Indeterminacy, labor and capital income taxes, and non-linear tax schedules

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A R T I C L E   I N F O

A B S T R A C T

Using a finance-constrained model, as in Barinci and Cheron (2001), this paper examines the role of procyclical and countercyclical tax rates on labor and capital income in aggregate fluctuations driven by the beliefs of agents. The analysis shows that the cyclicality of labor income tax rate has the monotonically negative impact on the possibility of indeterminacy, while the non-monotonic relations exist between the cyclicality of capital income tax rate and the likelihood of indeterminacy. It is shown that labor and capital income taxes have remarkably different impacts on the probability of indeterminacy for a sufficiently wide range of variability.

1. Introduction

It is important to examine how the variability of income tax rate has an impact on the probability of indeterminacy in dynamic general equilibrium models when evaluating the effectiveness of government tax policy as an "automatic stabilizer". Indeterminacy here means that the equilibrium paths converging to the same steady state are innumerable, and so we can endogenously explain aggregate fluctuations with self-fulfilling changes in agents' beliefs about the future. More specifically, we need not rely on persistently exogenous shocks relating to economic fundamentals to explain the occurrence of economic fluctuations.

Indeterminacy itself is possible in standard optimal growth models by considering the increasing returns arising from, for example, external effects in production. For instance, in a one-[two-]sector growth model, Benhabib and Farmer (1994, 1996) pointed out the importance of production externalities for the emergence of indeterminacy and showed that indeterminacy emerges with a sufficiently strong [relatively mild] degree of increasing returns. In related work, Barinci and Cheron (2001) clarified that endogenous fluctuations arise under weaker increasing returns using Woodford's finance-constrained model (1986). Drawing on the above, many economists have explored how government tax policy affects the range of parameter values associated with indeterminacy to design a stabilizing tax policy against agents' belief-driven aggregate fluctuations.

Several studies have already examined these issues using the one- and two-sector Ramsey models. Schmitt-Grohe and Uribe (1997), for example, pointed out the possibility that indeterminacy arises in the one-sector model without any production externalities if labor income tax rates endogenously adjust to finance the preset level of government expenditure. Schmitt-

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Grohe and Uribe (1997) found that countercyclical income taxes are important factors affecting the emergence of endogenous fluctuations. Similarly, Guo and Lansing (1998) considered non-linear tax rates on income, and investigated the relation between the likelihood of indeterminacy and the slope indexing the degree of income tax progressiveness. The conclusion is that the minimum values of increasing returns leading to indeterminacy are higher as income taxes become more progressive. Accordingly, progressive income taxes stabilize the economy by making indeterminacy less likely. Finally, using the two-sector model, Guo and Harrison (2001) drew a conclusion contrary to the one-sector model in their view that progressive income taxes raise the probability of indeterminacy for most reasonable values of production externalities.

A common feature in Guo and Lansing (1998) and Guo and Harrison (2001) is that there is no attempt to distinguish between labor and capital income taxes.[1] Although the current paper does not employ the Ramsey model, rather Woodford's finance-constrained model (1986) with production externalities, as in Barinci and Cheron (2001), we consider non-linear income taxes in which labor and capital income tax rates are separated, and compare how the variability of income tax rates influences the appearance of agents' belief-driven aggregate fluctuations. The present paper clarifies the appropriateness of such a distinction between labor and capital income taxes, because labor and capital income taxes have strikingly different effects on the likelihood of indeterminacy across a relatively wide range of variability.

Using a finance-constrained model (1986) as in Barinci and Cheron (2001), Gokan (2008) argued that indeterminacy is more (less) likely if labor (capital) income taxes are endogenously determined to finance the preset level of government expenditure. However, while Gokan (2008) distinguished between tax rates on labor and capital income, he considered endogenous income taxes associated only with countercyclical income taxes. Therefore, the present paper considers a wider range of cyclical income tax rates.

Further, some studies have also considered how the variability of tax rates influences the appearance of indeterminacy in a finance-constrained model, as studied in Grandmont et al. (1998). For example, Dromel and Pintus (2008) explored how progressive tax rates on labor income influence the range of elasticity of capital–labor substitution that induces indeterminacy. However, Dromel and Pintus (2008) focused almost exclusively on constant returns to scale in production and completely ignored progressive tax rates on capital income. Thus, Dromel and Pintus (2008) did not reach the conclusion in this paper that tax rates on labor and capital have remarkably different impacts on the likelihood of indeterminacy. Lloyd-Braga et al. (2007) likewise considered technology only with constant returns to scale and also ignored cyclical tax rates on capital income.[2] Unlike Dromel and Pintus (2008) and Lloyd-Braga et al. (2007), we compare how the variability of labor and capital income tax rates affects the emergence of indeterminacy.

The present paper focuses mainly on cyclical tax rates on labor and capital income that positively or negatively change with their own tax base in a finance-constrained model with production externalities, as in Barinci and Cheron (2001). We explore how cyclical income taxes affect the minimum values of increasing returns leading to indeterminacy. The findings show that the cyclicality of labor income tax rate has the monotonically negative impact on the possibility of indeterminacy, but the non-monotonic relations exist between the cyclicality of capital income tax rate and the likelihood of indeterminacy. The strikingly different results arise with labor and capital taxes when evaluating the stabilizing effects of cyclical income tax rates. Therefore, distinguishing between labor and capital income taxes is meaningful when examining how the cyclicality of income tax rates affects the occurrence of endogenous fluctuations because of the changes in agents' self-fulfilling expectations.

Moreover, we also examine how progressive and regressive tax rates on labor and capital influence the emergence of indeterminacy, and the obtained results are quite the same as in cyclical income taxes. To my best knowledge, the current paper is the first to do the comprehensive comparisons how the variability of labor and capital income tax rates influences the appearance of indeterminacy.

The rest of the paper is organized as follows. Section 2 analyzes the structure of the model. Section 3 derives the dynamic equations in the market equilibrium. Sections 4 and 5 investigate whether more procyclical tax rates on labor and capital income increase or decrease the minimum sizes of increasing returns generating indeterminacy. Section 6 describes the policy implications of cyclical income tax rates and Section 7 provides the intuition underlying the results. Section 8 compares how progressive and regressive income taxes influence local dynamics near a steady state. Section 9 presents some brief concluding remarks.

2. Framework

2.1. Workers

We focus directly on an overlapping generations structure with an infinite lifetime arising from the representative agent model as in Barinci and Cheron (2001). It is well understood that the corresponding equations reflect the actual dynamics of

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[1] Based on the one-sector Ramsey model, Guo (1999) clearly separates labor and capital income. However, Guo (1999) emphasizes only the importance of progressive labor income taxes to stabilize the economy and not how progressive labor and capital income taxes variously influence the likelihood of indeterminacy, as here.

[2] Dromel and Pintus (2008) considered progressive and regressive tax rates on income where agents' choices affect the marginal tax rates, while Lloyd-Braga et al. (2007) considered procyclical and countercyclical tax rates where, while income still affects the marginal income tax rates, agents view the marginal tax rates as independent of their own actions.