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The Choice of Monetary Regime: Fiscal Implications

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Abstract

The article examines how government spending is determined in a closed economy where the nominal wage is pre-set through contracts and the wage setters have perfect foresight regarding subsequent policy decisions. The monetary regime affects government spending because: (i) with a pre-set nominal wage, a given change in government spending has different effects on employment and inflation under different monetary regimes, and (ii) the authorities' inclination to expand government spending is affected by the inflation rate which depends on the monetary regime. If the costs related to inflation are high, a comparison between monetary regimes suggests that welfare is highest under nominal income targeting where the nominal income target is determined to bring about price stability.

Keywords: Monetary regimes; fiscal policy; monetary non-neutrality.

JEL classicification: E42, E61, E62.

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1 Introduction

The literature has discussed the choice of monetary regime in the context of notably two questions, namely first to what exctent it is possible through the choice of monetary regime to reach a reduction in inflation, and second to what extent the monetary regime affects output variability. The literature based on Kydland and Prescott (1977) and Barro and Gordon (1983) sees the choice of monetary regime as involving a trade-off between inflation and output variation.[1] The question of minimising output variation has been the central issue in the more recent literature based on optimising foundations and on the presence of nominal wage or price rigidities. In this literature, the optimal monetary regime is seen as the regime which brings average output as close as possible to potential output.[2]

Much less has been written on fiscal issues in the choice of monetary regime. Alesina and Tabellini (1987) and Debelle and Fisher (1995) analyse how the monetary regime impacts on the equilibrium levels of production and unemployment because the monetary regime determines the size of inflation tax/seignorage which in turn affects the tax rate on production. Jensen (1994) examines how the loss of inflation tax/seignorage in the case of low inflation leads to a rise in the tax rate on labour income which raises natural unemployment due to a weaker incentive to work. A number of studies consider issues related to the open economy, discussing the need for rules in a monetary union and the strategic interaction between monetary and fiscal authorities under different exchange rate regimes.[3] There is finally a literature which discusses the choice of monetary regime under the assumption that the price level is determined by the fiscal authority's budget constraint.[4]

In this article, the relationship between on the one side the monetary regime and on the other side the authorities' inclination to pursue an expansive fiscal policy is examined under the assumption that decisions on fiscal policy are made by a benevolent government which optimises a representative individual's utility. It is further assumed that there is a short-term nominal rigidity which in the analysis takes the form of one-period nominal wage contracts. The nominal wage contracts are pre-set at the beginning of the period by optimising agents who have perfect foresight concerning the authorities' subsequent policy decisions when the nominal wage is determined. This time sequence corresponds to Kydland and Prescott (1977) and Barro and Gordon (1983). The economic framework is based on optimising foundations.

[1] See e.g. Rogoff (1985) and Svensson (1997).

[2] See e.g. Goodfriend and King (1997), Erceg, Henderson and Levi (2000), and Gali (2002).

[3] See Agell, Calmfors and Jonsson (1996), Beetsma and Bovenberg (1998, 2001), Caselli (2001), Dixit (2001), Dixit and Lambertini (2001), and Ostrup (2000). There is further an extensive literature which deals with the specific problems of the European Monetary Union, see e.g. Levine and Brociner (1994).

[4] See e.g. Woodford (2001).

Based on these assumptions regarding policy behaviour and economic structure, it is demonstrated that the monetary regime affects government spending through two channels: (1) given a pre-set nominal wage, there are differences between monetary regimes with respect to how a change in government spending affects production and inflation, and (2) the government's inclination to expand government spending is affected by the inflation rate which in turn is determined by the monetary regime. None of these channels which provide for a connection between the monetary regime and government spending, have previously been discussed in the literature.

Due to this impact of the monetary regime on government spending, different monetary regimes lead to different levels of welfare. Government spending affects the representative individual's utility and thus welfare because the individual derives utility from public consumption, consisting of goods which are placed at the individual's disposal through the government budget, and because government spending affects the individual's possibility of reaching utility through private consumption, consisting of those goods which are bought directly from firms by the individuals. The finding of monetary regimes having an effect on welfare carries important policy conclusions. In their choice of monetary regime, it should be taken into consideration not only to what extent inflation can be reduced or - in the case of a stochastic model setting - to what extent it is possible to improve the trade-off between inflation and output variability. It should be considered also how the monetary regime has an effect on the representative individual's utility by affecting the size of government spending.

The article compares government spending under three types of monetary regime. In the case of policy discretion, monetary policy is determined to optimise a representative individual's utility. Under inflation targeting, the monetary authority uses monetary policy to optimise preferences which include an employment goal and a goal of price stability. Finally, under nominal income targeting monetary policy is used to maintain a specific growth in nominal income. It is demonstrated that government spending at low rates of inflation is highest under nominal income targeting. This is also the regime which at low rates of inflation brings government spending closest to its optimal level. In the case where the monetary authority under nominal income targeting can commit to a low rise in the nominal income target and thus to a low rate of inflation and if the costs related to inflation are relatively high, it follows that nominal income targeting should thus be preferred to the two other monetary regimes. This argument in favour of nominal income targeting is additional to those which have previously been discussed in the literature, in particular a better adjustment to supply shocks and a stabilising effect on inflation in the case where the monetary authority is unable to pre-commit.[5]

[5]For a discussion regarding the optimnal adjustment to shocks, see e.g. Beetsma and Jensen (1999), Feldstein and Stock (1994), Fischer (1995), Hall and Mankiw (1994), and McCallum and Nelson (1999). Jensen (2202) considers the impact of nominal income targeting on inflation when there is a staggered price setting and when the monetary authority is unable to precommit.

Section 2 sets out the basic model. *Section 3* derives natural employment. *Section 4* considers how government spending is determined. *Section 5* analyses government spending under policy discretion where monetary policy is set to optimise the individuals' utility. *Section 6* examines inflation targeting. *Section 7* considers nominal income targeting. *Section 8* compares the level of government spending under the three monetary regimes. *Section 9* discusses welfare implications. *Section 10* brings a summary and conclusion.

2 The model

The analysis is based on a standard model built on optimising foundations. The framework is deterministic. There are four types of economic agents: (i) individuals who optimise utility and who deliver a labour input to the firm, (ii) firms which determine production to optimise profit and which operate in competitive markets, (iii) the government which makes decisions on government spending and thus on the tax rate, and (iv) a monetary authority which controls the money supply. Individuals and firms operate at the microeconomic level, taking prices, wages, and economic policy variables as given in their optimisation.

The analysis considers, without loss of generality, a single time period. The interaction between economic agents which takes place in the course of this period, is repeated in all periods, implying that the analysis applies to a long-term equilibrium. At the beginning of the period, the nominal wage is set in advance for one period at a level which brings about equilibrium in the labour market during the contract period. Subsequently, in the course of the time period and on the basis of the pre-set nominal wage, the firm decides on employment and production while the individual determines the consumption of goods and the size of money balances. Also in the course of the time period, the government makes decisions on the level of government spending. An assumption is made of a balanced government budget, government spending being financed through a tax on production. In the case of a monetary regime based on policy discretion, monetary policy decisions are made subsequent to the wage setting at the same time as fiscal decisions, the aim of the monetary authority being to optimise the utility of the representative individual. In the case of a monetary regime based on rules in the form of inflation targeting or nominal income targeting, these rules are set in advance prior to the government's determination of government spending.

A distinction is made between two kinds of consumption which brings utility to the representative individual: (i) private consumption, and (ii) public consumption. Private consumption consists of those goods which are bought directly by the individual from the firms and which is thus controlled by the individual. Public consumption consists of those goods which are placed at the free disposal of the individual by the government, e.g. welfare services or other public services. The individual cannot affect the size

of public consumption which is determined by the government at the macroeconomic level. The government buys the goods which form part of public consumption from the firms. The representative firm's output is thus divided between private consumption and public consumption.

Besides utility from private consumption and from public consumption, the individual experiences utility from money holdings while there is disutility from work and from inflation. The inclusion of inflation in the individual's utility covers the negative effects which may result from inflation, e.g. costs related to the gathering of price information and shopping time.[6] The utility function of the representative individual is

$$(1) \qquad U = \log(C) + \vartheta \log(G) - \frac{\kappa}{\nu} L^{\nu} + \rho \log\left(\frac{M}{P}\right) - \frac{1}{2}\chi\pi^2,$$
$$\pi \equiv p - p_{-1}, \quad p_{-1} \equiv 0, \quad \vartheta > 0, \quad \kappa > 0, \quad \nu > 1, \quad \rho > 0, \quad \chi > 0,$$

where U represents the utility of a representative individual, C the private consumption of goods, G public consumption, L the supply of labour, M nominal money balances, P the price on goods, and π inflation. The parameter ϑ expresses the utility from public consumption, κ and ν the disutility from work, ρ the utility from money balances, and χ the disutility associated with inflation. p is the log of the price level P.

The individual receives an income from work and from dividends. Dividends are distributed lump-sum with an equal amount to each individual. In order to abstract from the effects arising from inflation tax/seignorage on the individual's incentive to work, it is assumed that the individual receives a lump-sum transfer from the government which is equal to the real cost associated with holding money. This gives the individual's budget constraint as

$$(2) \qquad \frac{W}{P}L + \psi + \varpi = C + \pi\frac{M}{P}, \quad \varpi = \pi\frac{M}{P},$$

where W is the nominal wage, L employment, ψ dividends received by the representative individual, and ϖ a lump-sum transfer from the government, the size of which corresponds to the individual's loss of purchasing power related to holding money balances.

The representative individual optimises the utility given by (1) under the budget constraint (2) with respect to private consumption C, employment L, and money balances M. In the optimisation, the individual takes prices P, the nominal wage W, public consumption G, dividends ψ, and government transfers ϖ as given. Optimising (1) with respect to consumption C, employment L, and money balances M under the

[6] There is no agreement in economic theory as to the exact nature of these costs. A discussion is found in Zhang (2000). The weight attached to inflation in policy discussions indicate, however, that the costs may be considerable.

constraint of (2) gives:

$$\kappa L^{\nu-1} = \frac{1}{C}\left(\frac{W}{P}\right), \tag{3}$$

$$\frac{M}{P} = C\left(\frac{\rho}{\pi}\right). \tag{4}$$

Equation (3) shows the labour supply as a function of consumption and of the real wage. The left-hand side reflects the marginal disutility from work while the right-hand side is the increase in utility which results from a further work effort. $(1/C)$ is the marginal utility from private consumption while the real wage W/P represents the rise in real income which can be reached by an increase in employment. (4) represents the demand for money balances.

We next consider the representative firm. The firm produces a single good which is used for private consumption and for public consumption. The firm operates under perfect competition in product markets. A tax is levied on the firm's production. The firm maximises

$$\Pi = (1-\tau)Y - \frac{W}{P}L, \quad 1 \geq \tau \geq 0, \tag{5}$$

where Π is real profit for the representative firm, τ the tax rate on production, and Y production.

The firm uses a labour input for production. The production technology is given as

$$Y = L^{\alpha}, \quad 1 > \alpha > 0, \tag{6}$$

where α is the elasticity of production with respect to labour.

Optimising (5) with respect to labour and using the production function specified by (6) gives the firm's demand for labour as

$$L^{1-\alpha} = \alpha(1-\tau)\left(\frac{W}{P}\right)^{-1}. \tag{7}$$

We next turn to the government. There is a balanced government budget. All government spending is used for public consumption. Due to the assumption made in (2) of inflation tax/seignorage being returned to the individuals through lump-sum transfers, government spending equals the tax revenue which is derived from the tax imposed on production. This gives the condition for the government budget as

$$g = \tau, \quad g \equiv \frac{G}{Y}, \tag{8}$$

where g shows government spending relative to production.

Production is used for either private consumption or for public consumption, implying that $Y = C + G$. Using (8), this can be expressed as

$$C = Y(1 - g). \tag{9}$$

Equation (9) gives the condition for equilibrium on the goods market, showing private consumption to equal production with the deduction of public consumption.

3 Natural employment

The nominal wage is set at the beginning of the time period through a contract at such a level that there is equilibrium on the labour market in the course of the contract period.[7] There is perfect foresight among firms and individuals concerning the policy setting which takes place subsequently during the wage contract period. The supply of labour is determined by the condition for the individual's optimisation with respect to work, shown by (3), while the demand for labour is determined from the firm's optimisation with respect to employment, given by (7). Combining (3) with (6), (7), and (9) gives

$$L' = \left(\frac{\alpha}{\kappa}\right)^{\frac{1}{\nu}}, \tag{10}$$

where L' is the employment which is realised in the course of the wage contract period, in the following referred to as the natural employment.

It follows from (10) that natural employment lies at an exogenously given level, being determined only by the production structure and by the individual's preferences with respect to work.

4 The determination of fiscal policy

The government determines government spending to optimise the representative individual's utility given by (1). In line with the literature, we neglect the utility which arises from money balances.[8] The government thus sets government spending to optimise preferences that are given as

$$V^g = \log(C) + \vartheta \log(G) - \frac{\kappa}{\nu} L^\nu - \frac{1}{2}\chi\pi^2, \tag{11}$$

[7] No difference in the basic findings would result if it had alternatively been assumed that the nominal wage is determined by a representative individual who is in a monopoly position in the labour market. For simplicity, we have chosen the assumption that the nominal wage is set at a level which brings about equilibrium in the labour market.

[8] See e.g. the 'New Open-Economy Macroeconomics' literature based on Obstfeld and Rogoff (1995).

where V^g expresses the government's preferences.

Optimising (11) with respect to government spending and using (8)-(9), gives the condition for the government's determination of fiscal policy

$$(12)\quad \frac{\partial V^g}{\partial g} = -\left(\frac{1}{1-g}\right) + \vartheta\left(\frac{1}{g}\right) + \left[1 + \vartheta - \frac{\kappa}{\alpha}L^\nu\right]\left(\frac{\partial y}{\partial g}\right) - \chi\pi\left(\frac{\partial p}{\partial g}\right) = 0,$$

where y is the log of production Y.

Equation (12) shows the increase in utility which can be reached by the government from a rise in government spending. There are four effects. The first term in $\partial V^g/\partial g$ shows the decrease in utility which follows because a rise in government spending, and thus in the tax rate, lowers private consumption. The second term in $\partial V^g/\partial g$ expresses the rise in utility which results from a rise in public consumption. The third term in $\partial V^g/\partial g$ shows the impact on utility which follows because a given change in government spending may affect production, a change in production having an impact on utility because it affects the utility which is derived from private and public consumption and the disutility which is caused by an increase in the work effort. Finally, the fourth term in $\partial V^g/\partial g$ reflects the impact on utility which arises because government spending may affect inflation.

It follows from the condition for the individual's optimisation with respect to labour, given by (10), that $(\kappa/\alpha)L^\nu = 1$. Combining (12) with (10), the condition for the government's optimisation with respect to government spending can thus be expressed as

$$(13)\quad g = \frac{\vartheta}{1 + \vartheta - \Phi}, \quad \Phi \equiv \vartheta(1-g)\left(\frac{\partial y}{\partial g}\right) - \pi\chi(1-g)\left(\frac{\partial p}{\partial g}\right),$$

where Φ is a functional relationship which depends on inflation and on the effects which a change in government spending has on production and on the price level.

The condition shown by equation (13) expresses how government spending is determined. Government spending relative to production is increased when there is a rise in Φ. It results that government spending relative to production is determined by (i) the effects which a given rise in government spending has on production and on inflation, expressed by respectively $\partial y/\partial g$ and $\partial p/\partial g$, and (ii) the rate of inflation π. The government opts for a higher level of government spending if a given rise in government spending has a bigger effect on production, implying that $\partial y/\partial g$ increases, and a smaller effect on inflation, implying that $\partial p/\partial g$ becomes smaller. It further follows that government spending to a larger extent will be determined by the consideration to reduce inflation when inflation is high. In the case where government spending raises inflation, that is, if $\partial p/\partial g > 0$, government spending relative to production is negatively affected by inflation.

The condition for the determination of government spending shown by (13) is central in the analysis. We will demonstrate in the following that the monetary regime

affects the condition (13) - and thus the level of government spending - through two channels. First, the monetary regime determines the impact which a given change in government spending has on production and on the price level, that is, the monetary regime determines $\partial y/\partial g$ and on $\partial p/\partial g$. Second, the monetary regime affects government spending because the monetary regime determines the level of inflation π.

5 Policy discretion

We will next consider how government spending is determined under a monetary regime where monetary policy is set discretely to optimise the individual's utility. In line with the literature, we disregard the impact of money balances on utility. The monetary authority's preferences are thus given as

$$V^m = \log(C) + \vartheta \log(G) - \frac{\kappa}{\nu} L^\nu - \frac{1}{2}\chi\pi^2, \tag{14}$$

where V^m shows the monetary authority's preferences.

Optimising (14) with respect to the money supply and using (8)-(9) gives the condition for the monetary authority's optimisation as

$$\left[1 + \vartheta - \frac{\kappa}{\alpha} L^\nu\right] \left(\frac{\partial y}{\partial m}\right)^{PD} - \chi\pi^{PD} \left(\frac{\partial p}{\partial m}\right)^{PD} = 0, \tag{15}$$

where the superscript PD denotes policy discretion. m is the log of the money supply M.

Monetary policy and government spending are determined after the nominal wage has been pre-set through contracts. This implies that the authorities in their decisions on monetary and fiscal policies base themselves on the effects which government spending and the money supply have on production and on the price level in a short-term model characterised by a pre-set nominal wage. Combining the condition for the firm's optimisation with respect to employment, shown by (7), with the condition for the individual's optimisation with respect to money balances, expressed by (4), and with (6) and (8)-(9) gives the equation system

$$y = -\frac{\alpha}{1-\alpha}(w - p) + \frac{\alpha}{1-\alpha}\log(1-g) + \frac{\alpha}{1-\alpha}\log(\alpha), \tag{16}$$

$$m - p = y + \log(1-g) - \log(\pi) + \log(\rho). \tag{17}$$

Equations (16) and (17) expresses the economic system on the basis of which the authorities determine monetary policy and government spending. (16) shows the supply of goods as a function of the real wage and government spending while (17) represents money market equilibrium. In the case of a pre-set nominal wage, equations (16) and

(17) determine production y and the price level p as functions of government spending relative to production g and of the money supply m.

Given a pre-set nominal wage, we derive from (16) and (17) the impact of changes in the money supply on production and the price level as

$$(18)\quad \left(\frac{\partial y}{\partial m}\right)^{PD} = \alpha > 0, \quad \left(\frac{\partial p}{\partial m}\right)^{PD} = 1 - \alpha > 0.$$

It follows from (18) that a rise in the money supply increases production and the price level. Using (18) in (15) and further using from (10) that $(\kappa/\alpha)L^{\nu} = 1$, gives the condition for the monetary authority's optimisation as

$$(19)\quad \pi^{PD} = \left(\frac{\vartheta}{\chi}\right)\left(\frac{\alpha}{1-\alpha}\right).$$

Equation (19) shows that inflation under policy discretion is determined by (i) the utility which the individual derives from public consumption, expressed by ϑ, and (ii) the disutility which the individual experiences from inflation, shown by χ.

Corresponding to the monetary authority, the government determines government spending on the basis of the nominal wage which has been pre-set at the beginning of the period. We derive from (16) and (17) the impact of government spending on production as

$$(20)\quad \left(\frac{\partial y}{\partial g}\right)^{PD} = 0, \quad \left(\frac{\partial p}{\partial g}\right)^{PD} = \frac{1}{1-g} > 0.$$

It follows from (20) that production is unaffected by a rise in government spending relative to production while there is a positive impact on the price level.

Combining (19) and (20) with (14), the condition for the determination of government spending is

$$(21)\quad g^{PD} = \frac{\vartheta}{1 + \vartheta - \Phi^{PD}}, \quad \Phi^{PD} \equiv -\vartheta\left(\frac{\alpha}{1-\alpha}\right).$$

Equation (21) shows how government spending is determined under a monetary regime which implies discretion in the setting of monetary policy.

6 Inflation targeting

We will next examine government spending in the case where the monetary authority adjusts the money supply to optimise preferences which include an inflation target and a target of bringing employment close to a desired level. We refer to this regime as

inflation targeting. There is an exogenously determined difference between the employment desired by the monetary authority and the natural employment. The monetary authority optimises

$$(22)\quad V^m = -\left(l - l''\right)^2 - \chi^m \pi^2, \quad \chi^m > 0, \quad l'' - l' = h > 0, \quad h = \overline{h},$$

where l'' is the monetary authority's desired employment (logarithmic value), χ^m is the weight which the monetary authority attaches to inflation, and h is the difference between the monetary authority's desired employment and natural employment.

The monetary authority optimises (22) with respect to the money supply on the basis of the pre-set nominal wage, i.e. on the basis of equations (16) and (17). Optimising (22) and using (16) and (17) gives the price and employment levels which are compatible with the monetary authority's optimisation:

$$(23)\quad \pi^{IT} = -\frac{1}{\chi^m}\left(l - l''\right)\left(\frac{1}{1-\alpha}\right),$$

where the superscript IT denotes inflation targeting.

The government acts on the basis of the monetary rule expressed by (23) when it determines government spending. Given a pre-set nominal wage, it follows from (23) in combination with (16) that the impact of government spending on production and on the price level is

$$(24)\qquad \left(\frac{\partial y}{\partial g}\right)^{IT} = -\left(\frac{1}{1-g^{IT}}\right)\left(\frac{\alpha}{1-\alpha}\right)\left(\frac{1}{A}\right) < 0,$$

$$\left(\frac{\partial p}{\partial g}\right)^{IT} = \left(\frac{1}{1-g^{IT}}\right)\left(\frac{A-1}{A}\right) > 0,$$

$$A \equiv 1 + \left(\frac{1}{\chi^m}\right)\left(\frac{1}{1-\alpha}\right)^2 > 0,$$

where A is a term.

It follows from (24) that a rise in government spending under inflation targeting reduces production and increases the price level. This can be explained as follows. A rise in government spending implies a higher tax on production, causing an increase in production costs which induces firms to lower production. It follows from the monetary authority's reaction function, shown by (23), that lower production induces the monetary authority to pursue a more expansive monetary policy. Due to the monetary authority's accomodative policy reaction, a rise in government spending causes a rise in the price level. A larger weight attached by the monetary authority to inflation - shown by a rise in χ^m - means that the monetary authority will be less accomodative with respect to countering the effects of higher government spending on production,

implying that a rise in government spending leads to a bigger fall in production and a smaller rise in the price level.

Firms and individuals have perfect foresight concerning the authorities' policy setting when the nominal wage is determined. This means that employment lies at the natural level, implying that $l - l'' = h$. Using this in (24) gives inflation under inflation targeting as

$$(25) \quad \pi^{IT} = \left(\frac{h}{\chi^m}\right)\left(\frac{1}{1-\alpha}\right).$$

Equation (25) shows inflation as determined by the difference between the authorities' desired employment and the natural employment, shown by h, and by the monetary authority's preferences with respect to inflation, expressed by χ^m. This corresponds to the standard Barro-Gordon model.

Combining (24) and (25) with the condition for the government's optimisation shown by (14) gives:

$$(26) \qquad g^{IT} = \frac{\vartheta}{1+\vartheta-\Phi^{IT}},$$

$$\Phi^{IT} \equiv -\left[\vartheta\alpha h + \chi\left(\pi^{IT}\right)^2\right]\left[(1-\alpha)h + \left(\pi^{IT}\right)\right]^{-1} < 0,$$

$$\frac{\partial\Phi^{IT}}{\partial\pi^{IT}} > 0, \quad \text{if} \quad \pi^{IT} < -(1-\alpha)h + \sqrt{(1-\alpha)^2h^2 + \left(\frac{\vartheta\alpha h}{\chi}\right)},$$

$$\frac{\partial\Phi^{IT}}{\partial\pi^{IT}} < 0, \quad \text{if} \quad \pi^{IT} > -(1-\alpha)h + \sqrt{(1-\alpha)^2h^2 + \left(\frac{\vartheta\alpha h}{\chi}\right)}.$$

Equation (26) specifies government spending under inflation targeting. Government spending is a positive function of Φ^{IT}. At relatively low non-negative rates of inflation, Φ^{IT} and thus the level of government spending g^{IT} is increased when there is a rise in inflation, implying that government spending at low non-negative rates of inflation is a positive function of inflation. If inflation increases above a certain level, government spending is reduced by a further rise in inflation. This can be explained as follows. A low inflation rate corresponds to a high value of χ^m, implying that there will be a relatively big fall in production when there is a rise in government spending, cf. (24). This effect induces the government to hold back on government spending at a low inflation. When inflation is increased due to a reduction in χ^m, the fall in production resulting from a rise in government spending becomes smaller, implying that the government becomes more inclined to expand government spending, thus explaining the positive relationship between inflation and government spending at low inflation rates. As, however, inflation rises to a higher level, the welfare loss from a further rise in inflation becomes more important, implying that the government to a

larger extent will be inclined to determine government spending from the consideration to reduce inflation. This stronger discipline arising from inflation explains why there will be a negative relationship between inflation and government spending after a certain rate of inflation has been reached.

7 Nominal income targeting

We finally examine how government spending is determined in the case of nominal income targeting, defined as a monetary regime where the monetary authority adjusts the money supply to maintain a specific level of nominal income. Nominal income targeting implies

$$p + y = n, \tag{27}$$

where n is the target for nominal income.

The government acts on the basis of the monetary rule shown by (27) when it determines government spending. In the case of a pre-set nominal wage, it results from (27) in combination with (16) that the impact of government spending on production and on the price level is

$$\left(\frac{\partial y}{\partial g}\right)^{NI} = -\alpha\left(\frac{1}{1-g^{NI}}\right) < 0, \quad \left(\frac{\partial p}{\partial g}\right)^{NI} = \alpha\left(\frac{1}{1-g^{NI}}\right) > 0. \tag{28}$$

where the superscript NI denotes nominal income targeting.

It follows from (28) that a rise in government spending decreases production under nominal income targeting while there is an increase in the price level. These different effects of government spending on production and on the price level follows from the nominal income target which means that any reduction in production is matched by a corresponding increase in the price level.

In an equilibrium situation where production lies at the same level in each time period, the pursuit of a nominal income target implies that inflation is determined by the rise in the nominal income target relative to the preceding period. Assuming an equilibrium situation, combining (16) with (7), (14), and (28), thus gives the setting of government spending as

$$\begin{aligned} g^{NI} &= \frac{\vartheta}{1+\vartheta-\Phi^{NI}}, \\ \Phi^{NI} &\equiv -\alpha\vartheta - \alpha\chi\pi^{NI}, \quad \pi^{NI} = n - n_{-1}, \end{aligned} \tag{29}$$

where n_{-1} is the nominal income target in the previous period.

Equation (29) specifies the condition for government spending under nominal income targeting, assuming an equilibrium situation with the same production in each period. It follows that a rise in inflation under nominal income targeting decreases government spending.

8 Comparison between monetary regimes

We will next compare the levels of government spending under the three monetary regimes which have been analysed above. The analysis is complicated by the feature that government spending under inflation targeting and under nominal income targeting depends on the rate of inflation. Under inflation targeting, inflation is determined by the weight which the monetary authority attaches to inflation χ^m while inflation under nominal income targeting is determined by the rise in the nominal income target. It follows from (26) that government spending under inflation targeting is increased by higher inflation up to a certain level of inflation. Above this level, government spending falls when there is a further rise in inflation. In the case of nominal income targeting, government spending is reduced by higher inflation, cf. (29). Under policy discretion, inflation and government spending lie at specific levels, given by respectively (19) and (21).

Comparing the levels of government spending under the three monetary regimes, determined by (21), (26), and (29), at given inflation rates under inflation targeting and nominal income targeting leads to the following conclusion:

$$
\begin{aligned}
(30) \qquad & g^{NI} > g^{IT} = g^{PD}, \quad \text{if} \quad \pi^{IT} = \pi^{NI} = 0, \\
& g^{NI} > g^{IT} > g^{PD}, \quad \text{if} \quad \alpha h > \pi^{IT} > 0, \quad \Lambda \quad \alpha h > \pi^{NI} > 0, \\
& g^{IT} > g^{NI} > g^{PD}, \quad \text{if} \quad \pi^{PD} > \pi^{IT} > \alpha h, \quad \Lambda \quad \pi^{PD} > \pi^{NI} > \alpha h, \\
& g^{IT} = g^{NI} = g^{PD}, \quad \text{if} \quad \pi^{IT} = \pi^{NI} = \pi^{PD}, \\
& g^{PD} > g^{NI} > g^{IT}, \quad \text{if} \quad \pi^{IT} > \pi^{PD}, \quad \Lambda \quad \pi^{NI} > \pi^{PD}, \\
& \pi^{PD} = \left(\frac{\vartheta}{\chi}\right)\left(\frac{\alpha}{1-\alpha}\right).
\end{aligned}
$$

It follows from (30) that in the case of price stability under inflation and nominal income targeting, government spending is highest under nominal income targeting while there is the same government spending under inflation targeting and policy discretion. When inflation rates under inflation targeting and nominal income targeting are positive but below a certain level given as αh, government spending is highest under nominal income targeting, second-highest under inflation targeting, and lowest under policy discretion. When inflation under inflation targeting and under nominal income targeting is above αh but lies below the inflation rate under policy discretion π^{PD}, government spending is highest under inflation targeting, second-highest under nominal income targeting, and lowest under policy discretion. In the case where the monetary authority under inflation targeting and nominal income targeting opts for an inflation rate which is equal to the rate that is realised under policy discretion, government spending lies at the same level under all three regimes. Finally, for inflation rates under inflation targeting and nominal income targeting which lie above the level

under policy discretion π^{PD}, government spending is highest under policy discretion, second-highest under nominal income targeting, and lowest under inflation targeting.

9 Welfare implications

The optimal government spending corresponds to the level which would follow from a benevolent government's optimisation if it could pre-commit, implying that it could determine government spending prior to the wage setting. In the case where government spending is determined prior to the wage setting, the government bases its fiscal decisions on the effect which government spending has on the production level that corresponds to natural employment. It follows from (10) that government spending does not impact on natural employment. Correspondingly, government spending has no impact on inflation under any of the three monetary regimes, cf. (19), (25), and (29). As government spending affects neither natural production nor inflation, it results that optimal government spending corresponds to the level which results from the optimisation of (11) under the constraints that $\partial y/\partial g = 0$ and $\partial \pi/\partial g = 0$. This gives the condition for the optimal government spending as

$$(31) \quad g'' = \frac{\vartheta}{1+\vartheta},$$

where g'' is the optimal government spending, corresponding to the level which would be determined by a benevolent government which makes decisions prior to the wage setting.

The condition specified by (31) corresponds to the case where $\Phi = 0$ in the condition shown by (13) Comparing (31) with the levels of government spending under the three monetary regimes, specified by the conditions (21), (26), and (29), it results that government spending under all three regimes is lower than optimal government spending:

$$(32) \quad g^{PD} < g'', \quad g^{IT} < g'', \quad g^{NI} < g''.$$

It follows from (32) that there is a restrictive bias in the fiscal policy setting which causes government spending to be set at a too level. This restrictive bias arises because the government determines government spending subsequent to the wage setting, thus acting on the basis of a short-term economic model where the nominal wage is given. In this short-term model, government spending is kept back under all three monetary regimes by a positive effect on the price level and - in the case of inflation targeting and nominal income targeting - by a negative impact on production. If the government had determined government spending prior to the wage setting, the government would have based its fiscal decisions on a situation with no impact of government spending on production and inflation.

The optimal monetary regime is the regime which both leads to low inflation and which brings about the optimal level of government spending. If the cost associated with inflation is relatively high, implying that high inflation rates should be avoided, it results that the best situation can be reached under nominal income targeting where the nominal income target is designed in such a way that price stability is maintained. In this case, there is price stability and at the same time government spending is brought closer to the optimal level than under the two other regimes. In the case where the costs associated with inflation are smaller, we find from a comparison between (26), (29), and (31) that government spending is brought closer to its optimal level under inflation targeting than under a nominal income target with price stability if the following condition is met

$$(33) \qquad \frac{1}{2}\chi\alpha\vartheta(1-E) < \pi^{IT} < \frac{1}{2}\chi\alpha\vartheta(1+E),$$
$$E \equiv \sqrt{1-4\left(\frac{h\chi}{\vartheta}\right)}, \quad 1 > 4\left(\frac{h\chi}{\vartheta}\right),$$

where E is a term.

If the condition given by (33) is met, implying that inflation under inflation targeting lies within the range indicated by the first line of (33) and implying that $1 > 4(h\chi/\vartheta)$, government spending is closer to the optimal level under inflation targeting than under nominal income targeting. In this case, inflation targeting should be preferred to a nominal income target regime where the nominal income target is designed so as to bring about price stability if the cost related to inflation is relatively low while the utility from bringing government spending closer to the optimal level is relatively high. Otherwise, the authorities should prefer nominal income targeting designed so as to bring about price stability. In the case where the condition given by (33) cannot be met because $4(h\chi/\vartheta) > 1$, nominal income targeting designed at price stability is the optimal regime regardless of the inflation rate under inflation targeting.

10 Summary and conclusion

The article has analysed how a benevolent government determines government spending under different monetary regimes when there is a short-term nominal rigidity in the form of wage contracts. It is the main finding from the analysis that the government's fiscal decisions are affected by the monetary regime through two channels. First, as the government determines government spending on the basis of nominal wage contracts, there are differences between monetary regimes with respect to the effects which a given rise in government spending has on production and on inflation. Second, when the government makes decisions on government spending, it takes into account to what extent a rise in government spending has negative welfare implications by raising the

price level. As the negative welfare effect arising from a further rise in the price level depends on the level of inflation, it follows that a benevolent government attaches a larger weight to the reduction of inflation in the setting of government spending when inflation is high. In a comparison between three monetary regimes - policy discretion, inflation targeting, and nominal income targeting - it has been found that the highest welfare is realised under nominal income targeting designed to bring about price stability if the costs associated with inflation are relatively high.

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