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A CRITICAL EVALUATION OF THE BARRO-GORDON APPROACH WITH SPECIAL REFERENCE TO MONETARY ISSUES IN THE EU

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1.) Introduction

Credibility theory plays the major role in the economic debates about monetary policy frameworks. The New Labour government in the UK has surprisingly given operational independence to the Bank of England, hoping to achieve low inflation with low social costs, via positive credibility effects. Gordon Brown when announcing the historic changes at the Bank of England emphasised the need to get politics out of the process, which is the most important conclusion of the credibility literature. The dominance of the credibility approach in the academic and popular economic debate is sufficient to make it relevant for economic analysis, due to its effect on the expectations and behaviour of key economic players. However, this does not necessarily mean that its conclusions are really relevant and appropriate or that there is likely to be a complete effect of self-fulfilling expectations. It is therefore interesting to have a closer and critical look at credibility models and their usefulness for policy evaluation.

This paper will critically examine the original model and various extensions and variations, the aim being to evaluate the appropriateness of the Barro-Gordon approach for different kinds of analysis and ultimately policy applications. The argument of this paper will be that there are very limited circumstances, in which the Barro-Gordon approach can serve as the ultimate basis for analysis or policy evaluation. The second part therefore tries to combine the approach with other lines of argument to analyse different issues. Finally, it will be suggested, in which way a more broadly applicable approach might be constructed.

In credibility models the efficiency of a policy is determined by the reaction of the private sector. It is of central importance how credible a policy announcement is. **The more credible a policy, the likelier it is that the announcement and private expectations coincide.** This credibility depends mainly on the reputation of the policy maker. **The reputation is build on the basis of past experiences, that is, on the basis of the differences between announced and realised policy goals of these periods. The stronger a central bank weighs the goal of low inflation in making monetary policy decisions, the harder is its reputation.**
The policy maker has to evaluate the trade-off between short-term advantages and long term disadvantages. This is always the case if a strategy is optimal at the time of the announcement, but suboptimal at a later point in time, when a divergence from the announced policy objective increases the utility of the policy institution. This is the time-inconsistency problem. Cheating deteriorates the reputation of the policy institution and therefore diminishes the credibility and subsequently the effectiveness of future policies.

2.) The Barro-Gordon-model[1]

a) questions

The model was developed in the early eighties to explain the on average too excessive inflation rates in the developed capitalist world, since the Second World War.[2] Furthermore, the authors state that there was a tendency to engage in active anticyclical monetary policy, although the unemployment rate has been normally invariant from it. Therefore, their model tries to explain this phenomenon, assuming that it is based on rational behaviour and that expectations are formed rationally.

b) The model

The foundations of the model are the assumptions of the new-classical standard model: The inflation rate is determined by the money growth rate. This is also the relevant theory for the expectational process. A demand reaction to an expansive policy is possible, but the supply of goods will only react if expectations are incorrect.
This Lucas supply effect is explained using imperfect information, as individual suppliers interpret the price rise as a relative rise of their own price.
In the case of an anticipated or even announced policy there are no real effects, even in the short term. The unemployment rate ($\mathbf{U_t}$), equals the natural rate ($\mathbf{U^n_t}$) and differs from it, if the expected inflation rate ($\mathbf{\pi^e_t}$) does not match the actual inflation rate (π_t). The divergence of the expected and actual inflation rate is due to incomplete information, as an overall shock is interpreted as a market specific shock. The magnitude of the impact of this difference is expressed in α, which can be interpreted as the elasticity of employment to the expectational error.

(1) $U_t = U^n_t - \alpha (p_t - p^e_t); \alpha>0$

The natural unemployment rate can change over time, due to exogenous shocks. U^n_t depends on the long-term average natural rate (U^n_l), as well as on the natural rate of the last period and a disturbance random variable, e_t, with an expected value of zero. The effect of a real shock has therefore, in contrast to the Lucas model, an impact over several periods which declines steadily, the expected value of the long term rate being constant.

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[1] Barro/Gordon: A Positive Theory of Monetary Policy in a Natural Rate Model, Journal of Political Economy, 1983, Vol. 91, No. 4; P.590-610

[2] The authors argue that the rates have been excessive from a welfare point of view, as inflation is seen as something negative by individuals, but has not had any positive macroeconomic effects.

(2) $U^n_t = \lambda U^n_{t-1} + (1-\lambda)U^n_l + e_t$; $0 \leq \lambda \leq 1$

It is assumed that all players act rationally and that the policy institutions act in accordance with the preferences of the public.[3] However, one has to ask whether it is possible to find out the individual preferences and to aggregate them subsequently into a social preference function. An alternative approach would be to interpret the public preference function as the result of a political bargaining process.[4]
The policy maker minimises its cost function Z_t, which depends on the unemployment and inflation rate in the period.
Costs go up if either the unemployment rate diverges from the target value or if the inflation rate diverges from zero, assuming that the target value is zero. The only rationale that can be given for a zero target in this context, is that it minimises transaction costs. It is assumed that distortionary effects of the public sector, bring the socially optimal unemployment rate below the natural rate.

(3) $Z_t = a(U_t - kU^n_t)^2 + b(\pi_t)^2$; $a, b>0$, $0 \leq k<1$

K is smaller than one, because the natural rate is perceived to be too high. The policy body controls the money supply and therefore the inflation rate.
The public objective function is the minimising of the expected discounted future costs, with r being the real discount factor, given all available information (Io).[5]

(4) $E\left[\sum_{t=1}^{\infty} Z_t / (1+r)^t \right] \mid I_o$

In a one shot game the policy problem reduces to choosing π_t, in order to minimise $E_{t-1}(Z_t) \mid I_{t-1}$. The economic agents assume a specific dependency of the policy maker's decision on the available information and build their expectations accordingly.

(5) $\pi^e_t = h^e(I_{t-1})$

[3] Barro/Gordon, s.a.; P.590
[4] For example, Kastner looks at the implications of such an approach: Kastner: Glaubwürdigkeit und Reputation der Geldpolitik, P. 1-40
[5] If the objective function is the result of a politeconomical process, then it can change at any time, causing extra uncertainty about government policy.

(5) is known to the policy maker.

In equilibrium the strategies of the private sector and the policy institutions have to be optimal, given the strategy of the other players and expectations must have been formed rationally, knowing the full structure of the model, including all objective functions.[6]
In a time inconsistent situation a policy that was optimal in one period is suboptimal in the next period and the policy maker has an incentive to cheat. This has to be incorporated into the expectational process of the private agents for a rational expectation equilibrium to exist. If policy is discretionary the equivalence of expectations and realisations is a characteristic of the equilibrium, but not a restriction in the optimisation process of the government. The policy maker tries to maximise its objective function, which incorporates its preferences regarding inflation and unemployment.[7] From this follows an activist policy stance to reduce unemployment by creating surprise inflation. In equilibrium the private agents will take this into account and the result is unaltered unemployment and higher inflation.[8] **Therefore the first-best result is not feasible, due to the model assumptions and the second-best result is a rule based and constant policy.**
The policy problem then becomes how to make a credible commitment.

c) results of the model

Substituting equation (2) for U^n_t and equation (5) for π^e_t in equation (1) results in the determining equation for the unemployment rate:

(6) $U_t = \lambda U^n_{t-1} + (1-\lambda)U^n_l + e_t - \alpha[\ \pi_t - h^e(I_{t-1})]$

Substituting this into equation (3) gives the cost function for period t, which the policy maker minimises with his choice for π:

$$Z_t = a\ \{[\lambda U^n_{t-1} + (1-\lambda)U^n_l + e_t\ ] - \alpha\ [\ \hat{\pi}_t - h^e(I_{t-1})] - kU^n_t\}^2 + b(\hat{\pi}_t)^2 \quad \min \hat{\pi}_t$$

Summarising gives:

(7) $$Z_t = a\{(1-k)\ [\lambda U^n_{t-1} + (1-\lambda)U^n_l + e_t\ ]- \alpha[\ \hat{\pi}_t - h^e(I_{t-1})]\}^2 + b(\hat{\pi}_t)^2 \quad \min \hat{\pi}_t$$

[6] Barro/Gordon, s.a., P.591: These conditions for an equilibrium are also behavioural assumptions. This points to a circular argument.
[7] Alternatively, the objective function can be seen as the result of a political bargaining process.
[8] It could be said, that the model really takes place as a simulation in the brains of the agents.

The expected costs are:

$E_{t-1}(Z_t) = a\{(1-k)\,[\lambda U^n_{t-1} + (1-\lambda)U^n_l] - \alpha\,[\,\hat{\pi}_t - h^e(I_{t-1})]\}^2 + b(\hat{\pi}_t)^2$

FIRST ORDER CONDITION:

$(\delta/\delta\pi_t)\,(E_{t-1}\,Z_t) = 2a\{(1-k)[\lambda U^n_{t-1} + (1-\lambda)U^n_l] - \alpha\,[\,\hat{\pi}_t - h^e(I_{t-1})]\}(-\alpha) + 2b\hat{\pi}_t = 0$

$a\{(1-k)[\lambda U^n_{t-1} + (1-\lambda)U^n_l] - \alpha\,[\,\hat{\pi}_t - h^e(I_{t-1})]\}(-\alpha) + b\hat{\pi}_t = 0$

$a\alpha\{(1-k)[\lambda U^n_{t-1} + (1-\lambda)U^n_l] - \alpha\,[\,\hat{\pi}_t - h^e(I_{t-1})]\} = b\hat{\pi}_t$

Rearranging gives:

(8) $a\alpha/b\{(1-k)[\lambda U^n_{t-1} + (1-\lambda)U^n_l] - \alpha\,[\,\hat{\pi}_t - h^e(I_{t-1})]\} = \hat{\pi}_t$

In equilibrium the following holds:

$h^e(I_{t-1}) = \hat{\pi}_t$ (9)

and the Nash-equilibrium is therefore:

(10) $\hat{\pi}_t = a\alpha/b\,(1-k)\,[\lambda U^n_{t-1} + (1-\lambda)U^n_l] = \pi^e_t$
and this implies: $U_t = U^n_t$

The policy maker is in a time-inconsistent situation. If he implements a policy that diverges from his announcement, he will minimise the loss function more than if he sticks to his goal. However, in equilibrium the economic agents take this into account and the result is a bigger loss than when he would stick to a rule of zero inflation. This is because inflation is now higher than zero, but unemployment remains at the natural rate.
So if the policy maker takes into account that $U_t = U^n_t$ (or $\pi^e = \pi$) the loss function is minimised if $\pi^* = 0$.

(3') $Z_t = (1-k)a(U^n_t)^2 + b(\pi_t)^2$; $a, b>0$ $\min \pi_t$

FIRST ORDER CONDITION:

$(\delta Z_t/\delta\pi_t) = 0 = 2b\,\pi_t$

From which follows:

(11) $\pi^*_t = o$

The problem is that this policy will tend not to be credible. If the policy body is not able to commit itself successfully, the above result is not an equilibrium and the economy is again at the non-cooperative equilibrium point, which has a higher cost level than (11).
The motivation to cheat is higher if people believe policy to be rule based, as it might be possible to achieve the first-best result, i.e., to cheat successfully. The policy maker will choose the inflation rate so that the marginal costs of inflation and unemployment are equal, which is exactly what the private agents will expect. Surprise inflation would need to be higher, but then cheating would no longer make sense.

So the following conclusions can be made for the situation without commitment:
The endogenous inflation bias of the monetary authority brings about an inflation rate that is inefficient in the sense that there are only negative implications, like adjustment costs. The stronger the preference for low unemployment and the higher the natural rate of unemployment, the higher the inflation rate. The policy maker cannot influence real economic activity, given the size of the public sector (a bigger public sector means a higher natural unemployment rate). A credible commitment to a low inflation policy would increase social welfare.

d) possible solutions identified in the credibility literature

In order to secure a cooperative outcome the monetary authority has to commit itself successfully to a low inflation policy.
The costs of breaking the rule have to be higher than the temptation to cheat.[9]
Only if the reputation has been build up over several periods, does it become plausible that the policy body will not throw this away for the benefit of a one-period gain, i.e., only then starts the policy body to act credibly. The penalty for cheating is the discounted future costs of the uncooperative equilibrium minus the costs of the cooperative equilibrium, for those periods where the credibility is not fully restored. The temptation to cheat is the one off profit from successfully cheating. If the penalty for cheating from the second period until

[9] Barro/Gordon: Rules, Discretion and Reputation in a Model of Monetary Policy, Journal of Monetary Economics, 1983, 12, P.101-121

the re-establishment of credibility times a discount factor, is higher than the temptation to cheat, then the rule-based policy is credible.
One Solution discussed by Rogoff and others is to give the task to a conservative central banker. As his preferences are likely to differ from those of the general public, a zero inflation goal may be credible. However, empirical studies looking at countries with independent central banks give a mixed picture. Although independence probably helps to get a hard reputation, only a good track record and credible overall monetary and fiscal arrangements seem to bring the desired reputation. This point will be further illustrated in the discussion of Herrendorf and Neumann's variation to the Barro-Gordon-model. If the policy maker has an informational advantage, then it will be easier to cheat. The advantage could be that the value of et is known before the authority implements its program, but after the private agents have made their choices. Consequently a commitment has to include an even higher penalty to ensure it exceeds the temptation. Due to the uncertainty introduced by this informational advantage, the penalty will have to be significantly higher.

Another possible solution is to make an international commitment, which will now be illustrated in an open-economy extension of the Barro-Gordon model:[10] The objective functions of governments will differ in the relative weights attached to inflation and unemployment. The different relative weights of countries can be expressed as different slopes of their indifference curves. A hard-nosed government is prepared to accept significantly higher unemployment to keep inflation low, the opposite is true for a wet government.

[10] A typical and compact presentation of such a model can be found in: De Grauwe: Economics of Monetary Integration ('92/'94); P. 44-55

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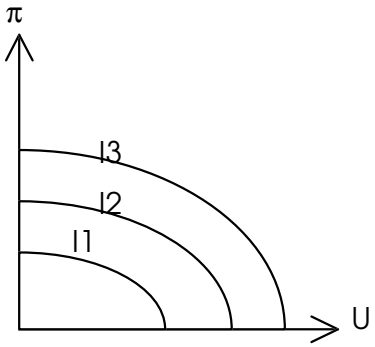
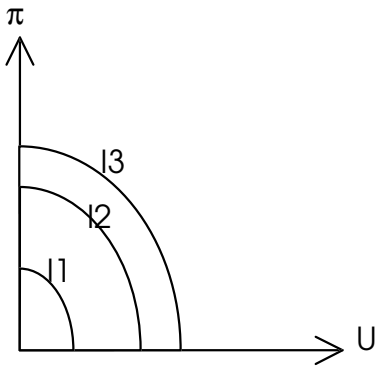
'HARD' GOVERNMENT

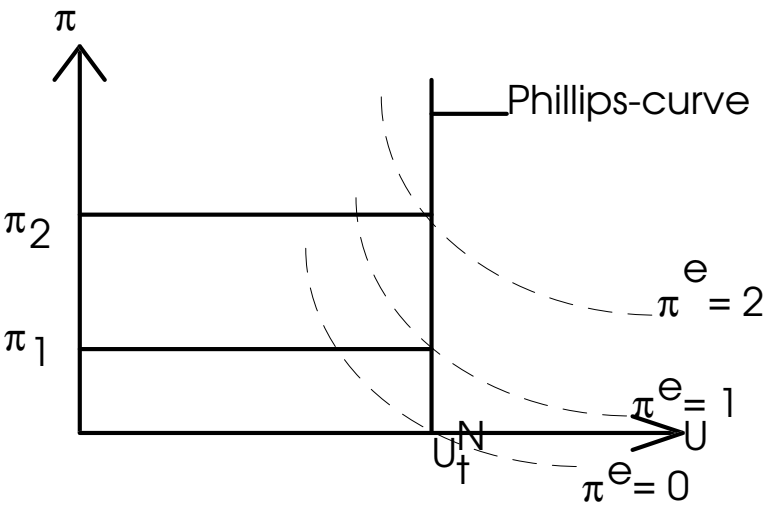


'WET' GOVERNMENT



If a wet government announces a zero inflation goal, this will not be credible, cheating would allow it to reach a higher indifference curve. This can be illustrated graphically:[11]

FIGURE 1



[11] compare: De Grauwe: Economics of Monetary Integration ('92/'94); P. 45-51 or Kastner: Glaubwürdigkeit und Reputation der Geldpolitik, P. 25-30

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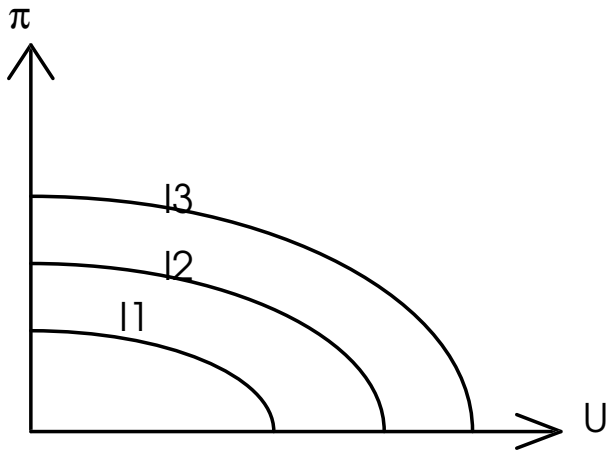
π^e stands for the expected inflation rate and the punctuated lines for the accompanying short term Phillips-curves. In equilibrium the Phillips-curve is vertical, as $\pi^e = \pi$, i.e., there is no employment effect. The "curve" defines the natural unemployment rate of the period.

Figure 2 shows the indifference curves of the policy institution. The concavity of the curves is due to the increasing marginal costs of both variables. It should be noted that utility increases to the origin, as the costs decrease if the rates of both factors diminish.

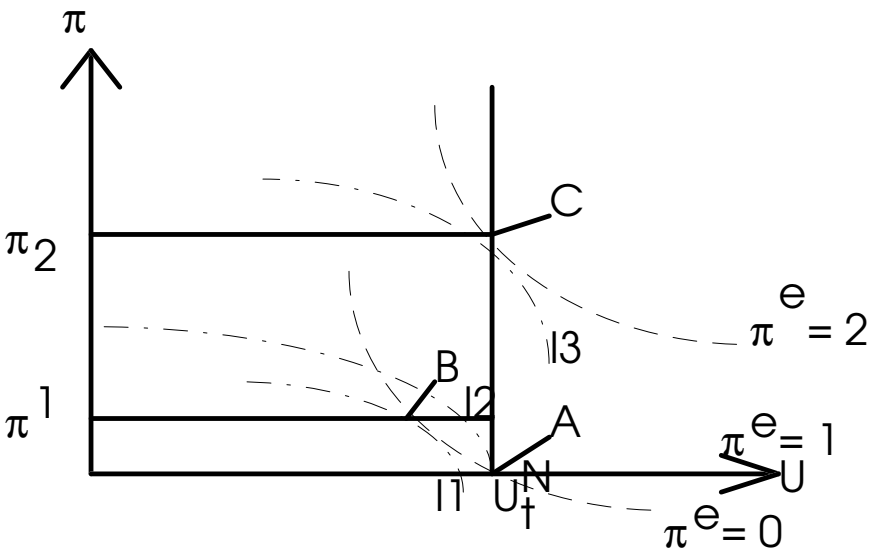
FIGURE 2



The steeper the indifference curves, the more weight is given to the unemployment costs relative to the inflation costs.

Figure 3 illustrates the three theoretical outcomes, discussed above:

FIGURE 3



Point B is the first-best outcome of surprise inflation. Surprise inflation can increase utility significantly.

However, this point is no rational equilibrium point. The economic agents adapt their behaviour, so that this process has to be repeated indefinitely. This development ends in point C, where the marginal costs of both factors are equal. According to the expectational hypothesis, the economy goes straight to C. This is the third-best result, the discretionary uncooperative equilibrium. The second-best result is an inflation rate of zero, the point A. The utility level lies between those of B and C.
Should the government really try to achieve zero inflation the social costs will be substantial, as private agents expect the Nash-equilibrium. In this case disinflation is obtained by higher unemployment.
The country with the tough reputation on the other hand can achieve low inflation with comparatively low costs. **The credibility-hypothesis says that it is advantageous for the first country to import the credibility of the second country to reduce the social costs of disinflation. This is typically done through credible exchange rate agreements.**
However, the problem of making an exchange rate agreement credible is analogous to the problem of making monetary policy credible. In fact, it is unproblematic to transfer the logic of the credibility model from monetary policy to exchange rate policy, as one is the derivative of the other. Here simpler versions of the credibility approach, like the following by Giovannini, will be used, in order to concentrate on the question of sustainability:[12]
The sequence is as usual, with the central bank having an informational advantage about the exogenous random shock variable (ε). y is the divergence of real income from trend and is determined by unanticipated exchange rate changes and ε. This relationship is derived from the purchase power parity assumption. s stands for the change in the exchange rate.

(1) $y = (s - s^e) - \varepsilon$; s^e = expected change of the exchange rate; $E(\varepsilon) = 0$

The social cost function consists of the expected change of the exchange rate leading to a divergence from price stability and the unemployment above the optimal rate, K, that is not compensated by y:

(2) $L = E[\, s^2 + \phi(K - y)^2]$; $\phi, K > 0$

The government's objective function is:

(3) $Z = s^2 + \phi(K - y)^2 \Rightarrow \min_s$, s.t. $y = (s - s^e) - \varepsilon$; with s^e given

[12] Giovannini: European Monetary Reform: Progress and Prospects, in: Brooking Papers on Economic Activity; 1990; No. 2; P.218-291; The following differs slightly from the original presentation.

The consolidated function is:

-> $Z = s^2 + \phi[K - s + s^e + \varepsilon]^2$

First-Order-Condition:

$\delta Z/\delta s = 2s + 2\phi[-K + s - s^e - \varepsilon] = 0$

↳ $s + \phi[s - s^e - \varepsilon - K] = 0$

↳ $(1+\phi)\, s = \phi(s^e + \varepsilon + K)$,

from this follows:

↳ (4) $s = [\phi / 1 + \phi] * (s^e + \varepsilon + K)$

As always private agents take this into account:

(5) $s^e = \phi\, (K)$

Inserting (5) in (4) gives:

(6) $s = \phi\, (K) + [\phi / 1 + \phi] * (\varepsilon)$

Using this typical result (1) gives the result for y in the discretionary equilibrium:

(7) $y = - (1 / 1 + \phi)\varepsilon$

A credible rule committed equilibrium with $s = 0 = s^e$ would have an expected cost level below the discretionary one. An announcement of such a rule has a probability of 1-p, which is revised in each period, given the reputation of the policy maker:

(7) $s^e = p\, s^{e,d}$; $s^{e,d}$ = expected depreciation in a discretionary exchange rate management regime

The expectations are based on the expected optimisation of the authorities:

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(8) $E(Z) = (s)^2 + \phi[s - p s^{e,d} - K]^2$

First-Order-Condition:

$(\delta/\delta s) E(Z) = 2s + 2\phi[s - p s^{e,d} - K] = 0$

$\Rightarrow s + \phi[s - p s^{e,d} - K] = 0$

$\Rightarrow (1 + \phi)s = \phi(ps^{e,d} + K)$

$\Rightarrow s = [\phi / 1 + \phi] * (ps^{e,d} + K)$

Solving for $s^{e,d}$, with $s = 0$, gives:

$\Rightarrow$ (9) $s^{e,d} = \{[1 - \phi(1 - p)]^{-1}\}\phi K$

and from this follows:

(10) $s^e = \{p / [1 - \phi(1 - p)]\}\phi K$

If the commitment is not credible, the following output costs occur:

$y = - s^e - \varepsilon = - \{p / [1- \phi(1-p)]\} \phi K - \varepsilon$

The existence of the random shock variable and the fact that the authorities have an informational advantage, makes it difficult for them to bind themselves. Naturally, this model has all the features criticised above, but the message that can be taken from this is that a shock can reduce credibility. This leads to higher depreciation expectations, which carry output costs. In turn, the accumulation of these costs can make the non-depreciation commitment unsustainable. The problem of fixed exchange rates is not a central bank overpowered by the financial markets, but the possibility of a situation where the stabilisation of the exchange rate comes second to other priorities. Furthermore, it is unlikely that a central bank is always willing to accommodate changes of the monetary base, necessary to stabilise the exchange rate against speculators.

3.) Critical Evaluation of the Barro-Gordon Model

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Concepts like reputation, credibility and sustainability are now rightly in the spotlight. All experience shows that there can not be an automatic mechanism that guarantees certain effects of specific policies. The expectations of agents, which had already been stressed by Keynes, are the turning point of these kind of models.

The danger of the credibility models lies in their narrowness and circularity. The underlying new classical assumptions are quite restrictive and the argument tends to be circular. A policy is successful if credible and a policy that has been successfully implemented must have been credible. Furthermore, a review of several empirical studies by Hamburg[13] shows that there is only a weak link between central bank independence and low inflation.

The truth is probably that an independent central bank makes it easier to stick to a low inflation policy and makes it more credible, but it does not deliver on its own speedy disinflation and low disinflation costs.

The Barro-Gordon model is stationary and assumes the full employment of resources as given. The only concession is a natural rate of unemployment above the full employment rate. This is explained with a given size of the public sector, which is not sufficient to explain how the employment of resources is actually determined. Departures from the natural rate are either due to random and unexplained shocks or monetary policy. On the other hand monetary policy is said to be inefficient, as the agents know the reaction function of the government. This inconsistency shows the effect of the restrictive nature of the model's assumption. Only a small change in the assumptions, for instance (temporarily) asymmetric information concerning the random variables, makes monetary policy efficient in the Barro-Gordon framework.

Barro and Gordon fail to show why inflation has social costs. They mention adjustment costs, but do not regard this argument as sufficient themselves. This illustrates the difficulty to explain inflationary processes in a neo-classical setting. Therefore, the whole argument normally rests on assigning the source of and solution to the problem completely to an institution. This, as Riese has repeatedly pointed out, is in contradiction to the liberal market approach.[14] So the emphasis on the credibility of policy institutions is partly the result of an inability to explain inflation as a market process.

It is also problematic to assume that the government maximises an objective function that is representing the aggregated and correctly revealed individual preferences.

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[13] Hamburg: Central Bank Independence and the European Monetary Union, Discussion papers in German Studies, No. IGS97/15, University of Birmingham

[14] Riese: Theorie der Inflation, 1986

Perfect foresight or a strict definition of rational expectations lies at the heart of the credibility approach. This would mean that a sufficiently large group of agents can and does invest enough resources to find out which of the many competing economic models is the relevant one in each situation. This is not a very realistic assumption and it is questionable if such an expectational process would be rational. If rational expectations are the application of the principle of rational behaviour in the search and processing of information, as Maddock and Carter defined them, then it is obvious that costs and asymmetries of the information process should be taken into account. Feige and Pearce call those economical rational expectations.

The conceptualisation of the expectational process is a good parameter for the grade of realism of models. It is important to model the interdependence of policy decisions and private expectations. However, it is controversial to impose rational expectations in the sense of Muth and at the same time to allow for deviations from the rule to secure the model's conclusions. Agents in this framework are not always able to distinguish a general from a market-specific shock and on the other hand they are well informed about the cost function and informational state of the government. Barro' s later model (1986) allows for uncertainty, but only between types of governments. However, to truly incorporate the ambivalent character of policy strategies requires to take into account that there is simply no mechanistic link between social preferences, government preferences, implemented policies and effective outcomes. There is uncertainty about the true character of the social preferences. It is well known in public economics, that there are serious problems in revealing the true preferences of agents, due to their strategic behaviour. Furthermore, it is far more likely that the government tries to act in accordance with the median voter as far as necessary and in accordance with its own clientele as far as possible. Having chosen its objective it is likely that the government lacks at least some necessary information to choose the absolute optimal policy strategy. When implementing the policy the effects can be adverse, because the policy is not believed or it is believed, but not credible for being judged unsustainable.

Consequently, looking at credibility could help to explain why policies are sometimes successful and at other times not. To assume complete certainty could negate this kind of approach.

The Barro-Gordon model assumes that the government can choose the inflation rate directly, without immediate cost. However, inflation is probably influenced by monetary **and** fiscal policy, **the reaction being lagged and typically uncertain**. **If there is general uncertainty about the real nature of aggregate processes, then policy can never be totally calculated and consequently not perfectly credible.**

The model abstracts from microfoundations. It neglects aggregate supply growth, phenomena of imperfect competition and coordination problems, that

might explain the level of unemployment. The model of Herrendorf and Neumann adds the labour market and introduces the median voter concept. Unfortunately, it leaves the macro-structure in its simple restrictive form. Forteza incorporates problems associated with bargaining externalities. Including these labour market features changes the conclusions of the standard model considerably, pointing to its restrictiveness. The examples of Hasekamp and Bleaney show how the nature of the conclusions changes dramatically, if only a few Keynesian features are included in the macro-structure. Unfortunately, Hasekamp only introduces a strategic interdependence of rational expectations, but stops short of changing the expectational concept altogether. Introducing a kind of near rational expectations would probably enhance the policy usefulness of the approach significantly. Bleaney introduces the possibility of a demand constraint equilibrium only via government policy. Nevertheless, monetary policy is not only about inflation, but also deflation and growth constraints. It could therefore prove to be extremely helpful to take the possibility of multiple equilibria and dynamic constraint processes into account.

4.) extensions and variations to the Barro-Gordon-model in the literature

In a later model[15] Barro deals with a rather implausible assumption, that is that agents can misinterpret their own prices, but know the government's objectives with absolute certainty:
However, he only allows for uncertainty about the type of government, of which there are two, a low inflation type and a high inflation type unable to commit itself. The time between elections spans from period 0 to period T. A government of type 1 always produces inflation of zero and a government of type 2 may pursue the same inflation objective at the beginning, in order to hold down inflationary expectations and therefore lower future costs and enhance the effect of surprise inflation later. However, such a government will always choose a positive inflation rate in period T, as a deceit is no longer useful. α_t is the probability that the policymaker is of type 1 and p_t is the conditional probability that a type 2 government tries to disguise itself. So the expected inflation for period t is:

$\pi^e_t = \pi^d_t(1 - \alpha_t)\ (1 - p_t)$; π^d_t = discretionary positive inflation rate

If the agents observe zero inflation they upgrade the possibility that the government is of type 1. This is the learning process the type 2 policymaker relies on. Accordingly, credibility is constant over time, as the growing belief that the government is of type 1 is offset by the reduction in the probability that a type 2 government wants to disguise itself.
The conclusions differ considerably from the original model, as a rule based zero inflation policy is optimal at the beginning ($\pi^e_t = \pi_t = 0$), but leads to social disinflation costs later in the period when inflation is too low relative to expected inflation. Discretionary policy with deceit is optimal at the beginning, followed by a positive surprise inflation effect and ends with the well known suboptimal discretionary equilibrium.

With two major flaws of the standard model deals the model of Herrendorf and Neumann.[16] It introduces the labour market in a insider-outsider framework with monopoly unions. Consequently, it gives up the notion of identical agents and that the authorities maximise social welfare.
The median voter is an insider, as the majority of the population has to back the bargaining system, where unions set nominal wages taking rational price expectations into account and maximising the utility of its members, who are

[15] Barro: Reputation in a Model of Monetary Policy with Incomplete Information, Journal of Monetary Economics, Vol. 17, 1986
[16] Herrendorf / Neumann (1996): A Non-Normative Theory of Inflation and Central Bank Independence

optimally employed. This implies that outsiders are underemployed and the natural employment rate is below the optimal one from a welfare point of view. However, as the authorities care only about the median voter, the systematic inflation bias is no longer in the system.
Employment is determined by the real wage, a productivity shock and a government competence shock, with the two shocks having zero covariance and zero means:

(1) $l_t = (p_t - w_t) + \varepsilon_t + \theta_t$

θ_t is assumed to be the same as in the last period if the incumbent is in office for the second period.
Although individuals differ in their employment situations, the insiders working the optimal amount from their perspective and the outsiders not able to work as much as they would like, their preferences are the same. Future utility is discounted by δ and depends positively on the real wage and negatively on deviations from the desired employment level and an inflation rate of zero:

(2a) $U^i(t) = \Sigma_{j=t}^{\delta j-t} [(w_j - p_j) - a/2 (l^i_j - l^-)^2 - b/2 \pi^2_j]$ (insider)

(2b) $U^o(t) = \Sigma_{j=t}^{\delta j-t} [(w_j - p_j) - a/2 (l^o_j - l^-)^2 - b/2 \pi^2_j]$ (outsider)

The government's utility depends positively on the rent from being in office, R^g, and the utility of the insiders, due to the fact that this determines their chance of being re-elected:

(3) $U^g(t) = \Sigma_{j=t}^{\delta j-t} (R^g + U^i(t))$

The utility of the central bank depends again positively on the rent from being in office and on V_j^{cb}, which is equal to $U^g(t)$ if the bank is dependent on the government or equal to $U^i(t)$ if it is independent, but has to take public opinion into account.[17]
The nominal wage is determined by the expected price level, the desired employment level and the expected government competence. Consequently, the employment equation becomes:

(4) $l_t = l^n + p_t - p_t^e + \varepsilon_t + \theta_t$

[17] This interpretation of independence differs from other authors who make the utility of the central bank indifferent to public opinion, resulting in the Rogoff trade-off between an inflationary bias with a dependent bank and suboptimal stabilisation with a conservative independent bank.

Only if there is a positive competence shock will the public re-elect the government. In this model θ_t cannot be directly observed, but only estimated by the employment effect. Therefore, there is an incentive to create surprise inflation before an election in order to achieve such an effect to cheat the electorate into thinking that there is a positive competence shock. The productivity shock occurs after the unions have set the nominal wage, but before the central bank decides its monetary policy stance.
The difference of the results of this extended model to the standard approach are obvious:
If the central bank is dependent, the inflationary bias is now only a problem in election years and with an independent central bank there is no inflationary bias, as in the standard model, but a reliance on public support is positive. This is due to the fact that only the median voter is important. Consequently, an independent bank in this model has no inflationary bias, but stabilises sufficiently in response to productivity shocks.

Forteza[18] includes the labour market in a way that also explains the inflationary bias as a divergence of private sector and government real wage targets:
Here there are many unions that disagree with the government on the real wage. This implies that government is assumed to maximise social welfare. The extent of target divergence depends on the degree of wage bargaining centralisation, as developed by Calmfors and Driffill in their 1988 analysis. At an intermediate level the externalities of wage setting are at their maximum and so are the resulting levels of real wages and unemployment. Another new feature of this approach is the open economy setting.
The domestic economy produces one good and the rest of the world another good. The demand for the domestic good is a decreasing function of the terms of trade. The sequence of events is that unions set nominal wages, then the government sets the exchange rate and finally firms choose output and employment. There is complete information. The firms are Cournot competitors:

(1) $p * Q_j - w_j * L_j \quad \max Q_j$

s.t. : $L_j = \alpha * Q_j$
$Q = (P / E)^{-\eta}$ (The price of the foreign good is the numeraire.)
$Q = Q_i + Q_j$; with Q = output and E = exchange rate

There is mark up pricing:

[18] Forteza: Credibility, Inflation and Incentive Distortions in the Welfare State, Ekonomiska Studier, Göteborg University, 1996, P. 13-41

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(2) $p = k * w$

Consequently, labour demand is a function of the wage paid by the firms, the wage paid by other firms and the exchange rate.

The government's objective is low inflation and a minimal divergence from its real wage target, which is also a international competitiveness target in this model. The cost function to be minimised is:

(3) $G = (w_t - E_t - w_g)^2 + \pi_t^2 \quad \min E_t \;; w_g$ = real wage target

This is the familiar picture where the government has to decide how far to accommodate the divergence of the nominal wage set by the unions from the target causing inflation against sticking to a low inflation goal with more unemployment as a result. Here not only credibility of the government is the issue. Even if government policy is fully credible, disinflation can still be painful, due to the externality effect of a not completely centralised wage bargaining structure. This could potentially explain the missing credibility effect of low social costs in apparently credible institutional settings.

Perhaps the greatest obstacle for the Barro-Gordon approach to forming an efficient basis for real world analysis, is its simple and quite restrictive macroeconomic framework of the Lucas supply model. One example of a variation of that framework has been developed by Hasekamp:[19]
He chooses a multiple equilibria framework, based on strategic interdependence of agents' rational expectations. The assumption of one representative agent is replaced by the assumption of many firms. Furthermore, there is a one-period production lag, so that labour demand becomes part of an investment decision, also including a decision about a possible capital stock adjustment. Consequently, there is no longer a unique outcome, as decisions by other firms can alter the productive capacity of the economy, as well as the relative scarcity of factors of production. The investment decision of one firm now also depends on the expected decisions of other firms, in other words there is a strategic interdependence of rational expectations and decision making.
The sequence of events is as usual that wages are determined, then the money supply and finally the investment decision. If agents believe that there will always be full market clearing, then w_t will equal p^e_t. However, if they believe that several outcomes are possible and that monetary policy influences these

[19] Hasekamp: Disinflation Policy and Credibility: The role of conventions, EUI Working Paper ECO No. 93/13, 1993

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outcomes, a decrease in the money supply would for example be interpreted partly as a change in prices and partly as a change in output. If a downturn is expected a reduction in a firm's labour demand is rational and leads in the aggregate to a fall in the natural rate of output. The rational expectation equilibrium therefore depends on the expected prevailing economic theory. The government should not only worry about credibility, but also about the possibility that agents form expectations interdependently under a different convention than conducive to its objectives, leading to uncalculated results.

Another way to introduce a richer macro-structure with near real world features is Bleaney's version.[20] He combines the inclusion of a insider-outsider/monopoly union labour market with the allowance of demand-constraint equilibria.[21] The wage earners prefer high real wages, low inflation and unemployment below a critical level. Unemployment only becomes a negative factor if it is high enough to potentially hurt the insiders. The government dislikes both unemployment and inflation.
Inflation will only be low, if the government can make a credible threat to reduce employment below the critical level. In stark contrast to the original Barro-Gordon model, credibility can only be achieved if unemployment is high enough to be included in the insider's considerations. Credibility is no way of disinflating with low social costs, but a necessary condition for a effective low inflation policy, requiring a significant level of unemployment. However, if government policy is not credible, unemployment will be even higher.

[20] Bleaney: Monetary Targetting and Policy Credibility in a Non-Market-Clearing Model, 1990, Discussion Paper No. 90/6, University of Nottingham, Department of Economics
[21] A demand constraint imposed by the government, as part of its disinflation strategy.

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5.) Conclusions and Applications

a) general policy relevance

Credibility theory of the Barro-Gordon type dominates the academic and professional debate of monetary policy arrangements. Therefore, it heavily influences the expectations of key decision-makers, independently of its real economic significance, giving it a de facto economic and political importance. The significant shift in economic theory due to this literature is the incorporation of game theory into the strategic component of macroeconomic models. The stressing of private expectations and strategic interdependence of different kinds of actors introduces relativity into economic modelling and explains the non-existence of strict determinacy of economic relationships. Furthermore, this kind of approach makes it possible to compare the effectiveness of different institutional arrangements and strategic policy designs. This general approach could help to improve the design of monetary policy frameworks.

The strict limits to the usefulness of the standard credibility approach for policy evaluation stems from its rudimentary and restrictive macro-structure. If this and the tendency of a circularity of argument are not taken into account, the conclusions will themselves suffer from a lack of relativity. The extensions and variations of the approach described above address this problem not comprehensively and illustrate how significant conclusions differ, as soon as the assumptions are changed only marginally.
The greatest significance of credibility theory probably lies in its ability to explain the break up of exchange rate arrangements. Exchange rates in the short term are determined in the financial markets and have to be seen primarily as asset prices. These markets are very flexible and information is readily available. If an exchange rate strategy is seen to be unsustainable over time, the strategy becomes less credible and a bet on a likely policy U-turn is profitable and serves itself as a re-enforcement of the underlying expectations. Such a market differs from the labour or goods market in that prices can be more easily changed and offers matched, there are several ways to hedge risks, information is easily accessible and generally seen as the most important asset and behavioural patterns can often be characterised by herd rather than purely analytical features. It is important to guess what everyone else will be doing next, not what a development means for longer-term utility maximisation.

Summing up, it can be said that apart from having a de facto significance, credibility theory can be useful in explaining market reactions in well-

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specified circumstances, i.e., the timing of exchange rate crises. In general, it has to be seen as not sufficient for the evaluation of economic policy options, but as a important supplementary tool of analysis and reasoning.

b) The Bank of England

One possible solution to the credibility problem is to make the central bank independent. However, it is not a automatic process. It is probably uncontroversial to say that independent central banks tend to achieve this goal easier than always changing and politically motivated governments. Still, the reputation has to be built and disinflation costs encountered.
The market reaction to the announcement to make the Bank of England independent, was in line with the model's predictions, as inflationary expectations dropped significantly and immediately, giving the typical picture of a credible monetary policy, where short term interest rates go up and long term rates go down respondingly. This is hardly surprising given the nature of financial markets, where the reaction to unexpected important developments always is significant, due to the fact that market makers are more concerned with second guessing the next move of everyone else than with economic reasoning. The information available to them is also far more than a normal citizen is prepared to incur costs for. Therefore, the financial market's reaction is a well-deserved reward for implementing a policy in an optimal manner, but it does not necessarily mean that future inflation can be held low without incurring social costs. The following period of successive rate rises, stabilised and strengthened the pound, but it also led to negative growth in the manufacturing sector and a slowdown in job creation. Although this disinflation strategy should be seen as necessary to achieve price stability, it could be argued that interest rates went up too high and came down too late, causing unnecessary social costs. An explanation for this is a belief in the validity of the Barro-Gordon-model. This strategy to gain credibility clearly might have lead to social costs, contradicting the model. A rise in money interest rates influences the willingness to give up liquidity negatively, resulting in a reduction of nominal GNP, with the relative magnitude of price and quantity effects being unpredictable.
It also has to be remembered, that UK monetary policy has to take US and European monetary policy into account, in order to stabilise exchange rate expectations and therefore cannot be analysed from a purely domestic perspective. However, this does not explain the slightly excessive disinflation strategy of the monetary policy committee, criticised above.

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c) The ERM Crisis

The Giovannini model has illustrated, that full credibility or better sustainability is hard to achieve in an exchange rate mechanism. A possible institutional solution could be escape clauses, saying that a change in the exchange rate only takes place, if the exogenous shock exceeds a certain amount. That would mean that p is constant, being the possibility of such a situation. The question is if a credible exchange rate system with escape clauses can be implemented. A rule-based equilibrium is not optimal, if a shock takes place, as it can not be compensated. Therefore, escape clauses should only take effect, if the costs would otherwise be significant, in order to make it credible, but the criteria should be low enough to avoid unnecessary costs. This is a difficult trade-off and the optimal solution is unlikely to be found. **It is hard to say if such a system would be more efficient, than a discretionary or common currency solution.**
For a situation where inflation rates of different countries in an exchange rate system converge only slowly, as in the case of the ERM in the eighties, the argument would suggest the following:
In countries with above average inflation rates the international competitiveness would deteriorate, leading to higher unemployment and public debt. As long as there is no realignment, the real overvaluation will increase. When decision-makers in the financial markets grow convinced that the situation will continue to deteriorate, unless there is a realignment, they will bet on the point in time when a substantial realignment or a break up of the arrangement takes place. The resulting destabilising capital flows, force the authorities to increase interest rates to stabilise the exchange rate. This paradoxically makes the realignment more likely, due to the further deterioration in real economic activity and in turn enhances the speculation. The game ends when expectations have been self-fulfilled.
The conclusion is that only a currency union or a crawling peg can be sustainable exchange rate systems.
So the lack of credibility is legitimately one of the most important factors in the debate among economists about the crisis in '92/'93, where the Pound Sterling and the Italian Lira were the first currencies to be forced out in September 1992. Almost one year later the system was practically abolished.[22]

[22] The margins around the central rates were increased to 15 % in each direction. However, some currencies like the French Franc managed to remain in the more narrow range with respect to the DM.

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Possibly an additional reason for the crisis, worsening existing real overvaluation effects, was the extraordinary asymmetric shock of German re-unification, which could not be compensated without realignments or fiscal transfers. At the beginning of the nineties, most European countries suffered from a recession. Germany slowed down significantly later, due to the unification boom.

An exchange rate system is by nature **asymmetric**. Germany as the leader country determines monetary policy on a purely domestic basis and the other countries have to subordinate their monetary policy to the stabilisation of the exchange rate. This is only possible if they sustain a interest rate mark-up over German rates, to take account of the incomplete credibility and differing risk premia. The German interest level caused therefore high social costs in other countries.

De Grauwe presents a formal model of the asymmetric functioning of the ERM: There are countries A and B.

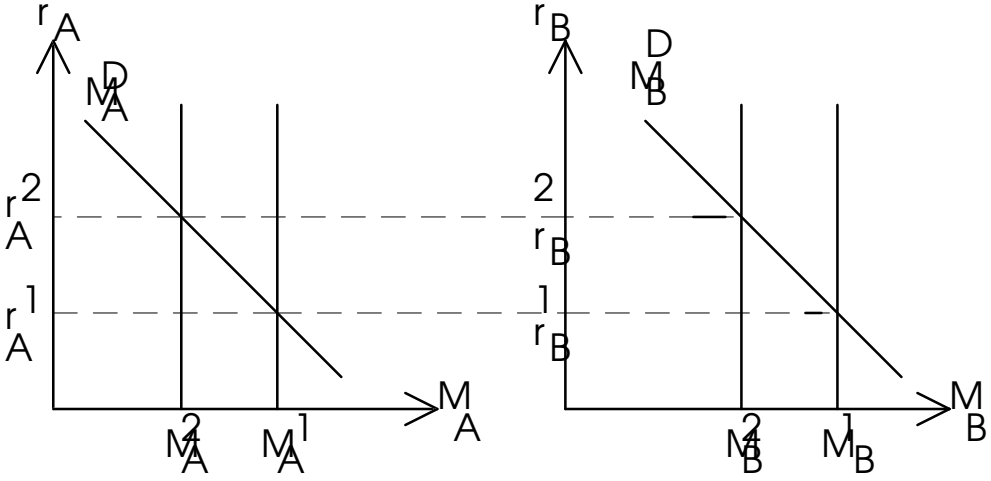
(1) $Mi^D = Pi + ayi - bri$; i = A, B

In equilibrium money supply ($\mathbf{M^S}$) equals money demand:

(2) $Mi^S = Pi + ayi - bri$

(3) rB = rA + μ; μ = expected depreciation rate of the B-currency

Without risk premia and if complete credibility is assumed, μ equals zero. The system is closed, if one country (here country A) is the leader.



The total differential of (1) with i = A and dP = dM = 0 is:

bdrA = adyA

and solved for drA this gives:

(4) drA = (a / b)dyA

The total differential of (2) (with i = B and dP = 0) is:

(2') dMB^S = adyB - bdrA

With interest parity (4) can be inserted in (2'):

dMB^S = adyB - b[(a / b)dyA]

(5) dMB^S = a(dyB - dyA)

Stronger (weaker) growth in A causes a too restrictive (expansive) monetary policy in B. If this is considerable, self-fulfilling speculation becomes relevant.

However, both the real overvaluation of ERM currencies and German currency union took place well before the break up of the system and the question is how the exact time of the crisis was determined.

A possible explanation could be that markets were convinced that governments would go through with the EMU project at whatever cost and this became doubtful only after the problems of ratifying the Maastricht-treaty, especially the catastrophic results of referenda and opinion polls.
The argument can be summed up in saying that fundamental flaws in the new ERM[23] lead to real overvaluation, the German currency union enforcing the negative effects and that additional factors then lead to the crisis.

In the case of Britain and Italy, accepting the standard credibility approach too readily lead to the strategic mistake of joining the new ERM to achieve disinflation automatically and with small social costs. Parities were chosen relatively high to achieve the full credibility effect. The real overvaluation

[23] The new ERM from '87 differed from the original ERM in that realignments were no longer used and capital controls abolished.

effect was therefore particularly strong, leading to the ejection of their currencies and high social costs before that.

d) EMU

The experience of the ERM has shown that an exchange rate system can never be totally credible and the argument goes that only a currency union has the necessary capacity to allow for positive credibility effects. However, as long as there are other relevant currencies, there will be factors as in the case of the national currencies, limiting credibility. This would lead to the logical conclusion that a world currency is needed. As this would almost certainly pose very serious questions of sustainability, due to asymmetric shocks, the limited nature of the credibility argument is revealed.

The Maastricht agreements lay down an institutional framework that make the central bank more or less as independent and fixed on price stability than the Bundesbank was. There remain however doubts about the intentions of central bank members. The most important being France, where leading politicians of all parties have repeatedly pointed out for many years that the main advantage of EMU is to end the German dictate of monetary policy, in order to establish a monetary policy that serves the objectives of overall economic policy. The unsuccessful French attempts to put a political institution in place that controls the ECB, has to be seen in that light. Another dimension of this is that there is no escape clause in the Amsterdam or Maastricht treaty, for the ECB in the case of a danger to price stability from the need to support the exchange rate policy of the European Council. Consequently, The Euro is seen as a weak currency, leading to a negative market reaction.

This together with a true or strategic belief in the necessity to establish a tough reputation might well lead to a relatively high interest rate level in the medium term.

Rigid rules like the Maastricht-criteria can lead to entry-credibility crises and self-fulfilling speculation. For example, the exchange rate condition of the Maastricht treaty is potentially incompatible with the fiscal criteria. If the government engages in restrictive fiscal policies to fulfil the criteria in a time of high unemployment and subdued economic activity, this can become to be seen as a unsustainable strategy. Consequently, speculative capital flows might make it necessary to raise interest rates to support the exchange rate, worsening the conditions for fiscal policy. When it comes to the point where the authorities are no longer willing to support the peg, the incentive for the strict fiscal policy

stance vanishes or a change in fiscal policy leads to a change in exchange rate policy. Rigid conditions like the Maastricht criteria can therefore imply a process, which makes entry into EMU more and more unlikely.

At first sight one could think that the Maastricht rules make the future central bank more credible, as participants are willing to incur high costs to be allowed in. Using the logic of the credibility models, one detects the old problems of time-inconsistency. No institutional solution will be capable of fully preventing that countries having succeeded in participating change their policies again.

The interdependence of monetary and fiscal policy should not be ignored and fiscal policy co-ordination take place. Here a trade-off exists between rules restricting fiscal policy to achieve nominal stability and the need for real stability, calling for flexibility in fiscal policy making and/or a federal fiscal policy. Problems of the real economy can not be defined away as in the credibility literature. It is unlikely that the mobility of production factors is sufficient to compensate for asymmetric shocks. A condition for a successful monetary union therefore has to be a central fiscal institution as insurance mechanism for the regions and instead of destabilising economies further in restricting their fiscal policy and making those countries pay penalties, they should simply be excluded from monetary and exchange rate policy making, if they pursue irresponsible policies. However, the criteria for fiscal prudence should be based on economics (for example the golden rule of borrowing) and not arbitrary Maastricht criteria.

POINTS FOR FURTHER DISCUSSION

Costs and asymmetries of the information process should be taken into account. It might also be preferable to assume different expectational processes for different kinds of social groups. This would potentially end the circularity of the credibility argument, as the result of different expectational processes, would introduce a certain randomness into the interaction of policy makers and economic agents. Moreover, for most of these groups of individuals the rational way to build expectations might well be to expect things to remain more or less static, unless some significant event occurs.

The inflation rate can be seen as being mainly determined in the labour market, through the interaction of the commodity and asset markets. If that is the case, price stability becomes a broad policy goal and it would clearly be insufficient to address it in a narrow monetary policy frame. In other words, monetary policy making would have a strong strategic feature, but without the automatism of the Barro-Gordon approach.

There have been adaptations of the theory to open economies, however they were mostly designed to analyse questions of sustainability of exchange rate agreements. An open economy adaptation should be seen as primarily the introduction of an external constraint to monetary policy making, independently of the existence of an exchange rate agreement.

If these points are dealt with, the result could be a useful model of monetary policy design.

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