



On the Ramsey equilibrium with heterogeneous consumers and endogenous labor supply[☆]

Stefano Bosi^{a,*}, Thomas Seegmuller^{b,1}

^a EQUIPPE (Université de Lille 1) and THEMA (Université de Cergy-Pontoise), Département d'Economie, Université de Lille 1, Bât. SH2, Cité Scientifique, 59655 Villeneuve d'Ascq Cedex, France

^b CNRS and GREQAM, Centre de la Vieille Charité, 2 rue de la Charité, 13236 Marseille Cedex 02, France

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ABSTRACT

In this paper, we address the stability issue, stressing the role of labor supply, in a Ramsey model with heterogeneous households subject to borrowing constraints. Making labor supply endogenous leads us to prove the existence of two kinds of steady state: the one where everybody supplies labor, the other where only the most patient agent refrains from working. Going beyond models with inelastic labor supply, we show how preferences of impatient agents affect the saddle-path stability of each type of steady state and the occurrence of endogenous cycles. When their elasticity of intertemporal substitution in consumption exceeds one, instability and cycles are less likely, requiring lower degrees of capital-labor substitution. Conversely, elasticity values below one promote the emergence of fluctuations. We end the paper by showing the existence of the intertemporal equilibrium under market incompleteness, using a local approach based on the first-order conditions.

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1. Introduction

Growth theorists are usually confronted with the question of convergence of economic systems. In neoclassical models of capital accumulation, commonly addressed questions are whether economies converge to the same long-run equilibrium, how convergence takes place and whether is monotonic, how fundamentals affect the stability properties of equilibrium.²

The most influential growth model is undoubtedly Ramsey which is characterized, in its basic version, by a representative infinite-lived agent, exogenous labor supply, saddle-path stability, equilibrium uniqueness and optimality. In order to add a degree of realism, economic literature has not only introduced various kinds of market imperfections, but also considered elastic labor supply and agents' heterogeneity.

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* Corresponding author. Tel.: +33 1 34 25 22 54.

E-mail addresses: stefano.bosi@u-cergy.fr (S. Bosi), thomas.seegmuller@univmed.fr (T. Seegmuller).

¹ Tel.: +33 4 91 14 07 27; fax: +33 4 91 90 02 27.

² Among others, Barro and Sala-i-Martin (1995) provide an introductory survey of the literature.

On the one side, several contributions have focused on the convergence of capital accumulation and distribution in the long run when consumers are heterogeneous and labor supply is inelastic. Heterogeneous discounting promotes a concentration of capital in the hands of the most patient agent. Unlike the case with a representative agent, consumers' heterogeneity accounts for borrowing transactions. These transactions allow impatient agents to consume more today and work more tomorrow to refund the debt: their consumption asymptotically vanishes (Le Van and Vailakis, 2003). Under borrowing constraints, not only there exists a stationary state where impatient agents consume, but also persistent cycles arise (Becker, 1980; Becker and Foias, 1987, 1994; Sorger, 1994).

On the other side, many economists have analyzed the role of elastic labor supply on growth under the assumption of representative consumer. This literature succeeded in shedding a light on the interplay between the consumption-labor arbitrage and the mechanism of capital accumulation.³

Surprisingly, only few works have investigated the role of elastic labor supply on equilibrium transition and the long run when consumers are heterogeneous. In this respect, most papers focus on heterogeneity in wealth (Sorger, 2000; Ghiglino and Sorger, 2002; Garcia-Penalosa and Turnovsky, 2006).

In our paper, we are mainly interested in the effects of labor supply on the saddle-path stability when heterogeneity concerns not only consumers' endowments but also preferences. In this connection, we consider infinite-lived consumers with preferences additively separable in consumption and leisure, and over time. Heterogeneity is now threefold and turns on capital wealth, time preference and intra-temporal preferences. In addition, in line with Becker (1980), Becker and Foias (1987, 1994), Hernandez (1991) and Sorger (1994), we assume that consumers cannot borrow against their future labor income. This borrowing constraint implicitly means that, in contrast to Le Van et al. (2007), markets are incomplete.

After having characterized the intertemporal equilibrium, we show that, as in Becker (1980), the most patient household owns the whole capital stock at a steady state, whereas the others consume their per-period labor income.⁴ However, some new elements emerge from the introduction of endogenous labor supply. First, there are two types of steady states, depending on the amount of leisure consumed by the most patient agent: one where he works and one where he supplies no labor. Second, when the utility functions are heterogeneous across the impatient agents, in contrast to Becker (1980), impatient consumers have different (labor) incomes, because of the heterogeneity of their labor supplies.

We study the stability properties around these steady states where the most patient consumer owns the entire stock of wealth. Population splits in two classes: on the one side, a (patient) capitalist with or without labor income, who spends his income to consume and invest; on the other side, (impatient) workers who neither get capital income nor invest.⁵

In order to study the convergence to the steady state, while underlining the role of heterogeneous preferences and elastic labor supply, we focus on their effects on the saddle-path stability and the occurrence of flip bifurcations.⁶ In economies with inelastic labor supply, the occurrence of endogenous cycles requires sufficiently weak capital-labor substitution and intertemporal substitution in consumption of the patient consumer. Introducing leisure in the utility functions, we find that the impatient agents' preferences play a crucial role on the stability properties of the steady state. More specifically, when the impatient agents' elasticity of intertemporal substitution becomes greater than one, the introduction of elastic labor supplies promotes stability, because the occurrence of cycles requires a weaker capital-labor substitution. However, the converse holds when their elasticity of intertemporal substitution in consumption is less than one. In addition, these results are reinforced by a larger elasticity of intertemporal substitution in leisure.

To understand why preferences play a role on the stability properties, we mind that, when each agent supplies inelastically one unit of labor, instability and endogenous cycles ensue from a negative response of the patient agent's capital income to a rise in the capital stock. Under elastic labor supply, a second channel works: the capital stock affects the real wage, which in turn affects the aggregate labor supply, the capital intensity and finally the return on capital. Since preferences underlie and determine the elasticity of labor supply with respect to the real wage, they have great influence on dynamics.

Finally, we end the paper by focusing on the existence of the intertemporal equilibrium. This is a quite difficult task, because markets are incomplete and the welfare theorems fail. However, using a local approach based on the first-order conditions and the stability properties of the steady states (see Stockey and Lucas, 1989), we show the existence of the intertemporal equilibrium around stationary solutions.

The rest of the paper is organized as follows. The model with heterogeneous consumers, elastic labor and borrowing constraints is presented in Section 2. In Section 3, we define the intertemporal equilibrium. Steady states are analyzed in Section 4. Sections 5 and 6 focus on the stability properties and the occurrence of bifurcations in the cases the patient agent works or supplies no labor, respectively. The results on local dynamics are discussed in Section 7, whereas we show

³ The interested reader is referred among others to De Hek (1998) and Le Van and Vailakis (2004) for one-sector models; Bosi et al. (2005) for a two-sector model; Ladron-de-Guevara et al. (1997) for endogenous growth; Nourry (2001) and Nourry and Venditti (2006) for OLG economies; Pintus (2006) and Garnier et al. (2007) for models with externalities.

⁴ This result is in contrast with Sorger (2000) who obtains a continuum of long-run equilibria. Sorger's assumption of a common discount factor across the agents prevents a long-run concentration of wealth in the hands of the most patient individual. A result different from ours is also obtained by Le Van et al. (2007) who show that without borrowing constraints consumption and leisure of impatient agents tend to zero in the long run.

⁵ Note that at the steady state where the patient agent supplies no labor, our model also provides foundations to models with population segmentation such as Mankiw (2000), Michel and Pestieau (1999) and Woodford (1989).

⁶ We focus on local dynamics. As in the model with exogenous labor, the steady state is determinate (see Becker and Foias, 1994). Note, however that, as shown by Sorger (1994), indeterminacy is possible without elastic labor supplies, when one studies some non-local dynamic properties.

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