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Financial Repression and External Openness in an Endogenous Growth Model

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Abstract

An endogenous growth model has been developed which extends Sidrauski (1967), Roubini and Sala-i-Martin (1992,1995) and Lucas (1988) by combining financial development, human capital investment, and external openness. Financial development and trade liberalization are shown to increase economic growth rate by increasing the marginal benefits of human capital investments. Expansionary governments, however, are provided with an incentive to increase the money supply growth rate, to repress the financial sector, to close its economy, and to impose a high proportional income tax rate.

1 Introduction

Human capital accumulation, financial development, and knowledge spillover stemming from the opening up to the global economy have been regarded as the main sources of economic growth. The positive effects of human capital accumulation on economic growth have been discussed ever since the seminal works of Schultz (1961) and Becker (1964). More recently, Lucas (1988) has suggested that human capital accumulation is an important determinant of long run economic growth.

The positive relationship between openness and economic growth has been accepted as a dominant view in Development Economics Literature since the study of Little, Scitovsky, and Scott (1970), subsequently supported by Balassa (1985), the World Bank (1987), Roubini and Sala-i-Martin (1991), Edwards (1992), and Harrison (1996). Furthermore, Grossman and Helpman (1991) formulate a model in which a core capital of economic growth, knowledge, diffuses from a developed country to a developing country as a result of international trade.

Based on the works of McKinnon (1973) and Shaw (1973), financial repression serves to reduce both the quantity and quality of investment in the economy as a whole, consequently preventing economic growth. This McKinnon-Shaw financial repression paradigm has exerted considerable influence on the macroeconomic policies of developing countries, in particular, by way of IMF-World Bank recommendations (Fry, 1995). Although there has been some debate over the effectiveness of financial liberalization, there still remains a consensus that excessive financial repression can be harmful to the economy (World Bank, 1993). As an alternative, King and Levine (1993) and Levine and Zervos (1998) suggest a productivity channel, wherein the financial development affects productivity and capital stock, as well as, output growth.

The analyses of how these factors affect economic growth suggest the importance of an integrated framework. The construction of which is important because it takes into account, both explicitly and simultaneously, the mechanism of human capital accumulation, financial development and knowledge spillovers from foreign countries. Without considering the interlinkage effects among these factors, the policy implications might be misleading. For example, the growth rates of two countries, even if they have the same degree of trade openness, can differ significantly if there remains a gap in their respective human capital accumulation rate or degree of financial development (Roubini and Sala-i-Martin, 1991; World Bank, 1991).

Following the need for an analysis of this kind, and by using the endogenous growth model, this paper shows that financial development and external openness serve to increase the steady state economic growth rate through enhanced human capital. The effects of these policy variables, apart from the money supply growth rate and proportional income tax rate, which are considered independent of the steady state economic growth rate, on the steady state government revenue share to GDP are then investigated. If a government tries to extend its presence in the economy, the resultant incentives often tend to increase the growth rate of the money supply, to increase the use of financial repression policies, and to increase the implementation of protectionist strategies. The government is further provided with an incentive to impose a high tax rate. These practices generally lead to a lower economic growth rate while they simultaneously create additional revenue for the government through seigniorage.

The extended model of Roubini and Sala-i-Martin (1992, 1995) and Lucas (1988) based upon the model of Sidrauski (1967) is introduced in the next section. The human capital accumulation function in line with Lucas (1988) has been incorporated into the model. Section 3 shows the derivation of balanced growth and how it is affected by external openness, financial repression and changes in the money supply growth and income tax rates. Section 4 discusses the government behaviors initiated in order to increase the ratio of its revenues to GDP through seigniorage and tax revenue. The final section summarizes results and discusses their policy implications.

2 The Model

2.1 Financial Repression and Economic Growth

The relationship between financial development and economic growth has been widely analyzed since McKinnon (1973) and Shaw (1973). Although a positive relationship between financial development and economic growth has been validated, recent emphasis has been focused on various transmission mechanisms by King and Levine (1993), Levine (1997), and Levine and Zervos (1998).

McKinnon (1973) defined 'financial repression' as the government policies that include usury restriction on interest rate, heavy reserve requirement on bank deposits, and compulsory allocation interacting with ongoing price inflation. Based on this definition, McKinnon (1973) and Shaw (1973) formulated several channels through which financial repression appears to deter economic development.

Financial intermediation affects the economy in a number of ways. First, non-market credit rationing has been shown to create an inefficient allocation of monetary resources forcing aggregate investment to become inefficient; under financial repression banks cannot ration out many low yielding investments. Second, it has been proven that the efficient use of information through monetary intermediation can be prevented. Third, increased transaction costs related to financial intermediation have been determined to increase capital costs. Last, firms generally enhance a self-finance ratio, thus the average scale of investments tends to decrease, which may lead to a productivity loss if there exists an economy of scale.

The following channels are incorporated into the model[1]: (1) financial intermediaries, which typically require resources when savings are transformed into capital accumulation,[2] and (2) financial development, which implies that higher credit availability improves human capital accumulation by financing it as an investment.

It is assumed here, for the first role of the financial sector, that a constant fraction of savings is absorbed during the financial intermediation process. Following Roubini and Sala-i-Martin (1992) and Pagano (1993), the cost is assumed as $1-\zeta(F)$, where F represents the degree of financial development with $0 \leq \zeta(F) \leq 1$. The more developed the financial sector, the more efficient the allocation of savings into investments due to decreased transaction and information costs. This implies that $1-\zeta(F)$ is a decreasing function of financial development, i.e. $\zeta(F)' \geq 0$.

The allocation of savings into investment is related to $\zeta(F)$as follows:

[1]King and Levine (1993) show that the financial systems influences long run economic growth through proper evaluation of prospective entrepreneurs and projects, mobilization of resources, risk diversification, and potential rewards to innovative activity. Furthermore, Levine and Zervos (1998) show that the financial system, which includes stock market liquidity and banking development, is positively and robustly correlated with capital accumulation, productivity and economic growth. Results of their empirical analyses suggest that both bank and stock markets have an independent and empirical connection with economic growth, capital accumulation, and productivity growth.

[2]Greenwood and Jovanovic (1990) presented a model in which both financial intermediation and growth are endogenous, where the roles of financial institutions are to collect and analyze information, and to channel investible funds to investment activities that yield the highest return.

$$\zeta(F)S_t = I_t$$

where S_t and I_t indicate aggregate savings and investment, respectively. As mentioned above, the McKinnon and Shaw model suggests a positive relationship between financial development and economic growth by considering how savings are allocated efficiently to investment.

As for the second channel, financial development loosens borrowing constraints by extending the financial services to include the decision of human capital investment. It consequently decreases the financial cost of investment as well, given the amount of the existing level of human capital and learning intensity.

To view this process intuitively, it can be illustrated through a diagram that a household determines optimal investment in human capital. This is done in order to equalize the marginal benefit (MB) and marginal cost (MC) of human capital investment with the MB curve sloping downward and the MC curve rising upward. The financial development results in the downward shift of the MC curve, thus resulting in the household increasing its optimal amount of human capital investment (see Figure 1). De Gregorio (1996) shows, through theoretical and empirical analyses, that a tight borrowing constraint is negatively related to secondary enrollment ratio and economic growth.[3]

In addition to financial development, opening up to the global economy can affect human capital accumulation through a trade in commodities and

[3]Moreover, the financial sector can be regarded as an important intermediary for providing efficient information across the country. Financial development increases efficiency of resource allocation by integrating various kinds of information for investments. This is another important role of the financial sector that can be the nexus of macroeconomic growth and financial development.

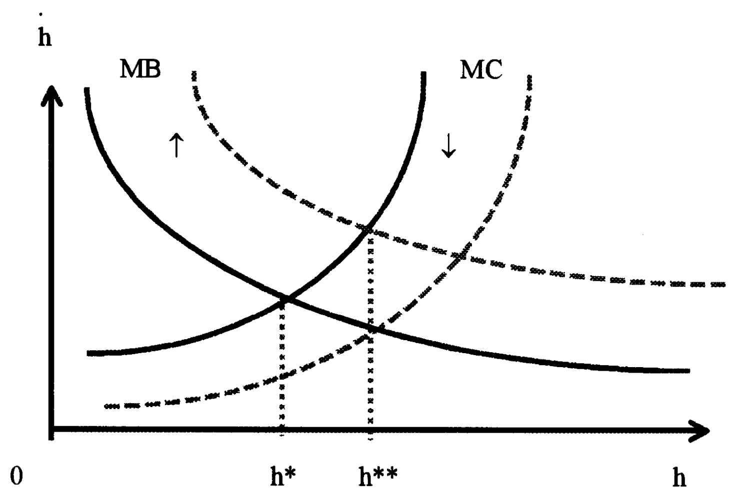

Figure 1: Determination of Human Capital

information spillovers.[4] External openness can then be regarded as an environmental factor upon the availability of advanced information from the spillover from foreign countries. The efficiency of technological knowledge can be assumed a positive function of openness, as in Grossman and Helpman (1991), Edwards (1992), and Sachs and Warner (1995). Through the openness to the world economy, countries are able to benefit from information spillovers such as scientific advances and improvements, given the level of human capital and learning intensity.

This process enhances the marginal benefits of human capital investment. The knowledge spillover, such as scientific advances and improvements, re-

[4]Trade does not only have effects through knowledge spillovers but also demand expansion through foreign market access. However, since the paper assumes no trade in commodities, the main effect of openness is through knowledge spillover.

quests highly skilled human capital acquainted with these. It does so by guaranteeing high income. Thus, the inflow of new ideas leads to increases in human capital investment in order to get higher future incomes. This is reflected in the upward shift of the MB curve in Figure 1.

Through the $MB - MC$ analysis, it is shown that the degree of human capital accumulation is positively related to the degree of external openness and financial development. Thus, these relations are applied to the following reduced form equation:[5]

$$\dot{h}_t = H\left(E_t, F_t; s_t, h_t\right)$$

where E represents the degree of external openness; s and h denote learning intensity, and existing level of human capital, respectively. Note that $H(\bullet)$ implies a positive function of the degree of openness, the financial development, the learning intensity and the level of human capital.[6]

2.2 Consumer and Government

It is assumed that an infinitely lived representative agent maximizes utility subject to an intertemporal budget constraint. The dynamic model of MIUF (Money in Utility Function) developed by Sidrauski (1967) is extended by incorporating the human capital accumulation process.[7] Following Roubini

[5] 'Dot' indicates a time derivative.

[6] This functional form is assumed rather than derived. De Gregorio (1996) shows how a binding borrowing constraint affects human capital accumulation.

[7] The cash-in-advance or Clower constraint is used as an alternative to the Sidrauski model. The simplest version of the cash-in-advance model shows that, in discrete time, purchases of goods must be paid for with money held at the beginning of the period. This implies that money is held for transaction purposes. Feenstra (1986) shows that maximization subject to a Baumol-Tobin transaction technology can be approximately rewritten as a maximization problem with money in the objective function. Hence, the maximization

and Sala-i-Martin (1992), the relative preference parameter, $\beta(F)$, is assumed to be a function of financial development F. $\rho > n$ is assumed to obtain bounded utility, where ρ and n are the discount and the population growth rates, respectively. The CRRA (Constant Relative Risk Aversion) form of lifetime utility function is used:

$$U_0 = \int_0^\infty \frac{\left(c_t^{1-\beta(F_t)} m_t^{\beta(F_t)}\right)^{1-\sigma} - 1}{1-\sigma} e^{-\rho t} L_t dt \tag{1}$$

where $L_t = L_0 e^{nt}$ and $L_0 = 1$. In equation (1), c_t and m_t reflect per capita consumption and real money balance. $\beta'(F) < 0$ and $\beta''(F) > 0$ are assumed so that the marginal utility of liquid money holding is a decreasing function of financial development.

Wealth is maintained by the representative agent in three asset forms: money, capital and foreign assets. Hence, the intertemporal budget constraint per capita becomes:

$$\frac{1}{\zeta(F_t)}\left(\frac{\dot{K}_t}{L_t}\right) + \frac{\dot{M}_t}{P_t L_t} + \frac{\dot{B}_t}{L_t} = r_t b_t + y_t - t_t - c_t + v_t - (ex_t - im_t) \tag{2}$$

where K, M and B represent aggregate capital stock, nominal money balance, and net foreign debt, respectively; and L and P indicate aggregate labor force and price level. Per capita GDP is denoted by y, per capita tax by t, per capita lump-sum transfer by v, and per capita net foreign debt by b. The current account deficit is equal to change in foreign debt, which is interest payment rb, minus trade surplus $ex - im$, where ex and im imply export and import per capita. Thus, the balance of payment is:

for the individual who faces an explicit transactions technology can be written as a maximization problem with a pseudo-utility function with money and consumption as in the Sidrauski model. All the results in this paper will hold even in a Cash-in-advance model.

$$\frac{\dot{B}_t}{L_t} = r_t b_t - (ex_t - im_t) \tag{3}$$

Assuming proportional income tax as the source of government tax revenue, i.e., $t = \tau y$ where τ is a tax rate, and combining (2) and (3),

$$\dot{k}_t + \zeta(F_t)\dot{m}_t = \zeta(F_t)(1-\tau_t)y_t - nk_t - (n+\pi_t)\zeta(F_t)m_t + \zeta(F_t)v_t - \zeta(F_t)c_t \tag{4}$$

where k and π reflect capital per capita and inflation rate, respectively.

If a government balanced budget holds for all periods, the government's intertemporal budget constraint per capita becomes

$$v_t = \mu m_t + \tau_t y_t \, . \tag{5}$$

where μ is the growth rate of the nominal aggregate money supply. This equation implies that the government expenditure, i.e., transfer to consumers, is equal to the sum of seigniorage and tax revenue.

Since $\frac{\dot{m}}{m} = \mu - n - \pi$, the social budget constraint from equations (4) and (5) ensures

$$\dot{k}_t + nk_t = \zeta(F_t)(y_t - c_t). \tag{6}$$

As $y_t - c_t$ implies average savings and the left hand side average investment, $1 - \zeta(F)$ indicates the financial intermediation cost of transforming savings into investment as mentioned above. Thus, financial repression can be defined as government policies which serve to decrease the level of F by increasing intermediation or adjustment cost.

2.3 Production Technology

The per capita production function is assumed to be

$$y_t = A_t k_t^{\alpha} (u_t h_t)^{1-\alpha} h_a^{\gamma} \tag{7}$$

where A represents a given technology parameter, and u reflects the agent's time allocation for the production of a final output, as determined endogenously by a household's optimization behavior. It is normalized to $u + s = 1$. Following Lucas (1988), h_a represents the average human capital and γ represents the degree of Marshallian externalities. Note that $h = h_a$ should be satisfied on the balanced growth path.

Recalling the discussion in section 2.1, human capital accumulation is positively related to external openness (E), financial development (F), learning intensity (s), and the existing level of human capital (h). The following human capital accumulation process is assumed.

$$\dot{h}_t = \phi\left(E_t, F_t\right)\left(1 - u_t\right) h_t \tag{8}$$

where $\phi(E, F)$ reflects the effect of external openness (E) and financial development (F) on human capital accumulation, with $\frac{\partial \phi}{\partial E} > 0$ and $\frac{\partial \phi}{\partial F} > 0$. Solving the differential equation of (8), the level of effective human capital at time t is:[8]

$$h_t = h_o \exp\left[\phi(E, F) \int_0^t (1 - u_s) ds\right]. \tag{9}$$

The first element, h_0, represents the initial degree of human capital, and $\phi(E, F)$ reflects marginal benefits and costs to enhance human capital. The final factor, $s = 1 - u$, denotes the intensity or speed of the development in human capital created by time allocation to the learning process. Therefore, the effective level of human capital is composed of an initial degree of human

[8]To simplify the exposition, E and F are assumed to be time-independent.

capital, an element of environmental efficiency of knowledge acquisition, and the agents' endogenous decision of human capital development.

3 The Balanced Growth Rates

As Lucas (1988) shows, there are two possible outcomes in a growing economy with Marshallian externalities, that is, the market solution and the optimal solution.[9] The market solution is derived from private agents' behavior, given the existence of externalities. The representative agent in a market economy maximizes (1) subject to the intertemporal budget constraint (4), the production function (7), given h_a, and the human capital accumulation equation (8). Using a set of the first order conditions of Hamiltonian formula, the growth rate in the market equilibrium is:[10]

$$g^{DC} = g_y^{DC} = g_k^{DC} = g_c^{DC} = g_m^{DC} = \frac{1-\alpha+\gamma}{\sigma(1-\alpha+\gamma)-\gamma}\left[\phi(E,F)-\rho\right] \quad (10)$$

$$g_h^{DC} = \frac{1-\alpha}{1-\alpha+\gamma} g^{DC} \quad (11)$$

where g_i^{DC} denotes the balanced growth rate of a variable i in the market economy.

The optimal solution is computed by internalizing the externalities such that the reduced form production function, $y = Ak^{\alpha}u^{1-\alpha}h^{1-\alpha+\gamma}$, is used to derive the balanced growth rate. A benevolent social planner would maximize (1) subject to intertemporal budget constraint (4), the reduced form

[9] It is not necessary to include an externality to get the implications of this paper. However, the derivations of market and social planner solutions can be compared to those of Lucas (1988).

[10] In this and the next sections, time subscripts are omitted. All derivations are in Appendix 1.

production function, and human capital accumulation equation (8). The social optimal growth is:

$$\begin{aligned} g^{SP} &= g_y^{SP} = g_k^{SP} = g_c^{SP} = g_m^{SP} \\ &= \frac{1-\alpha+\gamma}{\sigma(1-\alpha+\gamma)-\gamma}\left\{\phi(E,F)\left[\left(1+\frac{\gamma}{1-\alpha}u^*\right)\right]-\rho\right\} \end{aligned} \quad (12)$$

$$g_h^{SP} = \frac{1-\alpha}{1-\alpha+\gamma} g^{SP} \quad (13)$$

where g_i^{SP} denotes the growth rate of a variable i on the optimal growth path. The optimal schooling time is denoted by u^* with $0 \leq u^* \leq 1$. It is straightforward to show that the optimal growth rate is larger than or equal to the market growth rate, since $g_i^{DC} \leq g_i^{SP}$from (10) and (12). When there is no externality, i.e., $\gamma = 0$, the steady state growth rate in the market economy becomes the same as that in the planner's economy, $g_i^{DC} = g_i^{SP}$. This indicates that the existence of externality is the source of market failure in our model, as in the Lucas (1988) model.

To simplify the following analysis, we assume that there is no externality, i.e., $\gamma = 0$. The basic sensitivity results of our model in the following section are not affected by this assumption. Then, the balanced growth rate becomes:

$$\lim_{\sigma \to 1} g = \lim_{\sigma \to 1} \frac{1}{\sigma}\left[\phi\left(E,F\right)-\rho\right] = \phi\left(E,F\right)-\rho. \quad (14)$$

Several implications are suggested by the balanced growth rate. First, since $\frac{\partial \phi}{\partial E} > 0$ and $\frac{\partial \phi}{\partial F} >0$, it is concluded that a high degree of external openness and financial development serves to enhance the economic growth rate.

As discussed in Section 2, the main mechanism of economic growth is through human capital accumulation. As the first channel, the financial development affects human capital accumulation through: i) the intermediation cost of transforming savings into investment, and ii) the borrowing constraint in the decision on human capital investment. Thus, financial development decreases the intermediation cost and loosens borrowing constraints, which increase the long run economic growth rate through higher human capital investment. As the second one, knowledge spillover, such as scientific advances and improvements, requests highly skilled workers who are acquainted with them. The spillover then leads to increased long run economic growth rate through enhanced incentives of human capital investment.

Since the balanced growth rate is independent of the money supply growth rate, this model also implies the superneutrality of money as in the Sidrauski model.

Finally, a proportional income tax does not affect the balanced growth path. Since the main channel of economic growth in our model is human capital accumulation, a distortionary tax on physical capital does not have growth effects, which contrasts with Roubini and Sala-i-Martin (1995).

4 Government Revenue and Economic Policies

4.1 Government Revenue Ratio

There are four policy variables which can be manipulated by government decisions: (1) the growth rate of the nominal money supply, μ, (2) the level of financial development, F, (3) the degree of external openness, E, and (4) the income tax rate, τ. This section analyzes the effects of these variables on the long run ratio of government revenue to GDP. Seignorage and tax revenues are the sources of government revenue given the government budget constraint (5).

To find the effects of policy variables on the government revenue, the Buchanan-Wagner (1977) government that aims to maximize its revenue or expenditure is introduced. This behavior is rationalized by the microeconomic self–seeking behavior of voters, firms, bureaucrats, and politicians. Bureaucrats attempt to maximize their utilities by increasing their monetary and nonmonetary benefits through budgetary expansion. Politicians could also take advantage of incentives to increase the governmental budget in order to attract voters by providing various transfer opportunities, especially before elections. On the other hand, voters might demand an increase in public services provided by the government to increase their utilities; and firms could resort to lobbies to derive public expenditures and various subsidies, as well as, tax incentives from the government in order to maximize profits.

As in the Roubini and Sala-i-Martin (1992, 1995) model, the ratio of government revenue or expenditure to national income, θ, is assumed.

$$\theta = \frac{\mu m + \tau y}{y} \tag{15}$$

Deriving the steady state value of k/y, c/y, and m, government revenue along the balanced growth path becomes:[11]

$$\theta^{*} = \frac{\mu_t \beta(F) \xi(E, F, \tau)}{(1 - \beta(F))(\mu + \rho + n)} + \tau \tag{16}$$

where $\xi(E, F, \tau) \equiv 1 - (1 - \tau)\alpha + \frac{(1-\tau)\alpha\rho}{\phi(E,F)+n}$, and, where it is easily verified that $\frac{\partial \xi}{\partial F} < 0$ and $\frac{\partial \xi}{\partial E} < 0$.

[11] All derivations are in Appendix 2.

4.2 The Effects of Economic Policies

The effects of changes in the money supply growth rate, financial development, external openness and tax rate are investigated. First, the effect of change in the money supply growth rate on the share of the government, θ^*, is:

$$\frac{\partial \theta^*}{\partial \mu} = \frac{\beta(F)[1-\beta(F)]\xi(E,F,\tau)(\rho+n)}{[(1-\beta(F))(\mu+\rho+n)]^2} > 0. \tag{17}$$

It becomes clear that an expansionist government has an incentive to increase the money supply growth rate to create seigniorage revenue. This government's motivation will result in a higher inflation rate since $\pi = \mu - n - \phi(E,F) + \rho$ on the balanced growth path.

Second, using $\frac{\partial \xi}{\partial E} < 0$ and $\frac{\partial \xi}{\partial F} < 0$, the effect of financial development on government revenue is derived as:

$$\begin{aligned} \frac{\partial \theta^*}{\partial F} &= \frac{\mu\beta(F)\xi(E,F,\tau)[(\mu+\rho+n)(1-\beta(F)) + \mu\beta(F)]}{[(1-\beta(F))(\mu+\rho+n)]^2} \\ &+ \frac{\mu\beta(F)(1-\beta(F))(\mu+\rho+n)}{(1-\beta(F))(\mu+\rho+n)} \cdot \frac{\partial \xi(E,F,\tau)}{\partial F} < 0. \end{aligned} \tag{18}$$

There are two effects of financial development on the government share in the economy. The first term on the right hand side of (18) represents the marginal utility effect of financial development. A higher F decreases marginal utility of holding cash and this reduces real demand thereby causing seignorage revenue to decline. The second term indicates that financial development increases income more than it does real money demand. These two effects imply that the marginal propensity of money holding is less than one. Hence, the total effect on seignorage revenue becomes negative.

Equation (18) implies that financial repression increases government revenue which enables public expenditure to increase. The government, therefore, has an incentive to repress the financial sector. However, as we see from (10), financial repression decreases the economic growth rate by decreasing human capital accumulation due to a higher financial intermediation cost.

Third, the effect of openness is:

$$\frac{\partial \theta^*}{\partial E} = \frac{\mu \beta(F)}{(1-\beta(F))(\mu+\rho+n)} \cdot \frac{\partial \xi(E,F,\tau)}{\partial E} < 0. \tag{19}$$

As (19) suggests, the government possesses an incentive to use a protectionist trade policy. An enhancement of trade protection decreases income more than it does real money demand since the marginal propensity of money holding is less than one. Hence, the government can increase seignorage revenue, which decreases the long run economic growth because a closed economy generally tends to deter the flow of new information.

Finally, the effect of tax rate change is given as follows.

$$\frac{\partial \theta^*}{\partial \tau} = \frac{\alpha \mu \beta(F)(g+n)}{(1-\beta(F))(\mu+\rho+n)(\phi+n)} + 1 > 0 \tag{20}$$

While the first term indicates the effect on seigniorage, the second term reflects the effect on the tax revenue. As equations (A-20) and (A-22) in Appendix 2 show, the tax effect on seigniorage depends on its effect on the average propensity to consume. Since the increased tax rate will decrease disposable income, and given that the marginal propensity to consume is less than 1, the effect on $\frac{c}{y}$ will be positive. Therefore, a government with self-seeking motives will impose a higher income tax rate.[12]

[12]The non Laffer-Curve result comes from the definition of steady state government revenue to GDP. The general process of the Laffer curve comes from the joint response of tax rate and national income. A tax rate increase will lead to the increase of government tax revenue. However, a tax revenue increase will decrease the rate of return to investment, which leads to the decrease of national income. Thus, depending on the relative magnitude of tax rate and national income effects, total revenue might decrease, increases, or be left

5 Conclusion

An endogenous growth model has been presented by incorporating financial development, human capital investment, and external openness. The model also takes into consideration the optimization behaviors of private agents and the effects on the ratio of government revenue to GDP. Table 1 summarizes these analytical results. Financial development and openness lead to increases in human capital accumulation consequently affecting the economic growth rate by decreasing the net marginal cost of human capital investment. This mechanism might be labeled as an East Asian developmental structure.

On the other hand, financial repression and an inward-oriented policy tend to result in lower human capital investment, thus lowering long run economic growth rate, since these increase the net marginal cost of investment. It has been demonstrated that an increase in the money supply growth rate typically boosts the inflation rate. Additionally, financial repression and a low real interest rate can coincide with a low economic growth rate as evidenced by the Latin American countries' experiences in the early 80's.

In consideration of the second issue, an expansionist government generally has incentives to increase the money supply growth rate, to repress the financial sector, to close its economy, and to impose a high income tax rate since the government can utilize the increased seigniorage revenue to expand its political power in the economy. Unfortunately, these policies often create a higher inflation rate and a lower economic growth rate that will not be sustainable so that this might result in political instability.

Finally, it is concluded that openness and financial development offer a vision of a fundamentally valid structure for the advancement of successful

unchanged. If, however, we define absolute government size by $\tilde{\theta} = \mu m + \tau y$, then the government revenue shows a Laffer curve type relation between tax rate and government revenue. This is shown formally in Appendix 3.

and sustainable economic development.

Table 1: Summary of the Model Results

	Economic Growth Rate (F)	Government Revenue to GDP ratio (θ^*)
Money Supply Growth Rate (μ)	No effect	+
External Openness (F)	+	-
Degree of Financial Development (F)	+	-
Proportional Income Tax Rate (F)	No effect	+

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(Appendix 1) Derivation of the balanced economic growth rate

The representative agent maximizes equation (1) subject to equations (4) and (8), i.e., the problem of the private agent is given by setting up the Hamiltonian as follows:

$$
\begin{aligned}
H &= \frac{\left(c_t^{1-\beta(F)} m_t^{\beta(F)}\right)^{1-\sigma} - 1}{1-\sigma} \\
&\quad + \lambda_1(t)\left[\zeta(F)(1-\tau)Ak^{\alpha}(uh)^{1-\alpha}h_a^{\gamma} - \zeta(F)c - na - \pi\zeta(F)m + \zeta(F)v\right] \\
&\quad + \lambda_2(t)\phi(E,F)(1-u)h \qquad \text{(A-1)}
\end{aligned}
$$

where $a = k + \zeta(F)m$.

There are three control variables, $c(t), m(t)$ and $u(t)$, and two state variables, $k(t)$ and $h(t)$. Then, the set of first order conditions are:

$$
\begin{aligned}
& (1-\beta(F))\, c_t^{-\beta(F)} m_t^{\beta(F)} \left(c_t^{1-\beta(F)} m_t^{\beta(F)}\right)^{-\sigma} = \lambda_1\zeta(F) \qquad \text{(A-2)} \\
& \beta(F) c_t^{1-\beta(F)} m_t^{\beta(F)-1} \left(c_t^{1-\beta(F)} m_t^{\beta(F)}\right)^{-\sigma} \\
= \; & \lambda_1\zeta(F)\left[\zeta(F)(1-\tau)\alpha Ak^{\alpha-1}(uh)^{1-\alpha}h_a^{\gamma} + n + \pi\right] \qquad \text{(A-3)} \\
& \lambda_1\zeta(F)(1-\tau)(1-\alpha)Ak^{\alpha}u^{-\alpha}h^{1-\alpha}h_a^{\gamma} = \lambda_2\phi(E,F)h \qquad \text{(A-4)} \\
& \dot{\lambda}_1 = \rho\lambda_1 - \lambda_1\left[\zeta(F)(1-\tau)\alpha Ak^{\alpha-1}(uh)^{1-\alpha}h_a^{\gamma} - n\right]. \qquad \text{(A-5)}
\end{aligned}
$$

For the market equilibrium,

$$
\dot{\lambda}_2 = \rho\lambda_2 - \lambda_1\zeta(F)(1-\tau)(1-\alpha)Ak^{\alpha}u^{1-\alpha}h^{\gamma-\alpha} - \lambda_2\phi(E,F)(1-u). \qquad \text{(A-6)}
$$

For the social planner problem,

$$
\dot{\lambda}_2 = \rho\lambda_2 - \lambda_1\zeta(F)(1-\tau)(1-\alpha+\gamma)Ak^{\alpha}u^{1-\alpha}h^{\gamma-\alpha} - \lambda_2\phi(E,F)(1-u). \qquad \text{(A-7)}
$$

Since $\frac{\dot{m}}{m} = \frac{\dot{c}}{c}$ from (A-2) and (A-3), (A-2) gives:

$$-\sigma\frac{\dot{c}}{c} = \frac{\dot{\lambda}_1}{\lambda_1}. \tag{A-8}$$

Since $\frac{\dot{\lambda}_1}{\lambda_1} = \rho - \zeta(F)(1-\tau)\alpha A k^{\alpha-1}(uh)^{1-\alpha}h_a^{\gamma} - n$ from (A-5), the following relation is derived,

$$\frac{\dot{k}}{k} = \frac{1-\alpha+\gamma}{1-\alpha}\frac{\dot{h}}{h}. \tag{A-9}$$

First, to derive the market equilibrium, using (A-3) and (A-4),

$$\frac{\dot{\lambda}_2}{\lambda_2} = \rho - \phi(E,F). \tag{A-10}$$

Combining (A-4) with (A-9) and (A-10),

$$\frac{\dot{\lambda}_1}{\lambda_1} = \rho - \phi(E,F) - \frac{\gamma}{1-\alpha+\gamma}\frac{\dot{k}}{k}. \tag{A-11}$$

Then from (A-8) and (A-11),

$$-\sigma\frac{\dot{c}}{c} = \rho - \phi(E,F) - \frac{\gamma}{1-\alpha+\gamma}\frac{\dot{k}}{k}. \tag{A-12}$$

Since $\frac{\dot{y}}{y} = \frac{\dot{k}}{k}$ from the production function, then,

$$g^{DC} = \frac{1-\alpha+\gamma}{\sigma(1-\alpha+\gamma)-\gamma}\left[\phi(E,F)-\rho\right]. \tag{A-13}$$

If $\sigma = 1$ and $\gamma = 0$ (no externality) are assumed, then the market equilibrium is simplified to,

$$g^{DC} = \phi(E,F) - \rho. \tag{A-14}$$

Second, following the same process above, the social planner problem is derived. Combining (A-4) and (A-7),

$$\frac{\dot{\lambda}_2}{\lambda_2} = \rho - \phi(E,F)\left[1 + \frac{\gamma}{1-\alpha}u^*\right]. \tag{A-15}$$

where $u^* = 1 - \frac{g_h^{SP}}{\delta}$ denotes the optimal choice of u, and $g_h^{SP} = \frac{1-\alpha}{1-\alpha+\gamma}g_k^{SP}$ is the balanced growth rate of h in the social planner problem.

Thus,

$$g^{SP} = \frac{1-\alpha+\gamma}{\sigma(1-\alpha+\gamma)-\gamma}\left[\phi(E,F)\left[1 + \frac{\gamma}{1-\alpha}u^*\right] - \rho\right]. \tag{A-16}$$

(Appendix 2) Derivation of θ with $\sigma = 1$ and $\gamma = 0$

From (A-5) and (A-8), on a balanced growth path, it is ascertained:

$$\frac{\dot{c}}{c} = \zeta(F)(1-\tau)\alpha A k^{\alpha-1}(uh)^{1-\alpha} - n - \rho = \zeta(F)(1-\tau)\alpha\frac{y}{k} - n - \rho. \tag{A–17}$$

Substituting $g = \phi(E,F) - \rho$, it is obtained:

$$\frac{k}{y} = \frac{\zeta(F)(1-\tau)\alpha}{\phi(E,F)+n}. \tag{A–18}$$

From the first order conditions (A-2) and (A-3), the following results:

$$m = \frac{\beta(F)c}{(1-\beta(F))(\mu+\rho+n)} \tag{A–19}$$

where $i = \zeta(F)(1-\tau)\alpha A k^{\alpha-1}(uh)^{1-\alpha} - n - \rho = \zeta(F)(1-\tau)\alpha\frac{y}{k} - n - \rho$ is $\mu + \rho$.

Then, (A–14) is rewritten as follows:

$$\theta = \frac{\mu\beta(F)}{(1-\beta(F))\left[\phi(E,F)+2n+\pi\right]}\frac{c}{y} + \tau. \tag{A–20}$$

From the social budget constraints:

$$\frac{\dot{k}}{k} + n = \zeta(F)(\frac{y}{k} - \frac{c}{k}). \tag{A–21}$$

Using a balanced growth path, $g = \phi(E, F) - \rho$ and (A–18), $\frac{c}{k}$ is:

$$\frac{c}{y} = \frac{c}{k}\frac{k}{y} = \frac{\zeta(F)(1-\tau)\alpha}{\phi + n} \cdot \frac{\phi(E, F) + n - (1-\tau)\alpha\left[\phi(E, F) + n - \rho\right]}{\zeta(F)(1-\tau)\alpha} \tag{A-22}$$

Substituting equation (A–22) into equation (A–20), the steady state value of θ is:

$$\theta^* = \xi\left[1 - (1-\tau)\alpha + \frac{(1-\tau)\alpha\rho}{\phi(E, F) + n}\right] + \tau \tag{A–23}$$

where $\xi \equiv \frac{\mu\beta(F)}{(1-\beta(F))(\mu+\rho+n)}$.

(Appendix 3) Derivation of Level Variables

From (10), then,

$$c_t = c_0 e^{gt} = c_0 e^{(\phi-\rho)t} \tag{A-24}$$

Also from the human capital accumulation process, since the growth rate of human capital in the steady state is constant, the time spent on human capital accumulation is constant.

$$u = 1 - \frac{g}{\phi} = \frac{\rho}{\phi} \tag{A-25}$$

From (A-18) and (A-21), the following capital accumulation process along the balanced growth path is:

$$k = \frac{\zeta(F)(1-\tau)\alpha}{\phi + n} c_0 e^{(\phi-\rho)t}. \tag{A-26}$$

From (A-19), and (A-22),

$$m = \frac{\beta(F)c_0e^{(\phi-\rho)t}}{(1-\beta(F))(\mu+\rho+n)} \quad \text{(A-27)}$$

$$y = \frac{(\phi+n)c_0e^{(\phi-\rho)t}}{\phi(E,F)+n-(1-\tau)\alpha\left[\phi(E,F)+n-\rho\right]}. \quad \text{(A-28)}$$

Defining total tax revenue by $\tilde{\theta} = \mu m + \tau y$,

$$\tilde{\theta} = \xi c_0e^{(\phi-\rho)t} + \frac{(\phi+n)\tau c_0e^{(\phi-\rho)t}}{\phi(E,F)+n-(1-\tau)\alpha\left[\phi(E,F)+n-\rho\right]} \quad \text{(A-29)}$$

where $\xi \equiv \frac{\mu\beta(F)}{(1-\beta(F))(\mu+\rho+n)}$.

Since the first term is independent of the tax rate, the second term alone will be considered.

$$\begin{aligned}\frac{\partial\tilde{\theta}}{\partial\tau} &= \frac{(\phi+n)c_0e^{(\phi-\rho)t}}{\left[\phi(E,F)+n-(1-\tau)\alpha\left(g+n\right)\right]} \\ &\quad - \frac{(\phi+n)\tau c_0e^{(\phi-\rho)t}\alpha\left(g+n\right)}{\left[\phi(E,F)+n-(1-\tau)\alpha\left(g+n\right)\right]^2}\end{aligned}$$

Depending on the relative size of the two terms, the sign of the partial derivative of tax revenue with respect to tax rate will de decided.