Adjusting to Capital Account Liberalization

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Abstract

We study theoretically how the adjustment to liberalization of international financial transaction depends upon the degree of domestic financial development. Using a model with domestic and international borrowing constraints, we show that, when the domestic financial system is underdeveloped, capital account liberalization is not necessarily beneficial because TFP stagnates in the long-run or employment decreases in the short-run. Government policy, including allowing foreign direct investment, can mitigate the possible loss of employment, but cannot eliminate it unless the domestic financial system is improved.

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1 Introduction

"Capital account liberalization, it is fair to say, remains one of the most controversial and least understood policies of our day". (Eichengreen, 2002)

This paper is a theoretical study into how an economy adjusts to the liberalization of international financial transaction – capital account liberalization. Although most economists agree that trade liberalization generally improves efficiency of resource allocation, they are sharply divided on the costs and benefits of capital account liberalization. According to standard microeconomic theory, the international financial transaction is international trade of goods in different dates (possibly contingent on the states of nature), and thus capital account liberalization should have similar benefits with trade liberalization. Why do economists disagree? We think that the intertemporal exchange of present goods and claims to future goods is fundamentally different from intra-temporal exchange of different goods at least in one respect: the intertemporal exchange requires the commitment that agents will provide goods (or their purchasing power) in the future, while intra-temporal exchange does not require such commitment.[1] If people's ability to keep their promises is limited, then the equivalence of intertemporal trade and intra-temporal trade no longer holds, and thus we need to investigate the effects of capital account liberalization taking into account the limitation of commitment.

In this paper, we consider an economy in which the debtor does not keep his promise to repay unless debt is secured by collateralizable assets – assets he looses if he defaults. Then, the creditor limits her loan to the debtor so that the debt repayment does not exceed the value of collateral. Moreover, we consider the case in which the amount of

[1] Of course, international trade requires some commitment because the order, delivery, payment and consumption of goods are not simultaneous. But, the degree of commitment is usually more demanding for international borrowing than trade.

collateralizable assets for foreign credits is more restricted than for domestic credits, because foreign creditors have more difficulty in taking over control and utilizing the collateral assets in a different country. The extent of assets usable for collateral depends upon both technology and quality of institution of the economy which affects the development of financial system. The extent of collateralizable assets for domestic borrowing affects the overall financial depth of the economy. The gap between collateralizable assets for international borrowing and domestic borrowing – the relative tightness of international borrowing – affects how much the home economy is financially integrated into the international financial market. Our aim is to examine how the adjustment of the home economy to capital account liberalization depends upon the parameters of financial depth of the domestic economy and the relative tightness of the international borrowing constraint.

For this purpose, we construct a dynamic model of a small open economy with entrepreneurs and workers. At each date, some entrepreneurs are productive and others are not. Entrepreneurs hire workers to produce output in the following period, and they can borrow domestically against a fraction of future output. The fraction they can borrow from foreigners is smaller. When domestic financial system is underdeveloped, it fails to transfer enough purchasing power from savers (typically unproductive entrepreneurs) to investing agents (productive entrepreneurs), so that the unproductive entrepreneurs end up hiring workers. The productive entrepreneurs are credit constrained, the domestic interest rate to the savers remains low (symptom of interest rate suppression), and the total factor productivity (TFP) is low, which leads to low a wage rate (symptom of wage suppression).[2]

[2]Kiyotaki and Moore (1997), Kiyotaki (1998), Aghion, Banerjee and Piketty (1999), and Aghion and Banerjee (2005), for examples, investigate these symptoms of the borrowing constrained economy.

The way the economy adjusts to capital account liberalization depends upon the relative strength of wage suppression versus interest rate suppression. If the wage-suppression effect dominates the interest rate suppression, then even unproductive entrepreneurs may enjoy a higher rate of return on production than the foreign real interest rate before liberalization. Following capital account liberalization, both productive and unproductive entrepreneurs borrow from foreigners, causing capital inflow, which pushes up the wage rate. But the size and duration of the capital inflow are limited due to the poor domestic financial system, and TFP may deteriorate after liberalization.

If the interest rate suppression effect dominates the wage-suppression, then the domestic real interest rate faced by the savers (unproductive entrepreneurs) under financial autarky is lower than the foreign interest rate. Following capital account liberalization, they start lending abroad and reduce their production. With capital outflows, workers suffer from wage reduction and loss of employment until unproductive entrepreneurs stop producing. Here, capital account liberalization serves as a catalyst to reduce inefficient production by providing an alternative means of saving, improving TFP over time.

If domestic financial system is more advanced than the rest of the world, the productive entrepreneurial sector has enough borrowing capacity to absorb the domestic saving so that the domestic interest rate under autarky is higher than the world interest rate. After liberalization, the productive domestic entrepreneurs will attract foreign funds, causing capital inflow and higher investment. With a superior financial institution, the domestic economy can take advantage of cheaper funds possibly induced by financial suppression of the rest of the world.

What emerges from our analysis is that the adjustment of home economy to capital account liberalization depends not only on the absolute level of development of home financial system, but also on the relative level of development of home institutions com-

pared to the rest of the world.

Since capital account liberalization under poor domestic financial system leads to a costly adjustment for workers under financial suppression, a natural step would be to examine the role of government policy. When agents' commitment is limited, tax liability affects their capacity to borrow. For the economy under financial suppression, a subsidy to production of unproductive entrepreneurs mitigates the loss of the workers following capital liberalization at the cost of prolonging the transition to efficient production. Allowing foreign direct investment (FDI), which is considered as a more stable source of employment compared with private financial inflows, cannot eliminate workers' loss unless it helps to improve domestic technology and financial institutions.

There is an extensive literature that examines theoretically the relationship between domestic financial development and capital account liberalization. Aghion, Bacchetta and Banerjee (2004) show that an economy with an intermediate level of financial development may become unstable following capital account liberalization. Caballero and Krishnamurthy (2004) emphasize the interaction between domestic and international financial constraints in explaining the vulnerability of an economy to a financial crisis. Kim (2001) develops a two-country model of adoption of vintages of technologies, and shows that, following capital liberalization, the country with better domestic financial system specializes in adopting more recent technology, while the country with poor financial system ends up with adopting older technologies, leading to a substantial gap in the TFP between the two.

Concerning the direction of capital flows, Gertler and Rogoff (1990) propose a framework in which capital can flow from the poor South to the richer North in a context of a model of international lending under moral hazard. Recent contributions by Caballero, Fahri and Gourinchas (2006) emphasize the different financial development and

different supply of means of saving, while Mendoza, Quadrini and Rios-Rull (2007) focus on the different precautionary saving as determinants for the current pattern of global imbalances across countries.[3],[4]

While our analysis shares some of the aforementioned features, our distinctive contribution to the literature is to investigate the implications of limited commitment of private agents against both domestic and foreign creditors, for the entire adjustment process of the economy following capital account liberalization. In particular we emphasize the endogenous adjustment of TFP, pointing out to the existence of a certain threshold in terms of domestic financial development above which a country could benefit from a process of capital account liberalization.

[3]There is a vast empirical literature that has examined the effects of capital account liberalization. For an example, Obstfeld and Taylor (2004) analyzes the evolution of international financial integration from the late 19th century. Kose, Prasad, Rogoff and Wei (2008) summarizes previous studies of post WWII. experiences to conclude that there is no robust relationship between capital account liberalization and economics growth.

In a subsequent work Kose, Prasad and Taylor (2009) find evidence of threshold effects of capital account liberalization on growth in terms of domestic financial developement. By using the ratio of private credit to GDP as a proxy for financial depth, they find that greater financial depth leads to an improvement in the growth effects of financial liberalization but only up to a certain level of financial depth.

Also, Kose, Prasad and Terrones (2008) provide a comprehensive empirical analysis on the link between financial integration and TFP (see also Bonfiglioli (2008) on this). Interestingly they find that the composition of the underlying capital flows is crucial for understanding the link between financial integration and TFP growth. Indeed liberalization of FDI and equity tends to improve TFP while that of external debt liabilities does not (at least for poorly developed domestic financial system).

[4]In a different strand of literature, Kehoe and Perri (2001, 2004) consider implications of enforcement constraint between sovereign nations while abstracting from that between private agents. Jeske (2006) and Wright (2006) examine the problem of resident default risk and the implication for government intervention on capital flows.

2 Model

2.1 Framework

We consider a small open economy with one homogeneous goods and two types of continua of infinitely-lived agents: entrepreneurs and workers. Entrepreneurs hire workers to produce goods. Workers do not have production technology, simply supplying homogeneous labor in order to consume.

The preference of the entrepreneur is described by the expected discounted utility

$$E_t\left[\sum_{s=t}^{\infty}\beta^{s-t}\log c_s\right], \quad 0<\beta<1, \tag{1}$$

where c_s is the consumption at date s, and E_t is the expectations conditional on information at date t. The entrepreneurs have a constant returns to scale production technology

$$y_{t+1}=a_t l_t, \tag{2}$$

where y_{t+1} is output at date $t+1$, l_t is labor input at date t, and a_t is a productivity parameter which is known at date t. At each date some entrepreneurs are productive ($a_t=\alpha$), and the others are unproductive ($a_t=\gamma\in(0,\alpha)$). Each entrepreneur shifts stochastically between productive and unproductive states following a Markov process. Specifically, if an entrepreneur is productive in this period he/she may become unproductive in the next period with probability δ; an unproductive entrepreneur in this period may become productive in the next period with probability $n\delta$. The shifts of the productivity are exogenous and independent across entrepreneurs and over time. This transition matrix implies that the fraction of productive entrepreneurs is stationary over time and equal to $n/(1+n)$, given that the economy starts with such population

distribution. We assume that the probability of the productivity shifts is not too large:

$$\delta + n\delta < 1. \tag{3}$$

This assumption implies that the productivity of each agent is positively serially correlated.

We assume that the production technology is specific to the entrepreneur, and that only the entrepreneur who started the production has the necessary skill to obtain full amount described by the production function. We also assume that the entrepreneur cannot precommit to work, always having freedom to withdraw her/his labor. (The entrepreneur's human capital is *inalienable*, following Hart and Moore (1994)). Besides the entrepreneur, a lead creditor who has been monitoring the production throughout has a specific skill to obtain θ (< 1) fraction of full amount of output, if she takes over the entrepreneur's production. Although production is divisible, we assume that there is only one lead creditor for each segment of production, and that only a home resident can be a lead creditor. All the other (non-lead) outside creditors, home or foreign, can obtain only $\phi\theta$ fraction of full output, where $\phi \in [0, 1)$. Knowing this possibility in advance, the foreign lenders restrict their loan of this period so that the repayment (b^*_{t+1}) does not exceed $\phi\theta$ fraction of output in the next period[5]:

[5] Here, we apply Hart and Moore (1994) and Aghion, Hart and Moore (1992) on default and renegotiation between private parties. We assume the outside creditors have weak bargaining power against the producer and the lead creditor in the renegotiation, (even though the outside creditors are made to be senior creditors in order to maximize borrowing from them). Unlike Bronner, Martin and Ventura (2006) in which there are many domestic creditors who can correct a large fraction of returns, we have only one monopolistic domestic lead creditor for each project. Then the lead creditor pays the outside creditors $\phi\theta$ fraction of full output in order to acquire the outside creditors' right to the project as senior creditors. When the lead creditor and the producer-debtor negotiate after the outside creditors leave, we assume the producer has all the bargaining power. Then, after the producer pays θ fraction of maximum output to the lead creditor, the producer is allowed to complete the production to obtain $1 - \theta$ fraction of maximum output. The resource allocation is efficient ex post. But the ex ante resource allocation may not be efficient because of the credit constraint which arises from the possibility

$$b^*_{t+1} \leq \phi\theta y_{t+1}. \tag{4}$$

Also, the domestic lead creditor restricts her loan (b_{t+1}) so that the total sum of loans does not exceed θ fraction of output:

$$b_{t+1} + b^*_{t+1} \leq \theta y_{t+1.} \tag{5}$$

We take both θ and ϕ as exogenous parameters to represent the degrees of development of the country's financial institution. We consider the size of θ as a domestic collateral factor, representing the overall financial depth of the home economy. The gap between $\phi\theta$ and θ reflects the difference between the outside creditors and the lead creditor in their skills of production and bargaining (being influenced by legal protection of the outside creditors[6]).

The flow-of-funds constraint of the entrepreneur is given by

$$c_t + w_t l_t = y_t - b_t - b^*_t + \frac{b_{t+1}}{r_t} + \frac{b^*_{t+1}}{r^*}, \tag{6}$$

where w_t is the real wage rate, r_t is the domestic real gross interest rate, r^* is the foreign real gross interest rate, and b_t and b^*_t are domestic and foreign borrowing. Consumption c_t and investment on the wage bill $w_t l_t$ in the left-hand side (LHS) of this equation are financed by the net worth $y_t - b_t - b^*_t$ and the domestic and foreign new borrowing in the right hand side (RHS). The entrepreneur chooses consumption, labor input, output and domestic and foreign borrowing $\left(c_t, l_t, y_{t+1}, b_{t+1}, b^*_{t+1}\right)$ to maximize utility subject to

of the default and negotiation. We assume there is no reputation to enforce debts, because there is no record keeping of the past defaults.

[6]See La Porta, Shleifer, Lopez-de-Silanes and Vishny (1997,1998).

the constraints of production technology, the flow-of-funds, and the international and domestic borrowing constraints.

We now turn to workers. Unlike the entrepreneurs, the workers do not have production technology, nor any collateralizable asset in order to borrow either domestically or internationally. They choose consumption c_t, labor supply l_t, and domestic and foreign net borrowings (b_{t+1} and b^*_{t+1}) to maximize the expected discounted utility,

$$E_t\left[\sum_{s=t}^{\infty}\beta^{s-t}u\left(c_s - v(l_t)\right)\right],$$

subject to the flow of funds constraint

$$c_t = w_t l_t - b_t - b^*_t + \frac{b_{t+1}}{r_t} + \frac{b^*_{t+1}}{r^*},$$

and the borrowing constraints, $b_{t+1} \leq 0$ and $b^*_{t+1} \leq 0$. We make the standard assumptions $u'(c-v) > 0, u"(c-v) < 0$, and $v(0) = 0, v'(l) > 0, v"(l) > 0$. We normalize the population size of workers to be unity.

We finally assume that there is no constraint on domestic agent's lending to the foreigners and that the foreign interest rate r^* is exogenous being strictly less than the time preference rate[7]

$$r^* < 1/\beta. \tag{7}$$

2.2 Equilibrium

We now derive the general properties of the competitive equilibrium. If the domestic interest rate were strictly lower than the foreign interest rate, the domestic savers would

[7]The underlying assumption is that the rest of the world is also subject to credit frictions described above. As is shown later, the equilibrium interest rate under this environment is lower than β^{-1}.

lend to foreigners instead of lending to domestic borrowers while there would be many agents who want to borrow. This contradicts the market equilibrium. Therefore we obtain

$$r_t \geq r^*. \tag{8}$$

The entrepreneur has a few choices of accumulating net worth. Let $R_t(a_t)$ be the maximum rate of return on the net worth from date t to date $t+1$ for the entrepreneur with productivity a_t. Then, it is the maximum of all the options as:

$$R_t(a_t) = Max\left\{r_t,\ \frac{a_t}{w_t},\ \frac{a_t(1-\phi\theta)}{w_t-(a_t\phi\theta/r^*)},\ \frac{a_t(1-\theta)}{w_t-(a_t\phi\theta/r^*)-[a_t(1-\phi)\theta/r_t]}\right\}. \tag{9}$$

The first term in the brackets of RHS is the rate of return on domestic loan. The second term is the rate of return on production without borrowing. The third term is the rate of return on production with maximum foreign borrowing. By borrowing from foreigners secured by $\phi\theta$ fraction of output, the entrepreneur can finance externally $a_t\phi\theta/r^*$ amount of unit labor cost. Thus the denominator is the required net worth (downpayment) for the unit labor input, and the numerator is the output after repaying the debt. The last term is the rate of return on production with maximum borrowing from both foreigners and the domestic lead creditor. The denominator is downpayment for hiring unit labor, when the entrepreneur finances $a_t\phi\theta/r^*$ of unit labor cost by borrowing from foreigners, and finances $a_t(1-\phi)\theta/r_t$ by borrowing additionally from the domestic lead creditor at interest rate r_t. Note that the entrepreneur prefers to borrow maximum first from foreigners at a lower interest rate.

In the expression of maximum rate of return on net worth (9), each of the last three rates are strictly higher for the productive entrepreneur than the unproductive entrepreneur, while the rate of return on domestic loan is the same for both. Thus,

in equilibrium the unproductive entrepreneurs lend to productive entrepreneurs, and produce if and only if their rate of return on production is equal to the domestic interest rate - otherwise, they specialize in providing loan.[8] Therefore the domestic interest rate and employment of unproductive entrepreneur satisfy[9]

$$R_t(\gamma) = r_t \geq \frac{\gamma(1-\phi\theta)}{w_t - (\gamma\phi\theta/r^*)} \text{ and } 0 = l_t \left\{ r_t - \frac{\gamma(1-\phi\theta)}{w_t - (\gamma\phi\theta/r^*)} \right\}. \tag{10}$$

The productive entrepreneur always borrows to produce, and their rate of return is given by

$$R_t(\alpha) = \frac{\alpha(1-\theta)}{w_t - (\alpha\phi\theta/r^*) - [\alpha(1-\phi)\theta/r_t]} \geq r_t.$$

Given the optimal choice of accumulating net worth, the flow-of-funds constraint (6) can be written as

$$z_{t+1} = R_t(a_t)(z_t - c_t),$$

where $z_t \equiv y_t - b_t - b_t^*$ denotes the net worth of the entrepreneur at date t. When the entrepreneur chooses consumption to maximize his logarithmic utility subject to this flow-of-fund constraint, the first order condition is given by the Euler equation: $\frac{1}{c_t} = \beta R_t(a_t) E_t \left(\frac{1}{c_{t+1}} \right)$. Then we have the explicit consumption function as

$$c_t = (1-\beta) z_t = (1-\beta)(y_t - b_t - b_t^*). \tag{11}$$

The productive agents produce with their domestic and international borrowing constraints binding if the rate of return on production with maximum leverage exceeds the

[8] Later, we will show that the workers will not lend nor borrow in the equilibrium.

[9] We note here that as long as $r_t \geq r^*$, the rate of return on production with maximum borrowing from abroad is at least as great as the rate of return on production without borrowing.

domestic interest rate. Thus, from (4)(5)(6), and (11), their employment is given by

$$l_t \leq \frac{\beta z_t}{w_t - (\alpha\phi\theta/r^*) - [\alpha(1-\phi)\theta/r_t]}, \tag{12}$$

and equality holds if $R_t(\alpha) > r_t$.

Regarding the workers, their labor supply l_t^s is given by $w_t = v'(l_t^s)$, or

$$l_t^s = L^s(w_t), \quad \text{where } L^s(w) = v'^{-1}(w).$$

Thus $dL^s/dw_t > 0$. They will decumulate their asset until the borrowing constraint becomes binding, if the domestic real interest rate is strictly less than the time preference rate:

$$r_t < 1/\beta. \tag{13}$$

We will later verify this inequality holds in the neighborhood of the steady state equilibrium. Therefore, the aggregate consumption of the workers is equal to the aggregate wages[10]

$$b_t = b_t^* = 0, \text{ and } c_t = w_t L^s(w_t). \tag{14}$$

Now let us define aggregate variables. Denote aggregate quantities of the productive entrepreneurs, the unproductive entrepreneurs, and workers of a generic quantity y_t by Y_t, Y_t', and Y_t^w. Define B_t^* as the aggregate net debt of all the home entrepreneurs against foreigners matured at date t. Then, aggregate net worth of all the entrepreneurs,

[10]The workers do not save, not because the workers are impatient relative to the entrepreneurs, but because the real interest rate is lower than the time preference rate in equilibrium. The entrepreneurs nonetheless save because their rate of return on net worth exceeds the time preference rate when they are productive. If the workers expect sharp decline of wage in future, then they may save despite of the interest rate being lower than the time preference rate. Throughout the paper we do not consider such expectations.

denoted by Z_t, is given by

$$Z_t = Y_t + Y_t' - B_t - B_t' - B_t^*. \tag{15}$$

Furthermore, let s_t be the share of net worth of all the productive entrepreneurs, so that $s_t Z_t$ is the aggregate net worth of the productive entrepreneurs. Then, because of the linearity of (12), we derive the aggregate employment of the productive entrepreneurs as

$$L_t \leq \frac{\beta s_t Z_t}{w_t - (\alpha\phi\theta/r^*) - [\alpha(1-\phi)\theta/r_t]}, \tag{16}$$

and the equality holds if $R_t(\alpha) > r_t$. The aggregation of (10) and (14) respectively yields

$$0 = L_t^{'} \left\{ r_t - \frac{\gamma(1-\phi\theta)}{w_t - (\gamma\phi\theta/r^*)} \right\}, \tag{17}$$

and $C_t^w = w_t L^s(w_t)$. The market clearing condition for labor, goods, and domestic credit are written as

$$L_t + L_t' = L^s(w_t), \tag{18}$$

$$C_t + C_t' + C_t^w = Y_t + Y_t' + \left(\frac{B_{t+1}^*}{r^*} - B_t^* \right), \tag{19}$$

$$B_{t+1} + B_{t+1}' = 0. \tag{20}$$

The term in the bracket of the RHS of equation (19) are the net supply of goods by the foreigners to domestic agents. In equation (20), the domestic borrowing and lending should be net out in aggregate, even though the total debts of the domestic agents need not because of the international borrowing and lending.

The competitive equilibrium is defined as a set of prices (r_t, w_t) and quantities (y_t, l_t, c_t, b_{t+1}, b_{t+1}^*, Y_t, Y_t', L_t, L_t', C_t, C_t', C_t^w, B_{t+1}, B_{t+1}', B_{t+1}^*), which is consistent with the

choice of all the individual entrepreneurs and workers as well as the clearing conditions of markets for labor, goods and domestic credit. Because there is no shocks except for the idiosyncratic shock to the productivity of each entrepreneur, the agents have perfect foresight of future prices and aggregate quantities in the equilibrium.

By aggregating the consumption of the entrepreneurs (11) and using (15), market clearing condition (19) can be written as

$$w_t L^s(w_t) = \beta Z_t + \frac{B^*_{t+1}}{r^*}. \tag{21}$$

The LHS is gross investment on wage bill by the entrepreneurs, and the RHS is the sum of gross saving and foreign borrowing of the entrepreneurs. The foreign borrowing satisfies the international borrowing constraints:

$$B^*_{t+1} \leq \phi\theta(Y_{t+1} + Y^{'}_{t+1}) = \phi\theta(\alpha L_t + \gamma L^{'}_t), \tag{22}$$

where the equality holds if $r_t > r^*$.

We take the aggregate net worth of the entrepreneurs (Z_t) and the share of the productive entrepreneurs' net worth (s_t) as the state variables of the economy at date t. The law of motion of aggregate wealth is given by

$$\begin{aligned} Z_{t+1} &= (1 + x_t) r_t \beta s_t Z_t + r_t \beta (1 - s_t) Z_t \\ &= (1 + s_t x_t) r_t \beta Z_t. \end{aligned} \tag{23}$$

where

$$x_t \equiv \frac{R_t(\alpha) - R_t(\gamma)}{R_t(\gamma)} = \frac{\alpha - w_t r_t + \alpha\phi\theta \frac{r_t - r^*}{r^*}}{w_t r_t - \alpha\theta - \alpha\phi\theta \frac{r_t - r^*}{r^*}}. \tag{24}$$

is the extra rate of return of the productive entrepreneur over the unproductive entrepreneur. Here, the accumulation of wealth depends upon not only the interest rate and saving rate but also the distribution of wealth, because the saving of the productive entrepreneurs earns the extra rate of returns. We can also derive the law of motion of the share of productive entrepreneurs' net worth as

$$\begin{aligned} s_{t+1} &= \frac{(1-\delta)(1+x_t)r_t\beta s_t Z_t + n\delta r_t\beta(1-s_t)Z_t}{(1+s_t x_t)r_t\beta Z_t} \\ &= \frac{(1-\delta)s_t(1+x_t)+n\delta(1-s_t)}{1+s_t x_t}. \end{aligned} \tag{25}$$

The denominator of RHS of the first equation is the aggregate net worth in the next period. The numerator is the aggregate net worth of productive agents in the next period, which is the sum of the net worth of those who continue to be productive, $(1-\delta)(1+x_t)r_t\beta s_t Z_t$, and those who shift from unproductive to be productive, $n\delta r_t\beta(1-s_t)Z_t$. The evolution of the economy is characterized by the recursive equilibrium: $\left(Z_{t+1}, s_{t+1}, x_t, r_t, w_t, L_t, L_t', B_{t+1}^*\right)$ that satisfies (16 - 18), and (21 - 25) as functions of the state variables (s_t, Z_t).

Finally, in the subsequent analysis it would be of interest to see the total factor productivity (TFP) of the economy. Since labor is the only input, the TFP is defined as the average productivity of labor

$$A_t = \frac{\alpha L_t + \gamma L_t'}{L_t^s} = (\alpha-\gamma)\frac{L_t}{L_t^s} + \gamma. \tag{26}$$

The property that the TFP is an increasing function of the fraction of labor employed by productive entrepreneurs is a unique feature of our credit constrained economy.

3 Steady State under Financial Autarky

Before looking into how the economy adjusts to capital account liberalization, it is useful to analyze the steady state of the economy before liberalization - the economy which has no financial transaction with foreigners ($\phi = 0$). Since goods are homogeneous and labor is not mobile across the border, the economy becomes autarky. In the steady state, all the endogenous variables are constant. Let us define $X = sx$, the product of the share of net worth and the extra rate of return of productive agents – the importance of extra return of the productive entrepreneurs. Then, the equilibrium conditions can be written as

$$r \geq \frac{\gamma}{w}, \text{ and } L'(r - \frac{\gamma}{w}) = 0, \tag{27}$$

$$L \leq \frac{X}{(\alpha/r) - w}\beta Z, \text{ and the equality holds if } \frac{\alpha}{r} > r. \tag{28}$$

$$L + L' = L^s(w), \tag{29}$$

$$wL^s(w) = \beta Z, \tag{30}$$

$$x = \frac{(\alpha/r) - w}{w - (\alpha\theta/r)}, \tag{31}$$

$$1 = \beta(1 + X)r, \tag{32}$$

$$F(X, x) = X^2 + [\delta(1 + n) - (1 - \delta)x]\, X - n\delta x = 0, \text{ and } X \geq 0. \tag{33}$$

In the steady state equilibrium of the autarky economy, these seven equilibrium conditions determine (r, w, x, X, L, L', Z) endogenously. Then, we have the following proposition in which upper script a represents variables under autarky. (Proofs of all the Propositions are in Appendix).

Proposition 1 *The steady state equilibrium of the autarky economy depends upon the*

financial depth of the economy θ *as:*

1. *If* $\theta < \overline{\theta} \equiv \frac{\delta}{\frac{\alpha-\gamma}{\gamma}+(1+n)\delta}$, *the unproductive entrepreneurs produce in equilibrium, and the productive entrepreneurs are credit constrained with* $A^a(\theta), w^a(\theta)$ *being an increasing function of* θ *while* $r^a(\theta)$ *being decreasing in* θ.

2. *If* $\theta \in [\overline{\theta}, \frac{1}{1+n})$, *the unproductive entrepreneurs do not produce, while the productive entrepreneurs are credit constrained with* $A^a(\theta) = \alpha$, $w^a(\theta) = \alpha\beta$ *and* $r^a(\theta)$ *being an increasing function of* θ.

3. *If* $\theta > \frac{1}{1+n}$, *no entrepreneurs are credit constrained with* $A^a(\theta) = \alpha, w^a(\theta) = \alpha\beta$ *and* $r^a(\theta) = \beta^{-1}$.

Figure 1 illustrates Proposition 1. In the first region where θ is below the threshold $\overline{\theta}$, the allocation of labor is inefficient because the unproductive entrepreneurs employ workers. Intuitively, if the domestic financial system is underdeveloped, then it fails to transfer enough purchasing power from the unproductive entrepreneurs (savers) to the productive entrepreneurs (investors), so that the unproductive entrepreneurs end up employing workers. Since production allocation is inefficient, the aggregate wealth and the wage rate remain low.[11] Furthermore, both TFP and the wage rate are increasing functions of θ. Intuitively, the better the domestic financial system is with a higher θ, the larger is the share of workers employed by the productive entrepreneurs, the higher are TFP and wage rate.[12] The interest rate is an decreasing function of θ below the

[11] Note that $\overline{\theta}$ is an increasing function of the exit rate δ and an decreasing function of the productivity gap between productive and unproductive entrepreneurs $(\alpha - \gamma)/\gamma$. Thus for a given financial depth θ, the economy is more likely to be inefficient in production if the exit rate is high or the productivity gap is small so that the share of net worth of the productive entrepreneurs is limited.

[12] Kiyotaki (1998) and Caselli and Gennaioli (2003) made similar observation on why TFP depends upon the financial depth of the economy.

threshold $\overline{\theta}$, because the interest rate is equal to the rate of returns on production for the unproductive entrepreneurs (which is a decreasing function of wage rate and θ).

In the second region, $\theta \in [\overline{\theta}, \frac{1}{1+n})$, all the savings are transferred to the productive entrepreneurs so that aggregate output is at the maximum for a given total employment. It does not mean the allocation is the first best, because individual consumption is not smooth as the credit constraint is binding for productive entrepreneurs. Since the TFP is given by α, the wage is given by $\alpha\beta$. In this region, the interest rate is increasing in θ because a higher θ simply means a larger demand for domestic credit relative to supply.[13]

In the third region $\theta \geq \frac{1}{1+n}$ where the domestic financial system is so well developed that none is credit constrained. Both the productive and unproductive entrepreneurs enjoy the same rate of return on saving, behaving similarly, and thus the entrepreneurs as a whole behave like the representative entrepreneur. The economy achieves the first best allocation.

The autarky interest rate is lower than the time preference rate for $\theta < 1/(1+n)$. This verifies our conjecture (13).[14] Another property of the autarky steady state is that the interest rate is not monotone with respect to θ. It is decreasing in θ when $\theta < \bar{\theta}$ and is increasing when between $\bar{\theta}$ and $1/(1+n)$. As is analyzed below, this non-monotonicity has important implications for the effects of the capital account liberalization.

[13] In Figure 1, autarky net real interest rate could be negative in the neighborhood of $\bar{\theta}$. For those values of θ, there exists another equilibrium in which intrinsecally useless fiat money circulates with value and the net real interest rate becomes zero. As long as the net foreign interest rate is positive the existence of this equilibrium will not change the qualitative features of our analysis of capital account liberalization.

[14] Because (13) no longer holds for $\theta \geq 1/(1+n)$, workers may not be credit constrained. Also, since $x = 0$ ($X = 0$) we must use (16) instead of (28) in order to characterize the equilibrium. If we redefine Z as the total wealth of the economy, instead of the aggregate net worth of the entrepreneurs, then the remaining equilibrium conditions are unchanged.

4 Adjusting to Capital Account Liberalization

We now study how the economy is going to adjust to the liberalization of financial transactions with foreigners, starting from the steady state autarky equilibrium towards a new steady state. Because the interest rate under autarky steady state $r^a(\theta)$ is a decreasing function of θ for $\theta < \overline{\theta}$, and is an increasing function of θ for $\theta \in [\overline{\theta}, \frac{1}{1+n})$ by Proposition 1, let us assume that

$$r^a(0) > r^*, \quad r^a(\overline{\theta}) = \frac{\gamma}{\beta\alpha} < r^*. \tag{34}$$

and let us define two critical values of θ, $\theta_1 \in \left(0, \overline{\theta}\right)$ and $\theta_2 \in \left(\overline{\theta}, \frac{1}{1+n}\right)$, at which the foreign interest rate schedule intersects the domestic autarky interest rate (see Figure 2). The second inequality in (34) implies that the foreign interest rate is higher than the minimum value of the domestic interest rate in the steady state under autarky.[15]

Figure 2 shows that $r^a(\theta) > r^*$ for $\theta \in [0, \theta_1)$, $r^a(\theta) < r^*$ for $\theta \in (\theta_1, \theta_2)$, and $r^a(\theta) > r^*$ for $\theta > \theta_2$. Note that inefficiency of the production due to credit frictions affects the domestic interest rate $r^a(\theta)$ through the two channels: while smaller borrowing capacity of the productive entrepreneurs lowers $r^a(\theta)$, lower wage pushes up $r^a(\theta)$. In $\theta \in [0, \theta_1)$, the wage effect dominates and therefore $r^a(\theta)$ is higher than r^*, which will lead to capital inflow following the liberalization. We call this region 'wage suppression'. In $\theta \in (\theta_1, \theta_2)$, the effect of smaller borrowing capacity dominates that of lower wage. We call this region 'interest rate suppression'[16]. Since $r^a(\theta)$ is lower than r^*, the country will experience capital outflow after liberalization. Finally, when $\theta > \theta_2$, home economy

[15] If the foreign economy has the same environment as the home economy except for θ, then this assumption holds except for the exceptional case that foreign θ is exactly equal to $\overline{\theta}$.

[16] Shaw (1973) and McKinnon (1973) consider financial suppression as an outcome of government low interest rate policy to the savers. Because our financial suppression comes from the limitation of commitment and borrowing capacity, we call it as "interest rate suppression" hereafter.

has more advanced financial system than the rest of the world so that $r^a(\theta)$ is higher than r^*, causing capital inflow. We refer to this region as the 'advanced financial system'. Thus the direction of capital flow crucially depends on the degree of domestic financial development relative to the rest of the world.

While some analytical results are available, it is easier to illustrate transition dynamics based on numerical examples. Given that our model is highly stylized, we do not intend to calibrate the model to match a particular country. The purpose is the qualitative analysis of how a country's adjustment to liberalization depends on its degree of financial development relative to that of the rest of the world. The parameter values used in the numerical examples are explained in Appendix E.

4.1 Wage Suppression

Figures 3.1 and 3.2 show the dynamics of the economy under wage suppression for a low level of domestic financial development $\theta = 0.15 < \theta_1$. Under wage suppression, the wage rate is so low that even the unproductive entrepreneurs enjoy a higher rate of return on production under autarky than the foreign interest rate. Thus both unproductive and productive entrepreneurs borrow from abroad. However, since the borrowing capacity is small, capital inflow is limited. The productive entrepreneurs also borrow from the unproductive entrepreneurs who become their lead creditors in the domestic credit market. Here, the unproductive entrepreneurs serve as *financial intermediary*: they borrow from the foreigners secured by the fraction of their output at the world interest rate r^*, and, at the same time, extend loan to the productive entrepreneurs in the domestic credit market as the lead creditors at the domestic interest rate r_t. The fact that the unproductive entrepreneurs act as financial intermediary stems from the fact that in-

ternational borrowing constraint is tighter than the domestic borrowing constraint (i.e., $0 < \phi < 1$).[17]

The dynamics of the wage suppression economy is characterized by a temporary boom followed by stagnation. Immediately after the liberalization, the unproductive entrepreneurs expands production by borrowing from abroad at a cheaper interest rate. The total employment increases with capital inflow, which pushes up the wages. The expansion, however, is short-lived. Because the employment by the productive entrepreneurs is crowded out with a higher wage, TFP keeps decreasing from autarky level. After the international borrowing constraint becomes binding, output and wage rate start decreasing until the economy converges to its new steady state. The long-run effect on output is marginal.

4.2 Interest Rate Suppression

Figures 4.1 and 4.2 show the dynamics of the economy under the interest rate suppression for a medium level of domestic financial development $\theta = 0.3 \in [\theta_1, \theta_2]$. The adjustment process under the interest rate suppression is characterized by temporary drop in wages and employment followed by gradual expansion. Because the unproductive entrepreneurs start lending abroad and reduce employment, wage and total employment drop immediately after liberalization. While total employment and employment of unproductive entrepreneurs fall, employment of productive entrepreneurs rise due to cheap wage rate and borrowing rate. As a result, TFP improves. Over time, employment of productive entrepreneurs increases together with their accumulation of net worth, until

[17] During the rapid economic growth era after the World War II, Japanese general trading companies played a role of financial intermediary, borrowing from abroad against their international collateral and lending to domestic businesses. Possibly, countries like India and China (at least in the early stage) may experience this type of adjustment. Caballero and Krishnamurty (2001) has a similar feature.

it absorbs the entire employment. Thereafter, the wage rate and employment start recovering. Intuitively the international capital market has a catalyst effect by eliminating the inefficiency in production in the long run through accumulation of net worth.[18]

4.3 Advanced Domestic Financial System

When domestic financial system is more advanced than the rest of the world, autarky interest rate is higher than the world interest rate due to large borrowing capacity of the productive entrepreneurs. After liberalization, the productive domestic entrepreneurs will attract foreign fund, causing capital inflow. The unproductive entrepreneurs continue to specialize in lending. Figures 5.1 and 5.2 show the dynamics of the economy under advanced domestic financial system $\theta = 0.8 > \theta_2$. The total employment (which is equal to employment of the productive entrepreneurs) expands at the beginning and then stays roughly constant.[19]

Similar to the analysis by Caballero et al. (2006) and Mendoza et al. (2007) our framework suggests the existence of "equilibrium imbalances" in which countries with more developed financial system experience capital inflows as they integrate with less financially developed economies. Intuitively, the home economy can take advantage of the relatively low interest rate (and the saving glut) of the rest of the world. A distinguishing feature of our work is that capital inflow needs not be the result of superior domestic financial system, because it can be a result of wage suppression. But the key difference among these two types of capital inflow is that TFP stays high with capital inflow induced by a superior financial system, while the TFP deteriorates and the boom is

[18] Perhaps, some Latin American countries experience this type of adjustment, which is characterized by capital outflow and the loss of employment of the unproductive sector, which may cultivate the anti-globalization sentiment.

[19] This depends on the elasticity of labour with respect to wage. If labour supply is elastic enough, then the employment continues to increase.

temporary when capital inflow is caused by the wage suppression with an underdeveloped domestic financial system.

4.4 Steady State after Liberalization

The new steady state after capital account liberalization depends upon the *relative* level of domestic financial development to the rest of the world as:

Proposition 2 *Let $r(\theta)$ and $w(\theta)$ be the domestic interest rate and the wage rate in the steady state equilibrium after liberalization with financial depth θ.*

1. *Wage suppression, $\theta < \theta_1$: Unproductive entrepreneurs produce and the home interest rate stays above the foreign interest rate: $r^* < r(\theta) < r^a(\theta)$, $w(\theta) > w^a(\theta)$, $r'(\theta) < 0$ and $w'(\theta) > 0$.*

2. *Interest rate suppression, $\theta \in [\theta_1, \theta_2]$: Unproductive entrepreneurs do not produce, and the home and foreign interest rates are equalized: $r^a(\theta) \leq r(\theta) = r^*$, $A(\theta) = \alpha \geq A^a(\theta)$, and $w'(\theta) > 0$.*

3. *Advanced domestic financial system, $\theta > \theta_2$: Unproductive entrepreneurs do not produce. The home and foreign interest rates are equalized if $\theta_2 < \theta \leq \widetilde{\theta} \equiv \frac{\delta+\phi\theta[n\delta+(1/\beta r^*)-1]}{(1+n)\delta+(1/\beta r^*)-1} \in (\theta_2, 1)$. The home interest rate stays above the foreign interest rate if $\theta > \widetilde{\theta}$. In both cases, $r^a(\theta) > r(\theta)$, $w(\theta) > w^a(\theta)$, $A(\theta) = \alpha = A^a(\theta)$, $r'(\theta) \geq 0$ and $w'(\theta) > 0$.*

Note that unproductive entrepreneurs do not produce if the financial depth is at least as high as θ_1. Thus the economy is more likely to achieve efficiency in production for the same financial depth in the new steady state than autarky. Also, we observe that capital

account liberalization does not necessarily leads to the complete financial integration of the home economy with the rest of the world. If the financial depth of the economy is very different from the rest of the world, either extremely low $\theta < \theta_1$ or extremely high $\theta > \tilde{\theta}$, the domestic interest rate stays higher than the foreign interest rate because the international borrowing constraint is binding. From Proposition 2, we learn wage rate and total employment are increasing functions of the financial depth of the economy θ for the entire range of θ.

5 Welfare and Government Policies

5.1 Welfare Analysis

From the analysis of the previous section, we learn that the capital account liberalization is not necessarily beneficial, especially when the domestic financial system is underdeveloped. If the wage suppression is pronounced under financial autarky, the liberalization does not improve the TFP and thus the boom is temporary. If the interest rate suppression is significant, the liberalization causes capital outflow and decline in wages and employment during the transition, even though the TFP will improve in the long-run. A natural question is to what extent capital account liberalization is beneficial for the country, and how the costs and benefits are distributed among different groups. To answer this question, we examine the welfare effects on workers and productive and unproductive entrepreneurs separately. (We do not use Pareto efficiency criteria of whether everyone can be better off with suitable redistribution, because it is difficult to enforce redistribution with limited collateral).

We measure the welfare effect of capital account liberalization by a constant per-

	productive	unproductive	workers
wage suppression	-0.025	-0.025	0.0022
interest rate suppression	0.25	0.25	-0.018
advanced finance	-0.086	-0.19	0.014

Table 1: Welfare analysis

centage change of steady state autarky consumption that is required to make an agent indifferent between liberalizing capital account and staying in autarky. In computing this measure, we take into account the effects of the transition dynamics from autarky to the post-liberalization steady state. Formally, for each entrepreneurs i, we define this measure of welfare change - called the consumption equivalent μ^i - as

$$E_0 \sum_{t=0}^{\infty} \beta^t \log\left(c_t^i\right) = \frac{1}{1-\beta} \log\left[(1+\mu^i)c^{ia}\right] \tag{35}$$

where c_t^i is date t consumption of entrepreneur i after the liberalization at date 0, starting from the autarky steady state at date -1, and c^{ia} is his consumption under autarky steady state.

The welfare measure of workers is defined in a similar way. Assume that the utility of the workers is logarithmic: $u(c - v(l)) = \log(c - v(l))$ and that the disutility of labor is constantly elastic: $v(l) = \frac{1}{1+(1/\eta)} l^{1+(1/\eta)}$. Define μ^w as

$$\sum_{t=0}^{\infty} \beta^t \log\left(c_t - v(l_t)\right) = \frac{1}{1-\beta}[\log c^a(1+\mu^w) - v(l^a)], \tag{36}$$

where μ^w is consumption equivalent for the workers. Here c^a and l^a respectively denote consumption and labor supply under autarky.

Table 1 reports the welfare effect of capital account liberalization for the cases corresponding to wage suppression, interest rate suppression and advanced domestic financial

system, using the numerical example of the previous section. The headline of 'productive' implies the group of entrepreneurs who are productive and 'unproductive' is the group who is unproductive at the time of liberalization. Under wage suppression, capital inflow is limited and boom is temporary because the borrowing constraint is tight and as a result the welfare effects of liberalization are small compared to the other two cases. The workers gain only modestly from the temporary boom and the entrepreneurs lose modestly from the lower expected rates of return.

Under interest-rate suppression, the economy experiences an initial recession before improving the TFP in the long-run. The workers tend to lose since the loss from the lower wages during the initial recession is large compared to the possible long-run gains in a distant future. The entrepreneurs gain substantially because their rate of return become higher. The unproductive (savers) obtain better saving opportunities abroad at the higher world interest rate, and the productive entrepreneurs achieve higher rate of return due to lower wages. The welfare effects on the entrepreneurs are much larger than those on workers since changes in the rate of return have compound effects on their consumption through wealth accumulation.

Finally, in the case of advanced financial system, the workers gain due to permanently higher wages. The entrepreneurs lose because they face lower rate of return. In particular, unproductive entrepreneurs loose substantially because they are savers at the time of liberalization and their rate of return on saving drops to the world interest rate. In contrast, productive entrepreneurs do not loose as much because they can expand production by borrowing at a cheaper world interest rate even though the wage rate is higher.

From these analysis, we learn that there tends to be conflicts of interests between workers and entrepreneurs towards the capital account liberalization. The welfare of the

workers tend to be more influenced by the short-run movement of the aggregate economy immediately after the liberalization, because the workers do not smooth consumption due to the binding borrowing constraint. In contrast, the entrepreneurs tend to care more about the subsequent rates of return which depends upon the long-run performance of the economy.

From a policy maker's point of view, the case of interest-rate suppression would be of particular interest. This is because capital account liberalization of private capital flows can eventually eliminate the inefficiency of production, but such process can be painful to the workers who suffer from lower wage and employment. Can the government mitigate the loss of workers during the adjustment to the capital liberalization? One possibility is redistribution, but the government may face a limited enforcement problem similar to that of the private agents as long as the domestic financial and legal systems are not developed enough. Therefore, in the next two Sections we consider two different types of policy intervention. The first one is a simple tax and subsidy policy under balanced budget constraint, while the second one is to allow foreign direct investment (FDI) flows along with private capital flows in the process of capital account liberalization.

5.2 Tax and Subsidy under Interest Rate Suppression

The reason for which wages drop temporarily under interest-rate suppression is that the unproductive entrepreneurs lend abroad and shrink their production. In order to mitigate the drop in wages, we consider a production subsidy to unproductive agents by imposing taxes on the productive agents. We assume balanced budget, so the budget constraint of the government sector is given by

$$\sigma_{t-1} Y_t' = \tau_{t-1} Y_t, \tag{37}$$

where σ_t represents subsidy rate and τ_t represents tax rate.[20]

Limited commitment and shortage of collateral have implications for both private finance and public finance. Because the tax liability to the government is considered to be the most senior debt of the entrepreneur, it affects his domestic and international borrowing constraints as

$$\tau_t y_{t+1} + b^*_{t+1} \leq \phi\theta y_{t+1}, \tag{38}$$

$$\tau_t y_{t+1} + b^*_{t+1} + b_{t+1} \leq \theta y_{t+1}. \tag{39}$$

The first constraint implies that the foreign creditors will limit their loans so that the sum of the tax liability and the foreign debt repayment does not exceed the value of collateral for the outside creditors. The second constraint says the domestic lead creditor restricts her loan so that the sum of all liabilities of the entrepreneur does not exceed the collateral value of the project to the lead creditor. In what follows, we assume that the tax liability of the entrepreneur does not exceed the collateral value for the outside creditors: $\tau_t y_{t+1} \leq \phi\theta y_{t+1}$.[21] The flow-of-fund constraint of the productive entrepreneur becomes

$$c_t + w_t l_t = (1 - \tau_{t-1})y_t - b_t - b^*_t + \frac{b_{t+1}}{r_t} + \frac{b^*_{t+1}}{r^*} \tag{40}$$

The unproductive entrepreneur's flow-of-fund constraint is similar to (40), term $-\tau_{t-1}$ being replaced by σ_{t-1}.[22] In Appendix D we describe the set of equilibrium conditions.

[20] The role of public debt as liquidity in an economy under credit constraint is an interesting question. For example, Woodford (1990) considers a model with heterogeneous entrepreneurs who cannot borrow, in order to argue that government can issue public debt to absorb the saving of the unproductive entrepreneurs and improve the efficiency. See, also, Holmstrom and Tirole (1997). However, a systematic analysis of public debt under credit-constrained economy is beyond the scope of this paper and is left for future research.

[21] This constraint can be an outcome of limited power of government who cannot enforce tax liability more than the outside creditors.

[22] We assume that the unproductive entrepreneur who receive production subsidy cannot borrow against the future production subsidy, because the creditor who take over the project may not receive

	productive	unproductive	workers
without government	0.25	0.25	-0.018
with government	0.17	0.24	-0.013

Table 2: Welfare with government under interest-rate suppression

Figure 6 shows the dynamics of the economy with government under interest-rate suppression. Here, subsidy is chosen to set the wage immediately after liberalization as

$$w_t = \psi w^a + (1 - \psi) w_t^l,$$

where w^a is wage under autarky steady state and $w_t^l \equiv \gamma / r^*$ is wage immediately after liberalization without government policy. Here ψ is set 0.3. There is a trade-off for our government policy. On one hand, the unproductive entrepreneurs who receive subsidy employ more workers than the laissez faire economy during transition. As a result employment is larger with the government policy. On the other hand, taxation on the productive entrepreneurs decrease their capacity of private borrowing. As a result their accumulation of net worth and expansion of employment are slower. Thus the transition to the equilibrium with efficient production takes longer than the laissez faire economy.[23] Eventually, the unproductive entrepreneurs stop producing, and thereafter the adjustment is identical to the laissez faire economy. Table 2 shows welfare consequences of the government policy. Not surprisingly, workers' loss is mitigated. The productive entrepreneur's gain from liberalization shrinks by the taxation. The unproductive entrepreneur's gain does not change much, because their rate of return is still given by the foreign interest rate despite of receiving the production subsidy.

the production subsidy from the government.

[23] If subsidy is large enough to maintain the autarky wage, the employment of the productive entrepreneurs starts shrinking as their net worth deccumulates. Then the tax rate on output of the productive agents have to be higher in order to balance the budget, which leads to further deccumulation of their net worth. Thus, the large subsidy program is not sustainable in the long run.

5.3 Foreign Direct Investment

Another policy intervention which has become increasingly more important is to allow foreign direct investment (FDI) along with financial capital flows.[24] Allowing FDI might imply smaller distortion than the tax and subsidy policy of the previous section. Also, it has been argued that FDI tends to be the least volatile type of capital flows because it involves relatively irreversible types of investment (physical capital, human capital, managerial resources)[25]. Therefore allowing FDI may make countries less vulnerable to capital outflow. In this section we are interested in examining whether the FDI is able to mitigate the losses of workers in the interest rate suppression region.[26]

We assume that foreign firms have a similar production technology as domestic entrepreneurs:

$$y_{t+1} = \alpha^* l_t^*, \tag{41}$$

where y_{t+1} is output of goods at date $t+1$, l_t^* is the labor input at date t, and α^* is constant productivity of foreign firms. Here we assume that foreign productivity is at least as big as the productivity level of the productive entrepreneurs, $\alpha^* \geq \alpha$. Since we consider a small open economy, when foreigners make their decisions about FDI they

[24] As documented recently in Prasad and Rajan (2008), the share of foreign direct investment flows has now become far more important than that of debt in gross private capital flows to nonindustrial countries. The share of foreign direct investment in total gross inflows to emerging markets and other developing countries has risen from about 25 percent in 1990-94 to nearly 50 percent by 2000-04. Over the same period, the share of debt in inflows to emerging markets has fallen from 64 percent to 39 percent.

[25] Kose et al. (2006) looks at the volatility of different types of inflows, calculated as the cross-country averages of the standard deviations of different types of inflows (measured as ratios to GDP) over the period 1985-2004. They find that gross inflows of debt financing are substantially more volatile than FDI or equity inflows.

[26] A important issue in FDI is technology transfer (see for example Blalock and Gertler (2008) for the case of Indonesian manufacturing establishment). While it is certainly an important issue we abstract from it because our main focus in the paper is to explore how liberalization of international financial transactions affect resource allocation among heterogeneous producers subject to credit constraints. We believe we can analyze the role of FDI in this regard without considering the spillover effects.

are not subject to borrowing constraints. Therefore the relevant discount factor is the international interest rate r^*.

On the other hand, it seems natural to assume that foreign producers face frictions in expanding production: In particular, it takes time and cost for the foreign employers to recruit suitable workers who understand technology and organization of the firm. We capture this by search frictions along the line of Mortensen and Pissarides (1994). In order to hire a suitable worker, a foreign employer maintains an open vacancy at flow cost c. A flow of new worker-employer matches is given by a constant-returns-to-scale function $M(H_t, V_t)$, where H_t is the number of searching workers and V_t is the number of vacancies in the economy. Here we assume that all the workers (including the workers employed by the domestic firms) can costlessy look for jobs in foreign firms. Then given the constant population of workers, H_t is constant. For simplicity, we assume that workers can supply labor to domestic and foreign firms simultaneously, and that each worker supplies one unit of labor when they match with foreign producers, so that foreign firms have only extensive margin to adjust labor. Finally, the relationship between foreign firm and a worker might end every period with a exogenous separation rate $1 - \lambda$.

Total labor force in the FDI sector ($\sum l_t^* = L_t^*$) evolves according to

$$L_t^* = \lambda L_{t-1}^* + M(H, V_t), \tag{42}$$

where the first term represents the fraction of employed workers who remain employed in foreign firms and the second component represents workers who find a job. The

matching function is given by

$$M(H, V_t) = \tilde{\mu} H^{\sigma} V_t^{1-\sigma} = \mu V_t^{1-\sigma}. \tag{43}$$

The model is completed by the relationship that determines the link between the value of the vacancy and the value of the job. The recursive equation for the value of the vacancy is given by

$$J_t^v = -c + \mu V_t^{-\sigma} J_t + \frac{(1 - \mu V_t^{-\sigma})}{r^*} J_{t+1}^v, \tag{44}$$

where J_t^v is the value of the vacancy, $\mu V_t^{-\sigma}$ represents the rate at which the vacancy is filled and J_t is the value of the job that evolves accordingly to

$$J_t = \frac{\alpha^*}{r^*} - w_t + \frac{\lambda}{r^*} J_{t+1}. \tag{45}$$

In (45), the term $\frac{\alpha^*}{r^*} - w_t$ represents the current net benefit from the match while the last term represents the continuation value which depends on the separation rate. We assume free entry, implying that $J_t^v = 0$ at all times. In contrast to the production by the foreign firms, we continue to assume that all the workers are homogeneous and suitable for the production by the domestic entrepreneurs. Assuming that the foreign firms have full bargaining power against the workers, the foreigners will choose the wage equal to the competitive wage level.

The competitive equilibrium condition in the labor market is now

$$L_t + L_t' + L_t^* = L^s(w_t). \tag{46}$$

Once we use (42), (43) and (44) to substitute out the measure of vacancies, V_t, the dynamic evolution of the economy is characterized by the recursive equilibrium: $\left(Z_{t+1}, s_{t+1}, x_t, r_t, w_t, L_t, L_t^{'}, L_t^*, B_{t+1}^*, J_t\right)$ that satisfies (16), (17), (21 - 25), (42), (45), and (46) as functions of the state variables (s_t, Z_t, L_{t-1}^*).

In the subsequent analysis we focus on the adjustment in the case of interest-rate suppression when the economy starts from its steady state without international financial transactions but with FDI allowed. Then the economy liberalizes the international financial transaction with the continued presence of FDI. This exercise seems to be useful for thinking about the experience of some countries, such as China, which is allowing FDI while keeping strict restrictions on international financial capital flows.

Figure 7 shows how the presence of the FDI changes the adjustment of the financially suppressed economy to the liberalization of international financial transactions. The parameter values used are discussed in Appendix. Solid line and uneven dotted line plot the dynamic path with FDI. For comparison, even dotted lines plot the adjustment of the economy without FDI — identical to Figure 4.2. Prior to liberalization of international financial transaction with the presence of the FDI, employment of the unproductive domestic entrepreneurs is smaller and the TFP is higher than the steady state without the FDI, because a fraction of workers are employed by productive foreign firms.[27]

Immediately after the liberalization of international financial transaction, wages fall as much as the case without the presence of FDI. This is because, as long as the unproductive entrepreneurs still produce, the unproductive agents are indifferent between producing and lending abroad: $\gamma/w_t = r^*$. However, because employment of foreign

[27]Because of our specific feature of the domestic entrepreneurial sector (such as constant returns to scale production function, constant turnover rate, and constant saving rate), the FDI does not change the share of wealth and employment of the productive entrepreneurs within the domestic entrepreneurial sector. Thus the wage rate, total employment and domestic interest rate are not affected by the FDI in the steady state under financial autarky.

	productive	unproductive	workers
without FDI	0.2533	0.2533	-0.01815
with FDI	0.2532	0.2532	-0.01807

Table 3: Welfare with FDI under interest-rate suppression

firms expands in addition to that of productive entrepreneurs, it takes less time for the unproductive production to be eliminated and the wage level recovers more quickly.[28]

Table 3 reports the welfare effect of capital account liberalization with and without FDI. Qualitatively, we see that by shortening the initial recession FDI mitigates the workers's loss. However under our chosen parameter values the effect is very small.[29] The presence of FDI does not have much effect on the welfare of entrepreneurs either since their rate of return is not directly affected by the presence of FDI. Overall, by making domestic entrepreneurial employment smaller, the presence of FDI speeds up the necessary adjustment to the liberalization of the international financial transactions. However, the prices and the distributions among the domestic sectors in the new steady state are mostly determined by the domestic institution, not directly affected by the FDI in our framework in which there is no direct spillover effects from the FDI to the domestic technology and institution.

[28] At the new steady state again, the presence of the FDI does not affect the distribution of wealth and employment between productive and unproductive domestic entrepreneurs, and thus does not affect wage rate and total employment.

[29] The share of FDI in the initial period (i.e., at the time of liberalization) is important in determining the quantitative significance of the welfare effect on workers. As is explained in Appendix E we chose the parameter values such that the share of FDI is about 20%. If the share of FDI is higher, it takes less time for the unproductive production to be eliminated, and the resulting welfare gain is higher.

6 Final Remarks

We have developed a model of capital account liberalization under domestic and international borrowing constraints in which workers and entrepreneurs might not benefit from financial integration as long as the domestic financial system is underdeveloped. If wage suppression is dominant with underdeveloped domestic financial system, then the liberalization leads to a deterioration of TFP and long-run stagnation. If interest rate suppression is more pronounced, then the liberalization causes capital outflow and significant loss of employment during the adjustment. The reason for which capital account liberalization generates these costly adjustments is because under underdeveloped financial system funds are used by unproductive entrepreneurs and producers located in foreign countries rather than productive domestic entrepreneurs.

Our logic might extend to financial liberalization across regions or different segments of the economy. For example, Guiso, Sapienza and Zingales (2004) find that the regions with better local financial system in Italy enjoy better economic performance after the financial liberalization of the mid-1980s as they have more entries of new firms, smaller monopoly markup, and higher growth.[30]

Of course, an important remained question would be to examine how to improve the domestic financial system.

[30]Reinhart and Rogoff (2008) argue that the subprime mortgages could be interpreted as lending to developing countries, because those loans are directed to the "under-developed" segment of the U.S economy. Then, the financial liberalization of this segment may fail to improve the resource allocation in the long-run unless the financial system within this segment is improved..

Appendix

A Proof of Proposition 1:

From (27) and (28) , we learn there are three possible types of the equilibrium:

(i) Unproductive entrepreneurs produce ($L' > 0$, $r = \frac{\gamma}{w}$)

(ii) Unproductive entrepreneurs do not produce and productive entrepreneurs are credit constrained ($r \in \left(\frac{\gamma}{w}, \frac{\alpha}{w}\right)$)

(iii) Unproductive entrepreneurs do not produce and none is credit constrained $\left(r = \frac{\alpha}{w}\right)$

Let us now examine each type of equilibrium in turn in order to derive the necessary and sufficient condition on the parameters for such equilibrium to exist.

A.1 Autarky equilibrium with inefficient production:

Because the interest rate is less than the rate of return of production on productive entrepreneurs:

$$r = \frac{\gamma}{w} < \frac{\alpha}{w}, \tag{A.1}$$

the productive entrepreneurs are credit constrained. (28) becomes:

$$L = \frac{X}{(\alpha/r) - w}\beta Z = \frac{\gamma X}{\alpha - \gamma}\beta Z. \tag{A.2}$$

For employment of unproductive entrepreneurs to be positive, we need from goods market equilibrium condition (30) that:

$$wL = \frac{\gamma X}{\alpha - \gamma}\beta Z < wL^s(w) = \beta Z, \text{ or}$$

$$X < \frac{\alpha - \gamma}{\gamma}. \tag{A.3}$$

From (31) and $(A.1)$, we learn $x = (\alpha - \gamma)/(\gamma - \theta\alpha)$. Thus, from (33), X solves

$$F(X, \frac{\alpha - \gamma}{\gamma - \theta\alpha}) = X[X + \delta(1+n)] - \frac{\alpha - \gamma}{\gamma - \theta\alpha}[(1-\delta)X + n\delta] = 0. \tag{A.4}$$

Because $F(0, \frac{\alpha-\gamma}{\gamma-\theta\alpha}) < 0$, we know $X > 0$, which implies from (32) that

$$r = \frac{1}{\beta(1+X)} < \frac{1}{\beta}.$$

Thus, we verify the condition (13) that guarantees that workers do not save in the neighborhood of the steady state equilibrium. Also, we learn the condition for inefficient production $(A.3)$ holds if and only if, $F(\frac{\alpha-\gamma}{\gamma}, \frac{\alpha-\gamma}{\gamma-\theta\alpha}) > 0$, or

$$\theta < \frac{\delta}{\frac{\alpha-\gamma}{\gamma} + (1+n)\delta} \equiv \overline{\theta}. \tag{A.5}$$

From $(A.4)$, X and w are increasing functions of θ, and r is a decreasing function of θ.

A.2 Autarky equilibrium with efficient production and credit constrained productive entrepreneurs:

Here, because there is no employment by the unproductive entrepreneurs ($L' = 0$) and the productive entrepreneurs are credit constrained, the equilibrium conditions (28) - (30) imply

$$L^s = \frac{\beta Z}{w} = L = \frac{X\beta Z}{(\alpha/r) - w}, \text{ and}$$

$$w = \frac{\alpha}{(1+X)r} = \alpha\beta.$$

Together with (31) - (33), we learn

$$X = \delta \frac{1-(1+n)\theta}{\theta}. \tag{A.6}$$

Then, we learn the productive entrepreneurs earn extra return $X > 0$ so that they are credit constrained, if and only if

$$\theta < \frac{1}{1+n}.$$

Also we learn $r = 1/\left[\beta(1+X)\right] < 1/\beta$, which verifies (13).

A.3 Autarky equilibrium in which no one is constrained:

If, $\theta \geq 1/(1+n)$, then we learn

$$X = 0,\ r = 1/\beta,\ w = \beta\alpha,\ \text{and}\ s = \frac{n}{1+n}$$

satisfy all the equilibrium conditions of the steady state autarky equilibrium in which none of the entrepreneurs are credit constrained. (See footnote 13). Concerning the quantities, we have $L' = 0$ and:

$$L = L^s(\beta\alpha) = Z/\alpha.$$

Q.E.D. of *Proposition 1.*

B Proof of Proposition 2

From the generic equilibrium conditions, (16) - (18) and (21) - (25), the steady state equilibrium of the open economy is characterized by (r, w, x, X, L, L', Z) that satisfies the conditions (29), (32), (33) and

$$r \geq \frac{\gamma(1-\phi\theta)}{w-(\gamma\phi\theta/r^*)}, \text{ and } \left[r - \frac{\gamma(1-\phi\theta)}{w-(\gamma\phi\theta/r^*)}\right] L' = 0, \tag{B.7}$$

$$L = \frac{\beta X Z}{(\alpha/r) - w + \alpha\phi\theta[(1/r^*) - (1/r)]}, \tag{B.8}$$

$$\beta Z + \frac{\phi\theta}{r^*}\left[\gamma L^s(w) + (\alpha-\gamma)L\right] \geq wL^s(w), \text{ and} \tag{B.9}$$
$$(r-r^*)\left\{\beta Z + \frac{\phi\theta}{r^*}\left[\gamma L^s(w) + (\alpha-\gamma)L\right] - wL^s(w)\right\} = 0,$$

$$x = \frac{\alpha - wr + \alpha\phi\theta\frac{r-r^*}{r^*}}{wr - \alpha\theta - \alpha\phi\theta\frac{r-r^*}{r^*}}. \tag{B.10}$$

B.1 Wage suppression: $\theta < \theta_1$

Lemma 3 *: $r > r^*$ for $\theta < \theta_1$.*

Proof. Suppose not. Then, from (8), we learn $r = r^*$. Then we have

$$r^a > r^* = r, \text{ for } \theta < \theta_1,$$

by construction of θ_1. Then, from (32) , we learn

$$X^a < X.$$

Then from (33), we obtain

$$\begin{aligned} x^a &= \frac{\alpha-\gamma}{\gamma-\theta\alpha} < x = \frac{\alpha-wr}{wr-\theta\alpha}, \text{ or} \\ r &< \frac{\gamma}{w} < \frac{\gamma(1-\phi\theta)}{w-\gamma\phi\theta/r^*}. \end{aligned}$$

This contradicts $(B.7)$. ■

Guess $L' > 0$ in $(B.7)$. Then *Lemma* 3 implies

$$\begin{aligned} r &= \frac{\gamma(1-\phi\theta)}{w-(\gamma\phi\theta/r^*)}, \text{ or} \\ w &= \gamma\left(\frac{\phi\theta}{r^*}+\frac{1-\phi\theta}{r}\right) = \beta\gamma\left[1+X+\phi\theta(X^*-X)\right]. \end{aligned} \tag{B.11}$$

where $1+X^* = 1/\beta r^*$. Then from $(B.10)$, we learn

$$x = (\alpha-\gamma)\frac{1+\phi\theta\frac{X^*-X}{1+X}}{\gamma-\theta\alpha-(\alpha-\gamma)\phi\theta\frac{X^*-X}{1+X}}.$$

Thus from (33), we have

$$\widetilde{F}(X;\theta,\phi) \equiv X[X+\delta(1+n)] - \frac{\alpha-\gamma}{\gamma-\theta\alpha}[(1-\delta)X+n\delta+\phi\theta(X^*-X)(X+n\delta)] = 0.$$

Then we see $X'(\theta) > 0$, or $r'(\theta) < 0$. Also because $\widetilde{F}(X;\theta,\phi) < F(X,\frac{\alpha-\gamma}{\gamma-\theta\alpha})$ for $X \in (0,X^*)$, we learn $X > X^a$, or $r(\theta) < r^a(\theta)$. Then from $(B.11)$ and *Proposition 1*, we learn $w(\theta) > w^a(\theta)$. We can also verify that $L' > 0$ from (B.8) and (B.9) under Lemma 3.

B.2 Interest rate suppression: $\theta \in [\theta_1, \theta_2]$

Lemma 4 *$L' = 0$ for $\theta \in (\theta_1, \theta_2)$*

Proof. *By definition of (θ_1, θ_2), we know $r(\theta) \geq r^* > r^a(\theta)$ for $\theta \in (\theta_1, \theta_2)$. Thus $X < X^a$, or*

$$x = \frac{\alpha - wr + \alpha\phi\theta\left(\frac{r}{r^*} - 1\right)}{wr - \theta\alpha - \alpha\phi\theta\left(\frac{r}{r^*} - 1\right)} < x^a = \frac{\alpha - w^a r^a}{w^a r^a - \theta\alpha} \leq \frac{\alpha - \gamma}{\gamma - \theta\alpha}.$$

Thus $\gamma < wr - \alpha\phi\theta\left(\frac{r}{r^*} - 1\right)$, or

$$w > \frac{\gamma}{r} + \alpha\phi\theta\left(\frac{1}{r^*} - \frac{1}{r}\right) > \gamma\left(\frac{1 - \phi\theta}{r} + \frac{\phi\theta}{r^*}\right).$$

Thus from (17), we learn $L' = 0$ for $\theta \in (\theta_1, \theta_2)$. ■

Lemma 5 *$r = r^*$ for $\theta \in (\theta_1, \theta_2)$*

Proof. *Suppose that $r > r^*$. Then from Lemma 4, $(B.8)$ and $(B.9)$, we learn*

$$\begin{aligned}\left(w - \frac{\alpha\phi\theta}{r^*}\right)L &= \beta Z = \frac{1}{X}\left[\frac{\alpha}{r} - w + \alpha\phi\theta\left(\frac{1}{r^*} - \frac{1}{r}\right)\right]L, \text{ or} \\ w &= \alpha\beta(1 + \phi\theta X^*)\end{aligned}$$

Then,

$$x = X\frac{1 - \phi\theta}{1 - \theta - \theta(1 - \phi)X}.$$

Also from (33), we know

$$x = X\frac{X + (1 + n)\delta}{(1 - \delta)X + n\delta}.$$

Therefore we learn

$$\begin{aligned} 0 &= (1-\phi\theta)\left[(1-\delta)X+n\delta\right]-\left[X+(1+n)\delta\right]\left[1-\theta-\theta(1-\phi)X\right] \\ &= (1+X)\left\{\theta(1-\phi)X-\delta\left[1-\theta-n\theta(1-\phi)\right]\right\}, \text{ or} \\ X &= \delta\frac{1-\theta-n\theta(1-\phi)}{\theta(1-\phi)}. \end{aligned}$$

Because from equation (A.6) we know θ_2 *satisfies* $X^* = \delta\frac{1-(1+n)\theta_2}{\theta_2}$, *we learn that*

$$X > \delta\frac{1-\theta_2-n\theta_2(1-\phi)}{\theta_2(1-\phi)} > X^*, \text{ for } \theta < \theta_2.$$

This contradicts $r > r^*$ *because* $r = \frac{1}{\beta(1+X)}$. ■

Lemma 5 implies $X = X^* = \frac{1}{\beta r} - 1$. Then from (33) and $(B.9)$, we know

$$x = X^*\frac{X^*+(1+n)\delta}{(1-\delta)X^*+n\delta} = \frac{\alpha\beta(1+X^*)-w}{w-\alpha\beta\theta(1+X^*)}.$$

Thus

$$\begin{aligned} w &= \alpha\beta\left\{1+X^*\frac{\theta\left[X^*+(1+n)\delta\right]-\delta}{X^*+n\delta}\right\} \\ &= \alpha\beta[1+X^*k(X^*)(\theta-\theta_2)] = w(\theta), \text{ where} \\ k\left(X^*\right) &\equiv \frac{X^*+(1+n)\delta}{X^*+n\delta}. \end{aligned}$$

Lemma 4, 5, $(B.8)$ and (29) implies

$$Z = \alpha\left[1+k(X^*)(\theta-\theta_2\right]L^s\left(\alpha\beta\left[1+X^*k(X^*)(\theta-\theta_2\right]\right).$$

Thus Z is an increasing function of θ iff

$$\frac{wL^{s\prime}(w)}{L^s(w)} > \frac{1}{X^*}\frac{1 - X^*k(X^*)(\theta - \theta_2)}{1 + k(X^*)(\theta - \theta_2)}.$$

where the LHS is the elasticity of labour supply.

B.3 Advanced Domestic Financial System: $\theta > \theta_2$

Lemma 6 *$L' = 0$ for $\theta > \theta_2$.*

Proof. *Suppose $L' > 0$. Then we learn*

$$w = \gamma\left(\frac{1 - \phi\theta}{r} + \frac{\phi\theta}{r^*}\right).$$

Thus

$$x = (\alpha - \gamma)\frac{1 + \phi\theta\frac{X^* - X}{1+X}}{\gamma - \theta\alpha - (\alpha - \gamma)\phi\theta\frac{X^* - X}{1+X}}.$$

Thus from (33)*, we learn $X > X^*$ for $\theta > \theta_2 > \theta_1$. This contradicts $r > r^*$ for $\theta > \theta_2$.*

■

Lemma 6, $(B.8)$ and $(B.9)$ imply

$$\beta Z \geq \frac{X\left(w - \alpha\frac{\phi\theta}{r^*}\right)}{\frac{\alpha}{r} - w + \alpha\phi\theta\left(\frac{1}{r^*} - \frac{1}{r}\right)}\beta Z, \tag{B.12}$$

where the strict inequality implies $r = r^*$ while $r > r^*$ implies the equality.

The equilibrium with $r = r^*$ implies

$$w = \alpha\beta\left[1 + X^*k(X^*)(\theta - \theta_2)\right]$$

Then from $(B.12)$, $r = r^*$ if and only if

$$\theta \leq \widetilde{\theta} \equiv \frac{\theta_2}{1 - \frac{\phi}{k(X^*)}} = \frac{\delta + \phi\theta[n\delta + (1/\beta r^*) - 1]}{(1+n)\delta + (1/\beta r^*) - 1}.$$

If $\theta > \widetilde{\theta}$, we learn $r > r^*$ and thus from $(B.12)$,

$$w = \alpha\beta(1 + \phi\theta X^*).$$

Thus we get

$$\begin{aligned} x &= X\frac{1-\phi\theta}{1-\theta-\theta\left(1-\phi\right)X} \text{ and} \\ X &= \delta\frac{1-\theta-\theta(1-\phi)n}{\theta(1-\phi)}, \end{aligned}$$

from (33).

Q.E.D. of the *Proposition 2.*

C Welfare computation

Since consumption c_t^i is proportional to his net worth of date t, z_t^i, we can write c_t^i as:

$$\begin{aligned} c_t^i &= (1-\beta)\, z_t^i \\ &= (1-\beta)\, \beta^t z_0^i r_0^i r_1^i \cdots r_{t-1}^i, \end{aligned}$$

where r_t^i is the gross rate of return on saving of entrepreneur i. The level of r_t^i is equal to r_t when he is unproductive, and is equal to $(1 + x_t)\, r_t$ when he is productive at date

t. Then, we can write the consumption equivalent μ^i as

$$\log\left(1+\mu^i\right) = \beta \sum_{t=0}^{\infty} \beta^t \left(P^t R_t\right)_j - \beta \left[\left(I-\beta P\right)^{-1} R^A\right]_j, \tag{C.13}$$

where

$$P = \begin{bmatrix} 1-\delta & \delta \\ n\delta & 1-n\delta \end{bmatrix}$$

is the transition matrix for the productivity shift, and

$$R_t = \left[\log\left((1+x_t)r_t\right), \log r_t\right]',$$

and

$$R^A = \left[\log\left((1+x^A)r^A\right), \log r^A\right]$$

are the vectors of the log rate of return for the productive and unproductive entrepreneurs in the liberalization and in the autarky regimes respectively. Index $[\bullet]_j$ denotes the j column in matrix $[\bullet]$ in equation (C.13) and it identifies the type of entrepreneurs ($j=1$ for productive and $j=2$ for unproductive) at $t=0$ when the liberalization occurs. Since entrepreneurs can shift from the productive to the unproductive status, we will need to distinguish two groups depending on the productivity at the time of liberalization.

For workers we have that since workers's consumption is equal to wage income ($c_t = w_t l_t = w_t^{1+\eta}$), we can express μ^w as

$$\log\left(\frac{1}{1+\eta}+\mu^w\right) = \log\left(\frac{1}{1+\eta}\right) + (1-\beta)(1+\eta)\sum_{t=0}^{\infty}\beta^t \log w_t \tag{C.14}$$
$$-(1+\eta)\log w^A$$

D Tax and Subsidy

With production subsidy, the behaviour of the unproductive entrepreneurs is modified from (10) to:

$$r^* = r_t \geq \frac{\gamma(1+\sigma_t)}{w_t}, \text{ and } L_t' \left\{ r_t - \frac{\gamma(1+\sigma_t)}{w_t} \right\} = 0. \tag{D.15}$$

Term $\gamma(1+\sigma_t)/w_t$ represents the rate of return of the unproductive agents without borrowing, which is the relevant return in the case of interest-rate suppression. The employment of the productive entrepreneurs is modified from (16) to

$$L_t \leq \frac{\beta s_t Z_t}{w_t - \alpha\left[\phi\theta - \tau_t\right]/r^* - \left[\alpha(1-\phi)\theta/r_t\right]}, \tag{D.16}$$

and equality holds if

$$R\left(\alpha\right) = \frac{\alpha\left(1-\theta\right)}{w_t - \alpha\left[\phi\theta - \tau_t\right]/r^* - \left[\alpha(1-\phi)\theta/r_t\right]} > r_t.$$

The denominator of RHS is downpayment for unit labor input, when the productive entrepreneur borrows $\alpha(\phi\theta - \tau_t)/r^*$ from foreigners and $\alpha(1-\phi)\theta/r_t$ from domestic lead creditor for unit labor cost. This expression shows that taxation crowds out investment because it decreases collateral that can be used for private borrowing.

Since there is no government expenditure and no government bond, the goods market clearing condition (19) is not affected. The extra rate of return by the productive entrepreneur is modified from (24) to

$$x_t = \frac{R(\alpha) - R(\gamma)}{R(\gamma)} = \frac{\alpha\left[1-\phi\theta\right]/r_t + \alpha[\phi\theta - \tau_t]/r^* - w_t}{w_t - \alpha\left[\phi\theta - \tau_t\right]/r^* - \left[\alpha(1-\phi)\theta/r_t\right]}. \tag{D.17}$$

The competitive equilibrium with government policy is defined recursively by (w_t, r_t, x_t,

L_t, L'_t, τ_t, s_{t+1}, Z_{t+1}, B^*_{t+1}) as functions of the state variables $(s_t, Z_t,)$ that satisfy (18), (19), (22) (23), (25), (37), $(D.15)$, $(D.16)$, and $(D.17)$, for a given policy σ_t.

E Parameter Values in Section 4 and 5

We choose our parameters values such that one period in our model corresponds to a year. The discount factor, β, is set 0.92: this implies that the steady state interest rate under autarky ranges from 0% to 8.1% depending on the value of θ under which unproductive agents produce. Note that in a credit constrained economy, the steady state interest rate is lower than the inverse of the time preference rate.

η represents the Frish elasticity of labor supply. Micro studies estimate a low elasticity ranging from 0.1 to 0.4 (MaCurdi 1981), at 0.7 (Hall, 2009), at 1 (Kimball and Shapiro, 2008) and at 1.5 (Gourio and Noual, 2007) while macroeconomic models usually use higher values: for instance, King and Rebelo (1999) in their survey of RBC models use an elasticity of 4 in their basic model and an infinite elasticity in an extension of their model. New Keynesian models also use a high elasticity: Rotemberg and Woodford (1998) and Woodford (2003) use an elasticity close to 9. Since our results are not too sensitive to η, we set the elasticity to 3 lower than the value typically used in macro models but higher than what micro studies would suggest.

In order to characterize the gap between the productivity of productive and unproductive agents we use as a reference microeconometric studies that have measured firm-level productivity. Syverson (2004) computes labor productivity measure for 443 four-digit industries using plant-level data from the 1977 Census of Manufactures (CM) for the U.S. Once we focus on the interquartile range as a proxy for the gap between more productive and less productive firm we have that the ratio of labor productivity between

the 75th and 25th percentile plants is about 1.3 (Syverson, 2004), slightly higher than the one that we use to parametrize our economy where we set $\alpha = 1.2$ and $\gamma = 1.05$.

Parameters n and δ are set to 0.1 and 0.15, respectively. This implies that in the steady state the fraction of the productive agents is equal to n/(1+n)=0.09, and the expected time that an agent continues to be productive is $1/\delta = 6.66$ years. Finally, those parameters together imply that the unproductive agents produce in the autarky steady state when θ is less than 0.64

We choose the foreign interest rate to be at 4% on a yearly basis which is a quite standard in the real business cycle literature (see Schmitt-Grohe´and Uribe, 2003). The value of the parameter that determines the tightness of the international constraint, ϕ, is set to 0.5 so that foreigners can obtain half of the output compared to the domestic lead creditor. In a framework with only international borrowing constraint, Mendoza (2001) sets $\phi = 0.74$ so that his model-economy is likely to hit the borrowing limit. We choose a lower value so that the possibility of hitting the constraint is reduced but our analysis is robust to changes in ϕ.

In parametrizing the economy with the FDI sector, we set the curvature of the matching function σ to 0.3, in between the value of 0.24 reported in Hall (2005) and 0.36 estimated in Cooper, Haltiwanger and Willis (2007) and the productivity of the FDI sector, α^* is set to be 1.5 so that foreign productivity is 25% higher than productivity in domestic firms, which is a plausible value given the degree of heterogeneity in productivity even in more industrialized countries. The other parameters c, μ and $1-\lambda$ are chosen as to match the size of the FDI sector in the overall economy to a level of about 20%. (Lankes and Stern (1999) report that the share of FDI inflows over GDP in 1996 for emerging market economies ranges between 1% to 19% so that given the current expansion of FDI flows 20% seems a reasonable value for the size of FDI). In

doing so we obtain that $c = 0.2$, $\mu = 0.15$ and $1 - \lambda = 0.4$ which is higher than the value of 0.1for $1 - \lambda$ estimated by Shimer (2005) for the U.S. economy. The dynamics reported in Section 5 is robust against changing those parameters. As long as the implied share of FDI is kept at about 20%, the transition dynamics is very similar.

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Figure 1: Interest rate and wages under autarky steady state

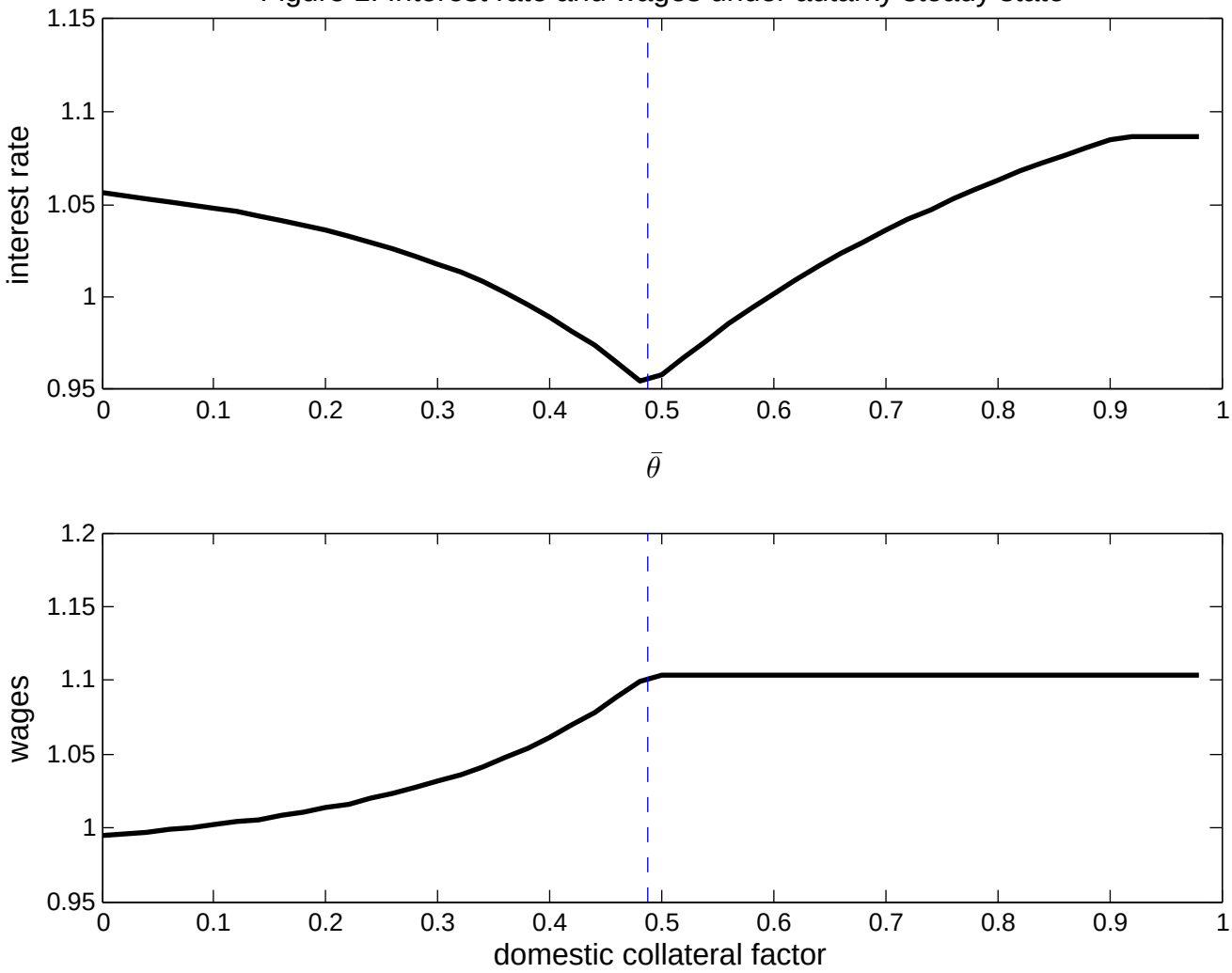

Figure 2: Directions of capital flows

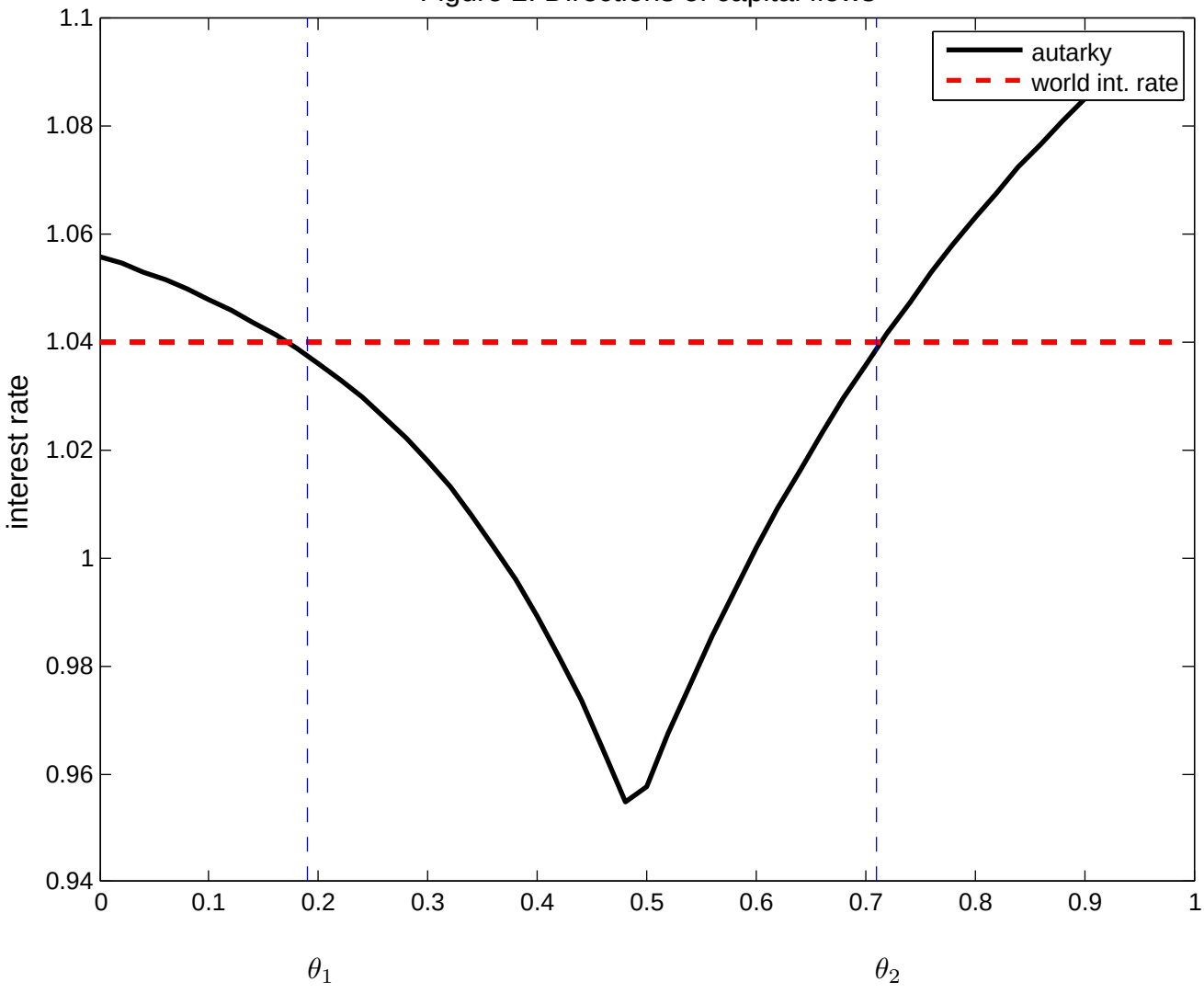

Figure 3.1: Dynamics under wage suppression: θ =0.15

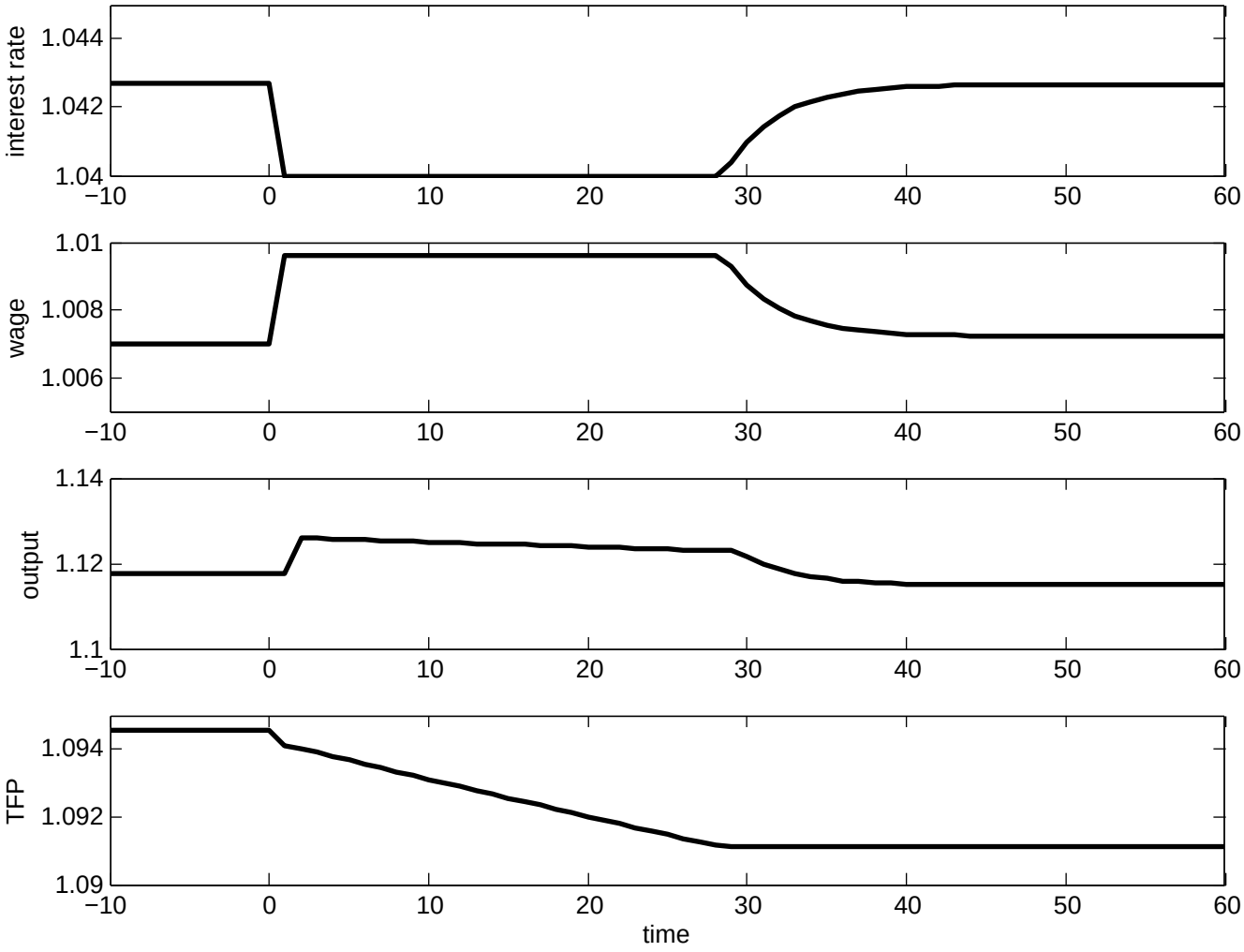

Figure 3.2: Employment under wage suppression: θ =0.15

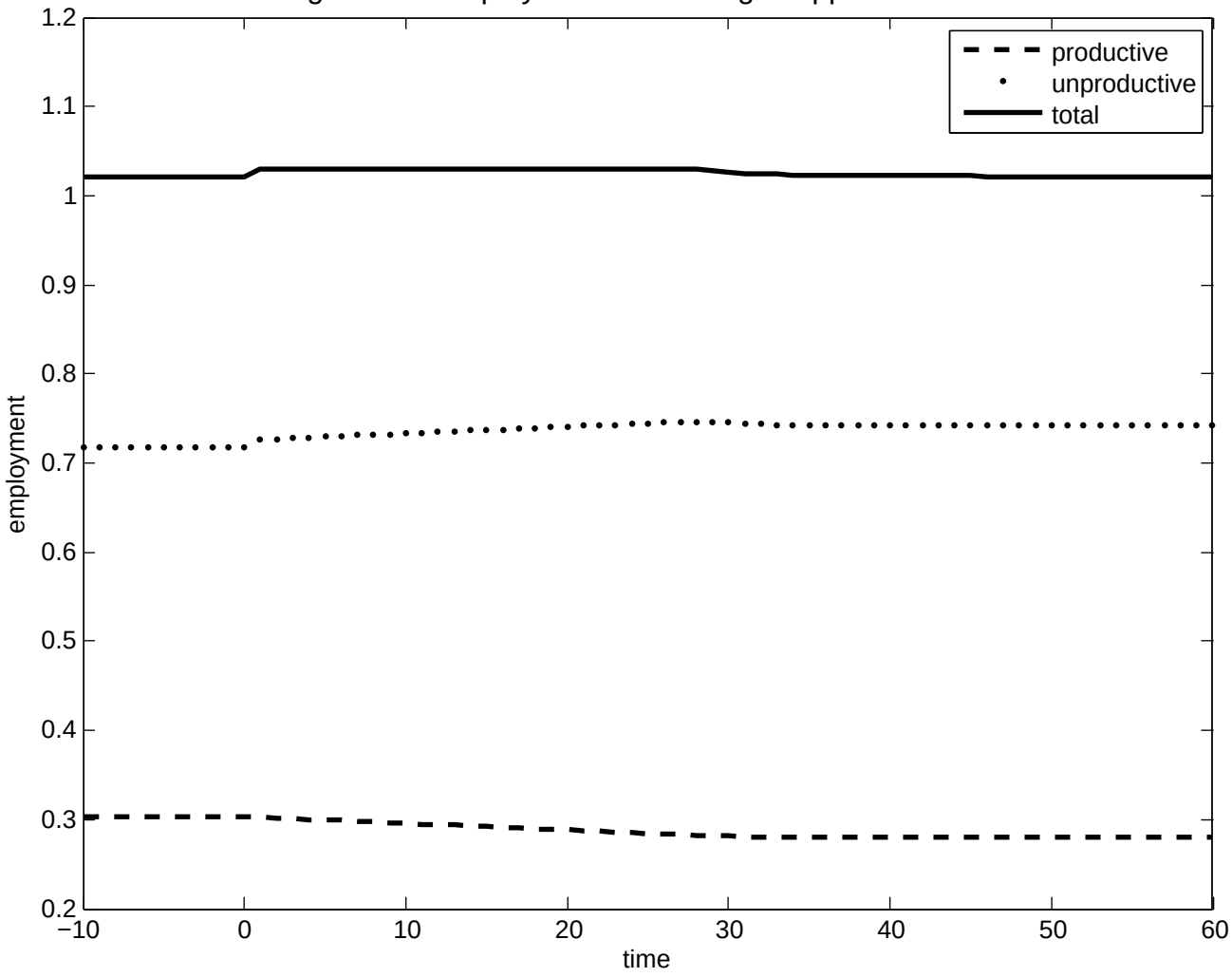

Figure 4.1: Dynamics under interest−rate suppression: θ =0.3

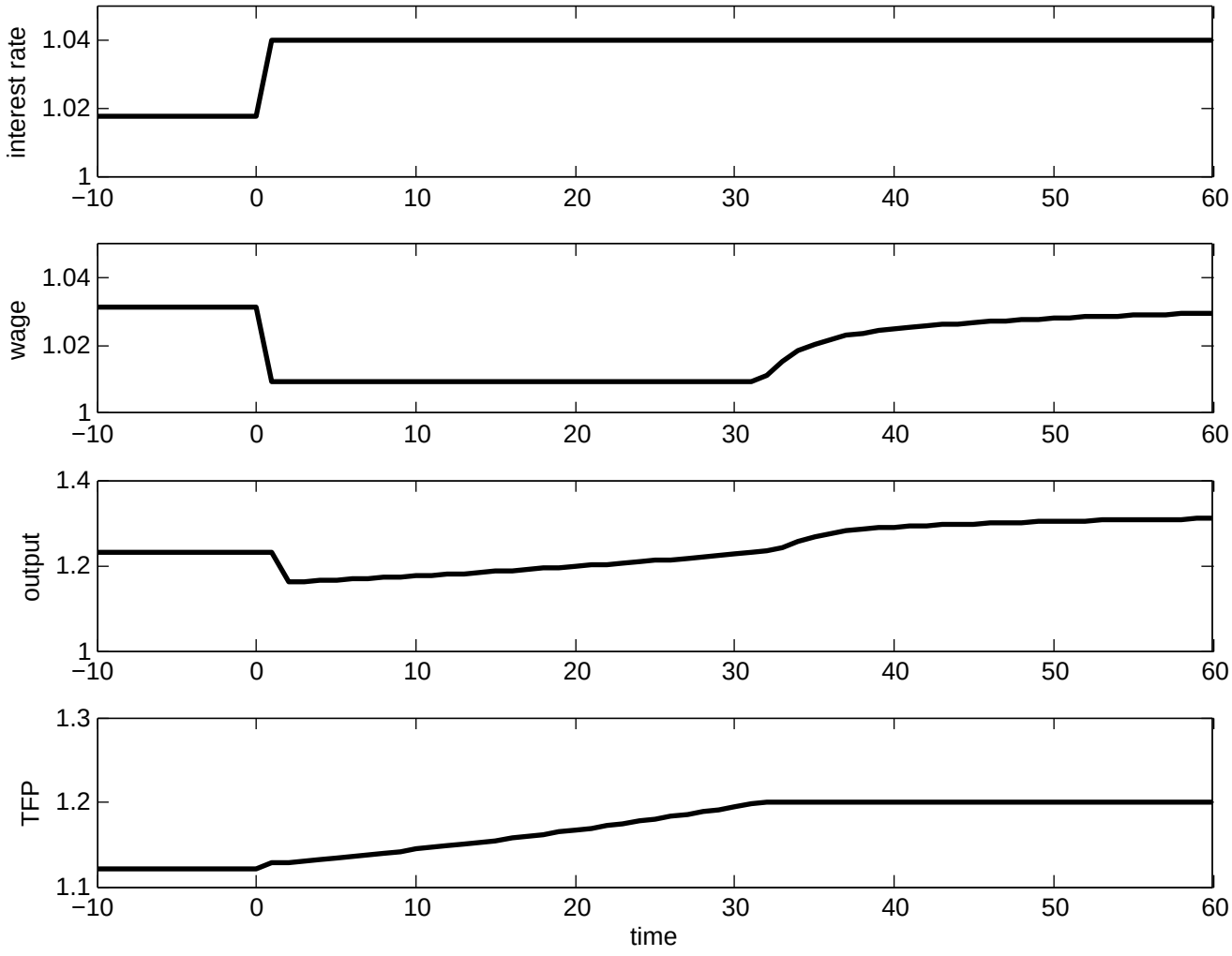

Figure 4.2: Employment under interest−rate suppression: θ =0.3

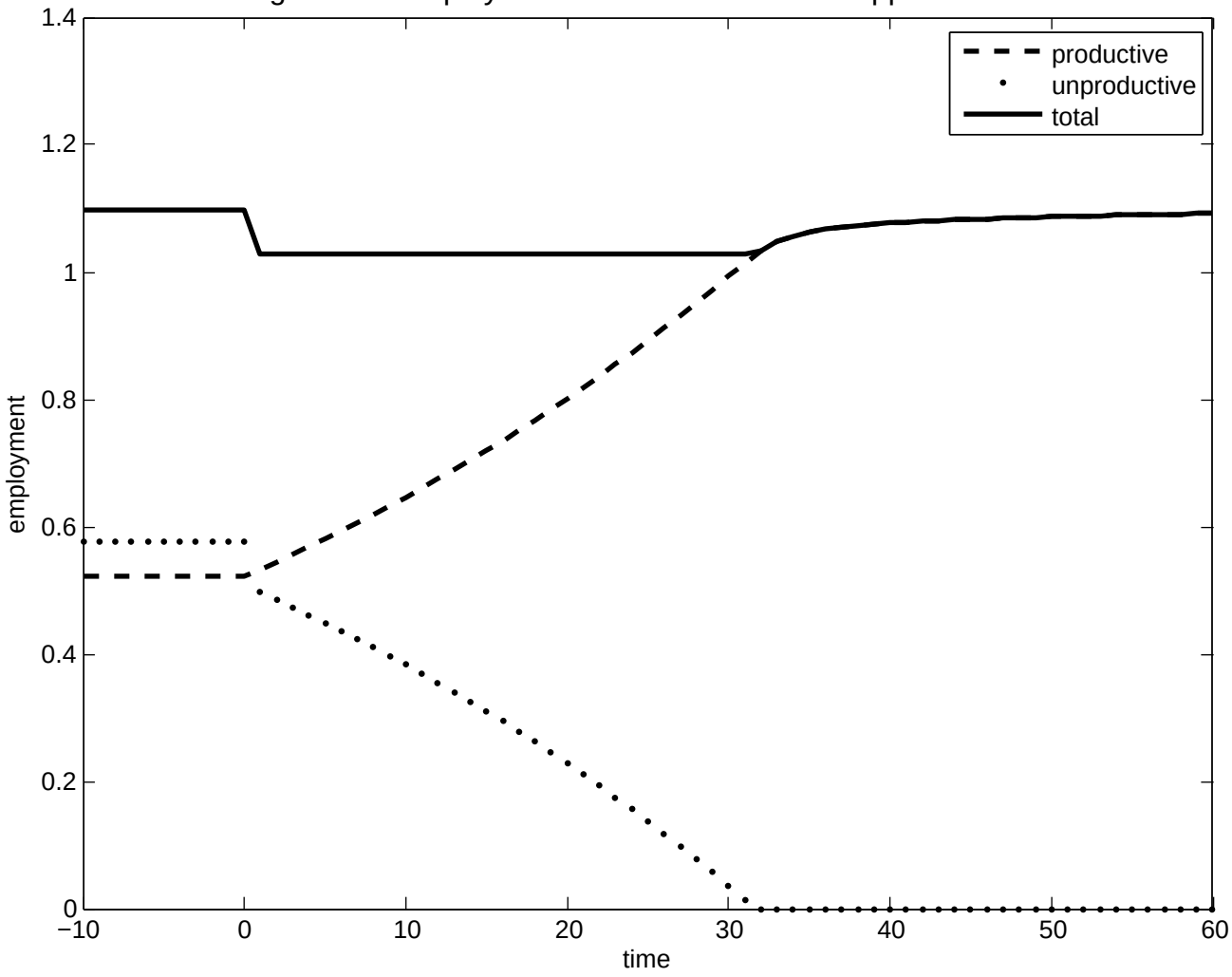

Figure 5.1: Dynamics under advanced domestic financyal system: θ =0.8

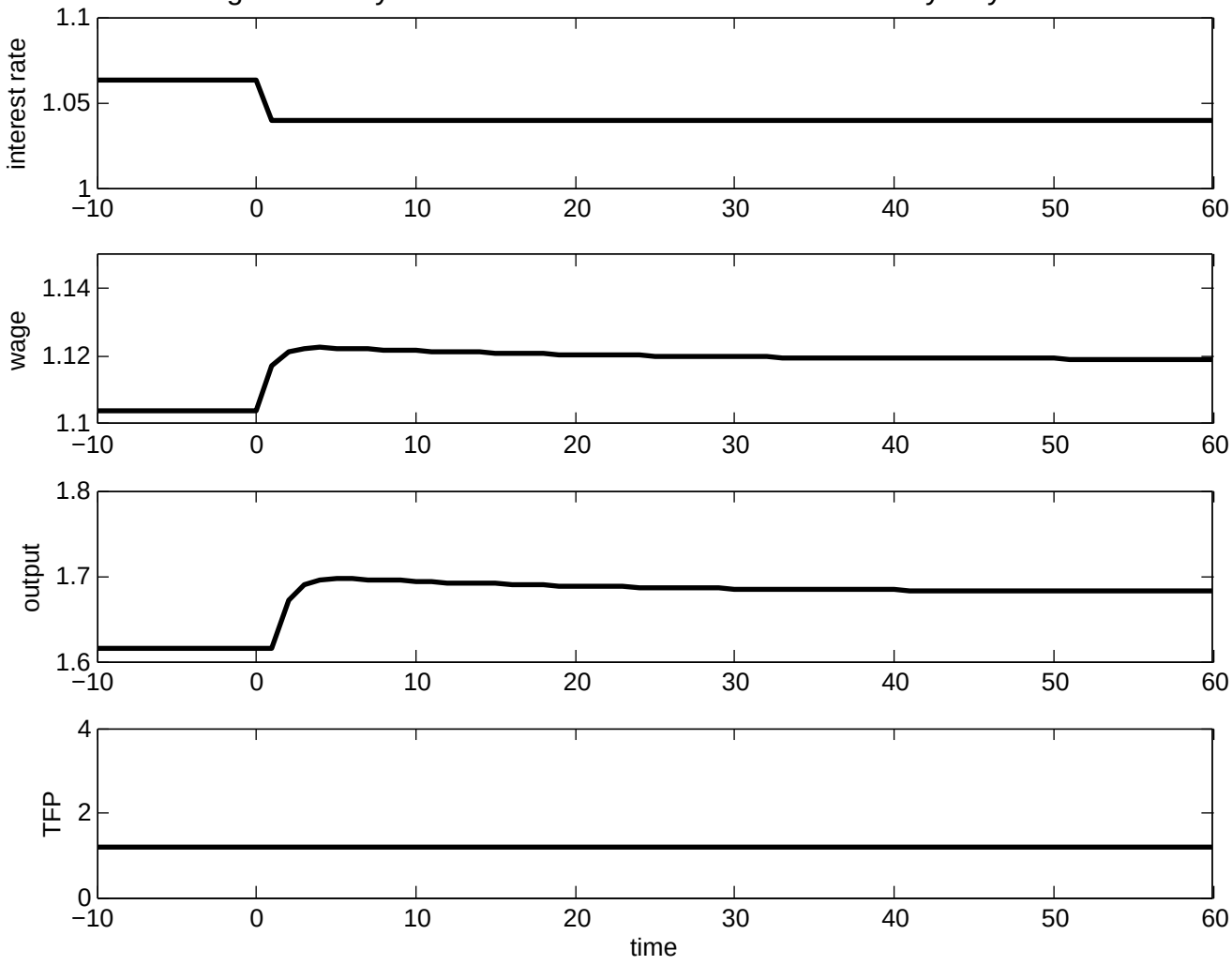

Figure 5.2: Employment under advanced domestic financyal system: θ =0.8

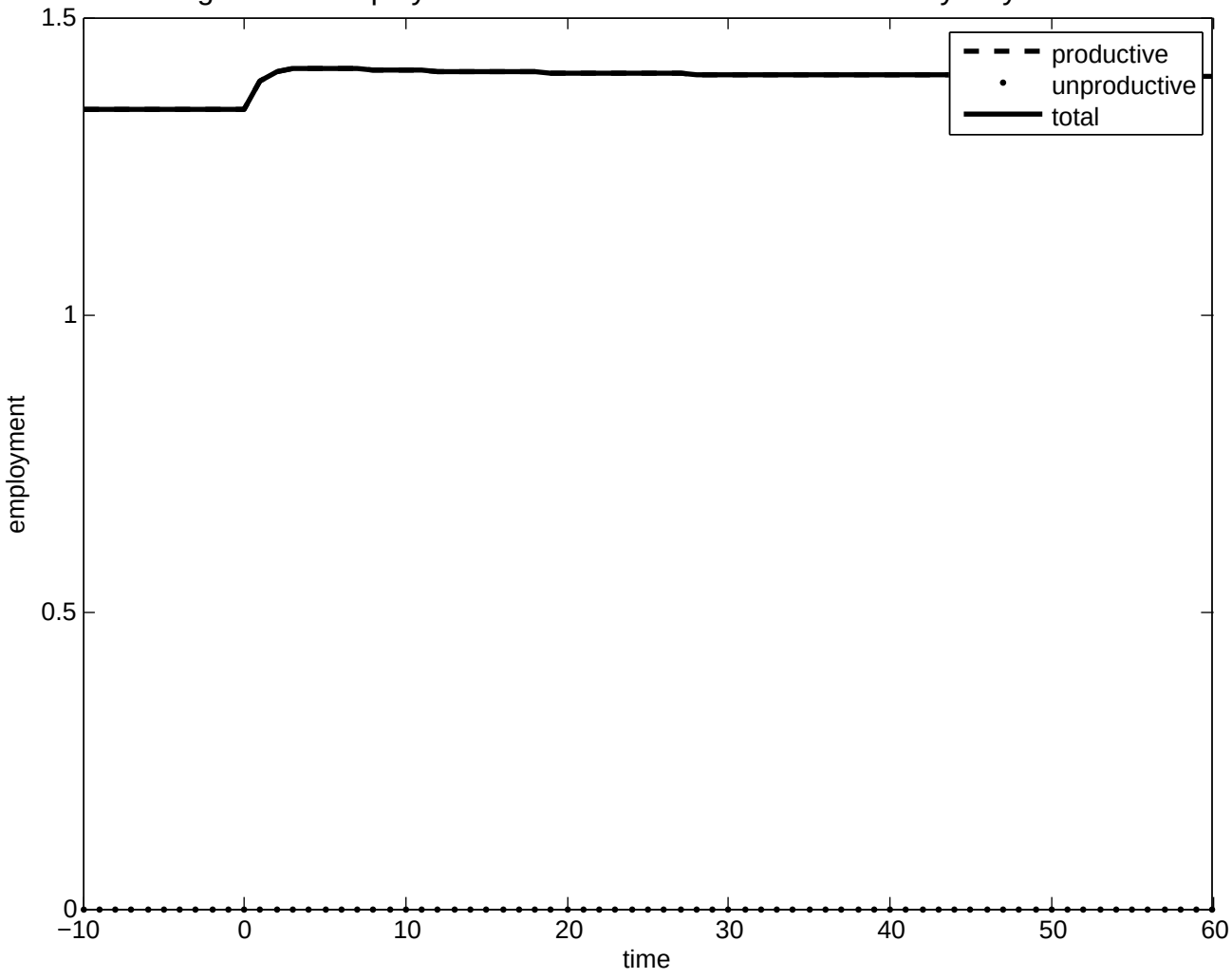

Figure 6 Adjustment with government policy: θ =0.3

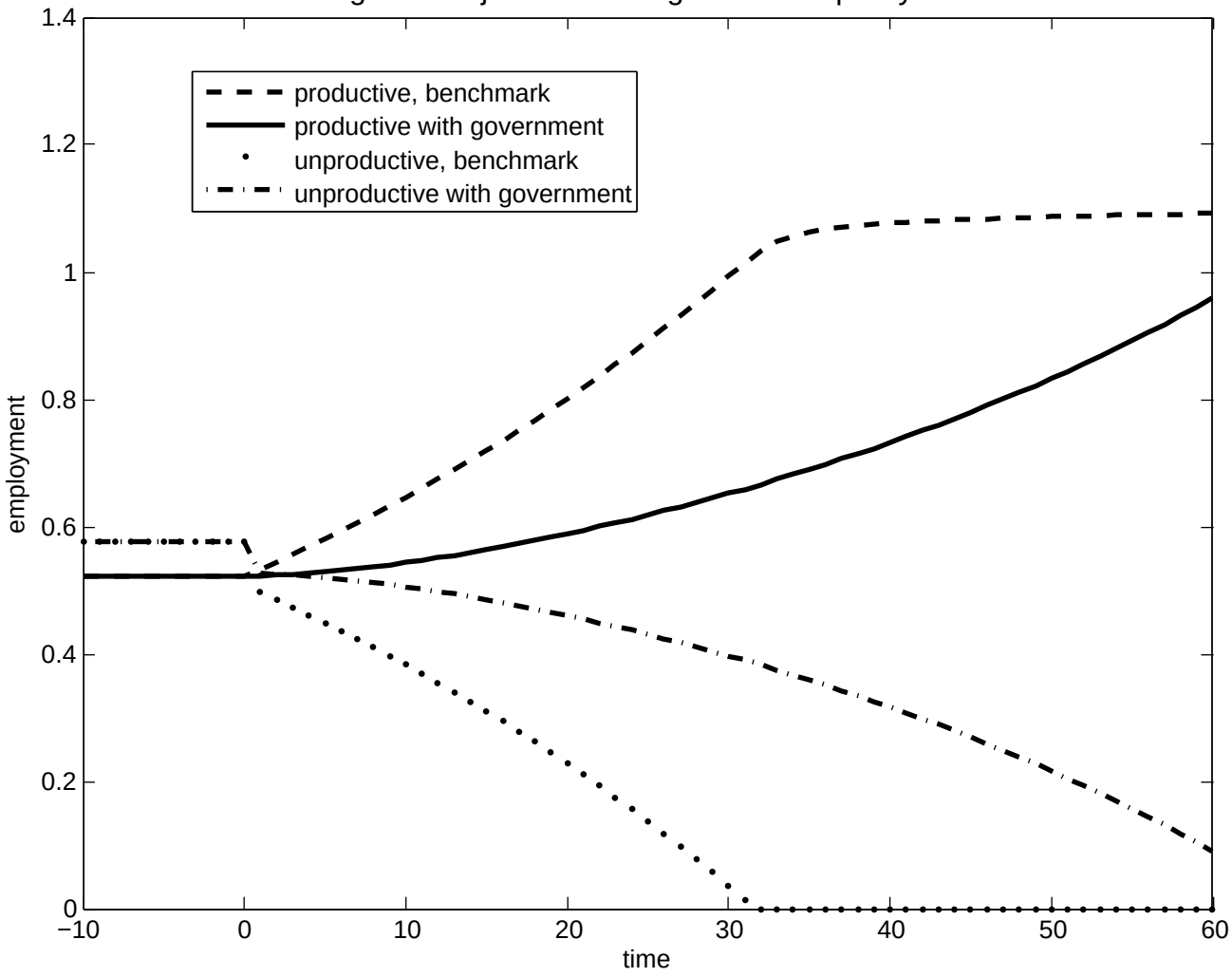

Figure 7: Adjustment with FDI: θ =0.3