Pekka Alajääskö

Endogenous Monetary Policy in Macroeconomic Models: The Role of Commitment, Conservative Central Banker and Optimal Central Bank Contracts in the Credibility of Monetary Policy

Abstract: This study focuses on the motives and constraints of the monetary policy authorities, i.e. the central banks. The fundamental theme is that the policy variable (inflation) is endogenous in the analysis. The behavior of this variable is a consequence of strategic and informational interactions between policymakers and private sector individuals and institutions.

It is our aim to integrate old and new contributions of endogenous monetary policy models in a common framework. We will show how in the optimal central bank contract a linear cost of inflation is added to the central bank's loss function. This type of a contract is a perfect substitute for commitments. It enables the policymaker to precommit policy; it makes her policy announcement credible. We will also show that participation in a monetary union is beneficial for an inflation prone country with relatively small output variation. In that case expected gains from less inflation outweigh expected costs from less stabilization the monetary union is assumed to provide.

In addition, it will be shown that the bigger the output variation of a country when the country's output is negatively correlated with the monetary union output, the more conservative (more weight on inflation than output stabilization) a central bank governor should be nominated in the country. This is because the more negative the output correlation is, the less weight the country prefers the monetary union to put on output stabilization. Each member country of the Economic and Monetary Union (EMU) can affect the monetary policy pursued by the EMU through its central bank governor.

Key words: Endogenous monetary policy, credibility, optimal central bank contract, EMU

Tiivistelmä: Tässä tutkimuksessa keskitytään motiiveihin ja rajoitteisiin, jotka ohjaavat ja joihin keskuspankki törmää harjoittaessaan rahapolitiikkaa. Politiikkamuuttuja (inflaatio) on analyysissä endogeeninen. Sen määräytyminen on seurausta politiikantekijän ja yksityisen sektorin strategisesta ja informaativisesta vuorovaikutuksesta.

Tutkimuksessa näytetään kuinka optimaalinen keskuspankkisopimus yhdistää rahapolitiikan joustavuuden ja uskottavuuden. Keskuspankkisopimuksessa lisätään inflaation kustannus keskuspankin tavoitefunktioon. Tämä tekee keskuspankille mahdolliseksi uskottavasti sitoutua ilmoittamaansa politiikkaan ja samalla se pystyy joustavasti reagoimaan muuttuneeseen taloudelliseen tilanteeseen. Lisäksi tutkimuksessa osoitetaan, että rahaliiton jäsenyys on hyödyllistä inflaatioherkälle maalle, jonka tuotannon vaihtelu on suhteellisen pientä. Rahaliiton jäsenyyden hyödyt alhaisempana inflaationa ylittävät tällöin epäoptimaalisemman stabilisaation kustannukset, jotka rahaliiton jäsenyys myös aiheuttaa.

Lopuksi tutkitaan seikkoja, jotka EMU:n kolmannen vaiheen jäsenmaan kannatta ottaa huomioon nimittäessään keskuspankillensa johtajaa. Tutkimuksen tulokseksi saadaan, että mitä suurempi jäsenmaan tuotannon vaihtelu on, sitä konservatiivisempi (panee enemmän painoa inflaation torjuntaan kuin tuotannon stabilisaatioon) johtaja jäsenmaan kannattaa keskuspankkiinsa nimittää. Näin on siksi, että kun jäsenmaan tuotanto on negatiivisesti korreloitunut rahaliiton keskimääräisen tuotannon kanssa ja mitä suurempi jäsenmaan tuotannon vaihtelu on, sitä vähemmän aktiivista jäsenmaa haluaa rahaliiton rahapolitiikan olevan. EMU:n rahapolitiikkaan kukin jäsenmaa voi vaikuttaa samalla painolla keskuspankkinsa johtajan kautta.

Asiasanat: Endogeeninen rahapolitiikka, uskottavuus, optimaalinen keskuspankkisopimus, EMU

ESIPUHE

Talouspolitiikan uskottavuus on poliitikkojen ja myös taloustutkijoiden iskusana. Ongelmana taloustutkijoiden kannalta on kuitenkin ollut se, että perinteisestä makrotaloustieteestä ei löytynyt riittävästi keinoja talouspolitiikan uskottavuuteen liittyvien seikkojen analysoimiseen.

Eräs mielenkiintoisimmista kehityssuunnista viimeisen vuosikymmenen kuluessa on ollut peliteorian soveltaminen makrotaloustieteessä. Peliteoriaa soveltava lähestymistapa on parantanut uskottavuusongelman kuvausta. Peliteorian avulla on myös päästy näiden ongelmien ratkaisujen jäljille. Politiikan uskottavuusongelmia peliteoria tutkii kuvaamalla politiikantekijän käyttäytymistä erilaisissa poliittisissa ja taloudellisissa ympäristöissä. Ongelmien ratkaisemisessa moderni makroteoria lähtee liikkeelle instituutioiden muutoksista, jotka puolestaan vaikuttavat politiikantekijän kannustimiin ja siten harjoitettavaan politiikkaan. Poliittisten ja taloudellisten rakenteiden muutoksilla onkin keskeinen rooli politiikan uskottavuuden saavuttamisessa.

Pekka Alajääskön tekemä tutkimus keskittyy niihin toimintaa ohjaaviin motiiveihin ja rajoitteisiin, joihin keskuspankki törmää harjoittaessaan rahapolitiikkaa. Politiikkamuuttuja (inflaatio) on analyysissä endogeeninen. Sen määräytyminen on seurausta politiikantekijän ja yksityisen sektorin strategisesta ja informatiivisesta vuorovaikutuksesta. Tältä pohjalta on mahdollista osoittaa taloudellisia, poliittisia ja muita institutionaalisia tekijöitä, jotka vaikuttavat enemmän tai vähemmän myönteisesti talouden inflaatiokehitykseen. Tutkimuksessa analysoidaan rahapolitiikan ajankohtaisia uskottavuusongelmia myös Suomessa, ja lisäksi esitetään keinoja niiden ratkaisemiseksi.

Tutkimus on hyväksytty myös Pekka Alajääskön lisensiaattityöksi Tampereen yliopistossa. Pekka Ahtiala, Tuulia Hakola, Pasi Holm, Veli Karhu, Pekka Mäkelä ja Pirkko Valppu ovat kommentoineet tutkimusta sen eri vaiheissa ja Iiris Koskela-Näsästä on avustanut kuvioiden piirtämisessä. Valtion taloudellisen tutkimuskeskuksen puolesta kiitän edellä mainittuja kommenteista ja avustamisesta ja Pekka Alajääsköä tutkimuksen suorittamisesta.

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Seppo Leppänen

FOREWORD

Credibility of macroeconomic policy is something policymakers talk much about but traditional macroeconomics has little to say about. Recent research has made some progress in dealing with credibility problems. The application of game theory to the analysis of economic policy has been among the most interesting developments in macroeconomics over the past decade. The modern approach treats a policymaker as responding to incentives, not to orders. For the policymaker it specifies an objective function with relevant constraints. An essential part of the constraints consists of private sector responses to the policy.

This approach provides positive models of economic policy in various institutional environments and normative prescriptions about institutional reforms. From the positive point of view, the theory describes the policymaker's behavior under different incentive constraints. From the normative perspective, it indicates how to embed desirable incentive constraints in existing political and economic institutions through appropriate changes in institutions. It is the changes in institutions and hence in policymaker's incentives that bring about changes in equilibrium policy.

This study by Pekka Alajääskö focuses on the motives and constraints of the monetary policy authorities, i.e. the central banks. The fundamental theme is that the policy variable (inflation) is endogenous in the analysis. The behavior of this variable is a consequence of strategic and informational interactions between policymakers and private sector individuals and institutions. Hence, it is possible to identify institutional, political, and other features of an economy that are more or less conducive to inflationary environments. The credibility problems of economic policy, especially monetary policy, topical also in Finnish economy are studied and ways to overcome them are suggested.

This study is also accepted as Pekka Alajääskö's licentiate's dissertation at the University of Tampere. Pekka Ahtiala, Tuulia Hakola, Pasi Holm, Veli Karhu, Pekka Mäkelä and Pirkko Valppu made helpful comments, and Iiris Koskela-Näsänen assisted during different phases of the project. On behalf of the Government Institute for Economic Research I would like to thank them, and Pekka Alajääskö for carrying out the study.

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Seppo Leppänen

YHTEENVETO

Talouspolitiikan uskottavuudesta on viime aikoina puhuttu paljon. Keskusteluun ovat osallistuneet pääasiassa poliitikot mutta myös taloustutkijat. Taloustutkijoiden kannalta ongelmana on kuitenkin ollut se, että perinteisestä makrotaloustieteestä ei löydy keinoja talouspolitiikan uskottavuuteen liittyvien seikkojen analysoimiseen. Yksi mielenkiintoisimmista kehityssuunnista viimeisen vuosikymmenen kuluessa on ollut peliteorian soveltaminen makrotaloustieteessä. Tässä lähestymistavassa politiikantekijän oletetaan reagoivan vaihteleviin insentiiveihin, jotka johtuvat eroista taloudellisissa ja poliittisissa instituutioissa. Talouspolitiikka on analyysissä endogeeninen. Politiikantekijälle spesifioidaan tavoitefunktio, jota se maksimoi relevanttien rajoitteiden alaisena. Olennaisen osan rajoitteista muodostavat yksityisen sektorin reaktiot harjoitettavaan politiikkaan.

Peliteoriaa soveltava lähestymistapa on edistynyt uskottavuusongelmien kuvauksessa. Se on ottanut myös ensiaskeleet näiden ongelmien ratkaisemiseksi. Politiikan uskottavuusongelmia lähestymistapa tutkii kuvaamalla politiikantekijän käyttäytymistä erilaisissa poliittisissa ja taloudellisissa ympäristöissä. Ongelmien ratkaisemisessa moderni makroteoria lähtee liikkeelle muutoksista instituutioissa, jotka puolestaan vaikuttavat politiikantekijän insentiiveihin ja siten harjoitettavaan politiikkaan. Muutoksilla poliittisissa ja taloudellisissa rakenteissa onkin keskeinen rooli politiikan uskottavuuden saavuttamisessa.

Tässä tutkimuksessa tarkastellaan lähemmin julkisuudessa usein esiintyvien käsitteiden teoreettista perustaa. Tutkimuksessa näytetään, mitä itseasiassa tarkoitetaan keskuspankin itsenäisyydellä. Lisäksi tutkitaan, mistä johtuu harkinnanvaraisen politiikan inflaatio-ongelma ja normipolitiikan uskottavuusongelma. Optimaalisia keskuspankkisopimuksia tarkastellaan, koska ne ovat saaneet viime aikoina huomiota eri maissa tekeillä olevien keskuspankkien asemaa ja toimintaa säätelevien lakien johdosta. Lopuksi arvioidaan kunkin jäsenmaan strategioihin vaikuttavia tekijöitä toteutettaessa EMU:n yhteistä rahapolitiikkaa.

Tutkimuksessa osoitetaan, kuinka optimaalinen keskuspankkisopimus yhdistää rahapolitiikan joustavuuden ja uskottavuuden. Keskuspankkisopimuksessa lisätään inflaation kustannus keskuspankin tavoitefunktioon. Tämä tekee keskuspankille mahdolliseksi uskottavasti sitoutua ilmoittamaansa politiikkaan ja samalla se pystyy joustavasti reagoimaan muuttuneeseen taloudelliseen tilanteeseen. Lisäksi tutkimuksessa näytetään, että rahaliiton jäsenyys on hyödyllistä inflaatioherkälle maalle, jonka tuotannon vaihtelu on suhteellisen pientä. Rahaliiton jäsenyyden hyödyt alhaisempana inflaationa ylittävät tällöin epäoptimaalisemman stabilisaation kustannukset, jotka rahaliiton jäsenyys myös aiheuttaa.

Lopuksi tutkitaan seikkoja, jotka EMU:n kolmannen vaiheen jäsenmaan kannatta ottaa huomioon nimittäessään keskuspankillensa johtajaa. Tutkimuksen tulokseksi saadaan, että mitä suurempi jäsenmaan tuotannon vaihtelu on, sitä konservatiivisempi (panee enemmän painoa inflaation torjuntaan kuin tuotannon stabilisaatioon) johtaja jäsenmaan kannattaa keskuspankkiinsa nimittää. Näin on siksi, että kun jäsenmaan tuotanto

on negatiivisesti korreloitunut rahaliiton keskimääräisen tuotannon kanssa ja mitä suurempi jäsenmaan tuotannon vaihtelu on, sitä vähemmän aktiivista jäsenmaa haluaa rahaliiton rahapolitiikan olevan. EMU:n rahapolitiikkaan kukin jäsenmaa voi vaikuttaa samalla painolla keskuspankkinsa johtajan kautta.

Instituutioiden ja rakenteiden muutokset ovat keskeisessä asemassa modernissa makrotaloustieteessä. Harjoitettavaan politiikkaan voidaan vaikuttaa vain niiden muutosten kautta. Rahapolitiikassa peliteoriaa soveltava lähestymistapa suosittelee yksiselitteisesti sääntöjä harkinnanvaraisuuden sijaan. Sääntöihin perustuvan politiikan uskottavuusongelman ratkaisemiseksi se suosittelee konservatiivista keskuspankkia. Jos keskuspankki on tarpeeksi itsenäinen, jotta sen konservatiivisuudella on merkitystä, itsenäinen keskuspankki auttaa rahapolitiikan uskottavuuden saavuttamisessa.

Optimaalinen keskuspankkisopimus menee askeleen pidemmälle. Sen mukaan on hyödyllistä sitoa keskuspankki sopimuksen avulla inflaatiotavoitteen saavuttamiseen. Käytännössä tällaisen sopimuksen on ajateltu toimivan niin, että eduskunta/hallitus asettaa keskuspankille inflaatiotavoitteen, jonka saavuttamiseen keskuspankilla on lakiin perustuva oikeus ja velvollisuus. Keskuspankin johto on puolestaan asemallaan vastuussa tavoitteen saavuttamisesta. Optimaalinen keskuspankkisopimus takaa rahapolitiikan uskottavuuden ja joustavuuden.

Suomen Pankilla näyttää tällä hetkellä olevan itsenäinen asema rahapolitiikan toteuttamisessa. Itsenäisyys ei ehkä kuitenkaan ole pysyvää, vaikka Maastrichtin sopimus yksiselitteisesti edellyttääkin keskuspankin itsenäistä asemaa. Maastrichtin sopimuksen ja modernin makrotalousteorian suositusten (instituutioiden muutokset ja optimaalinen keskuspankkisopimus) mukaan tulisi Suomessa viipymättä säätää laki keskuspankin itsenäisestä asemasta. Suomen Pankki -komitean mietintö antaa erinomaisen lähtökohdan tälle työlle.

SUMMARY

Credibility of macroeconomic policy is something especially policymakers and politicians but also economists have lately talked much about also in Finland. The traditional macroeconomics has little to say about the credibility of policy. In the traditional macroeconomics political objectives and their influence on economic policy are exogenous. Fortunately the recent research has made some progress in dealing with credibility problems. The modern approach treats policymakers as responding to incentives, not to orders. Economic policy is endogenous in the analysis. Thus it is not excluded from the analysis by taking it as given.

This approach provides positive models of economic policy in various institutional environments and normative prescriptions about institutional reforms. From the positive point of view, the theory describes the policymaker's behavior in different political and institutional environments. From the normative perspective, it indicates how to make changes in institutions in order to get the policymaker pursue desirable policies. It is the changes in institutions and hence in a policymaker's incentives that bring about changes in equilibrium policy.

This study takes a closer look at the theoretical underpinnings of the concepts widely used in public discussion. It shows what actually is meant by the idea of central bank independence. In addition, we show what causes the inflation bias of the discretionary policy, and the credibility problem of the policy commitment (norm policy). Optimal central bank contracts, that have recently gained momentum in the connection with the drafting and implementation of central-banking laws in various countries, are also considered. Possible strategies of member countries concerning common monetary policy in the EMU are analyzed.

Among the main results of the study we integrate an optimal central bank contract in our simple framework. In the optimal central bank contract a linear cost of inflation is added to the central bank's loss function. It enables the policymaker to precommit policy; it makes her policy announcement credible. It is also shown that participation in a monetary union is beneficial for an inflation prone country with relatively small output variation. In that case expected gains from less inflation outweigh expected costs from less stabilization the monetary union is assumed to provide.

In addition, we show that the bigger the output variation of a country when the country's output is negatively correlated with the monetary union output, the more conservative (more weight on inflation than output stabilization) a central bank governor should be nominated in the country. This is because the more negative the output correlation is, the less weight the country prefers the monetary union to put on output stabilization. Each member country of the EMU can affect the monetary policy pursued by the EMU through its central bank governor.

What matters the most in the endogenous policy models is the institution design. As far as the monetary policy conduct is concerned, the literature of endogenous policy models straightforwardly recommend rules over discretion. Furthermore, according to endogenous policy models it would be beneficial to have a conservative central bank(er) who is independent enough to allow her preferences to play a role; it may help to resolve the credibility problem associated with a low inflation policy.

The recent innovation in the form of optimal central bank contracts goes a step further. This approach argues that it would be beneficial to have a contract which makes the policymaker's (the agent) "utility" dependent on her success in meeting the inflation target. In practice this literature has been interpreted to favor such an institution reform that the principal (government and parliament) of the agent (central bank) imposes an explicit inflation target in addition to the general mandate for price stability (central-banking law), and makes the central bank leadership explicitly accountable for its success in meeting the target, i.e. the agent's utility (in practice her position or even paycheck etc.) is tied to her performance through the contract. This can be shown to guarantee both the credibility and flexibility of monetary policy.

Currently the Bank of Finland has the initiative concerning monetary policy; it seems to pursue monetary policy independently. However, this cannot be a permanent arrangement, because the Maastricht Treaty allows very little room for maneuver. What is needed according to the Maastricht Treaty, and the literature of endogenous policy models is to swiftly implement the law concerning the Bank of Finland's status. The work done by the committee considering this question provides an excellent starting point and guidelines to follow in drafting the central banking law. After all it is institution reforms that matter the most; they bring about changes in equilibrium policy.

CONTENTS

1   INTRODUCTION

The application of game theory to the analysis of economic policy has been among the most interesting developments in macroeconomics over the past decade. Although this research is still in its infancy, results derived using game theoretical models offer a promise of substantial progress in formalizing political and institutional issues that used to be analyzed using "nonquantitative" methods. Until recently, the theory of macroeconomic policy dealt with the economic consequences of given policies taking the behavior of policymakers as exogenous. The modern approach treats a policymaker as responding to incentives, not to orders. For the policymaker it specifies an objective function with relevant constraints. The policymaker in turn pursues a policy that maximizes her objectives subject to constraints. A fundamental part of the constraints consists of private sector responses to the policy. Economic policy is thus endogenous in the analysis; it is not excluded from the analysis by taking it as given.

This approach provides positive models of economic policy in various institutional environments and normative prescriptions about institutional reforms. From the positive point of view, the theory describes the policymaker's behavior under different incentive constraints. From the normative perspective, it indicates how to embed desirable incentive constraints in existing political and economic institutions through appropriate changes in institutions. It is the changes in institutions and hence in a policymaker's incentives that bring about changes in equilibrium policy.

In this study we focus on the motives and constraints of the monetary policy authorities, i.e. the central banks. The fundamental theme is that the policy variable (inflation) is endogenous in the analysis. The behavior of this variable is a consequence of strategic and informational interactions between policymakers and private sector individuals and institutions. Hence, it is possible to identify institutional, political, and other features of an economy that are more or less conducive to inflationary environments.

It is our aim to integrate old and new contributions of endogenous monetary policy models in a common framework borrowed from Persson and Tabellini (1990). Among the old results considered is the value of the ability to precommit policy. The ability to precommit policy is optimal from the perspective of stabilization and inflation. The trouble is that the commitment is not credible. The policy commitment is said to be time inconsistent. It is in the policymaker's interest to surprise the private sector ex post by a more expansionary monetary policy than ex ante announced. The time consistent (credible) policy, namely the discretionary monetary policy, and its inflation bias is also examined. Rogoff showed in his seminal paper (1985) that the delegation of monetary policy to an independent (conservative) central bank helps to reduce the inflation bias of the discretionary case but brings about

suboptimal stabilization compared to the commitment outcome. Thus, it forms an imperfect substitute for commitments.

Among the new results of this study we integrate an optimal central bank contract, suggested by Persson and Tabellini (1994) and Walsh (1995), in our framework. In the optimal central bank contract a linear cost of inflation is added to the central bank's loss function. This type of a contract is a perfect substitute for commitments. It enables the policymaker to precommit policy; it makes her policy announcement credible. Based on the approach in Alesina and Grilli (1991) we will show that participation in a monetary union is beneficial for an inflation prone country with relatively small output variation. In that case expected gains from less inflation outweigh expected costs from less stabilization the monetary union is assumed to provide.

In addition, it is shown that the bigger the output variation of a country when the country's output is negatively correlated with the monetary union output, the more conservative (more weight on inflation than output stabilization) a central bank governor should be nominated in the country. This is because the more negative the output correlation is, the less weight the country prefers the monetary union to put on output stabilization. Each member country of the Economic and Monetary Union (EMU) can affect the monetary policy pursued by the EMU through its central bank governor.

The outline of the rest of the paper is as follows. Chapter two reviews the recent history of macroeconomics from the perspective of stabilization. Chapter three considers the role of economic forecasts in economic-political decision making. Chapter four studies the inflation bias of the discretionary policy and the credibility problem of the policy commitment and suggestions to overcome these problems. Chapter five looks at factors worth considering when a country participates in a monetary union like the EMU. Chapter six discusses what one can learn from the endogenous monetary policy models. Chapter seven summarizes the results and concludes.

2   THE SCOPE FOR STABILIZATION POLICIES

What actually is the scope for stabilization policies? Attitudes towards this question have substantially changed during the last couple of decades. In the following we will briefly survey the recent history of macroeconomics from the stabilization perspective[1]. The expectations formation process has a key role in the development over time.

2.1   Constant expectations and discretionary policy[2]

Features of different macroeconomic approaches will be described using a simple model of two parts. The first part relates stabilization policy, aggregate demand, inflation and employment (production) in the goods market:

$$(2.1) \quad \pi + (x - \underline{x}) = g,$$

in which π is inflation, x is the actual and $\underline{x}$ the natural level of employment, and g measures how expansionary the policy is. According to (2.1), expansionary stabilization policy raises employment or inflation (or both).

The second part of the model considers wage formation and employment determination in the labor market. Wage contracts are signed based on inflation expectations. If actual inflation during a contract period is higher than expected inflation, real wages fall and actual employment is higher than natural employment. Let π^e be expected inflation and ε a supply shock, and let the labor market relation be as follows:

$$(2.2) \quad (x - \underline{x}) = (\pi - \pi^e) + \varepsilon$$

Equation (2.2) is a version of the Phillips curve. Ceteris paribus, according to (2.2) employment varies one to one with inflation. In addition, higher expected inflation and a negative supply shock (productivity falls, oil price rises and so on) shift the Phillips curve up. Thus the trade-off between inflation and employment will become worse.

When the government uses stabilizing measures during a particular period, it operates on a given Phillips curve, i.e. a more expansionary policy raises employment,

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[1]   The history of macroeconomics only goes back to the early 1930s; as Paul Samuelson has said "The year 1932 was the trough of the great depression, and from its rotten soil was belatedly begot a new subject that today we call macroeconomics." (see Mankiw 1992). Mankiw (1992) in turn calls chapter 12 that deals with stabilization policies, in particularly, monetary policy "The Macroeconomic Policy Debate".

[2]   The model of the chapter is borrowed from Persson, T. (1989). Also the analysis in the chapter follows closely the same source. Other useful sources are Blanchard (1990), Calmfors (1989), Klamer (1984), Mankiw (1990), Persson, M. (1989), Giavazzi (1989) and Viotti & Wissén (1989).

but at the price of higher inflation[3]. Inflation expectations play a very central role in this model determining the location of the Phillips curve.

Let the policymaker's objective function be:

(2.3) $M = - (\pi - \pi^*)^2 - v(x - x^*)^2$,

where π^* is inflation target, x^* employment target and coefficient v is the relative weight on employment. The closer the economy is to these targets the better from the policymaker's perspective[4].

During the 1950s and 1960s neo-Keynesian economics dominated macroeconomic analysis. Neo-Keynesian economists devised the IS-LM framework as a formal interpretation of Keynes's general theory. Initially prices and the labor market were not integrated into the IS-LM framework. In our model this means that equation (2.2) and in equation (2.1) inflation (π) can be dropped. Hence the production and thus employment is determined by aggregate demand in the goods market. A more expansionary policy increases employment in a trivial way.

In the late 1950s inflation prevailed along with unemployment. The Phillips curve offered an explanation. In the early 1960s neo-Keynesian economists added the Phillips curve to their kit of tools, i.e. the price variable was included in the Keynesian model. Now neo-Keynesians needed theoretical backing for the IS-LM and Phillips curves; for this they drew on neoclassical microeconomics. Accordingly, neo-Keynesian theory is often called the neoclassical synthesis.

The most interesting development here is the shift of focus toward the supply side of the economy or the labor market. Neo-Keynesian economists explained the inverse relationship between inflation and unemployment by disequilibrium in the labor market. In addition disequilibrium in the labor market, i.e. an excess supply of labor, has to persist to warrant the stability of the Phillips curve, which neo-Keynesians also claimed. The dilemma of persistent disequilibrium and stability of the Phillips curve was handled with reference to the stickiness of nominal wages.

In our macro model the assumption of sticky wages is analogous to constant inflation expectations, π^e. Under this assumption the scope for stabilization is not affected. During a particular period the government can achieve almost any outcome it wishes, simply by choosing an appropriately expansionary stabilization policy. The government operates on a Phillips curve. The effects of negative supply shocks can be dampened simply by expanding aggregate demand. The only price is higher infla-

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[3]   From (2.1) and (2.2) we can derive equilibrium inflation and employment $\pi = (g + \pi^e - \varepsilon)/2$, $x = \underline{x}$ + $(g - \pi^e + \varepsilon)/2$ respectively.

[4]   Chapter four discusses more about the targets, especially, about the employment target.

tion during the year stabilizing measures are used, the future scope for stabilization is not affected.

2.2 Backward looking expectations

Edmund Phelps (1967) and Milton Friedman (1968) were the first to make a distinction between real and nominal wages in the macroeconomic analysis during the late 1960s. At that time the concept of a natural rate of unemployment was introduced. This new concept was consistent with empirical observations, according to which increasing inflation during the 1960s and 1970s shifted the Phillips curve up in all developed economies making the trade-off between inflation and employment worse[5]. One of the key elements of the new theory was the integration of inflation expectations into the analysis.

In the early 1970s a typical assumption was that expectations are backward looking. Thus the expectations during a particular year are based only on the past experience, with special weight put on the preceding year. A simple expectation formation process of this fashion is $\pi^e = \pi_{-1}$; expected inflation equals exactly actual inflation of the preceding year[6].

This changes the scope for stabilization. During a given year there still is scope for stabilization policies, but now the expectation formation process ties different years together. Stabilization policies during a particular year are affected by the stabilizing measures used in previous years and in turn this period's policies affect the future scope for stabilization. To see how this changes the analysis, let us assume that no supply shocks hit the economy during a given year ($\varepsilon = 0$ in (2.2)). The policy-maker's desire to increase employment above the natural level ($x - \underline{x} > 0$) presumes that actual inflation is higher than expected inflation ($\pi - \pi^e = \pi - \pi_{-1} > 0$). This can be accomplished by a more expansionary policy. Yet, a more expansionary policy in one year raises inflation expectations in the future and thus shifts the Phillips curve up. In other words, a prerequisite for employment to exceed the natural level is that inflation rises year after year.

Next let us assume that a negative supply shock hits the economy. When the policy-maker decides on appropriate measures to respond to the shock, she has to consider effects of these measures on the future scope for stabilization besides the usual trade-off between inflation and employment during the current year. To get inflation expectations down again, a period of higher inflation must be followed by a period of lower than expected inflation. Lower than expected inflation in turn implies that

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[5]   This contrasted with the neo-Keynesian view of the *stable Phillips curve*.

[6]   One can choose a more sophisticated way to form inflation expectations. It would not change, however, the analysis as long as the expectations are backward looking. This particular form of expectations is called static or adaptive expectations.

actual employment is lower than the natural one. With backward looking expecta-
tions costs caused by the more expansionary policy are higher than with constant
expectations.

Measures to stabilize the economy during different periods can be seen as discretion-
ary decisions, that are tied together by private sector inflation expectations. The
policymaker is willing to pay the price of the aggregate demand expansion only if
she puts a high enough weight, v in (2.3), on employment or if she puts low weight
on the effects of the future trade-off between inflation and employment. Assuming
that the policymaker has the same objective function in every period, she should be
less willing to use stabilizing measures than in the case of constant expectations.

2.3   Forward looking expectations and norm policy

In the 1970s the work to refine the expectation formation process in the macro-
economic analysis continued. It was in the early years of the decade when the con-
cept of forward looking expectations was introduced. Robert Lucas (1973) and
Thomas Sargent and Neil Wallace (1975) were the first to integrate it into the
macroeconomic analysis. With forward looking expectations, inflation expectations
during a particular year are based also on other information besides the past inflation
experience. If all available information is used optimally, this is called rational ex-
pectations.

Labor market parties have no knowledge of possible supply shocks when signing
contracts for future periods. Since the supply shocks affect inflation, contracting
parties try take them into consideration. Even though inflation expectations of the
parties cannot be exactly correct, on average they can be assumed to be correct. The
best possible inflation forecast when the contracts are signed is average inflation $\bar{\pi}$[7].
Using equations (2.1) and (2.2) it can be shown that with such expectations $\bar{\pi} = \bar{g}$,
where $\bar{g}$ is the average of g. When the labor market parties understand how the
economy functions, in a systematic way (expected or learned) a more expansionary
policy drives inflation expectations up. In our simple model $\bar{\pi}$ rises in proportion to
$\bar{g}$.

Wage contracts that are based on rational inflation expectations further restrict the
scope for stabilization. A systematic way to increase employment through more
expansionary policies leads only to higher (average) inflation and leaves (average)
employment unchanged, i.e. employment stays at the natural level. Only unexpected
expansion in the aggregate demand increases employment[8].

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[7]   Average inflation is the best possible forecast only if the supply shock (ε) is uncorrelated over time and
has the expected value of 0.

[8]   With rational expectations, $\pi^e = \bar{\pi} = \bar{g}$, we can rewrite the expressions in footnote 3 for employment
and inflation in the equilibrium as x = $\underline{x}$ + (g - $\bar{g}$ + ε)/2 and π = $\bar{g}$ + (g - $\bar{g}$ - ε)/2 respectively.

Rational expectations of stabilization policies' systematic features make it natural to consider stabilization policy as a norm regarding how expansionary the policy should be. Since expected (average) inflation has no effect on employment, the best possible norm should equalize average and target inflation: $g = \pi = \pi^*$. Such a norm minimizes the average costs of inflation, while average employment stays at the same level as with any other norm, namely at the natural level. Employment effects of supply shocks can be cushioned, since the unexpected change in aggregate demand affects employment. Thus the government can still stabilize employment, but only around the natural level rather than around any level it wishes as was the case with constant expectations.

The inflation norm should stabilize the nominal GDP growth appropriately close to the real GDP growth. Similar reasoning can be found behind other inflation controlling norms such as the fixed exchange rate or the constant growth rate in money supply. The idea of norms in the connection of stabilization policies combined with rational expectations was seen as a possible solution to the problem of high inflation; if the government could credibly announce that it was going to follow a low inflation norm, inflation expectations should come down without a period of lower than the natural level of employment.

2.4 Forward looking expectations, employment rigidities and endogenous policy

2.4.1 Employment rigidities

During the 1980s macroeconomic research brought into daylight new ideas which were consistent with empirical observations and changed the perspective of stabilization policy. One of them is the theory of wage formation and unemployment, which can be seen as an attempt to explain high and persistent unemployment in Europe. One important conclusion is that equilibrium unemployment and thus employment can no longer be taken as constant. If unemployment rises during a particular year, it tends to stay at a higher level also in the future. There are basically three different explanations for this phenomenon widely known as a hysteresis: adjustment costs in firms' investment and hiring decisions, displacement of long-term unemployed from the labor market (because of the erosion of the human capital), and changing incentives in the wage formation process. These explanations are not mutually exclusive (see e.g. Calmfors 1989).

In our macro model we have taken the natural level of employment, $\underline{x}$, as a constant. Let us now, according to the theory of hysteresis, assume that $\underline{x}$ during a year

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depends on employment in the previous year[9]. Rigid employment adjustment over time is another factor that relates different years' stabilization policies. A drop in employment in one year has the same effect as the negative supply shock and higher inflation expectations: it makes the future trade-off between employment and inflation worse. Thus the policymaker should be more willing to use stabilizing measures against employment effects of temporary shocks. One should nevertheless bear in mind the restricted possibilities to affect employment through stabilization policies.

2.4.2   Endogenous policy

We have seen how economists' view of private sector behavior and the expectations formation process has become much less mechanical over time in macroeconomic analysis. In spite of this, the traditional macroeconomics has assumed the policymaker to behave in an overly mechanical and naive way. In fact stabilization policies are exogenous in models, i.e. they are excluded from the analysis. Another new approach in macroeconomics during the 1980s tries to explain observed difficulties in pursuing norm policies successfully (see e.g. Persson 1988). In this approach policy is endogenous in the analysis. It tries to explain what policy is actually pursued. The policymaker's incentives explain the policy in the analysis. Incentives in turn depend on the policymaker's preferences and institutions in the economic-political decision making. The private sector is assumed to understand these incentives when forming its expectations. This set-up makes it possible to handle questions that used to be impossible to tackle within the old framework, e.g. what kind of stabilization policy is both credible and politically feasible.

Stabilization policy is credible if it is optimal from the policymaker's perspective when the policy decision is actually made. It seems that the low inflation rule, according to which average inflation equals the inflation target, is also the best possible policy from the policymaker's perspective. Unfortunately the trouble with this norm is the credibility. When wage contracts are signed, the policymaker's incentive is to deviate from the norm. The reason is that with the second best policy instruments, it is beneficial to surprise by higher than expected inflation (by a more expansionary policy), which results in better employment (closer to target employment, represented in figure 2.1 by a move from point R to point F). In the short run with low average inflation, costs from higher inflation are lower than benefits from better employment, hence the policymaker has an incentive to move from point R to point F. If labor market participants understand the incentives of the policymaker, they revise their inflation expectations and thus nominal wage demands upward. In figure 2.1 this is represented by a Phillips curve shift from PC1 to PC2.

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[9]   An explicit formulation could be as follows: $\underline{x} = a\,x_{-1} + (1 - a)\tilde{x}$, i.e. natural employment in a particular year is the weighted average of the previous year's actual employment and exogenous (trend) employment in that particular year.
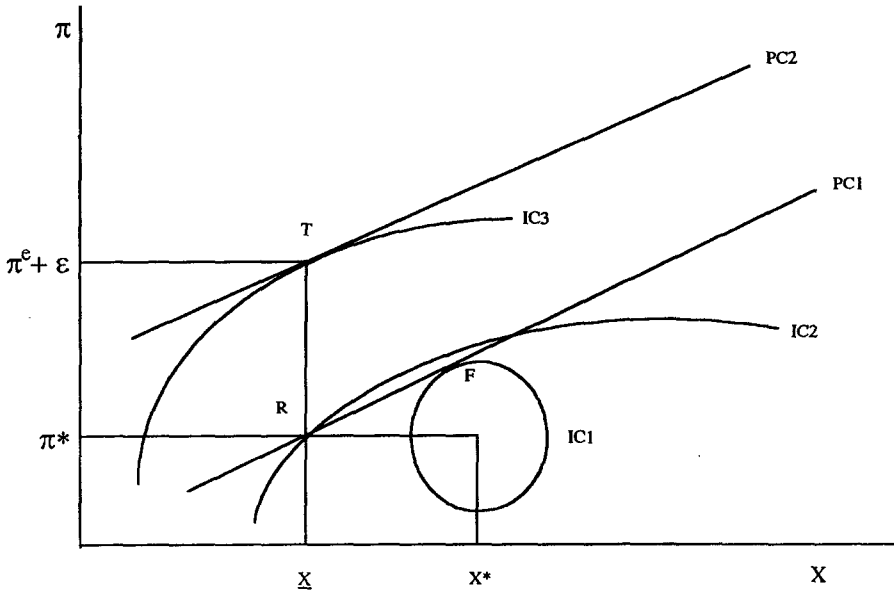
Figure 2.1 Monetary policy commitment, discretionary monetary policy and target employment-inflation outcomes in the employment-inflation framework represented with the help of Phillips and indifference curves.

If the low inflation policy is not credible, what policy is then credible? The answer is that the credible policy takes into account the policymaker's incentives, thus, costs and benefits from the more expansionary policy must be equal. At point T the policymaker has no incentive to deviate from the announced policy. This policy is the best possible from both the policymaker's and private sector's perspectives. However, this policy results in a worse outcome than the policy pursued in accordance with the low inflation norm (point R). This is because both policies give the same average employment (the natural one), but credible inflation is higher than inflation according to the low inflation norm. The target outcome represented by point F is unachievable with the second best policy instruments. Hence an attempt to move closer to the target (first best) solution leads to the third best outcome.

A higher target level of employment (compared to the natural level) and greater weight, v, on employment imply a higher credible average inflation[10]. A higher target level and greater weight mean a higher temptation to follow expansionary policies. The policymaker's temptation to implement expansionary measures drives up inflation expectations and thus actual inflation. Since the policymaker is not able

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[10]   This can be shown as follows: from the footnote 3 we know that with $\varepsilon = 0$ we get $\pi = (g + \pi^e)/2$ and $x = \underline{x} + (g - \pi^e)/2$. Let us substitute these expressions in the government's objective function (2.3) for π and x and then maximize with respect to g. First order conditions can be written as follows: $g(1 + v)/2 + \pi^e(1 - v)/2 = (\pi^* + v(x^* - \underline{x}))$. But if inflation expectations are correct we must have $\pi^e = g = \pi$, which gives $\pi = (\pi^* + v(x^* - \underline{x}))$.

to follow the low inflation norm, but instead acts in accordance with her own ex post incentives, it is meaningless to consider stabilization policy as a free choice between different norms. It is purposeless to recommend a noncredible norm. This fact was neglected from the discussion of stabilization policies with norms. To put this other way, it was assumed that the policymaker can make a binding promise to follow the announced policy once and for all.

Here the endogenous policy models are useful. They can be used to show how to change institutions in the economic-political decision making so that the announced policy would also be credible. It is the institutions that form the policymaker's incentives to pursue the announced policy. One solution that has been suggested to overcome the credibility problem is to increase central bank independence.

3   THE ROLE OF ECONOMIC FORECASTS

Economic forecasts are essential in reducing the risk-taking in economic-political decision making, i.e. in increasing the likelihood of successful stabilization. However, the best possible forecasts form only a necessary condition. One has to consider the strategic role the economic forecasts play in the economic-political decision making. The so-called Lucas critique also applies here; the policymaker not only has to worry about the accuracy of the economic forecasts but has to take into account their effects on the private sector behavior.

Many different economic forecasts are published both by private and public forecasters. The current economic recession has inspired general public discussion about the forecasts. Yet, the public discussion has mainly been concerned about the accuracy of the forecasts. In this chapter we will tackle questions like: Why do we need economic forecasts in the first place? Can they be used to influence private sector behavior? What constitutes a "good" economic forecast? What is required from the forecasts in order for the policymaker to have an information advantage over the private sector concerning the realization of shocks? The information advantage is one crucial condition for successful stabilization.

3.1   Policy without forecasts

To better see why the economic forecasts are needed, we start by considering cases when there is no need for them. We will do this using another simple model[11]. As a starting point let us introduce a short-run relation between the money supply m_t, a demand shock u_t, inflation π_t, and production y_t:

(3.1) $\pi_t + y_t = m_t + u_t.$

During period t an increase in the money supply or a positive demand shock leads to higher inflation or higher production (or both). Demand shocks originate in fluctuations in international trade or changes in households' savings ratios etc. The central bank determines the money supply.

Next let us consider a case in which the central banker takes prices as given, i.e. inflation π_t is determined by earlier decisions made in the private sector by signing wage contracts. A more expansionary monetary policy, higher m_t, affects y_t according to the equation (3.1). In addition, we assume the policymaker to minimize squared deviations of y_t from average production $\bar{y}$:

(3.2) $\text{Min } (y_t - \bar{y})^2.$

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[11]   The model of the chapter is borrowed from Persson & Ysander (1988). Also the analysis in the chapter follows closely the same source. Other useful sources are Englund (1988), Krusell (1988), Niklas et al. (1992), Mankiw (1992) and Westlund (1988).

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This objective function has two basic features: convexity and symmetry. The assumption of convexity - i.e. deviations from the goal (average production) are more harmful the greater they are - is probably not controversial. The assumption of symmetry - i.e. that negative and positive production deviations are equal from the policymaker's standpoint - is somewhat contentious.

Assume that the economy functions according to (3.1) and that the policymaker's goal is to stabilize the economy (avoid recessions and overheating). Then if the policymaker can directly and instantly observe both inflation and the demand shock when determining monetary policy, it is easy to see that the money supply is decided as follows:

(3.3) $m_t = \pi_t + y^* - u_t.$

Actual production always equals average (or target) production, $y_t = y^*$ ($= \bar{y}$). The policymaker reacts to positive demand shocks by contractionary monetary policy and negative demand shocks by expansionary monetary policy. In this kind of framework there is no role for forecasts.

3.2   Policy with forecasts

Forecasts are needed when time lags are introduced into our model. Basically three different kinds of time lags that provoke a need for the forecasts can be identified in this connection. First, one always has to determine the economic policy before relevant information necessary in the decision making is available. Second, it usually takes time before economic-political decisions go through the necessary steps in the administration. Third, some time will elapse before the chosen measures have any effect on the economy.

One obvious example of the time-lags originates in the simple fact that hardly any information on economic development is directly observable. It takes time before any relevant information is available, not to mention shocks, that are difficult to recognize and hardly any special information concerning them is available. However, let us assume that in our model the time-lag as far as the information on the demand shock, u_t, is concerned is exactly one quarter. Thus the monetary policy for the period t must be based on a forecast of u_t. Let $P_t(u_t)$ be the forecast. The forecast $P_t(u_t)$ can be based on all available relevant information: the realized u_{t-1} and other variables that can actually be observed in period t-1 and have significance on forecasting u_t.

Now the central banker makes the monetary policy decisions under uncertainty, i.e. she minimizes expected squared deviations from production target y^* in (3.2). The best possible monetary policy is given by the following rule[12]:

$$(3.4) \quad m_t = \pi_t + y^* - P_t(u_t).$$

Because of the uncertainty related to u_t, the production target is not achieved every period. Deviations from production target become according to (3.1) and (3.4):

$$(3.5) \quad y_t - y^* = u_t - P_t(u_t),$$

i.e. they depend on the magnitude of forecasting errors.

Another source of time lags is the time it takes to make an economic-political decision. A monetary policy decision can be made swiftly. From fiscal policies' standpoint these so-called decision lags are, however, considerably longer. In both cases there is a need for the forecasts. Into our model these decisions lags could be introduced in a similar fashion as in the case of observation (information) lags.

A third source of time lags is the time it takes before chosen policy measures have any effect on the economy. Empirical observations indicate that in the case of monetary policy effect lags are considerable and variable. Lags are present also when considering the effects of the fiscal and exchange rate policies. In our model effect lags are taken into account simply by assuming that monetary policy affects the economy exactly one quarter later. Now equation (3.1) becomes:

$$(3.6) \quad m_{t-1} + u_t = \pi_t + y_t.$$

The monetary policy decisions of our central banker at t-1 are based on the inflation, $P_{t-1}(\pi_t)$, and demand shock, $P_{t-1}(u_t)$, forecasts for the period t. With the policy target, y^*, we get the following monetary policy rule:

$$(3.7) \quad m_{t-1} = P_{t-1}(\pi_t) + y^* - P_{t-1}(u_t).$$

Deviations from the production target depend on errors made in forecasting future inflation and aggregate demand:

$$(3.8) \quad y_t - y^* = (u_t - P_{t-1}(u_t)) - (\pi_t - P_{t-1}(\pi_t)).$$

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[12] Theil (1964) among others has shown that a quadratic objective function makes the choice of the optimal policy independent of whether one minimizes the expected value of the objective function subject to actual outcome or minimizes the actual value of the objective function subject to expected outcome (which is done in (3.4)).

When time lags are considered reference is often made to the concepts of observation lag, decision lag and effect lag. Textbooks likewise often differentiate between the concepts of inside and outside lags. The inside lag consists of the observation and decision lags. The outside lag corresponds to the effect lag (see e.g. Mankiw 1992).

The need for forecasts is neither related to a special policy target nor preferences of policymakers. One could try to reduce the need for the forecasts by affecting the sources of time lags. Examples of such approaches consider ways to produce statistics faster, shorten economic-political decision processes and try to get effects of the policy measures through in the economy quicker e.g. by deregulating the goods and labor markets.

3.3   Political strategy and forecasts

A fundamental aspect of stabilization policies is to affect the private sector behavior. The policymakers try to choose a desired economic-political strategy considering effects on the goods and labor markets. Let us see how this affects the forecasts' role in the analysis.

As in the section 3.2, here also the central banker chooses a monetary policy m_{t-1}, which affects the economy one quarter later according to (3.6). However, inflation, π_t, is no longer exogenous. Instead agents in goods and labor markets determine inflation a quarter in advance (for example through price and wage contracts in the goods and labor markets). In addition, we assume that the agents in the goods and labor markets, when "deciding" inflation, do not observe monetary policy. It is now assumed that in the central banker's objective function there are targets for both inflation and production outcomes. Thus, let the objective function be as follows:

(3.9) $\text{Min } E[(y_t - y^*)^2 + (\pi_t - \pi^*)^2]$.

The central banker puts equal weights on deviations from both production and inflation targets. The role forecasts play in the economic-political decision making and realized outcome depends on two factors: first, the decision rule, according to which inflation is determined in the goods and labor markets; second, the extent to which information is shared between the central bank and private markets. These two points are elaborated upon in the following section.

3.3.1   Strategic coordination

The first example here considers the case in which agents in private markets have an inflation decision rule that helps the central banker to achieve her goals. In this ex-

ample labor market participants share the central bank's view of the economy, i.e. the relation in (3.6). Thus inflation is determined by the private sector's forecasts of the money supply $P^m_{t-1}(m_{t-1})$ and demand shock $P^m_{t-1}(u_{t-1})$, and in addition by the policymaker's production target y^{*}[13] as follows:

(3.10) $\pi_t = P^m_{t-1}(m_{t-1}) - y^{*} + P^m_{t-1}(u_t)$.

Assuming that the policymaker knows how inflation is determined and the private sector in turn sees how the monetary policy decisions are made, the best possible monetary policy rule with the policymaker's demand shock forecast, $P^p_{t-1}(u_t)$, is as follows:

(3.11) $m_{t-1} = \pi^{*} + y^{*} - P^p_{t-1}(u_t)$.

Namely, the money supply accommodates exactly the expected demand shock. When the central bank and private sector follow the rules (3.10 and 3.11), and the private sector expects monetary policy to be determined according to (3.11), deviations from inflation and production targets become:

(3.12a) $\pi_t - \pi^{*} = P^m_{t-1}(u_t) - P^m(P^p_{t-1}(u_t))$
(3.12b) $y_t - y^{*} = u_t - P^p_{t-1}(u_t) + P^m(P^p_{t-1}(u_t)) - P^m_{t-1}(u_t)$.

In (3.12) $P^m(P^p_{t-1}(u_t))$ is the market's view of the policymaker's demand shock forecast $P^p_{t-1}(u_t)$. Inflation (in 3.10) depends on the market forecasts of monetary policy and demand shocks. The markets anticipate the policymaker's forecasts. Since the policymaker knows how inflation is determined, $P^p_{t-1}(u_t)$ is the content of the monetary policy rule (in 3.11). It is the only element that causes uncertainty in this setup (see (3.11)). The difference between (3.12b) and (3.5) is that in the latter there is no policy lag. The difference compared to (3.8) is that in (3.8) the policymaker does not know how inflation is determined.

Assume that the central bank has no information advantage, i.e. private sector forecasts of aggregate demand trends (demand shocks) are no worse than those of the central bank. This makes things easy; all forecasts in (3.12) are identical:

(3.13) $P^p_{t-1}(u_t) = P^m_{t-1}(u_t) = P^m_{t-1}(P^p_{t-1}(u_t)) = P_{t-1}(u_t)$.

The convergence of the expectations eliminates the "unnecessary" deviations from the inflation and production targets in (3.12). The origin of the "unnecessary" deviations is the forecasting errors made by the private sector on the central bank's demand shock forecast. Hence, actual inflation will always equal the target one, $\pi_t - \pi^{*} = 0$, and production deviations are limited to unavoidable forecasting errors concerning aggregate demand, i.e. $y_t - y^{*} = u_t - P_{t-1}(u_t)$.

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[13]   Forecasts made by the policymaker and private sector have superscripts p and m respectively.

What happens if the central bank has an information advantage compared to private agents? Namely what if it makes better forecasts in sense that the forecasting errors and the variances of the errors are smaller compared to the forecasts made by the private sector? The last example above showed that it is desirable that private sector expectations concur with the policymaker's expectations. The central bank has a strong incentive to make the forecasts public and make sure that private agents know them. If the private sector accepts them and signs its own contracts based on the public forecasts, the situation is exactly the same as in the above case where the central bank has no information advantage[14].

The decisive factor is that the central bank's goals for monetary policy are consistent with the private sector behavior (with inflation determination). The optimal policy requires coordination between the conduct of monetary policy and private sector decision making.

3.3.2   Strategic conflict

Let us now consider a case where there is a conflict between private sector behavior and the policy targets. Here we assume that inflation is determined according to:

$$(3.14)\ \pi_t = P^m_{t-1}(m_{t-1}) - y^*$$

instead of (3.10). The difference between (3.10) and (3.14) originates in the fact that in the private markets the demand shock forecast (i.e. the aggregate demand forecast) is not taken into account when determining inflation. In the markets a simple rule of thumb may be used giving a good enough estimate for aggregate demand in the long run or private agents may set real wage targets without considering aggregate demand development. Let us see what happens when the central banker has a similar strategy for monetary policy as in (3.11). Now inflation and production deviations are:

$$(3.15a)\ \pi_t - \pi^* = - P^m_{t-1}(P^p_{t-1}(u_t))$$
$$(3.15b)\ y_t - y^* = u_t - [P^p_{t-1}(u_t) - P^m_{t-1}(P^p_{t-1}(u_t))]$$

If the central bank and private sector share the same information, then production deviations are independent of both the forecasts and policy: $y_t - y^* = u_t$. Since the money supply is always matched with equal inflation according to (3.14), the policymaker is not able to affect production. If instead of the policy rule described in (3.11) the policymaker chooses a constant growth rate in the money supply, i.e. $m_{t-1} = \pi^* + y^*$ (and announces it publicly), production fluctuations are not stabilized (y_t

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[14]   One can ask whether the central bank can achieve the same goal simply by announcing the money supply instead of the demand shock forecast. This would solve the inflation problem in (3.12a), $\pi_t = \pi^*$. "Unnecessary" GDP deviations would still remain; in this case they would be $y_t - y^* = u_t - P^m_{t-1}(u_t)$. On average fluctuations would be greater than in the case where the private sector knew the better forecast $P^p_{t-1}(u_t)$.

- $y^* = u_t$). However, now inflation, unlike in (3.15), always equals the target one $\pi_t = \pi^*$.

What happens if the central bank actually has an information advantage? If the forecast is made public, then the situation is exactly the same as above. Sometimes, however, the policymaker can benefit from the information advantage by keeping the forecast (and the money supply growth) secret.

To see this point we can study a case in which the markets are assumed to be able to forecast the average value of the demand shock. If we set this value equal to zero, it follows that $P^m_{t-1}(P^p_{t-1}(u_t)) = 0$. The central bank on the other hand has a better forecast for the demand shock u_t. If the central bank follows the earlier strategy in (3.11), we can see from (3.15) that inflation equals the targeted one, $\pi_t = \pi^*$, and at the same time production deviations are only the result of the forecast errors made by the policymaker, i.e. $y_t - y^* = u_t - P^p_{t-1}(u_t)$. The outcome is thus better than in the case where the forecast is made public. By keeping the forecast secret, the policy-maker retains a chance to surprise the private markets by more expansionary (contractionary) monetary policy than expected when the economy is hit by a negative (positive) demand shock.

There are of course several problems with this strategy: one special problem concerns difficulties in maintaining the credibility of "fixed" decision rules when one tries to explain variations in monetary policy by referring to secret forecasts. In the above example credibility problems are not considered. We have assumed that the central banker can credibly commit herself to a particular decision rule so that the secrecy effect materializes. However, such commitments are seldom feasible in reality. On the contrary, the credibility problems of monetary policy are common. The credibility issues make the forecasts' role in the desired economic-political strategy even more complicated.

Our example above implies, with some qualifications, that forecasts can act as strategic instruments in stabilization policy games. For a forecaster tied to policymakers, forecasts' strategic role brings about an insurmountable problem. To make the best possible forecasts the forecaster should consider at the same time both the market behavior and the conduct of the economic policy, which in turn affects decisions made in the markets. In addition, the forecaster is obliged to provide neutral forecasts for the economic-political decision making. The latter point presumes that the forecaster should neither anticipate the future economic-political strategy nor let it affect the forecasts. Even if this condition holds, the forecaster is forced to use data (surveys on firms' investment plans and households' plans to buy durable goods etc.) in which expectations of policy interventions are built in. This in turn introduces an impassable consistency problem. Often this dilemma is camouflaged, but not solved, by "labeling the product" as a forecast with policy unchanged.

3.4   Properties of good economic forecasts

What constitutes a good economic forecast cannot be determined a priori. One needs both a model for the economy (how the economy functions) and an objective function for the decision maker to be able to illustrate points relevant in this connection. In our simple model both of these features are explicit.

As a starting point let us consider a central banker from section 3.2 who tries to minimize the expected squared deviations from the production target. According to (3.5) this amounts to the same thing as minimizing $E(u_t - P_t(u_t))^2$, i.e. the expectation of the squared values of forecasting errors. The forecasting error is the difference between two stochastic variables; thus it is a stochastic variable. Let us label the forecasting error by f, i.e. let $f = u_t - P_t(u_t)$. It applies to the forecasting errors - and to any other stochastic variable - that:

$$(3.16)\ Ef^2 = (E(f))^2 + Var(f),$$

in which $E(f)$ is the mean and $Var(f)$ the variance of f. The best possible forecast - i.e. the one that minimizes Ef^2 - therefore gives the lowest sum of the squared mean and the variance of the forecasting error.

In other words a good forecast in our example should meet two criteria: accuracy and precision. First, it should be accurate in the sense that the mean of the forecasting error is as close to zero as possible. Second, it should be precise in the sense that the variance of the forecasting error is as small as possible.

If we compare different forecasting methods, it is apparent that one method is seldom both the most accurate and the most precise at the same time. Thus it is important to consider different forecasting methods and evaluate their properties carefully. On average a forecast that systematically overestimates/underestimates the level of aggregate demand but exhibits good precision dominates a forecast that does not make mistakes on average in predicting the level of aggregate demand but has a bad precision.

It should be stressed that both the objective function of the decision maker and the model of the economy she believes in determine what constitutes a good forecasting method. In our simplified model we had a quadratic objective function and a linear macroeconomic model. It is easy to imagine situations in which these simplifications are bad approximations. For example, if the policymaker finds the production growth say 2% above the target better than 2% below it, then her objective function is not symmetric around the target. The quadratic form assumed in (3.2) thus is a bad approximation. In addition, if the policymaker is of the opinion that a positive demand shock has a bigger chance to spill over into inflation than into production the bigger the shock is, then the macroeconomic model she believes in is not linear.

Again the linear form assumed in (3.1) is a bad approximation. Different assumptions can change the operational criteria of a good forecast. They can alter relative weights attached to the mean and the variance of the error; in (3.16) the weights are the same and equal to one. Also higher statistical moments than the variance can play a role in the analysis, for example, the third moment, i.e. the skewness of the forecasting error.

Even though in our little model the optimal monetary policy is not affected by the variance of the forecasting error, this is not the case with actual decisions made by policymakers. Unfortunately it is mostly point estimates that are provided to policymakers and taken into consideration in the policy making. This is far from a satisfactory situation. The policymakers should know the nature (and preferably extent) of the uncertainty related to forecasts. This may induce the policymakers to demand better forecasts, ask forecasts from various forecasters or give up their ambitions to try to fine tune the economy.

In addition, there is a disagreement over the form of the policymaker's objective function. It is reasonable to presume that there are certain asymmetries in policymaker's preferences; a recession is considered worse than overheating. This also increases the need to openly evaluate the margins of uncertainty, since this in turn increases the decision makers' possibilities to act according to their preferences and risk aversions.

The problem in the forecasting is not to come out with an ideal forecast, but simply to make the best possible forecast. Resources are always limited and they should be allocated in the best possible way from the decision maker's perspective. The best possible outcome from the decision maker's standpoint is to reach the targets set in the economic-political decision making. In general one has to evaluate whether the forecasts have adequately served their tasks in the economic-political decision making. In particular, costs of more precise forecasts should be weighted against benefits of better economic-political decisions.

Deregulation of the markets and new economic-political doctrines can fundamentally change the impression of a good forecast. New data sources become available - while old sources vanish - together with new forecasting methods actualized by the economic research. Such developments make it essential to have an ability to change and improve normal forecasting routines. There are already quite different forecasting methods in use. They differ from each other in how formalized they are and to what extent they use economic theory. It would be a demanding task to compare different methods from a statistical perspective - even more so if one considers statistical features from the economic-political standpoint. Here it is essential to know preferences over the different stabilization political outcomes; the policymakers have to make clear what they think is more and what less important.

4   ENDOGENOUS MONETARY POLICY MODELS

Previous chapters already suggested that rules to conduct monetary policy may be desirable. In chapter two we briefly reviewed the history of macroeconomics from the perspective of stabilization. In chapter three we considered the role of economic forecasts in the economic-political decision making. Both these chapters pointed to the direction of rules rather than discretion in the monetary policy conduct. In the following the credibility problem touched upon in the previous chapters will be studied more carefully; ways to overcome it will be suggested.

We will restrict our analysis to a one-shot game with no political conflict[15]. The central bank will be assumed to have an employment target corresponding to more employment than the natural rate of employment, because distortions in the labor market make the natural rate inefficiently low. The role of this output or employment target in the analysis is to introduce a benefit from surprise inflation. In addition, it is assumed that the central bank has an information advantage over the private sector concerning the realization of the shock. This allows for a trade-off between employment and inflation in the short run. In the long run there is assumed to be no trade-off to be exploited. This is traditionally seen as a long run or a closed economy assumption (our model assumes a closed economy) but as Buiter (1995) shows and argues with an open economy version of the Phillips curve, the long-run trade-off even in the open economy models "ceased to be intellectually respectable quite a while ago".

Let us start by describing the private sector behavior using a standard expectations-augmented Phillips curve[16], hence employment is:

(4.1) $x = (\pi - \pi^e) - \varepsilon,$

where ε is a symmetrically distributed supply shock with mean 0 and variance σ^2. The shock is observed by the central bank when setting policy but not by the private sector when setting wages. This specification of the Phillips curve allows for a trade-off between inflation and employment, i.e. there is scope for welfare improving stabilization policies[17]. The term π is the actual and π^e is the expected rate of inflation, and x is the log of the level of employment. Expected inflation is a shorthand for nominal wage growth, since the optimal wage changes one for one with

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[15]   Everybody agrees on inflation and employment targets.

[16]   This curve forms the first part of the simple model that provides an example of credibility problems in monetary policy. It has been extensively studied after it was first suggested by Kydland & Prescott (1977) and subsequently popularized and further developed by Calvo (1978) and Barro & Gordon (1983). Now it forms a standard in this literature.

[17]   Reasons are explained in Fisher (1977) and the subsequent rational expectations literature; labor contracts are not state-contingent and the central bank has an information advantage, since monetary policy can react on short notice once the stochastic shock has been realized, whereas wages cannot.

expected inflation[18]. The central bank is assumed to be able to control inflation directly[19] and minimize the following loss function:

$$(4.2) \quad L(x,\pi) = \frac{1}{2} E[\pi^2 + \lambda(x - x^*)^2],$$

where E is the expectation operator, λ is a relative weight and x^* is the log of the target level of employment, which is greater than the natural level of employment or the level of employment determined in the market[20].

4.1 Discretion

The equilibrium under discretion is defined by the Nash conditions according to which both players select the best response to the opponent's strategy. Hence, on one hand given the equilibrium policy rule, the nominal wage is optimal for wage setters. On the other hand given the equilibrium nominal wage, the policy rule is optimal for the policymaker, for any ε. The timing of events is as follows: first, wage contracts are set, and then inflation expectations formed. The shock hits subsequently the economy and the central bank observes it and reacts to it by pursuing an appropriately loose or tight monetary policy, i.e. in our model it sets the inflation rate based upon this new information. Wage contracts are not contingent upon the realization of the shock.

The central bank minimizes its loss function knowing private inflation expectations, π^e, i.e. by substituting (4.1) for x in (4.2) and minimizing L given $\pi^e = E(\pi)$. The equilibrium policy rule must satisfy the first order conditions. The first Nash equilibrium condition implies that private rational expectations are formed based on the first order conditions. Since the private information set does not include the realization of ε, by taking unconditional expectations of the first order condition we find that π^e equals λx^{*}[21]. Now given $\pi^e = \lambda x^*$ together with the first order conditions, we find the equilibrium inflation (policy) rule:

$$(4.3) \quad \pi(\varepsilon) = \lambda x^* + (\lambda/(1+\lambda))\varepsilon.$$

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[18]   See Persson & Tabellini (1990) pp. 8-9.

[19]   This is a shorthand for a more complete model in which the policymaker sets the money supply or the exchange rate in a closed or an open economy respectively. Consider e.g. the money supply, we could assume that the central bank controls the supply of money instead of inflation, and add a quantity equation (see Mankiw 1992) to close our model. The notion of control is twofold: First, the policymaker is able to control inflation, and second, the direct control is assumed for the sake of simplicity. The quantity equation would only complicate the algebra without providing additional insights into the problems in question.

[20]   Employment is determined by labor demand. Thus it is presumed that unions drive up wages high enough that individual workers are to the left of their labor supply curve. Hence, the labor market equilibrium has "union-voluntary", but "individual-involuntary" employment (see e.g. Calmfors 1989). In addition, natural employment is assumed away (assumed to be zero) from (4.1).

[21]   See section 2.3 in Persson and Tabellini (1990).

Using (4.3), (4.1) and $\pi^e = \lambda x^*$ we find the corresponding equilibrium employment rule:

(4.4) $x(\varepsilon) = -(1/(1+\lambda))\varepsilon$.

4.2   Commitment

The only difference between equilibrium solutions under commitment and discretion regards inflation. The optimal policy would eliminate the inflation bias λx^* in (4.3) without reducing the employment stabilization effect in (4.4)[22]. Suppose the central bank can commit to some simple shock contingent inflation rule e.g. $\pi(\varepsilon) = \bar{k} + k(\varepsilon)$. In this environment, two conditions define the equilibrium: 1) for any policy rule, the nominal wage is optimal for wage setters given that policy rule, 2) given the "reaction function" of wage setters as defined in condition 1, the policy rule is optimal for any realization of ε. In the literature this equilibrium notion is referred to as the Stackelberg equilibrium with the policymaker as the dominant player[23]. Thus the central bank minimizes L with respect to $\bar{k}$ and k given $\pi^e = E(\pi(\varepsilon)) = E[\bar{k} + k(\varepsilon)] = \bar{k} + kE(\varepsilon) = \bar{k}$. $\pi^e = \bar{k}$ because again ε is not observed by the private sector. After solving for $\bar{k}$ and k from the first order conditions, the optimal state-contingent inflation policy rule under commitment can be derived (simply by substituting solved values of zero (0) and $\lambda/(1+\lambda)$ for $\bar{k}$ and k respectively in the contingent inflation rule):

(4.5) $\pi(\varepsilon) = (\lambda/(1+\lambda))\varepsilon$.

This inflation rule, equation (4.1) and the private sector inflation expectations $\pi^e = \bar{k}$ together yield the same equilibrium employment rule with respect to commitment as with discretion in (4.4). Since expected inflation cannot stabilize employment and the policymaker can commit to the inflation rule, the optimal rule is chosen such that expected inflation in equilibrium is zero ($\bar{k} = 0$). Any inflation that occurs in the equilibrium with commitment is unanticipated. To be able to create positive inflation surprises the policymaker has to create negative surprises to keep down expected average inflation that gets embodied into wages. Unexpected inflation that occurs is consistent with rationality[24], since it is due exclusively to the information advantage of the central bank.

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[22]   The term λx^* in (4.3) implies that the average inflation rate is above zero, which is the optimal inflation rate according to (4.2), without higher average employment or lower employment variability.

[23]   The fact that nominal wages are by assumption optimal for any policy rule, and not just for the equilibrium policy rule, excludes implausible equilibria. In the game theoretic context this equilibrium is called a subgame perfect Nash equilibrium in an extensive form game with the policymaker moving first.

[24]   Here rational expectations mean unbiased predictors of equilibrium inflation, i.e. the notion of rationality is by no means unambiguous.

The key difference between equilibria with discretion and commitment is that under commitment the policymaker controls π^e through her inflation rule. With discretion the policymaker has to take π^e and hence nominal wages as given. This imposes a credibility or an incentive compatibility condition on the policymaker; she must have no ex post incentive to deviate from the equilibrium policy rule and create surprise inflation[25]. It is exactly this condition that demands the equilibrium inflation policy rule with discretion to satisfy the first order conditions of the policymaker's minimization problem. Namely according to the Nash condition given the equilibrium policy rule the nominal wage is optimal for wage setters. On the other hand, with commitment nominal wages are required to be optimal for any policy rule and not just for the equilibrium policy rule. The "equilibrium inflation policy rule" under commitment satisfies the first order conditions and hence it is optimal for the policymaker only if the commitment can be made. Otherwise the credibility is a matter of concern and the equilibrium inflation rule is provided in (4.3).

4.3   Simple monetary policy rule

If the central bank could credibly commit itself to a simple inflation rule (no shock contingent), i.e. it would minimize (4.2) with respect to π given $\pi = \pi^e$, this would lead to zero inflation ($\pi = \pi^e = 0$) with no employment stabilization x = -ε. Here the problem is the same as under commitment; the policy rule is not credible. If the private sector expects the policymaker to follow the simple rule $\pi^e = 0$, then the policymaker has an ex post incentive to surprise when shocks are present. She would minimize (4.2) with respect to π given $\pi^e = 0$, this would yield the following inflation rule:

(4.6) $\pi = (\lambda/(1+\lambda))(\varepsilon + x^*)$,

which is greater than expected. The inflation rule under commitment is not credible either. With commitment expected inflation is according to the equilibrium policy rule (4.5): $\pi^e = (\lambda/(1+\lambda))E[\varepsilon] = 0$. Thus again the policymaker has an ex post incentive to surprise by higher than expected inflation in accordance with the (4.6). In the discretionary regime this is not the case, since the private sector understands the policymaker's ex post incentive to surprise, hence the private sector forms its expectations based on these ex post incentives. The equilibrium inflation rule under discretion is said to be time consistent but suboptimal due to the inflation bias. The equilibrium rule under commitment (as well as the simple monetary policy rule) is said to be optimal but time inconsistent, i.e. not credible. As we already saw these statements are misleading, since rules with discretion and commitment are both equilibrium solutions. The fact that the inflation rule with commitment has more desirable features really says that from the policymaker's perspective it would be beneficial to be able to commit, i.e. to have a commitment technology available.

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[25]   See chapter 2 in Persson & Tabellini (1990).

4.4   Secrecy of forecasts

In chapter three we briefly dealt with the secrecy of the forecasts. In this chapter we have assumed that the policymaker has an information advantage concerning the realization of the shock. Let us see what happens if the policymaker publicly reveals her information on the shock to the private sector[26]. If the private sector could observe the realization of ε, it would anticipate that the government incentives to inflate have changed. If the wage setters were able to revise their nominal wage demands, they would set nominal wages according to the new information.

In an extreme case if the wage setters were able to renegotiate, whenever new information were available and the policymaker were willing to provide it, the stabilization effect would be lost. This can be seen by repeating the same steps as in section 4.1; now assuming that the private sector, in addition to anticipating the policymaker's ex post incentive to inflate, knows ε when setting wages. Hence the equilibrium inflation and employment are respectively:

$$(4.7) \quad \pi = \lambda(\varepsilon + x^*)$$
$$(4.8) \quad x = -\varepsilon.$$

These equilibria differ from the discretionary case, simply because the policymaker has no information advantage. This reminds us of the case considered in chapter two, i.e. that secrecy is beneficial from the stabilization perspective (in the form of better inflation and employment outcomes). However, the earlier qualifications concerning secrecy still hold[27].

4.5   Conservative central banker

One way that has been suggested to overcome the credibility problem of monetary policy is to appoint a conservative "central banker". Here we follow approaches in Rogoff (1985) and Alesina and Grilli (1991). Under discretion the equilibrium inflation increases when the weight, λ, increases (see equation (4.3)). The intuition here follows similar tracks as in chapter two, i.e. a higher λ raises the temptation to surprise the private sector with unexpected inflation making the central bank's credibility constraint more binding. Equilibrium inflation rises, since the larger temptation is matched by a larger marginal cost to inflate. At the same time, a higher λ means that the policymaker is more involved in employment stabilization. From equation (4.4), one can see that the negative effect of the supply shock on employment decreases when λ decreases. The decisive thing is the value of the parameter λ; the tougher the central bank is towards inflation (low value of parameter λ) the lower inflation is and the higher the variation in employment. The former point can be

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[26]   Cukierman & Meltzer (1986) considers the role of information in the discretionary regime in depth.

[27]   There are some other qualifications, see Persson & Tabellini (1990) p. 28.

seen directly from equation (4.3). The latter point can be seen when taking the variance of employment, var (x), using (4.4) we can determine the variance:

(4.9) $\text{var } (x) = \sigma^2/(1+\lambda)$

If $\lambda = 0$ inflation is completely eliminated (see (4.3)), meanwhile no stabilization is achieved (see (4.4)) and the employment variation is at its greatest (see (4.9)).

What λ should the appointed central banker have? To be able to consider this question we distinguish the society's preferences over different macroeconomic outcomes from institutions' or individuals' preferences who make the actual policy decisions. We assume two institutions: the government that formulates society's "true" preferences and the central bank that carries out monetary policy. In this set-up the relative weight that enters the government loss function (4.2) is assumed to be λ. Assume further that the government can appoint an independent central banker who minimizes a loss function equivalent to (4.2), with the weight λ, possibly different from λ. To find a probable range for the central bank's λ we substitute discretionary equilibrium inflation (4.3) and employment (4.4) for π and x in the loss function (4.2), which is thus written as a function of λ. Now minimizing $L(\lambda)$ with respect to λ, taking λ as given, we get the following first order condition:

(4.10) $L_\lambda(\lambda) = \lambda(x^*)^2 + \sigma^2(\lambda - \lambda)/(1 + \lambda)^3$.

From this first order condition we can implicitly define the choice of λ; at point $\lambda = \lambda$, the second term drops out and $L_\lambda(\lambda)$ is positive. Likewise, at the point $\lambda = 0$, the first term drops out and $L_\lambda(\lambda)$ is negative. Accordingly from the first order condition it follows that the optimal value of λ ($L_\lambda(\lambda) = 0$) is positive but smaller than λ[28]. Here it is claimed that the central banker should be more conservative (tough toward inflation) than the society's "true" preferences; implicitly this requires that the central bank is independent enough to be able to be tough.

4.6   Optimal central bank contracts

The literature on macroeconomic policy games (endogenous policy) has been fairly successful in providing positive models of policy emphasizing short-run and political incentives embedded in the policy process. Until now we have dealt with the credibility problem in monetary policy brought about by the employment motive for monetary expansion. Discretionary monetary policy also can be related to excess inflation and currency devaluation caused by revenue and balance of payments motives respectively. Countries with relatively narrow capital markets (and often poorly functioning tax collecting systems) whose governments cannot issue substantial amounts of debt tend to rely on seigniorage to finance budget deficits, i.e. mone-

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[28]   By differentiating (4.10) it can be checked that the second order conditions are fulfilled.

tary expansions (money printing) are revenue motivated. But also countries with better functioning capital markets in the presence of high nominal public debt may end up trying to monetize the debt in crisis situations.

Both the employment and revenue motive for inflation drive up inflation expectations and thus interest rates. Above we already saw suggestions to overcome the inflation bias of the employment motivated central banker. Basically, the same recommendations apply to the credibility problems regarding high debt and balance of payment deficits[29]. Other approaches to overcome debt-related credibility problems have considered solutions like debt indexation or debt of different maturities[30]. As a whole one can say though that the work concerning normative models of institution design in this literature has just begun. Let us conclude this section by considering a simple example of the recent innovation of normative approaches[31].

A way to eliminate the inflation bias of the discretion case without reducing employment stabilization effects of monetary policy is through contracts. The idea here is to design an optimal contract in a form of a transfer scheme such that the central bank would have every incentive to reach the low inflation target. As a matter of fact as Walsh (1995 p. 153) puts it "...by deriving the optimal contract, I show that the trade-off between inflationary bias and suboptimal stabilization in Rogoff (1985), Garfinkle and Oh (1993), and others arises because these authors place arbitrary restrictions on the targeting rules they consider. This trade-off disappears under the optimal contract: full credibility and flexibility are simultaneously achieved." In (4.3) the inflation bias λx^* disappears when we assume an ultra-conservative central banker with $\lambda = 0$ or if we assume no employment motivation for the central bank, namely $x^* = \underline{x} = 0$. From (4.4) we can see that with $\lambda = 0$ the stabilization effect is completely lost, i.e. zero average inflation is associated with suboptimal stabilization.

Here we consider features of the optimal contract from the perspective of society's ex-ante preferences. The optimal contract is assumed to be between society (the principal) and an independent central bank (the agent). The principal commits to the contract before wages are set, and is not allowed to renegotiate it later on. The central banker (the agent) minimizes the loss function (4.2) and any cost conditional on the central bank performance. Such a cost can be interpreted as a monetary compensation or penalty conditional to some publicly verifiable outcome. It also can be interpreted as affecting the central bank prestige as an institution, or the reputation (position) of the individuals with the highest responsibility in the institution[32].

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[29]   We will come back to the balance of payments motive for monetary expansion in chapter six.

[30]   See Persson & Tabellini (1990) and (1994a).

[31]   See Persson & Tabellini (1994a) and Walsh (1995).

[32]   See e.g. Goodhart (1994a), Persson & Tabellini (1994a) and Walsh (1995).

Next let us see how such a contract scheme appears within the context of the simple model used throughout this chapter[33]. Here the cost t is simply assumed to be a linear function of π, i.e. $t = a - b\pi$. The cost enters the loss function in the linear form implying that the central banker is risk neutral. The cost is made conditional with respect to inflation, since inflation is publicly verifiable and at the same time it is under direct control of the policymaker. The central banker minimizes the loss function $W(\pi)$, i.e. to the loss function (4.2) is added the cost t:

$$(4.11)\ W(\pi) = t - L(x,\pi)$$

with respect to π. She is assumed to know that $\pi^e = E(\pi)$ as above in the discretionary regime. From the first order condition with rational expectations we find that $\pi^e = E(\pi) = \lambda x^* - b$. Now, the first order condition and the rational inflation expectations together yield the equilibrium policy rule:

$$(4.12)\ \pi(\varepsilon) = -b + \lambda x^* + (\lambda/(1+\lambda))\varepsilon.$$

The inflation bias associated with discretion can be eliminated simply by setting b equal to λx^*. It is straightforward to check that by adding a linear cost of inflation $t = a - \lambda x^*\pi$ to the policymaker's loss function, the commitment case outcome can be achieved even though the policymaker acts in a discretionary way. With the cost t private sector inflation expectations are $\pi^e = E(\pi) = \lambda x^* - \lambda x^* = 0$. Hence, inflation expectations and the first order conditions together give the equilibrium inflation policy rule equal to the one in (4.5) with commitment. The optimal policy eliminating the inflation bias (zero average inflation is achieved) and at the same time preserving the stabilization effect of (4.4) is enforced by the cost[34]. Thus the optimal central bank contract forms a perfect substitute for commitments.

In this so-called targeting approach the political principal (government and parliament) of the central bank imposes an explicit inflation target, provides a general mandate to achieve price stability and makes the central bank leadership explicitly accountable for its success in meeting the target. For example, New Zealand (1989) and Canada (1991) can be said to follow according to their central-banking law more or less such an approach. In some countries central banks announce numerical values for such intermediate targets as monetary aggregates or the exchange rate, and to varying degrees are held accountable for deviating from the targets.

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[33]   Persson and Tabellini suggest this in the connection of a more general model in Persson & Tabellini (1994a). Other useful sources in this connection are Garfinkle & Oh (1993), Lohman (1992) and Walsh (1995).

[34]   Alesina & Gatti (1995) show using Alesina's (1987) model of two competing political parties that an independent and inflation-averse central bank reduces average inflation and eliminates "politically induced" output variability. The elimination of this type of real variability may or may not compensate for the suboptimal stabilization induced by a conservative central banker.

The analysis of optimal central bank contracts can be extended to various directions. One obvious direction would be to consider contracts that are based on intermediate targets, i.e. the policymaker controls inflation indirectly and imperfectly and correspondingly the private sector inflation monitoring is of the same nature. Among other directions are, for example, contracts that are partly based on non-verifiable and thus non-contractible information. This analysis suggests an important role for the central bank's policy announcements[35].

Giavazzi and Pagano (1988) use a fairly similar model and reasoning as in the case of optimal central bank contracts when they consider the Exchange Rate Mechanism (ERM) as an effective disciplinary device for inflation-prone countries within the EU. They argue that the ERM forces the respective policymakers to pursue more restrictive monetary policies than they would otherwise. The reason is that ERM membership brings potentially large credibility gains to policymakers in more inflation prone countries. The membership attaches an extra penalty to inflation in terms of real appreciation of the currency, i.e. the real appreciation's function in their model is similar to the transfer scheme's function in the case of optimal central bank contracts. In addition, they argue that the membership makes the public aware that the policymaker faces such a penalty, and thus may help to overcome the credibility problem and hence inefficiency stemming from the public's mistrust concerning the policymaker's policy announcements.

4.7   What should the central bank's policy target be?

According to Goodhart (1994a p. 1424) "Virtually every monetary economist believes that the CB can control the monetary base (hereafter Mo), and, subject to errors in predicting the monetary multiplier, the broader monetary aggregates as well. After all, Mo (apart from some relatively unimportant qualifications about coins from the Mint), represents the liabilities of the CB, and the CB should be able to control its own liabilities by open market operations. Hence the normal assumption is that Mo is controllable within a narrow margin. If the central bank should fail to do so, it must be because it has chosen some alternative operational guide, e.g. holding interest rates constant at some level, which operational rule is frequently decried as sub-optimal." In addition, he argues: "Almost all those who have worked in a CB believe that this view is totally mistaken; in particular it ignores the implications of several of the crucial institutional features of a modern commercial banking system, notably the need for unchallengeable convertibility, at par, between currency and deposits, and secondly that commercial bank reserves at the CB receive a zero, or below-market, rate of interest. The first means that fluctuations in the public's demand for cash, which are both strongly seasonal and somewhat unpredictable, must be accommodated. The second means that commercial banks will not willingly hold free reserves at the end of each day (...) beyond that needed to meet

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[35]   See more on this subject and other extensions in Persson & Tabellini (1994a), Svensson (1995) and Walsh (1995).

late fluctuations in the demand for cash after the money market has closed, or become thin."

Goodhart argues at length that monetary base control is a difficult task, and according to him people in charge of central banks regard monetary base control as a "non-starter". Hence, the instrument they claim to be able to and accordingly do control is the short-term money market rate[36]. The trouble with the interest rate targeting is that holding nominal rates constant has destabilizing effects in the money markets. Hence, instead of the interest rate targeting people in central banks try to figure how much and how fast they should adjust their main instrument(s) and in response to which economic developments. It seems that this is what the Bank of Finland tries to do, i.e. people in charge of monetary policy are trying to tie interest rates to movements in a larger set of information variables[37].

As critics state no-one has the information (good enough forecasts) necessary for discretionary setting of interest rates[38]. Besides, the relationship between interest rate changes and various monetary aggregates is far from certain, and subject to long and variable lags. Naturally, this applies to the relationship between monetary aggregates and nominal incomes and inflation. Moreover raising interest rates is (politically) unpopular, and lowering them is popular. Even without political subservience, it is often the case that interest rate increases are deferred until more information on economic developments become available. It seems evident that it would be advantageous to appoint an agent with a single, quantifiable and easily understood outcome. When the principal has multiple, potentially conflicting objectives for the agent, then the principal is probably not willing to delegate the choice among such objectives to the agent. Hence, the danger of not meeting the objective of price stability increases.

The current enthusiasm for independent central banks rests importantly but not only on general acceptance of the vertical long-term Phillips curve. There is no long-term trade-off to exploit. Thus, the best sustainable outcome the authorities can achieve through monetary policy is price stability. A shift to central bank independence in circumstances where there is a single, quantifiable objective which the central bank is mandated to achieve, makes it more rather than less democratically accountable. According to Goodhart (1994a p. 1428), "Both its objective, and success in achieving that target, can be made crystal clear."

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[36]   See, for example, Pikkarainen (1995) about the interest rate policy the Bank of Finland tries to pursue.

[37]   In Pikkarainen (1993) some hints can be found about variables and their changes the Bank of Finland monitors.

[38]   See Brunner & Meltzer (1993).

There are several suggestions for the final target in the literature[39]. There are advantages and disadvantages as regards, for instance, the use of levels or changes of consumer or retail price indices as final targets; the role of chief forecaster in a central bank committed to an inflation target is both difficult and exposed[40]. In addition, the difficulty or speed of achieving a final inflation objective does not differ much from the task of attaining intermediate (monetary) targets. However, opinion is moving in favor of making the final objective predominant as the quantified target. It is what people understand and follow; restrictive policies may be more easily accepted if they are imposed to control inflation, rather than to control the monetary aggregates.

From the principal's perspective a clear advantage with inflation targets is that they are controllable and transparent. In addition, as Goodhart (1994a p. 1431) puts it, "With CB officials themselves often happier to go for final price objectives than for intermediate monetary targets, why not let them try? Monetarists may predict failure, but as long as the cost of failure is internalized in CBs by an appropriate incentive structure, there would not seem a disadvantage for society in this strategy. Perhaps the recent relative success with hitting inflation targets in Canada and New Zealand has been due to the greater incentives on CB officials so to do." It is exactly this the optimal central bank contract does within the framework of our simple model[41].

However, the final price objective (level or change) is not an easy target. The optimal band-width around the target[42] depends on the credibility of the target and its issuer, as well as of the size of possible shocks that hit the economy and ability of the central bank to forecast. In addition, there are many complications related to different measures of inflation due to the fact that each one of them measures only representative parts of the economy[43], i.e. they measure only subcomponents of changes in the general price level. Thus, it is very important that private agents understand the indicator in which the inflation target is expressed, and its relation to the indicator the private sector follows. In Finland the indicator in terms of which

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[39]   See e.g. Goodhart (1994a).

[40]   Traditionally, the Bank of Finland has not revealed information concerning its economic forecasts. Now they will get publicity at least indirectly, namely how well the Bank of Finland meets the inflation target tells us something about its ability to forecast.

[41]   See more on this subject in Garfinkle & Oh (1993), Lohman (1992), Persson & Tabellini (1994a) and Walsh (1995).

[42]   The band-width around the target of 2 % change in price level is not specified in Finland. Naturally some deviation is allowed since the rate of inflation (increase in prices of goods and services i.e. changes in the consumer price index (CPI)) has been under the target (the Bank of Finland's target is based on the indicator of underlying inflation (IUI), which is calculated on the basis of the CPI, and is said not to be affected directly by fiscal and monetary policy measures) for some time.

[43]   See for example in Andersen (1995) about the issues (strengths, weaknesses etc.) related to different indicators of inflation. See also the discussion in section 4.7.

the central bank's inflation target is expressed is different from the consumer price index which the public follows and understands.

Among other reasons behind the recent acceleration in delegation of legal authority to central bank is the removal of barriers on international capital movements. Free international capital movements broaden opportunities for raising capital abroad and induce politicians to compete more strongly to attract finance and investment from abroad and to prevent capital flight. Handing over new authority to the central bank to grant more stability is seen to help the politicians to attract and/or reassure actual or potential investors and creditors[44].

In addition, the prospect of the EMU, the Maastricht Treaty and the breakdown of the ERM all reinforce the search for alternative nominal anchors. The record of the Bundesbank and the insistence of Germany on structuring a future ECB on the Bundesbank model supplies further impetus for achieving nominal stability by granting more independence to the central bank.

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[44] See Cukierman (1994).

5   EUROPEAN CENTRAL BANK

What kind of a central bank should the European Union have? This is one of the questions Alesina and Grilli (1991) study. Their approach can be seen as an application of the theoretical model we considered in chapter four. We will follow closely their analysis. However, we will present also new results and try to interpret the old ones presented but not discussed by Alesina and Grilli.

It is assumed that citizens of the European Union vote upon a "governor" (a central banker). Each possible governor has a different λ in her objective function. Hence, the voters vote on λ in the central bank's objective function. The voters themselves differ only with respect to λ. For example, voter j has preferences given by:

(5.1) $L^j = \frac{1}{2}E[\pi^2 + \lambda^j(x - x^*)^2]$.

The chosen governor and thus λ is such that there are no other candidates, λ^i, preferred to λ by a majority of voters in a pair-wise comparison. In this set-up[45], majority voting results in the selection of a candidate most preferred by the median voter λ^m. Taken that λ^m roughly equals $\tilde{\lambda}$, in section 4.5, the median voter approach leads to a similar analysis as above. By substituting λ^m for $\tilde{\lambda}$, in (4.10), we get:

(5.2) $L = \lambda(x^*)^2 + \sigma^2(\lambda - \lambda^m)/(1 + \lambda)^3$.

From the first order condition we can derive similar results as above; the appointed European central bank governor is more "conservative" than the median European voter, i.e. $\lambda < \lambda^m$, but not an ultraconservative one, i.e. $\lambda > 0$. By differentiating (5.2) we can also show that:

(5.3a) $d\lambda/d\sigma^2 = [(\lambda^m - \lambda)/(1 + \lambda)^3\{(x^*)^2 + \sigma^2[1 + \lambda + 3(\lambda^m - \lambda)]/(1 + \lambda)^4\} > 0$
and
(5.3b) $d\lambda/d\lambda^m = \sigma^2/(1 + \lambda)^3\{(x^*)^2 + \sigma^2[1 + \lambda + 3(\lambda^m - \lambda)]/(1 + \lambda)^4\} > 0$,

since $\lambda^m > \lambda > 0$. A more "liberal" median voter (i.e. higher λ^m) and a greater variance of employment (i.e. greater σ^2) mean that a more liberal central banker is chosen by the majority rule.

5.1   European system of central banks

In the previous section analysis the loss function and Phillips curve were assumed to be common for the whole Union. However, it is likely that the effects of common

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[45]   Preferences here are of the "intermediate" type, see Alesina & Grilli (1991), Grandmont (1978) and Persson & Tabellini (1990). Thus, even though two issues are considered (inflation and employment) voters' preferences differ only in parameter λ; preferences are single peaked.

monetary policies will be assessed on the national basis. In other words, while the monetary policy will be set at the European Union level, each country will evaluate the consequences of the policy according to its national loss function, which can be represented by:

(5.4) $L_i = \frac{1}{2}E[\pi^2_{EU} + \beta_i(y_i - y^*_i)^2]$,
where
(5.5) $y_i = (\pi_{EU} - \pi^e_{EU}) - \mu_i$.

In (5.4) y_i and β_i are output[46] and the relative weight of country i respectively, and μ_i is a stochastic shock[47] (mean 0 and variance $\sigma^2_{\mu i}$). We have assumed that inflation is the same for the whole Union, i.e. inflation (the policy variable) is controlled at the Union level. Substituting the time consistent or discretionary inflation policy of (4.3) and expected inflation ($\pi^e = \lambda x^*$) into (5.5) and (5.4) we obtain:

(5.6) $L_i = \frac{1}{2}E[(\lambda x^*_{EU} + \lambda\varepsilon/(1+\lambda))^2 + \beta_i(\lambda\varepsilon/(1+\lambda) - \mu_i - y^*_i)^2]$,

which represents "the loss suffered" by country i when the monetary policy is decided at the Union level. From (5.4) and (5.5) we can derive the equilibrium discretionary inflation and output policy rules at the national level:

(5.7) $\pi_i = \beta_i y^*_i + \beta_i\mu_i/(1 + \beta_i)$
and
(5.8) $y_i = -\mu_i/(1 + \beta_i)$

By substituting (5.7) and (5.8) for inflation and output in (5.4) we get the following "national" loss when monetary policy is decided at the national level:

(5.9) $L^N_i = \frac{1}{2}E[(\beta_i y^*_i + \beta_i\mu_i/(1 + \beta_i))^2 + \beta_i(-\mu_i/(1 + \beta_i) - y^*_i)^2]$.

To find out the difference between the two losses we subtract (5.9) from (5.6) and obtain:

(5.10) $L_i - L^N_i = (\lambda^2 - \beta^2_i)(x^*)^2 + (1 + \beta_i)[\lambda^2\sigma^2_\varepsilon/(1+\lambda))^2 - \beta^2_i\sigma^2_{\mu i}/(1 + \beta_i)^2]$
$\qquad\qquad - 2\beta_i[\lambda\sigma_{\varepsilon\mu i}/(1+\lambda) - \beta_i\sigma^2_{\mu i}/(1 + \beta_i)]$,

where σ^2_ε is the variance of ε (now assumed to be the random shock "at the Union level") and $\sigma_{\varepsilon\mu i}$ the covariance between μ_i and ε. In addition, it is assumed that $x^*_{EU} = y^*_i = x^*$.

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[46] Here output is used instead of employment; output can be assumed to be determined in the same way as employment, i.e. according to the expectation augmented Phillips curve relation.

[47] Usually supply shocks are assumed in the connection of Phillips curves, since the Phillips curve closely resembles the supply curve.

From equation (5.10) we can study welfare effects on country i when it joins the monetary union, and is not able to pursue monetary policy independently anymore. Let us first consider political divergence represented by differences between λ and β_i. By assuming away the economic differences ($\sigma_{\epsilon\mu i} = \sigma^2_{\mu i} = \sigma^2_\epsilon = \sigma^2$) and after some tedious manipulation (5.10) can be written:

(5.11) $L_i - L^N_i = (\lambda^2 - \beta^2_i)(x^*)^2 + \sigma^2[\lambda/(1+\lambda) - \beta_i/(1 + \beta_i)][((1 + \beta_i)/(1+\lambda))\lambda - \beta_i]$.

Assuming an ultraconservative European central banker with $\lambda = 0$, (5.11) becomes:

(5.11') $L_i - L^N_i = \sigma^2 - (x^*)^2(1+\beta_i)$.

Participation in the EMU can be welfare improving (loss is smaller) for country i if the variance of the supply shock (output) is so small that the expected gain from less inflation (more credibility) (captured by the second term on the right-hand side) outweighs the expected loss from less stabilization (captured by the first term). Inflation prone countries with relatively small output variation gain from the EMU in this extreme case. This is because inflation is costly and the EMU helps inflation prone countries to "buy" credibility. In fact the central banker with $\lambda = 0$ ensures zero inflation as compensation for the complete lack of output stabilization[48].

Let us in turn analyze the effects of economic differences on welfare. To do so we assume away differences in preferences, i.e. $\lambda = \beta_i$. Therefore (5.10) reduces to:

(5.12) $L_i - L^N_i = (\lambda^2/(1 + \lambda))(\sigma^2_\epsilon + \sigma^2_{\mu i} - 2\rho_i\sigma_\epsilon\sigma_{\mu i})$,

where ρ_i is a correlation coefficient between μ_i and ϵ. σ_ϵ and $\sigma_{\mu i}$ are standard deviations of ϵ and μ_i respectively. If the two shocks are perfectly positively correlated, i.e. $\rho_i = 1$, we get:

(5.13) $L_i - L^N_i = (\lambda^2/(1+\lambda))(\sigma_\epsilon - \sigma_{\mu i})^2$.

In the EMU country i's loss is bigger the more its output differs from the Union one. If $\sigma_\epsilon > \sigma_{\mu i}$ the European Central Bank (ECB) stabilizes too much from country i's perspective, on the other hand if $\sigma_\epsilon < \sigma_{\mu i}$ the ECB stabilizes too little.

If the Union output variability is similar to the national one, but the two outputs are not perfectly correlated, i.e. $\sigma^2_\epsilon = \sigma^2_{\mu i} = \sigma^2$ with $\rho_i \neq 1$, then (5.12) reduces to:

(5.14) $L_i - L^N_i = (\lambda^2/(1+\lambda))(\sigma^2(1 - \rho_i))$.

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[48]   See Alesina & Grilli (1993) and Persson & Tabellini (1990).

Equation (5.14) states that the smaller the correlation between μ_i and ε the worse off country i is by participating in the EMU. This is because the timing of the shocks is different the ECB tends to stabilize when there is not that great a need for stabilization from country i's perspective and vice versa.

As a summary one can conclude that the costs of joining the EMU depend on differences between national and "Union" output variations. The larger the difference in output variations and the lower the correlation between domestic and Union outputs the higher the potential costs of taking part in the EMU.

5.2   Characteristics of national central bank governors

Above the characteristics of the central banker (i.e. λ) were decided by a median voter approach or were exogenously given. The Maastricht Treaty states that monetary policy will be formulated by the ECB's governing council that is composed of members (at least 4) of the executive board and the national central bank governors of the EMU countries. The ECB's governing council will be a fully independent body that asks for and accepts advice from no one. Thus, each country has an opportunity to affect the common monetary policy through the national governor. The appointed governor has an opportunity to compensate for each country's economic divergence from the (median of the) EMU.

What would be appropriate characteristics of a country's governor? According to the Maastricht Treaty the decisions of the governing council will be made by simple majority. Hence, the policy that will be implemented is the one that is preferred (ex post) by the "median" member of the governing council. Therefore, the optimal appointment of a governor for country i is formally obtained by selecting a governor with λ minimizing (5.6). The first order condition determining the choice of λ is:

(5.15) $\lambda(x^*)^2 + (1 + \beta_i)(\lambda/(1 + \lambda)^3)\sigma^2_\varepsilon - \beta_i/(1 + \lambda)^2\sigma_{\varepsilon\mu i} = 0$.

By differentiating (5.15) it can be shown that:

(5.16a) $d\lambda/d\sigma_{\mu i} = \beta_i\rho_i\sigma_\varepsilon/(1 + \lambda)[(1+3\lambda)(x^*)^2 + (1 + \beta_i)\sigma^2_\varepsilon/(1 + \lambda)^3] > <0$
and
(5.16b) $d\lambda/d\rho_i = \beta_i\sigma_{\mu i}\sigma_\varepsilon/(1 + \lambda)[(1+3\lambda)(x^*)^2 + (1 + \beta_i)\sigma^2_\varepsilon/(1 + \lambda)^3] > 0$.

The bigger the standard deviation of domestic output and the stronger the correlation between domestic and Union output, the more liberal a national governor will be chosen for the governing council. Since the output variance comes from the shocks and in this analysis with shocks there is scope for stabilization, it is intuitively sensible that the bigger the shocks the more responsive policy is wanted. However, from (5.16a) it also can be seen that if the domestic output is negatively correlated with

the Union output, $(\rho_i < 0)$, the bigger the standard deviation of domestic output the more conservative a governor will be nominated. This may be because a more active monetary policy would not be of any help from the domestic economy's perspective. On the contrary activist monetary policy would probably aggravate domestic effects of shocks.

From (5.14) we learned that the smaller[49] the correlation between domestic and Union output, the worse off country i would be in the EMU. It may not be intuitively clear why a country would nominate a more liberal governor when the correlation is bigger. Yet, when the correlation is smaller (in the extreme case output is perfectly negatively correlated) it seems intuitively reasonable that a more conservative governor would be nominated (see the above discussion).

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[49]   In the extreme case of perfect negative correlation the ECB would be pursuing contractionary monetary policy when country i is experiencing a recession and vice versa.

6 WHAT CAN BE LEARNED FROM THE ENDOGENOUS MONETARY POLICY MODELS?

The case of central bank independence rests both on theoretical and empirical arguments. The empirical argument is partly based on the observation that there is, cross-sectionally, a negative correlation between various proxies for independence and inflation. Especially, several studies find that, within the group of industrial countries, there is a negative relationship between legal independence and inflation[50]. Some of the studies also find that there is no connection between growth and legal independence. Based on the evidence it seems that a free lunch is offered for industrialized economies by central bank independence; it brings about lower inflation without affecting the growth process[51].

The theoretical argument, on the other hand, is based on the view that policymakers (the principal) are subject to an inflationary bias. Monetary policy enables them quickly, but temporarily to achieve various real objectives such as boosting employment, financing of the budget deficit, curbing the current account deficit and reducing interest rates. In the process the money supply is increased, fueling inflation and inflationary expectations and creating an inflationary bias that persists long after the desirable effects of monetary expansion have disappeared[52].

Although the inflationary bias normally arises because of several objectives, the best known example is that associated with the employment objective for monetary expansion studied earlier. This motive does not seem to be directly applicable to Finland. However, a very similar case of a suboptimally high rate of inflation because of dynamic inconsistency arises in the presence of balance of payments objectives. Such objectives may arise due to a desire to have a sufficient level of foreign exchange reserves in a system with a fixed peg or due to a mercantilistic philosophy (named after features similar to mercantilism).

Following closely Cukierman's reasoning (1992 p.20), consider a small open economy with a fixed but adjustable peg that takes world prices as given. Suppose the policymaker dislikes deficits in the current account (simply due to foreign exchange reserve considerations) and also dislikes inflation (in real terms a currency appreciates in a fixed peg system due to higher inflation). As in the case of the employment motive, the labor market is characterized by a natural real wage that is above the market clearing level and by nominal contracts. After these contracts have been concluded, the policymaker can either devalue or maintain the fixed peg. If the policymaker chooses to devalue, she incurs a cost, since domestic prices and inflation rise. But by raising the domestic price level, a devaluation reduces the real wage

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[50]   See for example Alesina (1989), Grilli, Maciandro & Tabellini (1991), Cukierman (1992 and 1994), Alesina & Gatti (1995), Fischer (1995), Jonsson (1995) and McCallum (1995).

[51]   See Cukierman (1994).

[52]   See Cukierman (1992).

rate, increases employment and output, and leaves more resources for exports and for the production of import substitutes. This reduces the current account deficit. Both in the case of the employment and the balance of payments motives, the conflict concerns the real wage. Because of her employment and/or balance of payments objectives, the policymaker prefers a real wage that is lower than the one desired by unions.

Given that the policymaker's objective functions are known, nominal wages will be set in the labor market so as to neutralize any possible effects of devaluation on the real wage rate. As a consequence, although the policymaker devalues after contracts are signed, the real wage and output remain at their natural levels, and there is no effect on the deficit in the current account. A discretionary attempt to devalue only produces a devaluation bias with no real effects. The formal treatment of the balance of payments motive for monetary expansion is similar to the one used throughout chapter four of this study[53].

It is evident that not even the reasoning behind the balance of payment motive for monetary expansion is directly applicable to the Finnish case. Traditionally in Finland devaluations were used to maintain and increase the international competitiveness of the traded goods sector in the wake of high nominal wage settlements, but they were consistently followed by compensatory wage increases. Basically, the central bank could do nothing but accommodate excessive nominal wage increases. Still, attempts were made to maintain a fixed peg largely through credit rationing and barriers on international capital movements. The success usually lasted until the current account deficit was big enough so that speculation set in and the central bank was forced to devalue. The overall outcome has been described as a devaluation-wage spiral; it was not a question about whether to devalue, but merely when to devalue.

All the arrangements for the monetary policy conduct that require politically motivated principal's (government/parliament) close involvement or supervision are from the credibility's perspective troublesome. There is always a danger of the political manipulation of interest rates, and hence of the monetary aggregates (indirectly), that easily leads to a loss of credibility. Disadvantages of time-inconsistent behavior have become well understood, even among politicians. According to Goodhart (1994a), "This has provided much of the impetus for granting CBs more autonomy ('independence') to vary interest rates as they, the independent CBs, think right, but for the attainment of an objective, i.e. price stability, which has been imposed by government. What Fischer (1994) describes as *operational* independence, but without *goal* independence."

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[53]   See e.g. chapter 5 in Cukierman (1992).

Nevertheless, in Finland this international practice has not been followed, namely the Bank of Finland has self-imposed an inflation target[54], without (final) knowledge of operational independence. So even though the Bank of Finland now has proper instruments in its possession necessary for a fight against inflation, it remains to be seen how much autonomy it may have to vary interest rate(s)[55] if (and when) the desired inflation target (2%) "looks like being broken". Because the relationship between interest rate changes and various monetary aggregates is far from certain, and subject to long and variable lags, which also applies to the relationship between the monetary aggregates and nominal incomes and inflation, it will not be easy to reach consensus over when the target looks like being broken and when the proper time is to act and use contracting measures.

According to the quantity theory of money, inflation cannot persist without sustained increases in the money supply. Thus, if allowed, the central bank is able to control inflation, disregarding extreme economic conditions (e.g. policy co-ordination problems etc.) described for instance in Sargent and Wallace (1981). Alesina and Tabellini (1987) study a non-stochastic version of the model used in chapter four adding a fiscal authority that controls a fiscal instrument[56]. They show that it is still beneficial to have an independent central bank. However, they also show that some of the above derived results, in particular that rules dominate discretion, are not robust when there are policy co-ordination problems. Partly based on this type of reasoning and partly based on some other considerations (personal preferences etc.) some economists (not, however, the above-mentioned authors) feel that "excessive independence" may interfere with potential stabilization effects of monetary policy[57].

It would definitely be beneficial not to have policy co-ordination problems. In addition, if in the society the benefits of low (and harm of high) inflation were widely felt in the form that everybody understands and accepts, the road to price stability would be considerably smoother. However, this is not always the case, still it is probably beneficial to try and reach for the objective of price stability.

One has to consider very carefully the management of crisis situations, when preparing, for example, the new central banking law in Finland[58]. One solution the literature has suggested to handle this problem combines a simple rule with discretion,

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[54]   Albeit the approach to meet the target follows international "standards", see the above discussion.

[55]   See Pikkarainen (1993 and 1995) about the central bank instruments.

[56]   Lippi (1995) studies a stochastic version of a similar model (two policy instruments (fiscal and monetary), but only one policymaker) and concludes that partial discretion (rule only for monetary policy) is optimal from both a stabilization and credibility perspective. Unlike with optimal central bank contracts that restored the monetary policy flexibility and credibility, in this setup there seems to be a clear trade-off between credibility and flexibility of monetary policy.

[57]   For example Hetemäki (1994) refers to Sargent & Wallace (1981) and seems to take this position .

[58]   It appears that Hetemäki (1994) stresses this aspect even at the expense of management of normal times.

i.e. the "solution" would be a combination of rules for normal times with explicit escape clauses to deal with abnormal times[59]. Yet, it appears, judging from international and e.g. from Finnish experience, that the prerequisite for better success in reaching the goal of price stability is not how well we are prepared to deal with abnormal times, but to manage (to pursue properly accommodative monetary policy) normal times.

There is a large body of literature that handles the management of normal times, namely how to maintain a sound reputation in monetary policy. Models used in this literature abstract away from uncertainty caused by shocks[60] simply because the formal analysis of these multiperiod models of monetary policy is complicated and with uncertainty the analysis becomes very quickly even more so. Naturally, there is a lot to be learned from these models. Especially, from the positive point of view, repeated games with incomplete information provide a more realistic prescription of possible incentives involved in the policy making process. The relevant question models of reputation try to answer is whether reputation can form a substitute for commitments. The answer seems to be a qualified yes[61]. From the normative point of view, however, until now these models have not been that successful in providing answers to e.g. what should be a proper institution design in order to strive toward the goal of price stability. These models have something to say about the value of maintaining a reputation, once you have earned one. Yet, they have less, besides reputation building, which is mainly being tough on inflation, to say about how such a reputation can be acquired. It looks as if the suggestions derived from one-shot games in chapter four would provide a good starting point to reputation building.

Another problem with these models is that there are many possible reputation equilibria and the policymaker and all private agents must "co-ordinate" on one of them. This co-ordination problem has also been extended to cases were there is more than one policymaker in one country or at the international level, i.e. it is a question of double credibility; one deriving from interaction between policymakers and the other deriving from the interaction between each policymaker and the private sector. Other possible extensions of the models include e.g. structural dynamics, due to the complexity of the models solutions have been largely proceeded by computer simulations.

In the reputation literature the basic setting is the same as above, i.e. the policymaker has an incentive to improve employment through monetary expansion, at the expense of both future reputation and low inflation. If private agents have complete

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[59]   See Flood & Isard (1988) and Persson & Tabellini (1990).

[60]   See Persson & Tabellini (1990). The analytical tools used in this literature are formulated in the industrial organization literature. Tirole (1989) provides an excellent introduction to these concepts (repeated games of incomplete and complete information, signaling, mimicking etc.).

[61]   About the relevant qualifications in this connection check e.g. in Rogoff (1989) and Persson & Tabellini (1990).

information about the policymaker's preferences and the game is of finite horizon, then the policymaker always has an incentive to surprise in the end. With complete information rational private agents realize this and the equilibrium outcome is the same as in one-shot games under discretion. There is said to be a dominant strategy in this kind of a game; the dominant strategy for every period is the one with inflation bias. The future costs in the form of credibility loss and higher expected and actual inflation can be shown to help to relax this short-run incentive constraint so that equilibria with lower inflation can be sustained.

When private agents have incomplete information and try to learn about the policymaker's preferences by observing her actual policy choices, a possibility opens to use of richer models of reputation building in monetary policy. With these models one can get rid of some of the unattractive aspects of the models of complete information[62]. In addition, these models can be seen as an attempt to analyze changes in the policy regime, consequences of such changes for private behavior and the feedback of private behavior on policymaker's incentives.

In Finland attempts have been made to change the policy regime several times. The course of the process in Finland was roughly as follows; first came excessive wage increases, then accommodative monetary policy and finally "surprise" inflation in the form of a devaluation. It was a question of reputation building. Policymakers announcements of the regime shift were not credible. Private agents (labor unions and central wage-setting union) correctly anticipated "surprise" devaluation in their behavior after every "surprise" devaluation. The question concerned and still concerns whether the central bank is allowed to really surprise by lower than expected inflation already early enough during the process (spiral) rather than by devaluation in the end, and hence act more in accordance with the fixed peg regime[63].

Presumably, before the implementation of central banking law in Finland (its drafting seems to be taking a surprisingly long time; according to recent opinions it will not be implemented before the end of 1996), it will be seen how much autonomy the Bank of Finland may have to vary interest rates, especially its tender rate, which is claimed to be both the main monetary policy instrument and intermediate target. The current setting[64], in which the Bank of Finland has taken the initiative from other parties involved (government, parliament), may not last until its target(s) and status (and possibly means) are backed by the central banking law. Since the legislation is mostly in the hands of the other parties involved, it remains to be seen when and what sort of a law will be implemented[65].

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[62]   See for example Rogoff (1989), Persson & Tabellini (1990 and 1994a).

[63]   Among the first to consider similar approaches were Backus & Driffil (1985) and Tabellini (1985).

[64]   It is "unconventional" as far as the current division between operational and goal independence is concerned. Otherwise the Bank of Finland's approach for the monetary policy conduct appears to be in accordance with international "standards".

[65]   The drafting and implementation of the central banking law seems to take suspiciously long time taken

Although these and earlier models in this study shed light on several important issues, they suffer from shortcomings; the most serious of which is that these models are too ad hoc, especially, links between the policymaker's objective and private objectives and behavior are not spelled out clearly enough[66]. Accordingly there is a growing literature on the interaction between political parties in macroeconomic policy making largely motivated by this fact. In this literature, credibility-related issues arise as a direct result of elections, which potentially make constraints policymakers face before and after elections very different. This literature gives a new interpretation among other things to political business cycles, which earlier were considered to be a result of the irrational behavior of incumbents[67].

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that the Maastricht Treaty does not leave much room for different interpretations in different member countries concerning the central bank status. It is not clear why the drafting is taking so long, unless Finland wants to wait and see if the inter-govermental conference of 1996 will bring about changes relevant in the matter - although this matter may not be on the agenda (this seems to be the position e.g. Finland is taking). A further shortcoming with this strategy is that meanwhile the goal of price stability may gradually slip away and may not be attainable at reasonable costs. Accordingly, the work done by the committee considering the Bank of Finland's status (Suomen Pankki -komitea 1994) provides a good basis for a swifter law-making process.

[66]   See e.g. Cukierman (1992) , Goodhart (1994b) and Persson & Tabellini (1990).

[67]   See for example in Nordhaus (1975) about the traditional political business cycle theory with backward looking and irrational voters. For example in Rogoff & Sibert (1989), Alesina (1989), Persson & Tabellini (1990), Alesina & Roubini (1990), Alesina, Cohen & Roubini (1991), Persson & Tabellini (1994b) and Alesina & Rosenthal (1995) new approaches can be found including e.g. a theory which generates an equilibrium even with forward looking and rational voters. The traditional theory is inconsistent with forward looking voting behavior, namely why would a rational voter ever put any weight in her voting decision to policymaker's actions before the elections if what matters is the policymaker's behavior after the elections. This is one issue the new theory deals with.

7 CONCLUDING REMARKS

In the beginning of this study we briefly reviewed the recent history of macroeconomics from a stabilization perspective. From a theoretical point of view it is evident that in the course of time attitudes towards the scope for stabilization have become far less mechanical concerning, for example, the private sector expectation formation process or the role of the policy itself. This is partly because methods and thinking in macroeconomics have evolved over time. Perhaps more importantly, however, it is because the discretionary setting of policy has performed so poorly in practice from the perspective of price as well as output stability.

Accordingly, critics claim that no-one has the information necessary to devise a satisfactory forecasting method for discretionary setting of, for instance, main monetary policy instruments. The discretionary setting of policy instruments appears to be a complicated matter, even in the presence of necessary information concerning relevant time lags as demonstrated in chapter two. In this connection the relevant time lags consist of observation, decision and effect lags. The first two form the so-called inside lag, which is the time between a shock to the economy and the policy action responding to that shock. This lag arises since it takes time for policymakers both to recognize a shock and to put appropriate policies into effect. The effect or outside lag is the time between a policy action and its effect on the economy.

Suggestions that it may be desirable to have rules rather than discretion e.g. in monetary policy are based on macroeconomic games in which policy is made endogenous by specifying an objective function for the policymaker and assuming that the policymaker maximizes her objective under the constraints set by private equilibrium behavior. All the analyses of the policy credibility in various fields of macroeconomics share the same broad features; namely, the credibility problem arises because the constraints the policymaker faces ex ante are different from those faced ex post. Ex ante, before the private sector makes any choices, an optimal policy induces some response of private behavior. Ex post, after the choices have been made, the response to policy differs from the ex ante response, hence making the policymaker's ex post constraints different from the ex ante constraints.

If the policymaker is able to make a binding commitment to the ex ante optimal policy, then the policy is naturally optimal also ex post; no ex post incentive to deviate from the ex ante optimal policy can arise. Binding commitments cannot be made in practice, however, and optimal policies with commitments face a credibility problem because of ex post incentives to deviate from the policy. Forward-looking rational private agents only believe in policy announcements that are optimal to carry out also ex post. The credibility requirement in the form of ex post optimality adds an additional constraint to the policymaker's policy problem. This additional constraint in general implies welfare losses relative to the ex ante optimal policy.

In chapter four we considered how serious the credibility problem is, i.e. how does the ex post optimal policy differ from the ex ante optimal policy. The former is credible and time consistent, but it is associated with the inflation bias with no gains in real terms. The latter has no inflation bias, but it is optimal (credible) only if binding commitments can be made. Chapter four tried to find ways to avoid welfare losses due to the credibility problem, namely we studied ways to support the ex ante optimal policy taking into account the fact that binding commitments cannot be made. As we saw in chapter four institution reforms matter the most in the literature of macroeconomic games.

Among the first innovations concerning institution design in monetary policy was Rogoff's (1985) idea of a conservative central banker. If the central bank is independent enough to allow preferences of people in charge of monetary policy (the central banker) to play a role in the economic-political decision making, the appointment of a conservative central banker may help to solve the credibility problem associated with a low inflation policy. If the model, as in section 4.5, allows for uncertainty, a central banker who puts more weight on inflation than the median voter in the economy would improve the outcome compared to the discretionary regime. Thus delegating policy to an independent central banker who is averse to inflation improves credibility; the cost is suboptimal policy responses to shocks.

What sort of an incentive structure should the principal (government/parliament) establish for the central bank in order to eliminate the inflation bias of discretionary policy while still preserving the ability of the central bank to respond with discretion to new information? This is the question studies dealing with optimal central bank contracts try to answer. In section 4.6. we studied a simple transfer scheme within our model according to which the central bank's incentives should be dependent on the state of the economy (inflation) in order to achieve both the credibility and the flexibility in monetary policy. This sort of reasoning can also be found behind the recent wave of delegation of monetary policy to a central bank with a formal, legal mandate to achieve a single goal of price stability, and both the autonomy and incentives to do so.

As was argued in section 4.7, circumstances where there is a single, quantifiable objective the central bank is mandated to achieve make the central bank more, rather than less, democratically accountable. In Goodhart's (1994a) opinion both its objective, and success in achieving that target, can be made crystal clear. There are many different suggestions for the central bank goal; central bank officials themselves in various countries appear to have been in favor of final price objectives over intermediate targets. However, final price objectives cannot be achieved directly, but rather indirectly through intermediate instruments. Naturally there is a disagreement over which intermediate instrument (monetary base or interest rate) the central bank should seek to control. It seems that the best one can do is to let the central bank officials go for the final price objective, if they wish, using whichever intermediate

instrument they prefer as long as the cost of failure is internalized in the central banks by an appropriate incentive structure, i.e. by an optimal central bank contract.

In chapter five we showed based on the approach in Alesina and Grilli (1991) that participation in a monetary union is beneficial for an inflation prone country with relatively small output variation. In that case expected gains from less inflation outweigh expected costs from less stabilization the monetary union is assumed to provide. In addition, it was shown that the bigger the output variation of a country, and when the country's output is negatively correlated to the monetary union output, the more conservative (puts more weight on inflation than output stabilization) a central bank governor should be nominated in the country. This is because the more negative the output correlation is, the less weight the country prefers the monetary union to put on output stabilization. Each member country of the EMU can affect the monetary policy pursued by the EMU through her central bank governor.

In chapter six we briefly considered models in the so-called reputation literature and tentatively concluded that reputation can form a *substitute for commitment*. The weakness until now in these models is that they do not have much to say about how such a reputation can be acquired. Another problem with these models is that there are many possible reputation equilibria and the policymaker and all private agents must "co-ordinate" on one of them.

In chapter six and section 4.7 we also briefly evaluated Finnish experiences from the perspective of endogenous monetary policy models. Even though these models may not directly be applicable to the Finnish case and despite the models' deficiency of "microfoundations", there is definitely something to be learned from them.

What matters the most in the endogenous policy models is the institution design. It is precisely changes in institutions and hence in policymaker's incentives that bring about changes in equilibrium policy. As far as the monetary policy conduct is concerned, the literature of endogenous policy models straightforwardly recommend rules over discretion. Furthermore, according to endogenous policy models it would be beneficial to have a conservative central bank(er) who is independent enough to allow her preferences to play a role; it may help to resolve the credibility problem associated with a low inflation policy.

The recent innovation in the form of optimal central bank contracts goes a step further. This approach namely argues that it would be beneficial to have a contract which makes the policymaker's (the agent) "utility" dependent on her success in meeting the inflation target. In practice this literature has been interpreted to favor such an institution reform that the principal (government and parliament) of the agent (central bank) imposes an explicit inflation target in addition to the general mandate for price stability (central-banking law), and makes the central bank leadership explicitly accountable for its success in meeting the target, i.e. the agent's util-

ity (in practice her position or even paycheck etc.) is tied to her performance through the contract. This can be shown to guarantee both the credibility and flexibility of monetary policy.

Currently the Bank of Finland has the initiative concerning monetary policy; it seems to pursue monetary policy independently. However, this cannot be a permanent arrangement, because the Maastricht Treaty allows very little room for maneuver. What is needed according to the literature of endogenous policy models is to swiftly implement the law concerning the Bank of Finland's status. The work done by the committee considering this question provides an excellent starting point and guidelines to follow in drafting the central banking law. After all it is institution reforms that matter the most; they bring about changes in equilibrium policies.

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