

Chakrabarty, Debajyoti

Working Paper

Growth and business cycles with imperfect credit markets

ZEI Working Paper, No. B 29A-2002

Provided in Cooperation with:

ZEI - Center for European Integration Studies, University of Bonn

Suggested Citation: Chakrabarty, Debajyoti (2002) : Growth and business cycles with imperfect credit markets, ZEI Working Paper, No. B 29A-2002, Rheinische Friedrich-Wilhelms-Universität Bonn, Zentrum für Europäische Integrationsforschung (ZEI), Bonn

This Version is available at:

<https://hdl.handle.net/10419/39521>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn



Debajyoti Chakrabarty

**Growth and Business Cycles
with Imperfect Credit
Markets**

Working Paper

**B29A
2002**

Growth and Business Cycles with Imperfect Credit Markets*

Debajyoti Chakrabarty[†]

November 2002

Abstract

We study the process of growth and business cycles in an open economy which has access to international financial markets. The financial market imperfection originates from costly state verification and a positive probability of default on loans. The degree of credit market imperfection is endogenously derived. The results show that developed economies are able to borrow on easier terms than emerging countries. The credit market imperfection may cause some economies to fall into a development trap if the initial endowment of capital is too low. The financial market frictions also generate interesting business cycle dynamics. Financial market imperfections help in replicating the empirical fact that output growth shows positive autocorrelation at short horizons. The model also predicts that a poorer economy will experience a more severe and persistent effect on investment and output due to an exogenous shock.

Keywords: Costly state verification, Credit markets, Growth, Business Cycles

JEL classification: G14, D82, G21, O16

*I am thankful to Stephanie Schmitt-Grohe and seminar participants at Center for European Integration Studies, Mid-west Macroeconomics Conference and University of Cologne for several helpful comments and discussions.

[†]Center for European Integration Studies (ZEI), University of Bonn, Walter-Flex-Str. 3, 53113 Bonn, Germany, e-mail: dchakrab@uni-bonn.de, phone +49 228 1821, fax +49 228 1809.

1 Introduction

This paper develops a framework to study the role of credit market imperfections in the process of growth and business cycles in an economy. Economists have long regarded the credit market as key to understanding economic development and to transmitting cyclical shocks through modern industrial economies.

The literature on the connection between credit markets and the macroeconomy has developed in two directions. The growth branch of this literature started with Gurlley and Shaw([14]) who noted that economic growth is almost always accompanied by financial deepening, i.e., by more extensive use of external finance in investment and the gradual easing of distortions of the credit market. Subsequent papers in this literature have focused on the role of credit markets as efficient allocators of savings into productive investment opportunities. Bencivenga and Smith([3]) studied the growth effects of financial intermediation in an overlapping generation economy with agents characterized by uncertain liquidity needs. Intermediation enhances growth because banks are efficient providers of liquidity which frees the individuals from the need to hold low yield liquid assets. Greenwood and Jovanovic([12]) also derive similar results. For a summary of the work in this area see Greenwood and Smith([13]).

The cyclical fluctuation branch of the literature focuses on the connection between credit markets and business cycles. The main focus of attention is how the credit market propagates and amplifies external shocks through the economy. This general sentiment dates back to Fisher and, Friedman and Schwartz, who argued that adverse conditions in financial markets may have worsened the effects of prewar recessions, including the Great Depression. Much of business cycle research investigates the informational role played by the credit markets. A seminal contribution in this line of research was made by Brenanke and Gertler([4]). They developed a general equilibrium model where agency costs arise endogenously. An important insight of their model is the theoretical possibility that agency costs will enhance the propagation of productivity shocks. Carlstrom and Fuerst([6]) built on the Bernanke-Gertler paper by constructing a computable general equilibrium model. They try to quantitatively capture the effect of agency costs on business cycles.

A related attempt to model credit market imperfection is provided by Keotaki and

Moore([15]). They analyze the contracting problem between borrowers and lenders in an environment where value of a project cannot be extracted by the lender due to inalienability of human capital. The result is that borrowing is so tightly constrained by the value of collateral that default never occurs in equilibrium.

We follow Bernanke-Gertler approach and adopt costly state verification model of Townsend([17]). Our model differs from the earlier papers in the literature in three important respects. Firstly, we study the effect of agency costs in an economy which has access to international financial markets. Unlike Bernanke & Gertler, and Carlstrom & Fuerst, the economy does not face an absolute borrowing constraint from domestic savings. Secondly, the agency cost problem exists in the production of final good and not in the production of intermediate goods alone. Finally, the inter-temporal preferences are determined endogenously. This makes the evolution of the economy dependant on its history. It also provides us with an insight as to why economies differ in terms of their credit market institutions over a long period of time.

The paper is organized as follows. The next section describes the production technology and the interaction between investment and international credit market. The inter-temporal optimization problem of the economy is presented in section 3. In section 4, we characterize the steady states and their stability properties. In section 5, we simulate the behavior of an economy whose characteristics are similar to a standard real business cycle economy and study the effect of exogenous shocks on it. Section 6 concludes.

2 The Model

A: The Production technology

Consider an economy with two production sectors. Both the production sectors produce the same homogeneous product, which can be used for consumption or investment. For tractability we will name the production sectors as household (H) and industrial (I). The household sector of the economy is characterized by a simple but primitive technology, which requires only labor for production. The production function in this sector is given by

$$Y^H = aL^H, \quad (1)$$

where L^H denotes the labor input and “ a ” denotes the marginal productivity of labor. The industrial sector uses capital (K) and labor(L) simultaneously. Production in the industrial sector can be thought of as a project or an endeavor to come up with a new technology. If the project is successful then production is high but if the project is unsuccessful then output is zero. The production function in the industrial sector is given by

$$Y^I = \begin{cases} F(L^I) & \text{with probability } \pi(K^I) \\ 0 & \text{with probability } 1 - \pi(K^I) \end{cases} \quad (2)$$

where L^I and K^I are the amount of labor and capital inputs respectively. The probability of success of the project is an increasing function of the amount of capital invested.

B: Industrial Sector Investment and the International credit market

The international credit market revolves around a risk free asset which yields a gross return $R^* \geq 1$ which we will call the world interest rate. The international credit market consists of a large number of potential lenders so all lenders on average earn R^* on their loans.

Let us begin with the case when an industrial sector firm decides to borrow capital from the international market. Suppose the firm is endowed with K units of capital. The firm has the option of investing in its own industrial sector project or the risk free asset. In addition he can also borrow capital from international market at a lending rate of interest R^l . The firm can invest K^I units of capital out of its endowment in the industrial sector project and earn R^* on the remaining capital. The amount K^I is the owners equity in the project and is observed by everyone. Suppose the firm borrows B from the international credit market. The firm could in theory use B^I for the industrial project and invest the remaining amount in the risk free asset. This allocation of borrowed funds is not ex-ante observed by the international lender.

The optimal contract between the firm and the international lender is a standard debt contract where the firm repays the lender a gross interest rate of R^l on each unit of borrowed capital if the firm announces that the project was successful. If the agent

announces that the project was unsuccessful the lender must take over the project and verify that the firms's announcement was truthful. The takeover of project and subsequent verification of the status of the project is essential to prevent strategic defaulting. Let the verification cost to the lender on a loan size of B be mB ¹. On takeover of the project the lender is able to retrieve the amount of borrowed capital, which the firm had diverted into the risk-free asset $R^*(B - B^I)$. The limited liability clause in the debt contract prevents the lender from attaching other sources the agent's income on the takeover of the project. Hence the zero profit condition for the lenders in the international market can be written as

$$\pi(K^I + B^I) R^l B + [1 - \pi(K^I + B^I)] [R^*(B - B^I) - mB] = R^* B . \quad (3)$$

Simple manipulation of equation (3) yields

$$R^l = R^* \left[1 + \frac{1 - \pi(K^I + B^I)}{\pi(K_t^I + B^I)} \left(\frac{B_t^I}{B_t} \right) \right] + \left[\frac{1 - \pi(K_t^I + B_t^I)}{\pi(K_t^I + B_t^I)} \right] m . \quad (4)$$

Thus the economy can borrow capital from the international credit market as long as they pay the break-even interest rate to the lenders $R^l > R^*$. Given the contractual setup the only situation when the agent is going to declare bankruptcy is when the project has been unsuccessful. The difference between the lending rate and the risk-free interest rate is the interest premium. Let us now study the borrowing and investment decision of the domestic agent.

Assumption 1: The functions $F(\cdot)$ and $\pi(\cdot)$ are increasing and strictly concave in their arguments. In addition $\lim_{L \rightarrow 0} F'(\cdot) = \infty$, and $\lim_{K \rightarrow 0} \pi'(\cdot) = \infty$; where $F'(\cdot)$ and $\pi'(\cdot)$ denote the derivatives of functions $F(\cdot)$ and $\pi(\cdot)$ respectively.

Assumption 1 ensures some amount of investment in the industrial sector firm is worthwhile in the sense that it yields positive expected return.

Proposition 1 *If the industrial sector firm borrows in the international credit market then the entire borrowing is invested in the industrial project.*

Proof: See the appendix. ■

¹This means that monitoring cost is constant for every unit of loan. We make this assumption as this is the usual assumption in the literature. Relaxing this assumption however, will not alter our results significantly.

Once the lenders internalize this fact they will be willing to lend at a rate given by

$$R^l = \frac{R^*}{\pi(K^I + B)} + \left[\frac{1 - \pi(K^I + B)}{\pi(K^I + B)} \right] m. \quad (5)$$

Proposition 2 *The firm will never borrow and lend simultaneously in the international credit market. All debt contracts exhibit maximum equity participation i.e., $K^I = K$.*

Proof: See the appendix. ■

The intuition behind the above result is that the benefit to the firm from investing the entire capital in the project in terms of being able to borrow at a lower interest rate outweighs the gain in income from the risk-free asset. Thus proposition 2 establishes that the economy will save in the risk-free asset if it does not need to borrow from the international credit market. The borrowing interest rate in the international credit market is given by

$$R^l = \frac{R^*}{\pi(K + B)} + \left[\frac{1 - \pi(K + B)}{\pi(K + B)} \right] m. \quad (6)$$

Having derived some basic results concerning the working of the credit market let us now see how the aggregate economy behaves. Suppose the economy consists of a continuum of identical industrial sector firms of unit measure. The economy consists of a representative agent who is endowed with \bar{L} units of labor in every period. The agent invests his capital equally among the industrial sector firms and at the end of each period receives dividends from the successful firms. In each period $\pi(\cdot)$ proportion of the firms will be successful. The proportion of the successful firms in each period depends on the amount of investment in the industrial sector project. Depending on the amount of capital the agent brings into period t the economy will either borrow or lend in the credit market. This decision will in turn determine the inter-temporal budget constraint of the agent and then determine the long run output of the economy. Let K_t denote the amount of capital brought into period t by the agent. The aggregate production function of the economy is

$$Y(K_t) = \pi(K_t^I + B_t)[F(L_t^I) - R_t^l B_t] + a(\bar{L} - L_t^I) + R^*(K_t - K_t^I).$$

Proposition 3 *Let K^* be solution to $\pi'(K)F(L^I) = R^*$. If $K_t \in [0, K^*)$ then $K_t^I = K_t$ and $B_t > 0$. If $K_t \in [K^*, \infty)$ then $K_t^I \leq K_t$ and $B_t = 0$.*

Proof: See the appendix. ■

When the capital brought into period t by the agent is sufficiently small the agent will borrow from the credit market. Also, from equation (6) we can see that if the capital endowment of the agent is high the interest premium is lower. This corresponds well with the fact that industrialized economies find it easier to borrow funds in comparison to emerging economies. Once the return from investment in the industrial sector project falls below the rate of return on the risk free asset the agent will become a lender in the international credit market.

The domestic agent when faced with a lending rate R_t^l will borrow until

$$\frac{\pi'(K_t + B_t)F(L_t^I)}{\pi(K_t + B_t) + \pi'(K_t + B_t)B_t} = R_t^l. \quad (7)$$

Equation (7)²implies the level of investment in the industrial project is decreasing in the lending rate. The amount of investment in the industrial project when the agent has to borrow from the international credit market is less than the first-best³.

In any period t , the agent also decides on the amount of labor and the capital to employ in the industrial sector, and whether to borrow or lend in the international credit market. From assumption 1, the optimal allocation of labor across the industrial and household sector will satisfy

$$\pi(K_t^I + B_t)F'(L_t^I) = a$$

if $L_t^I < \bar{L}$. Hence, L_t^I is an increasing function of the amount of investment in the industrial sector $(K_t^I + B_t)$. Let us write the labor employed in the industrial sector as $L^I(K_t + B_t)$. From Proposition 3 we know that the economy will borrow if $K_t < K^*$ and the entire capital stock will be invested in the industrial sector. Therefore from equation (7) we can write B_t as a function of K_t . Once the economy attains K^* units of capital it will stop borrowing from the international credit market and invest any additional amount of capital i.e., $(K_t - K^*)$ in the risk free asset. To save on notation, in the subsequent analysis L_t^I and B_t will refer to the optimal choice of labor and borrowing given the level of capital.

²For detailed derivation of this condition see Appendix: Proof of Proposition 3.

³The first best level of investment will be given by the solution to $\pi'(K_t + B_t)F(L_t^I) = R^*$. According to equation (7) the demand for credit from the agent satisfies $\frac{\pi'(K_t+B_t)F(L_t^I)}{\pi(K_t+B_t)+\pi'(K_t+B_t)B_t} = R_t^l$. $R_t^l > R^*$ and $\frac{\pi'(K_t+B_t)F(L_t^I)}{\pi(K_t+B_t)+\pi'(K_t+B_t)B_t} < \pi'(K_t + B_t)F(L_t^I)$, hence the level of investment is less than first best.

Proposition 4 *If $K_t \in [0, K^*)$ then total investment in the industrial sector is increasing in K_t .*

Proof: See the appendix. ■

When an economy is a borrower in the international credit market, the lending rate of interest will decrease as the capital stock of the economy increases. As a result the level of investment in the industrial sector increases with the level of capital.

3 Inter-temporal optimization

Now we study the inter-temporal problem faced by the economy. In order to ensure the existence of at least one steady state equilibrium we assume the agent's preferences are characterized by endogenous rate of time preference. One way of interpreting these preferences is to view the discount factors as an agents probability of surviving to the next period⁴. The agent given the initial endowment of capital, has to decide his consumption and savings. The discount factor between periods t and $t + 1$ ($\rho_{t,t+1}$) is a continuous function of consumption at time t in the following way:

$$\rho_{t,t+1} = \beta(C_t) \tag{8}$$

where $0 < \beta(C_t) < 1$.

Let the period utility function of the agent be $U(C_t)$. The maximization problem faced by the agent is

$$\max E_0 \sum_{t=0}^{\infty} \rho_{0,t} U(C_t) ,$$

subject to

$$K_{t+1} = Y(K_t) - C_t , \tag{9}$$

$$Y(K_t) = \max_{K_t^I, L_t^I} \pi(K_t^I + B_t)[F(L_t^I) - R_t^I B_t] + a(\bar{L} - L_t^I) + R^*(K_t - K_t^I), \tag{10}$$

⁴For a detailed discussion of the preferences used below see Chakrabarty([7]).

and a transversality condition

$$\lim_{t \rightarrow \infty} \rho_{0,t} K_t \geq 0. \quad (\text{TC})$$

At this point we make some assumptions concerning the functions $U(\cdot)$ and $\beta(\cdot)$ to ensure that the necessary conditions for maximum are also sufficient.

Assumption 2: $U(C_t) > 0$, $U'(C_t) > 0$, $U''(C_t) < 0$, and $\beta''(C_t) < 0 < \beta'(C_t)$ for all C_t .

Let R_t denote the rate of return on capital in period t . From Proposition 3, we have

$$R_t = \begin{cases} R^* + [1 - \pi(K_t + B_t)]m & \text{if } K_t \in [0, K^h), \\ R^* & \text{if } K_t \in [K^h, \infty). \end{cases}$$

The solution to the economy's optimization problem will satisfy the following difference equations⁵.

$$\frac{U'(C_t) + \beta'(C_t) \phi_{t+1}}{\beta(C_t)[U'(C_{t+1}) + \beta'(C_{t+1}) \phi_{t+2}]} = \beta(C_t) R_{t+1}, \quad (11)$$

$$\phi_t = U(C_t) + \beta(C_t) \phi_{t+1} \quad \text{for all } t \geq 1, \quad (12)$$

and (9). The variable ϕ_{t+1} is the present discounted value of future consumption from period $t + 1$ onwards⁶.

Definition 1 A rational expectation equilibrium (REE) of this economy are sequences $\{C_t\}_{t=0}^{\infty}$, $\{K_{t+1}\}_{t=0}^{\infty}$, $\{K_t^I\}_{t=0}^{\infty}$, $\{L_t^I\}_{t=1}^{\infty}$, $\{\phi_t\}_{t=1}^{\infty}$, $\{B_t\}_{t=1}^{\infty}$ such that (9), (11), (12) and TC hold for a given K_0 .

Equation (9) is the inter-temporal budget constraint of the agent. Equation (11) tells us that the loss in welfare due to foregoing consumption in period t has to equal the discounted value of gain in welfare from period $t + 1$ onwards. This condition is commonly referred to as the Fisher equation.

⁵See the appendix for a detailed derivation.

⁶ $\phi_{t+1} = \sum_{s=t+1}^{\infty} \rho_{t+1,s} U(C_s)$

4 Steady-State Equilibria and Stability

Let us first study the steady state solutions to the difference equations (9), (11), (12) . In a steady state, equations (9), (11) and (12) reduce to

$$C = Y(K) - K , \quad (\text{BC})$$

$$\beta(C)R(K) = 1, \quad (\text{RR})$$

and

$$\phi = \frac{U(C)}{1 - \beta(C)}, \quad (13)$$

where $R(K) = \max\{R^* + [1 - \pi(K + B)]m, R^*\}$. Equation (RR) is the steady state counterpart of the Fisher's inter-temporal optimum. Equation (BC) gives us the locus of points along which the agent's consumption and capital stock are constant and satisfy the budget constraint. The (BC) curve is increasing in the level of capital⁷. The slope of RR curve in consumption-capital plane is given by $-\frac{R'(K)\beta(C)^2}{\beta'(C)}$ which is positive when $K \in [0, K^*)$. When $K \in [K^*, \infty)$ the (RR) curve is a horizontal line. Now we characterize the steady states and their stability properties.

Proposition 5 *If $\beta^{-1}(\frac{1}{R(0)}) < Y(0)$ and $\beta^{-1}(\frac{1}{R^*}) > Y(K^*) - K^*$ then there exists at least one steady state level of capital stock $K \in [0, K^*)$ which is locally unique.*

Proof: See the appendix. ■

The proposition above establishes a sufficient condition for the existence of at least one stable steady state equilibrium. The condition in the proposition means that when an economy has no capital the discount factor should be sufficiently high to induce the economy to save and accumulate capital. Note that it is possible that there may be more than one stable steady state equilibria.

⁷Using the envelope theorem, the slope of BC curve is $\pi'(K + B)R^l - 1$ if $K \in [0, K^*)$ and $R^* - 1$ if $K \in [K^*, \infty)$. Hence the slope of the BC curve is always positive.

5 Simulation

In this section we study the behavior of a simulated economy whose characteristics are similar to a standard international business cycle model except for the credit market imperfection. We assume that the period utility and discount factor are of the following functional forms:

$$U(C) = \frac{C^{1-\sigma}}{1-\sigma}, \quad \sigma > 1,$$

$$\beta(C) = \bar{\beta} - (\bar{\beta} - \underline{\beta})e^{-\delta C}, \quad \text{where } \bar{\beta} > \underline{\beta} > 0 \text{ and } \delta > 0.$$

The production functions in the industrial and household sectors are

$$F(L) = AL^\theta \text{ and } Y^H = aL$$

respectively. The probability of success of an industrial sector project is

$$\pi(K+B) = \begin{cases} \tau(K+B)^\alpha & \text{if } 0 < K+B < \tau^{-\frac{1}{\alpha}} \\ 1 & \text{if } K+B > \tau^{-\frac{1}{\alpha}} \end{cases}$$

where $\tau < 1$. From the first-order condition for optimal allocation of labor, the amount of labor employed in the industrial sector is given by

$$L^I = \begin{cases} \left(\frac{A\tau\theta}{a}\right)(K+B)^{\frac{\alpha}{1-\theta}} & \text{if } K < \bar{L}, \\ \bar{L} & \text{otherwise.} \end{cases}$$

The level of capital when the economy starts lending in the international credit market $K^* = \left(\frac{c}{R^*}\right)^{\frac{1-\theta}{1-\alpha-\theta}}$, where $c = \alpha\tau A\left(\frac{A\tau\theta}{a}\right)^{\frac{\theta}{1-\theta}}$. Note that as long as $K^* < \tau^{-\frac{1}{\alpha}}$ the economy which borrows from the international credit market will have to pay an interest premium. These functional forms yield us a Cobb-Douglas production function for the industrial sector. We now simulate the economy using certain parameter values which are presented in Table 1. The relationship between capital stock of the economy and the lending rate is given in Figure 1a. The corresponding optimal level of borrowing is shown in Figure 1b. The solution to inter-temporal maximization problem of the economy shows the possibility of two stable steady state equilibria. The function $g(K) = \beta(Y(K) - K)R(K) - 1$ is shown in figure 2. If the initial endowment of capital of the economy is less than K_u the economy converges to the poverty trap steady state K_p . If the initial endowment of capital exceeds K_u the economy converges to the high level steady state K_h . Some characteristics of the two steady states are summarized in Table 2. Understandably the poverty trap steady

state shows a lower share of industrial sector in GDP. The debt-equity ratio(B/K) is higher for K_p . We now study the impact of a small productivity and interest rate shock on these economies. These shocks are assumed to follow the following processes:

$$\begin{aligned}\widehat{R}_t^* &= 0.9\widehat{R}_{t-1}^* + v_R, \\ \widehat{A}_t &= 0.95\widehat{A}_{t-1} + v_A,\end{aligned}$$

around their steady state values, where v_R and v_A are serially uncorrelated shocks to world interest rate and productivity respectively.

The impulse response functions for capital and output due to a 1% productivity shock are shown in Figures 3a and 3b. Both the steady state economies experience amplification and persistence. This is due to the credit market friction. Figures 4a and 4b are the deviation in capital and output from their steady state values due to a 1% shock to the world interest rate. Interestingly the effect on the poverty trap steady state is more severe and persistent.

This behavior of the impulse response functions is similar to Carlstrom and Fuerst([6]). However, in their model an economic expansion is associated with an increase in risk premium and bankruptcy rates. Our model predicts a lowering of risk premium and bankruptcy rates during periods of expansion. This is due to the fact that in our model economies can borrow from the foreign markets and are not constrained by domestic savings.

6 Conclusion

We develop a model of imperfect credit markets where an economy has access to foreign capital markets and potentially can borrow unlimited amount of funds. On a purely theoretical level this adds to the present literature by allowing the economy to borrow beyond domestic savings. In conjunction with endogenous rate of time preference this paper explains why history of an economy matters in the process of development. The model also predicts hump shaped impulse response functions: a well established empirical fact(see for example Cogley and Nason([8])).

In future work we would like to carefully calibrate the parameters of the model to quantitatively evaluate the predictions of the model. In this paper we have played down

the role of the banking system. Explicit modeling of the banking system will not alter our results as there is no aggregate uncertainty in the economy. Introduction of aggregate uncertainty in the production process may lead to phenomenon such as banking crisis and self fulfilling expectations. The role of banking system would become important in such a scenario. Such issues are left for future research.

Appendix

Proof of Proposition 1:

We want to show that if $B > 0$ then $B^I = B$. If the firm decides to borrow funds from the international capital market it maximizes expected income i.e.,

$$\max_{B, B^I, K^I} \pi(K^I + B^I)[F(L^I) + R^*(B - B^I) - R^l B] + R^*(K - K^I),$$

with respect to B and B^I . If $B > 0$ and $B^I < B$, then it is possible to increase the expected income of the agent by reducing B since $R^l > R^*$ which is a contradiction. ■

Proof of Proposition 2:

We want to show that if $B > 0$ then $K^I = K$. Incorporating the previous proposition we can re-write the expected income of the agent as

$$\max_{B, B^I, K^I} \pi(K^I + B)[F(L^I) - R^l B] + R^*(K - K^I).$$

If $B > 0$ then $\pi'(K^I + B)[F(L^I) - R^l B] - \pi(K^I + B) R^l \geq 0$. Suppose $K^I < K$ then $\pi'(K^I + B)F(L^I) = R^*$. Substituting this in the previous inequality we get that $R^* - R^l B - \pi(K^I + B)R^l \geq 0$. Substituting (6) and carrying out simple manipulation we get that for the $B > 0$ and $K^I < K$ to hold simultaneously $-R^l B - [1 - \pi(K^I + B)]m$ has to be non-negative which is a contradiction. ■

Proof of Proposition 3:

The expected income of the domestic agent in period t is

$$Y(K_t) = \pi(K_t^I + B_t)[F(L_t^I) - R_t^l B_t] + a(\bar{L} - L_t^I) + R^*(K_t - K_t^I).$$

First order conditions for optimum with respect to L_t^I yields

$$\pi(K_t^I + B_t)F'(L_t^I) \geq a.$$

$L_t^I > 0$ from our assumptions and is increasing in $(K_t^I + B_t)$ as long as $L_t^I < \bar{L}$. Therefore we can write $L_t^I = L(K_t^I + B_t)$; where $L'(\cdot) > 0$ if $L_t^I < \bar{L}$ and $L'(\cdot) = 0$ otherwise. Let K^*

be solution to $\pi'(K)F(L^I) = R^*$. We want to show if $K_t \geq K^*$ then $B_t = 0$. If $K_t \geq K^*$ then $\pi'(K_t+B_t)F(L_t^I) - \pi'(K_t+B_t)B_t - \pi(K_t+B_t)R_t^l \leq R^* - \pi'(K_t+B_t)B_t - \pi(K_t+B_t)R_t^l < 0$ implying borrowing will lower expected income. Hence $B_t = 0$ when $K_t \geq K^*$. Using Proposition 2, optimal choice of B_t after some manipulations can be written as

$$\frac{\pi'(K_t + B_t)F(L_t^I)}{\pi(K_t + B_t) + \pi'(K_t + B_t)B_t} - R_t^l \geq 0 \text{ if } B_t > 0.$$

Notice the first order condition for maximum is also sufficient since $\pi''(K_t + B_t)[F(L_t^I) - R_t^l] - 2\pi'(K_t + B_t)R_t^l < 0$. Define $z(B, K_t) = \frac{\pi'(K_t+B)F(L_t^I)}{\pi(K_t+B) + \pi'(K_t+B)B} - R_t^l$. If $K_t < K^*$ then $z(0, K_t) = \frac{\pi'(K_t)F(L_t^I)}{\pi(K_t)} - R^* > 0$. Hence optimal $B_t > 0$. ■

Proof of Proposition 4:

The optimal level of borrowing by an economy with capital less than K^* solves

$$\pi'(K_t + B_t)F(L_t^I) - \pi'(K_t + B_t)B_t - \pi(K_t + B_t)R_t^l = 0.$$

The condition above gives the borrowing function $B_t = B(K_t)$. $B'(K) = \frac{dB}{dK}$

$= \frac{\pi''(K+B)[F(L^I) - R^l B] - \pi'(K+B)R_t^l}{\pi''(K+B)[F(L^I) - R^l B] - 2\pi'(K+B)R_t^l} > -1$. Therefore total investment $K_t + B_t$ is increasing in K_t . ■

Inter-temporal Optimization problem of the economy:

The Lagrangian for the agent's problem can be written as

$$\mathcal{L} = \sum_{t=0}^{\infty} \{ \rho_{0,t} U(C_t) + \tilde{\lambda}_t [Y_t - C_t - K_{t+1}] \}.$$

The first-order conditions for maximum are

$$\rho_{0,t} U'(C_t) + \sum_{s=t+1}^{\infty} \frac{\partial \rho_{0,s}}{\partial C_t} U(C_s) = \tilde{\lambda}_t,$$

$$\tilde{\lambda}_t = \tilde{\lambda}_{t+1} R_{t+1},$$

and the transversality condition holding with equality. Let $\left(\frac{\tilde{\lambda}_t}{\rho_{0,t}} \right) = \lambda_t$ and $\sum_{s=t+1}^{\infty} \rho_{t+1,s} U(C_s) = \phi_{t+1}$, where ϕ_{t+1} is the present discounted value of future consumption from period $t+1$ onwards. The first order conditions can now be re-written as

$$U'(C_t) + \beta'(C_t) \phi_{t+1} = \lambda_t, \tag{14}$$

$$\lambda_t = \lambda_{t+1}\beta(C_t)R_{t+1}, \quad (15)$$

and

$$K_{t+1} = Y_t - C_t . \quad (16)$$

Substituting (14) in (15) we get,

$$\frac{U'(C_t) + \beta'(C_t) \phi_{t+1}}{\beta(C_t)[U'(C_{t+1}) + \beta'(C_{t+1}) \phi_{t+2}]} = \beta(C_t)R_{t+1} \quad (17)$$

Notice that the variable ϕ_t , the present discounted value of utilities from period t onwards, evolves in the following fashion:

$$\phi_t = U(C_t) + \beta(C_t) \phi_{t+1} \quad \text{for all } t \geq 1 . \quad (18)$$

■

Proof of Proposition 5:

Define $g(K) = \beta(C)R(K) - 1$. Substituting (13) for C , $g(0) = \beta(Y(0))R(0) - 1 > 0$ if $\beta^{-1}(\frac{1}{R(0)}) > Y(0)$ and $g(K^*) = \beta(Y(K^*) - K^*)R^* - 1 < 0$ if $\beta^{-1}(\frac{1}{R^*}) < Y(K^*) - K^*$. Then there must exist a $K_s \in [0, K^*)$ such that $g(K_s) = 0$. Moreover the derivative of the function $g(\cdot)$ along that steady state is $g'(K_s) = \beta'(C)R(K_s)(R(K_s)-1) + \beta(C)R'(K_s) < 0$. To study the stability properties of the steady state, we first log-linearize equation (9), (12) and (11) around steady state which yields

$$\widehat{K}_{t+1} = \beta^{-1}\widehat{K}_t + s_1 \widehat{C}_t, \quad (19)$$

where ‘ $\widehat{\cdot}$ ’ denotes percentage deviation of the variable from its steady state value and $s_1 = -C/K$ at steady state. Log-linearization of (12) gives us

$$\widehat{\phi}_{t+1} = -\beta^{-1}\Delta_2 \widehat{C}_t + -\beta^{-1}\widehat{\phi}_t \quad (20)$$

where $\epsilon_\beta(C) = \left(\frac{\beta'(C)C}{\beta(C)}\right) > 0$, $\epsilon_U(C) = \left(\frac{U'(C)C}{U(C)}\right) > 0$ and $\Delta_2 = (1 - \beta)\epsilon_U(C) + \beta\epsilon_\beta(C) > 0$. We rewrite the above equation as

$$\widehat{\phi}_{t+2} - \widehat{\phi}_{t+1} = -\beta^{-1}\Delta_2 \widehat{C}_{t+1} + (\beta^{-1} - 1) \widehat{\phi}_{t+1}, \quad (21)$$

to simplify our analysis in future. From (14), we have

$$[s_2\sigma(C) + s_3\eta_\beta(C)\phi] \widehat{C}_t + s_3 \widehat{\phi}_{t+1} = \widehat{\lambda}_t,$$

where $\sigma(C) = \left(\frac{U''(C)C}{U'(C)}\right) < 0$ and $\eta_\beta(C) = \left(\frac{\beta''(C)C}{\beta'(C)}\right) < 0$. $s_2 = \left(\frac{U'(C)}{\lambda}\right)$ and $s_3 = 1 - s_2$. We write the above equation more compactly as

$$\Delta_1 \widehat{C}_t + s_3 \widehat{\phi}_{t+1} = \widehat{\lambda}_t, \quad (22)$$

where $\Delta_1 = [s_2\sigma(C) + s_3\eta_\beta(C)\phi] < 0$, from our previous assumptions.

From (15) we have

$$\widehat{\lambda}_t - \widehat{\lambda}_{t+1} = \epsilon_\beta(C) \widehat{C}_t + R'(K)\widehat{K}_{t+1} \quad (23)$$

We can now use equations (19), (20), (21), (22) and (23) to write a system of difference equations in \widehat{C}_t , $\widehat{\phi}_t$ and \widehat{K}_t where the dynamical system can be expressed as

$$\begin{bmatrix} \widehat{C}_{t+1} \\ \widehat{\phi}_{t+1} \\ \widehat{K}_{t+1} \end{bmatrix} = M \begin{bmatrix} \widehat{C}_t \\ \widehat{\phi}_t \\ \widehat{K}_t \end{bmatrix}, \quad (24)$$

where

$$M = \begin{bmatrix} M_{11} & M_{12} & M_{13} \\ -\beta^{-1}\Delta_2 & \beta^{-1} & 0 \\ s_1 & 0 & \beta^{-1} \end{bmatrix},$$

$$M_{11} = \left(\frac{\epsilon_\beta(2 - \beta^{-1}) + s_1R'(K)K - \Delta_1}{\epsilon_\beta - \Delta_1}\right), M_{12} = \left(\frac{\epsilon_\beta(\beta^{-1} - 1)\Delta_2^{-1}}{\epsilon_\beta - \Delta_1}\right) \text{ and } M_{13} = \left(\frac{R'(K)K\beta^{-1}}{\epsilon_\beta - \Delta_1}\right).$$

The eigenvalues of matrix M are going to determine the local behavior of the system.

The roots of the polynomial $\det[M - \mu I] = 0$, will determine the behavior of the above system.

$$\det[M - \mu I] = (\beta^{-1} - \mu)[(M_{11} - \mu)(\beta^{-1} - \mu) + M_{12}\beta^{-1}\Delta_2 - s_1M_{13}].$$

Therefore $\mu_1 = \beta^{-1}$ is one of the roots of the polynomial. The other two roots of $\det[M - \mu I]$ are the roots of the polynomial,

$$P(\mu) = \mu^2 - (M_{11} + \beta^{-1})\mu + (M_{11}\beta^{-1} + M_{12}\beta^{-1}\Delta_2 - s_1M_{13}).$$

Consider $(M_{11}\beta^{-1} + M_{12}\beta^{-1}\Delta_2 - s_1M_{13}) = \beta^{-1}$

$(\frac{\epsilon_\beta + \epsilon_\beta(1-\beta^{-1}) + s_1R'(K)K - \Delta_1 + \epsilon_\beta(\beta^{-1}-1) - s_1R'(K)K}{\epsilon_\beta - \Delta_1}) = \beta^{-1}$. Therefore $P(0) = \beta^{-1} > 1$.
 $P(1) = 1 - M_{11} - \beta^{-1} + \beta^{-1} = 1 - M_{11} = \frac{\epsilon_\beta(\beta^{-1}-1) - s_1R'(K)K}{\epsilon_\beta - \Delta_1} < 0$ if $\epsilon_\beta(\beta^{-1}-1) - s_1R'(K)K < 0$. Note that if $g'(K_s) = \beta'(C)R(K_s)(R(K_s) - 1) + \beta(C)R'(K_s) < 0$ it implies that $\epsilon_\beta(\beta^{-1} - 1) - s_1R'(K)K < 0$. Hence there exists at least one root of the polynomial $\det[M - \mu I]$ which is less than one. Its easy to show that the third root is strictly greater than unity in absolute value. Hence the steady state is a saddle path and locally unique. ■

References

- [1] Azariadis, C and Chakraborty, S., (1999) Agency Costs in Dynamic Economic Models, *Economic Journal* 109 (455), 222-41.
- [2] Azariadis, C and Smith, B., (1998) Financial Intermediation and Regime Switching in Business Cycles, *American Economic Review* 88 (3), 516-36.
- [3] Bencivenga, V. and Smith, B.(1991) Financial Intermediation and Endogenous Growth, *Review of Economic Studies* 58, 195-209.
- [4] Bernanke, B. and Gertler, M.(1989) Agency Costs, Net Worth and Business Fluctuations, *American Economic Review* 79, 14-31.
- [5] Bernanke, B. and Gertler, M.(1995) Inside the Black Box: The Credit Channel of Monetary Policy Transmission, *Journal of Economic Perspectives* (Fall).
- [6] Carlstrom, C. T and Fuerst, T. S. (1997) Agency Costs, Net Worth, and Business Fluctuations: A Computable General Equilibrium Analysis, *American Economic Review* 87(5), 893-910.
- [7] Chakrabarty, D. (2000) Poverty Traps and Growth in a Model of Endogenous Time Preference, *Rutgers University Working Paper Series* 2000-18.

- [8] Cogley, T. and Nason, J. M. (1995) Output Dynamics in Real Business Cycle Models, *American Economic Review* 85(3), 77-81.
- [9] Epstein, L.G. (1983) Stationary Cardinal Utility and Optimal Growth under Uncertainty, *Journal of Economic Theory* 31, 133-152.
- [10] Gale, D. and Hellwig, M. (1985) Incentive-Compatible Debt Contracts: One-Period Problem, *Review of Economic Studies* 52, 647-63.
- [11] Galor, O. and Zeira, J.(1993) Income Distribution and Macroeconomics, *Review of Economic Studies* 60, 35-52.
- [12] Greenwood, J. and Jovanovic, B. (1990) Financial Development, Growth and Distribution of Income, *Journal of Political Economy* 98(5), 1076-107.
- [13] Greenwood, J. and Smith, B. (1997) Financial Markets in Development, and Development of Financial Markets, *Journal of Economic Dynamics and Control* 21, 145-81.
- [14] Gurley, J and Shaw, E. (1967) Financial Development and Economic Development, *Economic Development and Cultural Change* 15, 257-68.
- [15] Kiyotaki, N. and Moore, J. (1997) Credit Cycles, *Journal of Political Economy* 105, 211-48.
- [16] Mendoza, E. (1991) Real Business Cycles in a Small Open Economy, *American Economic Review* 81(4), 797-818.
- [17] Townsend, R. (1979) Optimal Contracts and Competitive Markets with Costly State Verification, *Journal of Economic Theory* 21, 265-93.
- [18] Solow, R.M. (1956) A contribution to the theory of Economic Growth, *Quarterly Journal of Economics* 70 (February), 65-94.
- [19] Uzawa, H. (1968) Time preference, the consumption function, and optimum asset holdings, chapter 21 in J. N. Wolfe, ed., *Value, Capital, and Growth*. Papers in honor of Sir John Hicks. Edinburgh: University Press, 485-504.

- [20] Williamson, S. (1986) Costly Monitoring, Financial Intermediation, and Equilibrium Credit Rationing, *Journal of Monetary Economics* 18, 159-79.
- [21] Williamson, S. (1987) Financial Intermediation, Business Failures and Real Business Cycles, *Journal of Political Economy* 95(6), 1196-216.
- [22] World Bank (1989), *World Bank Development Report*, New York: Oxford University Press.

Table 1: Simulation Parameters

| Parameter | Value | Description |
|-----------------|-------|--|
| R^* | 1.025 | World interest rate(per annum) |
| m | 0.005 | Average monitoring Cost |
| τ | 0.1 | Shift parameter for probability of success of industrial sector projects |
| α | 0.53 | Elasticity of “probability of success” with respect to investment in the industrial sector |
| θ | 0.26 | Elasticity of output with respect to labor in the industrial sector |
| A | 34 | Shift parameter in the industrial sector production function |
| a | 1 | Labor productivity in household sector |
| \underline{b} | 0.40 | Lower bound of the discount factor |
| \bar{b} | 0.99 | Upper bound of the discount factor |
| δ | 0.03 | $-\frac{\beta''(C)}{\beta'(C)}$ |
| σ | 1.5 | Elasticity of marginal utility |

Table 2: Some steady state characteristics

| | B/K | Y'/Y | $R^l B/F(L^l)$ | C/Y | $b(C)$ | R^l |
|-------|-------|--------|----------------|-------|--------|-------|
| K_p | 70.22 | 75.93 | 17.64 | 77.39 | 0.89 | 1.10 |
| K_h | 21.99 | 87.04 | 8.56 | 63.80 | 0.90 | 1.05 |

Figure 1a: Lending Rate

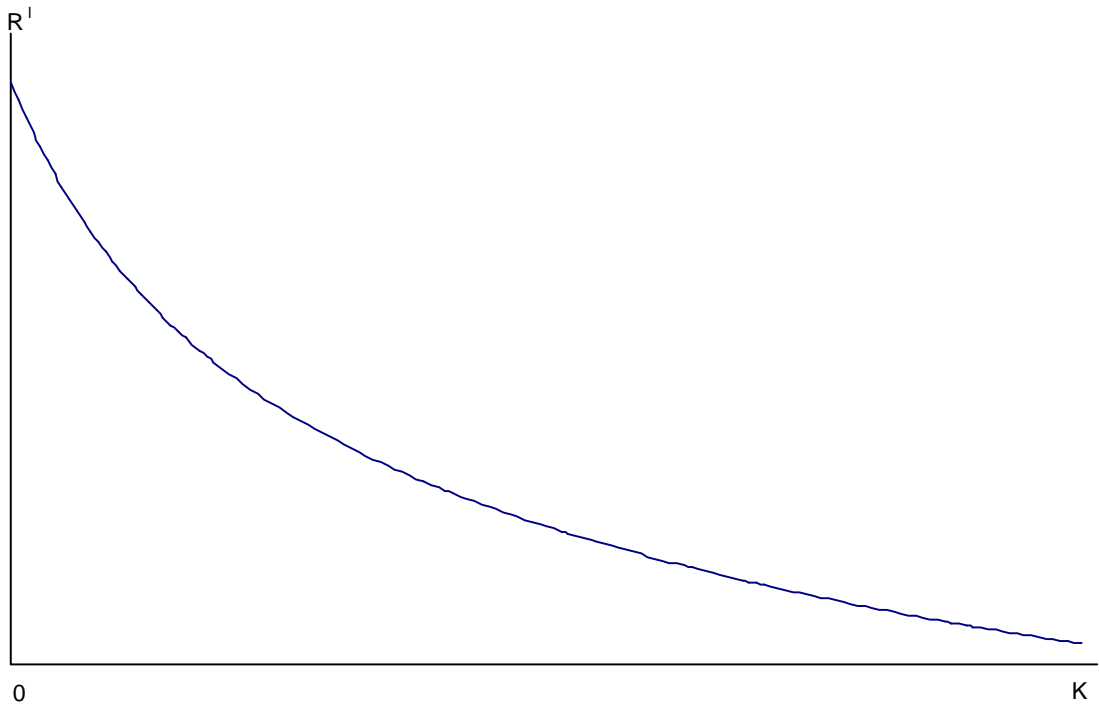


Figure 1b: Borrowing

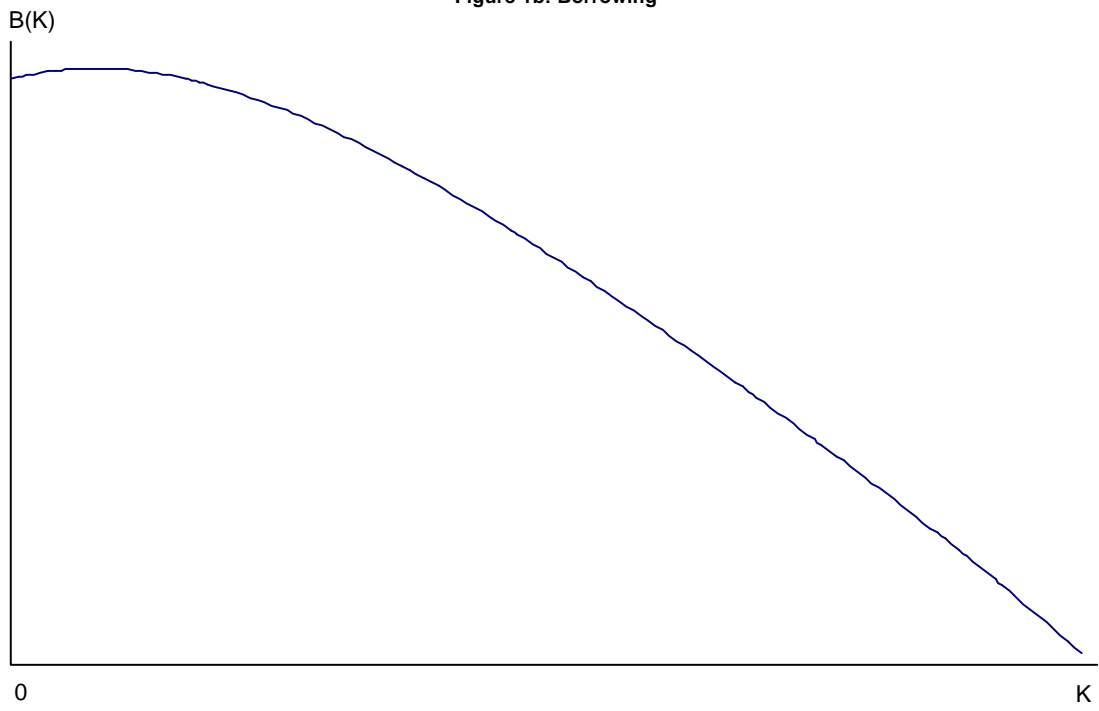


Figure 2: Steady States

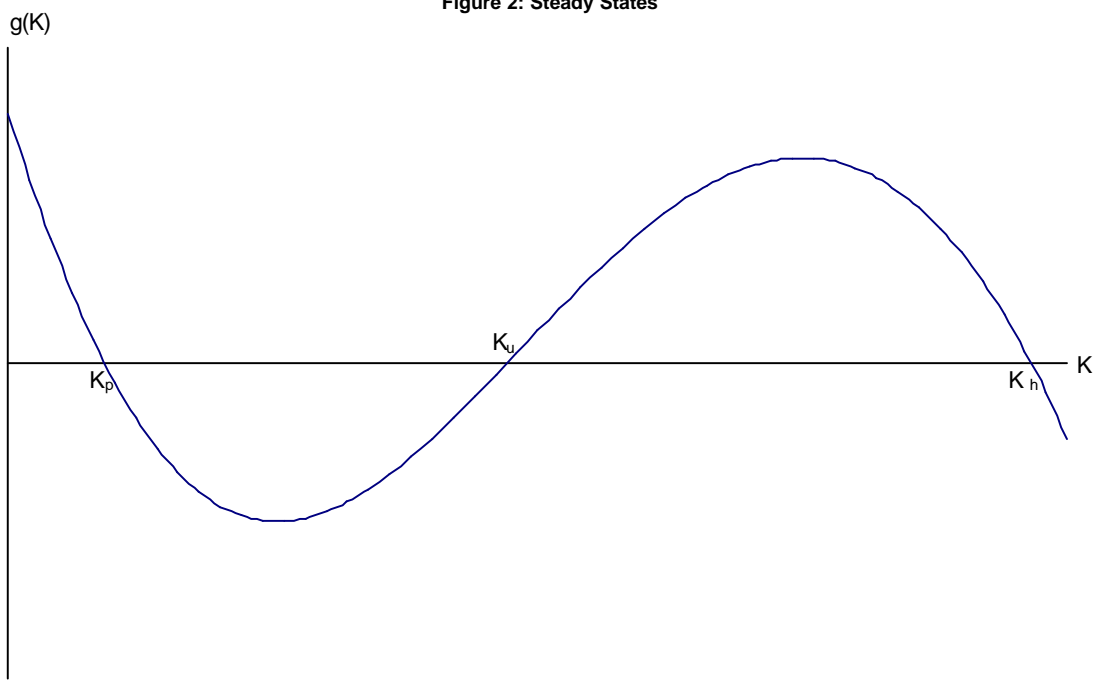


Figure 3a: IRF for capital due to a 1% productivity shock

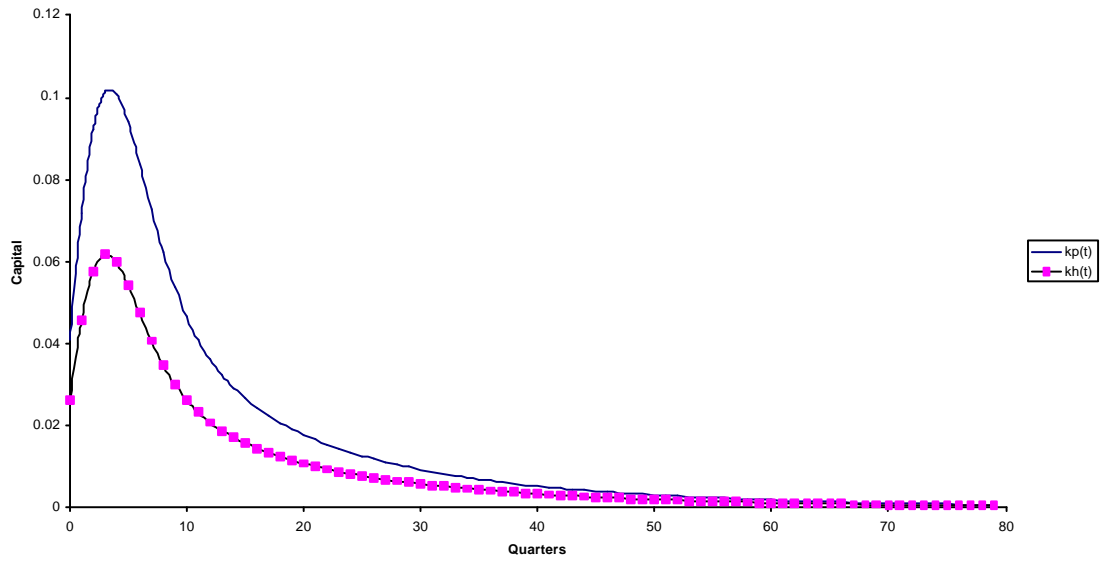


Figure 3b: IRF for output due to a 1% productivity shock

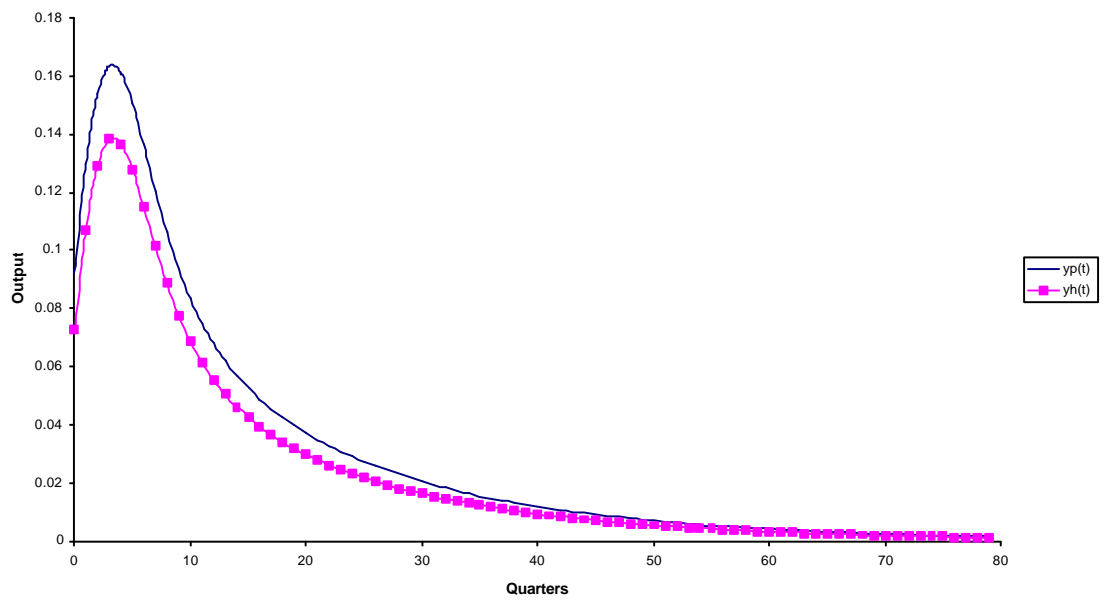


Figure 4a: IRF for capital due to a interest rate shock

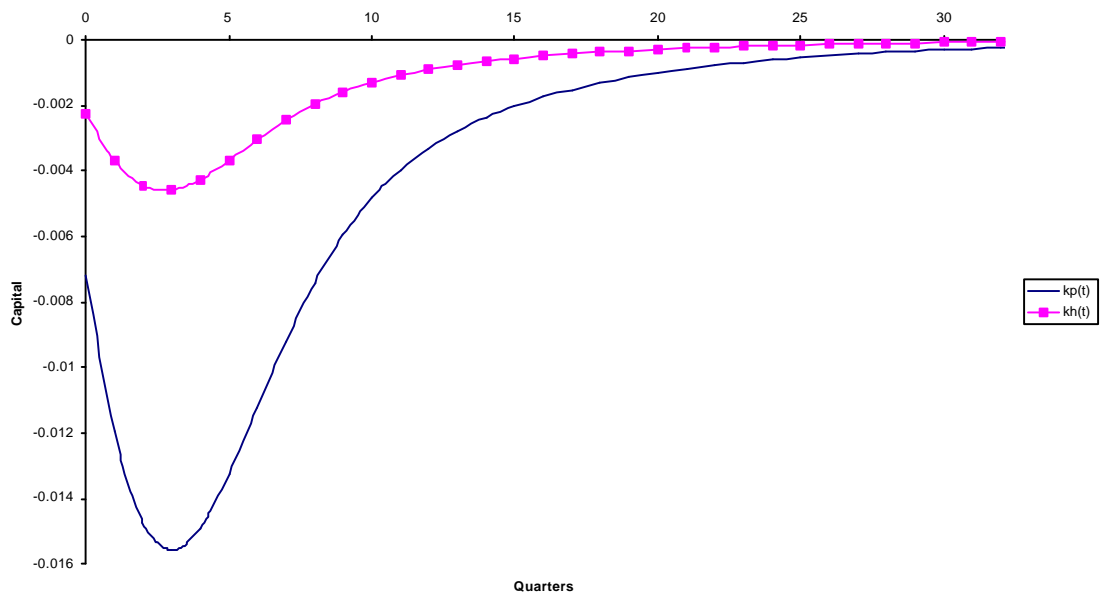
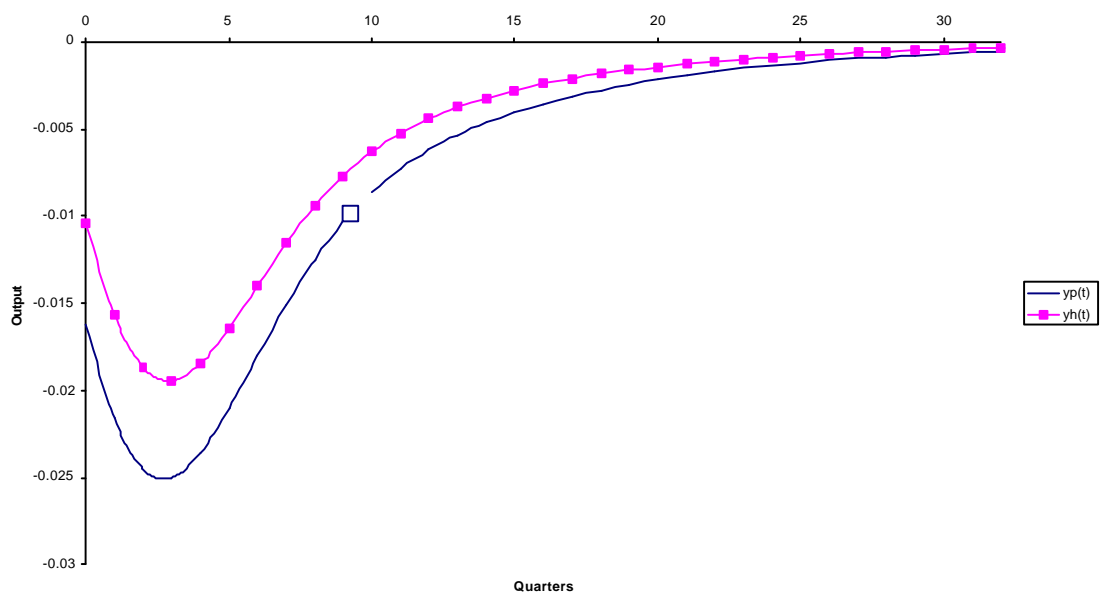


Figure 4b: IRF for output due to a interest rate shock



| | | |
|-------------|---|---|
| 2008 | | |
| B01-08 | Euro-Diplomatie durch gemeinsame „Wirtschaftsregierung“ | <i>Martin Seidel</i> |
| 2007 | | |
| B03-07 | Löhne und Steuern im Systemwettbewerb der Mitgliedstaaten der Europäischen Union | <i>Martin Seidel</i> |
| B02-07 | Konsolidierung und Reform der Europäischen Union | <i>Martin Seidel</i> |
| B01-07 | The Ratification of European Treaties - Legal and Constitutional Basis of a European Referendum. | <i>Martin Seidel</i> |
| 2006 | | |
| B03-06 | Financial Frictions, Capital Reallocation, and Aggregate Fluctuations | <i>Jürgen von Hagen, Haiping Zhang</i> |
| B02-06 | Financial Openness and Macroeconomic Volatility | <i>Jürgen von Hagen, Haiping Zhang</i> |
| B01-06 | A Welfare Analysis of Capital Account Liberalization | <i>Jürgen von Hagen, Haiping Zhang</i> |
| 2005 | | |
| B11-05 | Das Kompetenz- und Entscheidungssystem des Vertrages von Rom im Wandel seiner Funktion und Verfassung | <i>Martin Seidel</i> |
| B10-05 | Die Schutzklauseln der Beitrittsverträge | <i>Martin Seidel</i> |
| B09-05 | Measuring Tax Burdens in Europe | <i>Guntram B. Wolff</i> |
| B08-05 | Remittances as Investment in the Absence of Altruism | <i>Gabriel González-König</i> |
| B07-05 | Economic Integration in a Multicore World? | <i>Christian Volpe Martinicus, Jennifer Pédussel Wu</i> |
| B06-05 | Banking Sector (Under?)Development in Central and Eastern Europe | <i>Jürgen von Hagen, Valeriya Dinger</i> |
| B05-05 | Regulatory Standards Can Lead to Predation | <i>Stefan Lutz</i> |
| B04-05 | Währungspolitik als Sozialpolitik | <i>Martin Seidel</i> |
| B03-05 | Public Education in an Integrated Europe: Studying to Migrate and Teaching to Stay? | <i>Panu Poutvaara</i> |
| B02-05 | Voice of the Diaspora: An Analysis of Migrant Voting Behavior | <i>Jan Fidrmuc, Orla Doyle</i> |
| B01-05 | Macroeconomic Adjustment in the New EU Member States | <i>Jürgen von Hagen, Iulia Traistaru</i> |
| 2004 | | |
| B33-04 | The Effects of Transition and Political Instability On Foreign Direct Investment Inflows: Central Europe and the Balkans | <i>Josef C. Brada, Ali M. Kutan, Tanner M. Yigit</i> |
| B32-04 | The Choice of Exchange Rate Regimes in Developing Countries: A Multinomial Panel Analysis | <i>Jürgen von Hagen, Jizhong Zhou</i> |
| B31-04 | Fear of Floating and Fear of Pegging: An Empirical Analysis of De Facto Exchange Rate Regimes in Developing Countries | <i>Jürgen von Hagen, Jizhong Zhou</i> |
| B30-04 | Der Vollzug von Gemeinschaftsrecht über die Mitgliedstaaten und seine Rolle für die EU und den Beitrittsprozess | <i>Martin Seidel</i> |
| B29-04 | Deutschlands Wirtschaft, seine Schulden und die Unzulänglichkeiten der einheitlichen Geldpolitik im Eurosystem | <i>Dieter Spethmann, Otto Steiger</i> |
| B28-04 | Fiscal Crises in U.S. Cities: Structural and Non-structural Causes | <i>Guntram B. Wolff</i> |
| B27-04 | Firm Performance and Privatization in Ukraine | <i>Galyna Grygorenko, Stefan Lutz</i> |
| B26-04 | Analyzing Trade Opening in Ukraine: Effects of a Customs Union with the EU | <i>Oksana Harbuzyuk, Stefan Lutz</i> |
| B25-04 | Exchange Rate Risk and Convergence to the Euro | <i>Lucjan T. Orlowski</i> |
| B24-04 | The Endogeneity of Money and the Eurosystem | <i>Otto Steiger</i> |
| B23-04 | Which Lender of Last Resort for the Eurosystem? | <i>Otto Steiger</i> |
| B22-04 | Non-Discretionary Monetary Policy: The Answer for Transition Economies? | <i>Elham-Mafi Kreft, Steven F. Kreft</i> |
| B21-04 | The Effectiveness of Subsidies Revisited: Accounting for Wage and Employment Effects in Business R+D | <i>Volker Reinthaler, Guntram B. Wolff</i> |
| B20-04 | Money Market Pressure and the Determinants of Banking Crises | <i>Jürgen von Hagen, Tai-kuang Ho</i> |
| B19-04 | Die Stellung der Europäischen Zentralbank nach dem Verfassungsvertrag | <i>Martin Seidel</i> |

| | | |
|-------------|--|--|
| B18-04 | Transmission Channels of Business Cycles Synchronization in an Enlarged EMU | <i>Iulia Traistaru</i> |
| B17-04 | Foreign Exchange Regime, the Real Exchange Rate and Current Account Sustainability: The Case of Turkey | <i>Sübidey Togan, Hasan Ersel</i> |
| B16-04 | Does It Matter Where Immigrants Work? Traded Goods, Non-traded Goods, and Sector Specific Employment | <i>Harry P. Bowen, Jennifer Pédussel Wu</i> |
| B15-04 | Do Economic Integration and Fiscal Competition Help to Explain Local Patterns? | <i>Christian Volpe Martincus</i> |
| B14-04 | Euro Adoption and Maastricht Criteria: Rules or Discretion? | <i>Jiri Jonas</i> |
| B13-04 | The Role of Electoral and Party Systems in the Development of Fiscal Institutions in the Central and Eastern European Countries | <i>Sami Yläoutinen</i> |
| B12-04 | Measuring and Explaining Levels of Regional Economic Integration | <i>Jennifer Pédussel Wu</i> |
| B11-04 | Economic Integration and Location of Manufacturing Activities: Evidence from MERCOSUR | <i>Pablo Sanguinetti, Iulia Traistaru, Christian Volpe Martincus</i> |
| B10-04 | Economic Integration and Industry Location in Transition Countries | <i>Laura Resmini</i> |
| B09-04 | Testing Creditor Moral Hazard in Sovereign Bond Markets: A Unified Theoretical Approach and Empirical Evidence | <i>Ayse Y. Evrensel, Ali M. Kutan</i> |
| B08-04 | European Integration, Productivity Growth and Real Convergence | <i>Taner M. Yigit, Ali M. Kutan</i> |
| B07-04 | The Contribution of Income, Social Capital, and Institutions to Human Well-being in Africa | <i>Mina Baliamoune-Lutz, Stefan H. Lutz</i> |
| B06-04 | Rural Urban Inequality in Africa: A Panel Study of the Effects of Trade Liberalization and Financial Deepening | <i>Mina Baliamoune-Lutz, Stefan H. Lutz</i> |
| B05-04 | Money Rules for the Eurozone Candidate Countries | <i>Lucjan T. Orłowski</i> |
| B04-04 | Who is in Favor of Enlargement? Determinants of Support for EU Membership in the Candidate Countries' Referenda | <i>Orla Doyle, Jan Fidrmuc</i> |
| B03-04 | Over- and Underbidding in Central Bank Open Market Operations Conducted as Fixed Rate Tender | <i>Ulrich Bindseil</i> |
| B02-04 | Total Factor Productivity and Economic Freedom Implications for EU Enlargement | <i>Ronald L. Moomaw, Euy Seok Yang</i> |
| B01-04 | Die neuen Schutzklauseln der Artikel 38 und 39 des Beitrittsvertrages: Schutz der alten Mitgliedstaaten vor Störungen durch die neuen Mitgliedstaaten | <i>Martin Seidel</i> |
| 2003 | | |
| B29-03 | Macroeconomic Implications of Low Inflation in the Euro Area | <i>Jürgen von Hagen, Boris Hofmann</i> |
| B28-03 | The Effects of Transition and Political Instability on Foreign Direct Investment: Central Europe and the Balkans | <i>Josef C. Brada, Ali M. Kutan, Taner M. Yigit</i> |
| B27-03 | The Performance of the Euribor Futures Market: Efficiency and the Impact of ECB Policy Announcements (Electronic Version of International Finance) | <i>Kerstin Bernoth, Juergen von Hagen</i> |
| B26-03 | Sovereign Risk Premia in the European Government Bond Market (überarbeitete Version zum Herunterladen) | <i>Kerstin Bernoth, Juergen von Hagen, Ludger Schulknecht</i> |
| B25-03 | How Flexible are Wages in EU Accession Countries? | <i>Anna Iara, Iulia Traistaru</i> |
| B24-03 | Monetary Policy Reaction Functions: ECB versus Bundesbank | <i>Bernd Hayo, Boris Hofmann</i> |
| B23-03 | Economic Integration and Manufacturing Concentration Patterns: Evidence from Mercosur | <i>Iulia Traistaru, Christian Volpe Martincus</i> |
| B22-03 | Reformzwänge innerhalb der EU angesichts der Osterweiterung | <i>Martin Seidel</i> |
| B21-03 | Reputation Flows: Contractual Disputes and the Channels for Inter-Firm Communication | <i>William Pyle</i> |
| B20-03 | Urban Primacy, Gigantism, and International Trade: Evidence from Asia and the Americas | <i>Ronald L. Moomaw, Mohammed A. Alwosabi</i> |
| B19-03 | An Empirical Analysis of Competing Explanations of Urban Primacy Evidence from Asia and the Americas | <i>Ronald L. Moomaw, Mohammed A. Alwosabi</i> |

| | | |
|-------------|---|--|
| B18-03 | The Effects of Regional and Industry-Wide FDI Spillovers on Export of Ukrainian Firms | <i>Stefan H. Lutz, Oleksandr Talavera, Sang-Min Park</i> |
| B17-03 | Determinants of Inter-Regional Migration in the Baltic States | <i>Mihails Hazans</i> |
| B16-03 | South-East Europe: Economic Performance, Perspectives, and Policy Challenges | <i>Iulia Traistaru, Jürgen von Hagen</i> |
| B15-03 | Employed and Unemployed Search: The Marginal Willingness to Pay for Attributes in Lithuania, the US and the Netherlands | <i>Jos van Ommeren, Mihails Hazans</i> |
| B14-03 | FICs and Economic Activity: Some International Evidence | <i>Charles Goodhart, Boris Hofmann</i> |
| B13-03 | The IS Curve and the Transmission of Monetary Policy: Is there a Puzzle? | <i>Charles Goodhart, Boris Hofmann</i> |
| B12-03 | What Makes Regions in Eastern Europe Catching Up? The Role of Foreign Investment, Human Resources, and Geography | <i>Gabriele Tondl, Goran Vuksic</i> |
| B11-03 | Die Weisungs- und Herrschaftsmacht der Europäischen Zentralbank im europäischen System der Zentralbanken - eine rechtliche Analyse | <i>Martin Seidel</i> |
| B10-03 | Foreign Direct Investment and Perceptions of Vulnerability to Foreign Exchange Crises: Evidence from Transition Economies | <i>Josef C. Brada, Vladimír Tomsík</i> |
| B09-03 | The European Central Bank and the Eurosystem: An Analysis of the Missing Central Monetary Institution in European Monetary Union | <i>Gunnar Heinsohn, Otto Steiger</i> |
| B08-03 | The Determination of Capital Controls: Which Role Do Exchange Rate Regimes Play? | <i>Jürgen von Hagen, Jizhong Zhou</i> |
| B07-03 | Nach Nizza und Stockholm: Stand des Binnenmarktes und Prioritäten für die Zukunft | <i>Martin Seidel</i> |
| B06-03 | Fiscal Discipline and Growth in Euroland. Experiences with the Stability and Growth Pact | <i>Jürgen von Hagen</i> |
| B05-03 | Reconsidering the Evidence: Are Eurozone Business Cycles Converging? | <i>Michael Massmann, James Mitchell</i> |
| B04-03 | Do Ukrainian Firms Benefit from FDI? | <i>Stefan H. Lutz, Oleksandr Talavera</i> |
| B03-03 | Europäische Steuerkoordination und die Schweiz | <i>Stefan H. Lutz</i> |
| B02-03 | Commuting in the Baltic States: Patterns, Determinants, and Gains | <i>Mihails Hazans</i> |
| B01-03 | Die Wirtschafts- und Währungsunion im rechtlichen und politischen Gefüge der Europäischen Union | <i>Martin Seidel</i> |
| 2002 | | |
| B30-02 | An Adverse Selection Model of Optimal Unemployment Assurance | <i>Marcus Hagedorn, Ashok Kaul, Tim Mennel</i> |
| B29B-02 | Trade Agreements as Self-protection | <i>Jennifer Pédussel Wu</i> |
| B29A-02 | Growth and Business Cycles with Imperfect Credit Markets | <i>Debajyoti Chakrabarty</i> |
| B28-02 | Inequality, Politics and Economic Growth | <i>Debajyoti Chakrabarty</i> |
| B27-02 | Poverty Traps and Growth in a Model of Endogenous Time Preference | <i>Debajyoti Chakrabarty</i> |
| B26-02 | Monetary Convergence and Risk Premiums in the EU Candidate Countries | <i>Lucjan T. Orłowski</i> |
| B25-02 | Trade Policy: Institutional Vs. Economic Factors | <i>Stefan Lutz</i> |
| B24-02 | The Effects of Quotas on Vertical Intra-industry Trade | <i>Stefan Lutz</i> |
| B23-02 | Legal Aspects of European Economic and Monetary Union | <i>Martin Seidel</i> |
| B22-02 | Der Staat als Lender of Last Resort - oder: Die Achillesverse des Eurosystems | <i>Otto Steiger</i> |
| B21-02 | Nominal and Real Stochastic Convergence Within the Transition Economies and to the European Union: Evidence from Panel Data | <i>Ali M. Kutan, Taner M. Yigit</i> |
| B20-02 | The Impact of News, Oil Prices, and International Spillovers on Russian Financial Markets | <i>Bernd Hayo, Ali M. Kutan</i> |

| | | |
|-------------|---|--|
| B19-02 | East Germany: Transition with Unification, Experiments and Experiences | <i>Jürgen von Hagen, Rolf R. Strauch, Guntram B. Wolff</i> |
| B18-02 | Regional Specialization and Employment Dynamics in Transition Countries | <i>Iulia Traistaru, Guntram B. Wolff</i> |
| B17-02 | Specialization and Growth Patterns in Border Regions of Accession Countries | <i>Laura Resmini</i> |
| B16-02 | Regional Specialization and Concentration of Industrial Activity in Accession Countries | <i>Iulia Traistaru, Peter Nijkamp, Simonetta Longhi</i> |
| B15-02 | Does Broad Money Matter for Interest Rate Policy? | <i>Matthias Brückner, Andreas Schaber</i> |
| B14-02 | The Long and Short of It: Global Liberalization, Poverty and Inequality | <i>Christian E. Weller, Adam Hersch</i> |
| B13-02 | De Facto and Official Exchange Rate Regimes in Transition Economies | <i>Jürgen von Hagen, Jizhong Zhou</i> |
| B12-02 | Argentina: The Anatomy of A Crisis | <i>Jiri Jonas</i> |
| B11-02 | The Eurosystem and the Art of Central Banking | <i>Gunnar Heinsohn, Otto Steiger</i> |
| B10-02 | National Origins of European Law: Towards an Autonomous System of European Law? | <i>Martin Seidel</i> |
| B09-02 | Monetary Policy in the Euro Area - Lessons from the First Years | <i>Volker Clausen, Bernd Hayo</i> |
| B08-02 | Has the Link Between the Spot and Forward Exchange Rates Broken Down? Evidence From Rolling Cointegration Tests | <i>Ali M. Kutan, Su Zhou</i> |
| B07-02 | Perspektiven der Erweiterung der Europäischen Union | <i>Martin Seidel</i> |
| B06-02 | Is There Asymmetry in Forward Exchange Rate Bias? Multi-Country Evidence | <i>Su Zhou, Ali M. Kutan</i> |
| B05-02 | Real and Monetary Convergence Within the European Union and Between the European Union and Candidate Countries: A Rolling Cointegration Approach | <i>Josef C. Brada, Ali M. Kutan, Su Zhou</i> |
| B04-02 | Asymmetric Monetary Policy Effects in EMU | <i>Volker Clausen, Bernd Hayo</i> |
| B03-02 | The Choice of Exchange Rate Regimes: An Empirical Analysis for Transition Economies | <i>Jürgen von Hagen, Jizhong Zhou</i> |
| B02-02 | The Euro System and the Federal Reserve System Compared: Facts and Challenges | <i>Karlheinz Ruckriegel, Franz Seitz</i> |
| B01-02 | Does Inflation Targeting Matter? | <i>Manfred J. M. Neumann, Jürgen von Hagen</i> |
| 2001 | | |
| B29-01 | Is Kazakhstan Vulnerable to the Dutch Disease? | <i>Karlygash Kuralbayeva, Ali M. Kutan, Michael L. Wyzan</i> |
| B28-01 | Political Economy of the Nice Treaty: Rebalancing the EU Council. The Future of European Agricultural Policies | <i>Deutsch-Französisches Wirtschaftspolitisches Forum</i> |
| B27-01 | Investor Panic, IMF Actions, and Emerging Stock Market Returns and Volatility: A Panel Investigation | <i>Bernd Hayo, Ali M. Kutan</i> |
| B26-01 | Regional Effects of Terrorism on Tourism: Evidence from Three Mediterranean Countries | <i>Konstantinos Drakos, Ali M. Kutan</i> |
| B25-01 | Monetary Convergence of the EU Candidates to the Euro: A Theoretical Framework and Policy Implications | <i>Lucjan T. Orłowski</i> |
| B24-01 | Disintegration and Trade | <i>Jarko and Jan Fidrmuc</i> |
| B23-01 | Migration and Adjustment to Shocks in Transition Economies | <i>Jan Fidrmuc</i> |
| B22-01 | Strategic Delegation and International Capital Taxation | <i>Matthias Brückner</i> |
| B21-01 | Balkan and Mediterranean Candidates for European Union Membership: The Convergence of Their Monetary Policy With That of the European Central Bank | <i>Josef C. Brada, Ali M. Kutan</i> |
| B20-01 | An Empirical Inquiry of the Efficiency of Intergovernmental Transfers for Water Projects Based on the WRDA Data | <i>Anna Rubinchik-Pessach</i> |
| B19-01 | Detrending and the Money-Output Link: International Evidence | <i>R.W. Hafer, Ali M. Kutan</i> |

| | | |
|-------------|--|--|
| B18-01 | Monetary Policy in Unknown Territory. The European Central Bank in the Early Years | <i>Jürgen von Hagen, Matthias Brückner</i> |
| B17-01 | Executive Authority, the Personal Vote, and Budget Discipline in Latin American and Caribbean Countries | <i>Mark Hallerberg, Patrick Marier</i> |
| B16-01 | Sources of Inflation and Output Fluctuations in Poland and Hungary: Implications for Full Membership in the European Union | <i>Selahattin Dibooglu, Ali M. Kutan</i> |
| B15-01 | Programs Without Alternative: Public Pensions in the OECD | <i>Christian E. Weller</i> |
| B14-01 | Formal Fiscal Restraints and Budget Processes As Solutions to a Deficit and Spending Bias in Public Finances - U.S. Experience and Possible Lessons for EMU | <i>Rolf R. Strauch, Jürgen von Hagen</i> |
| B13-01 | German Public Finances: Recent Experiences and Future Challenges | <i>Jürgen von Hagen, Rolf R. Strauch</i> |
| B12-01 | The Impact of Eastern Enlargement On EU-Labour Markets. Pensions Reform Between Economic and Political Problems | <i>Deutsch-Französisches Wirtschaftspolitisches Forum</i> |
| B11-01 | Inflationary Performance in a Monetary Union With Large Wage Setters | <i>Lilia Cavallar</i> |
| B10-01 | Integration of the Baltic States into the EU and Institutions of Fiscal Convergence: A Critical Evaluation of Key Issues and Empirical Evidence | <i>Ali M. Kutan, Niina Pautola-Mol</i> |
| B09-01 | Democracy in Transition Economies: Grease or Sand in the Wheels of Growth? | <i>Jan Fidrmuc</i> |
| B08-01 | The Functioning of Economic Policy Coordination | <i>Jürgen von Hagen, Susanne Mundschenk</i> |
| B07-01 | The Convergence of Monetary Policy Between Candidate Countries and the European Union | <i>Josef C. Brada, Ali M. Kutan</i> |
| B06-01 | Opposites Attract: The Case of Greek and Turkish Financial Markets | <i>Konstantinos Drakos, Ali M. Kutan</i> |
| B05-01 | Trade Rules and Global Governance: A Long Term Agenda. The Future of Banking. | <i>Deutsch-Französisches Wirtschaftspolitisches Forum</i> |
| B04-01 | The Determination of Unemployment Benefits | <i>Rafael di Tella, Robert J. McCulloch</i> |
| B03-01 | Preferences Over Inflation and Unemployment: Evidence from Surveys of Happiness | <i>Rafael di Tella, Robert J. McCulloch, Andrew J. Oswald</i> |
| B02-01 | The Konstanz Seminar on Monetary Theory and Policy at Thirty | <i>Michele Fratianni, Jürgen von Hagen</i> |
| B01-01 | Divided Boards: Partisanship Through Delegated Monetary Policy | <i>Etienne Farvaque, Gael Lagadec</i> |
| 2000 | | |
| B20-00 | Breakin-up a Nation, From the Inside | <i>Etienne Farvaque</i> |
| B19-00 | Income Dynamics and Stability in the Transition Process, general Reflections applied to the Czech Republic | <i>Jens Hölscher</i> |
| B18-00 | Budget Processes: Theory and Experimental Evidence | <i>Karl-Martin Ehrhart, Roy Gardner, Jürgen von Hagen, Claudia Keser</i> |
| B17-00 | Rückführung der Landwirtschaftspolitik in die Verantwortung der Mitgliedsstaaten? - Rechts- und Verfassungsfragen des Gemeinschaftsrechts | <i>Martin Seidel</i> |
| B16-00 | The European Central Bank: Independence and Accountability | <i>Christa Randzio-Plath, Tomasso Padoa-Schioppa</i> |
| B15-00 | Regional Risk Sharing and Redistribution in the German Federation | <i>Jürgen von Hagen, Ralf Hepp</i> |
| B14-00 | Sources of Real Exchange Rate Fluctuations in Transition Economies: The Case of Poland and Hungary | <i>Selahattin Dibooglu, Ali M. Kutan</i> |
| B13-00 | Back to the Future: The Growth Prospects of Transition Economies Reconsidered | <i>Nauro F. Campos</i> |

| | | |
|-------------|---|--|
| B12-00 | Rechtsetzung und Rechtsangleichung als Folge der Einheitlichen Europäischen Wahrung | <i>Martin Seidel</i> |
| B11-00 | A Dynamic Approach to Inflation Targeting in Transition Economies | <i>Lucjan T. Orłowski</i> |
| B10-00 | The Importance of Domestic Political Institutions: Why and How Belgium Qualified for EMU | <i>Marc Hallerberg</i> |
| B09-00 | Rational Institutions Yield Hysteresis | <i>Rafael Di Tella, Robert MacCulloch</i> |
| B08-00 | The Effectiveness of Self-Protection Policies for Safeguarding Emerging Market Economies from Crises | <i>Kenneth Kletzer</i> |
| B07-00 | Financial Supervision and Policy Coordination in The EMU | <i>Deutsch-Franzosisches Wirtschaftspolitisches Forum</i> |
| B06-00 | The Demand for Money in Austria | <i>Bernd Hayo</i> |
| B05-00 | Liberalization, Democracy and Economic Performance during Transition | <i>Jan Fidrmuc</i> |
| B04-00 | A New Political Culture in The EU - Democratic Accountability of the ECB | <i>Christa Randzio-Plath</i> |
| B03-00 | Integration, Disintegration and Trade in Europe: Evolution of Trade Relations during the 1990's | <i>Jarko Fidrmuc, Jan Fidrmuc</i> |
| B02-00 | Inflation Bias and Productivity Shocks in Transition Economies: The Case of the Czech Republic | <i>Josef C. Brada, Arthur E. King, Ali M. Kutan</i> |
| B01-00 | Monetary Union and Fiscal Federalism | <i>Kenneth Kletzer, Jurgen von Hagen</i> |
| 1999 | | |
| B26-99 | Skills, Labour Costs, and Vertically Differentiated Industries: A General Equilibrium Analysis | <i>Stefan Lutz, Alessandro Turrini</i> |
| B25-99 | Micro and Macro Determinants of Public Support for Market Reforms in Eastern Europe | <i>Bernd Hayo</i> |
| B24-99 | What Makes a Revolution? | <i>Robert MacCulloch</i> |
| B23-99 | Informal Family Insurance and the Design of the Welfare State | <i>Rafael Di Tella, Robert MacCulloch</i> |
| B22-99 | Partisan Social Happiness | <i>Rafael Di Tella, Robert MacCulloch</i> |
| B21-99 | The End of Moderate Inflation in Three Transition Economies? | <i>Josef C. Brada, Ali M. Kutan</i> |
| B20-99 | Subnational Government Bailouts in Germany | <i>Helmut Seitz</i> |
| B19-99 | The Evolution of Monetary Policy in Transition Economies | <i>Ali M. Kutan, Josef C. Brada</i> |
| B18-99 | Why are Eastern Europe's Banks not failing when everybody else's are? | <i>Christian E. Weller, Bernard Morzuch</i> |
| B17-99 | Stability of Monetary Unions: Lessons from the Break-Up of Czechoslovakia | <i>Jan Fidrmuc, Julius Horvath and Jarko Fidrmuc</i> |
| B16-99 | Multinational Banks and Development Finance | <i>Christian E. Weller and Mark J. Scher</i> |
| B15-99 | Financial Crises after Financial Liberalization: Exceptional Circumstances or Structural Weakness? | <i>Christian E. Weller</i> |
| B14-99 | Industry Effects of Monetary Policy in Germany | <i>Bernd Hayo and Birgit Uhlenbrock</i> |
| B13-99 | Financial Fragility or What Went Right and What Could Go Wrong in Central European Banking? | <i>Christian E. Weller and Jurgen von Hagen</i> |
| B12-99 | Size Distortions of Tests of the Null Hypothesis of Stationarity: Evidence and Implications for Applied Work | <i>Mehmet Caner and Lutz Kilian</i> |
| B11-99 | Financial Supervision and Policy Coordination in the EMU | <i>Deutsch-Franzosisches Wirtschaftspolitisches Forum</i> |
| B10-99 | Financial Liberalization, Multinational Banks and Credit Supply: The Case of Poland | <i>Christian Weller</i> |
| B09-99 | Monetary Policy, Parameter Uncertainty and Optimal Learning | <i>Volker Wieland</i> |
| B08-99 | The Connection between more Multinational Banks and less Real Credit in Transition Economies | <i>Christian Weller</i> |

- B07-99 **Comovement and Catch-up in Productivity across Sectors: Evidence from the OECD** *Christopher M. Cornwell and Jens-Uwe Wächter*
- B06-99 **Productivity Convergence and Economic Growth: A Frontier Production Function Approach** *Christopher M. Cornwell and Jens-Uwe Wächter*
- B05-99 **Tumbling Giant: Germany's Experience with the Maastricht Fiscal Criteria** *Jürgen von Hagen and Rolf Strauch*
- B04-99 **The Finance-Investment Link in a Transition Economy: Evidence for Poland from Panel Data** *Christian Weller*
- B03-99 **The Macroeconomics of Happiness** *Rafael Di Tella, Robert McCulloch and Andrew J. Oswald*
- B02-99 **The Consequences of Labour Market Flexibility: Panel Evidence Based on Survey Data** *Rafael Di Tella and Robert McCulloch*
- B01-99 **The Excess Volatility of Foreign Exchange Rates: Statistical Puzzle or Theoretical Artifact?** *Robert B.H. Hauswald*
- 1998**
- B16-98 **Labour Market + Tax Policy in the EMU** *Deutsch-Französisches Wirtschaftspolitisches Forum*
- B15-98 **Can Taxing Foreign Competition Harm the Domestic Industry?** *Stefan Lutz*
- B14-98 **Free Trade and Arms Races: Some Thoughts Regarding EU-Russian Trade** *Rafael Reuveny and John Maxwell*
- B13-98 **Fiscal Policy and Intranational Risk-Sharing** *Jürgen von Hagen*
- B12-98 **Price Stability and Monetary Policy Effectiveness when Nominal Interest Rates are Bounded at Zero** *Athanasios Orphanides and Volker Wieland*
- B11A-98 **Die Bewertung der "dauerhaft tragbaren öffentlichen Finanzlage" der EU Mitgliedstaaten beim Übergang zur dritten Stufe der EWWU** *Rolf Strauch*
- B11-98 **Exchange Rate Regimes in the Transition Economies: Case Study of the Czech Republic: 1990-1997** *Julius Horvath and Jiri Jonas*
- B10-98 **Der Wettbewerb der Rechts- und politischen Systeme in der Europäischen Union** *Martin Seidel*
- B09-98 **U.S. Monetary Policy and Monetary Policy and the ESCB** *Robert L. Hetzel*
- B08-98 **Money-Output Granger Causality Revisited: An Empirical Analysis of EU Countries (überarbeitete Version zum Herunterladen)** *Bernd Hayo*
- B07-98 **Designing Voluntary Environmental Agreements in Europe: Some Lessons from the U.S. EPA's 33/50 Program** *John W. Maxwell*
- B06-98 **Monetary Union, Asymmetric Productivity Shocks and Fiscal Insurance: an Analytical Discussion of Welfare Issues** *Kenneth Kletzer*
- B05-98 **Estimating a European Demand for Money (überarbeitete Version zum Herunterladen)** *Bernd Hayo*
- B04-98 **The EMU's Exchange Rate Policy** *Deutsch-Französisches Wirtschaftspolitisches Forum*
- B03-98 **Central Bank Policy in a More Perfect Financial System** *Jürgen von Hagen / Ingo Fender*
- B02-98 **Trade with Low-Wage Countries and Wage Inequality** *Jaleel Ahmad*
- B01-98 **Budgeting Institutions for Aggregate Fiscal Discipline** *Jürgen von Hagen*
- 1997**
- B04-97 **Macroeconomic Stabilization with a Common Currency: Does European Monetary Unification Create a Need for Fiscal Insurance or Federalism?** *Kenneth Kletzer*
- B-03-97 **Liberalising European Markets for Energy and Telecommunications: Some Lessons from the US Electric Utility Industry** *Tom Lyon / John Mayo*
- B02-97 **Employment and EMU** *Deutsch-Französisches Wirtschaftspolitisches Forum*
- B01-97 **A Stability Pact for Europe** *(a Forum organized by ZEI)*

ISSN 1436 - 6053

Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Walter-Flex-Strasse 3
D-53113 Bonn
Germany

Tel.: +49-228-73-1732
Fax: +49-228-73-1809
www.zei.de