



# Distribution forecast targeting in an open-economy, macroeconomic volatility and financial implications



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## ABSTRACT

In an open-economy faced with parameter uncertainty, this paper uses distribution forecasts to investigate the impact of alternative inflation targeting policies on macroeconomic volatility and their potential implications on financial stability. Theoretically, Domestic Inflation Targeting (DIT) leads to less volatility than Consumer Price Index Inflation Targeting (CPIIT) for several macroeconomic variables and, in particular, for the interest rate. Empirically, a positive relationship between interest rate volatility and financial instability emerges for the US, UK and Sweden since the early 1990s. Bridging theory and empirical evidence, we conclude that the choice of the inflation targeting regime has an important impact on macroeconomic volatility and potential implications for financial stability.

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## 1. Introduction

Central banks are called to take monetary policy decisions in an uncertain contest. As a result, policy practice and research have always been challenged to experiment more efficient ways to tackle uncertainty. In this respect, during the last decade, distribution forecasts of the main macroeconomic variables, commonly known as fan charts, have become an important instrument for both monetary policy decisions and communication with the public.<sup>1</sup> A key feature of a distribution forecast is its volatility at each future point in time. This information matters in that lower volatility implies more forecast accuracy and, in general, less expected uncertainty surrounding the path of the variable at issue.

Motivated by the pervasive role played by uncertainty in the decision making process of any economic agent, this paper first theoretically investigates to what extent, if any, alternative inflation targeting policies impact on the expected volatility of the macroeconomic variables in presence of parameter uncertainty. We choose an open-economy framework as in this case the presence of the exchange rate even more separates alternative inflation targeting policies. In this framework, we compare the performance of different inflation targeting policies in terms of the expected volatility of the macroeconomic variables. Our motivation, in doing so, stems from the fact that central banks continuously face various types of uncertainty in setting the monetary policy, an important one being parameter uncertainty. Furthermore, this matters for the private sector, which has to constantly take decisions subject to the expected distribution forecast of inflation, output gap and the interest rate.

In line with this motivation, our interest on “raw” expected volatilities rather than a function of these volatilities, as a utility based welfare measure, is due to the fact that the former bears the advantage to be operational for policy decisions. Specifically, investigating expected volatilities of the macroeconomic variables

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<sup>1</sup> Indeed, a large number of central bank during this period have released to the general public the distribution forecasts of inflation and real activity by publishing these forecasts on their website. Some central banks have also published the distribution forecast of the interest rate.

is consistent with the *inflation forecast targeting* operating procedure in use at various central banks as the Bank of England, Sweden's Riksbank, Norway's Norges Bank, and the Reserve Bank of New Zealand. In contrast, a utility based welfare measure it is not (Holmsen et al., 2008; Svensson, 2010; Adolfson et al., 2011). As to the policies, the focus is on Domestic Inflation Targeting (DIT), where the central bank aims to stabilize inflation related to the goods domestically produced, and CPI Inflation Targeting (CPIIT), which also considers the goods imported from the rest of the world.

These alternative policies can be respectively referred to the stabilization of core inflation and headline inflation. Core inflation, which excludes international food and energy prices from the consumer basket, tends to be used as a proxy for domestic inflation.<sup>2</sup> Generally, central banks target headline inflation. Yet there is one central bank, the Bank of Thailand, that explicitly targets core inflation. Furthermore, in most central banks core inflation is constantly monitored and plays an important role in decision-making and communication. The Norges Bank of Norway, for example, reports on its home page both current core inflation and CPI inflation stating that uses the former as an operational guide since it can better indicate the underlying trend of inflation.

With respect to the Fed, however, it has been found that core inflation is not necessarily the best predictor of total inflation (Crone et al., 2013). Nevertheless, as argued by Mishkin (2007a,b), both for the purposes of internal deliberations and for communications with the public, central bankers are truly concerned with the underlying rate of inflation, for which core inflation can be a useful proxy.

Thus, in our opinion, comparing the performance of the alternative targeting policies in terms of the expected volatility of the main macrovariables should not simply be used to judge the superiority of one policy over the other in this specific respect. Rather, more broadly, volatilities comparison is useful to see how both policies can complement each other in decision-making and communication with the public. We think this especially matters when it is acknowledged that policymakers continuously face, among the others, parameter uncertainty. With this caveat in mind, the main result of our analysis is that, considering parameter uncertainty, DIT implies less volatility of the main macroeconomic variables than CPIIT, in particular for the interest rate. This finding is relevant for real-world monetary policy effectiveness. Indeed, best practice monetary policy is largely implemented via forward guidance by steering short-term interest rates and shaping the expected path of these short rates. By making this task harder, interest rate volatility plays against here. Empirically Fernández-Villaverde et al. (2011) show that interest rate volatility matters as it affects output, consumption and investment in emerging small open economies. Thus, this result is important *per se* as it suggests that giving more attention to the stabilization of domestic inflation can reduce macroeconomic volatility.

In addition, beyond being a key variable in the real sector, the interest rate is a key variable also in the financial sector. Sharp increases in the official interest rate strain financial markets, as it occurred for example in 1994 in the US. In general, changes in the current and expected future official rates are transmitted to market rates and asset prices. Thus, official rates uncertainty results in a cascade of lower-level uncertainties that pose constraints to financial institutions and, in turn, to households and firms. For example, interest rate uncertainty adversely affects loan growth and pushes banks to use more interest rate derivatives (Brewer

et al., 2014). We thus conjecture that excessive short-term interest rate volatility can be associated with financial instability. In empirically testing this hypothesis, we find a significant positive relation between interest rate volatility and financial instability in all US, UK and Swedish economies since the early 1990s. This second result of the paper thus suggests that concentrating on DIT rather than CPIIT can also assist in fostering financial stability.

The intuition for these findings is based on the combined action of three factors. The *level of policy activism* implied by the choice of the inflation targeting policies, the *consideration of parameter uncertainty* on the part of the central bank, and the transmission mechanism of monetary policy to the real and financial sector. Our findings show that under CPIIT there is more policy activism than under DIT. Thus, when the central bank decides the optimal policy and takes into account model parameter uncertainty, a more active policy results in more volatility for most of the macroeconomic variables, market rates and asset prices.

Arguably, the findings that we have obtained have important policy implications for inflation-targeting economies like the US, UK and Sweden. According to our theoretical results, more emphasis on DIT (or to a targeting policy closer to DIT than CPIIT) would lower interest rate volatility. The beneficial impact of the latter potentially extends to financial stability. Bernanke (2013) noted that in order to address financial stability concerns the Federal Open Market Committee (FOMC) amongst other things provides greater clarity concerning the likely course of the federal funds rate. Indeed, the empirical part of our paper shows that lower interest rate volatility (which we proxy by the 2-year moving standard deviation of the interest rate and a GARCH representation) reduces financial instability in all three economies.

The literature on the choice of the inflation measure to stabilize has identified various important factors to consider. Mankiw and Reis (2003) in a static and closed economy set-up show that monetary policy should target inflation in the sticky-price sector. The same result, in a dynamic set-up, is found by Aoki (2001) and Benigno (2004), respectively in a closed economy and a monetary union, and by Gali and Monacelli (2005) in an open economy. This finding suggests one should target domestic inflation as it tends to be stickier than CPI inflation. Regarding this literature, we also find that domestic inflation should be targeted, although this finding depends on different factors. Specifically, longer transmission lags necessary to affect domestic inflation versus CPI inflation, larger exposure of CPI inflation to foreign shocks, and structural parameters uncertainty that makes CPI inflation more volatile than domestic inflation.

CPI inflation has been also questioned as the inflation measure to target considering economic indeterminacy (Batini et al., 2005), and external price shocks (Eckstein and Segal, 2010). Contrasting results, instead, emerge considering alternative producers price setting behaviors (Corsetti et al., 2010), the elasticity of substitution between domestic and foreign goods (Sutherland, 2006), and the intertemporal elasticity of substitution in consumption (De Paoli, 2009; Kirsanova et al., 2006). CPI inflation seems, finally, preferable to domestic inflation in presence of complete and immediate exchange rate pass-through (Svensson, 2000), sticky wages (Campolmi, 2014), or if imports are production inputs and not only used in final consumption (Jakab and Karvalits, 2010).

With respect to the previous literature, the novelty of this work is twofold. It frames the comparison between alternative inflation measures within the *inflation forecast targeting* operating procedure in use at many central banks, and accounts for parameter uncertainty.

This innovation is carried out by comparing distribution forecasts associated with alternative inflation targeting policies. We do so in three steps. First, we obtain distribution forecasts considering

<sup>2</sup> It is worth noticing that the correlation between domestic price inflation and CPI inflation for the countries that we empirically study in this paper, i.e. US, UK and Sweden is, respectively, 0.85, 0.87, and 0.92.

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