



**AN ANALYSIS OF FISCAL POLICY AND ECONOMIC GROWTH: THE CASE OF
TRANSITION ECONOMIES**

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DISCUSSION PAPER 02.12

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**An Analysis of Fiscal Policy and Economic Growth:
The Case of Transition Economies**

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Based on a low level of elasticity of substitution between labor and capital in the transitional economies, this paper theoretically suggests how they should be able to reach a stable growth path after a period of rapid dynamic short-run movement. The paper places particular emphasis on the role of government fiscal policy in exploring this phenomenon.

Key Words: The transition economies, capital accumulation, budget deficit, tax rate

JEL Classification: E62, O40, O50

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Introduction

The negative growth rates experienced by many of the Eastern European and Baltic countries during the initial phase of their transformation to a market economy were larger than most economists had expected. However, some of the more advanced transition countries are now in a stage of positive growth. Blanchard (1996) points out that explaining this U-shaped pattern of output during 1991-1996 is the major theoretical challenge facing economists working on transition economies. Modifying and applying conventional growth theories with an overlapping generations model, this paper theoretically explains what the optimal fiscal policy for these transitional economies should be to achieve economic growth through desirable capital accumulation.

Dynamic Equilibrium Path with Fiscal Policy

The role of the public sector can be important in raising the marginal productivity of private capital through various instruments such as public investment, the provision of education and establishing infrastructure. The public sector is financed through the imposition of taxes (or bonds), which can distort an agent's savings decisions, and, thereby, adversely affects the rate of growth. As summarized in Table 1, excessive, persistent fiscal deficits are one of the common features of many transitional countries, including some of those economies that are relatively well advanced in the transition process. We analyze the effects of fiscal policies - budget deficits and taxation - on the economic growth for these economies.

Suppose that the economy starts out at the beginning with a given amount of capital stock per worker, k_0 , and some initial stock of national debt per worker as the result of a deficit in the

government budget at $t = 0$, b_0 . All public debt is supposed to mature in one period. The government issues new debt and levies lump sum taxes on the young and the elderly.

Each agent who is born at period t maximizes the intertemporal utility function, which is assumed to be the CRRA (constant relative risk averse), subject to budget constraints:

$$(1) \quad \text{Max} \quad U(c_{1t}, c_{2t}) = \frac{c_{1t}^{1-\gamma} - 1}{1-\gamma} + \beta \frac{c_{2t}^{1-\gamma} - 1}{1-\gamma}$$

subject to $c_{1t} = w_t - s_t - \tau_1^t$ and $c_{2t} = (1 + r_{t+1})s_t - \tau_2^t$,

where w is wage, s is saving and τ is tax.

Firms are producing outputs at t by borrowing capital at $t-1$ and hiring labor at t . Suppose the firm's production function is CES (constant elasticity of substitution):

$$(2) \quad Y_t = F(K_t, L_t) = A_t [aK_t^{-\rho} + (1-a)L_t^{-\rho}]^{-1/\rho},$$

where A_t is the total factor productivity, which depends on such factors as internal technological progress, technological spillover and human capital ($A > 0, \forall t$), L_t is labor input, and K_t is capital input. It is conventionally assumed that $a \in (0,1)$, and $\rho \geq -1$.

The CES production function with per capita output and per capita capital stock is:

$$(3) \quad y_t \equiv \frac{Y_t}{L_t} = f(k_t) = A_t [ak_t^{-\rho} + (1-a)]^{-1/\rho},$$

where $y_t = \frac{Y_t}{L_t}$ and $k_t = \frac{K_t}{L_t}$ are the output and capital input per worker, respectively. The

elasticity (technical rate) of substitution between two factors (σ) is equal to $\frac{1}{1+\rho} \geq 0$. As is

well known, when $\sigma = 1$ the economy will have a Cobb-Douglas production function in the form of $f(k_t) = A_t k_t^\sigma$, and when $\sigma \rightarrow 0$ we have a Leontieff production function in the form of

$f(k_t) = A_t \min\{k_t, \lambda\}$ (Barro and Martin, 1995). For the transitional economies where capital was obsolete and markets are relatively less flexible, we assume that the elasticity of substitution is small, i.e., $\sigma \in (0,1)$ ¹. In this case, the intensive CES production function can be defined as,

$$(4) \quad f(k_t) = A_t \ln(1 + k_t).$$

Note that f is a twice continuously differentiable, increasing, concave, and $\lim_{k \rightarrow 0} f(k) = 0$. We also

have $\lim_{k \rightarrow 0} f'(k_t) = \frac{A}{(1+k_t)} = A > 0$, and $\lim_{k \rightarrow \infty} f'(k_t) = \frac{A}{(1+k_t)} = 0$. This production function

satisfies the neoclassical conditions that assure the existence of an interior solution to the producers' profit-maximization problem.

The interest rate and wage income for each worker in this economy can be determined in terms of the intensive production function:

$$(5a) \quad 1 + r_t \equiv R_t = f'(k_t) + 1 - \delta, \text{ where } \delta \text{ is the rate of depreciation.}$$

$$(5b) \quad w_t = f(k_t) - k_t f'(k_t).$$

Dynamic equilibrium in this economy satisfies the condition that capital per worker at $t+1$ is equal to the saving by workers with wage income w_t , capital transferred from period t and per capita net FDI, z_{t+1} ²:

$$(6) \quad (1+n)k_{t+1} = s(R_{t+1}, w(k_t)) + k_t(1-\delta) + z_{t+1},$$

where $s(R_{t+1}, w(k_t))$ is the saving function that maximizes (1), z_t is the per capita net foreign capital in period t owned by domestic agents³ and n is the population growth rate. We suppose

¹ The low level of elasticity of substitution for these economies has been confirmed by various empirical studies. For example, see Weitzman (1970) and Lee and Tcha (2002), which found that it is commonly less than 0.3.

² FDI in equation (6) plays a role of the shifter, and does not change the result of our analysis. For more discussion on the role of FDI in these economies, please see Lee and Tcha (2002).

that s is an increasing function of R and w , $s(0,w) = 0 \forall w \geq 0$ and $s(R,0) = 0 \forall R \geq 0$, and $\partial s(R,w) / \partial w \in (0,1)$.

From the first order condition to solve the consumer's problem with intertemporal budget constraint, the savings function is obtained as

$$s_t = \Phi_t w_t, \text{ where } \Phi_t = \frac{1}{1 + (1 + \rho)^{1/\gamma} (1 + r_t)^{(1-\gamma)/\gamma}}.$$

Therefore, using this result, the equilibrium path of capital stock, (6) can be written as:

$$(7) \quad k_{t+1} = \frac{A_t \Phi_t}{(1+n)} \left(\ln(1+k_t) - \frac{k_t}{1+k_t} \right) + \frac{k_t(1-\delta)}{(1+n)} + \frac{z_{t+1}}{(1+n)}.$$

Equilibrium is an infinite sequence of k_t and b_t that satisfies the equations (8) and (9):

$$(8) \quad (1+n)(k_{t+1} + b_{t+1}) = s[R(k_{t+1}), w(k_t) - \tau_1^t, \tau_2^t] + z_{t+1}$$

$$(9) \quad (1+n)b_{t+1} = R(k_t)b_t + g_t - \tau_1^t - \frac{\tau_2^{t-1}}{1+n} = R(k_t)b_t + d_t,$$

where g_t is the government spending per capita and d_t is the size of the budget deficit. Note that τ_2^{t-1} is the tax on the elderly born in time $t-1$. Equation (8) equates the aggregate savings to the sum of the stocks of physical capital and public debt, and equation (9) represents the government budget constraints. As most of the Eastern European transitional economies recorded budget deficits, our focus is on this scenario.

The phase line for the steady state capital stock is

$$b_t = \Psi(k_t) = \frac{s[R(k_t), w(k_t) - \tau_1^t, \tau_2^t] + z_t - (1+n)k_t - d_t}{R(k_t)}.$$

³ The existence of FDI (z_t) does not affect the result of our analysis, however, it is included in this study as FDI explains a significant portion of capital formation for these economies in transition. We assume that z_t is exogenous to k_t .

The explicit functional form for $\Psi(k_t)$ is, combined with the consumers' and producers' problems,

$$(10) \Psi(k_t) = \frac{\Phi_t (1+k_t)}{A_t} \left[A_t \left(\ln(1+k_t) - \frac{k_t}{1+k_t} \right) - \tau'_t + (\beta R_{t+1})^{-\frac{1}{\gamma}} \tau'_2 \right] + \left(\frac{1+n}{A_t} \right) (z_t - d_t - k_t)(1+k_t) \text{ for } \gamma \neq 1, \text{ and}$$

$$\Psi(k_t) = \frac{(1+k_t)}{A_t(1+\beta^{-1})} \left[A_t \left(\ln(1+k_t) - \frac{k_t}{1+k_t} \right) - \tau'_t + (\beta R_{t+1})^{-1} \tau'_2 \right] + \left(\frac{1+n}{A_t} \right) (z_t - d_t - k_t)(1+k_t)$$

$$\text{for } \gamma = 1, \text{ where } \Phi_t = \frac{1}{1 + (\beta R_{t+1})^{-\frac{1}{\gamma}}}.$$

Notice that $\left. \frac{d\Psi(k)}{dk} \right|_{k=0} < 0$, and $\lim_{k \rightarrow \infty} \frac{d\Psi(k)}{dk} = -\infty$. It can be shown that for a relatively large

$$A_t, \frac{d\Psi(k)}{dk} > 0 \text{ for some } k > 0, \text{ and for a relatively small } A_t, \frac{d\Psi(k)}{dk} < 0 \forall k. ^4$$

There are two possible scenarios for this equilibrium with regards to fiscal policy and growth.

$$\text{Case I. } \tau'_t > (\beta R_{t+1})^{-\frac{1}{\gamma}} \tau'_2, \forall t$$

Figure 1 depicts the phase diagrams with long run budget deficits when the amount of modified discounted present value of tax paid by the elderly (agents) born in time t is smaller than the amount of tax paid by the young (agents) born in time t , $\tau'_t > (\beta R_{t+1})^{-\frac{1}{\gamma}} \tau'_2, \forall t$. We have two

⁴See Appendix for the derivation of the phase line equations of steady states for capital stock and government bonds.

steady states in this case: one is source and the other is saddle. We call the saddle steady state capital stock, which is the equilibrium steady state, k^E , and the golden rule capital stock k^* . The vertical intercept (F in Figure 1) of the phase line for the steady state capital stock $k_{t+1}=k_t$ takes a

value of $\frac{\Phi\left[(\beta R_t)^{-1/\gamma} \tau_2^t - \tau_1^t + (1+n)(z_t - d_t)\right]}{A_t}$ which will also depend on the per capita FDI z_t

and the budget deficit d_t . The increase in per capita FDI and decrease in budget deficit will shift the phase line for the steady state capital stock; therefore, the economy will experience the increase in the equilibrium capital stock per capita k^E .

Case II. $\tau_1^t = (\beta R_{t+1})^{-1/\gamma} \tau_2^t, \forall t$

Figure 2 depicts the phase diagram with long run budget deficits in the situation where the total modified discounted present value of tax paid by the elderly (agents) born in time t is the same as the total tax paid by the young (agents) born in time t , $\tau_1^t = (\beta R_{t+1})^{-1/\gamma} \tau_2^t, \forall t$. In this case, as in Case I, two steady states also exist: saddle and sink. We label the saddle steady state capital stock k^{EE} , and the golden rule capital stock k^* . The phase line for steady state capital stock ($k_{t+1} = k_t$) in Case II has shifted upwards compared to the phase line for steady state capital stock in Case I, which implies that $k^{EE} > k^E$. In other words, the steady state capital stock in Case II is greater than that in Case I. From comparative static, we have $\frac{ds_t}{d\tau_1^t} < 0$, $\frac{ds_t}{d\tau_2^t} > 0$, $\frac{dk_{t+1}}{d\tau_1^t} < 0$, and

$\frac{dk_{t+1}}{d\tau_2^t} > 0$, which support the results in Figures 1 and 2. As in Case I, an increase in per capita

FDI and a decrease in budget deficit will shift the phase line for the steady state capital stock; therefore, there will be further increase in the equilibrium capital stock per capita, k^{EE} .

Under a regime of deficit budget spending, in order to accumulate more (per capita) capital stock for further growth, governments should impose taxes in such a way that the total modified discounted present value of tax paid by the elderly (agents) born in time t ($= (\beta R_{t+1})^{-1/\gamma} \tau_2^t$) should be the same as the total current value of tax paid by the young (agents) born in time t ($= \tau_1^t$).

Conclusion

Many transition economies, which experienced a dramatic decline in output during the initial phase of transformation to a competitive market structure, had experienced for almost a decade prior to the onset of the transition, a decline in output coupled with a decline in investment and a constant level of total factor productivity. With low elasticity of substitution between capital and labor and low total factor productivity, they have suffered from faster diminishing marginal rates of productivity and poverty than those countries with higher elasticity of substitution between capital and labor and higher total factor productivity. This study examines from a theoretical perspective how fiscal policy could help these economies to escape the poverty trap through the rapid formation of domestic capital. Our finding indicates that, in order to accumulate more (per capita) capital stock for further growth, governments should impose taxes in such a way that the total modified present value of tax paid by the elderly (agents) born in time t should be the same as the tax paid by them in time t . The modification depends on the time discount factor, the interest rate and the degree of relative risk averse in the intertemporal utility function.

Appendix. Phase Line Equations

1) Phase line for $k_{t+1} = k_t$

$$k_{t+1} \geq k_t \Leftrightarrow b_t \leq \Psi(k_t),$$

$$\begin{aligned} \text{where } \Psi(k_t) &= \frac{s[R(k_{t+1}), w(k_t) - \tau_1', \tau_2'] + z_t - (1+n)k_t - d_t}{R(k_{t+1})} \\ &= \Phi_t [(1+k_t) \ln(1+k_t) - k_t] + \left(\frac{1+n}{A} \right) (z_t - k_t)(1+k_t) - \frac{d_t}{A}(1+k_t), \end{aligned}$$

$$\text{and } \Phi_t = \frac{1}{1 + (1+\rho)^{1/r} (1+r_t)^{(r-1)/r}}.$$

2) Phase line for $b_{t+1} = b_t$

$$b_{t+1} \geq b_t \Leftrightarrow b_t (R(k^*) - R(k_t)) \leq d_t,$$

where k^* is the capital stock value that satisfies the golden rule, $f(k^*) = n + \delta$.

Therefore, $b_{t+1} \geq b_t \Leftrightarrow b_t (f'(k^*) - f'(k_t)) \leq d_t$. This implies either (a) or (b);

$$\begin{aligned} &\left[\begin{array}{l} \text{(a) } k_t \geq k^* \quad \text{and} \quad b_t \leq \frac{d_t}{f'(k^*) - f'(k_t)} \\ \text{(b) } k_t \leq k^* \quad \text{and} \quad b_t \geq \frac{d_t}{f'(k_t) - f'(k^*)} \end{array} \right. \\ &\Leftrightarrow \left[\begin{array}{l} \text{(a) } k_t \geq k^* \quad \text{and} \quad b_t \leq \frac{\frac{d_t}{A}}{\frac{1}{1+k^*} - \frac{1}{1+k_t}} \\ \text{(b) } k_t \leq k^* \quad \text{and} \quad b_t \geq \frac{\frac{d_t}{A}}{\frac{1}{1+k_t} - \frac{1}{1+k^*}} \end{array} \right. \end{aligned}$$

$$\Leftrightarrow \begin{cases} (a) k_t \geq k^* & \text{and } b_t \leq \frac{d_t(1+k^*)(1+k_t)}{A(k_t-k^*)} \\ (b) k_t \leq k^* & \text{and } b_t \geq \frac{d_t(1+k^*)(1+k_t)}{A(k^*-k_t)} \end{cases}$$

Note that in Figures 1 and 2, (a) $b_{t+1} = b_t$ depicts the phase line for $b_t = \frac{d_t(1+k^*)(1+k_t)}{A(k_t-k^*)}$ and (b)

$b_{t+1} = b_t$ depicts the phase line for $b_t = \frac{d_t(1+k^*)(1+k_t)}{A(k^*-k_t)}$.

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Table 1. General Government Budget Balances in Eastern Europe and Baltic Countries
(in per cent of GDP)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000 [♦]	2001 [♦]
Albania	-15	-31	-22	-15	-12	-10	-12	-12.6	-10.4	-13.8	-9.1	-8.5
Bulgaria	-7.7 [♦]	–	-5.2	-10.9	-5.8	-6.4	-13.4	-3.0	1.0	–	1.5	0.4
Croatia	–	–	-4	-0.8	1.7	-0.9	-0.5	-1.3	0.6	-3.6	-2.2	-5.2
Czech	–	–	–	2.7	0.8	0.4	-0.2	-2.1	-2.6	-5.0	-0.6	-3.3
Estonia	–	5.2	-0.3	-0.7	1.3	-1.2	-1.5	2.2	-0.3	-3.0	-4.7	-0.4
Macedonia	–	–	-9.6	-13.6	-3.2	-1.3	-0.4	-0.4	-1.7	-7.8	–	–
Hungary	0.4	-2.2	-5.5	-6.8	-8.2	-6.5	-3.5	-4.9	-4.6	-4.5	-3.4	–
Latvia	–	–	-0.8	0.6	-4.1	-3.5	-1.4	0.1	-0.8	-3.8	-3.3	–
Lithuania	-5.4	2.7	0.8	-3.1	-4.2	-3.3	-3.6	-1.8	-5.8	-7.0	-2.8	–
Poland	3.1	-6.7	-6.6	-3.4	-2.8	-3.6	-3.1	-3.1	-3.0	-3.0	-2.2	–
Romania	1	3.3	-4.6	-0.4	-1.9	-2.6	-3.9	-3.6	-3.3	-2.7	-4.0	–
Slovak	–	–	–	-7	-1.3	0.1	-1.2	-4.4	-5.8	-3.2	-3.5	–
Slovenia	-0.3	2.6	0.2	0.3	-0.2	0	0.3	-1.7	-1.4	-1.0	-1.4	–
Average*	-3.4	-3.7	-5.2	-4.5	-3.1	-3.0	-3.4	-2.8	-2.9	-4.9	-3.0	-3.4

Source: Transition Report (1997, 1999), the World Bank Group: <http://www.worldbank.org/data/>
Notes: * unweighted average for countries with budget balances data. [♦] from the World Bank Group. – not available.

Figure 1 Case I: $[\tau'_1 > (\beta R_{t+1})^{-1/\gamma} \tau'_2]$

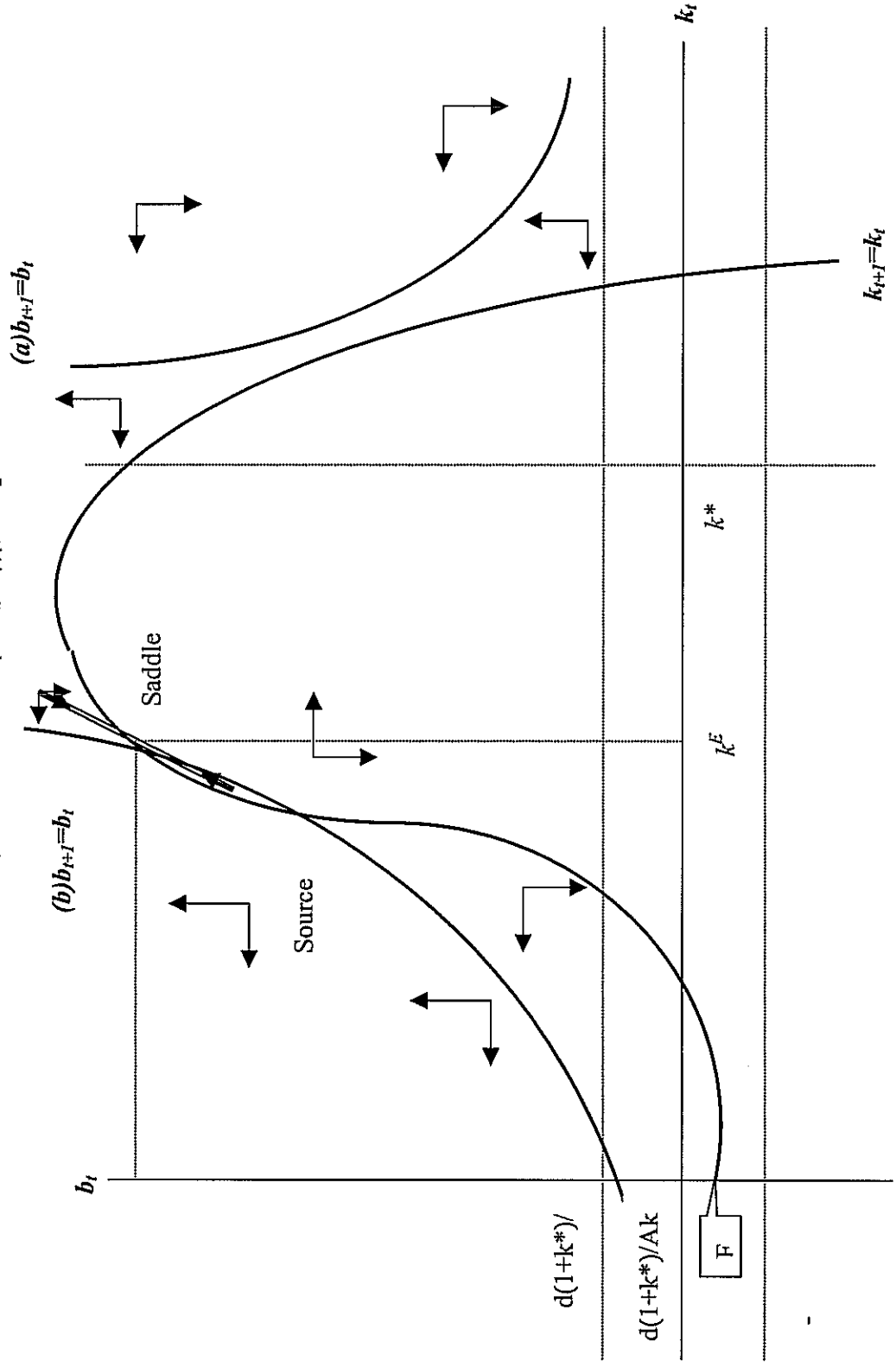
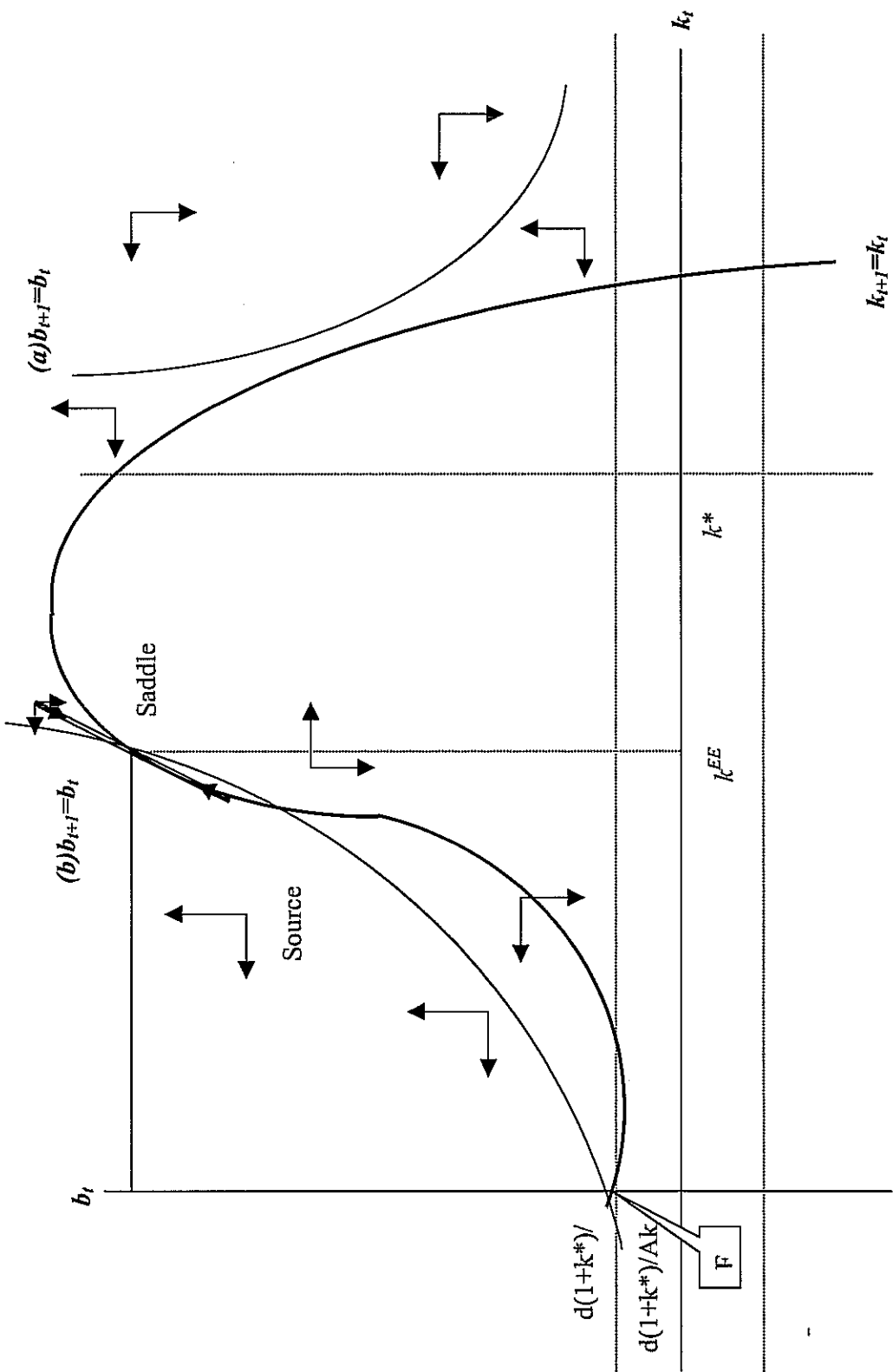


Figure 2 Case II: $[\tau_1^i = (\beta R_{t+1})^{-1/\gamma} \tau_2^i, \forall t]$



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