables, such as the risk premium of the country and the Fed rate. Thus it has more freedom to carry out its optimal policy which need not then be automatic. A major finding of this analysis is that the band is much larger for inflation targeters.

In Table 7 we report the baseline regression of Table 4, but now with an endogenously determined symmetric band of 80 basis points Inside the band, all variables become statistically insignificant except for the Fed rate. Outside the band, all variables become significant and have their expected signs, and the coefficient on the Fed rate increases from 0.86 to 1.15. Imposing the same band for all countries assumes that all monetary regimes are identical. However, as our earlier analysis showed, significant differences are found between coefficients of the various regimes. In Table 8.1 we allow for the regression to determine different bands for non inflation targeters, all inflation targeters and final inflation targeters.. **The main finding is that central banks that adopted inflation targeting can exploit a broader spread vis á vis the Fed rate in conducting their policy.** For inflation targeters the interest rate band more than doubles relative to the non targeters, from 1.0 to 2.4 and 2.5, and about half of the data points are within the band. For the non targeters, less than one tenth of data points are within the band. For both groups of targeters, almost all the coefficients are statistically significant both inside and outside of the band. The Fed rate coefficient are 1.06 and 1.03 outside the band and .59 and .58 inside the band: outside the band the central bank must follow the international interest rate, but inside it the bank has more leeway to carry its desired monetary policy. The non-targeters have less freedom within their much narrower band and a coefficient of 0.86. Outside the band their coefficient is also close to 1 - 1.05.

Outside the band the central bank is less protected against speculative attacks, and hence it would be more pressed to show that it fights inflation. This is especially true for inflation targeters who are not yet established as final targeters, so the inflation

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[26] The procedure employed ran in fact two regressions, for data points inside and outside the band. The algorithm searches for the symmetric band which maximizes the t-value of the coefficient on the Fed rate in the equation outside thew threshold.

coefficient outside the band is 0.84 for all targeters, the highest of all inflation coefficients. The FDI/GDP coefficient is very negative outside the band for the non targeters, as expected. But for the targeters, the coefficients' signs are not as expected, although their size and statistical significance are lower.

In order to test, more directly, our hypothesis that exchange rate variability has a differential effect on economies that pursue inflation target policies, we regressed the nominal yield spread on country risk, inflation and exchange rate volatility. Normally, the spread acts as a measure of risk and should be positively affected by exchange rate risk. However, according to our hypothesis, within a band around the FED rate, exchange rate uncertainty may increase the credibility of the inflation target regime as it frees the central bank to conduct a more independent policy.

We therefore proceeded to estimate the differential effect of exchange rate variability on the spread using a threshold regression method: the band width selected corresponded to the maximal t-value of the coefficient on the standard deviation of changes in the exchange rate.

Our results, for the short run rate and long run yield spreads are reported in Table 8. Outside the band, we obtain the usual positive and significant relationship between exchange rate risk and spread. In contrast, within the band, higher exchange rate variability has no significant effect on risk. Its sign is reversed: within the band, higher variability allows more freedom for the central bank to determine the spread. This becomes more evident in the 10 year bond yield spread analysis: inside the band the short-term variability supports the independence of central bank and its long term credibility, so it actually stabilizes investors' expectations and reduces the long spread. However, if the spread is outside the band then the added variability is interpreted as added risk, and it thus increases the spread.

To conclude, when the interest rate spread is within the band, exchange rate variability is beneficial, as it acts as a barrier for arbitrage transactions and allows more freedom for central banks in the short run. This freedom allows investors to assume that stability will also prevail for longer horizons. This effect is stronger for inflation targeters than for those economies that do not follow inflation targets.

6. Summary and Conclusion

In this paper we showed that the credibility established by central banks under the inflation targeting regime provides them with the freedom to pursue an independent monetary policy which may also include anti-cyclical policy more successfully than under alternative regimes. The set of rules associated with inflation targeting, when applied successfully, achieves inflation stability. Under the Gold Standard, it was the pegging to a precious metal that was the basis for the credibility. Once the credibility is established, the central bank makes use of monetary policy to pursue anti-cyclical policy under both regimes. But the inflation targeting regime allows more flexibility and thus more room for policy than under the gold standard.

First, under the gold standard, national currencies are pegged to gold at a fixed price. If the price of gold relative to other commodities increases, the price level must decline, and vice-versa. Indeed, under the Classical Gold Standard, the price of gold increased in the period 1875-1898 causing price deflation, and decreased after the gold discoveries in the Klondike River in Alaska, causing the price level to increase (Barsky and De Long 1991). Therefore, the adoption of a fixed exchange rate with a commodity in itself does not imply price stability. Inflation targeting is free of these exogenous changes.

Secondly, the decision to target the *inflation rate* and not the price *level* implies that past mistakes of inflation targeting need not be corrected – this is the *forward looking* nature of inflation targeting. In view of the stochastic nature of inflation, this is an advantage. Thirdly, all countries choose to have a small and positive inflation target, as compared to the zero inflation dictated by the gold standard. It is believed that the miniscule inflation introduces a measure of flexibility, especially in the labor market where nominal wages are downward sticky, and thus can prevent deflation and unemployment. (See: Bernanke et. al. (1999) on the considerations for the choice of targets).

Our empirical findings, that inflation targeting provides central banks with more freedom to pursue anti-cyclical policies , supports the interpretation of Bernanke et al. (1999) of inflation targeting, as opposed to that of James Galbraith. In the review of their book, Galbraith (1999) claims that inflation targeters are only worried about stopping inflation, and not about supporting full employment. Bernanke et al. (1999) deny that claim in their rebuttal.

A result of successful inflation targeting is the weakening of the relation between devaluation and inflation – the coefficient of the pass-through. A high coefficient requires the central bank to target partially the exchange rate, and its freedom to address the business cycle is limited. As the inflation target becomes more established, the historical, institutional and expectational links weaken, and the coefficient declines gradually.

Our analysis of the determination of short- and long-term interest rates sheds an interesting light on the Optimal Currency Area (OCA) literature, which thrived again during the adoption of the Euro. Sweden, Denmark and Britain that joined the EU but not the Euro are inflation targeters that can pursue an independent monetary policy more attuned to their idiosyncratic business cycles. They are integrated into the world's and Europe's capital markets, while still enjoying the benefits of the union as a customs union and a single labor market. This means that their governments can borrow long term at similar rates as their Euro counterparts and their economies enjoy low and stable inflation rates. Therefore, the decision to adopt the Euro for these economies is reduced to valuing the transaction costs that are still involved exchanging the currencies versus the benefit of conducting an independent monetary policy. Obviously, the attractiveness of OCA's is diminished in a world of inflation targeting: similar inflation targets imply stable exchange rates in the long run (according to relative PPP theory) similar to the OCA and short term exchange rate flexibility that frees monetary policy, which is otherwise constrained in an OCA.

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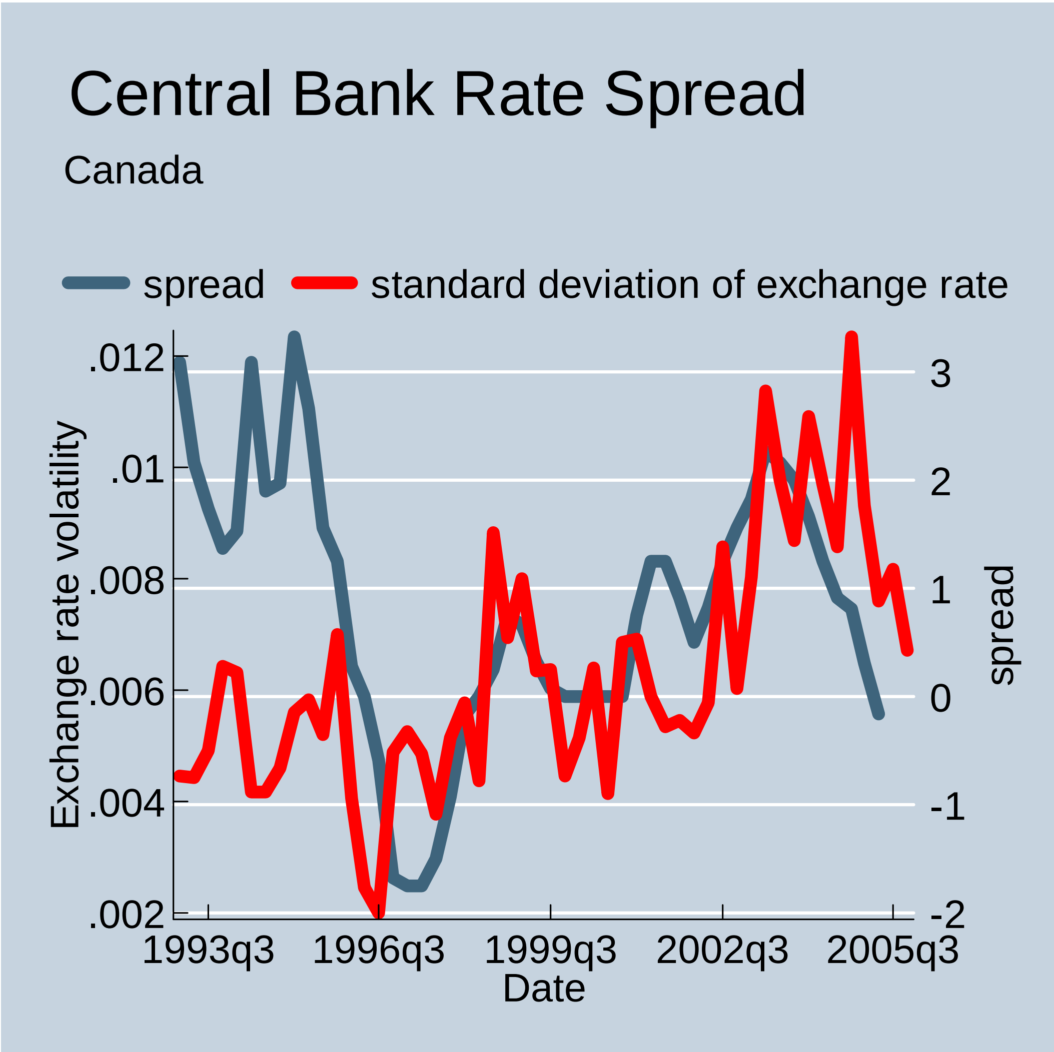
Figure 1: Spread vs. Exchange Rate Volatility in Canada, New Zealand and Australia
(Monthly data 1993-2005)



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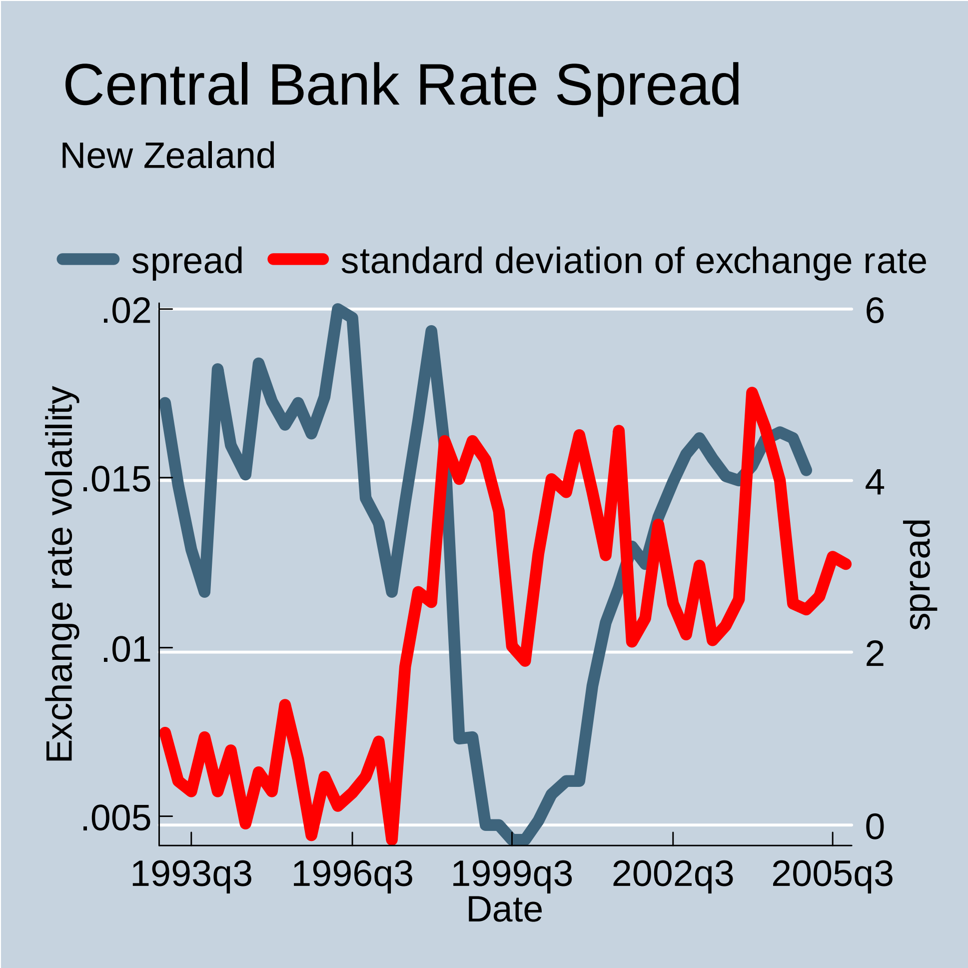
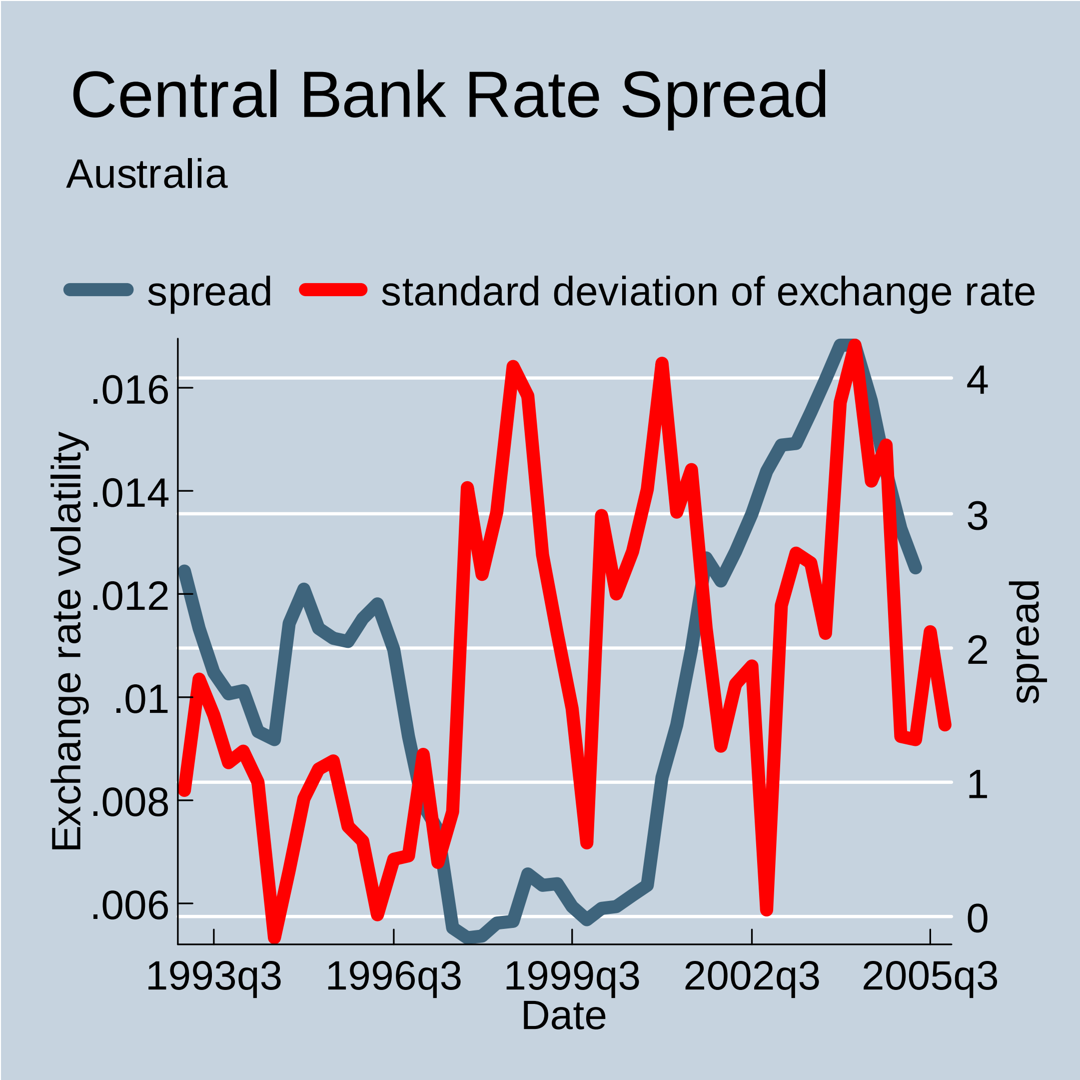


Central Bank Rate Spread
New Zealand
spread
standard deviation of exchange rate
Exchange rate volatility
.02
.015
.01
.005
6
4
2
0
spread
1993q3
1996q3
1999q3
2002q3
2005q3
Date



Central Bank Rate Spread
Australia
spread
standard deviation of exchange rate
Exchange rate volatility
.016
.014
.012
.01
.008
.006
4
3
2
1
0
spread
1993q3
1996q3
1999q3
2002q3
2005q3
Date

Table 1: Short term spreads and 10 year spreads*
(in basis points)

Variable	Regime	Observations	Mean	Std. Dev	Min	Max
10 Yr spread	All	542	210	290	-131	1302
Short spread	All	542	294	354	-225	1685
10 Yr spread	Inflation Target	381	177	206	-129	883
Short spread	Inflation Target	381	292	312	-225	1600
10 Yr spread	Final Inflation Target	259	115	147	-129	735
Short spread	Final Inflation Target	259	205	221	-225	842

*Based on our data for countries with annual inflation of less than 10%.

Table 2: Correlation of short term and long term interest rates with the U.S rates *

Dependent variable	Regime			
		US rate	R-Square (within country)	Observtions
Central bank rate	All	0.64 (0.06)	0.18	542
10 year bond	All	1.21 (0.06)	0.45	542
Central bank rate	Final inflation target	0.47 (0.06)	0.20	259
10 year bond	Final inflation target	1.02 (0.06)	0.50	259

*Using panel fixed effects for countries with less than 10% annual inflation
Standard deviation in parenthesis

Table3: Uncovered interest rate parity
long interest rates (10 year) and short interest rates, 1993-2006.

Dependent Variable	10 year	10 year	Discount rate*	Discount rate*	Discount rate
Method	GLS	GLS	GLS	GLS	GLS
U.S bond/Fed rate	0.932 (0.060)	1.013 (0.065)	0.467 (0.064)	0.520 (0.065)	1.070 (0.072)
Target*U.S bond	0.183 (0.054)	0.181 (0.054)	0.522 (0.096)	0.549 (0.096)	0.086 (0.088)
Final target*U.S bond	-0.209 (0.037)	-0.210 (0.036)	-0.530 (0.083)	-0.565 (0.079)	-0.709 (0.077)
PPP	0.582 (0.046)	0.586 (0.046)	1.010 (0.058)	1.021 (0.059)	0.857 (0.026)
Target*PPP	-0.087 (0.072)	-0.107 (0.073)	-0.037 (0.088)	-0.123 (0.103)	-0.010 (0.070)
Final Target*PPP	-0.217 (0.075)	-0.184 (0.077)	-0.420 (0.106)	-0.364 (0.110)	-0.396 (0.108)
FDI/GDP	-19.005 (3.698)	-19.563 (3.725)	-14.965 (3.794)	-15.991 (3.848)	-29.215 (4.545)
Target*FDI/GDP	3.629 (5.639)	4.402 (5.680)	1.215 (7.144)	2.493 (7.348)	18.628 (8.234)
Final Target*FDI/GDP	13.910 (4.433)	13.562 (4.474)	13.278 (6.283)	13.002 (6.523)	9.723 (7.169)
Percent change of exchange rate		0.852 (0.338)		1.303 (0.440)	1.818 (0.380)
Observations	530	530	530	530	916

* For consistency sample includes only countries that issue 10 year bonds
Excluding observations with fixed exchange regime
Including observations with annual inflation rate under 100%
Standard deviation in parenthesis

Table 3.1 Gold Standard Period uncovered interest rate parity:
short and long rates 1880-1914.[27]

[27] Bordo-MacDonald (2006) p. 317.

Table 1
FIML estimates of interest rate parity

Interest rate combination	$i_t = \alpha + \beta i_t^* + v_t$					
	α	β	$t_\beta = 1$	l Max	Trace	LM(4)
Short rates						
UK–France, bank rate	−0.535	1.320	1.45	24.02*	31.45*	6.67
	(0.68)	(0.22)		7.43	7.43	(0.15)
UK–German, bank rate	0.056	0.805	0.42	18.71*	28.88*	2.17
	(0.59)	(0.14)		10.17	10.17	(0.70)
German–France, bank rate	0.552	1.195	0.57	17.20*	25.26*	11.02
	(1.03)	(0.34)		8.06	8.06	(0.03)
Long rates						
UK–France, long rates	0.004	1.167	0.64	19.56**	25.41*	7.16
	(0.01)	(0.26)		5.85	5.85	(0.13)
UK–German, long rates	0.003	1.031	0.11	13.94**	22.80*	6.69
	(0.02)	(0.29)		8.23	8.23	(0.15)
German–France, long rates	0.004	0.868	0.13	18.02**	24.02*	2.21
	(0.003)	(0.37)		6.02	6.02	(0.70)

Notes: The first column describes the interest rate/country combination. The numbers in the columns labeled α and β are the estimated constant and slope coefficient from the interest parity regression Eq. (6). The numbers not in parenthesis in the column headed $t_\beta = 1$ are tests of the hypothesis that the slope coefficient is unity. The numbers in the columns labeled l Max and Trace are the estimated values of Eqs. (17) and (16) in the text and LM(4) is a Lagrange Multiplier test for fourth-order serial correlation. Numbers in brackets below point estimates are Fisher standard errors, while numbers in brackets below the LM tests are marginal significance levels. A single *denotes significance at the 5% level, while **denotes significance at the 10% level.

Table 4: Reaction functions

Dependent Variable	Discount rate
Method	GLS
Fed rate	0.878 (0.079)
Target*Fed rate	-0.110 (0.113)
Final Target*Fed rate	-0.469 (0.102)
Inflation	0.770 (0.025)
Target*inflation	0.096 (0.071)
Final Target*inflation	-0.528 (0.084)
Change in unemployment rate	0.441 (0.146)
Target*Change in unemployment rate	-0.355 (0.217)
Final Target*Change in unemployment rate	-0.167 (0.230)
FDI/GDP	-23.726 (4.614)
Target*FDI/GDP	5.664 (8.780)
Final Target*FDI/GDP	17.508 (7.717)
Observations	1002

*sample includes only countries that issue 10 year bonds and flexible exchange rates
Standard deviation in parenthesis

Table 5: Risk premium

Dependent Variable	EMBI+ spread – individual countries	EMBI spread
Method	XTGLS	XTREG
FDI/GDP	-2.10 (0.65)	-2.19 (0.88)
EMBI+ average index	0.85 (0.05)	0.89 (0.66)
C	.11 (0.10)	-0.04 (0.23)
N	515	515
Log likelihood	-443	
R^2		0.18 0.32 within

Xtgls specification with heteroskedastic panels
Xtreg specification with random effects (Hausman tests rejects fixed effects) - robust standard errors

Table 6: Uncovered interest rate parity cointegration tests results for panel data

a: Cointegration with the Fed rate

	All countries		Targeters		Final Targeters	
	D.F statistic* (- 1.95, 5%)	β	D.F statistic (- 1.95, 5%)	β	D.F statistic (- 1.95, 5%)	β
Argentina	-4.08	1.27 (0.94)				
Australia	-1.76	0.32 (0.06)	-1.76	0.32 (0.06)	-1.76	0.32 (0.06)
Brasil	-3.73	1.82 (0.61)	-9.11	0.41 (0.14)		
Bulgaria	Currency board	0.72 (1.17)				
Canada	-2.48	0.59 (0.10)	-2.48	0.59 (0.10)	-2.57	0.64 (0.07)
Chile	-2.60	0.51 (0.14)	-2.63	0.41 (0.10)	-2.33	0.37 (0.23)
Czech	-2.05	0.89 (0.19)	-2.81	0.63 (0.13)		
Ecuador	-2.39	8.14 (1.73)				
Hungary	-3.22	0.28 (0.21)				
Israel	-2.32	1.18 (0.15)	-1.65	1.09 (0.17)	-2.07	-0.96 (0.38)
Korea	-3.44	1.47 (-.23)	-2.07	0.37 (0.07)		
Mexico	-4.54	3.05 (1.23)	-5.19	2.63 (0.25)		
Netherlands	-5.37	0.20 (0.12)				
New Zealand	-2.42	-0.71 (0.15)	-2.42	-0.71 (0.15)	-2.42	-0.71 (0.15)
Nigeria	-2.61	-0.67 (0.31)				
Norway	-3.05	0.06 (0.14)	-2.66	0.34 (0.32)		
Panama	-3.41	0.42 (0.05)				
Peru	-4.41	2.18 (0.24)	-11.27	-0.19 (0.19)		
Philippines	-4.02	0.82 (0.18)	-4.03	0.13 (0.31)		
Poland	-0.59	2.05 (0.23)	-1.34	1.12 (0.44)		
South Africa	-2.03	1.06 (0.18)	-2.11	0.35 (0.14)		
Sweden	-2.40	0.79 (0.14)	-2.40	0.79 (0.14)	-1.65	0.75 (0.13)
Thailand	-3.07	0.82 (0.18)	-1.08	0.24 (0.05)		
Turkey	-4.53	3.03 (3.96)				
Venezuela	-3.32	1.78 (1.09)				

*Cointegration cannot be rejected for values more negative than -1.95. t-values for β in parenthesis.

<u>b: Cointegration with the U.S 10 year bond</u>

Method	Including constant		No constant	
	D.F statistic (- 1.95, 5%)	β	D.F statistic (- 1.95, 5%)	β
Australia	-1.50	1.26 (0.11)	-1.52	1.20 (0.02)
Canada	-1.63	1.13 (0.09)	-1.53	1.10 (0.02
Chile	-1.70	-.16 (0.14)	-1.78	1.04 (0.03)
Czech	-2.69	1.54 (0.19)	-1.31	1.11 (0.03)
Hungary	-2.48	0.92 (0.21)	-2.43	1.62 (0.04)
Israel	-1.36	-1.26 (0.15)	-1.71	1.77 (0.11)
Korea	-1.56	1.73 (-.29)	-1.27	1.29 (0.04)
Mexico	-1.88	0.67 (0.47)	-1.94	2.22 (0.06)
Netherlands	-1.80	0.92 (0.07)	-1.86	0.95 (0.01)
New Zealand	-2.84	0.70 (0.06)	-1.38	1.20 (0.02)
Norway	-2.19	0.89 (0.10)	-2.18	1.07 (0.02)
South Africa	-2.15	2.09 (0.18)	-2.33	2.33 (0.04)
Sweden	-2.07	1.72 (0.17)	-1.66	1.16 (0.03)
Thailand	-3.15	1.42 (0.29)	-2.57	1.04 (0.03)

Table 7: Reaction functions for all sample with threshold*

Dependent variable	Discount rate	Discount rate
Method	FGLS with heteroskedastic errors	
Band	**0.8**	
	Outside Band	Inside Band
Variable	Coefficient	Coefficient
fdi_gdp	-24.205 (4.802)	-1.559 (1.683)
dl_fdi_gdp	23.047 (5.175)	1.521 (1.869)
Fed_rate	1.152 (0.084)	0.862 (0.029)
dl_fed_rate	-0.354 (0.117)	-0.015 (0.108)
df_fed_rate	-0.326 (0.112)	0.042 (0.107)
Inf	0.665 (0.024)	0.022 (0.015)
dl_inf	0.226 (0.073)	0.002 (0.156)
df_inf	-0.532 (0.099)	0.045 (0.158)
_cons	3.074 (0.259)	0.554 (0.116)
N	1015	118
Log likelihood	-3057.687	-41.679

* Standard errors in parentheses. Dummy variables for different regimes.

Table 7.1: Reaction functions with threshold by regime *

	Non inflation targeters		All Inflation targeters		Final Inflation targeters	
Band	1		2.4		2.5	
	Outside Band	Inside Band	Outside Band	Inside Band	Outside Band	Inside Band
Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Fdi_gdp	-24.190 (5.224)	0.495 (2.035)	0.952 (4.365)	-3.235 (0.964)	1.260 (3.209)	-3.163 (1.022)
Fed_rate	1.057 (0.171)	0.863 (0.047)	1.034 (0.076)	0.581 (0.032)	1.058 (0.069)	0.591 (0.035)
Inf	0.668 (0.026)	0.017 (0.007)	0.836 (0.053)	0.209 (0.037)	0.378 (0.080)	0.304 (0.045)
Cons	3.651 (0.770)	0.457 (0.235)	2.391 (0.299)	1.846 (0.139)	3.224 (0.312)	1.598 (0.163)
N	621	52	255	205	107	168
Log likelihood	-2135.718	-41.679	-557.7318	-246.946	-165.174	-200.773

*Standard errors in parentheses.

Table 8: The effect of exchange rate variability on the spread*
(bank rate and 10 year bond)

Bank rate spreads

	All sample		**Inflation target**	
Band	1.6		2.1	
	Outside Band	Inside Band	Outside Band	Inside Band
Variable	Coefficient	Coefficient	Coefficient	Coefficient
fdi_gdp	-13.548 (3.523)	-2.103 (0.879)	2.878 (4.270)	-2.707 (1.152)
Std_xr	89.057 (17.019)	17.794 (14.445)	126.523 (22.797)	-9.862 (17.790)
Inf	0.755 (0.021)	0.041 (0.021)	0.876 (0.048)	0.113 (0.041)
cons	1.951 (0.241)	0.144 (0.169)	0.754 (0.252)	0.587 (0.205)
N	707	209	277	183
Log likelihood	-2064.249	-254.040	-615.712	-250.433

*Standard errors in parentheses.

10 year bond spreads

Band	1.4	
	Outside Band	Inside Band
Variable	Coefficient	Coefficient
fdi_gdp	-8.062 (1.820)	-1.042 (1.250)
Std_xr	57.044 (22.812)	-23.158 (14.049)
Inf	0.439 (0.032)	0.142 (0.029)
_cons	0.146 (0.258)	0.366 (0.157)
N	382	157
Log likelihood	-790.560	-149.175

*Standard errors in parentheses.

APPENDIX: DATA SOURCES

1. Countries List (27)

Argentina, Australia, Brazil, Bulgaria, Canada, Chile, Czech Republic, Ecuador, Hungary, Israel, Korea, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Panama, Peru, Philippines, Poland, Russia, South Africa, Sweden, Thailand, Turkey, Venezuela.

2. Variables and Sources of Information

Variable	Source	Comments
exchange rate (daily)	St. Louis Fed, IFS, CB	
exchange rate STD	our calculations	
CB declared interest rate	IFS, CB	
10 year bond rate	CB, IFS	
targeters	list in IMF (2006)	all inflation targeting countries
final targeters	our calculations	targeters with annual average inflation less than 3%
Inflation	Statistical Bureaus, CB, IFS	
PPP	our calculations	inflation difference with U.S.
FDI	CB, IFS	purchase of at least 10% of shares of a company
GDP	Statistical Bureaus, IFS	
Output Gap	our calculations	using HP filter
Unemployment	IFS	
EMBI+	JPMorgan **www.morganmarkets.com**	sovereign spreads

CB = the country's central bank.
IFS = International Financial Statistics of the IMF.

3. Detailed Sources per Country

Country	**exchange rate (daily)**	**CB** declared **interest rate**	**10 year bond rate**	**inflation**	**FDI**	**GDP**
Argentina	**IFS**	Dirección Nacional de Cuentas Internacionales		IFS and Dirección Nacional de Cuentas Internacionales*	IFS and Dirección Nacional de Cuentas Internacionales	Dirección Nacional de Cuentas Internacionales
Australia	St. Louis Fed	Reserve Bank of Australia	Reserve Bank of Australia	Australian Bureau of Statistics	**IFS**	**IFS**
Brazil	St. Louis Fed	Banco Central do Brasil	Banco Central do	**IFS**	Banco Central do Brasil	Banco Central do Brasil

*Minesterio de Economía Producción **http://www.mecon.gov.ar/cuentas/internacionales/intro.htm**

			Brasil			
Bulgaria	CB	Bulgarian National Bank		National Statistical Institute	Bulgarian National Bank	National Statistical Institute
Canada	St. Louis Fed	IFS	IFS	IFS	IFS	IFS
Chile	CB	Banco Central de Chile	Banco Central de Chile	Banco Central de Chile	Banco Central de Chile	Banco Central de Chile
Czech Republic	CB	Ceska Narodni Banka	Ceska Narodni Banka	Ceska Narodni Banka	Ceska Narodni Banka	Czech Statistical Office
Ecuador	CB	Banco Central del Ecuador		IFS	IFS and Banco Central del Ecuador	Banco Central del Ecuador
Hungary	CB	Magyar Nemzeti Bank	Magyar Nemzeti Bank	IFS	Magyar Nemzeti Bank	IFS
Israel	CB	Bank of Israel	Bank of Israel	Bank of Israel	Bank of Israel	Bank of Israel
Korea	St. Louis Fed	IFS	Bank of Korea	Bank of Korea	Bank of Korea	Bank of Korea
Mexico	St. Louis Fed	Banco de Mexico	Banco de Mexico	IFS	Banco de Mexico	National Institute of Statistics (INEGI)
Morocco		IFS	IFS	IFS	IFS	IFS
Netherlands	CB	De Nederlandsche Bank	IFS	De Nederlandsche Bank	De Nederlandsche Bank	Statistics Netherlands (CBS)
New Zealand	St. Louis Fed	Reserve Bank of New Zealand	Reserve Bank of New Zealand,	Reserve Bank of New Zealand	Statistics New Zealand	Reserve Bank of New Zealand,
Nigeria	CB	IFS		IFS	IFS	IFS
Norway		Norges Bank	Norges Bank	Statistics Norway	IFS	Statistics Norway
Panama		IFS and Superintendencia de Bancos de Panamá		IFS	Directorate of Statistics and Census	IFS and Directorate of Statistics and Census
Peru	CB	Banco Central de Reserva del Peru		National Institute of Statistics and Informatics	**IFS**	National Institute of Statistics and Informatics
Philippines	CB	- Bangko Sentral ng Pilipinas	Bangko Sentral ng Pilipinas	**IFS**	Bangko Sentral ng Pilipinas	**IFS and** National Statistical Coordination Board
Poland	CB	National Bank of Poland	Ministry of Finance	IFS	IFS	National Bank of Poland
Russia	CB	Central Bank	Central	IFS	Central Bank of	IFS

		of Russia	Bank of Russia		Russia	
South Africa	St. Louis Fed	South African Reserve Bank	South African Reserve Bank	Statistics South Africa	South African Reserve Bank	IFS
Sweden	St. Louis Fed	Sveriges Riksbank	Sveriges Riksbank	Statistics Sweden	Sveriges Riksbank	Statistics Sweden
Thailand	St. Louis Fed	Bank of Thailand	Bank of Thailand	Bank of Thailand	Bank of Thailand	Bank of Thailand
Turkey	CB	Türkiye Cumhuriyet Merkez Bankasi	Türkiye Cumhuriyet Merkez Bankasi	Türkiye Cumhuriyet Merkez Bankasi	Türkiye Cumhuriyet Merkez Bankasi	Türkiye Cumhuriyet Merkez Bankasi
Venezuela	CB	Banco Central de Venezuela	IFS	Central Office of Statistics and Informatics (OCEI)	Banco Central de Venezuela	Central Office of Statistics and Informatics (OCEI)

Table A. De Facto Exchange Rate Arrangements and Anchors of Monetary Policy for countries in our sample as of June 2004

Exchange Rate Regime	**Monetary Policy Framework**			
	Exchange rate anchor	**Monetary aggregate target**	**Inflation targeting**	**Other**
Exchange arrangements with no separate legal tender	Ecuador Panama			
Currency board arrangements	Bulgaria			
Other conventional fixed peg arrangements	Morocco			
Pegged exchange rates within horizontal bands			Hungary	
Managed floating with no pre-determined path for the exchange rate			Czech Rep Peru Thailand	Argentina Nigeria Russia
Independently floating		Uruguay	Australia Brazil Canada Chile Israel Korea Mexico New Zealand Philippines Poland South Africa Sweden Turkey	

Source: IMF (2004). Classification of Exchange Rate Arrangements and Monetary Policy Fra meworks as of June 30, 2004.