Real Business Cycles and the Animal Spirits Hypothesis in a CIA Economy

Jean-Paul Barinci*
Arnaud Chéron†‡

n^o **2001-10**

*EPEE-Université d'Evry - Val d'Essonne and EUREQua - Université de Paris 1. Address: Université d'Evry - Val d'Essonne, Boulevard François Mitterrand, 91025 Evry Cedex, France. E-mail: Jean-Paul.Barinci@eco.univ-evry.fr

†Université du Maine and CEPREMAP. Address: Avenue Olivier Messiaen, Faculté de Droit et de Sciences Economiques, 72085 Le Mans Cedex 9, France. E-mail: acheron@univ-lemans.fr.

‡Nous remercions J-P Benassy pour ses remarques, tout en demeurant seuls responsables des éventuelles erreurs et insuffisances.

Real Business Cycles and the Animal Spirits Hypothesis in a CIA Economy

This paper examines the dynamical properties of a one-sector cash-in-advance constraint model with *constant* returns to scale. Its aim is to overcome some of the difficulties encountered by earlier models in establishing the empirical relevance of indeterminacy and sunspots. It is first established that, in opposition to available results, indeterminacy occurs for values of the intertemporal elasticity of substitution in consumption consistent with the bulk of empirical estimates. It is then shown that sunspot shocks generate procyclical movements in consumption. Lastly, allowing both beliefs and technological disturbances, the model is found to perform as well as real sunspot models with increasing returns to scale in matching the business cycle. Keywords: Money, Indeterminacy, Sunspots, Business Cycle.

Cycles Réels et Esprits Animaux dans une Economie avec Contrainte d'Encaisses Préalables

Ce papier examine les propriétés dynamiques d'un modèle unisectoriel avec contrainte d'encaisses préalables et rendements d'échelle de production constants. Son objectif est de dépasser certaines des difficultés rencontrées par des modèles précédents en établissant la pertinence empirique de l'indétermination et des taches solaires. Il est tout d'abord montré que, contrairement au résultats disponibles, l'indétermination intervient pour des valeurs de l'élasticité de substitution intertemporelle de la consommation conformes à la majorité de ses estimations. Il est ensuite montré que des chocs de croyances peuvent générer des mouvements procycliques de la consommation. Finalement, considérant simultanément l'occurrence de taches solaires et de chocs technologiques, il apparaît que le modèle est en mesure de rendre compte du cycle des affaires d'une manière aussi satisfaisante que des modèles réels avec rendements croissants.

Mots clés: Monnaie, Indétermination, Taches solaires, Cycle d'affaire.
Classification au JEL: E32.

1 Introduction

The present contribution studies the dynamical properties of a competitive one-sector real business cycle model with money introduced by imposing a cash-in-advance constraint. Our aim is to examine the empirical plausibility of indeterminacy and to assess the relevance of sunspots for business cycle considerations.

Recent research in macroeconomics, following the contributions of Benhabib and Farmer (1994) and Farmer and Guo (1994), has focused on models in which business cycles are driven by self-fulfilling changes in agents' beliefs.[1] In such models, indeterminacy and sunspot equilibria arise as a consequence of some increasing returns to scale, often triggered by external effects. While early results relied on empirically unrealistic scale economies, more recent researches departing from the simplest one-sector model have demonstrated that the magnitude of increasing returns needed to induce indeterminacy is consistent with the empirical estimates provided, for instance, by Basu and Fernald (1997).[2] Even though these models offer a plausible theory in which economic fluctuations are the consequence of animal spirits, they nonetheless suffer from two weaknesses.

First, most studies assume that the households' utility function is logarithmic in consumption, which is equivalent to setting the intertemporal elasticity of substitution (IES) in consumption equal to one. Noticeable exceptions are Bennett and Farmer (2000) and Harrison (2001) who consider non-separable preferences and a more generalized CRRA utility function, respectively. Setting the IES significantly greater than one, they are able to generate indeterminacy with empirically plausible scale economies. However, this requisite is at odds with the empirical evidence which suggests that the IES is much lower than unity, many estimates being indeed below 0.5 (see,

[1] See Benhabib and Farmer (1999) for an excellent survey.

[2] Examples include, Wen (1998), Bennett and Farmer (2000), Benhabib and Farmer (1996), Harrison and Weder (2000a), Harrison and Weder (2000b), Harrison (2001), Schmitt-Grohé (2001).

e.g., Kocherlakota (1996) and Campbell (1999)).[3]

The second weakness of these models is their inability to match various moments of key macroeconomics variables. In particular, for reasonable values of the externality parameters, they generate a time series for consumption that is countercyclical. This counterfactual result has been documented by many authors, including Benhabib and Farmer (1996), Harrison (2001) and Schmitt-Grohé (2001). It relies on the fact that when consumption and leisure are normal goods, the household's intratemporal first-order condition, which equates the marginal rate of substitution between consumption and leisure with the real wage, forces consumption and hours worked, hence output, to move in opposite directions.

The previous considerations cast some doubts on the empirical relevance of indeterminacy and expectations-driven business cycle. Yet, productive externalities are not the only market imperfections giving rise to indeterminacy and sunspots. For instance, the use of money as a medium of exchange is a well known source of multiplicity. Recently, Farmer (1997) builds on this idea by developing a business cycle model that includes real money balances as an argument of the utility function. Clearly, Farmer sought to produce a realistic calibrated model with multiple equilibria and *constant* returns to scale. However, it turns out that for standard parameter values, Farmer's model does not produce indeterminacy. As a matter of fact, implausible returns to scale remain necessary (see Sossounov (2000)).

We know that a money-in-the-utility function specification, as Farmer's one, must represent a reduced form indirect utility function for some underlying environment where agents get utility from goods and leisure and face some exchange constraints involving money. In this paper, the exchange constraint we focus on is the cash-in-advance (CIA) constraint on consumption. More precisely, we study the basic (no externalities) monetary Real Business Cycle

[3]Notice that models in which the utility function is logarithmic in consumption, actually almost all sunspot models, are subject to the same criticism.

model of Cooley and Hansen (1989) with constant returns to scale extended to account for *non-logarithmic* utility in consumption. We establish that this model exhibits indeterminacy for values of the IES in accordance with the bulk of empirical estimates. We then evaluate the ability of the model to fit the data. Numerical simulations indicate that fluctuations solely driven by sunspot disturbances are characterized by procyclical movements in consumption. The intuition for this result is the following. Provided that the CIA constraint binds in equilibrium, the marginal rate of substitution between consumption and leisure is not equal to the real wage. Consequently, a spontaneous increase in consumption does not necessarily requires a fall in hours worked.[4] However, in order to generate realistic fluctuations in other respects, fundamental disturbances are necessary. Allowing both sunspots and productivity shocks, we show that this "simple" one-sector model with constant returns to scale perform as well as more "complex" real (one or two-sector) models with increasing returns to scale.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 deals with the local dynamics. Section 4 discusses the cyclical properties. Section 5 provides some concluding remarks.

2 The Model

Environment

The economy consists of households, firms and a monetary authority.

The representative household chooses sequences of consumption $\{c_t\}$,

[4] Barinci and Chéron (2001) build on a related idea and demonstrate that a model with heterogeneous households and borrowing constraint outperform standard sunspots models in explaining business cycle facts, notably procyclical consumption.

hours worked $\{l_t\}$, capital stock $\{k_{t+1}\}$ and cash balances $\{m_{t+1}\}$ to solve

$$\begin{aligned}
\max_{\{c_t, l_t, k_{t+1}, m_{t+1}\}} & \quad E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{c_t^{1-\sigma}}{1-\sigma} - A \frac{l_t^{1+\chi}}{1+\chi} \right\} \\
\text{s.t.} \quad c_t + k_{t+1} + \frac{m_{t+1}}{p_t} &= w_t l_t + (r_t + 1 - \delta) k_t + \frac{m_t}{p_t} \qquad (1) \\
c_t &\leq \frac{m_t}{p_t} \qquad (2)
\end{aligned}$$

for E the rational expectation operator, $A > 0$, $\sigma > 0$, $\chi > 0$, $\beta \in (0,1)$ the discount factor, $\delta \in (0,1)$ the depreciation rate of capital, p_t the price level, r_t the rental rate and w_t the real wage. (1) is the usual intertemporal budget constraint; (2) is the cash-in-advance constraint (hereafter CIA). Let λ_t and μ_t denote the Lagrange multipliers associated with the budget constraint (1) and the CIA constraint (2), respectively. The first-order conditions for the household are:

$$\begin{aligned}
c_t^{-\sigma} &= \lambda_t + \mu_t \qquad (3) \\
A l_t^{\chi} &= \lambda_t w_t \qquad (4) \\
\lambda_t &= \beta E_t \left[\lambda_{t+1} (r_{t+1} + 1 - \delta) \right] \qquad (5) \\
\lambda_t &= \beta E_t \left[(\lambda_{t+1} + \mu_{t+1}) \frac{p_t}{p_{t+1}} \right] \qquad (6) \\
\mu_t \left(\frac{m_t}{p_t} - c_t \right) &= 0, \quad \mu_t \geq 0 \qquad (7)
\end{aligned}$$

along with the budget constraint (1) and the transversality conditions omitted for simplicity.

On the production side, the technology of the representative firm is described by the Cobb-Douglas production function:

$$z_t k_t^{\alpha} l_t^{1-\alpha}, \quad \alpha \in (1,0)$$

where z is the state of technology which evolves as:

$$\log z_t = \rho_z \log z_{t-1} + (1-\rho_z)\log z^\star + \sigma_z \zeta_t \quad (8)$$

where $0 \leq \rho_z < 1$, $\sigma_z \geq 0$ and ζ_t is a zero-mean i.i.d. random variable with unit variance. Markets being perfectly competitive, profit maximization implies that factors are paid according to their marginal productivities:

$$r_t = z_t \alpha k_t^{\alpha-1} l_t^{1-\alpha} \quad (9)$$

$$w_t = z_t(1-\alpha) k_t^{\alpha} l_t^{-\alpha} \quad (10)$$

Lastly, as we do not study the effects of the monetary policy shocks, we assume that the monetary authority plays a fairly limited role: it supplies a constant quantity of money $M_t = M$, $\forall\ t \geq 0$.

Equilibrium

We will limit our attention when the CIA constraint is binding.[5] Using the fact that $p_t c_t = M$ together with (3)-(6) and (9)-(10), it is straightforward to see that an equilibrium is a sequence $\{(c_t, k_t, l_t) \in R^3_{++}\}$ which satisfies:

$$\frac{l_t^{\chi+\alpha}}{z_t k_t^{\alpha}} = \beta E_t\left[\left(z_{t+1}\alpha k_{t+1}^{\alpha-1} l_{t+1}^{1-\alpha} + 1 - \delta\right)\frac{l_{t+1}^{\chi+\alpha}}{z_{t+1}k_{t+1}^{\alpha}}\right] \quad (11)$$

$$\frac{A l_t^{\chi+\alpha}}{z_t(1-\alpha)k_t^{\alpha}} = \beta E_t\left[\frac{c_{t+1}^{1-\sigma}}{c_t}\right] \quad (12)$$

$$k_{t+1} = z_t k_t^{\alpha} l_t^{1-\alpha} + (1-\delta)k_t - c_t \quad (13)$$

along with the transversality conditions.

It is worth stressing that if one assumes that the household's utility is logarithmic in consumption, *i.e.*, $\sigma = 1$, the dimension of the equilibrium

[5] It is not difficult to see that this will be the case at a steady state. Indeed, in a steady state, the gross return on capital, $r + 1 - \delta$, is greater than the gross return on money which is equal to 1 (no inflation) as the quantity of money is constant. Thus, along a stationary equilibrium, the household is not willing to carry cash from one period to the next. Otherwise stated, the CIA constraint is binding. A continuity argument ensures that the CIA is binding in a "small" neighborhood of a steady state.

system (11)-(13) would actually be lowered. As a matter of fact, in such circumstances (12) would boil down to a static relation defining, for instance, c_t as a function of l_t and k_t.[6]

3 Local dynamics

In this section we carry out the analysis of the local (deterministic) dynamics of the equilibrium system (11)-(13) around its stationary solution ($c^\star$, $l^\star$, $k^\star$, $z^\star$). According to the usual procedure we study the first order Taylor expansion of the equilibrium system (11)-(13) evaluated at the steady state. Let J denotes the Jacobian matrix of the linearized system and T, Σ and D be the trace, the sum of the principal minors of order two and the determinant of J, respectively. The characteristic polynomial associated to J writes as follows:

$$Q(\psi) = -\psi^3 + T\psi^2 - \Sigma\psi + D$$

$$\begin{aligned} T &= 1 + \beta^{-1} + \frac{1}{1-\sigma} + \frac{\nu}{\chi+\eta} \\ \Sigma &= \beta^{-1} + \frac{1}{1-\sigma} + \frac{1}{\beta(1-\sigma)} + \nu\frac{1+\chi}{(\chi+\eta)(1-\sigma)} \\ D &= \frac{1}{\beta(1-\sigma)} \end{aligned}$$

for

$$\rho \equiv \beta^{-1} - 1 + \delta \tag{14}$$

$$\eta \equiv \beta\rho(1-\alpha) + \alpha \tag{15}$$

$$\nu \equiv (\frac{\rho}{\alpha} - \delta)\beta\rho(1-\alpha) \tag{16}$$

Since one variable is predetermined and the others are free, indeterminacy occurs when J has at least two roots located inside the unit circle.

[6] In addition, it is not difficult to see that the equilibrium is bound to be determinate.

Case 1: $\sigma < 1$. As $Q(1) = -\nu\frac{\sigma+\chi}{(\chi+\eta)(1-\sigma)} < 0$ and $Q(0) > 0$, by continuity $\psi_1 \in (0,1)$. Now, noticing that $\psi_1\psi_2\psi_3 = D > 1$, $\psi_1 \in (0,1)$ implies $|\psi_2||\psi_3| > 1$. It follows that at least one root is located outside the unit circle, and this notably precludes the appearance of two complex eigenvalues with norm lesser than one. Whenever ψ_2 and ψ_3 are real, it also implies, along with $Q(-1) > 0$ and $T = \psi_1 + \psi_2 + \psi_3 > 0$, that they are positive and greater than one. One finally concludes that if $\sigma < 1$ the equilibrium is locally unique.

Case 2: $\sigma > 1$. In this alternative case, one deduces from $Q(1) > 0$ and $Q(0) < 0$ that $\psi_1 \in (0,1)$, $\psi_2 > 1$ and $\psi_3 < 0$. It follows that indeterminacy requires $\psi_3 \in (-1,0)$, that is $Q(-1) > 0$. This will be the case if:

$$\sigma > 2 + \frac{\nu\chi}{2(1+\beta^{-1})(\chi+\eta)+\nu} \equiv 2 + \Delta \tag{17}$$

As Δ is positive, indeterminacy emerges for values of the IES $(1/\sigma)$ lesser than 0.5. Hence, in opposition to available results (see the discussion in the introductory section), the values of the IES that place the economy within the indeterminacy region are in accordance with the recent empirical estimates (see, *e.g.*, Campbell (1999)). Moreover, it is worthy to note that such low values are nowadays fairly standard in the RBC literature (see, *e.g.*, King and Rebelo (1999) who set $\sigma = 3$). How the "critical" IES depends on the shape of the utility function? Setting $\chi = 0$, *i.e.*, assuming an infinite labor supply elasticity, the "critical" IES is equal to 0.5. On the other hand, letting χ increases without bound, *i.e.*, lowering the labor supply elasticity, Δ converges to $\nu/2(1+1/\beta)$. For example, setting $\beta = 0.93$, $\delta = 0.1$, $\alpha = 0.3$, the "critical" IES converges to 0.4999[7].

Indeterminacy appears then more likely empirically plausible in the current model than in real models since it requires neither a "high" IES value nor an infinite elasticity of the labor supply in order to exhibit indeterminacy.

[7] Actually, it can be seen from (16) which shows that ν is close to zero.

4 Business cycle properties

This section addresses the question of whether the predictions of the model are consistent with actual fluctuations. It is well-known that some time series properties of real sunspot models are not consistent with the business cycles data. For example, for plausible degrees of increasing returns, they generate time series for consumption that are countercyclical (see, *e.g.*, Benhabib and Farmer (1996) and Schmitt-Grohé (2001)). As a matter of fact, in a walrasian model, the marginal rate of substitution between consumption and leisure equates the real wage. As a consequence, beliefs shocks that shift the labor-supply schedule along the (downward-sloping) labor-demand schedule, tend to force consumption and hours worked to move in opposite directions.[8]

In the current model, as long as the CIA constraint is binding, the marginal rate of substitution between consumption and leisure does not equate the real wage. Thus, a spontaneous increase in consumption (optimistic beliefs) does not necessarily translates into a fall in hours worked. Indeed, the increase in consumption reflects a decrease in the weight of the CIA constraint in the households' objective, *i.e.*, a decrease of the Lagrange multiplier associated with this CIA constraint ($\searrow \mu_t$). Hence, it is possible that the decrease in the marginal utility in consumption would be sustained by an increase in the weight of the budget constraint, *i.e.*, a rise of the multiplier associated with the budget constraint ($\nearrow \lambda_t$). In such a case, the value of the real wage is improved, and this entails higher hours worked (see equations (3) and (4)).

In order to evaluate the ability of the model to replicate the business cycle we follow the RBC approach. Model parameters reported in table 1

[8]This explains the counterfactual behavior of consumption observed in the Benhabib and Farmer's (1996) model. In Schmitt-Grohé (2001), the assumption of a countercyclical markup could allow for a procyclical consumption since animal spirits affect the labor-demand. Nevertheless, for plausible parameter values, the consumption remains “slightly” negatively correlated with the output.

are calibrated in a fairly standard way. The average value for hours worked being set to $l^{\star} = 0.2$, equations (11) and (13) give long-run values for the capital stock and the consumption. Even though it is not currently needed for indeterminacy, as an infinite value for the labor supply elasticity is usually assumed in the literature, we set $\chi = 0$ (recall however that this assumption is unnecessary to see indeterminacy emerging).[9] Thus, indeterminacy results when $\sigma > 2$ (see (17)). Following King and Rebelo (1999), we fix $\sigma = 3$ (IES = 1/3).

Table 1: PARAMETERS

β	δ	α	σ	χ
0.99	0.025	0.3	3	0

As a benchmark, we first examine how the model responds to sunspots alone, without technology shocks. Table 2 (last column) shows that our "endogenous business cycle" (EBC) CIA model is able to produce a procyclical consumption.[10] Nonetheless, it suffers from two stringent weaknesses: the investment is countercyclical and the volatilities of consumption and investment relatively to that of output are hugely overestimated. These counterfactual results come from the fact that, even though sunspots induce simultaneous increase in consumption and hours worked, the rise of hours, hence output, is very small. Consequently, a strong increase in consumption can only be sustained by a strong decrease in investment: investment is countercyclical, and relative volatilities to that of output are overestimated. This actually suggests that technological disturbances (supply shocks) must be added. Technological parameters are set to $\rho_z = 0.95$ and $\sigma_z = 0.007$ (see Prescott [1986]). In addition, since we now consider two sources of uncer-

[9] An infinite labor supply elasticity can be justified by the indivisible labor and employment lottery assumptions (see Hansen (1985)).

[10] Empirical properties for the US are taken from Cooley and Prescott (1995). All series (empirical and simulated) are logged and detrended using the Hodrick-Prescott filter.

tainty, the covariance matrix between technology and belief shocks has to be calibrated. Let σ_e and $\rho_{e\zeta} \in [-1, 1]$ stand for the standard deviation of sunspots and the correlation between sunspots and technological shocks, respectively. Table 2 compares several possible moments when the correlation parameter takes three possible values: $\rho_{e\zeta} \in \{-1, 0, 1\}$. One should notice in particular that whenever $\rho_{e\zeta} = 0$ beliefs correspond to "pure" sunspots while whenever $\rho_{e\zeta} = 1$, beliefs are assumed to be simply positive overreactions to news about fundamentals.

In each cases we calibrate σ_z/σ_e so that the model replicates the relative standard deviation of consumption to that of output. It is seen in Table 2 that our CIA model generate realistic aggregate fluctuations provided that the correlation between beliefs and technological disturbances is positive. This requisite means that sunspots are overreactions to news about fundamentals. For purposes of comparison, we also report the dynamical properties of the Benhabib and Farmer's (1996) model generated with $\rho_{e\zeta} = 1$. It appears that *our monetary model with constant returns to scale performs as well as a more "intricate" two-sector real model with increasing returns.*

5 Concluding remarks

This paper has examined a cash-in-advance one-sector model in which indeterminacy occurs for *constant* returns to scale and values of the intertemporal elasticity of substitution in consumption consistent with the bulk of empirical estimates. Indeterminacy appears then more likely empirically plausible in this model than in real (one and two-sector) models. However, the model was not found to endogenously produce a procyclical consumption in a satisfactory way. This supports the wisdom that animal spirits (demand shocks) cannot be invoked solely to explain the business cycle. Whenever sunspots and technological disturbances (supply shocks) are simultaneously allowed, the model performs equally as well as existing real sunspot models with increasing returns.

Table 2: Comovements

		US (data)	BF	CIA ($\sigma_z > 0$)			CIA ($\sigma_z = 0$)
			$\rho_{e\zeta} = 1$ $\frac{\sigma_z}{\sigma_e} = 1$	$\rho_{e\zeta} = 1$ $\frac{\sigma_z}{\sigma_e} = 0.7$	$\rho_{e\zeta} = 0$ $\frac{\sigma_z}{\sigma_e} = 0.9$	$\rho_{e\zeta} = -1$ $\frac{\sigma_z}{\sigma_e} = 1.1$	$\rho_{e\zeta} = 0$ $\sigma_z = 0$
Consumption c							
	(1)	0.74	0.74	0.74	0.74	0.74	15.31
	(2)	0.83	0.51	0.52	0.22	0	0.96
Investment i							
	(1)	4.79	3.45	4.05	4.96	5.51	51.92
	(2)	0.91	0.83	0.81	0.84	0.86	-0.96
Hours Worked l							
	(1)	0.94	0.89	0.55	0.51	0.48	1.35
	(2)	0.74	0.70	0.88	0.88	0.88	0.94

(1):$\sigma(x)/\sigma(y)$, (2): $cor(x,y)$, y: real per capita output.

References

Barinci J.-P., Chéron A. (2001), Sunspots and the Business Cycle in a Finance Constrained Economy, *Journal of Economic Theory* 97, 30-49.

Basu S., Fernald J. (1997), Returns to scale in U.S. production: Estimates and implications, *Journal of Political Economy* 105, 249-283.

Bennett R.L., Farmer R.E.A. (2000), Indeterminacy with non-separable utility, *Journal of Economic Theory* 93, 118-143.

Benhabib J., Farmer R.E.A. (1994) Indeterminacy and increasing returns, *Journal of Economic Theory* 63, 19-41.

Benhabib J., Farmer R.E.A. (1996), Indeterminacy and sector specific externalities, *Journal of Monetary Economics* 37, 397-419.

Benhabib J., Farmer R.E.A. (1999), Indeterminacy and Sunspots in Macroeconomics, in Taylor J.B., Woodford M. (Eds.), *Handbook of Macroeconomics*, North-Holland, Amsterdam.

Campbell J.Y. (1999), Asset prices, Consumption and the Business Cycle, in Taylor, J.B., Woodford M. (Eds.), *Handbook of Macroeconomics*, North-Holland, Amsterdam.

Cooley T.F., Hansen G.D. (1989), The Inflation Tax in a Real Business Cycle Model, *American Economic Review* 79, 733-748.

Cooley T.F., Prescott E. (1995), Economic Growth and Business Cycles, in *Frontiers of Business Cycle Research*, Princeton University Press.

Farmer, R.E.A. 1997. Money in a Real Business Cycle Model. *Journal of Money, Credit, and Banking* 29, 568-611.

Farmer R.E.A., Guo J.T. (1994), Real Business Cycles and the Animal Spirits hypothesis, *Journal of Economic Theory* 63, 42-72.

Hansen G.D. (1985), Indivisible Labor and the Business Cycle, *Journal of Monetary Economics* 16, 309-327.

Harrison S.G. (2001), Indeterminacy in a Model with Sector-specific Externalities, *Journal of Economic Dynamics and Control* 25, 747-764

Harrison S.G., Weder M. (2000a), Indeterminacy in a Model with Aggregate and Sector-specific Externalities, *Economic Letters* 69, 173-179

Harrison S.G., Weder M. (2000b), Tracing Externalities as Sources of Indeterminacy, Barnard College, unpublished manuscript.

King R. and Rebelo S. (1999), Resuscitating Real Business Cycles, in Taylor J.B., Woodford M. (Eds.), *Handbook of Macroeconomics*, North-Holland, Amsterdam.

Kocherlakota N.R. (1996), The Equity Premium: It's Still a Puzzle, *Journal of Economic Literature* 36, 42-71.

Schmitt-Grohé S. (2001), Endogenous Business Cycles and the Dynamics of Output, Hours and Consumption, *American Economic Review* 90, 1136-1159.

Sossounov K.A. (2000), Analyzing Indeterminacies in a Real Business Cycle Model with Money, *Journal of Money, Credit, and Banking* 32, 280-291.

Wen Y. (1998), Capacity Utilization under Increasing Returns to Scale, *Journal of Economic Theory* 81, 7-36.