Máté Barnabás Tóth: Monetary policy rules and a normative approach to the central bank's objective function

This study attempts to explain in an understandable manner that the central bank's effort to keep inflation low is not an end in itself, but ultimately serves the interests of social welfare. We attempt to substantiate this argument on the basis of economic theory, based on the logic of New Keynesian models, by describing loss functions that contain welfare relevant variables and interest rules that minimise them. By using this framework, we point out that – taking into account the limits of measurability, learning and potentially non-rational expectations – decision-making rules that give considerable weight to a departure from the inflation target and take into account real economy considerations generally perform well in terms of welfare and may be considered robust in New Keynesian-type models with forward looking agents. Finally, we argue that through the strategy of inflation targeting the normative implications of the above framework can be put into practice.

INTRODUCTION

It is a generally accepted view in economics and in the practice of monetary policy that the best way for a central bank to contribute to the long-term welfare of society is to create a stable, predictable environment for market agents by maintaining price stability and anchoring inflation expectations. However, this does not mean that, in addition to their price stability objective, central banks do not or should not take into account real economy considerations to some extent.

In establishing monetary policy objectives, it is of primary importance to evaluate such objectives from a welfare perspective. On the one hand, any monetary policy can be maintained legitimately in keeping with the norms of democracy if, by considering the structure of the economy as a given, it leads to the maximum welfare of society for the longest possible period of time. In order to provide a normative definition for the optimal monetary policy as described above, it is indispensable to ensure that the decisions (regarding interest rates) made by the central bank can be evaluated in respect of their impact on welfare. In order to do so – within the framework of economic models – we need to define an objective or loss function that is suitable for evaluating the outcome of variables that are relevant for welfare and for ranking, in keeping with the above, monetary policies that weigh diverse considerations in different ways.

For a long time, economics was not able to provide a solid welfare criterion which was in line with the decision-making practices of central banks and which could serve as a basis for classifying and prioritising various types of monetary policies. The primary reason for this was that for a long time there was no realistic analytical framework with a microeconomic basis to model the impact of monetary policy on the real economy and the explicit welfare costs of inflation. Consequently, comparison between different monetary policies happened in an *ad-hoc* manner and/or on the basis of loss functions with arbitrarily chosen parameters. Naturally, an *ad-hoc* format is also capable of describing a central bank's system of goals, but a loss function which can be analytically deducted from a realistic model and which contains the so-called deep parameters of the model constitutes an objective basis for comparison, which helps formulate normative implications for monetary policy.

WHAT DOES ECONOMIC THEORY SAY: A NORMATIVE APPROACH

In the past decade, the so-called New Keynesian or neo-Wicksellian analytical framework has became widespread in both academic research and the practices of central banks (see Clarida et al., 1999; Woodford, 2003; Gali and Gertler, 2007). Compared to previously widespread models, the most novel feature of the New Keynesian framework is that it deducts conclusions from first principles,[1] with a microeconomic basis and has an explicitly modelled connection between monetary policy and the real economy. Due to the microeconomic basis, the aforementioned framework has proven suitable for evaluating the impact of monetary policy on welfare and for approaching monetary policy from a normative perspective (see Rotemberg and Woodford, 1997). An additional feature of New Keynesian

[1] Such is, for example, the maximisation of utility by households and of profit by companies.

models is that their basic versions can be described in a transparent three equation system by using the first order conditions arising from the optimisation problems of households and firms and by adding a monetary policy rule.

In the following we would like to provide a simplified description of the main features of the New Keynesian model that can be reduced to three equations starting from the most simple specification to the more complex and at the same time more realistic ones. It is important to note that we do not believe that the results generated by the New Keynesian models can be directly and unconditionally translated into central bank practice: their most important merit is that they provide a logically consistent, normative framework for thinking about monetary policy.

New Keynesian models differ from similar, general equilibrium models (e.g. real business cycle models) in that they presuppose market imperfections that impact nominal variables. In this framework, corporations have market power (which means that they are price-setters) and compete in an oligopolistic way while there is friction in their pricing decisions.[2] This friction (or rigidity) may arise, for example, if obtaining information for a pricing decision or the very process of pricing is costly for corporations. The simplest New Keynesian model approaches this friction with the so-called Calvo pricing (see Calvo, 1983).[3] Due to these frictions, pricing is not instant and is not synchronised between firms. Therefore, in any given time period non-zero inflation leads to unintended changes in relative prices (in other words, causes a real effect) because there will be firms that are able to establish an optimal price, while others are unable to change their prices to their optimal level. Due to this friction, the actual output will fluctuate around the so-called natural level (which would occur in the absence of nominal rigidities).

In the absence of nominal rigidities, the steady state price set by firms would equal the sum of their nominal marginal cost and a desired price mark-up; however, due to the 'stickiness' of prices the actual and desired price mark-up will differ as a result of various shocks. Firms that are unable to change the price of their product at a given moment in time will have to adapt to the change in profit margin, which occurs as a result of a change in their relative prices, by way of their output. Therefore, companies that are in the process of making their pricing decisions will determine their current prices as a function of the prices and marginal costs which they expect in the coming periods, in other words, the expected profit margin. The former is reflected in the real marginal cost indicator which is the inverse of the above-mentioned profit margin, that is, the ratio of the nominal marginal cost and the price.

The so-called New Keynesian Phillips curve, which is an approximation of the steady state supply side of the model, is a result of the above-described pricing behaviour of profit-maximising companies. The New Keynesian Phillips curve is forward-looking in which inflation at any given time depends on the output gap and the inflation expected in the next period.

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa \tilde{y}_t \qquad (1)$$

Where π_t is the inflation at time t, $\tilde{y}_t$ is the output gap which, in this framework, is the difference between the actual (y_t) and the 'natural' level (y_t^n) of output. E_t is an operator that indicates (rational) expectations which are based on information that is available at time t, while β and κ are coefficients which are derived from the structural or 'deep' parameters of the model. The output gap – in the case of certain assumptions concerning preferences, technology and labour market structure (see Clarida et al., 1999) – fluctuates in proportion to the deviation of real marginal cost from its steady state value. However, as a result of various nominal (or real) frictions, the proportionality between the real marginal cost and the output gap ceases to exist and a trade-off emerges between the stabilisation of inflation and the output gap (we will discuss the role of trade-offs below in more detail).

Another important, demand-side consequence of assuming not instantly adjusting (or 'sticky') prices is that monetary policy is capable of having a short-term impact on the forward-looking real interest rate by changing the nominal interest rate, which thus affects the distribution of household consumption over time periods. If time preference remains the same,[4] an increase in the real interest rate compared to its

[2] There may be several reasons for this: prices fixed in a long-term contract, costs related to re-pricing a product (menu cost), etc.

[3] In the Calvo type pricing, firms can change their prices at any given time only as a function of an exogenous process and only with a certain degree of probability, regardless of whether they changed their prices in the previous periods. As a result of this, the time periods during which the prices of various products remain fixed overlap, that is, the changes in prices will not be synchronised. The Calvo type time-dependent pricing is of an ad-hoc nature; however, if used in standard models, it yields results that are similar to those produced by the more realistic but mathematically more complex state-dependent pricing (see e.g. Klenow and Kryvtsov, 2005). At the same time, however, Lombardo and Vestin (2007) point out that although that the two most popular time and state-dependent pricing types (Calvo- and Rotemberg pricing) result in identical aggregate behaviour of firms (Phillips curve), they may have different welfare implications if the distortion that appears as a result of the oligopolistic competition cannot be perfectly offset by the government.

[4] The utility function of households in a given time period contains consumption and leisure. The time preference measures the amount of future utility a household is willing to sacrifice for the sake of current utility.

natural level motivates households to reallocate their consumption from the present to the future and the other way round when real interest rates decrease. In keeping with the above, the demand side of the standard New Keynesian model – presupposing a closed economy and not taking into account investments – can be described in the form of the IS curve below which is derived from the behaviour of a utility maximising household:

$$\tilde{y}_t = E_t\{\tilde{y}_{t+1}\} - \frac{1}{\sigma}(i_t - E_t\{\pi_{t+1}\} - r_t^n) \qquad (2)$$

where i_t is the nominal interest rate which can be affected by the central bank, $i_t - E_t\{\pi_{t+1}\}$ is the forward-looking real interest rate, and r_t^n the natural level of the real interest rate (which prevails in an equilibrium without nominal rigidities).

The two equations described above also clearly show the basic transmission channel of monetary policy: by changing the interest rate the central bank diverts the real interest rate from its natural level and, by way of its impact on aggregate demand, opens the output gap which affects inflation through the New Keynesian Phillips curve. Since both inflation and the output gap are forward-looking variables, it is clear that they are affected not only by the current interest rate but by its future path as well.

As we have indicated before, in the New Keynesian framework the welfare loss of households resulting from a deviation from flexible price equilibrium[5] allocation can be approached with a loss function[6] which is directly suitable for examining the impact of monetary policy on welfare (see Rotemberg and Woodford, 1997; Woodford, 2003).

$$W \equiv E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{U_t - U_t^n}{U_C C} \right) = \frac{1}{\lambda} E_0 \sum_{t=0}^{\infty} \beta^t (\kappa \tilde{y}_t^2 + \varepsilon \pi_t^2) \qquad (3)$$

where U_t^n is the (hypothetical) utility of households in the given period if prices were perfectly flexible and U_t designates utility under the actual imperfections. U_c is the marginal utility of consumption, C is the level of consumption in a stable equilibrium, and the product of the two yields a utility measure. The quadratic loss function above results from a second order approximation to this welfare loss which, in addition to its microeconomic foundations, is also intuitive because it is similar in form to objective functions that are widely used in the literature,[7] but which contain parameters and variables in an *ad-hoc* way.

MONETARY POLICY IN THE NEW KEYNESIAN MODEL

The New Keynesian models are closed with a monetary policy block that determines the nominal interest rate. If we describe monetary policy as a feedback rule that reacts to endogenous variables, the inflation parameter must be greater than one if we want stable equilibrium, that is, the forward interest must also increase if inflation increases. For monetary policy[8] to be optimal, the central bank must determine the interest rate in a way that minimises social loss on the basis of the welfare criterion defined above.

$$i_t = r_t^n + \phi_\pi \pi_t + \phi_y \tilde{y}_t \qquad (4)$$

In the simplest New Keynesian model, monetary policy has an easy task: it follows a rule of action that always closes the output gap and therefore also brings the rate of inflation to zero[9] by simultaneously minimising social loss; this is also true the other way around. It is important to underline that in the framework of the New Keynesian model monetary policy reduces social loss not when it unconditionally 'smoothes' fluctuations in output, but rather when it attempts to approximate it to its natural level which, in the case of technology shocks, may be volatile. Therefore, the approach of the New Keynesian model is fundamentally different from the approach that defines the output gap as a difference between actual and long-term trend-output.

Monetary policy also has an easy task when only demand shocks (those that are related to the 'IS equation') can divert the economy from a state of stable equilibrium. The demand shocks that are assumed to be exogenous in the above framework change the output gap and inflation in the same direction, therefore the optimal reaction of monetary policy – which minimises welfare loss – is trivial.

Because target variables are forward looking, that is, they also depend on the values that they will take on in the future, at any given time they will be determined not only by current

[5] In the standard New Keynesian model the Pareto-optimal or efficient (lacking any kind of distortions) and the natural output are the same. Although the latter contains distortions (similar to dead weight losses) that arise from the presence of monopolistic competition; however, based on an implicit assumption, fiscal policy is capable of providing a counterweight in the form of lump sum (non-distorting) taxes.

[6] With a second order Taylor series approximation around the flexible price equilibrium allocation.

[7] The so-called loss functions are widespread in the literature and contain the sum of the deviation of inflation from its target value and the square of the output gap in respect of a particular period. The popularity of the square loss function can be explained by the fact that it is a good representation of the symmetrical nature of monetary policy: decision makers do not want high inflation, deflation, output below or in excess of its potential. On the other hand, a quadratic target function yields a mathematically easily manageable system coupled with equations that describe the demand and supply in the economy in a linear (or log-linear) form (see, for example, Benigno and Woodford, 2006).

[8] It is important to note that normative conclusions depend on the assumption that expectations are rational and monetary policy is fully credible.

[9] Blanchard and Gali (2005) calls this phenomenon 'divine coincidence'.

monetary policy but also by the expectations related to it. The so-called 'discretionary' monetary policy does not recognise that expectations can be influenced and re-optimises in every period. At the same time, non-discretionary monetary policy recognises that – if there is a short-term trade-off between inflation and the output gap (see below) – welfare loss can be reduced by using the expectations channel. Monetary policy can influence expectations if it is credibly committed to an optimal interest rule in the long term (indefinitely). In order to be able to benefit from such a commitment, the central bank must be fully credible, that is, it must stick to its decisions made in the past even if they did not have the optimal result in respect of a given time period ('history dependence', see Woodford, 2003). Naturally, in real life central banks are unable to commit themselves for an indefinite period of time; however, the above serves as an important lesson in the practice of monetary policy. Establishing credibility and managing and/or anchoring expectations result in welfare gain, and expectations for the future are important for effectively achieving the stabilisation goals of monetary policy.

It is important to explain the difference between optimal and simple interest rules. The optimal rules minimises the loss function derived from the utility of the representative agent; its coefficients result from the 'deep' parameters of the model, and it assumes a knowledge of the natural level of output and real interest rates. Because the latter are variables that are not directly observable, therefore the optimal rules that contain them are not necessarily suitable for direct use in monetary policy practice. On the other hand, the so-called simple rules are based on observable variables and are not derived from the optimisation of a concrete model (an example is the classic Taylor-rule[10]). In an ideal case, simple rules may have the advantage of 'performing well' in several models with different specifications, in other words, they result in a social welfare loss that is close to one that can be achieved with a monetary policy that is considered optimal in the given models.

In the above cases monetary policy could minimise the social loss function without confronting a trade-off. Therefore, this feature of the standard New Keynesian model implies a loss-minimising monetary policy which immediately returns inflation to zero in the case of exogenous shocks. Maintaining zero inflation eliminates welfare loss arising from the presence of nominal price rigidities; in the New Keynesian framework this is the most that monetary policy can do. Although central banks that follow inflation targeting are often accused of leaving all factors, other than the inflation process, out of consideration, the simplified approach above is not characteristic of them either because the short-term trade-off between output gap and inflation stabilisation is an empirically well-established fact.

TRADE-OFF BETWEEN TARGETS

The trade-off between inflation and output gap can be illustrated by making a small change to the standard models described above. The simplest way to introduce the trade-off is to supplement the New Keynesian curve above with an *ad-hoc* 'cost shock.' As a result of the cost shock, the output gap and inflation start moving in opposite directions, therefore their simultaneous stabilisation is no longer possible. In such cases, the task of monetary policy is to distribute the effect of the shock in an optimal manner – in an attempt to minimise social loss – between output gap and inflation.

$$\pi_t = \beta E_t\{\pi_{t+1}\} + \kappa y_t + u_t \qquad (5)$$

Although the introduction of an ad-hoc cost shock (u_t) makes the implications of the New Keynesian model regarding monetary policy more realistic, it is not in line with the principle of building from microeconomic foundations. However, the trade-off can also be introduced from a 'deeper' foundation: the possibility of stabilising inflation and output gap simultaneously depends primarily on the frictions implied in the model. One example is when there is a time-varying difference between 'effective' (completely frictionless) and natural (absent of nominal frictions) level of output. A trade-off results also when price rigidities are coupled with a rigid labour market causing the real wage of the representative household deviating from its 'natural' level. This is another factor that, by distorting the real marginal costs of companies and the choice of households between labour or leisure, results in a non-optimal allocation and therefore leads to social loss.

Erceg et al. (2000) introduces nominal wage rigidities into the standard New Keynesian model analogously to Calvo pricing: the nominal wage of households remains fixed to a certain degree of probability in every time period, regardless whether the wage changed in the previous period or not. As a result of the frictions affecting prices and nominal wages, wage inflation (changes in nominal wages, π_w) is also included in the social loss function; however, the simultaneous stabilisation of inflation, wages and the output

[10] The classic Taylor rule (Taylor, 1993) is an estimated feedback rule which ties the level of the central bank's prime rate to one constant (or the deferred prime rate) to the deviation from the target value of inflation and a variable that measures tension in the real economy.

gap will no longer be feasible and there will be a trade-off between these goals.[11]

$$W \equiv E_0 \sum_{t=0}^{\infty} \beta^t (\phi_y \tilde{y}_t^2 + \phi_p \pi_t^2 + \phi_w \pi_{w,t}^2) \qquad (6)$$

In this case, an optimal monetary policy reacts to price and wage inflation as well as the output gap by giving more weight to the 'stickier' nominal variable. In the previous framework Erceg et al. (2000) examined the performance of several simple interest rules in addition to that of the optimal one. The results show that a welfare loss generated by the optimal rule can also be achieved by a rule that reacts to price and wage inflation, or price inflation and the output gap.

Besides labour market rigidities, the trade-off between inflation and output gap may also emerge when the New Keynesian model is extended to an open economy, and we assume that there is friction concerning the pass-through of exchange rate movements into prices. Gali and Monacelli (2005), by placing both foreign and domestic goods in the representative consumer basket and assuming that the pass-through of exchange rate changes into consumer prices is immediate and complete, concluded that social loss depends on domestic consumer price inflation and on the output gap. In this approach foreign monetary policy is assumed to be optimal (which means that it reached the flexible price equilibrium allocation) and the law of one price holds in the case of imported consumer goods (which means that the domestic and foreign prices of these products, if calculated in the same currency, will be the same at all times) Based on the above, this open economy model approach is analogous to the standard New Keynesian model, that is, there is no trade-off between the output gap and the stabilisation of domestic inflation, therefore the optimal monetary policy can be approximated with an interest rate rule that reacts to the inflation of domestic consumer goods in addition to the natural level of the real interest rate. Having a monetary policy that reacts to the entire price index or fixes the nominal exchange rate may result in greater welfare loss because, due to the partial or full stabilisation of the exchange rate, the relative price adjustments of foreign and domestic consumer goods will occur, partially or fully, through the nominally rigid domestic prices.

Monacelli (2005) proved in a similar open economy framework that by relaxing the implausible assumption of complete and immediate pass-through (see Campa and Goldberg 2005) of exchange rate movements into prices there will be a trade-off between the stabilisation goals of monetary policy. Due to the incomplete pass-through in the short term, the law of one price does not hold in the case of foreign consumer goods, and exchange rate changes directly affect the output gap and inflation. In this case monetary policy could reach the flexible price equilibrium allocation if it could simultaneously stabilise domestic inflation and the deviation from the law of one price, which is infeasible in this case. With respect to social welfare loss, a monetary policy with commitment that reacts to the whole consumer price index appears to be the least costly on the basis of a loss function, used by Monacelli (2005), which contains the output gap and total consumer price inflation. However, it is important to note that the partial stabilisation of exchange rate changes is implicit in this monetary policy.

THE LIMITS OF IMPLEMENTING OPTIMAL MONETARY POLICIES

In this sub-section we describe the problems – which are related to the basic assumptions of the theoretical framework described above – that modify some of the normative implications stemming from the simpler New Keynesian models. One such problem may arise from model-uncertainty and non-rational expectations of market participants. Orphanides and Williams (2007) assume that the central bank and economic agents, instead of rational expectations, have imperfect information about economic structures, especially concerning natural rates (output, unemployment, real interest rate). Agents form their expectations on the basis of a learning process, in the course of which they use a simple forecast model which is continuously re-estimated as new data come in. These circumstances considerably change loss minimising monetary policy compared to models that consider known economic structure and rely on rational expectations. On the basis of the objective function used by Orphanides and Williams (2007) – which is similar to those described above, but is not deduced from the utility of the representative household – a loss-minimising monetary policy reacts stronger to inflation and to a lesser extent and more gradually (by interest rate smoothing) to real economy variables, which are estimated with uncertainty.

In connection with the above, it is important to note that the real time estimates of the output gap may be rather inaccurate due to various methodological problems and frequent data revisions and may not even have the appropriate sign (see Orphanides et al., 2000). It has been demonstrated within a

[11] We have mentioned above that monetary policy is an economic policy tool that is suitable primarily for eliminating distortions that result from nominal rigidities. If in the above-mentioned case only wage rigidities prevailed, monetary policy would be able to eliminate them similarly to the standard New Keynesian model. However, the simultaneous prevalence of price and wage rigidities directly affects the accommodation of real wages and therefore results in a real economy distortion that monetary policy is unable to counterbalance.

model framework by Clarida and others (2000) that a monetary policy, which gives considerable weight to real time output gap estimates, may lead to strongly suboptimal outcomes. The problem of taking real economy considerations into account explicitly is apparent when a central bank's loss function or policy rule contains deviations from the estimated long-term output trend (that is, from an atheoretic measure generated by a simple time series method) as a variable that measures real economy tensions. Although at first sight a monetary policy that attempts to 'smooth' real economy fluctuations appears to be justifiable from a welfare perspective, output should fluctuate as an 'effective' response to technological shocks that cannot be observed in real time. If in this case monetary policy attempts to return output to its long-term trend, it may generate inflation or deflation, contrary to its original intention. On the basis of the above, an explicit reaction to the output gap estimate that is available for decision makers in real time poses a risk which is also reflected in the practice of central banks: typically, they take into account real economy considerations within the tolerance band surrounding the inflation target, in the time-horizon of monetary policy reaction, or by targeting a certain core inflation indicator (see Palmquist, 2007). Targeting core inflation means that monetary policy hardly, or not at all, takes into account changes in price index components that are frequently affected by cost/supply shocks (this is the monetary policy that is carried on, for example, by the US Fed). The tolerance band around the inflation target also allows for such impact.

The New Keynesian models described above also assume an absolute credibility of monetary policy; however, this is not always the case in real life. If market agents do not find the central bank's commitment to fighting inflation credible, taking into account and emphasising real economy considerations may be perceived as an inflation bias. In order to avoid this, clear communication, transparency and accountability by the central bank are of key importance.

WHAT DOES GOOD MONETARY POLICY LOOK LIKE ON THE BASIS OF THE LOGIC OF NEW KEYNESIAN MODELS?

On the basis of the logic of the New Keynesian model framework described above, we can formulate the following normative implications in respect of monetary policy:

- Monetary policy must take into account that theoretically, all it can do is to eliminate the impact on welfare of distortions that result from nominal rigidities; in other words, it cannot attempt to reach an output that is permanently higher than the natural level.
- It has a decision-making rule that focuses on stabilising those price and/or wage inflation indices that exhibit nominal rigidities. The weight(s) given to stabilising individual price and/or wage indexes is in proportion to the extent of their stickiness. It is especially important for the central bank's interest rate to change in the same direction as the inflation but to a greater extent, that is, for example, in the case of a demand shock that increases inflation, the real interest rate must increase as well.
- A deviation from the natural level of output is included in the loss function of the representative market player, and monetary policy also attempts to minimise it. If the economy suffers a shock that changes inflation and the output gap in opposite directions, an optimal monetary policy would distribute its effect between the two variables. Furthermore, when taking into account real economy considerations, it is important to ensure that the price stability goals of the central bank's monetary policy is credible.
- It is aware that expectations of future changes in monetary policy, when market players are forward looking, are just as important in respect of welfare-relevant variables as current interest rate changes. A loss-minimising monetary policy benefits from the welfare gains stemming from the management of expectations and creates a high degree of credibility in order to do so. Credibility depends primarily on whether previously declared goals and commitments have been met.
- If there is considerable uncertainty about the models that describe the economy or if assumptions about being perfectly informed and about expectations being rational are not realised, a loss-minimising monetary policy will react to a considerably greater degree to inflation and to a lesser extent to variables which reflect the slack in the real economy but cannot be directly observed. Furthermore, under the conditions described above a lower welfare loss may result if monetary policy changes the interest rate only gradually (smoothing over the interest rate) in response to new information.

CONCLUSIONS: IS INFLATION TARGETING A GOOD MONETARY POLICY?

We argue that inflation targeting provides a strategic framework within which the implications formulated above can be put into practice. Central banks that conduct the 'best practice' of inflation targeting (hereinafter IT central

[12] Such is the British, Canadian, Norwegian, Swedish and New Zealand central bank.

banks)[12] typically do not have a well-defined real economy target in addition to their explicit numerical inflation target. This, however, does not mean that they do not take into account real economy considerations. This may not be evident, but by attempting to reach their price stability goals for a horizon of 1-2 years, IT central banks implicitly declare that they are unwilling to take any magnitude of real economy cost in order to stabilise inflation in the short term when shocks that move inflation and the output gap in opposite directions occur. However, making decisions 1-2 years ahead requires the central bank to prepare forecasts and formulate its monetary policy accordingly. This practice ('inflation forecast targeting' – see Svensson 1997) also allows real economy considerations to be taken into account even though the central bank only reacts if the inflation forecast deviates from the target. This is because the inflation forecast by definition includes the impact of all variables that may have a significant impact on inflation in the future. They typically include the current values of variables that may be considered relevant in respect of welfare on the basis of the models that are described above (e.g. wage and output gap estimates). As Svensson (2007) points out, most modern central banks follow 'flexible' inflation targeting (which means that they also take into account real economy considerations). 'Strict' IT (which is only construction with inflation), on the other hand, can be considered more of a theoretical construction with the possible exception of periods when monetary policy has credibility problems.

IT central banks also fit into the described theoretical framework because they typically use a short-term interest rate as an instrument, and, furthermore, their behaviour ex post can be well approximated with an estimated Taylor rule that gives considerable (greater than unity) weight to deviation form the inflation target.[13] This, however, does not mean that in practice monetary policy follows a pre-defined interest rate rule that is effective at any point in time. There is a commitment that is in line with the theoretical implications; however, it is not a commitment to an interest rule but to a medium-term target criterion that constitutes the inflation target (see Svensson and Woodford, 2003). This practice – if it appears to be credible for economic agents – creates inflation expectations that correspond to price stability and – as we have mentioned above – provides adequate flexibility in the short run in adapting to supply or cost shocks.

In order to use short-term flexibility effectively and/or to create credibility that is necessary for anchoring medium-term expectations, IT central banks focus on transparency and the accountability of decision makers. Furthermore, commitment, transparency and the accountability of decision-makers also ensure that monetary policy does not systematically attempt to reach an output that is higher than the natural level.

Consequently, the current practice of inflation targeting places considerable weight on reaching price stability while also taking into account real economy considerations, mostly by avoiding potential risks arising from explicit reactions to variables that are hard to observe or measure in real time. Furthermore, inflation targeting takes advantage of managing expectations in the form of a commitment to a medium-term target criterion. Based on the above, we can claim that the strategy of inflation targeting satisfies the most important normative implications that can be derived from the theoretical framework introduced above.

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