

Federal Reserve Bank of Minneapolis
Research Department

Transition to FDI Openness*

Ellen R. McGrattan

Working Paper 671

April 2009

ABSTRACT

Empirical studies quantifying the benefits of increased foreign direct investment (FDI) have been unable to provide conclusive evidence of a positive impact on host country's economic performance. I show that the lack of robust evidence is not inconsistent with theory, even if the eventual gains to FDI are large, if restrictions on FDI are lifted only gradually and part of FDI is intangible investment. Anticipation of future increases in FDI can result in large shifts in patterns of domestic investment and employment. Furthermore, since intangible investments are expensed, both gross domestic product (GDP) and gross national product (GNP) are low during periods of abnormally high FDI investment.

*McGrattan: Federal Reserve Bank of Minneapolis and University of Minnesota. I want to thank seminar participants at the LSE and the European University Institute for their comments on an earlier draft. The views expressed herein are those of the author and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

1. Introduction

Empirical studies quantifying the benefits of increased foreign direct investment (FDI) have been unable to provide conclusive evidence of a positive impact on host country's economic performance. Kose et al. (2006) provide a survey of eleven empirical studies and report that only one finds a positive link between FDI and growth in per capita GDP. Critics of capital account liberalizations have used the empirical results to argue that lower restrictions on capital movements provide little benefits but could generate significant volatility in developing economies.

This paper reconsiders the empirical findings in light of the theory of McGrattan and Prescott (2008, 2009) which predicts large gains to FDI openness, especially for small countries integrating with larger countries or with a union of other countries. Specifically, I derive the properties of equilibrium paths for a multicountry general equilibrium model following the announcement of lower restrictions on FDI at a specified future date. Countries in this analysis are assumed to differ only in size, where size depends not only on a country's population but also on its level of technology. A country is small if it has few people or a low level of technology or both.

Of particular interest is the path of a small country that commits to a policy of lowering restrictions on FDI. In the model I analyze, if there is a gradual lowering of the restrictions, the paths of per capita GDP and employment fall below historical trends and do not recover until barriers have fallen sufficiently. This occurs because households immediately raise consumption and leisure in response to higher permanent income.

A second factor affecting the path of GDP is intangible investment that is expensed and therefore not counted in gross product. When multinationals make intangible investments in subsidiaries abroad, the host country's profits are lower and their GDP is lower.

Theory predicts that these investments are abnormally high as barriers to FDI are lifted, implying a negative correlation between FDI investment and host country GDP.

To demonstrate that the changes in GDP and other key macroeconomic aggregates are large for plausible parameterizations, I take the benchmark parameters from McGrattan and Prescott (2009) who use a version of the same model to study the U.S. current account. With the parameterized model, I compute equilibrium paths and the impact of an anticipated liberalization of FDI restrictions. At first, I assume, in the absence of restrictions on FDI, that asset markets are complete and countries differ only in size. In this case, households in the small country increase their consumption and leisure by borrowing from abroad as soon as the government announces its intention to lower FDI restrictions in the future. The lower restrictions imply a higher effective level of total factor productivity (TFP). I then compare the equilibrium of the complete-market case to one in which the capital restrictions are imposed on both FDI and portfolio investment.¹

If there are no restrictions on portfolio investments, I find that the GDP per capita of a country committing to join a union ten times bigger in size falls to roughly 55 to 75 percent of its pre-liberalized level, with the value depending on the delay between policy announcement and policy change. GDP is lowest when FDI investment surges. For the parameterized model, this investment rises to between 30 and 40 percent of output in the small country. Once the policy is implemented and barriers are lowered, GDP per capita is higher than the historical level by about 30 percent. If I assume the union is bigger or the degree of openness reaches a level above a level consistent with U.S. data, then the changes in GDP are even more dramatic.

If there are restrictions on portfolio investments that are relaxed after countries open

¹ Most of the theoretical literature on capital account liberalization focuses on portfolio investment and the integration of countries with different financial systems at different stages of financial development. Recent examples include Caballero et al. (2008), Mendoza et al. (2006), and Aoki et al. (2006).

to foreign FDI investment, the transitional patterns change but the main conclusions to be drawn do not. Consumption in the small country rises gradually prior to the lifting of capital controls and then jumps once the policy change takes place. When this happens, GDP is roughly 75 percent of its pre-liberalized level. As in the case with no portfolio restrictions, FDI investment is negatively correlated with GDP because the small country is making large intangible investments. Thus, care must be taken when studying worldwide capital flows that appear to be flowing in the wrong direction.²

The goal of the paper is to better understand why empirical studies do not find evidence of the benefits of financial integration. If I were to apply the standard empirical analysis to the data generated from the model studied here, I too would conclude that lower restrictions on capital movements provide few benefits. In contrast to Gourinchas and Jeanne (2006), the failure to find benefits is not due to the fact that the theoretical gains to openness are small; the potential gains to openness are large in the model I analyze. The failure to find benefits using standard analysis is due to how we measure the performance of developing economies. A fall in per-capita GDP or measured total factor productivity (TFP) is not necessarily indicative of the actual performance of the economy.

Section 2 lays out a model which has a central role for FDI. Section 3 is a set of propositions about the pattern of transition of a small country joining a larger financially integrated union. In Section 3, I also demonstrate that the shifts in aggregate activity are large for plausible parameterizations of the model. Section 4 concludes.

² Using international accounts for the period 1980–2000, Gourinchas and Jeanne (2008) show that countries with lower GDP and TFP growth receive most of the capital inflows, which is inconsistent with the neoclassical growth model. Here, I show that this finding is not inconsistent with the neoclassical growth model extended to include intangible capital.

2. Model

In this section, I describe a version of the multicountry general equilibrium model of McGrattan and Prescott (2009).³ I first describe the technologies available to multinationals and then the problems faced by households in the different countries.

2.1. Multinationals

Multinationals from country j operating in country i produce output Y_{it}^j at time t ,

$$Y_{it}^j = A_{it}\sigma_{it} \left(N_{it}M_t^j\right)^\phi \left(Z_{it}^j\right)^{1-\phi},$$

with *technology capital* M_t^j and a composite of country-specific inputs denoted by Z_{it}^j .⁴ Technology capital is accumulated know-how from investments in R&D, brands, and organizational capital that can be used in as many locations as firms choose, both at home and abroad. The total number of locations available in country i at time t is N_{it} and firms take this as given in solving their optimization problem. Since technology capital can be used simultaneously in multiple locations, it is not indexed by i . The span of control of this organizational capital is limited due to the fact that countries are assumed to have a fixed number of production locations.

Country i 's technology level in t is denoted by A_{it} . For countries incorporated outside i , the effective technology level if they operate in i is $A_i\sigma_i$, where σ_i is the degree of openness of country i to foreign direct investment. A value for σ_i of 1 implies that the country is totally open—so domestic and foreign firms have the same opportunities. A value of less than 1 implies that domestic and foreign firms are not treated equally. In particular, there are costs to foreign firms, and these costs have the same effect as if they had lower TFP than domestic firms.

³ I do not distinguish between equity and debt portfolio income of households, I use constant tax rates, and I abstract from nonbusiness activity.

⁴ See McGrattan and Prescott (2008) for a micro-foundation of this aggregate production function.

The composite capital-labor input in country i is modeled as a Cobb-Douglas technology,

$$Z_i^j = \left(K_{T,i}^j\right)^{\alpha_T} \left(K_{I,i}^j\right)^{\alpha_I} \left(L_i^j\right)^{1-\alpha_T-\alpha_I} \quad (2.1)$$

with inputs of tangible capital, $K_{T,i}^j$, plant-specific intangible capital, $K_{I,i}^j$, and labor L_i^j . This specification of technology implies that multinationals use two types of intangible capital, one that is plant-specific and one that is not.

The stand-in multinational from j maximizes the present value of the stream of after-tax dividends:

$$\max (1 - \tau_d) \sum_t p_t D_t^j, \quad (2.2)$$

where dividends are the sum of dividends across all operations in all countries indexed by i and are given by $D_t^j = \sum_i D_{it}^j$ with

$$D_{it}^j = (1 - \tau_{pi}) \left(Y_{it}^j - W_{it} L_{it}^j - \delta_T K_{T,it}^j - X_{I,it}^j - \chi_i^j X_{M,t}^j \right) - K_{T,i,t+1}^j + K_{T,it}^j, \quad (2.3)$$

$\chi_i^j = 1$ if $i = j$ and 0 otherwise, $X_{I,i}^j$ is investment in plant-specific capital which is split among locations in country i that j operates, and X_M^j is the technology capital investment of multinational j used in all locations in which j operates.⁵ The multinational takes as given sequences of prices p_t and wages W_{it} . The same wage rate is paid by all multinationals operating in i .

Dividends for j are equal to worldwide after-tax profits less net investment of tangible capital, $\sum_i (K_{T,i,t+1}^j - K_{T,it}^j)$. Taxable profits are equal to sales less expenses, where the expenses are wage payments, tangible depreciation, and expensed investments on plant-specific intangible capital and technology capital. Taxable profits in country i are taxed at rate τ_{pi} . The capital stocks of the multinational next period are given by

$$K_{T,i,t+1}^j = (1 - \delta_T) K_{T,it}^j + X_{T,it}^j$$

⁵ McGrattan and Prescott (2009) assume that all dividends are taxed at the same rate. If not, one has to account for clientele effects.

$$K_{I,i,t+1}^j = (1 - \delta_I) K_{I,it}^j + X_{I,it}^j$$

$$M_{t+1}^j = (1 - \delta_M) M_t^j + X_{M,t}^j.$$

2.2. Households

In each period t , households in i choose how much to consume C_{it} , how much total labor to supply L_{it} , and how much to borrow from abroad, $B_{i,t+1} - B_{i,t}$. Without loss of generality, I assume that households in i own all of the equity shares of multinational firms incorporated in i and thus foreign borrowing and lending residually determines their net portfolio income. The maximization problem for the stand-in household is

$$\max_{\{C_{it}, L_{it}, B_{i,t+1}\}} \sum_t \beta^t N_{it} [\log(C_{it}/N_{it}) + \psi \log(1 - L_{it}/N_{it})]$$

subject to

$$\sum_t p_t [C_{it} + B_{i,t+1} - B_{it}] \leq \sum_t p_t [(1 - \tau_{li}) W_{it} L_{it} + (1 - \tau_d) D_t^i + r_{bt} B_{it} + \kappa_{it}],$$

where the total population in i is assumed to be proportional to the total number of locations N_{it} . Without loss of generality I assume a constant of proportionality of 1 between the number of people and the number of production locations within a country. Households take the sequence of returns on portfolio income, r_{bt} , wage rates W_{it} , prices, p_t , and government transfers, κ_{it} , as given. Labor is not mobile across countries, but can be supplied to domestic or foreign companies. Taxes are levied on labor at rate τ_{li} and dividends at rate τ_d .⁶

⁶ Given taxes are constant, I combine taxes on consumption and labor into the labor wedge τ_{li} .

2.3. Competitive Equilibrium

The competitive equilibrium is defined as a set of prices $\{p_t, r_{bt}, W_{it}\}$ and quantities $\{D_{it}^j, Y_{it}^j, K_{T,it}^j, K_{I,it}^j, M_t^j, L_{it}^j, L_{it}, C_{it}, B_{it}, X_{T,it}^j, X_{I,it}^j, X_{Mt}^j\}$, that are consistent with the maximization problems of multinationals and households. In addition, markets must clear. The market clearing condition for the labor market in each country i is

$$\sum_j L_{it}^j = L_{it}.$$

The market clearing condition for financial assets is

$$\sum_i B_{it} = 0.$$

The market clearing condition for goods is

$$\sum_i \left\{ C_{it} + \sum_j \left(X_{T,it}^j + X_{I,it}^j \right) + X_{M,t}^i \right\} = \sum_{i,j} Y_{it}^j$$

These conditions along with household budget constraints above imply that government transfers in country i satisfy

$$\kappa_{it} = \tau_{li} W_{it} L_{it} + \tau_d D_t^i + \tau_{pi} \left\{ \sum_j \left(Y_{it}^j - \delta_T K_{T,it}^j - X_{I,it}^j \right) - W_{it} L_{it} - X_{M,t}^i \right\}.$$

Before deriving properties of the competitive equilibrium, I need to describe how to construct national accounting statistics for the model which are the inputs in the empirical studies surveyed by Kose et al. (2006).

2.4. Accounting Measures

In this section, I describe how to construct the relevant accounting measures for the model.

Gross domestic product (GDP) for country i at date t is given by

$$\text{GDP}_{it} = C_{it} + \sum_j X_{T,it}^j + NX_{it}, \quad (2.4)$$

where NX_i is net exports of goods and services by country i . Consumption and investment include both private and public expenditures. Intangible investments are expensed and therefore are not included in the measure of GDP. In other words, GDP is not a measure of total output.

To see this, consider a second way of calculating GDP, namely to add up all domestic incomes. Specifically, if we sum up compensation of households ($W_i L_i$), total before-tax profits of businesses operating in i , ($Y_i - W_i L_i - \sum_j (\delta_T K_{T,i}^j + X_{I,i}^j) - X_M^i$), and tangible depreciation ($\sum_j \delta_T K_{T,i}^j$), we have GDP from the income side:

$$\text{GDP}_{it} = Y_{it} - X_{M,t}^i - \sum_j X_{I,it}^j. \quad (2.5)$$

This has to be equal to product in (2.4). From (2.4) and (2.5), it is easy to calculate net exports as total output produced in country i less the sum of consumption and all investments.

Given that we are interested in measurement, it is worth noting that GDP for country i , as defined in (2.5), is *not* a measure of production of country i in the model economy. In the model economy, total production in country i is Y_i . GDP is lower because some investments are expensed.

Next, consider adding flows to and from other countries. The BEA's measure of gross national product (GNP) is the sum of GDP plus net factor income from abroad. Net factor receipts (NFR) are the sum of FDI income of multinationals and portfolio income of households:⁷

$$\text{NFR}_{it} = \sum_{l \neq i} \{D_{lt}^i + K_{T,l,t+1}^i - K_{T,lt}^i\} + \max(r_{bt} B_{it}, 0). \quad (2.6)$$

⁷ Equity holdings are categorized by the BEA as direct investment when the ownership exceeds 10 percent. Otherwise they are categorized as portfolio income.

Analogously, net factor payments (NFP) from i to the rest of the world are the sum of FDI income of foreign affiliates in i sent back to foreign parents, and portfolio incomes of country i that are sent to investors outside of i :

$$\text{NFP}_{it} = \sum_{l \neq i} \{D_{it}^l + K_{T,i,t+1}^l - K_{T,it}^l\} + \max(-r_{bt} B_{it}, 0). \quad (2.7)$$

Adding net factor income to net exports and to GDP, we have the current account (CA) and GNP, respectively:

$$\text{CA}_{it} = \text{NX}_{it} + \text{NFR}_{it} - \text{NFP}_{it} \quad (2.8)$$

$$\text{GNP}_{it} = \text{GDP}_{it} + \text{NFR}_{it} - \text{NFP}_{it}. \quad (2.9)$$

In the balance of payments, the current account must be equal to the financial account which sums up new acquisitions abroad. For the model, the financial account for country i is

$$\text{FA}_{it} = \sum_{l \neq i} (K_{T,l,t+1}^i - K_{T,lt}^i) - \sum_{l \neq i} (K_{T,i,t+1}^l - K_{T,it}^l) + B_{it+1} - B_{it}, \quad (2.10)$$

where the first term is net FDI investment by multinationals from i abroad, the second term is the (negative) of net new investment by foreigners operating in i , and the third term is new portfolio acquisitions by households from i . Empirical studies report regressions of per capita growth of GDP on FDI investment (or FDI investment relative to some measure of aggregate output), controlling for changes in other variables. The right hand side variable is the second term of (2.10).

3. Equilibrium Paths

In this section, I examine the properties of the equilibrium paths as the degree of openness (σ) changes for a world with two countries. The two countries differ only in their *size*, where size is defined to be $N_{it} A_{it}^{1-(1-\phi)(\alpha_T+\alpha_I)}$ for country i . One interpretation of the exercise is

a small country joining a union of countries that are already financially integrated. The joiner is called “small” if it has few people or a low technology level relative to the union it is joining.

3.1. Qualifying the effects

In this section, I qualify the effects of increased FDI by proving several propositions about the equilibrium paths. Propositions 1–3 assume no restrictions on borrowing and lending and Proposition 4 assumes that $B_{t+1} = 0$ for $t = 1, \dots, t^*$.

In Figure 1, I display the path of the degree of openness that I’ll use for the propositions that follow. I assume it is the same for both countries. The policy σ_{it}^* is announced in $t = 1$, and the restrictions are lifted in $t = t^* + 1$. I’ll assume that $N_{it} = N_i(1 + \gamma_N)^t$ and $A_{it} = A_i(1 + \gamma_A)^t$ for some fixed N_i and A_i . All results will be described in terms of historical trends where γ_N is the common trend growth rate in populations and γ_A is the common trend growth rate in technologies. The historical trend is assumed to be consistent with no borrowing or lending and therefore $B_{i0} = 0$ for the equilibrium described below.

In order to make precise statements about the equilibrium paths, I make two additional assumptions. The first concerns σ_{it} : at $t = 0$, the countries are completely closed to each other’s FDI ($\sigma_{i0} = 0$), and at $t = t^* + 1$, σ_{it}^* is high enough so that the small country does not find it optimal to make any further expenditures in technology capital ($X_{M,t}^i = 0$ for $t > t^*$ with i indexing the small country).⁸ The second assumption is that foreign households receive a very small amount of income denoted by ϵ_t between periods $t = 1$ and $t = t^*$. The income stream is such that $r_{b,t+1}$ is constant in equilibrium prior to

⁸ The patterns do not change for $\sigma_{i0} > 0$ as long as it is below a particular threshold.

t^* .⁹ I show below that this “trick” allows me to make very precise statements about a complicated dynamic path in an economy that is so close to the economy of interest (with $\epsilon_t = 0$) that the paths cannot be distinguished when graphed. I refer to this related economy as the ϵ -economy.

Proposition 1. The small country’s output and labor in the ϵ -economy are below their historical trend between $t = 1$ and $t = t^*$.

Proof. Let $x_{it} = X_{it}/(1 + \gamma_Y)^t$ where

$$\gamma_Y = (1 + \gamma_N)^{\frac{1-(1-\phi)(\alpha_T+\alpha_I)}{(1-\phi)(1-\alpha_T-\alpha_I)}} (1 + \gamma_A)^{\frac{1}{(1-\phi)(1-\alpha_T-\alpha_I)}} - 1$$

is trend growth rate of all variables that grow with the exception of labor inputs; labor inputs grow at rate γ_N . Unless otherwise noted, i indexes the small country.

At $t = 1$, detrended consumption c_{it} in the small country rises relative to its historical trend, $c_{i1} > c_{i0}$, because the value of the country’s endowment is higher given effective TFP is higher in the future, and households want to smooth their consumption over time. Between $t = 2$ and $t = t^*$, $c_{it} = c_{i1}$ because r_{bt} is constant (by choice of $\{\epsilon_t\}$). To be consistent with the intertemporal condition for asset holdings, this rate has to equal $(1 + \gamma_y)/\beta - 1$ where γ_y is the rate of growth of per capita consumption, $\gamma_y = (1 + \gamma_Y)/(1 + \gamma_N) - 1$.

From the intratemporal first-order condition of households (assuming log preferences),

$$\frac{y_{it}}{l_{it}} = \frac{y_{it}^i}{l_{it}^i} \propto \frac{c_{it}}{1 - l_{it}}, \quad t = 1 \dots t^*. \quad (3.1)$$

The first equality in (3.1) follows from the fact that countries are initially closed and all labor in i is therefore supplied to domestic companies and all output in i is produced by

⁹ In the numerical experiments shown later, the income needed to have a constant rate of return is on average about one-tenth of one percent of income. If the additional income is set equal zero, the rate of return is approximately, but not exactly, constant.

domestic companies. With capital stocks initially fixed and consumption higher in period $t = 1$, it must be the case that $l_{i1} < l_{i0}$ and $y_{i1} < y_{i0}$ if (3.1) holds. With capital fixed, it must also be the case that labor falls by more than output in $t = 1$.

In period $t = 2$, output and labor must fall further because domestic capital stocks fall between the first and second periods. To see this, note that the capital-output ratio is pinned down by the return r_{bt} . If this return in the second period is equal to $(1 + \gamma_y)/\beta - 1$, then the capital-output ratios have to be equal to their historical levels (at $t = 0$). Using this fact along with the production technologies, it follows that labor productivity in the second period must also be at its historical level. It then follows from (3.1) that $y_{i2} < y_{i1}$ and $l_{i2} < l_{i1}$ since the labor productivity in the second period is below the labor productivity in the first period.

Since the return does not change between $t = 2$ and t^* , the same logic as above can be used to show that $y_{it} = y_{i2}$ and $l_{it} = l_{i2}$, $t \leq t^*$. ■

The proof is constructive in that it implies specific patterns for the key macroeconomic aggregates. Consumption in the small country rises at the announcement of the new policy but stays flat until the change occurs. At that point, it will increase further because worldwide output will be higher. At the announcement of the union, labor and output fall for two periods and then remain flat until the policy change occurs. The economy will appear to be immediately depressed. The beginning-of-period domestic capital stocks fall for one period and then remain flat. After $t = 1$ and prior to the policy change, capital-output ratios and labor productivity remain at their historical trends.

With multinationals investing in intangible capital, the relevant measure of economic performance is not output but rather GDP or GNP.

Proposition 2. The small country's GDP and GNP in the ϵ -economy initially rise above their historical trends and fall below trend between $t = 2$ and $t = t^*$.

Proof. Recall the definitions of GDP and GNP in (2.5) and (2.9), respectively. In the first period, when the policy is announced, net factor incomes for the period are already determined, and therefore GNP must be equal to GDP. To show that both are above their historical trend in $t = 1$, I have to show that intangible investments fall by more than output since GDP is defined as output less the sum of investment in plant-specific intangible capital and technology capital. This is shown as follows:

$$\begin{aligned} \frac{x_{I,i1}^i - x_{I,i0}^i}{x_{I,i0}^i} &= \frac{1 + \gamma_Y}{\delta_I + \gamma_Y} \left(\frac{k_{I,i2}^i - k_{I,i0}^i}{k_{I,i0}^i} \right) \\ &= \frac{1 + \gamma_Y}{\delta_I + \gamma_Y} \left(\frac{y_{i2}^i - y_{i0}^i}{y_{i0}^i} \right) \\ &< \frac{1 + \gamma_Y}{\delta_I + \gamma_Y} \left(\frac{y_{i1}^i - y_{i0}^i}{y_{i0}^i} \right) \end{aligned}$$

where the first equality uses the capital accumulation equation after detrending all variables, the second equality follows from the fact that the capital-output in the second period is equal to the historical capital-output ratio, and the third equality follows from Proposition 1. Since $\delta_I \leq 1$, it must be the case that plant-specific intangible investment falls by more than output. The same argument can be made for technology capital. Therefore GDP and GNP are both above trend in $t = 1$.

In the second period, since the capital-output ratios are at their historical trends, it must be the case that GDP in the small country is below its own trend by the same amount as output. At $t = t^*$, GDP falls further below its historical trend than output has fallen because investment of foreign multinationals in both tangible and plant-specific intangible rises above zero. GDP is lower because of the rise in plant-specific intangible.

The path of GNP depends on the path of borrowing and lending from abroad. The

small country's budget constraint and information about the other aggregates can be used to determine that the small country receives portfolio income only for $t = 2$ and pays portfolio income to foreigners after that period. This implies that GNP is below GDP after that period. It further implies that GNP is below trend. ■

Proposition 3. At $t = t^*$, the small country's FDI investment from abroad in the ϵ -economy increases above its historical trend of zero.

Proof. This follows immediately from the fact that tangible capital from abroad earns a positive rate of return in $t = t^*$ and multinationals gain from increased FDI abroad. ■

Next, I consider the case with $B_{t+1} = 0$, $t = 1, \dots, t^*$. With $\sigma_t = 0$, the two economies are effectively closed and changes in the time series are due to the anticipation of future relaxation of the capital accounts.

Proposition 4. The small country's output and labor in the case of full capital account restrictions are below their historical trend between $t = 1$ and $t = t^*$.

Proof. At $t = 1$, detrended consumption in the small country rises relative to its historical trend, $c_{i1} > c_{i0}$, because the country's endowment is now higher. From the intratemporal first-order condition of households in (3.1), it follows that labor and output fall initially (between $t = 0$ and $t = 1$) and, with capital fixed, it is the case that labor falls by more than output.

With no borrowing or lending across countries, total investment $y_{i1} - c_{i1}$ falls. With returns equated across assets, it must be the case that investment in all three assets—namely tangible capital, plant-specific intangible capital, and technology capital—all fall.

In period $t = 2$, output and labor must fall further because domestic capital stocks fall between the first and second periods. Since households cannot borrow from abroad, output, investment, and labor continue to fall until $t = t^*$, and net exports remain equal to zero until the restrictions on FDI are lifted. ■

Regardless of whether there are restrictions on portfolio investment, the rise in FDI investment from abroad is coincident with the drop in GDP. The path of openness chosen for the analysis here is very stark, but it is easy to demonstrate numerically that if σ_{it} rises more smoothly than shown in Figure 1, the general pattern that emerges is one of abnormally low GDP during periods when FDI investment is abnormally high.

3.2. Quantifying the effects

To demonstrate that the depression of per capita GDP and labor in the small economy is potentially large, consider parameters of Table 1 taken from McGrattan and Prescott's (2009) model based on U.S. data.¹⁰ In addition, I assume that the relative size of the big country to the small country is 10 and a period is equal to 5 years.

In Figure 2, I plot output and labor for the small country. In this figure and all that follow I display the results for the economy with $\epsilon_t = 0$ for all t in order to demonstrate that the patterns derived above for the ϵ -economy are the same as those shown in the figures for the economy of interest. In particular, notice that in $t = 1$, labor falls further below its historical trend than output. In $t = 2$, they both fall even further and stay low until the policy is actually implemented. For the parameters of Table 1, the decline is large. The economy is just over 80 percent of its historical trend between the time the policy is announced and the time it is implemented.

In Figure 3, I plot consumption relative to its historical trend. Notice that at $t = 1$,

¹⁰ Averages are used for any time-varying exogenous parameters.

consumption jumps up 8 percent and stays there until $t > t^*$. At the time of the policy change, consumption grows steadily to its new level (relative to trend) which is about 10 percent above the historical trend.

In Figure 4, end-of-period capital stocks are shown. Initially, all drop to just over 80 percent of their historical trend level, as with output and labor. When the policy change occurs, investment in the technology capital of the domestic companies ceases. At this point, it becomes optimal to let foreign multinationals invest in technology capital. Total tangible and plant-specific intangible capital stocks rise due to the fact that foreign companies are now investing in the small country.

Output shown in Figure 1 includes investment in intangible. In Figure 5, I show GDP and GNP which are accounting measures and commonly used to assess an economy's economic performance. As the propositions above show, both GDP and GNP are above trend initially. In $t = 2$, GDP is down by the same amount as true output and stays constant relative to its historical trend until intangible investment by foreign multinationals rises significantly. GNP falls throughout the pre-liberalization period because the small country is paying portfolio income to households abroad.

Another standard accounting measure used to assess an economy's economic performance is TFP, which is typically constructed as follows:

$$\text{TFP}_{it} = \frac{\text{GDP}_{it}}{K_{T,it}^{1/3} L_{it}^{2/3}}$$

where $K_{T,it}$ is the total tangible capital in country i . Like GDP, total factor productivity is low when intangible investments are high. Thus, care must be taken when diagnosing economies with low or slow-growing GDP and TFP.

In Figure 6, I display foreign direct investment by foreign multinationals relative to output in the small country. For the model, the FDI investment by foreign multinationals

is summarized by the second term in (2.10), which is the net investment in tangible capital. What is clear is this investment is very high when GDP is very low. The reason is simple: FDI is high because foreign tangible investment is high, GDP is low because foreign plant-specific intangible investment is high, and both investments are high when countries are open to FDI.

In Table 2, I show how the results change as I change the relative size of countries, the maximal degree of openness, the share of income that goes to technology capital, and the economy's tax rates. If either the relative size or maximal degree of openness increases, the swings in GDP, GNP, and labor are even larger than in the baseline parameterization. This is shown in the columns marked "Higher relative size" and "Higher σ^* ." If technology capital plays a small role (lower ϕ), a larger threshold for σ^* is needed to get the same results as the baseline case. This is shown in the column marked "Higher σ^* , Lower ϕ ." Finally, I show that the level of tax rates is not crucial to the results as long as a ψ is set in a way to get the same fraction of time at work.

Figure 7 shows how the path of GDP changes as I vary t^* . In the case of $t^* = 1$, foreign investment is made in the same period as the policy change is announced. GDP is low in the first period because of the increase in intangible investments by foreign multinationals. It is high the next period because TFP is now effectively higher. I show two other intermediate cases with $t^* = 3$ and $t^* = 5$. As I showed above, GDP is always higher than trend in the period of the policy announcement and below trend until $t = t^*$. In terms of the quantitative predictions based on parameters of Table 1, the sequence of paths show that GDP per capita falls to a level in the range of 55 to 75 percent of its pre-liberalized level, with the value depending on the delay between policy announcement and policy change. Once barriers are lowered, GDP per capita is higher than the historical

level by about 30 percent. The length of delay does affect the long-run trend, but only modestly.

In Figures 8 and 9, I compare the equilibrium paths of GDP and consumption for the case with no restrictions on portfolio investment and the case with restrictions on portfolio investment. As the propositions make clear, the transitions are affected by the households ability to borrow from abroad. If they cannot, adjustments are slow prior to $t = t^*$, but adjust rapidly when restrictions on FDI are lifted.

In the simulation shown, the capital account liberalization assumes that FDI is liberalized first (in 1995) and portfolio investment second (in 2000). If the two types of investment are simultaneously liberalized, the decline in GDP at $t = t^*$ would be larger than shown in Figure 8, and the change in consumption would be smaller than shown in Figure 9.

4. Conclusion

This paper derives equilibrium paths for a small country joining a larger financially integrated union. The goal of the exercise is to reconcile theoretical findings that there are large gains for small countries to lowering restrictions on FDI with the empirical findings that show no robust evidence for such benefits.

References

- Ahearne, Alan, Finn Kydland, and Mark A. Wynne, 2006, "Ireland's Great Depression," *The Economic and Social Review*, 37: 215–243.
- Aoki Kosuke, Gianluca Benigno, Nobuhiro Kiyotaki, 2006, "Adjusting to Capital Account Liberalization," Manuscript, LSE and Princeton.
- Caballero, Ricardo, Emmanuel Farhi, and Pierre-Olivier Gourinchas, 2008, "An Equilibrium Model of 'Global Imbalances' and Low Interest Rates," *American Economic Review*, 98: 358–93.
- Gourinchas Pierre-Olivier, and Olivier Jeanne, 2006, "The Elusive Gains from International Financial Integration," *Review of Economic Studies*, 73: 715–741.
- Gourinchas Pierre-Olivier, and Olivier Jeanne, 2008, "Capital Flows to Developing Countries: The Allocation Puzzle," Working paper 13602, National Bureau of Economic Research.
- Kose, M. Ayhan, Eswar Prasad, Kenneth Rogoff, and Shang-Jin Wei, 2006, "Financial Globalization: A Reappraisal," IMF Working paper 06-189.
- McGrattan, Ellen R., and Edward C. Prescott, 2008, "Openness, Technology Capital, and Development," *Journal of Economic Theory*, forthcoming.
- McGrattan, Ellen R., and Edward C. Prescott, 2009, "Technology Capital and the U.S. Current Account," Staff Report 406, Federal Reserve Bank of Minneapolis.
- Mendoza, Enrique, Vincenzo Quadrini, and Victor Ríos-Rull, 2006, "Financial Integration, Financial Deepness and Global Imbalances," Working paper, University of Maryland.

TABLE 1. MODEL CONSTANTS AT ANNUAL RATES^a

PARAMETER	EXPRESSION	VALUE
GROWTH RATES (%)		
Population	γ_N	1.0
Technology	γ_A	1.2
PREFERENCES		
Discount factor	β	.98
Leisure weight	ψ	1.32
TAX RATES (%), ALL i		
Labor wedge	$\tau_{l,i}$	34
Profits	$\tau_{p,i}$	37
Dividends	τ_d	28
INCOME SHARES (%)		
Technology capital	ϕ	7.0
Tangible capital	$(1 - \phi)\alpha_T$	21.4
Plant-specific intangible capital	$(1 - \phi)\alpha_I$	6.5
Labor	$(1 - \phi)(1 - \alpha_T - \alpha_I)$	65.1
DEPRECIATION RATES (%)		
Technology capital	δ_M	8.0
Tangible capital	δ_T	6.0
Plant-specific intangible capital	δ_I	0
SIZE		
Small country, $i = s$	$N_s A_s^{1-(1-\phi)(\alpha_T+\alpha_I)}$	1
Big country, $i = b$	$N_b A_b^{1-(1-\phi)(\alpha_T+\alpha_I)}$	10
MAXIMAL DEGREE OF OPENNESS		
Both countries $i = s, b$	σ_{it}^*	0.9

^a See McGrattan and Prescott (2009) for the motivation behind these parameter choices.

TABLE 2. SENSITIVITY OF RESULTS

	Percentage Values Relative to Trend in: ^a				
	Baseline (Table 1)	Higher Rel. Size	Higher σ^*	Higher σ^* , Lower ϕ	Lower Taxes
Output					
$t = 1$	93.7	89.2	86.3	92.5	94.6
$t = 2$	82.1	68.3	59.5	79.8	84.7
$t = t^*$	82.1	68.3	59.4	79.9	84.7
$t = t^* + 1$	125.6	135.2	142.8	125.5	127.9
$t = \infty$	115.0	127.6	138.5	119.5	117.0
GDP					
$t = 1$	102.7	105.1	106.8	101.4	102.3
$t = 2$	82.1	68.3	59.5	79.8	84.7
$t = t^*$	61.2	37.6	23.5	55.4	64.0
$t = t^* + 1$	132.6	143.2	151.1	128.1	134.9
$t = \infty$	123.1	136.6	148.2	124.2	125.2
GNP					
$t = 1$	102.7	105.1	106.8	101.4	102.3
$t = 2$	82.9	69.8	61.4	80.4	85.8
$t = t^*$	64.1	32.8	13.0	56.3	82.3
$t = t^* + 1$	102.8	91.8	84.3	96.2	109.6
$t = \infty$	96.6	87.5	83.6	93.3	101.7
Labor					
$t = 1$	90.5	83.8	79.8	89.0	91.8
$t = 2$	82.1	68.3	59.4	79.8	84.7
$t = t^*$	82.1	68.3	59.4	79.9	84.8
$t = t^* + 1$	110.5	112.0	113.2	109.7	112.5
$t = \infty$	103.3	107.3	109.5	105.4	105.3
Consumption					
$t = 1$	107.9	113.9	117.8	108.9	106.7
$t = 2$	107.9	113.9	117.8	108.9	106.7
$t = t^*$	107.9	113.9	117.8	108.9	106.7
$t = t^* + 1$	108.5	114.3	118.9	109.5	107.3
$t = \infty$	109.7	115.2	121.2	110.7	108.5
%FDI/Output ^b					
$t = 1$	0.0	0.0	0.0	0.0	0.0
$t = 2$	0.0	0.0	0.0	0.0	0.0
$t = t^*$	40.1	60.4	77.7	43.5	49.7
$t = t^* + 1$	7.0	6.7	6.7	7.6	8.9
$t = \infty$	5.5	5.5	5.5	5.7	7.0

^a Alternatives to baseline are (i) relative size of 20, (ii) $\sigma^* = .99$, (iii) $\sigma^* = .99$, $\phi = .04$, (iv) all tax rates set to 0 and $\psi = 2.1$.

^b These values are not relative to the historical trend which is 0.

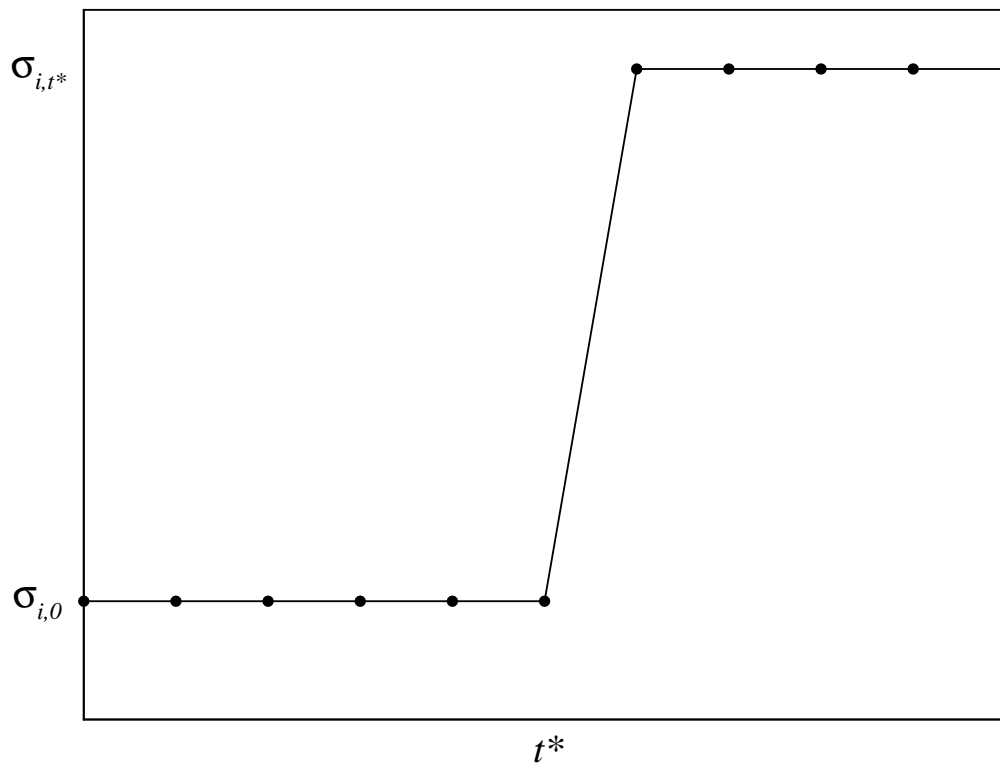


FIGURE 1. PATH OF OPENNESS

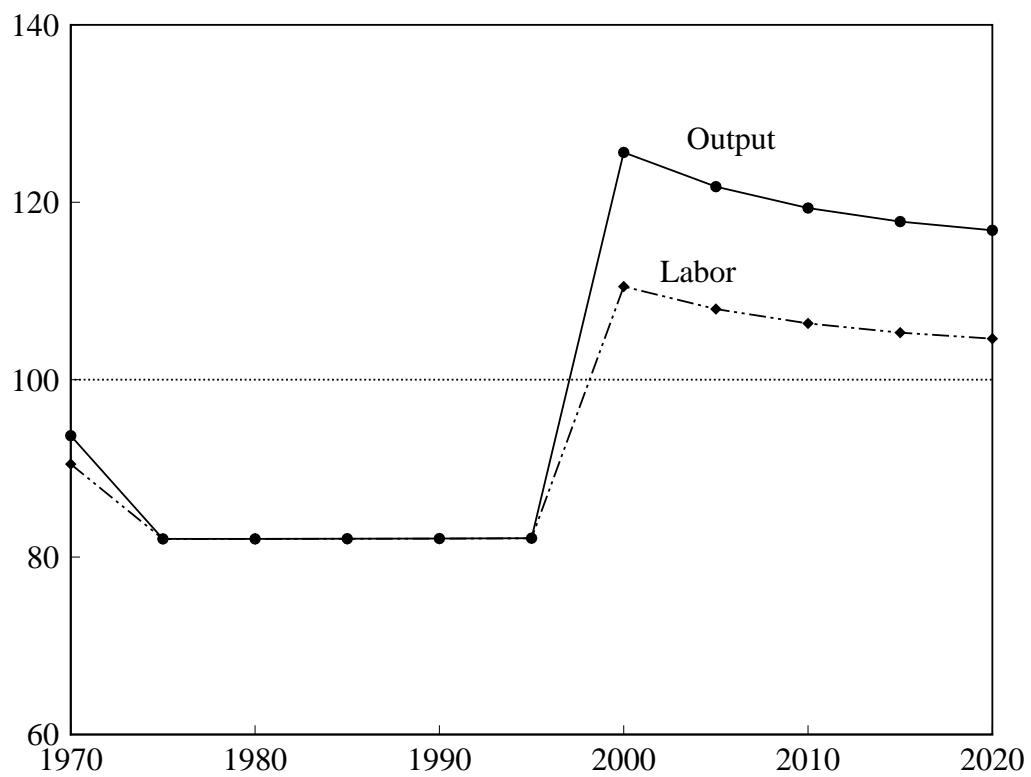


FIGURE 2. OUTPUT AND LABOR RELATIVE TO TREND IN THE SMALL COUNTRY

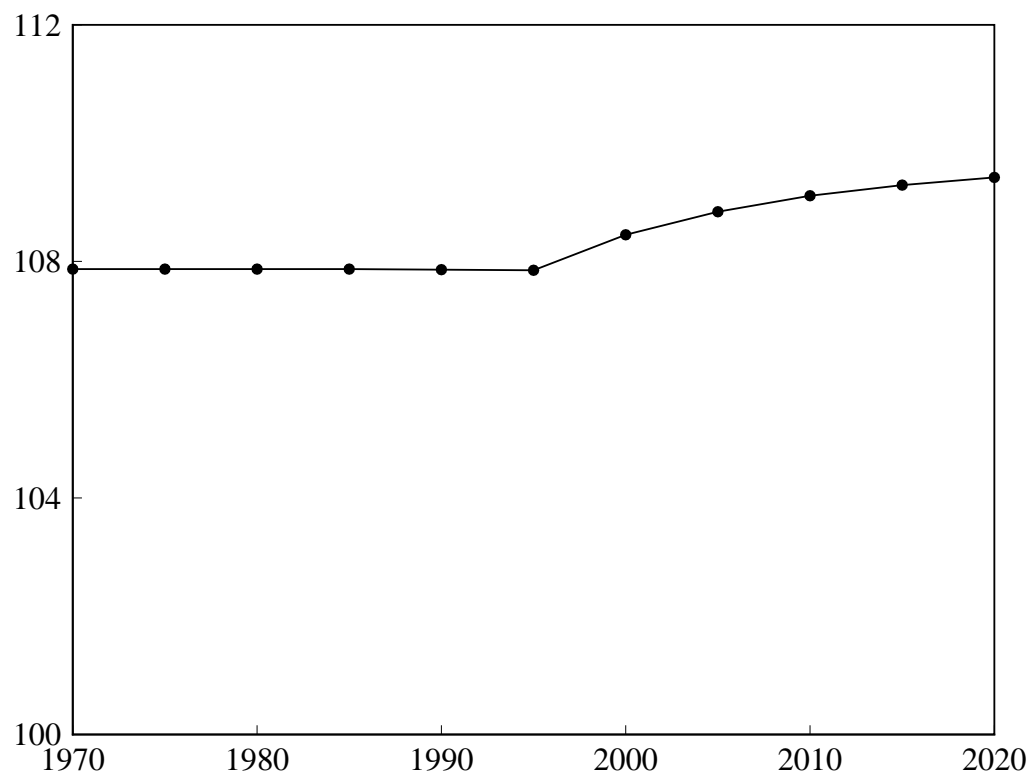


FIGURE 3. CONSUMPTION RELATIVE TO TREND IN THE SMALL COUNTRY

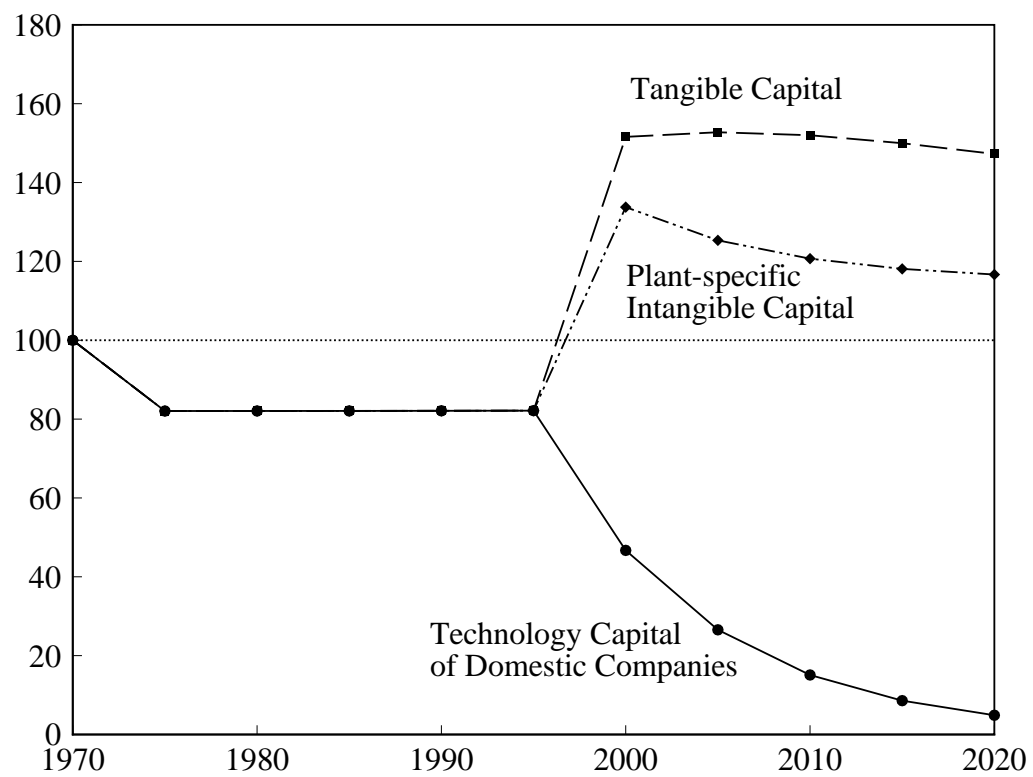


FIGURE 4. CAPITAL STOCKS RELATIVE TO TREND IN THE SMALL COUNTRY

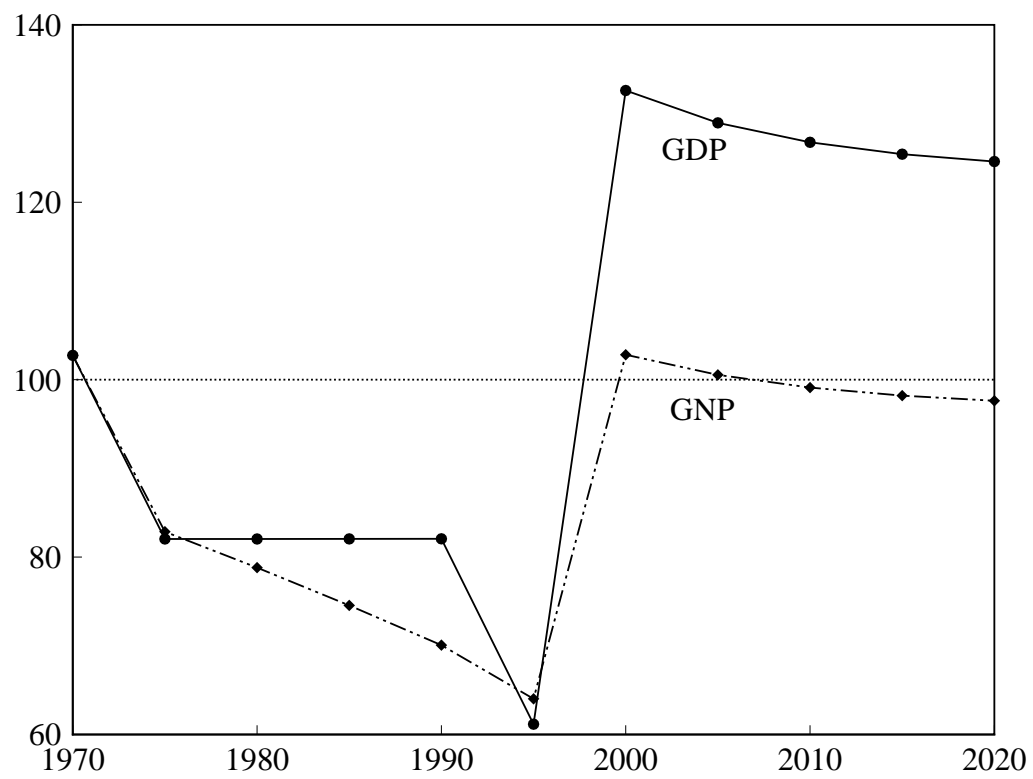


FIGURE 5. GDP AND GNP RELATIVE TO TREND IN THE SMALL COUNTRY

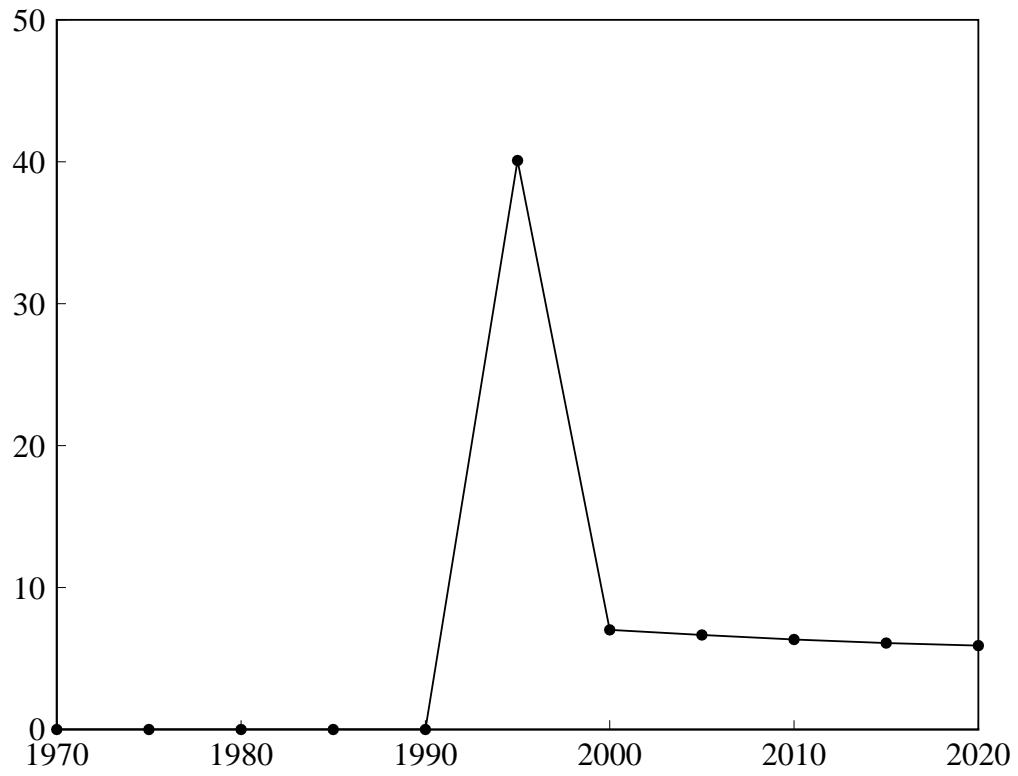


FIGURE 6. FDI INVESTMENT RELATIVE TO OUTPUT IN THE SMALL COUNTRY

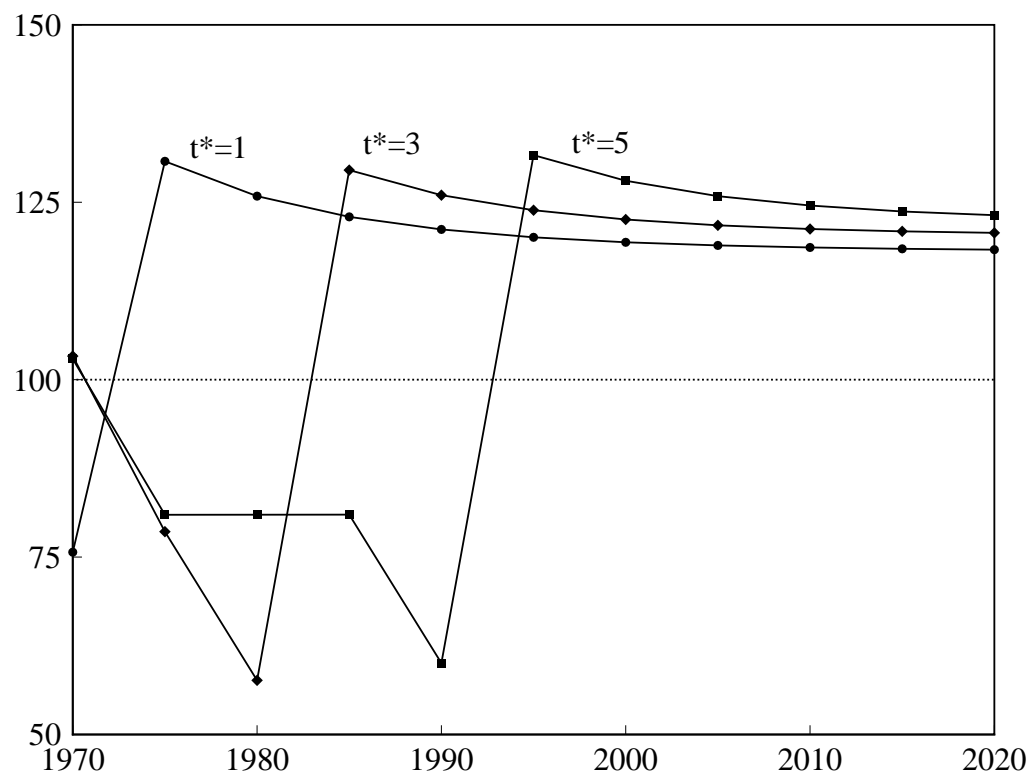


FIGURE 7. GDP RELATIVE TO TREND IN THE SMALL COUNTRY, VARYING t^*

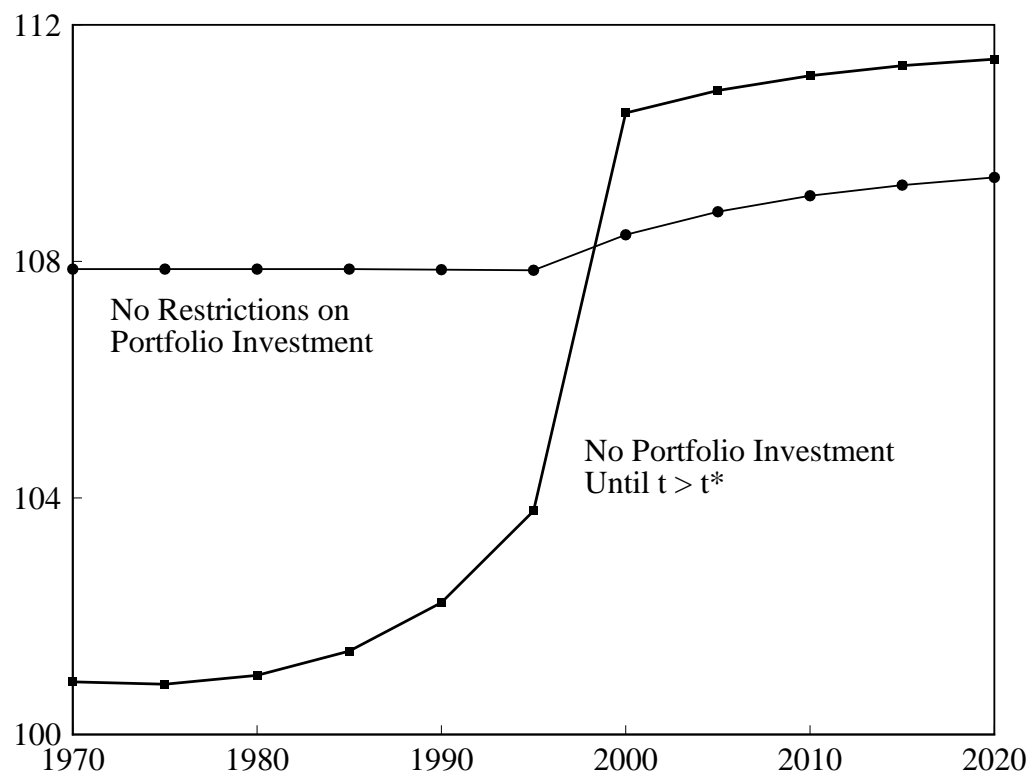


FIGURE 8. CONSUMPTION RELATIVE TO TREND IN THE SMALL COUNTRY,
WITH AND WITHOUT RESTRICTIONS ON PORTFOLIO INVESTMENT

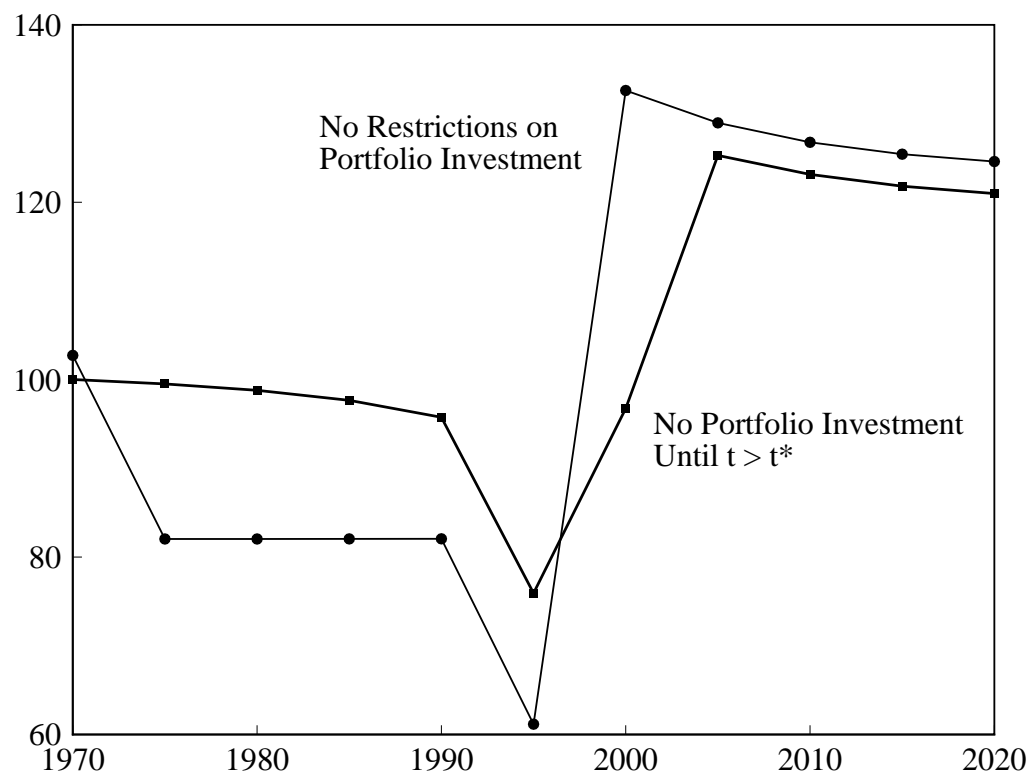


FIGURE 9. GDP RELATIVE TO TREND IN THE SMALL COUNTRY,
WITH AND WITHOUT RESTRICTIONS ON PORTFOLIO INVESTMENT