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Who gains from capital market integration : Tax competition between unionized and non-unionized countries*

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Abstract

The welfare effects of capital market integration are examined under a model of tax competition with two asymmetric countries. The asymmetry is expressed through the labor market: one country has a perfect labor market whereas the other country is unionized. Our results show that the welfare effects of capital market integration are different depending on whether governments play an active role in attracting capital: in the absence of active governments, the capital market integration benefits the country with a competitive labor market and harms the unionized country. If the governments are active and compete for mobile capital using tax/subsidy, the market integration benefits both countries. The government's incentive to participate in a tax/subsidy game is also examined in the integrated capital market. We find that the unionized country always prefers to participate in the tax/subsidy game, but the non-unionized country avoids the game if it is a capital importer.

Keywords: Capital Market Integration, Capital Mobility, Tax Competition, Trade Unions, Welfare.

JEL Classification Number: F21, H73, J51

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1 Introduction

Given the increases in capital flows among countries, many scholars have analyzed the effects of capital market integration during the past few decades. One of the most important strands in this field is the tax competition theory, which has a long history dating back at least to Zodrow and Mieszkowski (1986) and Wilson (1986). The theory has investigated the role of governments in attracting capital to their jurisdiction. Taking into consideration the fact that regions differ in many aspects, quite a few studies in tax competition have analyzed the case of asymmetric regions. They have given due weight to regional characteristics and disparities in population, technology, preference, and the initial endowment.[1] The aim of this paper is to introduce new aspect of regional disparities in terms of the domestic labor market: one country has a competitive labor market and operates well and therefore unemployment is of limited importance but the other country fights unemployment as the trade union has a voice in wage bargaining.[2] Given other things, such as technology, preferences, and initial endowments, being equal, this paper examines how capital market integration changes the resulting equilibrium and the domestic policy choices in the countries with contrasting labor markets.

A large number of tax competition works address the issue of an imperfect labor market, i.e., the unemployment in the local market.[3] Most works are in the framework of symmetric tax competition where all countries encounter the problem of unemployment. In contrast to these existing studies, this paper focuses on regional asymmetry in the labor market. In particular, our main research focus is the effect on two different countries of the lifting of the curbs on mobile capital.[4] Our paper resolves this issue using two models: (i) a benchmark model in which the

[1]The representative studies focusing on the regional asymmetries are as follows. The effects of the differences in population size are examined by Bucovetsky (1991), Wilson (1991), Kanbur and Keen (1993), Ottaviano and van Ypersele (2005), and Sato and Thisse (2007). The effects of asymmetric capital endowment are investigated by DePater and Myers (1994), Peralta and van Ypersele (2005), and Itaya, Okamura and Yamaguchi (2008).

[2]Other strands of studies on capital market integration include the literature on foreign direct investment (FDI), where many papers analyzed the interactions between trade unions and FDI. See Skaksen and Sorensen (2001) and Zhao (2001) among others.

[3]See, for instance, Lejour and Verbon (1996), Fuest and Huber (1999), Richter and Schneider (2001), Boadway, Cuff and Marceau (2002), Koskela and Schöb (2002), Lozachmeur (2003), Leite-Monteiro, Marchand and Pestieau (2003), Ogawa, Sato and Tamai (2006), and Sato (2009).

[4]The effects of capital market integration on domestic policies have been examined in the unemployment model of symmetric tax competition. Gabszewicz and van Ypersele (1996) shows that market integration initially lowers the minimum wage in each country. Leite-Monteiro, Marchand and Pestieau (2003) shows that market integration

government in each country plays no active role in capital attraction and (ii) a model in which the government is active and uses capital tax/subsidy as a policy tool. The significant finding in our study is that the welfare effects of market integration vary with government interference.

Our study is motivated by the work of Aloi, Leite-Monteiro and Lloyd-Braga (2009), which shows that the workers in the unionized country receive higher income in autarky, while the workers in the non-unionized country benefit from capital market integration. The benchmark model in our paper is analogous to their model, and our first result is in accordance with theirs, i.e., the unionized country loses and the non-unionized country gains from the capital market integration. The new result we find in the second model with government intervention is that the lifting of the curbs changes the welfare effect so that both countries gain from market integration.

Our first result shows that when the government does not play an active role in capital attraction, the capital market integration harms the unionized country and benefits the non-unionized country. The intuition behind this result is simple. In the unionized country, labor is overpaid as compared to its marginal product and capital rent is far below its intrinsic level. In the non-unionized country, labor and capital are paid according to their marginal product. Once the capital market is integrated, capital flows from the unionized country to the non-unionized country in search of higher rents. This capital flow simply benefits the non-unionized country. The capital outflow from the unionized country harms the unionized country as it reduces labor productivity, and by extension, labor demand, which results in the worsening of the unemployment problem. It is also shown that such capital flows reduce total world output.

When the government plays an active role in capital attraction, the welfare effects of the market integration get amended: both countries benefit from the market integration. When the capital market is not integrated, the amount of capital available for production in each country is fixed at the endowment level. Thus, the governments can do nothing to control capital allocation in the market, and the equilibrium with government intervention accords with the one without. Once the capital market is integrated, the unionized country that is plagued by

reduces employment subsidy in a fixed-wage model of tax competition. Lejour and Verbon (1996) finds that the unemployment benefit decreases as the mobility of capital increases in a wage-bargaining model, and a similar result is obtained in the minimum-wage model of Lozachmeur (2003).

the unemployment problem has an incentive to attract capital since capital inflow increases the productivity of labor, and by extension, labor demand, which reduces unemployment. On the other hand, the non-unionized country with an efficient labor market still has no incentive to use tax/subsidy policy to control the amount of capital in the domestic market. As such, the non-unionized country is not active while the unionized country actively subsidizes capital, resulting in possible capital flow from the non-unionized country to the unionized country. While the direction of capital flow is ambiguous and depends on the degree of labor market imperfection in the unionized country, the tax/subsidy instrument can be employed by active governments to improve welfare gain in both countries.

The organization of this paper is as follows. In the next section, we set up the basic model. Section 3 examines the welfare effects of capital market integration in the absence of governments. In Section 4, the active governments are taken into account to derive the main result of this paper. Section 5 studies the government's incentive to participate in the tax/subsidy game in the integrated capital market. Section 6 concludes.

2 Model

There are two countries, and in each country $i(= 1, 2)$, there is a single government and there are immobile residents/workers with preference $u(c_i) = c_i$ defined over the consumption of a private good c_i. Without any loss of generality, we assume each country has a continuum of residents of size one. The two countries are identical, except for the labor market: in country 1, the labor market is imperfect due to union bargaining, whereas in country 2, there exists a perfect competitive labor market.

The economy has a stock of capital that is perfectly mobile among countries. Each country has capital stock $\bar{K}$, so that the total supply of capital in this economy is fixed at $2\bar{K}$. The mobile capital will be allocated between countries 1 and 2 to satisfy $2\bar{K} = K_1 + K_2$. We assume that the capital stock in the economy is equally owned by the entire population, implying that all

capital income is distributed to the capital owners (residents), and there is no absentee capital owner in the economy.

Private goods are produced using labor and capital. The production technology is formulated as $Y_i = F(K_i, L_i)$, where the production function is homogenous of degree one with respect to two inputs. Y_i is the output level, L_i is the labor input, and K_i is the capital input in country i. Denoting the capital per labor input as $k_i \equiv K_i/L_i$, we have $Y_i/L_i = f(k_i)$, where $f(k_i) \equiv F(k_i, 1)$; further, we assume that $f'(\cdot) > 0$ and $f''(\cdot) < 0$.

Each worker is assumed to be endowed with one unit of labor, which she/he supplies inelastically when employed. We assume that the residents in the same country are identical with respect to preference and initial endowments. However, as the residents in country 1 may be unemployed due to labor market imperfection, the residents do differ in terms of their status of employment. The residents are classified into two types of workers indexed by superscript j: the resident is not employed by a firm $j = u$ and is employed if $j = e$. Unemployment is seen as merely an unfortunate accident befalling individual workers, in which those fortunate enough to be employed receive wages whereas the unemployed start their own business and earn income $\bar{w} \equiv 1$.[5] Labor income differs between firm-employed and self-employed workers, but all of them earn a return on capital. By contrast, in country 2, since the labor market is perfect, all residents are employed by firms.

The budget constraint of the residents indexed by superscript j in country 1 are given as

$$c_1^j = \begin{cases} r_1\bar{K} + w_1 + h_1 & \text{if} \quad j = e \\ r_1\bar{K} + 1 + h_1 & \text{if} \quad j = u. \end{cases} \tag{1}$$

In (1), h_1 denotes the lump-sum transfer made by government 1, r_1 is the net return on capital investment, and w_1 is the wage rate in country 1.[6] Since all residents in country 2 are employed by firms, the budget constraint of a resident in country 2 is simply given by

$$c_2 = r_2\bar{K} + w_2 + h_2.$$

[5] This can also be interpreted as the value of leisure.

[6] When the capital market is not integrated, the owner (resident) of endowed capital in country i invests all capital in county i. In this case, the net return of capital investment, r_i, differs between country 1 and 2 as the amount of labor input differs. Under perfect capital mobility accompanied by the capital market integration, however, the capital owners are now able to invest their endowments in both countries, so that the net return of capital investment should be equalized.

The firm's profit in country i is given by $\pi_i = [f(k_i) - (r_i + \tau_i)k_i - w_i]L_i$, where τ_i is the unit tax rate on capital in country i. The profit maximization gives

$$r_i = f'(k_i) - \tau_i, \tag{2}$$

$$w_i = f(k_i) - k_i f'(k_i). \tag{3}$$

Note that the capital substitutes for labor when the wage rate increases in country i:

$$\frac{dk_i}{dw_i} = -\frac{1}{k_i f''(k_i)} > 0. \tag{4}$$

There is a single trade union in country 1. The trade union is concerned over job opportunities and the wage rent that is given by the union wage minus the reservation wage, $w_1 - 1$. The objective of the trade union is, thus, assumed to be given by $U_1 = L_1^{\beta_1}(w_1 - 1)^{\beta_2}$, where $\beta_1 > 0$ and $\beta_2 > 0$ represent the concern for the level of employment and for the wage rent, respectively.[7] The union, taking the effects of a change in w_1 on k_1 as given by (4), decides on the wage level w_1. Using $k_i \equiv K_i/L_i$ and (3), given K_1, the problem of the trade union can be formulated as

$$\max_{w_1} \quad U_1 = \left(\frac{K_1}{k_1}\right)^{\beta_1} (w_1 - 1)^{\beta_2}.$$

The first-order condition is

$$\frac{w_1}{k_1}\frac{dk_1}{dw_1} = \frac{\beta w_1}{w_1 - 1}, \tag{5}$$

where $\beta \equiv \beta_2/\beta_1 > 0$. In country 1, from (4) and (5), we have $w_1 = 1 - \beta k_1^2 f''(k_1)$. Combining this equation with (3), we obtain

$$f(k_1) - k_1 f'(k_1) = 1 - \beta k_1^2 f''(k_1). \tag{6}$$

Under certain conditions, (6) uniquely determines the capital per labor in country 1 as $k_1 = k_1^*$.[8] In the following analysis, we assume $k_1^* > \bar{K}$, which ensures unemployment in country 1 (see

[7] The objective function follows McDonald and Solow (1981). Some empirical literature, e.g., MaCurdy and Pencavel (1986), suggests that the union places more weight on employment rather than the wage rent, i.e., $\beta_1 > \beta_2$. We, however, do not exclude the case of $\beta_1 \leq \beta_2$.

[8] One set of sufficient conditions for a unique k_1^* is given by the following three conditions: (i) when $f(0) = 0$, $f'(k_1)$ and $f''(k_1)$ are finite, (ii) $\lim_{k_1 \to \infty} f(k_1) - k_1 f'(k_1) > 1 - \beta \lim_{k_1 \to \infty} k_1^2 f''(k_1)$, and (iii) $(1 - 2\beta)k_1 f''(k_1) > \beta k_1^2 f'''(k_1)$. Condition (i) implies that the left hand side of (6) is smaller than the right hand side of it at $k_1 = 0$. Condition (ii) requires that the opposite holds true as $k_1 \to \infty$, which ensures that there exists at least one k_1 that satisfies (6). The uniqueness comes from condition (iii) because it implies that the left-hand side is steeper than the right-hand side.

Subsection 3.1). Using (3) and (6), the wage rate in country 1 is determined as

$$w_1^* = 1 - \beta k_1^{*2} f''(k_1^*) > 1. \tag{7}$$

Note that k_1^* and w_1^* do not change regardless of whether or not there are curbs on the mobility of capital.[9]

The government in each country imposes a tax on mobile capital. The tax revenue is distributed to the resident in each country as a lump-sum transfer. Hence, the budget constraint of a government in country i is $h_i = \tau_i K_i$. For the main analysis that will be developed in Section 4, we now present the optimization problem of an active government, which strategically chooses it's tax/subsidy rate on mobile capital so as to control capital allocation. We assume a utilitarian government that maximizes the sum of utilities residing in the country. Then, the government's objective function in country 1 is formulated as $W_1 = L_1 \cdot u(c_1^e) + (1 - L_1) \cdot u(c_1^u)$. From $u(c_i) = c_i$, and by substituting (1) and $h_i = \tau_i K_i$ into the objective function, we get the optimization problem of government 1 as

$$\begin{aligned} \max_{\tau_1} \quad & W_1 = L_1 \cdot u(c_1^e) + (1 - L_1) \cdot u(c_1^u) \\ & = r_1 \bar{K} + (w_1^* - 1) L_1 + \tau_1 K_1 + 1. \end{aligned} \tag{8}$$

We mention here that this objective function is equivalent to the social surplus in our framework. Since $L_2 = 1$ holds in country 2, the maximization problem of government 2 is defined as

$$\max_{\tau_2} \quad W_2 = u(c_2) = r_2 \bar{K} + w_2 + \tau_2 K_2. \tag{9}$$

3 Equilibrium without active governments

Before introducing the model with active governments, we start our analysis from the benchmark model. As the benchmark case, we present the equilibrium characteristics when the governments

[9] We now describe how the equilibrium values of K_1, K_2, and L_1 are determined. Assume that the capital market is integrated, so that capital is freely mobile between country 1 and 2: $f'(k_1) - \tau_1 = f'(k_2) - \tau_2$. In country 1, the union determines the wage level as $w_1 = w_1^*$. Therefore, following (5), $k_1 = k_1^*$. Then, given the tax rate in both countries, τ_1 and τ_2, the equilibrium ratio of capital to labor in country 2 is determined by the equilibrium condition for capital markets $f'(k_1) - \tau_1 = f'(k_2) - \tau_2$ as $k_2 = k_2^*$. In country 2, the equilibrium number of workers employed by firms is equal to unity, $L_2^* = 1$, as the labor market is perfectly competitive. By $k_2 = k_2^*$ and $L_2^* = 1$, capital input in country 2 is given by $K_2^* = k_2^*$. Finally, capital input in country 1 is determined as $K_1^* = 2\bar{K} - K_2^*$. When the capital market is not integrated, so that capital is immobile, the capital stock of each country is equal to $\bar{K}$, and the process described above can be applied.

play no active role, as in the model presented in Aloi, Leite-Monteiro and Lloyd-Braga (2009). In the first part of this section, an autarky is considered where the capital market is not integrated, i.e., capital is immobile. In the second part, we attempt an analysis of the lifting of the curbs on the mobility of capital to derive the welfare impacts of capital market integration. The governments do not play an active part in attracting capital throughout.

3.1 Autarky

The equilibrium values in an autarky are indicated by superscript a. Since capital is immobile, the amount of capital used in country i is $K_i^a = \bar{K}$. As the government has no active policy, $\tau_i = 0$, and the wage bargaining of the trade union determines the capital per labor ratio in country 1 as $k_1 = k_1^*$, the return on capital and the employment level in country 1 are given by $r_1^a = f'(k_1^*)$ and $L_1^a = \bar{K}/k_1^* < 1$, respectively. Then, the equilibrium welfare of country 1 is obtained as

$$W_1^a = r_1^a \bar{K} + (w_1^* - 1)\, L_1^a + 1. \tag{10}$$

Since labor market clearing in country 2 requires $L_2 = 1$, we have $k_2^a = \bar{K}$. The return on capital is, thus, $r_2^a = f'(k_2^a)$, and the wage rate is $w_2^a = f(k_2^a) - k_2^a f'(k_2^a)$. In this paper, we focus on the case in which workers in country 2 have an incentive to be employed, which, in the case of autarky, gives the assumption that $f(\bar{K}) - \bar{K} f'(\bar{K}) > 1$. The welfare of country 2 is obtained as

$$W_2^a = r_2^a \bar{K} + w_2^a. \tag{11}$$

In an autarky with non-active governments, we have the following characteristics in equilibrium:

Lemma 1. *$r_1^a < r_2^a$ and $w_1^a > w_2^a$.*

Proof: See Appendix A-(i).

In country 1, the presence of a trade union increases the wage rate as compared to the marginal productivity of labor; on the other hand, in country 2, the wage rate is set in accordance

with the marginal productivity principle. In country 1, as a consequence of higher wage, the return on capital decreases in country 1. At the same time, the return on capital in country 2 is given by the marginal productivity of capital and is greater than the return on capital in country 1. Since the capital market is not integrated, the difference in the return on capital persists.

3.2 Capital Market Integration

We now lift the curbs on capital mobility between the countries. The equilibrium values in the integrated market are indicated by superscript m. Since capital is mobile between two countries, the difference in capital returns is eliminated, and the net return on capital is equal in equilibrium: $r_1 = r_2 = r^m$. Then, we obtain the capital flow in the equilibrium as follows.

Lemma 2. *$K_1^m < \bar{K}$ and $K_2^m > \bar{K}$.*

Proof: See Appendix A-(ii).

Lemma 2 indicates that as the capital market is integrated, capital flows from country 1 to country 2. Furthermore, from Lemma 2, we easily get that $r_2^a > r_1^a = r^m$, $w_2^m > w_2^a$, and

$$L_1^m = \frac{2\bar{K} - K_2^m}{k_1^*} < \frac{\bar{K}}{k_1^*} = L_1^a, \tag{12}$$

showing that the market integration increases unemployment in country 1.

As shown in Lemma 1, the return on labor in the unionized country is set at a higher level than in the non-unionized country. When the capital market is not integrated and capital is pegged in the original country, the rent for capital in country 1 decreases, and the net return on capital in country 1 is lower than that in country 2. Once the curbs are lifted, capital flows from country 1 to country 2 to pursue higher return, which reduces output $L_1 f(k^*)$ and labor demand L_1 in country 1 ($L_1^m < L_1^a$). Note that the capital market integration does not alter the level of capital income $f'(k^*)\overline{K}$. The decline in labor demand aggravates the unemployment problem in the unionized country, which is harmful for it. By contrast, capital inflow and the

market integration result in output expansion and wage increase in country 2, which benefits the residents in the non-unionized country.

The above argument on the welfare effects of capital mobility can be formally proved as follows. Using the equilibrium values, the welfare of countries 1 and 2 can be given by

$$W_1^m = r^m \bar{K} + (w_1^* - 1) L_1^m + 1, \tag{13}$$

$$W_2^m = r^m \bar{K} + w_2^m. \tag{14}$$

Comparing (10) and (11) with (13) and (14), respectively, we obtain the welfare effects of the capital market integration when the governments are inactive. These results are similar to those of Aloi, Leite-Monteiro and Lloyd-Braga (2009).

Proposition 1. *When governments are inactive, the unionized country loses and the non-unionized country gains from the capital market integration,* $W_1^m < W_1^a$ *and* $W_2^m > W_2^a$.

Proof: See Appendix B.

Proposition 2. *When governments are inactive, the capital market integration reduces world surplus,* $W_1^m + W_2^m < W_1^a + W_2^a$.

Proof: See Appendix C.

The world surplus is equal to the total world output (total world income), which is

$$\begin{aligned} W_1 + W_2 &= f(k_1^*)L_1 + 1 - L_1 + f(K_2) \\ &= f(k_1^*)\frac{K_1}{k_1^*} + 1 - \frac{K_1}{k_1^*} + f(K_2) \\ &= f(k_1^*)\frac{2\bar{K} - K_2}{k_1^*} + 1 - \frac{2\bar{K} - K_2}{k_1^*} + f(K_2). \end{aligned}$$

Therefore, capital inflow into country 2 alters the world surplus as

$$\frac{\partial(W_1 + W_2)}{\partial K_2} = -\frac{f(k_1^*) - 1}{k_1^*} + f'(K_2).$$

The first term shows the decrease in output in country 1 and the second term represents the increase in output in country 2. Though the first term is constant because of union bargaining, the second term declines as K_2 increases. In equilibrium under the capital market integration, the effect of the first term dominates that of the second term because $-(f(k_1^*)-1)/k_1^*+f'(k_1^*) < 0$, which results in a lower total output than in the equilibrium under autarky.

4 Equilibrium with active governments

It is a natural argument that the government in each country has an incentive to employ a tax/subsidy policy to exert an influence on the allocation of mobile capital. Specifically, the country that is plagued by an unemployment problem may have a strong incentive to employ fiscal policy instruments to attract mobile capital. To include active governments in the model, we solve (8) and (9) explicitly.

4.1 Autarky

Although governments can put tax/subsidy polices to use, they do not employ such policy instruments since they have no impact on the capital allocation in autarky, where capital is fixed in each country. Thus, the equilibrium agrees completely with the equilibrium presented in subsection 3.1.

4.2 Capital Market Integration

The government in country 1 is faced with $r = f'(k_1^*) - \tau_1$. In choosing the optimal tax/subsidy rate on mobile capital, it takes into account the policy effects on the capital price and the domestic variables, which are shown in Appendix D. Equation (8) gives the first-order condition for government 1's optimal policy choice as

$$\begin{aligned}\frac{\partial W_1}{\partial \tau_1} &= \bar{K}\frac{\partial r}{\partial \tau_1} + L_1\frac{\partial w_1^*}{\partial \tau_1} + (w_1^* - 1)\frac{\partial L_1}{\partial \tau_1} + K_1 + \tau_1\frac{\partial K_1}{\partial \tau_1} \\ &= -\bar{K} + \frac{w_1^* - 1}{k_1^* f''(k_1^*)} + K_1 + \frac{\tau_1}{f''(k_1^*)} = 0,\end{aligned}$$

where we used (21), (23), (24) and (26) as in Appendix D. Using (7), we solve this equation with respect to τ_1 as

$$\tau_1^{\mu} = f''(k_1^*)(\bar{K} - K_1^{\mu} + \beta k_1^*), \tag{15}$$

where superscript μ stands for the equilibrium values under the capital market integration with active governments.

The optimization problem of the government in country 2, (9), gives the first-order condition as

$$\begin{aligned}\frac{\partial W_2}{\partial \tau_2} &= \bar{K}\frac{\partial r}{\partial \tau_2} + \frac{\partial w_2}{\partial \tau_2} + K_2 + \tau_2 \frac{\partial K_2}{\partial \tau_2} \\ &= \tau_2 \frac{\partial K_2}{\partial \tau_2}.\end{aligned}$$

Since $\partial r/\partial \tau_2 = 0$ and $\partial w_2/\partial \tau_2 = -K_2$, the first three terms disappear (see (21) and (23) in Appendix D), indicating that the government in country 2 has no incentive to use a tax/subsidy instrument and chooses[10]

$$\tau_2^{\mu} = 0. \tag{16}$$

This suggests that the government in country 2 does not employ a tax/subsidy policy on mobile capital even if the capital market is integrated.

From (15) and (16), we have the results on optimal tax/subsidy policy in the integrated economy.

Proposition 3. *When governments are active, the unionized country subsidizes capital and the non-unionized country does not employ a capital tax/subsidy instrument,* $\tau_1^{\mu} < 0$ *and* $\tau_2^{\mu} = 0$*, under the capital market integration.*

Proof: See Appendix E.

As capital and labor are complementary in production, as shown in (26) in Appendix D, an increase in capital accompanied by a reduction in the tax rate increases employment in country 1,

[10]Note that since $\partial K_2/\partial \tau_2 = 1/f''(k_2) < 0$ (see (25) in Appendix D), $\partial W_2/\partial \tau_2 \gtreqless 0$ if $\tau_2 \lesseqgtr 0$, showing that W_2 takes a maximum when $\tau_2 = 0$.

$\partial L_1/\partial \tau_1 < 0$. Moreover, it increases capital income sufficiently to compensate for the reductions in tax revenue. Thus, the government in country 1, which is troubled over unemployment, has an incentive to provide capital subsidy in the integrated capital market.

We now state the capital flow in equilibrium with active governments. As shown in Lemma 2, when governments are inactive, capital moves from country 1 to country 2 if the capital market is integrated. In contrast,the effects of the market integration on capital flow are somewhat complex when governments are active. On the one hand, once the capital market is integrated, the capital owners have an incentive to invest in the non-unionized country to seek a higher return. On the other hand, they may find the investment in the unionized country attractive since its government provides capital subsidy. The capital subsidy works as a barrier against capital outflow. As a matter of fact, capital subsidy may lead to capital influx into country 1 even though the return on capital, $f'(k_1)$, is reduced.

To provide further insight as to how the capital migrates between two countries, consider the familiar quadratic production function, $f_i = (A - k_i)k_i$, where $A > 2k_i$.[11] In the equilibrium with active governments, we have $K_1^\mu = (3\bar{K} - (1-\beta)(1-2\beta)^{-1/2})/2$ and $K_2^\mu = (\bar{K} + (1-\beta)(1-2\beta)^{-1/2})/2$, which reveals that $\bar{K} \gtreqless K_2^\mu \leftrightarrow \bar{K} \gtreqless (1-\beta)(1-2\beta)^{-1/2}$.[12] The combination of $(\bar{K}, \beta)$ where the sign of $\bar{K} - K_2^\mu$ is determined is shown in Figure 1. This figure clearly shows that capital is likely to move from country 2 to country 1 (from country 1 to country 2) to the extent that the trade union in country 1 places high (low) weight on the wage rent. This is simply because the government in the unionized country provides significant capital subsidy to attract capital as the labor market is distorted to a considerable degree.[13] Hence, the extensive capital subsidy in the unionized country results in capital outflow from the non-unionized country. The opposite argument applies to the case in which the trade union places low weight on the wage rent.

[11] This condition ensures $f_i' = A - 2k_i > 0$.

[12] $0.5(\bar{K}-1)(\bar{K}+1)/\bar{K}^2 < \beta < 0.5$ is assumed to satisfy $k_1^* = (1-2\beta)^{-1/2} > 0$ and $L_1^a = \bar{K}/k_1^* < 1$. We here present the figure only for country 2 as the figure for country 1 is inextricably linked.

[13] Since $\tau_1^\mu = \bar{K} - (1+\beta)(1-2\beta)^{-1/2} < 0$, we have $\partial \tau_1^\mu / \partial \beta < 0$, indicating that capital subsidy increases as β increases.

[Figure 1. HERE]

Capital flow depends on the preference of the trade union, β, and therefore its direction is unclear. However, we obtain the following proposition on the welfare effects of market integration when governments are active.

Proposition 4. *When governments are active, both countries gain from the capital market integration,* $W_1^\mu > W_1^a$ *and* $W_2^\mu > W_2^a$*. Hence, in this case, the market integration increases world surplus,* $W_1^\mu + W_2^\mu > W_1^a + W_2^a$*.*

Proof: See Appendix F.

This result is in contrast to Proposition 1. The following two lemmas are useful in interpreting this intriguing result.

Lemma 3. When governments are active, country 1 exports (imports) capital in the integrated market if and only if $(f(k_1^*) - 1)/k_1^* < f'(\bar{K})$ $((f(k_1^*) - 1)/k_1^* > f'(\bar{K}))$.

Proof: See Appendix A-(iii).

Lemma 4. Starting from equilibrium under autarky, capital export (import) by country 1 increases world surplus if and only if $(f(k_1^*) - 1)/k_1^* < f'(\bar{K})$ $((f(k_1^*) - 1)/k_1^* > f'(\bar{K}))$.

Proof: See Appendix A-(iv).

These lemmas show that the government of country 1 determines the subsidy rate so that country 1 exports capital if and only if the capital endowment is small enough and the marginal productivity of capital is sufficiently high in country 2. In such a case, capital export by country 1 increases total world output. By contrast, if the capital endowment is large and the marginal productivity of capital is low in country 2, country 1 sets a subsidy rate that enables it to import capital, which leads to higher total world output.

Keeping these lemmas in mind, we can explain the reason behind Proposition 3 as follows. Once the capital market is integrated, the government in country 1 reduces the tax rate and starts

providing subsidy for mobile capital. Such reduction in tax rate generally produces two effects. First, it raises the net return on capital, $\partial r/\partial \tau_1 < 0$. Second, it changes the allocation of capital between countries 1 and 2, which affects the labor demand and wage rate, and consequently the labor income in each country.

Assume that the unionized country is a capital importer and the non-unionized country is a capital exporter, $K_1^\mu > \bar{K} > K_2^\mu$. Take country 1 as an example. The rise in capital price, r, along with the market integration increases the payment for capital import in country 1, which triggers welfare reduction. However, capital inflow owing to the capital subsidy increases labor demand and leads to more job opportunities, $\partial L_1/\partial \tau_1 < 0$. While employment increases, wage rate remains unchanged at w_1^* given by (7) since the trade union has bargaining power in the labor market. This increases labor income, and by extension, welfare in country 1. In sum, the positive and negative factors affect the resulting welfare change, but the active government can choose its subsidy rate to achieve net welfare gain when the capital market is integrated. Note here that country 1 can attain the same capital distribution as that under autarky because capital subsidy merely redistributes income within a country when the subsidy level is set such that net capital export is zero. If country 1 chooses a subsidy level other than this, it implies that welfare in country 1 is higher than that under autarky.

When $K_1^\mu < \bar{K} < K_2^\mu$, the same argument applies. On the one hand, the increase in capital price, accompanied by the market integration, increases the reward from capital export, which increases welfare in country 1. On the other hand, the capital outflow increases unemployment, which reduces labor income, and thus lowers welfare. The government uses a subsidy policy to ensure that the positive effect is stronger than the negative one. Thus, the market integration always benefits the unionized country with an active government.

Now, we consider the effects of market integration on welfare in country 2. Assume that $K_1^\mu > \bar{K} > K_2^\mu$, i.e., country 2 exports capital in equilibrium. The resulting capital subsidy attracts investment in country 1, and yields capital outflows from country 2, which decreases wage rate in country 2. This has a negative impact on welfare in country 2. However, tax

reduction in country 1 increases the capital price, which benefits country 2 since it increases the reward from capital export. As the positive effect is stronger than the negative effect because capital export alleviates the low marginal productivity of capital, market integration benefits country 2. When $K_1^\mu < \bar{K} < K_2^\mu$, i.e., country 2 imports capital from country 1, we can interpret the result in a similar way. The capital subsidy in country 1 increases the capital price, which increases the payment for capital import. This is a negative aspect of market integration for country 2. However, with the market integration, capital flows into country 2, which increases wage, and increases welfare in country 2. If the marginal productivity of capital is high under autarky, the positive effect of capital inflow is large and stronger than the negative effect, and therefore the market integration benefits country 2.

5 Comparison of equilibria with and without active governments

In this section, we perform a comparison between the equilibria with and without active governments. By ranking welfare in the integrated market, we refer to the governments' incentives to participate in a tax/subsidy game in the integrated market. We start by comparing the capital allocation with active governments and with non-active governments.

Lemma 5. *Assume that the capital market is integrated. With active governments, country 1 has more capital and thus higher employment than with non-active governments,* $K_1^\mu > K_1^m$ *and* $L_1^\mu > L_1^m$*. In contrast, in country 2 with active governments, has less capital than with non-active governments,* $K_2^\mu < K_2^m$*.*

Proof: See Appendix A-(v).

Since capital flows from country 1 with market integration if no capital subsidy is provided; capital subsidy works as a barrier against this flow.

Based on Lemma 3, we have the result on the governments' incentive to participate in the tax/subsidy game.

Proposition 5. *Assume that the capital market is integrated. The government in the unionized country becomes active and participates in a tax/subsidy game since it always gains from this game. By contrast, the government in the non-unionized country may become inactive and avoid the tax/subsidy game since it may lose from it.*

Proof: See Appendix G.

If the non-unionized country is a capital importer in equilibrium with active governments, the capital subsidy policy employed in the unionized country increases the capital price, which increases the payment for capital import and may reduce welfare in the non-unionized country. This makes the capital-importing country develop a preference for the equilibrium without active governments and reluctant to participate in the tax/subsidy game.

6 Concluding Remarks

This paper examined the consequences of the capital market integration for the residents' welfare in unionized and non-unionized countries. We first examined the model in which governments do not play an active role and proved that once the capital market is integrated to allow capital mobility between countries, capital moves from the unionized country to the non-unionized country. This leads to an increases in unemployment, and therefore the market integration harms the residents in the unionized country. By contrast, capital inflow in the non-unionized country increases output, and therefore the market integration benefits the residents in the non-unionized country. The necessary condition for this result is that capital outflow induced by market integration reduces the demand for labor in the unionized country, which is assured when the natural assumption that capital and labor are complementary in production is made.

This result, however, needs an amendment if we consider active governments. In the framework of active tax competition between unionized and non-unionized countries, our result shows that capital market integration benefits both countries. The unionized country has an incentive

to provide subsidy for mobile capital since it is plagued by an unemployment problem. Unemployment gives the government in the unionized country an incentive to raise labor productivity so as to boost labor demand. To raise labor productivity, the government tries to attract mobile capital that is complementary in production. For this purpose, it strategically uses a subsidy policy and succeeds in attracting capital. In contrast, the government in the country with a perfect labor market keeps choosing zero tax rates on capital even though the market is integrated, i.e., there is no point in using tax/subsidy policy instruments for the non-unionized country. The capital subsidy provided by the unionized country changes the allocation of capital between countries, net return for capital investment, wage, and unemployment level. All of these affect the welfare in each country, but the tax/subsidy instrument can be used to bring welfare gain in both countries.

Finally, we examined the incentives to participate in a tax/subsidy game in the integrated capital market. The results reveal that while the unionized country always becomes active and desires to participate in the game by employing capital subsidy, the non-unionized country may prefer the environment without active governments. If the non-unionized country is a capital importer, the capital subsidy policy employed in the unionized country increases the capital price, which increases the payment for capital and reduces welfare in the non-unionized country. This makes the non-unionized country reluctant to participate in the tax/subsidy game.

Our argument reveals that whether the capital market integration harms or benefits the unionized and non-unionized countries depends on whether the governments in these countries are active in controlling the capital allocation using a tax/subsidy policy, which has been recognized as the key component in the era of globalization.

It is worth pointing out that one of the most important extensions is to check the robustness of our results in the case of three or more countries. Although we can interpret more than two countries in our framework as the mass of unionized countries and that of non-unionized countries, this perspective neglects the strategic interactions among governments within each mass (i.e., among governments of unionized (or non-unionized) countries). Investigating the

results of such strategic interactions is an important direction for future research.

Appendixes

Appendix A: Proof of Lemmas

(i) Proof of Lemma 1.

Since $f(\cdot)$ is concave in k_i, from $k_1^a (= k_1^*) > \bar{K} = K_2^a = k_2^a$, we get $r_1^a < r_2^a$. Furthermore, from (3), we obtain $w_1^a > w_2^a$.

(ii) Proof of Lemma 2.

Although K_1 changes, k_1 does not change even if the market is integrated. Hence, $k_1^* = k_1^a = k_1^m$. From $r^m = f'(k_1^m) = f'(k_2^m)$, we readily have

$$k_1^* = k_2^m = K_2^m > \bar{K}. \tag{17}$$

From $2\bar{K} = K_1^m + K_2^m$ and (17), we have $K_1^m < \bar{K}$.

(iii) Proof of Lemma 3.

In equilibrium under the capital market integration, the distribution of capital K_1^μ is determined by

$$f'(k_1^*) - \tau_1^\mu = f'(K_2),$$

which is rewritten as

$$f'(k_1^*) - f''(k_1^*)(\bar{K} - K_1 + \beta k_1^*) = f'(2\bar{K} - K_1). \tag{18}$$

The left hand side (LHS) of (18) is decreasing in K_1 and the right hand side (RHS) of (18) is increasing in K_1. If and only if the LHS of (18) is smaller than the RHS of (18) at $K_1 = \bar{K}$, K_1^μ is smaller than $\bar{K}$, which implies that country 1 exports capital. This condition is equivalent to

$$f'(k_1^*) - \beta k_1^* f''(k_1^*) < f'(\bar{K}).$$

Using (6), this can be rewritten as

$$\frac{f(k_1^*) - 1}{k_1^*} < f'(\bar{K}).$$

Similar arguments show that country 1 imports capital if and only if

$$\frac{f(k_1^*)-1}{k_1^*} > f'(\bar{K}).$$

(iv) Proof of Lemma 4.

Capital import by country 1 changes the world surplus as

$$\frac{\partial(W_1+W_2)}{\partial K_1} = \frac{f(k_1^*)-1}{k_1^*} - f'(2\bar{K}-K_1).$$

Evaluating this at $K_1=\bar{K}$, we have

$$\left.\frac{\partial(W_1+W_2)}{\partial K_1}\right|_{K_1=\bar{K}} = \frac{f(k_1^*)-1}{k_1^*} - f'(\bar{K}),$$

which gives the lemma.

(v) Proof of Lemma 5.

$f'(K_2^\mu) = f'(k_2^\mu) = f'(k_1^*) - \tau_1^\mu > f'(k_1^*) = f'(k_2^*) = f'(K_2^m)$. This yields $K_2^\mu < K_2^m$ and hence $K_1^\mu > K_1^m$. Moreover, we have $L_1^\mu = K_1^\mu/k_1^* > K_1^m/k_1^* = L_1^m$.

Appendix B: Proof of Proposition 1.

From $w_1^* > 1$ and $L_1^m < L_1^a$ in (12), we get that country 1 loses from the lifting of the curbs since $W_1^m - W_1^a = (w_1^*-1)(L_1^m - L_1^a) < 0$. By contrast, country 2 gains since

$$\begin{aligned} W_2^m - W_2^a &= (r^m - r_2^a)\bar{K} + w_2^m - w_2^a \\ &= K_2^a\left(f'(K_2^m) - f'(K_2^a)\right) + f(K_2^m) - K_2^m f'(K_2^m) - f(K_2^a) + K_2^a f'(K_2^a) \\ &= f(K_2^m) - f(K_2^a) - (K_2^m - K_2^a) f'(K_2^m) > 0, \end{aligned}$$

where $K_2^m > K_2^a$ from (17). The last inequality comes from the assumption that $f''(\cdot) < 0$.

Appendix C: Proof of Proposition 2.

Simple comparison yields

$$\begin{aligned} W_1^m - W_1^a + W_2^m - W_2^a = \left(f(k_1^m) - k_1^m f'(k_1^m) - 1\right)\left(\frac{K_1^m}{k_1^m} - \frac{\bar{K}}{k_1^a}\right) \\ + f(K_2^m) - f(K_2^a) - (K_2^m - K_2^a) f'(K_2^m). \end{aligned}$$

Using the results that $k_1^m = k_1^a = k_1^* = k_2^m = K_2^m$, $K_1^m = 2\bar{K} - K_2^m$, and $K_2^a = \bar{K}$, we obtain

$$W_1^m - W_1^a + W_2^m - W_2^a = \bar{K}\left(\frac{f(k_1^*) - 1}{k_1^*} - \frac{f(\bar{K}) - 1}{\bar{K}}\right). \tag{19}$$

Moreover, we can see that

$$\begin{aligned}
&\mathbf{sgn}\left[\frac{d}{dk}\left(\frac{f(k)-1}{k}\right)\right] = \mathbf{sgn}\left[1 - f(k) + kf'(k)\right], \\
&\frac{d\left(1 - f(k) + kf'(k)\right)}{dk} = kf''(k) < 0,
\end{aligned}$$

which implies that

$$1 - f(k_1^*) + k_1^* f'(k_1^*) < 1 - f(\bar{K}) + \bar{K}f'(\bar{K}).$$

From the assumption that the workers in country 2 under autarky have an incentive to be employed ($f(\bar{K}) - \bar{K}f'(\bar{K}) > 1$), we have

$$\frac{d}{dk}\left(\frac{f(k)-1}{k}\right) < 0, \forall k > \bar{K}. \tag{20}$$

From (19) and (20), we have $W_1^m + W_2^m - (W_1^a + W_2^a) < 0$.

Appendix D: Policy effects on equilibrium values

We now derive the equations representing the policy effects on the equilibrium values used in Subsection 4.2. Total differentiation of (2) gives

$$\begin{pmatrix} -1 & 0 \\ -1 & f''(k_2) \end{pmatrix} \begin{pmatrix} dr \\ dk_2 \end{pmatrix} = \begin{pmatrix} d\tau_1 \\ d\tau_2 \end{pmatrix}.$$

After some manipulations, we have

$$\frac{\partial r}{\partial \tau_1} = -1 \text{ and } \frac{\partial r}{\partial \tau_2} = 0 \tag{21}$$

$$\frac{\partial k_1^*}{\partial \tau_1} = \frac{\partial k_1^*}{\partial \tau_2} = 0, \ \frac{\partial k_2}{\partial \tau_1} = -\frac{1}{f''(k_2)} > 0, \text{ and } \frac{\partial k_2}{\partial \tau_2} = \frac{1}{f''(k_2)} < 0. \tag{22}$$

Equations (3) and (22) give

$$\frac{\partial w_1^*}{\partial \tau_1} = \frac{\partial w_1^*}{\partial \tau_2} = 0, \ \frac{\partial w_2}{\partial \tau_1} = k_2 > 0, \text{ and } \frac{\partial w_2}{\partial \tau_2} = -k_2 < 0. \tag{23}$$

Since $k_2 = K_2$ and $K_1 + K_2 = \bar{K}$, we have

$$\frac{\partial K_1}{\partial \tau_1} = -\frac{\partial K_2}{\partial \tau_1} < 0 \text{ and } \frac{\partial K_2}{\partial \tau_1} = \frac{\partial k_2}{\partial \tau_1} > 0, \tag{24}$$

$$\frac{\partial K_1}{\partial \tau_2} = -\frac{\partial K_2}{\partial \tau_2} > 0 \text{ and } \frac{\partial K_2}{\partial \tau_2} = \frac{\partial k_2}{\partial \tau_2} < 0. \tag{25}$$

Furthermore, as $L_1 = K_1/k_1$, we have

$$\frac{\partial L_1}{\partial \tau_1} = -\frac{1}{k_1^*}\frac{\partial K_2}{\partial \tau_1} < 0 \text{ and } \frac{\partial L_1}{\partial \tau_2} = -\frac{1}{k_1^*}\frac{\partial K_2}{\partial \tau_2} > 0. \tag{26}$$

Appendix E: Proof of Proposition 3.

Suppose that $\tau_1^\mu \geq 0$. Equation (15) implies that $\bar{K} < K_1^\mu$ because we have $f'' < 0$. From $K_1^\mu = 2\bar{K} - K_2^\mu$, we obtain $K_2^\mu < \bar{K} < k_1^*$. Capital mobility requires that $f'(k_1^*) - \tau_1 = f'(k_2^\mu) = f'(K_2^\mu) > f'(\bar{K}) > f'(k_1^*)$. This implies that $\tau_1^\mu < 0$, which is a contradiction.

Appendix F: Proof of Proposition 4.

In autarky, we have

$$\begin{aligned}
W_1^a &= f'(k_1^*)\bar{K} + (f(k_1^*) - k_1^* f'(k_1^*))L_1^a + 1 - L_1^a \\
&= f'(k_1^*)\bar{K} + \frac{f(k_1^*)\bar{K}}{k_1^*} - f'(k_1^*)\bar{K} + 1 - \frac{\bar{K}}{k_1^*}, \\
W_2^a &= f'(\bar{K})\bar{K} + f(\bar{K}) - \bar{K}f'(\bar{K}) = f(\bar{K}).
\end{aligned}$$

Assume $K_1^\mu > \bar{K} > K_2^\mu$. Then, in the integrated market with active governments, we have

$$\begin{aligned}
W_1^\mu &= f'(k_1^*)\bar{K} + (f(k_1^*) - k_1^* f'(k_1^*))L_1^\mu + 1 - L_1^\mu + \tau_1^\mu(K_1^\mu - \bar{K}) \\
&= f'(k_1^*)\bar{K} + \frac{f(k_1^*)K_1^\mu}{k_1^*} - f'(k_1^*)K_1^\mu + 1 - \frac{K_1^\mu}{k_1^*} + \tau_1^\mu(K_1^\mu - \bar{K}), \\
W_2^\mu &= f'(K_2^\mu)K_2^\mu + f(K_2^\mu) - f'(K_2^\mu)K_2^\mu + (f'(k_1^*) - \tau_1^\mu)(K_1^\mu - \bar{K}) \\
&= f(K_2^\mu) + f'(K_2^\mu)(\bar{K} - K_2^\mu).
\end{aligned}$$

The comparison gives

$$W_1^\mu - W_1^a = \left(\frac{f(k_1^*)}{k_1^*} - f'(k_1^*)\right)(K_1^\mu - \bar{K}) + \frac{\bar{K} - K_1^\mu}{k_1^*} + \tau_1^\mu(K_1^\mu - \bar{K}).$$

Substituting (15) and using (6), we have $W_1^\mu - W_1^a = -f''(k_1^*)\left(\bar{K} - K_1^\mu\right)^2 \geq 0$.

Furthermore, the comparison of W_2^μ and W_2^a gives

$$W_2^\mu - W_2^a = f(K_2^\mu) - f(\bar{K}) + f'(K_2^\mu)(\bar{K} - K_2^\mu).$$

Combined with the concavity of $f(\cdot)$, $W_2^\mu - W_2^a$ takes a non-negative value, from which we find that the market integration benefits country 2.[14]

When $K_1^\mu < \bar{K} < K_2^\mu$, a similar procedure can be applied, which leads to Proposition 4.

Appendix G: Proof of Proposition 5.

From (17) and $K_1^m + K_2^m = 2\bar{K}$, we have $K_1^m < \bar{K}$. In addition, $K_2^\mu < K_2^m$ from Lemma 5. Thus, the simple comparison of welfare levels yields

$$\begin{aligned} W_1^\mu - W_1^m &= \tau_1 \left(K_1^\mu - \bar{K}\right) + (w_1^* - 1)\left(L_1^\mu - L_1^m\right) \\ &= -f''(k_1^*)\left(\bar{K} - K_1^\mu\right)^2 + (w_1^* - 1)L_1^m \left(\frac{\bar{K}}{K_1^m} - 1\right) > 0, \end{aligned}$$

which proves the former result. The welfare comparison in country 2 gives

$$W_2^\mu - W_2^m = \bar{K}[f'(K_2^\mu) - f'(K_2^m)] + f(K_2^\mu) - K_2^\mu f'(K_2^\mu) - f(K_2^m) + K_2^m f'(K_2^m).$$

If country 2 imports capital under tax/subsidy game ($K_2^\mu \geq \bar{K}$), we have

$$\begin{aligned} W_2^\mu - W_2^m &\leq K_2^\mu[f'(K_2^\mu) - f'(K_2^m)] + f(K_2^\mu) - K_2^\mu f'(K_2^\mu) - f(K_2^m) + K_2^m f'(K_2^m) \\ &= f(K_2^\mu) - f(K_2^m) - f'(K_2^m)(K_2^\mu - K_2^m) < 0, \end{aligned}$$

where the last inequality comes from the concavity of $f(\cdot)$. If country 2 exports capital, the welfare effect of the tax game is ambiguous for country 2.

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[14] Assume that $K_2^\mu > \bar{K}$ holds in equilibrium. Then, $f(K_2^\mu) - f(\bar{K}) > 0$ and $f'(K_2^\mu)(K_2^\mu - \bar{K}) > 0$. Because of the concavity of $f(\cdot)$, $f(K_2^\mu) - f(\bar{K})$ is greater than $f'(K_2^\mu)(K_2^\mu - \bar{K})$, which results in $W_2^\mu > W_2^a$. Correspondingly, when $K_2^\mu < \bar{K}$ is assumed in equilibrium, $f(K_2^\mu) - f(\bar{K}) < 0$ and $f'(K_2^\mu)(K_2^\mu - \bar{K}) < 0$ hold. As $f(\cdot)$ is concave, the latter is greater than the former in terms of the absolute value. Thus, $W_2^\mu > W_2^a$.

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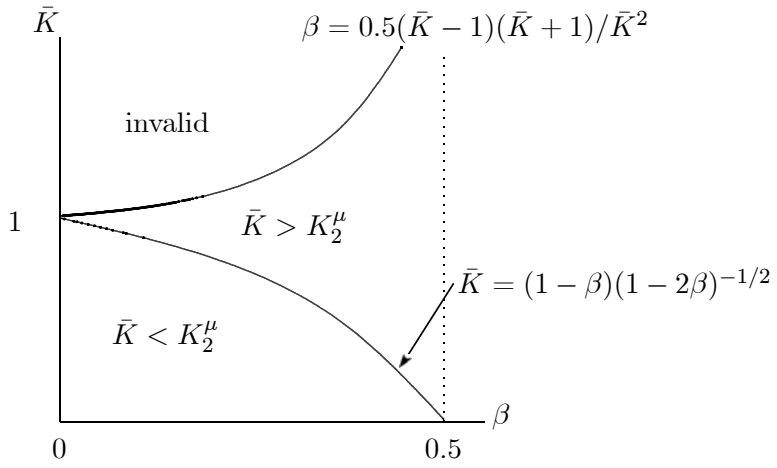

Figure 1. Capital flow in the integrated market with active governments.