

N° 306

Diciembre 2005



Documento de Trabajo

ISSN (edición impresa) **0716-7334**

ISSN (edición electrónica) **0717-7593**

Financial Integration, Technology Differences and Capital Flows

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Versión impresa ISSN: 0716-7334
Versión electrónica ISSN: 0717-7593

PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE
INSTITUTO DE ECONOMIA

Oficina de Publicaciones
Casilla 76, Correo 17, Santiago
www.economia.puc.cl

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FLOWS**

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Financial Integration, Technology Differences and Capital Flows

Sebastian Claro*

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September 2005

Abstract

The one-to-one mapping between cross-country differences in capital returns and the size and direction of international capital flows after financial integration vanishes in a multi-sector world with a labor-intensive non-tradable sector if financial liberalization generates significant swings in the demand for the non-tradable good. For example, a high return to capital country may become an exporter of capital after financial integration if access to world capital markets enhances demand for the non-tradable good. Because domestic wages are determined by the competitiveness conditions in tradable industries, excess demand for labor created by the expansion of non-tradable demand is eliminated with capital outflows. These "non-standard" effects of financial integration on non-tradable demand are possible, for example, if financial liberalization affects the rate of productivity growth.

Key Words: Financial Integration, Technology Differences, Capital Flows, International Factor Price Differences.

JEL:F15, F21, F41.

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1 Introduction

One of the traditional paradigms in international economics states that cross-country differences in per capita income and wages are determined by international differences in factor endowments. In particular, labor abundant countries have low wages, high return to capital and low per capita income. Faced with international capital market integration, these countries should be importers of capital. In other words, financial integration must generate a flow of capital from high to low income-per-capita countries.

This paradigm has been challenged in two dimensions. First, cross-country differences in factor abundance seem unable to explain international differences in per capita income. In other words, differences in factor endowments must be many times greater than they actually are in order to explain observed differences in per capita income across countries (Prescott, 1998; Parente and Prescott, 2002, Caselli, 2004). Second, capital does not tend to flow from rich to poor countries, as cross-country differences in capital returns should mandate. This is not to say that capital does not flow to poor countries, but the vast majority of capital flows occur across developed countries (with the exception of China in recent years).¹ This "puzzle" led Lucas (1990) to search for an answer on why capital does not flow from rich to poor countries.

Both challenges have given rise to a similar answer: international productivity differences. This broad concept should be interpreted as the component of per-capita income differences that cannot be accounted for by differences in the quantity and quality of factors.² The rationale for introducing international productivity differences is twofold. First, cross-country differences in productivity seem able to explain a significant share of the cross-country variance in factor returns and income per capita. Treffer (1993) and Hall and Jones (1999) present direct evidence on this. Second, international productivity differences break the link between relative capital abundance and factor price differences. In particular, a labor-abundant country may not only be a low-wage but also a low-return to capital country, meaning that it may end up

¹See Razin, Rubinstein and Sadka (2003).

²The term international productivity differences has several interpretations. It can reflect international differences in technology, human capital externalities (Lucas, 1990), institutional factors (Hall and Jones, 1999; Acemoglu et al, 2002), or policy distortions (Parente and Prescott, 2002).

exporting capital after financial integration.³

Regardless on the source of international rental rate differences, i.e., factor endowments or productivity, the size and direction of capital flows after financial integration is completely determined by pre-integration capital return differences. In other words, capital will flow from low- to high-return to capital countries. The intuition for this is simple. Financial integration leads to a fall in the capital return in a high return to capital economy. If the domestic labor market remains segmented from international competition, the rise in the relative cost of labor shifts the output structure toward a more capital-intensive mix, and also each industry becomes more capital intensive. The resulting excess supply of labor cannot be corrected by wage changes because the wage rate is set according to external competitiveness conditions in tradable industries. Therefore, capital inflows are required to clear the domestic labor market.

The objective of this paper is to challenge the idea that pre-integration capital return differences are a sufficient predictor of the direction and size of capital flows. I do so by introducing a non-tradable labor-intensive industry in a traditional two-sector dynamic Heckscher-Ohlin model (Atkeson and Kehoe, 2000). This apparently harmless extension of the model has crucial implications, as the reaction of non-tradable demand to financial liberalization will affect the size and direction of capital flows independent of pre-integration factor return differences.

Consider the case of a high return to capital country. As mentioned above, financial integration will generate an excess supply of domestic labor –and hence capital inflows– unless non-tradable demand expands after capital market liberalization. Because non-tradable production is labor-intensive, an expansion of non-tradable demand following capital market integration can generate an excess demand for labor at the wage rate consistent with zero-profit conditions in tradable industries. Therefore, capital outflows are required to assure labor market equilibrium, and a country with high return to capital before financial integration may become an exporter of capital. Likewise, a low return to capital country may become an importer of

³Tornell and Velasco (1992) provide an alternative explanation for the lack of capital flows from rich to poor countries. They argue that if property rights are not well defined, a private backward technology for asset accumulation can dominate an enhanced public technology, generating capital flows out of the country with low protection for property rights.

capital if financial liberalization is associated with a high enough shrinkage in non-tradable demand.

The paper explores conditions under which such "abnormal" responses of non-tradable demand to financial liberalization are possible. In particular, following the literature on financial integration and TFP growth,⁴ I focus on the effects of financial liberalization on productivity growth. The final effect on non-tradable demand will depend upon the effect of financial integration on permanent income and the real exchange rate. For example, financial integration boosts productivity growth, the rise in permanent income can expand the demand for the non-tradable good at any level of the real exchange rate. Labor market equilibrium requires capital outflows, even in a country with a pre-integration rental rate higher than the international rate.

The rest of the paper is structured as follows. Next section introduces international productivity differences and a non-tradable labor-intensive sector into the dynamic version of the Heckscher-Ohlin model developed by Atkeson and Kehoe (2000). I solve for the steady state equilibrium of developed countries (early bloomers), where international prices are set, and then focus on the dynamic path of development for developing countries (late bloomers) that are off steady state. I assume free trade in goods but no trade in financial assets. Section 3 discusses the implications of financial integration, i.e., access to international trade in financial assets, on capital flows for alternative scenarios on productivity growth. Section 4 concludes.

2 The Model

2.1 General Framework

The general setting is a dynamic Heckscher-Ohlin model, as in Atkeson and Kehoe (2000).⁵ The world consists of a large number of small countries that are inhabited by identical individuals whose preferences are

$$U = \int_0^\infty \frac{1}{1-\theta} C_t^{1-\theta} e^{-\beta t} dt \tag{1}$$

⁴See Levine (2004) for a survey.

⁵Lucas (1988) also describes a dynamic two-sector model.

where $\theta > 0$ is the inverse of the intertemporal elasticity of substitution, $\beta > 0$ is the subjective discount rate and $C_t = \tilde{n}_t^{1/2} \tilde{c}_t^{1/2}$ is a bundle of the non-tradable good n and the tradable consumption good c . A $\sim$ above a variable denotes consumption while a variable without a $\sim$ denotes production. In the case of the non-tradable good, $\tilde{n} = n$, but this need not be the case for the tradable consumption good.

Aside from the two consumption goods there is an investment good that I denote x . Consumption of x adds to the gross stock of capital and, together with labor, they are the only two factors of production. Capital accumulation is governed by the following relationship

$$\dot{k} = \tilde{x} - \delta k \quad (2)$$

where k is capital per capita, $\tilde{x}$ is investment and $\delta > 0$ is the depreciation rate. Throughout the paper, all quantity variables are expressed in per capita terms.

In each country, production of n , c , and x is characterized by Leontief constant returns to scale production functions. The fixed-proportions assumption does not affect any result in the paper, and it is considered for analytical simplicity.⁶ Denoting k_i the technology-given capital-labor ratio in industry $i = n, c, x$, I assume that $k_x > k_c > k_n = 0$, meaning that investment good x is the most capital intensive and the non-tradable good n is produced only with labor. This is also assumed for analytical simplicity, and all the results of the paper go through assuming that $0 < k_n < k_c < k_x$. Denoting a_{Fi} the requirement of factor $F = L, K$ to produce one unit of good i , the factor market clearing conditions are given by

$$1 = a_{Lc}c_t + a_{Lx}x_t + a_{Ln}n_t \quad (3)$$

$$k_t = a_{Kc}c_t + a_{Kx}x_t. \quad (4)$$

The absence of intertemporal trade implies that consumption in each country in each period is restricted by the following static resource constraint that is expressed in units of the tradable consumption good:

$$\tilde{c}_t + p_t \tilde{x}_t + n_t q_t = r_t k_t + w_t \quad (5)$$

⁶It eliminates second order effects on factor intensities following changes in relative factor prices after capital market integration. The assumption is restrictive though to analyze countries with extreme relative factor endowments, in which case the fixed-proportion assumption is not consistent with domestic factor market clearing conditions.

where p_t is the relative price of the investment good, q_t is the relative price of the non-tradable good (the inverse of the real exchange rate), and w_t, r_t are the real return to labor and capital respectively.

2.2 Early Bloomer

Following Atkeson and Kehoe (2000), consider that all but one country in the world start developing at the same time with the same initial capital stock (early bloomers). The remaining country (late bloomer) is small enough, so its behavior does not affect the time path for p . In equilibrium, all early bloomers make identical choices, and the world equilibrium is the same as one for a single country that does not trade goods and that has no access to inter-temporal asset trade.

I therefore solve for the steady state of the early bloomer using optimal control techniques. Given the Cobb-Douglas specification for C_t we know that $\tilde{c}_t = n_t q_t$, meaning that $\tilde{c}_t$ can be expressed as $C_t \sqrt{q_t}$. The representative agent's problem can be expressed with the following Hamiltonian

$$H = e^{-\beta t} \cdot \left[\frac{1}{1-\theta} C_t^{1-\theta} + \lambda_t \left(\frac{r_t k_t + w_t - 2C_t q_t^{1/2}}{p_t} - \delta k_t \right) \right]. \quad (6)$$

The optimality conditions are

$$C_t^{-\theta} = 2\lambda_t \frac{q_t^{1/2}}{p_t} \quad (7)$$

$$\frac{\dot{\lambda}_t}{\lambda_t} = \beta + \delta - \frac{r_t}{p_t} \quad (8)$$

which imply

$$\frac{\dot{C}_t}{C_t} = -\frac{1}{\theta} \left[\frac{\dot{\lambda}_t}{\lambda_t} + \frac{1}{2} \frac{\dot{q}_t}{q_t} - \frac{\dot{p}_t}{p_t} \right] \quad (9)$$

and

$$\frac{\dot{\tilde{c}}}{\tilde{c}} = -\frac{1}{\theta} \left[\frac{\dot{\lambda}_t}{\lambda_t} + \frac{(1-\theta)}{2} \frac{\dot{q}_t}{q_t} - \frac{\dot{p}_t}{p_t} \right]. \quad (10)$$

The steady state is such that $\dot{\lambda}_t = \dot{k}_t = \dot{C}_t = \dot{q}_t = \dot{p}_t = 0$, meaning that $r^* = p^*(\beta + \delta)$, where a $*$ sign denotes the steady state value. As expected, the steady state value of the capital return is pinned down by the preference parameter, the depreciation rate, and the relative price of the investment good. Also, $\tilde{c}$ and

n are constant. Equation (2) assures positive production of the investment good in equilibrium ($\tilde{x}^* = \delta k^*$). Because all three goods are produced, the following zero-profit conditions hold

$$1 = a_{Lc}w^* + a_{Kc}r^* \quad (11)$$

$$p^* = a_{Lx}w^* + a_{Kx}r^* \quad (12)$$

$$q^* = a_{Ln}w^*. \quad (13)$$

Together with the condition $r^* = p^*(\beta + \delta)$, equations (11) to (13) determine equilibrium product and factor prices (in terms of the consumption good).⁷ Recalling that the equilibrium is that of a closed economy, i.e., $\tilde{x}^* = x^*$ and $\tilde{c}^* = c^*$, steady-state quantities are solved for with the following conditions:

$$1 = a_{Lc}c^* + a_{Lx}x^* + a_{Ln}n^* \quad (14)$$

$$k^* = a_{Kc}c^* + a_{Kx}x^* \quad (15)$$

$$x^* = \delta k^* \quad (16)$$

$$c^* = n^* \cdot q^*. \quad (17)$$

The first two equations are the labor and capital market clearing conditions. Equation (16) states that investment is such that the capital stock is constant. Finally, the ratio of tradable to non-tradable consumption is determined by the real exchange rate. These conditions assure that the resource constraint (5) is satisfied.

2.3 Late Bloomer

Consider now the case of a country that starts its development process late. The late bloomer is small compared to the rest of the world that already reached its steady state, meaning that it is open to intra-temporal trade of c and x at a world relative price p^* . The real exchange rate is endogenously determined.

⁷Equilibrium prices are $w^* = \frac{1}{a_{Lc}} \cdot \frac{1 - a_{Lx}(\beta + \delta)k_x}{1 - a_{Lx}(\beta + \delta)(k_x - k_c)}$; $r^* = \frac{a_{Lx}}{a_{Lc}} \cdot \frac{(\beta + \delta)}{1 - a_{Lx}(\beta + \delta)(k_x - k_c)}$; $p^* = \frac{r^*}{(\beta + \delta)}$ and $q^* = a_{Ln}w^*$.

However, the country has no access to intertemporal trade in financial assets, meaning that the resource constraint (5) must be satisfied each period.

Aside from starting its development process later on, the late bloomer has a low total-factor-productivity level in the production of both tradable goods compared to the early bloomer. Productivity differences are reflected in differences in factor requirements per unit of output in tradable industries. Analytically, factor requirements per unit of output in the late bloomer in industries c and x are given by $a_{Fi} = a_{Fi}^*(1 + d)$ where a_{Fi}^* is the factor requirement per unit of output in industry i in the early bloomer and $d \geq 0$ is the productivity gap. I do not consider productivity differences in the non-tradable sector n , meaning that $a_{Ln} = a_{Ln}^*$, as in the traditional Balassa-Samuelson world.

The path of development of the late bloomer will depend upon the productivity gap and the level of capital per worker. Both d and k jointly determine the output and trade structures, factor returns and the real exchange rate consistent with an optimal transition path toward the steady state. The rest of the section is devoted to analyze such development process. For that, I establish conditions under which the late bloomer will produce both tradable goods and conditions under which it will be specialized in only one tradable good. Of course, the non-tradable good is always produced.

2.3.1 Tradable Diversification

If the late bloomer produces both tradable goods, the following zero-profit conditions must hold (for simplicity I hereafter eliminate time subscripts unless required for expositional clarity):

$$1 = (1 + d)(a_{Lc}^*w + a_{Kc}^*r) \quad (18)$$

$$p^* = (1 + d)(a_{Lx}^*w + a_{Kx}^*r) \quad (19)$$

$$q = a_{Ln}^*w. \quad (20)$$

Because p^* is set in world markets, equations (18) to (20) can be solved for w , r and q . In particular, $w/w^* = r/r^* = q/q^* = 1/(1 + d)$, meaning that factor price differences are solely determined by TFP differences, and the relative price of the non-tradable good is completely determined by external competitiveness

conditions.

The factor market clearing conditions consistent with production of the three goods are

$$1 = (1+d)a_{Lc}^*c + (1+d)a_{Lx}^*x + a_{Ln}n \quad (21)$$

$$k = (1+d)a_{Kc}^*c + (1+d)a_{Kx}^*x \quad (22)$$

where k is the initial level of capital per worker in this economy, which is a state variable. Conditions (21) and (22) set a range for the level of non-tradable production n consistent with factor market equilibrium and production of both x and c . In other words, for any initial level of k , production of the non-tradable good must be such the residual factor supply –after non-tradable market clearing– assures production of x and c , i.e., the residual capital-labor ratio must lie between k_c and k_x . Combining (21) and (22) it is possible to show that n must belong to $\left(\frac{1}{a_{Ln}^*}\left(\frac{k_c-k}{k_c}\right), \frac{1}{a_{Ln}^*}\left(\frac{k_x-k}{k_x}\right)\right)$.⁸ Because n is positive, tradable diversification is only possible if $k < k_x$.⁹ Therefore, for any $k \in (0, k_x)$ there is a range for n such that both c and x are produced and factor markets clear.

For each level of n , the consumption of c is determined by the level of the real exchange rate according to the following relationship: $\tilde{c} = n \cdot q$. Therefore, the optimal ratio of tradable to non-tradable consumption determines a lower and upper bound for $\tilde{c}$ at any level of k . Given the equilibrium level of the real exchange rate, if $k < k_c$, $\tilde{c}$ is restricted to the range $(w^*(k_c - k)/(1+d)k_c; w^*(k_x - k)/(1+d)k_x)$, while if $k \geq k_c$, $\tilde{c} \in (0, w^*(k_x - k)/(1+d)k_x)$.¹⁰ Figure 1 shows the range of possible values for $\tilde{c}(k)$ consistent with tradable diversification. The actual level of $\tilde{c}$ results from the analysis of the behavior of the dynamic system.

[Insert Figure 1]

⁸Factor market clearing requires that after non-tradable demand is satisfied, the residual relative factor supply belong to the cone of tradable diversification, i.e., $\frac{\bar{K}}{L-L_n}$ is smaller than k_x and greater than k_c , where L_n is the employment level in the non-tradable sector. Analytically, this implies $k_c < \frac{k}{1-a_{Ln}^*n} < k_x$, from which the expression in the text is derived.

⁹Also, if $k > k_c$, the lower bound for n is not binding, revealing that tradable diversification is possible if $n \in \left(0, \frac{1}{a_{Ln}^*}\left(\frac{k_x-k}{k_x}\right)\right)$.

¹⁰Recall that $q = q^*/(1+d) = a_{Ln}^*w^*/(1+d)$. The limiting values for $\tilde{c}$ are such that $\tilde{c}_{\min} = n_{\min} \cdot q$ and $\tilde{c}_{\max} = n_{\max} \cdot q$.

Within the cone of diversification, $\dot{q} = \dot{p} = 0$, which means that the evolution of $\tilde{c}$ is given by

$$\frac{\dot{\tilde{c}}}{\tilde{c}} = \frac{1}{\theta p^*} [r - r^*]. \quad (23)$$

Because $r = r^*/(1+d) < r^*$, it is straightforward to see that $\dot{\tilde{c}} < 0$, revealing that consumption decreases over time if the return to capital is lower than the discount rate. The dynamic path of capital accumulation is obtained combining (2) and (5):

$$\dot{k} = \frac{1}{p^*} [w + k(r - \delta p^*) - 2\tilde{c}]. \quad (24)$$

Equations (23) and (24) govern the dynamic system within this region, where factor prices are constant. Manipulating (24) we obtain the following condition for $\dot{k} = 0$:

$$\tilde{c} = \frac{1}{2} \left[\frac{w^*}{1+d} + \frac{k}{1+d} \cdot p^*(\beta - \delta d) \right]. \quad (25)$$

The slope of this relationship depends upon the sign of $\beta - \delta d$. If $d = \beta/\delta$, $\dot{k} = 0$ implies $\tilde{c} = w^*/2(1+d)$, while if $\beta > \delta d$, $\tilde{c}$ is an increasing function of k . Figure 1 also depicts three possibilities for $\dot{k} = 0$, depending on the level of d . For simplicity, throughout the paper I will focus on the case where $d = \beta/\delta$, but none of the results depends upon the specific assumption regarding the size of d .¹¹ The evolution of k depends upon the consumption level of $\tilde{c}$. A high value of $\tilde{c}$ is associated with a low investment rate –given the resource constraint– and hence capital decumulation. The opposite happens if $\tilde{c}$ is lower than expression (25).

The evolution of the dynamic system within the cone of diversification is depicted in Figure 2, which shows the time path for $\tilde{c}$ and k . For any level of $k \in (0, k_x)$, there are infinite combinations of $\tilde{c}$ and n consistent with production diversification. However, as will become clear below, only one combination puts the economy in its dynamic path toward the steady state. Within the cone, the real exchange rate is completely determined by external competitiveness conditions, and hence the evolution of aggregate consumption C and tradable and non-tradable consumption depend upon the difference between the domestic and foreign rental

¹¹The equilibrium levels of n and $\tilde{c}$ must also satisfy an additional condition, namely, consumption of the investment good has to be non-negative, i.e., $\tilde{x} \geq 0$. This means that $\tilde{c} \leq \frac{1}{2(1+d)a_{Lc}^*} \left(\frac{1-a_{Lx}^*(\beta+\delta)k_x}{1-a_{Lx}^*(\beta+\delta)k_c} \right)$. This condition is also depicted in Figure 1, and it is never binding.

rates. Because $r \leq r^*$ (recall that the domestic economy is technology backward), C , $\tilde{c}$ and n decrease over time.

[Insert Figure 2]

2.3.2 Specialization in Consumption Good c

Specialization in the labor-intensive consumption good c implies that (18) and (20) hold with equality but that $p^* < (1 + d)(a_{Lx}^*w + a_{Kx}^*r)$, so $x = 0$. The equilibrium level of non-tradable consumption and production is determined in equations (21) and (22), which yield $n = (k_c - k)/(a_{Ln}^* \cdot k_c)$. (Recall that $x = 0$.) In this case, for any level of $k < k_c$ there is a unique level of non-tradable production that is consistent with production of good c and assures factor market equilibrium.

However, the range of possible levels for $\tilde{c}$ depends upon the level of the real exchange rate ($\tilde{c} = n \cdot q$), that is not determined by external competitiveness conditions as in before. Because the capital-intensive industry x is not competitive, the economy specializes in c as long as $r > r^*/(1 + d)$ and $w < w^*/(1 + d)$ where (w, r) satisfy (18). Therefore, the upper bound for q is $q^*/(1 + d)$, which means that $\tilde{c} < (w^*/(1 + d)) \cdot (k_c - k/k_c)$, which coincides with the lower bound for $\tilde{c}$ if tradable production diversification takes place. The minimum possible value for $\tilde{c}$ for any k is restricted by the lowest possible value of q , which is zero. The maximum level of r consistent with the zero-profit condition in industry c is $1/a_{Kc}^*(1 + d)$, which implies $w \rightarrow 0$ and $q \rightarrow 0$. Therefore, $\tilde{c} > 0$.

The evolution of the capital stock with the cone of specialization in c is the following. Although equation (24) is still valid, domestic factor prices are not determined by the zero profit conditions in tradable industries. In particular, combining (18), (20) with the condition $\tilde{c} = n \cdot q$, and imposing $n = (1/a_{Ln}^*)((k_c - k)/k_c)$, we can solve $r = r(w)$ and $w = w(\tilde{c}, k)$ to get the following expression for $\dot{k}$:

$$\dot{k} = \frac{1}{a_{Kc}^*(1 + d)p^*} \cdot [k(1 - a_{Kc}^*(1 + d)\delta p^*) - \tilde{c}a_{Kc}^*(1 + d)] \quad (26)$$

from which the following condition for $\dot{k} = 0$ follows:

$$\tilde{c} = k \left(\frac{1 - a_{Kc}^*\delta p^*(1 + d)}{a_{Kc}^*(1 + d)} \right). \quad (27)$$

This represents a positive relationship between $\tilde{c}$ and k .¹² Moreover, valued at $k = k_c/2$, $\dot{k} = 0$ under specialization in c coincides with $\dot{k} = 0$ under tradable diversification, revealing that $\dot{k} = 0$ is continuous.¹³ Figure 3 depicts $\dot{k} = 0$ within the cone of specialization in consumption good c . For values of $\tilde{c}$ greater than that in expression (27) $\dot{k} < 0$ while the opposite happens below $\dot{k} = 0$.

[Insert Figure 3]

The evolution of $\tilde{c}$ is governed by equation (10), but unlike the case of production diversification where the real exchange rate is constant, in this case the evolution of q does affect the time path of consumption. From (10) we have that

$$\frac{\dot{\tilde{c}}}{\tilde{c}} = \frac{1}{\theta p^*} [r - r^*] - \frac{(1 - \theta)}{2\theta} \frac{\dot{q}}{q}. \quad (28)$$

However, we also know that

$$\frac{\dot{\tilde{c}}}{\tilde{c}} = \frac{\dot{q}}{q} + \frac{\dot{n}}{n} = \frac{\dot{q}}{q} - \frac{\dot{k}}{k_c - k}. \quad (29)$$

Plugging (29) into (28) and combining it with the expression for $\dot{k}$ obtained above it yields

$$\begin{aligned} \frac{\dot{\tilde{c}}}{\tilde{c}} = & \frac{-2}{(1 + \theta)a_{Kc}^*(1 + d)p^*(k_c - k)} \cdot \left[\frac{a_{Kc}^*(1 + d)(1 + \theta)}{2} \tilde{c} - k_c(1 - a_{Kc}^*(1 + d)r^*) + \right. \\ & \left. k \left((1 - a_{Kc}^*(1 + d)r^*) + \frac{1 - \theta}{2}(1 - a_{Kc}^*(1 + d)\delta p^*) \right) \right]. \end{aligned} \quad (30)$$

Although the slope and position of the equation $\dot{\tilde{c}} = 0$ depends upon the size of θ , it is always the case that it pivots around a unique combination of $(\tilde{c}, k)$ that does not depend on θ .¹⁴ As shown below, this is

¹²The numerator in (27) must be positive to assure the existence of a steady state. Because the steady state will be unambiguously reached when the domestic return to capital reaches r^* , it must be the case that the highest possible level for r consistent with specialization in c is higher than r^* . This conditions assures that the numerator in (27) is positive, and hence $\partial \tilde{c} / \partial k > 0$. In other words, for all values of d there is a level of k such that labor-abundant countries have a higher domestic capital return than the international level.

¹³The same result holds if the assume that $d \neq \beta/\delta$. However, in this case, the intersection of $\dot{k} = 0$ with diversification and $\dot{k} = 0$ with specialization in c is at $k > k_c/2$.

¹⁴It is possible to show that $(\tilde{c}; k) = \left(k_c \cdot \frac{1 - a_{Kc}^*(1 + d)r^*}{1 - a_{Kc}^*(1 + d)r^* + 1 - a_{Kc}^*(1 + d)p^*\delta} \cdot \frac{1 - a_{Kc}^*(1 + d)p^*\delta}{a_{Kc}^*(1 + d)}; k_c \cdot \frac{1 - a_{Kc}^*(1 + d)r^*}{1 - a_{Kc}^*(1 + d)r^* + 1 - a_{Kc}^*(1 + d)p^*\delta} \right)$ belongs to $\dot{\tilde{c}} = 0$ regardless of the size of θ .

the steady state level of k and $\tilde{c}$. Unless θ is sufficiently high, $\dot{\tilde{c}} = 0$ defines a negatively sloped relationship between $\tilde{c}$ and k , above which $\dot{\tilde{c}} < 0$.¹⁵

Figure 3 depicts $\dot{\tilde{c}} = 0$ assuming $\theta = 1$. The dynamic system reveals the existence of a saddle path toward the steady state, where $\dot{\tilde{c}} = \dot{k} = 0$. Again, for each level of $k < k_c$ there are infinite values of $\tilde{c}$ consistent with production specialization in the tradable consumption good, but only one level puts the economy in its path toward the steady state.

2.3.3 Specialization in Investment Good x

Specialization in the investment good x implies that (19) and (20) hold with equality but (18) does not, so $c = 0$. Again, the internal marginal matters for determining q . Following the same logic as in last section, production of the non-tradable good is uniquely determined for any level of k and it is equal to $n = (k_x - k)/k_x a_{Ln}^*$, meaning that specialization in x requires $k < k_x$. Because industry c is uncompetitive and the zero-profit condition for x holds, factor returns satisfy $r < r^*/(1+d)$ and $w > w^*/(1+d)$. Therefore, $\tilde{c}$ belong to $(w^*(k_x - k)/k_x(1+d); p^*(k_x - k)/k_x(1+d)a_{Lx}^*)$.

The evolution of the capital stock within this cone of specialization is given by equation (24) where w and r can be expressed as functions of $\tilde{c}$ and k . This implies that $\dot{k} = 0$ is satisfied when

$$\tilde{c} = k \left[\frac{p^* - a_{Kx}^*(1+d)\delta p^*}{a_{Kx}^*(1+d)} \right].$$

This is an upward-sloping relationship between $\tilde{c}$ and k , which is depicted in Figure 4. For $d = \beta/\delta$, $\dot{k} = 0$ valued at $k = k_x/2$ yields $\tilde{c} = w^*/2(1+d)$, confirming that $\dot{k}$ is a continuous function within all the relevant range.

[Insert Figure 4]

¹⁵Otherwise, $\dot{\tilde{c}} = 0$ defines a positively sloped relationship between $\tilde{c}$ and k , with a positive intercept in the y-axis and with slope lower than that of $\dot{k} = 0$.

The dynamic pattern of $\tilde{c}$ is given by

$$\frac{\dot{\tilde{c}}}{\tilde{c}} = \frac{-2}{(1+\theta)a_{Kx}^*(1+d)p^*(k_x-k)} \cdot \left[\frac{a_{Kx}^*(1+d)(1+\theta)}{2} \tilde{c} - k_x(1-a_{Kx}^*(1+d)r^*) + k \left((1-a_{Kx}^*(1+d)r^*) + \frac{1-\theta}{2}(p^*-a_{Kx}^*(1+d)\delta p^*) \right) \right]. \quad (31)$$

As in last section, unless θ is sufficiently high, $\dot{\tilde{c}} = 0$ defines a negatively-sloped relationship between $\tilde{c}$ and k , above which $\dot{\tilde{c}} < 0$. It is possible to show that for different values of θ , $\dot{\tilde{c}} = 0$ pivots around a unique combination $(\tilde{c}, k)$ where $k < k_x/2$. Also, it is never the case that $\dot{\tilde{c}} = 0$ and $\dot{k} = 0$ intersect each other in the cone of specialization in Figure 4 –that depicts $\dot{\tilde{c}} = 0$ for $\theta = 1$ –, meaning that there is no steady state with specialization in production of the investment good x . Therefore, the unique steady state is the one depicted in Figure 3. The intuition for this is simple. The conditions $\dot{\tilde{c}} = 0$ and $\dot{k} = 0$ require $\dot{q} = 0$, which according to (28) is satisfied with a domestic return to capital equal to r^* . However, because $d \geq 0$, this is inconsistent with specialization in sector x and no production of the tradable consumption good.

2.3.4 Steady-State

Figure 5 depicts the whole dynamic system derived above. The steady state is unambiguously reached with production specialization in the labor-intensive tradable good c . Combining $\dot{\tilde{c}} = 0$ and $\dot{k} = 0$ derived in section 2.3.2, the steady state level of capital per capita for any $d \geq 0$ is

$$k^{ss} = k_c \left[\frac{1 - a_{Kc}^*(1+d)r^*}{1 - a_{Kc}^*(1+d)r^* + 1 - a_{Kc}^*(1+d)p^*\delta} \right]. \quad (32)$$

Three elements are worth emphasizing of expression (32). First, late bloomers with $k > k^{ss}$ have a domestic return to capital lower than r^* . Their developing path implies capital decumulation and investment (consumption of the investment good) smaller than δk . Conversely, if $k < k^{ss}$ the domestic return to capital is higher than r^* and the late bloomer accumulates capital by means of a low consumption level.¹⁶

[Insert Figure 5]

¹⁶If $k > k^{ss}$ then $\dot{\tilde{c}} < 0$ and $\dot{k} < 0$. Because $\frac{\dot{\tilde{c}}}{\tilde{c}} = -\frac{2}{1+\theta} \left(\frac{\dot{\lambda}}{\lambda} + \frac{(1-\theta)}{2} \frac{\dot{k}}{(k_c-k)} \right)$, it follows that $\dot{\lambda} < 0$, meaning that r must be higher than $r^* = p^*(\beta + \delta)$. The opposite happens if $k < k^{ss}$.

Consider the case of a late bloomer that starts its development process with a level of capital per worker such that it specializes in the production of the investment good and it imports the tradable consumption good from the early bloomer. As the late bloomer decumulates capital the non-tradable sector expands. This process is accompanied with a fall in q (a depreciation of the real exchange rate), that results from the fall in the domestic wage rate. Also, because $r < r^*$, $\tilde{c}$ falls over time. When r reaches $r^*/(1+d)$, the late bloomer starts producing both tradable goods and domestic factor prices and the real exchange rate remain constant. The economy continues decumulating capital, and production of the non-tradable good fall within the cone of diversification in response to the falling pattern in tradable consumption good.

Beyond some point, the late bloomer specializes in the production of the tradable consumption good, and capital per worker continues falling as the real exchange rate depreciates. The steady state is reached when the domestic return to capital is equal to r^* . The domestic wage rate is lower than w^* , reflecting its technological backwardness, meaning that the late bloomer ends up with a more depreciated real exchange rate than the early bloomer.

A second implication of (32) is that k^{ss} is a decreasing function of d , meaning that TFP-backward countries have a steady state with lower capital per capita. The intuition behind this result is the following. A higher level of d decreases the steady-state level of w and q . The fall in w^{ss} lowers real income at any level of k , depressing the steady state level of tradable consumption $\tilde{c}^{ss}$. Also, a higher steady state level of the real exchange rate also discourages consumption of the tradable consumption good in favor of the non-tradable good. This bias in demand away from $\tilde{c}$ toward n requires a lower steady state level of capital per worker to assure domestic labor market equilibrium. This result has an important implication for cross-country differences in steady state income per capita $y^{ss} = w^{ss}(d) + r^* \cdot k^{ss}(d)$. Because both w^{ss} and k^{ss} fall with d , productivity differences amplify steady state differences in income per capita.

Finally, the model reveals that regardless of the starting value of k , a late bloomer ends up with a lower level of capital (and income) per worker than the early bloomer. This result contrasts with the one obtained by Atkeson and Kehoe (2000), where the steady state level of income per capita depends upon the starting value for k . According to their results, late bloomers that start with a level of k consistent with specialization

in the labor-intensive tradable good reach a steady state capital-labor ratio lower than k^* . In equilibrium, they specialize in the production of the labor-intensive good, and in spite of having the same factor prices, income per capita is lower than early bloomer's. The opposite happens to countries with a starting value for k high enough so that the late bloomer specializes in the production of the investment good during the transition and has a steady state level of income per capita greater than the early bloomer. In this paper, the existence of a productivity gap between the early and late bloomers assures that the steady state for the former is reached with specialization in the consumption tradable good, and income per capita never reaches the early bloomers' level. The result of Atkeson and Kehoe is replicated as d approaches 0. As the productivity gap vanishes, the steady state level of capital per worker is smaller than k^* if the starting level of the capital stock is such that it specializes in the production of the labor-intensive tradable good, and it is higher than k^* if the initial level of k is such that it specializes in the production of the tradable investment good.

3 Financial Integration

This section analyzes the effects of financial integration, i.e., the possibility of intertemporal trade, for the early bloomer. Consider that at the moment of financial integration the level of capital per worker k differs from k^{ss} . Up to this point we have assumed that domestic consumption is the pivoting variable for accumulating or decumulating capital towards its steady state level. However, this may not be case if the country has access to intertemporal trade, in which case the late bloomer can borrow or lend to reach its steady-state level of capital per worker automatically.

Once the economy opens up to intertemporal trade, the country can buy foreign assets b_t (denominated in terms of the tradable consumption good), meaning that its flow constraint becomes

$$\dot{b}_t = \rho b_t + (w_t + r^* k_t) - (\tilde{c}_t + n_t q_t) \quad (33)$$

where ρ is the interest rate of the bond. In equilibrium, the country must be indifferent between saving in a foreign bond that yields ρ or buying the investment good that has a unitary price of p^* , yields r^* , and

it depreciates at a rate δ . This implies that $\rho = (r^* - p^*\delta)/p^* = \beta$.¹⁷ This explains why expression (33) rules out the possibility of investing, i.e., $\tilde{x} = 0$. Rather than exchanging capital goods, the late bloomer will trade bonds that yield the same return in real terms.

Integrating (33) forward we get the following intertemporal resource constraint¹⁸

$$\int_0^\infty (w_t + r^*k_t) e^{-\rho t} dt = \int_0^\infty (\tilde{c}_t + n_t q_t) e^{-\rho t} dt = \int_0^\infty 2\tilde{c}_t e^{-\rho t} dt \quad (34)$$

where $\int_0^\infty r^*k_t e^{-\rho t} dt = p^*k_0$. The optimization problem of the representative agent can be represented with the following Lagrange function

$$\max \mathcal{L} = \int_0^\infty \frac{C_t^{1-\theta}}{1-\theta} e^{-\beta t} dt + \psi \left(\int_0^\infty w_t e^{-\rho t} dt + p^*k_0 - \int_0^\infty 2C_t q_t^{1/2} e^{-\rho t} dt \right)$$

where ψ is the Lagrange multiplier. The first order conditions are

$$C_t^{-\theta} = 2\psi q_t^{1/2}$$

and

$$\int_0^\infty w_t e^{-\rho t} dt + p^*k_0 = \int_0^\infty 2C_t q_t^{1/2} e^{-\rho t} dt.$$

Along a perfect foresight equilibrium path ψ is constant, meaning that the evolution of C_t depends solely on the evolution of the real exchange rate, and the level of C_t depends upon the present value of income and q_t . The evolution of w_t depends upon the path of d_t after integration, but at any point in time is determined by the external competitiveness condition of the tradable consumption good. The post-integration wage rate at any time t $w_{at}(d_t)$ is equal to $w_{at}(d_t) = (1/a_{Lc}^*) \cdot ((1 + d_t)^{-1} - a_{Kc}^* r^*)$ where d_t is the technology gap at time t and the subscript a refers to the post-integration level. The time path for the real exchange rate

¹⁷Postponing one unit of consumption today is possible through two mechanisms. On the hand the late bloomer can buy one bond (recall that they are expressed in terms of the tradable consumption good) and get ρ every period. The present value of such strategy is $PV_b = \int_0^\infty \rho e^{-\rho t} dt = 1$. On the other hand, the country can buy $1/p^*$ units of capital. The present value of this strategy is $PV_x = \int_0^\infty r^*k_t e^{-\rho t} dt = (r^*/p^*) \cdot \int_0^\infty (1-\delta)^t e^{-\rho t} dt$, that is equal to $(r^*/p^*) \cdot 1/(\rho - \ln(1-\delta)) = r^*/(p^*(\rho + \delta))$. Equalizing PV_b and PV_x implies $\rho = (r^* - p^*\delta)/p^*$.

¹⁸Expression (35) assumes that the stock of financial assets at the moment of financial integration is zero, i.e., $b_0 = 0$.

is determined by the evolution of productivity in the tradable sectors, as in Balassa (1964) and Samuelson (1964).

What are the implications of financial integration for the size and direction of capital flows? Without loss of generality, consider that right before integration the late bloomer is specialized in the production of the tradable consumption good c . Market clearing conditions are given by

$$k = (1 + d_0)a_{Kc}^*c \quad (35)$$

$$1 = (1 + d_0)a_{Lc}^*c + a_{Ln}^*n \quad (36)$$

where d_0 is the technology gap right before financial liberalization. Equations (35) and (36) imply that the size of the non-tradable sector is $n_b = (k_c - k_0)/(a_{Ln}^*k_c)$ where b stands for "before" integration. After financial integration, these two conditions still hold –because the economy continues specialized in the production of the tradable consumption good–, but k becomes endogenous and c and n are such that the new first order conditions for the consumer problem are satisfied. Therefore, denoting n_a the size of the non-tradable sector right after financial integration, the change in the domestic capital stock that assures labor market equilibrium is given by

$$\Delta k = k_a - k_0 = a_{Ln}^*k_c(n_b - n_a). \quad (37)$$

Expression (37) reveals that the sign and size of capital flows depend upon whether the non-tradable sector expands or not. In other words, capital outflows are required to clear the domestic labor market if the non-tradable sector expands after financial integration, i.e., $n_a > n_b$. The increase in labor demand following the expansion of the non-tradable sector generates an incipient excess demand for labor at the wage rate consistent with the external competitiveness condition of the tradable consumption good. This excess demand for labor is eliminated through capital outflows. The opposite occurs if n falls after financial integration.

The size of the non-tradable sector after financial liberalization is given by $n_{at} = \tilde{c}_{at}(d_t)/q_{at}(d_t)$, where $q_{at}(d_t) = a_{Ln}^* \cdot w_{at}(d_t)$. The level of d_t and its evolution over time determines the wage rate and the real

exchange rate in every period. Recalling that $\tilde{c}_t = C_t\sqrt{q_t}$ we get

$$\int_0^\infty w_t e^{-\rho t} dt + p^* k_0 = \int_0^\infty 2\tilde{c}_t e^{-\rho t} dt$$

where

$$\frac{\dot{\tilde{c}}_t}{\tilde{c}_t} = -\frac{(1-\theta)}{2\theta} \cdot \frac{\dot{q}_t}{q_t}.$$

These two conditions are sufficient to obtain the level of $\tilde{c}_t$ and n_t in all period. In the rest of the section I analyze the evolution of non-tradable production and the capital stock under three scenarios regarding the effects of financial integration on productivity growth in the late bloomer.

3.1 No Productivity Gains

Consider the case when financial integration has no effect on the level or evolution of the productivity gap between the early bloomer and the rest of the world. The post-integration equilibrium wage rate is constant and equal to $w_a(d_0) = (1/a_{Lc}^*) \cdot ((1+d_0)^{-1} - a_{Kc}^* r^*)$. The wage rate is higher than the pre-integration level if $r_0 < r^*$, where r_0 is the pre-integration domestic rental rate associated with a domestic capital stock k_0 . The opposite happens if $k_0 < k^{ss}$.

The constant wage rate implies that $\int_0^\infty w_t e^{-\rho t} dt = w_a(d_0)/\rho$. Because the real exchange rate is also constant ($q_a(d_0) = a_{Ln}^* w_a(d_0)$), C_t is flat, and it is equal to the permanent income level. The equilibrium level of $\tilde{c}$ is $\tilde{c}_a(d_0) = (w_a(d_0) + \rho p^* k_0)/2$, and the post-integration equilibrium level of non-tradable production and consumption n_a is equal to

$$n_a(d_0) = \frac{1}{2a_{Ln}^*} \left[\frac{1 - a_{Lc}^*(1+d_0)(k_c - k_0)\beta p^* - a_{Kc}^*(1+d_0)p^*\delta}{1 - a_{Kc}^*(1+d_0)p^*(\beta + \delta)} \right].$$

The size and sign of capital flows follows from comparing $n_a(d_0)$ with n_b . It is straightforward to show that non-tradable production expands ($n_a > n_b$) —meaning that the late bloomer is an exporter of capital— if and only if $k_0 > k^{ss}$, which is equivalent to saying that the pre-integration domestic return to capital is lower than r^* . This is the traditional result in the literature; a low return to capital country will be an exporter of capital after financial integration. Although financial integration lowers real income expressed

in terms of the consumption good (the rise in the return to capital is dominated by the fall in the wage rate because $k_0 > k_c$), the fall in the real price of the non-tradable good is even higher meaning that non-tradable consumption and production rises. At $w_a(d_0)$ there is excess labor demand that is eliminated with capital outflows. The opposite happens to a high return to capital country, i.e., $k_0 < k^{ss}$. Financial integration raises both real income and the real exchange rate, and the latter effect dominates, meaning that there is a fall in non-tradable production. Labor market equilibrium requires an increase in capital, which implies that the new equilibrium is reached with capital inflows.

3.2 Once-and-For-All Productivity Gain

Consider now the scenario in which financial integration leads to changes in the technology gap d . In particular, I assume financial integration generates a discrete and once-and-for-all fall in d : $d_t = d_1 < d_0$ for all $t > 0$. The fall in the productivity gap rises domestic wages (relative to the case of integration with no productivity change), which means that $\int_0^\infty w_t e^{-\rho t} dt = w_a(d_1)/\rho > w_a(d_0)/\rho$. Therefore, the present value of aggregate consumption is higher.

Because the wage rate and the real exchange rate are flat ($\dot{d} = 0$), so is aggregate consumption C . The post-integration level of non-tradable production is given by

$$n_a(d_1) = \frac{\rho(1+d_1)a_{Lc}^*}{2a_{Ln}^*} \cdot \frac{(p^*k_0 + w_a(d_1)/\rho)}{(1 - a_{Kc}^*(1+d_1)r^*)}.$$

It follows that $n_a(d_1) < n_b$ if and only if $k_0 < \bar{k}$ where $\bar{k} > k^{ss}$. This reveals that there is a range for $k_0 \in (k^{ss}, \bar{k})$ for which the late bloomer is an importer of capital in spite of having a pre-integration return to capital lower than r^* . Compared to the case where financial integration did not lead to productivity gains, the once-and-for-all fall in d generates a rise in permanent income and a fall in the real exchange rate. The later effect dominates, as the higher productivity raises the domestic wage rate and q by more than the productivity gain because the rental rate is set in the international market. Therefore, non-tradable demand falls (even more than in the case with no productivity gains), and the incipient excess supply of labor is eliminated with capital inflows. This is a permanent effect on the steady state level of capital per

worker.

This result does not imply that pre-integration rental rate differences are irrelevant to predict the direction of capital flows. The natural result of financial integration for a high return to capital country is a shrinkage in the non-tradable sector that leads to capital inflows. However, if the shrinkage in non-tradable demand is high enough, for example due to a significant fall in the real exchange rate, the traditional result is reverted. The strength of this second effect will mainly depend upon the size of the technology gain.

3.3 Decreasing Path of Productivity Gap

Consider an alternative scenario where in which financial integration boosts productivity growth but it does lead to productivity gains at the moment of integration.¹⁹ In terms of the model, d_t falls over time but it does not change on impact. The decreasing path for d_t has three effects on non-tradable consumption. First, there is a rise in permanent income beyond the level with no productivity gains, boosting demand for the tradable and non-tradable consumption goods at any level of the real exchange rate. Second, the increasing path for q_t discourages non-tradable consumption over time, shifting the consumption pattern toward good c . Finally, the decreasing path for the real exchange rate encourages the substitution of future consumption toward the present, as lower levels of the real exchange rate in the future deflate the real value of debt denominated in terms of the tradable consumption good.²⁰ The impact of a rising level of q_t on the level of $\tilde{c}_t$ depends upon the level of θ .

Consider for simplicity that $\theta = 1$. In such case, $\tilde{c}_t$ is constant and equal to

$$\tilde{c}_a = \frac{1}{2} \left(\rho p^* k_0 + \rho \int_0^\infty w_t e^{-\rho t} dt \right)$$

where $\int_0^\infty w_t e^{-\rho t} dt > w_a(d_0)/\rho$. Because permanent income has risen and the level of the real exchange does not change on impact with financial integration, i.e., $q_a(d_0) = q_b$, it is straightforward to see that

¹⁹See, for example, Arestis and Demetriades (1997), Bekaert et al (2004), Bencivenga and Smith (1991) and Aghion et al (2005). Levine (2004) presents an in-depth survey on the link between financial integration and productivity growth.

²⁰Dornbusch (1983).

non-tradable production raises compared to the case of no productivity gains. Indeed, the condition for $n_a(d_0) > n_b$ is $k_0 > \underline{k}$ where $\underline{k} < k^{ss}$. There is a range for $k_0 \in (\underline{k}, k^{ss})$ for which a high return to capital country becomes an exporter of capital after financial integration. Future productivity gains raise permanent income and consumption, boosting non-tradable consumption at the post-integration level of the real exchange rate. Excess domestic demand for labor requires capital outflows to clear the domestic labor market.

Over time, as q_t increases, there is a fall in non-tradable demand, and therefore part of the capital inflow is reverted. The long run level of capital per worker will depend on the long run level of d . If productivity gains in the long run are high enough, the high relative price of the non-tradable good depresses non-tradable demand and labor market equilibrium may end up requiring a level of capital per capita smaller than k_0 . In other words, if $\lim_{t \rightarrow \infty} d_t$ is small enough, capital outflows are a short run phenomenon, and in the long run there are capital inflows. Conversely, if the long run level of d is high enough, non-tradable consumption is high and the economy ends up with a level of capital per worker higher than k_0 .

The short run effect on capital outflows is strengthened if $\theta < 1$. In such case, the increasing path for q_t discourages tradable consumption $\tilde{c}_t$ over time. Because the present value of income does not depend upon θ , the short run increase in $\tilde{c}_t$ and n after financial integration is higher, and therefore the range of k for which a high return to capital country faces capital outflows widens. The opposite happens if $\theta > 1$. Indeed, for a high enough level of θ consumption of the tradable good can fall significantly on impact, shrinking non-tradable demand at the equilibrium real exchange rate. This effect increase the value of $\underline{k}$ and it may eventually lead to capital inflows in a low return to capital country.

4 Conclusion

The main message of this paper is that cross-country differences in capital returns may not be a sufficient predictor of the size and direction of capital flows after financial integration. The conventional view states that a high return to capital country will be an importer of capital after capital market integration. Finan-

cial integration leads to a fall in the cost of capital (relative to labor), rendering labor-intensive industries uncompetitive and shifting production processes within each industry toward more capital-intensive techniques. Because wages are set according to external competitiveness conditions, excess labor supply requires capital inflows to clear the domestic labor market.

However, in the presence of a labor-intensive non-tradable sector, the response of labor demand –and hence capital flows– also depends upon the reaction of non-tradable demand to financial liberalization. For example, a boom in demand for the non-tradable good after financial integration induces a rise in labor demand that cannot be eliminated with wage adjustments. The equilibrium is therefore reached with capital outflows, meaning that a high return to capital country may be an exporter of capital after financial integration. Conversely, a high enough fall in demand for the non-tradable after financial integration may lead to capital inflows to a low return to capital country.

I explore possibilities for these non-standard effects on non-tradable demand to occur. In particular, I focus on the effects that financial integration may have on the productivity growth. With no productivity gains associated with integration to world capital markets, the traditional result holds: capital flows from low- to high-return to capital countries. However, if integration leads to productivity improvements, either on impact or over time, the one-to-one mapping between rental rate differences and capital flows is weakened.

These results emphasize that the search for an answer of why capital does not flow from rich to poor countries should not only focus on understanding cross-country differences in capital returns but also on the effects that financial integration have on non-tradable demand. This model has emphasized the role of productivity improvements, but there are alternative avenues to explore. For example, price rigidities can also generate strong responses of non-tradable demand with important implications for capital flows in the short run.

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Figure 1
Production Diversification

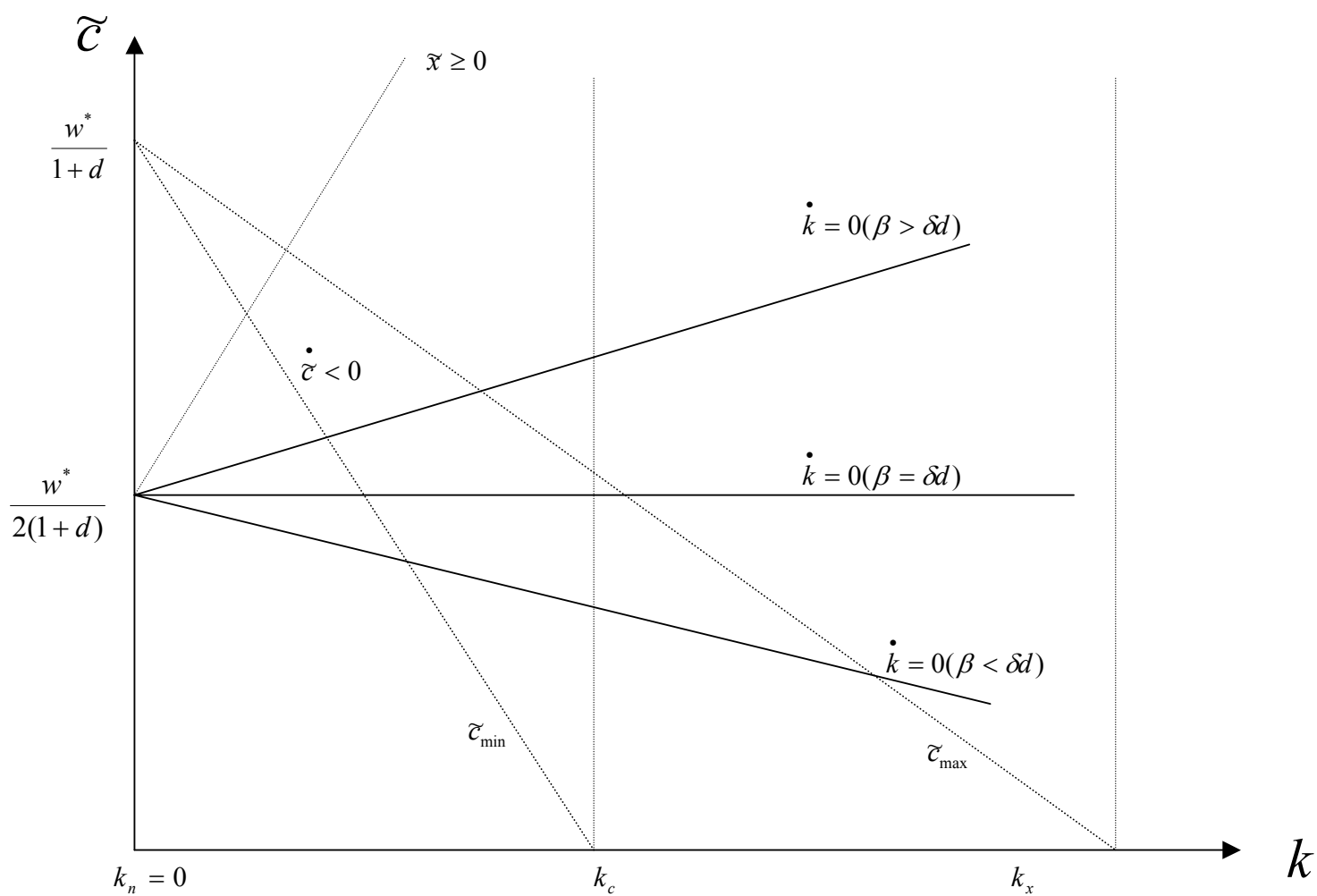


Figure 2
Dynamic System with diversification in c and x

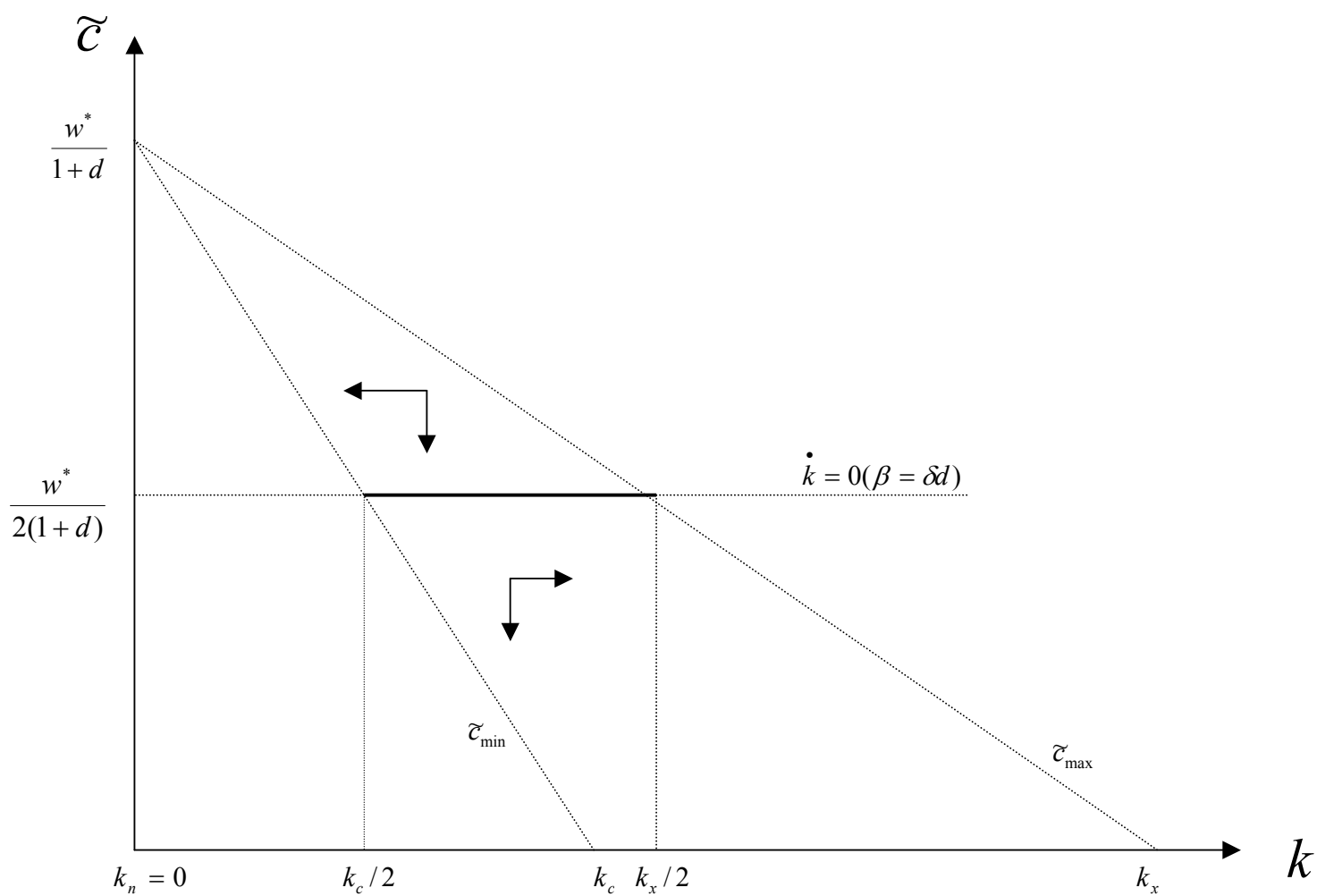


Figure 3
Production Specialization in Consumption Good c

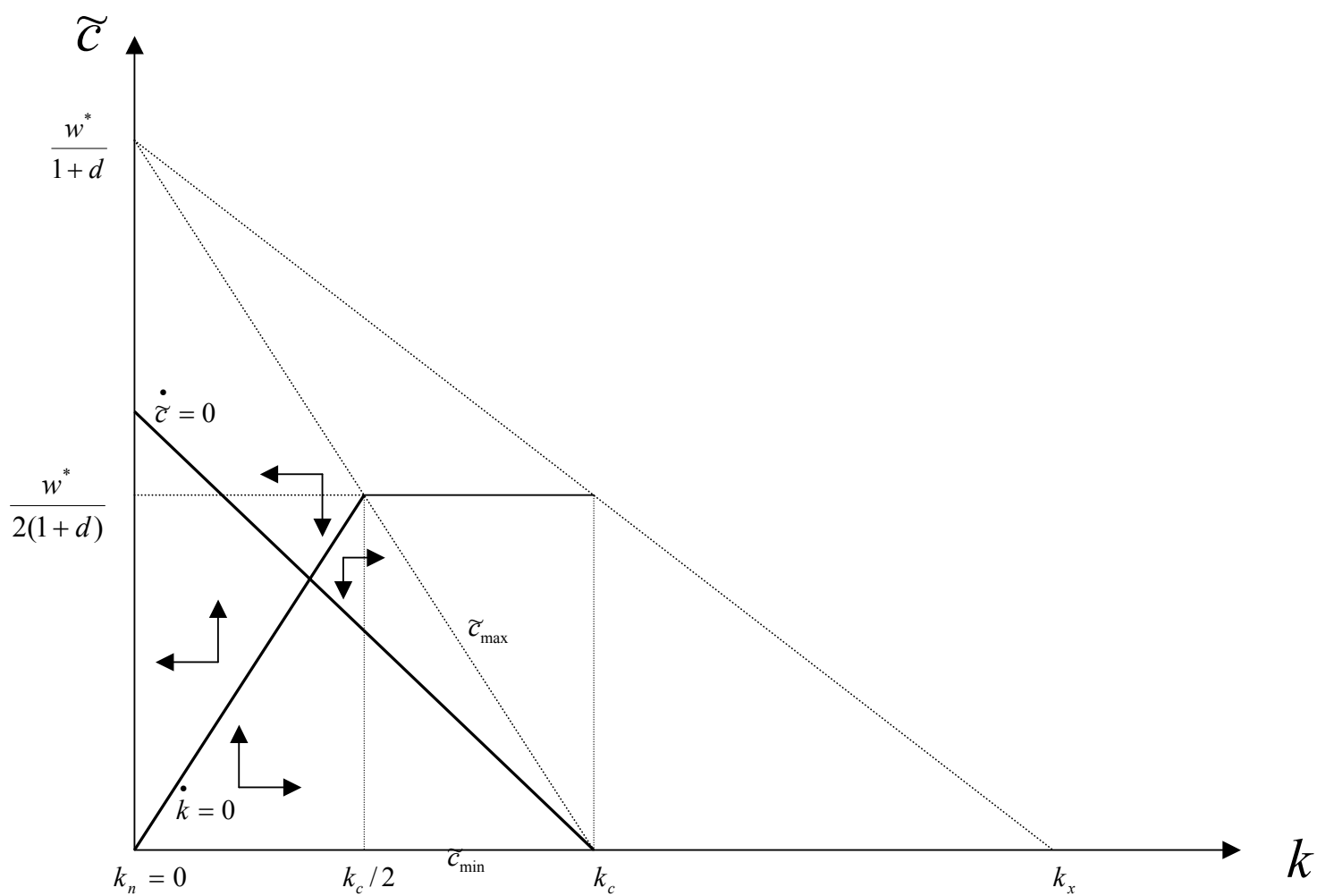


Figure 4
Dynamic System with specialization in x

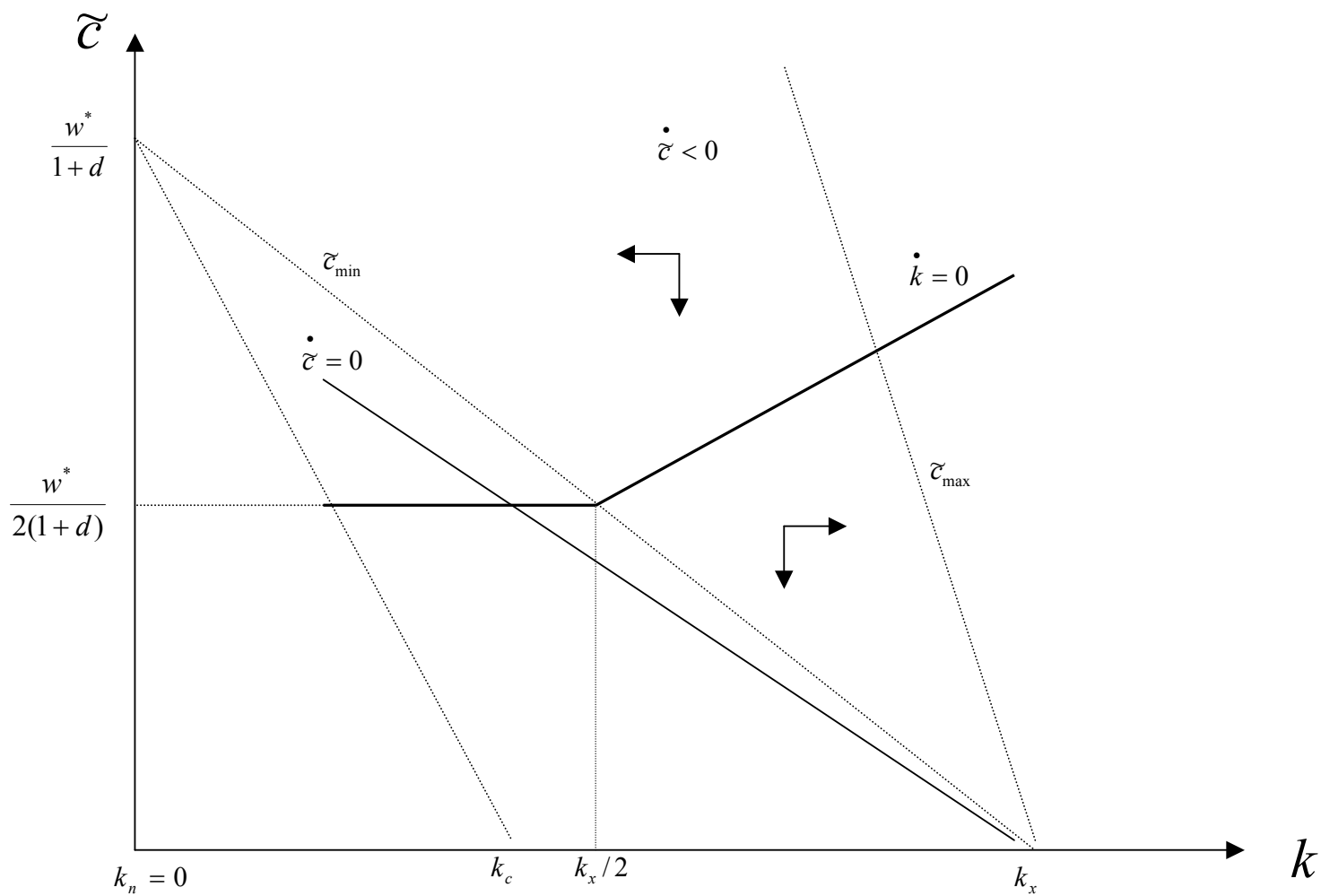


Figure 5
Aggregate Dynamic System

