Section 2
International Factor Movement - The Host Country

1 Introduction

This and the following two sections examine various issues related to international capital movement, including the causes and effects of capital movement and some policies that the governments of relevant countries can consider. Before we present the analysis, it is necessary to describe some of the features of the analysis.

First, we examine movement of physical capital, which is often called direct investment. Portfolio investment, however, is not considered. In other words, the analysis looks at physical capital that plays the role of a factor of production that affects production and thus income of an economy. As a result, international capital movement could affect consumption, welfare, and other variables such as employment level. Second, for simplicity, the analysis presented in these sections considers movements of capital only, while international labor migration and international trade in goods are not allowed. This of course is not what is happening in reality for most of the countries. The approach taken in these sections is to consider this simple framework so that the direct effect of capital movement can be derived. If trade in goods and labor migration are also allowed, they will generate indirect effects, but these indirect effects depend very much on the properties of the economies involved, and are more difficult to examine. In some later sections, more complete frameworks will be considered in order to derive the direct and indirect effects of capital movement in some cases.

Third, even though trade in goods is not considered in this and the following two sectors, flow of goods across countries is still expected: They represent the remittance of the earnings of the investors with their capital working in another country.

Fourth, some of the analysis and results provided below can be extended to the case of international labor migration. However, there are some important differences between capital movement and labor migration, which require new analysis. These differences and the analysis about labor migration will be given later.

This section focuses on the host country that receives foreign capital from another country. The case of the source country will be considered in the next section. Another section will focus on the case of multinational corporations, which have operations in more than one countries. This means that the analysis is not just about the movement of factors of production. It is also about the activities of firms that have certain monopoly power in either or both countries.
2  A One-Sector Model

A simple model is now introduced for the analysis presented below. Consider an economy that satisfies the following assumptions. (a) All sectors in the economy can be grouped into one composite sector with a homogeneous output. (b) There is a well-behaved aggregate production function, with two factors, labor and capital, used to produce the output. (c) The economy is endowed with given amounts of labor \( (\bar{L}) \) and capital \( (\bar{K}) \). (d) The economy has a large number of identical, perfectly competitive firms. (e) Both factors can flow freely, costlessly, and instantaneously within the economy. This implies that in equilibrium all firms pay the same wage rate to the workers and the same rental rate to the capital. (f) Prices are flexible. This implies that in equilibrium all factors are fully employed, with the prices adjusting to clear all markets. The assumption of price flexibility will be dropped later when issues related to unemployment are considered.

Denote the production function of the sector by

\[
Y = F(L, K)
\]

where \( Y \) is the output, and \( L \) and \( K \) are labor and capital inputs, respectively. The marginal products of labor and capital are

\[
MP_L = \frac{\partial F}{\partial L}
\]

\[
MP_K = \frac{\partial F}{\partial K}.
\]

Cost minimization by firms implies that factors are employed up to the point at which the price of a factor is equal to the value of marginal product of the factor. Since there is only one sector, we can set the price of the good to be unity. Thus, the cost minimization conditions are

\[
w = MP_L
\]

\[
r = MP_K.
\]

where \( w \) is the wage rate and \( r \) is the rental rate of capital. The total cost is \( C = wL + rK \), while the revenue is \( Y \), as the price of output is set to unity. Perfect competition implies zero profit, i.e.,

\[
Y = wL + rK.
\]

1 A well-behaved production function is concave, and has positive but declining marginal product of each of the factors.

2 The production function is assumed to be concave, and to have positive but declining marginal products. Differentiability is assumed for simplicity.

3 These are partial derivatives, which mean that when evaluating the marginal product of labor, for example, the quantity of the other factor, capital, is held constant.

4 Another way of saying this is that the output is chosen as a numeraire, with all prices expressed in terms of the price of the output.
This output level represents the (real) gross domestic product (GDP) of the economy. For the time being, no international factor movement has been considered. So, it is also equal to the economy’s gross national product (GNP).\(^5\)

## 3 The Autarkic Equilibrium

For the time being, assumed that the economy is closed, with no international factor movement. This implies that factor inputs in the production process are equal to the factor endowments. The resulting output is \(Y^a = F(\bar{L}, \bar{K})\). From (3), the autarkic wage rate \(w^a\) (or the autarkic rental rate \(r^a\)) is equal to the marginal product of labor (capital) when given the labor and capital endowments. Equation (4) gives \(Y^a = w^a\bar{L} + r^a\bar{K}\).

![Figure 2.1](image)

The autarkic equilibrium variables can be derived graphically. Figure 2.1 shows the marginal-product-of-capital curve labeled \(MP_K\), when given the labor endowment. By the Law of Diminishing Returns, the curve is assumed to be downward sloping. By (3b), when taking the rental rate as given, firms hire capital up to the point at which the rental rate is equal to \(MP_K\). Thus, equation (3b) or the curve in Figure 2.1 can be regarded as the demand for capital, which represents the amount of capital the firms want to hire when given a rental rate. The supply of capital can be represented by a vertical line passing through the value of capital, \(\bar{K}\). The intersection between the demand and supply curves, point B, denotes the autarkic equilibrium, which gives the corresponding autarkic rental rate, \(r^a\).

The diagram can be used to derive the autarkic values of other variables. From the definition of marginal product, the area below the marginal-product curve is the

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\(^5\)Assuming no capital depreciation, gross domestic (national) product is the same as the net domestic (national) product.
output, i.e., the output under autarky, \( Y^a \), is equal to area ABCO.\(^6\) The total payment to capital, \( r^a K \), is equal to area BCOD. By equation (4), the payment to labor is equal to \( w^a L = Y^a - r^a K \), which is equal to area ABD. This implies that graphically the autarkic wage rate is given by

\[
w^a = \frac{\text{area ABD}}{L}.
\]

As pointed out, in the absence of factor movement, the economy’s gross national product (GNP) is the same as its GDP. Since the GNP of the economy is the sum of the income of national factors, it represents the welfare of the economy, \( W \).\(^7\) The autarkic welfare level is then equal to

\[
W^a = GNP^a = GDP^a = w^a L + r^a K.
\]

Graphically, the autarkic welfare is equal to area ABCO.

### 4 Capital Inflow

We are now ready to analyze the effects of capital inflow and the optimal policy. Suppose that there are two countries, labeled Home and Foreign, which have similar production structures (but not necessarily the same production function). Denote the autarkic rental rates of capital in Home and in Foreign by \( r^a \) and \( r^* \), respectively, and assume that \( r^a > r^* \). This implies that when capital is allowed to move internationally, it tends to flow from Foreign to Home.

Suppose that a certain amount of Foreign capital comes to Home. The owners of the capital do not move with capital, but remit the earnings received (net any possible taxes) in Home back to Foreign. For the time being, assume that both governments do not impose any taxes on the earnings and remittance. More specifically, Foreign capital earns market rental rate in the Home country, and the earnings will be remitted out of the economy.

If Foreign capital is allowed to come to Home freely and costlessly, Foreign capital will continue to come until the rental rates in both countries are equalized. Denote the amount of Foreign capital that has moved by \( k^* \), and let the rental rates in Home and Foreign be \( r^f \) and \( r^* \), respectively. Rental rate equalization means that \( r^f = r^* \). If a smaller amount of Foreign capital \( k^* < k^* \) is allowed to move to Home, the rental rate will not be equalized, \( r > r^* \).

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\(^6\) We assume that no output is produced when there is no capital in the economy.

\(^7\) The social (indirect) utility of the economy can be expressed as a function of its income and prices. In the present framework, prices are fixed. So, social utility or welfare is positively dependent on national income.
5 Effects of An Exogenous Capital Inflow

For Home, the host country, the capital inflow changes the amount of capital in the economy, and the factor inputs in the production process are

\[ L = \bar{L} \]  \hspace{1cm} (6a)  
\[ K = \bar{K} + k^*. \]  \hspace{1cm} (6b)

Assuming no government intervention, the impacts of the increase in the capital stock on Home can be analyzed as follows. First, the capital inflow will raise the marginal product of labor but lower that of capital. As indicated by condition (3), there will be a rise in the wage rate but a drop in the rental rate. Second, for the Foreign country, the outflow of capital will drive up its rental rate. This implies that the initial movement of capital movement tends to diminish the gap between the rental rates in the two countries. Third, the capital inflow contributes to Home’s output level, GDP.

Fourth, because Foreign capital’s earning in Home, the Home welfare, \( W \), is measured by its GNP, which is equal to

\[ W = GNP = GDP - rk^* = F(L, K) - rk^*. \]  \hspace{1cm} (7)

Substituting equations (6) into (7), we have

\[ W = F(\bar{L}, \bar{K} + k^*) - rk^*. \]  \hspace{1cm} (8)

Note that the rental rate \( r \) depends on the capital stock and thus on \( k^* \). Differentiate the welfare function with respect to \( k^* \) to give

\[ \frac{dW}{dk^*} = MP_K - \frac{d(rk^*)}{dk^*} = r - r - k^* \frac{dr}{dk^*} = -k^* \frac{dr}{dk^*}. \]  \hspace{1cm} (9)

Condition (9) gives the change in Home welfare as a result of an inflow of one unit of Foreign capital. In the condition, \( dr/dk^* < 0 \), i.e., the Home rental rate drops as more Foreign capital flows in. To evaluate the expression in (9), first consider the following special cases:

**Case (a):** \( k^* \approx 0 \) (i.e., a very small amount of \( k^*\))

Equation (9) gives \( dW/dk^* \approx 0 \). This means that a very small amount of foreign capital inflow has negligible welfare effect on the Home country. To understand this result, recall that the contribution to the Home economy of the first unit of capital inflow is equal to the marginal product of capital, but that unit of capital is paid the market rental rate, which is the marginal product of capital. In other words, the capital takes away what it has contributed. So, the Home welfare is left unchanged.
Case (b): $k^*$ is finite. The welfare effect is given by (9). Because $dr/dk^* < 0$, so $dW/dk^* > 0$, i.e., an additional inflow of capital must raise the Home welfare.

Case (b) can be illustrated graphically by Figure 2.2.

The diagram describes the Home capital market. An inflow of capital shifts the supply of capital curve to the right, while the demand-for-capital curve is stationary. The new equilibrium is depicted by E, which represents a drop in the wage rate, $w$.

By equation (5), the autarkic welfare is equal to $W^a = \text{area } (a + b + c)$. The new welfare level, using (7), is $W = \text{area } (a + b + c + d + e) - \text{area } e = \text{area } (a + b + c + d)$. The change in welfare is, $\Delta W = \text{area } d$, which is positive. This welfare gain, can be called the capital-inflow surplus.

That finite capital inflow benefits the Home economy can be explained intuitively. Suppose that there is a finite amount of Foreign capital in the Home economy. (Case (b) examined earlier.) The total contribution to Home’s GDP of this Foreign capital is equal to area $(d + e)$, but the total payment to it is only area $e$. Thus, the economy receives a net amount of $d$. If the amount of Foreign capital is small (case (a)), then area $d$ is very small, meaning that the net welfare effect of a very small amount of capital inflow is negligible. Figure 2.2 also shows that if more capital flows in, the benefit to the Home economy increases.

The above results can be summarized by Figure 2.3, which shows how Home welfare ($W$) depends on the amount of capital inflow ($k^*$). When $k^* = 0$ (i.e., before any inflow of capital), Home has its autarkic welfare level, $W^a$. The welfare effect of capital inflow is illustrated by curve ACB, with its slope representing $dW/dk^*$. The above analysis shows that the slope of the curve when $k^*$ is very small is zero, but it is positive when $k^*$ is finite. Point B corresponds to the amount of free capital movement, $k^{*f}$, which gives equalization of rental rates, $r^f = r^{*f}$. 
6 Optimal Tax Policy

Suppose now that the Home government imposes an income tax on the earning of foreign capital working in Home, while the Foreign government still allows free movement of capital. Denote the income tax per unit of capital by \( t \). In equilibrium, the two rental rates are related by

\[ r = r^* + t, \]  

i.e., the after-tax earning per unit of capital, \( r - t \), in Home is equal to the foregone per-unit earning in Foreign, \( r^* \). The objective of the government is to choose a tax rate that will maximize domestic welfare. Note that because of the negative relation between tax rate and the amount of capital flow, the problem can be stated in terms of maximizing domestic welfare by choosing the amount of capital flow, subject to condition (10).

In the presence of the income tax, the home welfare can be defined as the GDP minus the after-tax payment to foreign capital:

\[
W = F(\bar{L}, \bar{K} + k^*) - rk^* + tk^*
= F(\bar{L}, \bar{K} + k^*) - r^*k^*, \]  

where \( tk^* \) is the tax revenue, and where (10) has been used. Differentiate equation (11) with respect to \( k^* \) to get:

\[
\frac{dW}{dk^*} = r - r^* - k^* \frac{dr^*}{dk^*}. \]  

In general, the sign of the derivative in (12) is ambiguous. Let us consider some special cases:

Case (a): \( k^* \approx 0 \). Then (12) gives \( dW/dk^* \approx r^a - r^{*a} > 0 \). This means that in the presence of the income tax, even a small inflow of foreign capital is beneficial.

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Case (b): $k^* \approx k^{*f}$, i.e., $r \approx r^*$. Condition (12) reduces to $dW/dk^* \approx -k^*(dr^*/dk^*) < 0$, where it is noted that $dr^*/dk^* > 0$. This implies that in terms of Home’s welfare, too much foreign capital has flown in. A small drop in the amount of capital will benefit Home.

![Figure 2.4](image)

Making use of the above results, we can construct curve ADEB in Figure 2.4, which shows how in the presence of an income tax the home welfare is affected by foreign capital inflow. The diagram also shows curve ACB, which represents the change in Home’s welfare without the income tax, as Figure 2.3 shows. Curve ADEB has the following features:

1. Curve ADEB should be entirely above curve ACB, because of the tax revenue, except at point A (when there is no capital movement and thus no tax revenue) and point B (when $r = r^*$ so that the tax revenue is zero).

2. When $k^*$ is small, more capital inflow is better. (case (a))

3. When $k^*$ is close to $k^{*f}$, less capital inflow is better. (case (b))

4. Because of continuity of the curve, there exists a maximum welfare, which can be achieved by an optimal amount of $k^*$, and this optimal capital inflow is positive but less than $k^{*f}$.

We now need to find out the optimal income tax and the resulting maximum welfare. To do that, set $dW/dk^* = 0$. This gives

$$\tilde{r} = \tilde{r}^* + \tilde{k}^* \frac{dr^*}{dk^*},$$

(13)

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8 In other words, as Foreign is losing capital, its rental rate rises.

9 This is what is called the first-order condition. We assume that the second-order condition is satisfied.

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which implies that the optimal income tax is equal to
\[ \tilde{t} = \tilde{r} - \tilde{r}^* = \tilde{k}^s \frac{dr^*}{dk^*} > 0. \]  
Equation (14) implies that the optimal tax is positive (so that a positive subsidy is never optimal). In (13), note that the two rental rates depend on the amount of capital inflow. Thus, the equation contains only one unknown, \( k^* \), and the equation can be solved for the optimal amount of capital inflow, \( \tilde{k}^* \). The above analysis shows that \( \tilde{k}^* \) is positive, but less than \( k^{*f} \). Once the optimal capital inflow is known, the optimal income tax rate can be obtained by using condition (14).

\[ \tilde{r} = r^* + \frac{k^*}{\tilde{k}^*} \frac{dr^*}{dk^*} \]

Figure 2.5

The result derived above suggests that from Home’s point of view, it is good to allow some foreign capital inflow, but a certain income tax can further improve Home’s welfare. The role of the income tax is to extract part of the earning of the investing foreign capital in the home economy.

The use of the income tax by the home government can be compared with the monopsonist case. Refer to Figure 2.5, with curve ACF and curve BDF showing how \( r \) and \( r^* \) are affected by different levels of capital flow, respectively. The two curves intersect at point F, the free-capital-movement point, at which the two rental rates are equal, \( r^f = r^{*f} \). The diagram also shows curve BC, representing \( r^* + k^*(dr^*/dk^*) \), which is analogous to the marginal expense of capital. Because \( r^* \) increases with \( k^* \), curve BC is above curve BDF, except at point B when \( k^* = 0 \). The optimal capital inflow occurs at the intersection point between curve ACF and curve BC, as equation (13) suggests. By equation (14), the gap between curve ACF and curve BC is the optimal income tax rate, \( \tilde{t} \).

The theory of monopsony suggests that to maximize its profit, it tends to under-employ a factor because doing so will suppress the price of the factor. Similarly, in the present case of capital inflow, the home government has an incentive to allow in an
amount of foreign capital less than the free-movement level in order to suppress the payment (after-tax income) to foreign capital. Note that in the present case, the home firms are not able to under-employ foreign capital because they are all price-takers and are not able to exploit the external monopsony power. The home government has to make use of an income tax to induce the local firms to hire less foreign capital.

Note that the argument for using an optimal income tax in the case of capital inflow is analogous to that for using an optimal tariff in the case of import of goods. Both situations involve the inflow of something from Foreign, either product or capital, and both arguments suggest that the home government restricts the inflow of this thing in order to pay less per unit.

We can consider a special case in which Home is a small open economy. In this case, Foreign rental rate will hardly change as capital flows across countries. So, Home takes foreign rental rate $r^*$ as given, implying that $dr^*/dk^* = 0$. The first-order condition (13) reduces to $\tilde{r} = \tilde{r}^*$, implying that the optimal tax rate is zero, $\tilde{t} = 0$: Free capital movement is the optimal policy for a small open economy. This result is analogous to the earlier result that in the case of trade in goods, free trade is the optimal policy for a small open economy.

7 Capital Inflow in the Presence of Unemployment

The analysis so far is based on the assumption of price flexibility, which implies full employment of factors in the economy. There are, however, many countries that are bothered by the presence of unemployment, and foreign capital inflow is regarded as a way to help solve the unemployment problem. To analyze unemployment, the assumption of price flexibility is now dropped. The straight-forward way of modelling unemployment is to assume that the wage rate is downward rigid.\(^{10}\) To see this point, suppose that the prevailing wage rate is higher than the equilibrium level. If the wage rate resists to fall, an excess supply of labor appears. This is unemployment of labor, and the unemployment generally is bigger the higher the prevailing wage rate is.

Wage rigidity and unemployment can be illustrated by Figure 2.6, which describes the labor market. The diagram shows the marginal-product-of-labor curve AFD when given the capital endowment of the economy (before any inflow of foreign capital). This curve is interpreted as the (derived) demand curve of labor and, by the Law of Diminishing Returns, is downward sloping. (Forget about curve GEH for the time being.) The supply-of-labor curve is the vertical line passing through the point on the horizontal axis at which $L = \bar{L}$.

If the wage rate is flexible, the autarkic equilibrium is at point B, the intersecting point between the demand and supply curves. The autarkic wage rate is equal to

\(^{10}\)One common reason for wage downward rigidity is that firms have contracts with labor unions about the wage rates in a certain period of time. While the wage rates are downward rigid, it will be more acceptable to have a rise in the wage rates.
Suppose now that for some reasons the wage rate in the economy is equal to $\bar{w}$, which is higher than $w^a$. As shown in the diagram, firms’ demand for labor at this wage rate is only $L'$. The resulting excess supply, $\bar{L} - L'$, is the unemployment level.

Foreign capital inflow increases the demand for labor, shifting the $MP_L$ curve to the right: Unemployment of labor drops. Assume that the wage rate is not affected by capital inflow and that a sufficient amount of foreign capital, denoted by $\hat{k}^*$, moves in, shifting the $MP_L$ curve to GEH in Figure 2.6. This labor-demand curve cuts the labor-supply curve at point E, yielding a market wage rate of $\bar{w}$. In other words, the excess supply of labor at this wage rate is zero, implying no unemployment.

The welfare impact of capital inflow in the presence of unemployment can be
derived using Figure 2.7, which shows the capital market. Under autarky, labor unemployment exists and the labor employment is only $L'$. With this labor input, the marginal product of capital is illustrated by curve AEB. As explained, capital inflow at the prevailing downward-rigid wage rate $\bar{w}$ improves labor employment. This in turn raises the marginal product of capital at any given level of capital, meaning that the curve shifts up and to the right. The amount of foreign capital inflow that eliminates unemployment is denoted by $\hat{k}^*$. The corresponding equilibrium occurs at F, at which the new capital-demand curve CFD cuts the vertical capital-supply line corresponding to the new capital stock, $\bar{K} + \hat{k}^*$. The equilibrium point F has one very important property. As $\hat{k}^*$ units of foreign capital come in, the wage rate remains unchanged. Since the production function is assumed to be linearly homogeneous, the marginal products of factors depend only on the capital-labor ratio. This means that as foreign capital comes in, the capital-labor ratio remains unchanged. This further implies that the rental rate does not change. Thus, point F gives a rental rate the same as the autarkic rate.

To determine the welfare implication of an inflow of $\hat{k}^*$ units of foreign capital when unemployment initially exists, refer again to Figure 2.7. The autarkic welfare $W^a$ (GDP and GNP) is represented by the area below the initial $MP_K$ curve AEB from $K = 0$ to $K = \bar{K}$, and is equal to area $(a + b)$, i.e., $W^a = \text{area } (a + b)$. In the presence of the foreign capital inflow, the new GDP is area $(a + b + c + d + e + f)$. Since the payment to foreign capital is area $(e + f)$, the new welfare, or GNP, of Home is $W = GDP - r^a \hat{k}^* = \text{area } (a + b + c + d)$. Therefore, the change in the welfare level is

$$\Delta W = W - W^a = \text{area } (c + d) > 0. \quad (15)$$

The welfare gain has two components: area $c$ and area $d$. Area $d$ is the usual capital-inflow surplus analyzed above. Area $c$ represents the additional welfare gain caused by a drop in or removal of unemployment in the economy.

If the amount of foreign capital inflow is greater than $\hat{k}^*$, then since the wage rate is upward flexible, there is no labor market imbalance. Therefore, the analysis presented earlier can be applied.