Dynamic Trade Creation

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1. INTRODUCTION

The emergence of large trading blocs as a central feature of the world economy has led to renewed interest in customs unions and free trade areas. Analysis of preferential trading arrangements has traditionally focused on static trade creation and diversion. However, as world capital markets have become increasingly integrated, it is clear that the dynamic effects of trade policy are also of great significance.

The analysis of preferential trading areas necessarily involves changes from a tariff-ridden equilibrium, so we are already in a world of the second best. Hence, it would not help further to muddy the analytical waters by assuming that the source of growth is some economy-wide externality. Thus we are drawn to the class of growth models studied by Jones and Manuelli (1990) and Rebelo (1991). Also, because we are interested in the effects of commercial policies across time, it is natural to assume that agents do not live forever. Thus, we maintain analytical simplicity by imposing the discipline of a strictly neoclassical framework with no increasing returns and no bequest motives.

The burden of this discipline is that endogenous economic growth can occur only if the economy has at least two sectors. The most natural economy has a consumption sector, an investment sector, a

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1 Thus, we hark back to an older tradition of two-sector models in international economics, originating with Uzawa (1964) and Srinivasan's (1964) extensions of Ramsey's (1928) classic. Galor (1992) has put some new wine into that old bottle.

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reproducible factor, and a fixed factor. Boldrin (1992) and Jones and Manuelli (1992) show implicitly that one-sector growth models ignore a crucial element in the development process: that investment goods become cheaper over time so that the fixed factor can afford an increasingly large stock of the reproducible factor from a finite stream of revenues. Fisher (1992) showed that the supply side of Rebelo's (1991) model captures the asymptotic behavior of a wide class of neoclassical economies where agents have finite lives and long-run growth can occur.

Why are two sectors necessary? The assumption of finite lives (without a bequest motive or an explicit role for government policy) imposes a very stark financing constraint on a growing economy. In particular, each generation must purchase an increasingly large stock of reproducible resources (capital, broadly defined) from a finite stream of revenues (lifetime labor income). Even though real wages become unboundedly large in a growing economy, the rate of growth of real wages does not keep up with the rate of growth of the capital stock. Thus, the financing constraint will bind eventually, and sustained growth will be impossible.

A one-sector growth model with a Cobb-Douglas production function provides some sharp intuition. In this case, endogenous growth can occur only if capital's share is unity, but then labor's share is zero. Hence, there is no source of savings from wage income, and the economy with overlapping generations cannot grow.

How can one overcome this financing constraint? There are three possibilities. First, one can assume that there is an economy-wide growth externality; indeed, this is the path that much of the modern literature has followed. For us, this tack has an unfortunate and ineluctable side effect: it introduces a further complication into a second-best world where preferential trading arrangements are already distorting. Second, one can assume that there is a role for government; permanently redistributive policies, typically in the guise of capital taxation, will overcome the financing constraint. This assumption may be tenable for the closed economy, but it is hard to see a simple analog for the open economy. Taxing domestic capital to enhance world growth typically would not be politically feasible. Third, one can assume that there are two sectors in the economy. This assumption introduces one relative price - the current price of investment (in terms of consumption forgone). Then growth can occur because the real price
of investment may become increasingly cheap as the world economy develops.

Again, the Cobb–Douglas case gives sharp intuition. Consider now an economy with Cobb–Douglas production functions in two sectors. Assume that the share of labor income in the consumption sector is strictly greater than zero, and its share in the investment sector is exactly zero. The latter assumption allows the economy to grow, and the former assures that there will be some wage income in every generation. On a balanced growth path, the value shares of the two sectors in gross domestic product (GDP) remain constant. However, at constant base-year prices, the consumption sector grows more slowly than the investment-goods sector, the engine of growth for the economy. The key insight is that the GDP shares of consumption and investment remain constant only because the relative price of investment good decreases as the economy grows. Hence, the real wage can grow sufficiently rapidly to purchase a rapidly growing stock of capital from a finite stream of wage income.

Several economists have already sought to adumbrate a theoretical basis for the dynamic effects of liberalized trade. Baldwin (1992) defines and calibrates dynamic gains from trade in Europe due to induced capital accumulation along the transition between steady states in a variant of a Solow growth model. Using endogenous growth models, several authors have identified links between economic integration and growth. Some are based on externalities associated with learning by doing (e.g., Lucas, 1988; Young, 1991), and others focus on economies where novel ideas or products generate growth (e.g., Grossman and Helpman, 1991; Rivera-Batiz and Romer, 1991). Applying a hybrid of these models, Kehoe (1994) shows that Spain grew rapidly following her entry into the European Community. Since the role of preferential trading regimes motivates much of this recent work, it seems appropriate to analyze these arrangements explicitly.

Our model may seem old fashioned to a modern reader. In particular, world growth occurs only because of capital accumulation. There are no economy-wide externalities, there is no emphasis on Schumpeterian innovation, and there are no simple Pareto-improving government

2 Spain entered the Community in 1986. Kehoe documents a change in its trend of investment from an annual 1% decline in the five years preceding entry into an average increase of 10% per annum for the five following years. Similarly, the growth rate of foreign investment in Spain increased fivefold between these periods.
policies. These facts may cause some readers to dismiss this analysis out of hand, but we beg for a moment's indulgence. Because the analysis of preferential trading areas is already complicated enough, we are really proposing the simplest economy in which endogenous growth is possible and agents have finite lives.

The skeptical reader might further ask, why bother with overlapping generations? Isn't the standard model in macroeconomics the one with infinitely lived agents? Some might argue, quite to the contrary, that many interesting issues in general equilibrium theory arise precisely in models in which agents' lives are finite. In a model of economic growth, this has two very important implications. First, commercial policies influence both people alive now and those not yet born. In international economics, the former are Stolper-Samuelson effects, and the latter are growth-enhancing effects. Second, world growth trajectories typically cannot be Pareto ranked. In particular, increasing the rate of world growth is usually not Pareto improving.

In international economics, this observation gives rise to an important subtlety in the analysis of any commercial policy. There are four classes of agents that matter: (1) the current generation at home, (2) their counter-parts abroad, (3) future generations at home, and (4) their counter-parts abroad. Consider, for example, a domestic tariff that protects a capital-intensive industry in a two-by-two economy. The Stolper-Samuelson effects imply a rise in the real income of domestic capitalists and a fall in that of domestic workers. If the tariff reduces domestic imports of capital-intensive goods, it will also lower the real income of foreign capitalists and raise the real income of laborers abroad. The effect that such a tariff has on the world growth trajectory is also obviously important, and it will surely influence an infinite stream of unborn generations at home and abroad. We show that the growth effect depends on whether the country – more generally, the trading bloc – in question is a host or source of foreign investment. Because the financing constraint plays such an important role in these economies, the link between commercial policy and foreign investment should not come as a complete surprise. But, to the best of our knowledge, no one has analyzed this link so explicitly before.

Our central contribution is to identify dynamic trade creation. Static trade creation is an increase in the volume of trade when the world growth rate remains unchanged; we show later that this corresponds
to increased volume of trade in final goods that is the counter-part of interest income from abroad. Dynamic trade creation is an increase in the volume of trade in final goods when the world growth rate changes. Net trade creation is the sum of these two effects. Our main result is that any change in commercial policy that creates net trade enhances world growth.

In a static economy, the growth rate is given exogenously, each country's current account is balanced, and static trade creation occurs when a policy raises the volume of trade. In a dynamic economy, the world growth rate is determined endogenously, a country's current account typically is not balanced, and dynamic trade creation occurs when a change in distorting tariffs changes growth and affects the volume of trade. Commercial policy always has two effects in a growing world economy: it alters the volume of trade at the (fixed) original growth rate and it affects the volume of trade as world growth changes. An important contribution of this chapter is to show that the sum of these two effects is positive if and only if a change in tariffs increases a country's external surplus, induces a fall in world interest rates, and causes a rise in world growth. Thus, when moving from one second-best equilibrium to another, there is net trade creation if and only if world growth increases. We show that the static and dynamic effects always work in opposite directions, but their relative magnitudes can be determined unequivocally.

Commercial policy creates dynamic trade through its influence on the incomes and savings patterns of a trading bloc. Although our model captures the long-run behavior of a wide class of economies, its supply side has a special structure, and the final-goods sector is labor intensive. The Stolper-Samuelson Theorem then implies that a tariff on this sector raises the real wage, the source of savings. In countries that are sources of foreign investment, this policy enhances growth. But in those that host foreign investment, such a tariff reduces growth and benefits fixed factors at the expense of the current owners of capital and future generations in all countries.

Although these results are quite general, applying to all the trade structures we consider, the case of free trade areas is worth particular mention. Richardson (1995) notes that a common feature of this form of preferential trade is the proliferation of rules of origin designed to prevent arbitrage across member countries with different external tariffs. Even though these rules protect domestic producers by specifying
minimum local content requirements, a free trade area that removes tariffs on internal trade in investment unambiguously reduces global protection of investment goods. This result suggests that rules of origin may be less restrictive than they appear because administrators face difficulties in disentangling current domestic content from that produced using past vitrages of capital.

The rest of this chapter is structured as follows. The second section describes the model, and the third section defines a balanced growth path for the distorted world economy. The fourth section derives the direction of trade, and it examines the growth effects of both most-favored-nation tariffs and the formation of customs unions. The fifth section analyses protection-reducing and protection-enhancing free trade areas. The sixth section suggests directions for future research and argues that all our results are much more robust than the assumptions of specific utility functions and production functions might lead the reader to believe.

2. THE MODEL

We use the model of overlapping generations developed by Fisher (1992, 1995); its supply side is in the spirit of the models of Jones and Manuelli (1990) and Rebelo (1991). In each country in any period, there are two generations, the young and the old. In the initial period, the old generation lives only for one period and finances consumption from the ownership of the economy's inherited stock of capital. Every other agent is endowed with one unit of labor when young and nothing else. This agent lives for two periods and saves some of his wage in order to purchase capital and finance consumption when old.

There are \( n \) countries and two goods. In keeping with the Heckscher-Ohlin paradigm, we assume that technologies are identical across countries. Country \( j \) has a fixed number of agents per generation, \( L_j \), and its capital stock at time \( t \) is \( K_j^t \). The first sector produces the consumption good, and the second produces the investment good. As in the literature (Ethier and Horn, 1984; Richardson, 1995), each sector can be thought of as a composite of many goods, some imported and others exported. The consumption aggregate comprises all the final goods.

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3 It is simple to generalize our results to the case where all countries' populations are increasing at the same exogenous rate.
goods that create utility for agents in the world economy; output of the consumption good in country $j$ at time $t$ is

$$Q_{t,1}^j = (K_{t,1}^j)^{\theta} (L_{t,1}^j)^{1-\theta},$$

(1)

where $K_{t,1}^j$ is the input of capital and $L_{t,1}^j$ is that of labor. The investment aggregate consists of intermediate goods that increase the world’s capital stock. Its output is

$$Q_{t,2}^j = \Gamma K_{t,2}^j,$$

(2)

where the input is analogous.

All goods and factor markets are perfectly competitive, so each factor is fully employed. The full employment conditions in country $j$ are

$$L_{t,1} \leq L^j \quad \text{and} \quad k_{t,1}^j + k_{t,2}^j \leq k_{t}^j.$$

(3)

Capital in the $j$th country follows the transition equation

$$k_{t+1}^j = Q_{t,2}^j + Z_t^j,$$

(4)

where $Z_t^j$ are imports of investment goods into country $j$ at time $t$. We are implicitly assuming that capital depreciates completely. This assumption underscores the notion that a period corresponds to the working life of the typical agent. Although we treat this reproducible factor as physical capital, it could just as well be any accumulable input whose private and social rates of return are equal.

Trade in investment goods is different from trade in financial claims. The pattern of ownership of firms in each period is determined by the disparate saving decisions of all the agents in the world economy. In the model of overlapping generations, (perpetually) imbalanced trade is the norm, not the exception.⁴ In international economics, it is best to think of these as models of pure absorption. A country with a high savings rate has a relatively low propensity to spend from current income, and it will tend thus to run surpluses on current account. In a growing world economy, this means that it will acquire net foreign assets in each

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⁴ This is an old (if poorly understood) point. David Gale (1971) showed that perpetual trade imbalances arise because countries earn interest on net foreign assets, but the current account was balanced in each period in his model. Fisher (1990) emphasized that trade imbalances can arise solely because of government policies. Of course, in a model of endogenous growth, because new assets are being created in every period, countries can run perpetual trade deficits and permanent current account surpluses!
generation. We now turn our attention to the determinants of savings in the world economy.

An agent in country $j$ born at time 0 has preferences given by

$$u^{j,0}(c^{j,0}_1) = \log c^{j,0}_1,$$

and the analogous agent born at time $t \geq 1$ has the utility function

$$u^{j,t}(c^{j,t}_t, c^{j,t}_{t+1}) = (1 - \sigma^j) \log c^{j,t}_t + \sigma^j \log c^{j,t}_{t+1},$$

where $c^{j,s}_t$ is the consumption at time $t$ of an agent born at time $s$ in country $j$. Since $\sigma^j$ is the marginal propensity to save from permanent income, the preferences described by Equation (5b) entail that the savings rate is independent of the real interest rate. This assumption is not without loss of generality, but it makes for a simple description of the balanced growth path in terms of the savings rates and commercial policies of each country.

Let $P_{t,i}$ be the border price in period $t$ of good $i$. Also, let $\tau^j_i$ be country $j$'s constant gross ad valorem tariff rate on good $i \in \{1, 2\}$; thus, the domestic price of good $i$ is $\tau^j_i P_{t,i}$. The numeraire is the consumption good in the first period and $P_{t,1} = 1$. Hence, all prices are present prices, $P_t = P_{t,1} P_{t,2}$ is the relative world price of the consumption good in period $t$, and $1 + i_{t+1} = P_{t,1} P_{t+1,1}$ is the world real interest rate from periods $t$ to $t + 1$.

Firms in sector $i \in \{1, 2\}$ choose their inputs of capital and labor to maximize profits in each period. Let $W^j_t$ and $R^j_t$ be the present value of the wage and rentals rates, respectively, in country $j$ at time $t$. Also, let $k^j_{t,1}$ be the capital–labor ratio in the first sector in that country at that time. Then equilibrium in the factor markets implies

$$\tau^j_1 P_{t,1} \theta (k^j_{t,1})^{\theta-1} \leq R^j_t \quad \text{and} \quad \tau^j_2 P_{t,2} \Gamma \leq R^j_t,$$

with equality if either output is strictly positive. Also,

$$\tau^j_1 P_{t,1} (1 - \theta) (k^j_{t,1})^\theta \leq W^j_t,$$

again with equality if output of the consumption good is strictly positive. If both consumption and investment outputs are strictly positive,

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5 We make the assumption of constant tariffs because we are interested in their long-run growth effects. Varying tariff rates across time would have transitional effects on the relative price of the consumption good in each country and on the real interest rate in the world economy.
then inequalities (6) imply

\[ k_{t,1}^j = (\theta \tau^j p_t / \Gamma)^{1/\gamma}, \]

(8)

where \( \tau^j \equiv \tau^j_1 / \tau^j_2 \) is the relative rate of protection in sector 1 in country \( j \) and is unity under free trade. Equation (8) is the standard relationship between domestic relative prices and resource allocation between sectors.

We can now describe the consumer's choices. The old in country \( j \) in period 1 choose \( c_{t,0}^j \) to maximize Equation (5a) subject to the present value budget constraint

\[ \tau^j_1 c_{t,0}^j \leq R^j_1 k_1^j, \]

(9a)

where \( k_1^j \) is the stock of capital per worker owned by the original residents of country \( j \). Equation (9a) says that an old person in period 1 buys consumption at the local price and has income from rents on the capital. Each young agent is endowed with one unit of labor. He chooses \( (c_{t,t}^j, c_{t+1,1}^j) \) to maximize Equation (5b) subject to

\[ \tau^j_1 (P_{t,1} c_{t,t}^j + P_{t+1,1} c_{t+1,1}^j) \leq W_{t}^j. \]

(9b)

In each period, the young purchase investment goods to finance consumption in the final period of their lives. No term having to do with capital enters Equation (9b) because investment entails no profits in equilibrium.\(^6\)

The utility function (5a) and budget constraint (9a) imply that

\[ c_{t,0}^j = R^j_1 k_1^j / \tau^j_1, \]

(10a)

and Equations (5b) and (9b) imply that the consumption profile of a person born in period \( t \geq 1 \) is

\[ (c_{t,t}^j, c_{t+1,1}^j) = \left( (1 - \sigma^j) W_{t}^j / \tau^j_1 P_{t,1}, \sigma^j W_{t}^j / \tau^j_1 P_{t,1} \right). \]

(10b)

This completes the specification of the model. The next section defines an equilibrium for the distorted economy and uses the

\[ ^6 \text{We have created a model that captures in chiaroscuro Pasinetti's (1962) distinction between the savings propensities of workers and capitalists. Of course, our model is in contrast with his, because the marginal propensity of capitalists to save is zero and all savings is accomplished by workers, the owners of the fixed factors of production. Still, Pasinetti, among many others, neglected to recognize that many capitalists start out as workers and acquire assets during the course of their lives. Our model is apposite precisely because the decision to acquire capital is indeed a central part of the development process.} \]
market-clearing conditions to derive expressions for the real interest rate and growth rate along a balanced growth path.

3. BALANCED GROWTH PATHS

Let \( W_t = (W_t^1, \ldots, W_t^n) \) and \( R_t = (R_t^1, \ldots, R_t^n) \) be the list of country-specific wage and rentals rates at time \( t \) and \( \lambda^j = L^j / \sum_{j=1}^{n} L^j \) be country \( j \)'s constant share of the world population. Then consumption and investment per worker in the world economy are

\[
c_t = \sum_{j=1}^{n} \lambda^j \left( c_t^{j,t-1} + c_t^{j,t} \right),
\]

and

\[
q_t = \sum_{j=1}^{n} \lambda^j Q_{t,2}^j / L^j.
\]

A thorny issue in any general equilibrium model with distorting taxes is how to redistribute the tariff revenues in a neutral manner. This issue becomes very complicated in a model with overlapping generations, where society's marginal propensity to save is influenced by how the government disburses tariff revenues. We follow Rebelo (1991, p. 505) and impose that tariff revenues are used to finance the provision of public goods that have no effect on individuals' savings decisions or the production possibilities of the private sector in any country.\(^7\) In effect, this assumption isolates the effects of fiscal policy from the distorting effects of tariffs. We justify this assumption in three ways. First, tariff revenues are a very small share of national income in most modern industrial economies.\(^8\) Second, there is no practical transparent link between tariff revenues and fiscal policies designed to affect national savings rates. Third, since there is only one consumption aggregate in this model, the redistribution of tariff revenues will not distort the pattern of consumption, but fiscal policy, in the guise of redistribution of these revenues, certainly will influence an economy's savings and

\(^7\) Until now, these distorting taxes could have been easily interpreted as import or export subsidies. In the rest of the chapter, we are explicitly assuming that any government must actually raise revenues from its distorting policies. Since we are analyzing equilibria in which the local demand and the local supply for intermediate investment good are equal, it is best now to think of these revenues as arising from a broad aggregate of tariffs on final consumption goods.

\(^8\) In 1995, revenues from custom duties and fees were about $19 billion in the United States, where GDP was near $7200 billion. Indeed, the interest payments on the national debt were greater than $232 billion, more than ten times national tariff revenues.
growth rates. Thus Rebelo’s assumption is particularly appealing in a model of overlapping generations.

Let the vector of consumption and investment tariffs be \( \tau = (\tau_1, \tau_2, \ldots, \tau_n) \). Given these distortions, an \textit{equilibrium for the world economy} is a sequence of prices \( \{(P_{t,1}, P_{t,2}, W_t, R_t)\}_{t=1}^{\infty} \) and corresponding aggregate quantities \( \{(c_t, q_t)\}_{t=1}^{\infty} \) such that (i) Equations (1), (2), and (3) describe each country’s production and resource constraints; (ii) Equations (10a) and (10b) give each agent’s consumption decisions; (iii) Equations (6) and (7) relate factor prices and intensities; and (iv) Equation (4) describes the law of motion for each country’s capital stock, taking as given the initial ownership of capital \( (k_1, \ldots, k_n) \).

A \textit{balanced growth path} is an equilibrium for the world economy in which all countries’ gross domestic products grow at the same rate. Then \( k_t = \sum_{j=1}^{\infty} \lambda^j k^j_t \) gives capital per worker in the world economy at time \( t \). On a balanced growth path, the gross growth rate of capital per worker is a constant independent of time. Because each country’s share of world wealth is a constant, countries with relatively high savings rates acquire a disproportionate share of the new assets created in each period. They run perpetual current account surpluses.

Since the tariffs are constant through time, intertemporal arbitrage implies that

\[
P_{t,2} = \Gamma P_{t+1,2}, \tag{11}
\]

where \( \Gamma \) is the marginal efficiency of investment. Thus, the decline in the present price of the investment good is determined by the marginal rate of transformation between capital in periods \( t \) and \( t + 1 \).

The relationship between savings and investment is

\[
\sum_{j=1}^{\infty} \lambda^j \sigma^j W_t^j = \sum_{j=1}^{\infty} \lambda^j \tau^j_2 P_{t,2} k^j_{t+1}. \tag{12}
\]

This equation shows that each agent born in generation \( t \) spends a fraction \( \sigma^j \) of the present value of his permanent income on the purchase of capital. Using Equations (6), (7), (8), and (11), we can show that Equation (12) implies the following relationship between the gross growth rate of the stock of capital \( G \) and the interest rate:

\[
G = k_{t+1}/k_t = (p_t/p_{t-1})^{1/(1-\theta)} = \left[ \Gamma/(1 + \theta) \right]^{1/(1-\theta)}. \tag{13}
\]
Because the marginal efficiency of investment is fixed at \( r \), an increase in growth can occur only if real interest rates fall and firms absorb the increased outflow of capital.

Using Equations (7), (8), (10b), and (13), we can write country \( j \)'s imports of the consumption good \( m_i^j \) as

\[
m_i^j = \left( p_i \tau_i^j \theta / \Gamma \right)^{\frac{\theta}{\theta - \sigma}} \left( (1 - \theta) \sigma_i^j \Gamma / G - \Phi_i^j \right),
\]

where \( \Phi_i^j = 1 - (1 - \sigma_i^j)(1 - \theta) > 0 \). Now let the world excess demand for imports be \( M_t(\tau, G) = \sum_{j=1}^{n} \lambda_i^j m_i^j \), where the dependence on the tariffs and the world growth rate is explicit. The market-clearing condition for the consumption good in period \( t \) is

\[
M_t(\tau, G) = \left( p_t \theta / \Gamma \right)^{\frac{\theta}{\theta - \sigma}} \sum_{j=1}^{n} \lambda_i^j \left( (1 - \theta) \Gamma / G - \Phi_i^j \right) = 0.
\]

It is important to note that Equation (15) is independent of \( p_t \), the international relative price the consumption good. Markets clear for any \( p_t \); thus, tariffs do not have the usual static term-of-trade effects, but Equation (13) shows instead that the rate of change of the terms of trade captures the model’s essential growth effect. Solving Equation (15) for the growth rate yields \(^9\)

\[
G = \frac{(1 - \theta) \Gamma \sum_{j=1}^{n} \lambda_i^j \tau_i^j \theta / (1 - \theta) \sigma_i^j}{\sum_{j=1}^{n} \lambda_i^j \tau_i^j \theta / (1 - \theta) \Phi_i^j}.
\]

The gross growth rate of the world's physical stock of capital is an increasing function of the marginal efficiency of investment, and it is a smooth function of any country’s relative tariff. Thus, the equilibrium illustrates a dynamic version of Lerner’s symmetry theorem: if there are no income effects, a tariff on the consumption good is equivalent to an export tax on the investment good. Showing the existences of a

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\(^9\) Equation (16) assumes implicitly that all countries have strictly positive outputs of both goods in each period. A sufficiently large consumption tariff can induce a country to specialize in the consumption good, but full employment implies that there can never be complete specialization in the investment good. One can show that the condition for complete specialization is independent of time and, hence, that there is a balanced growth path where some countries produce only consumption goods. If such specialization occurs in country \( j \), then \( k_{r,1}^j = k_r^j \) and Equation (16) is changed accordingly to reflect the lower rate of growth of the world economy. Also, marginal increases in country \( j \)'s consumption tariff will have no effect on the world growth rate.
balanced growth path for an arbitrary array of distorting tariffs, Equation (16) is an important contribution of this chapter. To the best of our knowledge, no other paper has been able to determine explicitly the world growth rate for an arbitrary specification of a second-best equilibrium. Furthermore, it is worth emphasizing here that the equilibrium is a balanced growth path; because all production in both sectors and preferences is so simple, there are no transition dynamics in this model.

Finally, Equation (13) implies that $1 + i_{t+1} = \Gamma / G^{1-\theta}$; thus, on a balanced growth path the real interest rate is a constant that is strictly greater than $G$, the growth rate of world consumption. Hence, the distributive inefficiency that arises from tariffs as distorting taxes is the usual static one, even though a tariff in any country has a fundamental effect on the growth rate of the entire world economy.

4. DYNAMIC TRADE CREATION AND THE GROWTH EFFECTS OF CUSTOMS UNIONS

It is useful to examine the link between a country's trade pattern and its savings behavior. Substituting Equation (16) into Equation (14) yields

$$m^j_i = \frac{\sum_{i=1}^{n} \lambda^i (\tau^i)^{\theta/(1-\theta)} (\sigma^i \Phi^i - \sigma^i \Phi^j)}{\sum_{i=1}^{n} \lambda^i (\tau^i)^{\theta/(1-\theta)} \sigma^i} (k^j_{t,1})^\theta. \tag{17}$$

Consider an equilibrium with free trade. Then $\tau^j = 1$, and $\Phi^j = \theta + \sigma^j(1-\theta)$ for all $j$. Let $\bar{\sigma} = \sum_{i=1}^{n} \lambda^i \sigma^i$ be the average savings rate in the undistorted world economy. Then Equation (17) reduces to $m^j_i = \theta (k^j_{t,1})^\theta (\sigma^i - \bar{\sigma})/\bar{\sigma}$, and a country with an above-average savings rate imports the consumption aggregate under free trade. The term $\theta (k^j_{t,1})^\theta$ is the share of world consumption output that accrues to capital, and $(\sigma^j - \bar{\sigma})/\bar{\sigma}$ is net foreign assets per capita. Thus the analog of Equation (17) corresponds exactly to country $j$'s interest income from abroad, and it ties down the pattern of trade in the world economy. Recall that a high-savings country runs a perpetual current account surplus in a growing world economy. Since imports of the consumption aggregate just offset interest income from abroad, a high-savings country imports

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10 Since each generation saves a constant fraction of its wage income, country $j$'s current account surplus at time $t$ is $(G^j - 1)(1-\theta)\theta(k^j_{t-1,1})^\theta (\sigma^j - \bar{\sigma})/\bar{\sigma}$ in an undistorted world economy.
the consumption good. These imports are simply the interest payments on net foreign assets that accrue to its older generation. Likewise, in an equilibrium distorted by tariffs, a country with a high value of $\sigma^j/\Phi^j$ serves analogously as a source of outward investment and growth. Whether a country is a source or host for foreign investment is crucial in understanding the effects of tariffs on the world economy.

We can now formally define static and dynamic trade creation. Since country $j$'s imports depend on its tariffs and the world growth rate, differentiation of Equation (14) shows

$$
\frac{dm^j/m^j}{d\tau^j/\tau^j} = \frac{\partial m^j/m^j}{\partial \tau^j/\tau^j} + \left(\frac{\partial m^j/m^j}{\partial G/G}\right)\left(\frac{dG/G}{d\tau^j/\tau^j}\right). \tag{18}
$$

The first partial derivative on the right side of Equation (18) holds the growth rate constant and defines static trade creation. In a model of exogenous growth, this is the only kind of trade creation, because commercial policy ipso facto has no effect on the growth rate. The second term on the right side of Equation (18) defines dynamic trade creation. This partial derivative holds country $j$'s tariffs constant, and the total derivative captures the overall increase in the world growth owing to a change in that distortion.

Logarithmic differentiation of Equation (14) shows that $(\partial m^j/m^j)/(\partial \tau^j/\tau^j) = \theta/(1 - \theta) > 0$. Thus, static trade creation is a positive constant; it captures the Stolper–Samuelson effect in this model. Consider a 1% increase in $\tau^j$. The magnification effect implies that real wages rise by $\theta/(1 - \theta)$%. At fixed real interest rates, Equation (10b) shows that country $j$'s marginal propensity to consume from permanent income is unity; thus, aggregate consumption also rises by $\theta/(1 - \theta)$%. Also, Equation (8) shows that capital per worker in that sector rises by $1/(1 - \theta)$%. Finally, Equation (1) shows that output per worker rises by $\theta/(1 - \theta)$%. Thus, static trade creation occurs if a source country for foreign investment raises its tariff on consumer goods or if a host country for foreign investment raises its tariff on investment goods. Because this expression does not depend on any of the distortions in the world economy, it serves to underscore that even the static effects of tariff changes in a growth model are fundamentally different from the usual static effects that have been explored before. Static trade creation occurs because interest payments from net foreign assets increase. Even if the growth rate is unchanged, the share of net foreign assets owned
Dynamic Trade Creation

by a high-savings country will increase. At constant world interest (and, thus, growth) rate, this country will import more of the consumption good.

What about the dynamic effects of tariffs? Differentiation of Equation (16) and some algebra using Equations (8), (14), and (17) show that

$$\frac{dG/G}{d\tau_j^i} = \frac{\lambda^i m^i_j (\tau^i_j)^{\theta/(1-\theta)} (\frac{\partial m^i_j}{\partial \tau^i_j})}{(k_{1,j})^\theta \sum_{i=1}^n \lambda^i_j (\tau^i)^{\theta/(1-\theta)} \Phi^i} \left( \frac{\partial m^i_j}{\partial \tau^i_j} \right).$$

Thus, world growth increases if and only if a source country for foreign investment raises its tariff on consumption goods or a host country for foreign investment raises its tariff on investment goods. The intuition is that the Stolper-Samuelson effects in a static model have growth effects when world savings depend on the distribution of income in the world economy. Moreover, a bit more algebra implies

$$\left( \frac{\partial m^i_j}{\partial G/G} \right) \left( \frac{dG/G}{d\tau^i_j} \right) = -\frac{\lambda^i_j (\tau^i_j)^{\theta/(1-\theta)} (\frac{\partial m^i_j}{\partial \tau^i_j})}{\sum_{i=1}^n \lambda^i_j (\tau^i)^{\theta/(1-\theta}) \sigma^i} \left( \frac{\partial m^i_j}{\partial \tau^i_j} \right).$$

Hence, dynamic trade creation has the opposite sign from static trade creation, but its magnitude is smaller. Also, dynamic trade creation depends on all the distortions in the world economy, and it is particularly strong for a large country.

What is the economic intuition? Consider a source country for foreign investment that raises its tariff on consumption goods. The static effect creates trade, since the change in distortions raises the real income of and, thus, interest payments to the fixed factors (namely, the savers) in a country importing consumption goods. Also, the change in commercial policy raises world growth, so in the long run agents everywhere in the world will be better off. But some of that increase in growth is at the expense of a lower volume of trade in final goods, because the surplus country has a lower than average rate of absorption and acquires more net foreign assets on the new growth path.

What have we shown? If a change in tariffs creates net trade, it raises world growth. Notice that there are two ways to create net trade. We have already explored the first: a surplus country can raise its tariff on final consumption goods. But there is a second possibility: a deficit country can raise its tariff on intermediate investment goods. This result
is really quite general. We have focused on second-best equilibria in a model that captures the general properties of growing economies where economies of scale do not come into play and agents do not live forever. In this class of models, net trade creation is synonymous with increases in economic growth. This result is the second fundamental contribution of this chapter.

It is straightforward to apply the preceding analysis to customs unions. Since each economy has a standard concave production frontier, the supply curve in each sector is upward sloping. Thus, if countries in a union trade with countries outside the bloc, the relative price in any member is determined by the common external tariff. Hence, the effects of customs union formation are captured by changing the various tariffs to a common external tariff. Then the union’s effect on world growth depends on whether it increases the average rate of protection of the consumption sector.

Let $U \subseteq \{1, \ldots, n\}$ be the index set of the countries forming the customs union and suppose that the union imposes a common external relative consumption tariff $\tau^0$, while removing all internal trade barriers. A customs union increases the average rate of protection of the consumption sector if and only if

$$
(\tau^0)_{j \not\in U} > \frac{\sum_{j \in U} \lambda^j (\tau^j)_{i \not\in U}}{\sum_{j \in U} \lambda^j}.
$$

If the members had the same relative tariffs $\tau^j$, then Inequality (20) collapses to $\tau^0 > \tau^j$.

Again, the growth effects of customs union formation depend on the presence of dynamic trade creation. Suppose that the countries in the union were a net source of foreign investment in the original distorted equilibrium. Then Equations (15) and (19) imply that growth increases if and only if Inequality (20) holds. Increased protection of consumption raises the share of income going to the high savers in the world economy, and the customs union creates an excess supply of investment and raises growth. On the other hand, if the union chose a high common external investment tariff, then the resulting excess

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11 Thus, we need not be concerned with the special case analyzed by Wonnacott and Wonnacott (1981), in which the formation of a customs union causes one of the members to switch all of its exports of a good from the rest of the world to its partners. Also, because the supply curves are upward sloping, we will not have the type of trade diversion that occurs in models with perfectly elastic supply when all of one partner’s imports are switched from outside the bloc to a union partner.
demand for investment slows growth. These results are reversed if the bloc had the opposite trade pattern in the original equilibrium. Finally, Equation (19) implies that any union has a strong effect on world growth if it is large or if the marginal efficiency of investment is high.

5. THE GROWTH EFFECTS OF A FREE TRADE AREA

Our analysis of free trade areas makes use of the important insight of Richardson (1995). He shows that producer prices will be equalized across countries within the free trade area even if rules of origin prevent consumer arbitrage between partner countries. This simple but valuable observation is employed by Grossman and Helpman (1995) to narrow the number of interesting outcomes from the formation of a free trade area down to three cases. They refer to these as enhanced protection, reduced protection, and intermediate protection, a combination of the first two.

Assume that countries $j$ and $k$ are partners in the free trade area. We follow Grossman and Helpman in focusing on protection of a single good; however, we do not impose their small-country assumption. The interesting cases involve commodities that are imported by at least one of the partners. Without loss of generality, assume that the consumption tariff rate in $j$ is not lower than that in $k$; thus, $\tau_j^f \geq \tau_k^f$.

Before the formation of the free trade area, consumers and producers in $j$ and $k$ face prices $\tau_j^f P_{t,1}$ and $\tau_k^f P_{t,1}$, respectively. If $j$'s demand for consumption at $\tau_j^f P_{t,1}$ exceeds total output in the free trade area, then $j$ will import consumption goods from the rest of the world at $\tau_j^f P_{t,1}$, the common producer price in the bloc. All of $k$'s consumption output is exported to $j$, while all consumption in $k$ is imported from the rest of the world at the lower price $\tau_k^f P_{t,1}$. Thus, for given world prices, producer and consumer prices in $j$ and consumer prices in $k$ are unaffected by the free trade area, but producers in $k$ receive greater protection than before. This is Grossman and Helpman's enhanced protection case.

In contrast, if, at the lower price $\tau_k^f P_{t,1}$, the combined output in the free trade area exceeds the demand for consumption in $j$, then the consumer and producer price in both countries will be driven down to $\tau_k^f P_{t,1}$, the reduced protection case. Now the free trade area is equivalent to a fall in $j$'s most-favored-nation consumption tariff.
The intermediate case arises if there exists a price between $\tau_j^1 P_{t,1}$ and $\tau_k^k P_{t,1}$ at which $j$'s demand for consumption is exactly satisfied by the combined outputs of $j$ and $k$. This situation is essentially a combination of the reduced and enhanced protection cases. For our purposes, sufficient insight can be obtained by focusing on the two polar cases. However, it is necessary to make clear what is meant by these two cases in the presence of terms-of-trade effects and in a dynamic framework.

Incorporating terms-of-trade effects is straightforward. Simply define enhanced and reduced protection as before with the world prices taken at their market-clearing levels in each period. However, the complication arising from a dynamic analysis is potentially more troublesome. For example, a case of enhanced protection may later switch to one of reduced protection. Fortunately, the same regime applies for all time.

To see this, consider now the case of a free trade area between $j$ and $k$. Let

$$\Delta_t \equiv \lambda^j (k_{t,1}^j)^\theta + \lambda^k (k_{t,1}^k)^\theta - \lambda^j \left[c_t^{j,t-1} (\tau^k, p_t) + c_t^{j,t} (\tau^k, p_t)\right] < 0 \quad (21)$$

define the enhanced protection case. The term $\lambda^k (k_{t,1}^j)^\theta$ makes explicit that output of the consumption good in country $k$ now depends on producer prices in country $j$. Since $\Delta_t = \lambda^k (k_{t,1}^j)^\theta - m_t^j$, it follows from Equation (17) that $\Delta_t / (k_{t,1}^j)^\theta$ is independent of $t$. Thus the condition in Equation (21) is independent of time.

Likewise,

$$\Psi_t \equiv \lambda^j (k_{t,1}^k)^\theta + \lambda^k (k_{t,1}^k)^\theta - \lambda^j \left[c_t^{j,t-1} (\tau^k, p_t) + c_t^{j,t} (\tau^k, p_t)\right] > 0 \quad (22)$$

defines the reduced protection case, where now firms in both countries produce using the capital–labor ratio $k_{t,1}^k$. Now the terms $c_t^{j,t-1} (\tau^k, p_t)$ and $c_t^{j,t} (\tau^k, p_t)$ show that consumers in $j$ face the consumption price in $k$. Since Equation (8) implies that $k_{t,1}^j / k_{t,1}^k$ is independent of $t$, one can show analogously that $\Psi_t / (k_{t,1}^k)^\theta$ and, hence, Equation (22) are also independent of time. Continuity establishes the analogous fact for the regime of intermediate protection. Hence, a free trade area will stay in the same regime.

We first consider a free trade area that involves changes in consumption tariffs. Again, the reduced protection case for consumption
is equivalent to country $j$'s lowering its most-favored-nation relative tariff to $r^f_j / r^j_j$. Thus the growth effects of the free trade area depend on whether $j$ was a host or a source of foreign investment in the original distorted equilibrium. If $j$ had been a host of foreign investment, the positive growth effects are captured by Equation (19). Otherwise, the free trade area slows growth. These effects are significant if the marginal efficiency of investment is high or if country $j$ itself is large.

The case of a free trade area that gives rise to enhanced consumption protection is less straightforward. Now producer prices in $k$ are higher than consumer prices there, and the term for $m^k_k$ in Equation (15) is replaced by

$$\left(p_i r^j_j (1 - \theta) \left(\frac{r^j_j}{r^k_k} \cdot \frac{\theta^G}{\theta^1} \right) \frac{\alpha}{\alpha^G} \right)^{\frac{\alpha}{\alpha^G}} - 1).$$

Since $r^j_j \geq r^j_j$, the partial derivative of this expression with respect to $r^j_j$ is positive if country $k$ imports the consumption good before the advent of the free trade area. In this case, a protection-enhancing policy raises world growth. Thus, a sufficient uncondition for such a free trade area to raise growth is that the low-tariff partner was originally a source of foreign investment.

We consider second a free trade area that changes investment tariffs. The situation is different for trade in these goods. A free trade area necessarily entails a regime of reduced protection for investment goods. The argument is by contradiction. Let $r^j_j = \min\{r^j_j, r^k_k\}$ and $r^k_k = \max\{r^j_j, r^k_k\}$ be the minimum and maximum of the two relevant investment tariffs. Suppose there is an equilibrium with enhanced protection for investment. Then “consumer” and producer prices for investment in one country are $r^j_j P_{1,2}$, while the consumer price of the investment in the other country is $r^k_k P_{1,2}$ and the producer price there is $r^k_k P_{1,2}$. Of course, the consumer price of the intermediate investment good is what firms pay to acquire an increment to their capital stock, whereas its producer price is what a firm in the investment-goods sector earns by selling it.

Consider buying a machine in the country with the high investment tariff and then renting out the increment to the capital stock in the next period; such a transaction earns unity in present prices because it is a simple risk-free way to transfer income across periods. But a producer in the low-tariff country can also buy an investment good from the rest of the world and use the incremental capital to produce investment
goods for resale in the trading partner's market. This transaction yields a return of $\tau_2'' P_{t+1.2}/\tau_2' P_{t.2} > 1$, since the price of the investment good in the trading partner's market is $\tau_2' P_{t+1.2}$. Of course, this situation is inconsistent with equilibrium, even when rules of origin ensure protection of local intermediate goods.

Hence, reduced protection of the investment good will mean that the appropriate relative tariffs become $\tau_i^1/\tau_2^1$ and $\tau_k^1/\tau_2^1$, and the country with the formerly higher investment tariff now experiences an increase in its $\tau_i$. Thus, world growth increases if and only if that country was a source of foreign direct investment in the original distorted equilibrium. The unifying principle is this: a free trade area increases world growth if and only if it increases the bloc's imports of consumption, yielding a world excess supply of investment and an equilibrating fall in interest rates.

6. CONCLUSION

Our work can answer some broad empirical questions with minimal data. For example, it is possible to predict that a preferential trading arrangement will cause dynamic trade creation and, hence, increased world growth simply by knowing the bloc's pattern of trade, trade barriers, national populations, savings ratios, and direction of foreign investment. Most of these data are readily available. If one also knows the technological parameters and tariff revenues, then it is possible to calculate explicit growth effects for each case we have analyzed.

Although we have pursued positive questions, our analysis has strong normative implications for the welfare effects of the formation of preferential trading arrangements. Calculating the full effects of tariffs in a dynamic framework, however, requires deriving the transition path, whereas we have confined ourselves to balanced growth. An evaluation of a free trade area might contrast the long-run growth effects against the usual short-run static effects. An exercise comparable to that performed by Baldwin (1992) would reveal the relative magnitudes of these two considerations.

We might emphasize that our results do not depend on the specific production functions (1) and (2) and utility functions (5a) and (5b). There are three crucial elements that determine the balanced growth path: the marginal efficiency of investment, the income share
of the fixed factor, and the marginal propensity to save from permanent income. Let $f_2(k_{t,2}^r)$ be the intensive form of investment production; then define $\lim_{k_{t,2}^r \to \infty} f_2(k_{t,2}^r) \equiv \Gamma$, and all the properties about the marginal efficiency of investment used in describing the balanced growth path are still true. Likewise, let $f(k_t)$ be any neoclassical production function; then the sequence $\{k_{t,1}^r f_1(k_{t,1}^r)/f_1(k_{t,1}^r)\}_{t=1}^{\infty}$ has at least one accumulation point because capital's share is between zero and one. Let this accumulation point be $e_j$ and set $e_j = \sum_{j=1}^{n} \lambda_j \theta^j$; then the growth rate would still not exceed $(1 - \theta)^{\Gamma}$, just as Equation (16) shows.

How general is our assumption about utility function (5b)? As long as preferences are smooth, one can always define a savings rate from permanent income; this rate might depend on the real interest rates in the world economy. Still, on a balanced growth path, there would be some constant real interest rate and some corresponding savings propensity so that an analog of Equation (13) describes the growth rate. Thus, any entirely general specification of a neoclassical economy with two sectors would help describe the transitional effects of commercial policy, and a general specification of our model might have multiple equilibria with balanced growth. But in the long run, the growth effects of trade policies would be much as we have described.

The assumption that agents live for only two periods might seem restrictive. However, what really matters is not that agents live for two periods but rather that the fixed factor that we have called labor is used intensively in the consumption-goods sector. Then protecting that sector raises the share of income that accrues to savers in that country. How this affects the world savings rate is the essence of our analysis. Any theory of endogenous growth that takes seriously the notion that people do not live forever must confront the fact that they acquire an arbitrarily large amount of the capital from finite streams of income. Thus, it is not the fact that agents live for two periods that matters, but it is crucial that tariffs have simple general equilibrium effects on the distribution of income.

On the other hand, our assumption about the redistribution of tariff revenues matters quite a bit. National generational surpluses or deficits indeed affect the growth rate of the world economy, as Fisher (1994) has emphasized. Still, we isolated the effects of commercial policy from policies that redistribute income across generations. It is then a robust
result in a wide class of models that increased relative consumption tariffs raise the real income of fixed factors. Then the growth effect of commercial policy depends on whether the country in question is a source of outward foreign investment.

REFERENCES


