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A quantitative analysis of optimal sustainable monetary policies

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ABSTRACT

This study examines the quantitative properties of optimal sustainable monetary policies using a monetary model with a stabilization bias. As in Kurozumi (2008), the optimal sustainable policy is a strategy considered in the absence of commitment technologies; however it is implemented following an optimal quasi-sustainable policy derived by assuming that the commitment technologies are present. This study finds that solving for the policy function of the University of Tokyo the optimal quasi-sustainable policy yields a result basically identical to the Ramsey-optimal commitment policy under a set of parameters commonly used in the literature. The simulation shows two further results: policymakers have incentive to deviate from the Ramsey-optimal commitment policy when the lagged output gap is large and the optimal quasi-sustainable policy endogenously diminishes the steadfastness of policymakers' commitment.

1. Introduction

In New Keynesian (NK) models used in recent monetary policy analysis, the Ramsey-optimal commitment policy usually yields higher social welfare than an optimal discretionary policy, in which policymakers cannot commit to future policies.[1] Time-inconsistency plagues the optimal commitment policy (Kydland and Prescott, 1977; Barro and Gordon, 1983) because policymakers are tempted to abandon their previously announced policy and exploit the private sector's expectation.

To overcome the time-inconsistency problem, Kurozumi (2008) proposes the optimal sustainable monetary policy by analyzing Chari and Kehoe's (1990) sustainable plans in an NK model. The optimal sustainable monetary policy is based on the more realistic assumption that policymakers cannot access commitment technologies but can use reputation among the private sector. Therefore, when considering conduct of monetary policy, the optimal sustainable monetary policy is an important alternative to the Ramsey-optimal commitment policy. However, Kurozumi's analysis considers only qualitative properties; i.e., it merely checks whether policymakers have incentives to deviate from the optimal commitment policy.

This study presents a quantitative analysis of optimal sustainable monetary policies. As stated in Kurozumi (2008), *the optimal sustainable policy* is a strategy for the best sustainable equilibrium in the *absence* of commitment technologies. However, it is implemented by following *the optimal quasi-sustainable policy* derived from the Lagrange method of Marcet and Marimon (1994), revised in Marcet and Marimon (1998, 2011), assuming the *presence* of commitment technologies.[2]

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[1] We assume that the optimal commitment policy considered here is under *time-0* perspective. See a discussion later in the introduction.

[2] The optimal sustainable policy exploits an explicit punishment for the deviation from the current policy. This out-of-equilibrium punishment in the optimal sustainable policy serves as the commitment technologies in the optimal quasi-sustainable policy.

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This study applies a version of the policy function iteration method in Kehoe and Perri (2002) to solve for the policy function of the optimal quasi-sustainable policy. While doing this, it examines the equilibrium dynamics of optimal sustainable monetary policies, such as impulse response functions and stochastic simulations.

This study finds that the optimal commitment policy is sustainable (i.e., the optimal quasi-sustainable policy yields a result basically identical to the optimal commitment policy) given a particular parameter set and a price markup shock as calibrated from U.S. data and commonly found in the literature.[3] This finding contrasts to Kurozumi's finding that the optimal commitment policy is not sustainable for some plausible parameters.

There are two types of the optimal commitment policy in the literature. No commitment is made in the past at an initial period t_0. If the policymaker made commitment in period $t_0 > -\infty$, the optimal commitment policy is under *time-0* perspective. In contrast, such an initial period is set in the infinite past under *timeless* perspective (Woodford, 1999). Dennis (2010) and Sauer (2010a,b) show that the optimal discretionary policy can be superior to the optimal commitment policy under the timeless perspective when the lagged output gap is large. The lagged output gap measures policymakers' previous commitment; the larger the gap, the greater are policymakers' incentives to deviate from that commitment. In this study, the optimal quasi-sustainable policy endogenously diminishes the steadfastness of their commitment when the lagged output gap is large. In an economy with some alternative parameters, the optimal quasi-sustainable policy yields higher social welfare than the optimal commitment policy in terms of the unconditional expected utility. This occurs because the optimal quasi-sustainable policy diminishes the steadfastness of policymakers' commitment and reduces the volatility of inflation and the output gap.

1.1. Related literature

Drawing upon game theory, Chari and Kehoe (1990) propose the concept of sustainable plans that become optimal in dynamic decision-making for a player who cannot commit to future plans in the present. Their standard is subgame perfect equilibria in repeated games between a strategic player and an infinite number of small agents. Chari and Kehoe (1990) follow Abreu (1988) in using the worst sustainable equilibrium to characterize the entire set of sustainable equilibria. The best sustainable equilibrium is then supported by the reputation of the strategic player among small agents. The equilibrium condition is summarized by *the sustainability constraint,* an inequality implying that any sustainable equilibrium outcome is above the worst.

The source of the time inconsistency in NK models is not only the well-known inflation bias but also a stabilization bias following price markup shocks and a trade-off between stabilizing inflation and stabilizing the output gap. Kurozumi (2008) proposes the notion of optimal sustainable monetary policy after analyzing Chari and Kehoe's sustainable plans in an NK model. He examines stabilization bias with an infinite length of punishment under the optimal discretionary policy and finds that the sustainability constraint is binding for some plausible parameters and the upper bound of the markup shock. Loisel (2008) considers inflation bias and stabilization bias with a finite duration of punishment under the optimal discretionary policy and concludes that both can be overcome (i.e., the sustainability constraint is not binding) by the reputation of the policymaker when the duration is a few years. However, Kurozumi (2008) and Loisel (2008) examine only whether the sustainability constraint is binding and disregard the optimal sustainable policy itself.

Woodford (1999) overcomes time-inconsistency in the Ramsey-optimal commitment policy by disregarding time—i.e., by assuming policymakers committed to future policies in the indeterminate past. The optimality condition in the initial period then can be ignored and a time-invariant policy rule can be derived. However, when the policies are evaluated according to policymaker's objectives from date $t_0 > -\infty$ forth, and taking the state of the economy at date t_0 as given, the optimal discretionary policy can be superior to the optimal commitment policy under the timeless perspective (Dennis, 2010; Sauer 2010a,b). Thus, policymakers concerned with social welfare from date t_0 forth may have incentive to abandon previous commitments.

Computations to solve time-inconsistency problems are difficult because analysis must handle dynamic incentive constraints, which defy Bellman's principle of optimality. Marcet and Marimon (1994), revised in Marcet and Marimon (1998, 2011), develop a Lagrange method—the recursive saddle point method—to consider incentive constraints in a dynamic economy. Kehoe and Perri (2002) apply the method in a two-country model with incomplete markets. Similar to this study, they numerically solve for the policy function using a version of policy function iteration method closely related to methods for handling occasionally binding constraints (e.g., Christiano and Fisher, 2000) because incentive constraints are occasionally binding. Adam and Billi (2006) studied the optimal commitment policy with an occasionally binding zero lower bound (ZLB) on nominal interest rates utilizing Marcet and Marimon's method.

The reminder of the paper proceeds as follows. Section 2 explains the model, the policy game, and computational procedures and calibrations. Section 3 discusses quantitative properties of optimal sustainable monetary policies, such as impulse responses and stochastic simulations. Section 4 presents an analysis using the alternative parameter sets in Kurozumi (2008) for comparison. Section 5 concludes. Analytical results and computational details appear in the Appendix.

[3] See Rotemberg and Woodford (1998), Woodford (2003), Adam and Billi (2006, 2007), Nakov (2008), Giannoni (2010), and Bodenstein et al. (2012).