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1 Introduction

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Economic processes are dynamic. Human, physical, and knowledge capital stocks change over time, as do natural resources stocks. People and capital migrate, populations grow, and investment rates change. Although these assertions are self-evident, most applied commercial policy analysis ignores them. For the simple reason that dynamic processes are difficult to capture formally, most applied analysts work with static models. This is an important shortcoming because commercial policies can have dynamic effects and the presence of time-varying factor stocks, technologies, etc. can affect the way in which we evaluate commercial policy. Moreover, trade theory now offers rigorous, formal treatment of many dynamic issues, including interactions between, on the one hand, commercial policy and, on the other hand, the endogeneity of factor endowments (location and size of stocks), natural resource depletion, and the evolution of the technology and skills base.

This volume brings together the work of research economists who are developing and refining methods and models that allow quantification of dynamic effects in applied computation models. The overall objective of the volume is to extend the basic conceptual underpinnings of applied commercial policy analysis in the direction of dynamic issues and applications. Our immediate objective in this introductory chapter is more modest. In this chapter, we offer our own brief tour of major issues related to the extension of applied trade models to address dynamics issues better. In the process of this tour, we provide an overview of the chapters in the volume, placing them within our own characterization of the broader thematic context.

1 Neoclassical growth and trade

From its roots in the seminal work of Solow and his contemporaries (see Stiglitz and Uzawa (1969)), neoclassical growth theory has emphasized

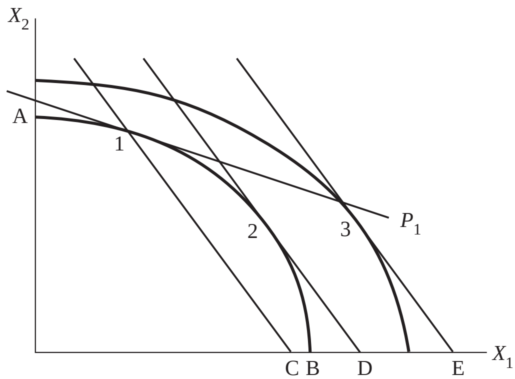

Figure 1.1 Steady-state impact of trade liberalization with endogenous capital stocks.

two important dynamic mechanisms: ongoing technical change (treated as an exogenous mechanism) and population growth. Population growth can contribute to an increase in per capita income, or to a simple expansion of the base of economic activity, with no consequent increase in per capita income. The latter is called extensive growth, while the former is called intensive growth (Reynolds 1983). At the extreme, population growth may actually depress long-run per capita income growth by taxing limited and non-renewable resources (Brander 1992). Physical capital accumulation is also an important factor in the dynamics of neoclassical growth models. A process of continuous capital accumulation is generally necessary to maintain income levels for a growing population, while transitional growth is intimately linked to accumulation. However, with a diminishing marginal product for capital, capital accumulation alone is not a source of sustained economic growth in the neoclassical framework.

Although capital accumulation may not have long-run growth effects in these models, it can still involve important shifts in steady-state national resource bases, as well as significant transitional effects. Figures 1.1 and 1.2 illustrate what we mean by both steady-state and transitional effects in the context of a simple trade model. The production possibility frontier for a small economy producing and trading two goods is represented by AB in Figure 1.1. An initial tariff-distorted equilibrium is represented by production point 1, at world price P_W and internal price P_1. In a static general equilibrium model, trade liberalization moves the economy from point 1 to point 2, with internal prices $P_2 = P_W$. The shift in GDP (at world prices) is then CD. In a general equilibrium model with capital accumulation, however, this is not the end of the story. From

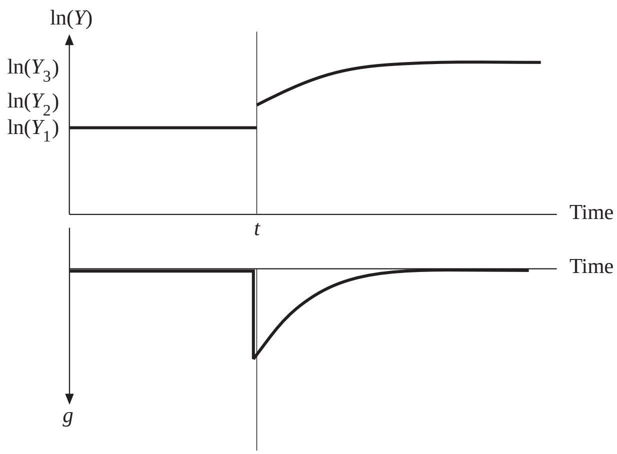

Figure 1.2 **Transitional output effects of trade liberalization with endogenous capital stocks.**

point 2, there may be induced changes in the capital stock, such that there is a shift in the production possibility frontier, leading to a new equilibrium at point 3. The shift in GDP is then from C to D to E. Furthermore, for large countries, there may also be induced changes in the terms of trade (not shown).

Figure 1.2 illustrates the transitional growth effects of such an experiment. The GDP level at point 1 in Figure 1.1 is represented in Figure 1.2 by GDP level Y_1. The static impact of the policy shock, where production moves from point 1 to point 2 in Figure 1.1, involves a shift in GDP from Y_1 to Y_2 in Figure 1.2. The accumulation of additional capital implies a new steady-state level of income, represented by point 3 in Figure 1.1 and by income Y_3 in Figure 1.2. Comparative steady states then involve incomes Y_1 and Y_3, while dynamic adjustment involves economic growth during the transition to the higher level of GDP. Underlying growth rates are represented in the bottom of Figure 1.2, where for convenience we have assumed that permanent (exogenous) growth rates are zero.

The theoretical literature, which has elaborated these basic effects in much greater detail, shows that adding neoclassical growth mechanisms yields substantially different results from those derived in a static framework (see Smith (1976, 1977), Srinivasan and Bhagwati (1980), Baldwin and Seghezza (1996)). Moreover, some empirical work, e.g. Levine and Renelt (1992), finds support for the theoretical prediction that trade openness can affect economic growth via its impact on investment.

In the applied context the impact of trade policy on national capital stocks was recognized in a number of early studies (see Baldwin (1989, 1992), de Melo and Tarr (1992: Ch. 6)). More recently, however, applied commercial policy analysts increasingly allow for endogenous physical capital stocks (see Francois and Shiells (1994), Harrison et al. (1994), Keuschnigg and Kohler (1996)). Although the importance of including induced capital formation effects is now widely recognized, analysts are still experimenting with a variety of approaches and methods.

Three chapters in this volume make significant contributions to this literature. First, Baldwin, Forslid, and Haaland (BFH), Chapter 8, examine the interaction of capital accumulation and preferential trade liberalization, taking the European Union's Single Market programme as an example. They demonstrate that discriminatory liberalization tends to increase the steady-state capital stock of the integrating region and to cause capital depletion elsewhere. Hence, in addition to the static diversionary impact of discriminatory liberalization, regional integration may also lead to shifts in steady-state capital stocks, i.e. 'investment diversion'. The economic channel highlighted in BFH is simple. Since traded goods tend to be more capital intensive than non-traded goods (think of industry versus government services), preferential liberalization within a region tends to raise the derived demand for capital in the integrating region and to lower the capital demand in excluded regions. In the first instance, this shock raises the return to capital in the integrating region and lowers it in the excluded region. Of course, in order to restore capital rates of return to their pre-liberalization levels, a higher capital stock is required in the integrating region and lower steady-state capital stocks are required in the excluded regions.

Whereas the BFH chapter is concerned with regional integration, Francois, McDonald, and Nordström (FMN), Chapter 7, consider more methodological issues. The existing applied general equilibrium models have adopted two distinct approaches to determining steady-state capital stocks: constant savings rates (as in the Solow model) and intertemporal optimization (as in the Ramsey model). According to the standard back-of-the-envelope method for assessing accumulation effects in steady state (based on Baldwin (1989)), the savings specification is not critical because both constant savings rates and Ramsey-type endogenous savings rates lead to the same reduced-form result. This equivalence, however, depends upon assumption of a stylized Cobb–Douglas GDP function. FMN show that this is actually a very special case. Theoretically, they show that with more general GDP functions – ones that allow for more sectors or for more general functional forms – assumptions on savings behaviour matter in the sense that one obtains fundamental differences in the qualitative results depending upon whether one assumes constant savings rates or optimal savings rates. To drive this point home, they use an applied general equilibrium model to evaluate the Uruguay Round of multilateral trade liberalizations under the two alternative savings rules. What they find is that differences in the representation of savings behaviour can lead to opposite conclusions regarding the direction and magnitude of the regional impact of trade liberalization under the Uruguay Round. The message is that our understanding of underlying savings behaviour is critical to our understanding of the long-run dynamic implications of commercial policy.

Both the BFH and FMN chapters are concerned with comparative steady-state analysis, namely the long-run effects and the characteristics of the steady state. In contrast, Francois, Nordström, and Shiells (FNS), Chapter 2, focus on the importance of transition dynamics for trade policy analysis, particularly for developing countries. In terms of Figure 1.2, this involves examination of the *path* from Y_1 to Y_3, rather than just comparing the values of Y_1 and Y_3. To make their point formally, the authors employ a simple growth model, for which they develop the transitional dynamics, contrasting policy reforms in countries near their steady-state income levels (developed countries) with countries far from steady-state income levels (developing countries). Their results show that policy reforms that appear identical based on applied analysis in a static or steady-state framework can have a substantially greater impact on developing countries once transitional accumulation effects have been accounted for. This in turn implies that steady-state analysis alone may miss important dynamic effects related to the welfare effect of transitional adjustment. These effects are going to be most important for countries undergoing relatively rapid transitional growth. They further support the relevance of this point by arguing that the empirical evidence from cross-country growth regressions points to important transitional growth effects related to trade policy reforms.

Applied trade policy analysis with dynamic considerations inevitably raises the issue of the appropriate reference scenario and time-frame used to evaluate policies. The standard static approach is to calibrate a simulation model to actual values in a base year and then to use the model to produce a counterfactual outcome. In essence, this approach asks what the world would have looked like in the base year if other policies than those actually pursued had been in effect. However, once one admits that dynamic considerations are important, this standard approach makes less sense. Two shortcomings are worth noting.

First, the interaction between the trade agreements being analysed and the underlying policy environment may be important. In the absence of forward progress in negotiations, the appropriate counterfactual may involve a worsening of trade restrictions, rather than maintenance of the status quo. Hence, to the extent that ongoing liberalization serves as insurance against protectionist backsliding, the true welfare effects of incremental trade liberalization are much greater than the results from comparative static exercises would normally suggest.

Secondly, because the underlying economy undergoes many changes – for example, growth – the actual effects may differ substantially from those predicted by the counterfactual base year approach (the 'counterfactual' approach for short). For instance, the efficiency loss of a particular quantitative restriction, say the Multi-Fibre Agreement quotes, grows along with domestic demand. Consequently, the timing of the liberalization matters greatly. If a quota is phased out immediately, the counterfactual base year will give a reasonable answer. However, if it is phased out over ten years and economies grow during this time, the counterfactual approach will significantly understate the gains from liberalization. An alternative, which might be called the 'prospective' approach, is to simulate what the economy would look like in ten years (assuming GDP growth rates, etc.) without liberalization. The evaluation would then consist of comparing this simulated no-liberalization case with a simulated liberalization case, with both cases representing what the economy would look like in ten years.

This point has important implications in the endogenous capital models discussed in BFH, FMN, and FNS. In many of these models, many of the gains from liberalization stem directly or indirectly from economy-wide scale effects. That is, the gains from freer trade follow from increased competition and fuller exploitation of scale economies. As economies grow, however, domestic markets may become larger relative to economies of scale in production, so, even without liberalization, domestic monopoly distortions are reduced. It follows, therefore, that the pro-competitive effects of trade will be correspondingly smaller. In other words, competition and scale are limited by the extent of the market. To extend the market, one can open trade or wait for the domestic economy to grow.

Of course, this need not happen in the real world; for instance, the minimum efficient scale of production may rise over time, or new sectors with ever-larger scale economies may emerge. However, given the standard function forms assumed in virtually all applied general equilibrium models, this sort of dilution of gains from trade will occur. For example, with constant elasticity of substitution (CES) preferences over differentiated products, the proportional increase in utility (i.e. dU/U) from a marginal increase in the number of varieties (i.e. dn) equals $1/(\sigma-1)n$ times dn, where $\sigma > 1$ is the elasticity of substitution.

Thus, a very common functional form for preferences implies diminishing gains from extra variety. Another example comes from models (e.g. Haaland and Norman 1992) with small-group monopolistic competition (i.e. models that assume that the perceived elasticity of firms depends upon market shares as well as σ). In such models, increasing market sizes without liberalization allows the equilibrium number of firms to rise, resulting in greater firm size and lower market-power distortions. There are two implications of this. First, it is important to realize that the use of counterfactual or prospective approaches will affect results. Secondly, it may be worth exploring function forms that avoid this dilution effect.[1]

2 Endogenous growth and trade

There is now a sizeable theoretical literature linking international trade with endogenous growth. This literature attempts to provide formal mechanisms for representing the interplay between trade policies and income growth, without recourse to exogenous assumptions regarding the sources of long-run growth. The empirical foundations for believing in such a linkage seem compelling, with numerous studies reporting a positive correlation between an 'open' trade regime and growth performance (see, for example, Henrekson et al. (1996) on regional integration and growth).

In neoclassical growth theory, technical change is taken to be exogenous. In contrast, recent research on endogenous growth has emphasized the mechanisms driving technical change. In particular, the new growth theories have focused attention on formal modelling of how market forces can give rise to technical change and in turn to economic growth. Such economic theories are said to model technical change 'endogenously' (i.e. as a result of the explainable, rational actions of individuals) rather than as the result of unexplained, 'exogenous' developments that are beyond the influence of the economic decisions made by individuals. In such models, the actions of individuals responding to market forces can lead to endogenous technical change and hence to permanent growth. Because trade liberalization can change the market conditions under which firms operate, including available technologies and the incentives for funding education and research, in these models trade liberalization can also lead to changes in the rate of long-run economic growth.

Models of endogenous technical change closely resemble, in terms of mathematical structure, static models of external scale effects. In both, there is a decline in production costs associated with increased industry-

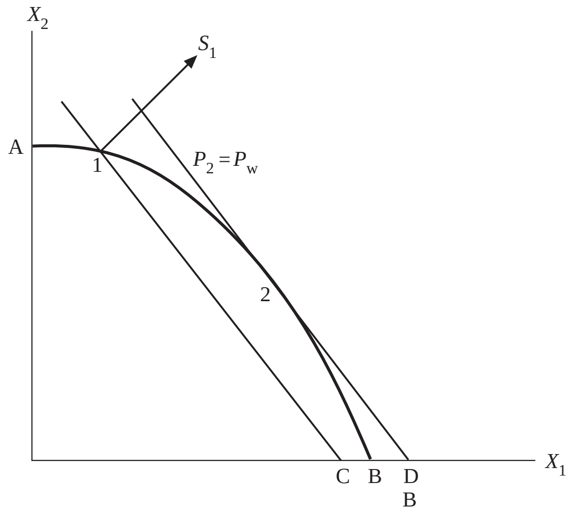

Figure 1.3 Endogenous growth in a small open economy.

level output. In particular, both endogenous growth models (see Grossman and Helpman (1991)) and static models of two-way trade (see Ethier (1982) and Helpman and Krugman (1985)) emphasize vertical or horizontal differentiation of intermediate or final goods. Changes in specialization, in turn, yield changes in the cost of producing utility, either directly in the case of consumer goods, or indirectly in the case of intermediate goods. The basic difference is that, in endogenous growth models, these changes are realized over time. Whether static or dynamic, such scale effects are called ‘external’ because the benefits that follow from increased specialization are not within the control of individual firms, because they depend on the activities of all of the firms in an industry.

We illustrate some of the differences between neoclassical and endogenous growth models with Figures 1.3 and 1.4, in conjunction with Figures 1.1 and 1.2. As in Figure 1.1, the production possibility frontier for a small economy is again represented by AB in Figure 1.3. However, with an endogenous growth model, we now assume that some feature of the underlying model generates a permanent underlying rate of growth, so that over time the production possibility frontier is shifting out. As drawn, this involves a path of steady-state equilibria as illustrated by the path S_1. In terms of Figure 1.4, this means that there is a steady-state growth path for income such as Y_1, and growth rate g_1. A trade policy shock at time t can, in an endogenous growth model, lead to a shift in the

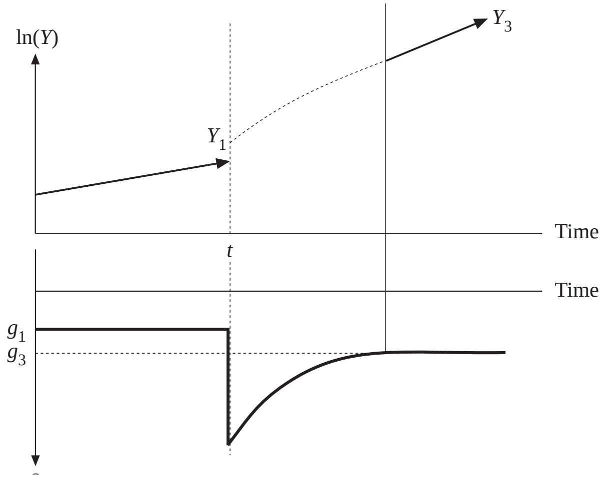

Figure 1.4 Transitional and permanent growth effects with endogenous growth.

steady-state path of income, illustrated in Figure 1.4 by the eventual shift to Y_3 and g_3. In comparing Figures 1.2 and 1.4, transitional effects will again lead to an acceleration of growth. The critical difference is that, because we have modelled permanent growth rates explicitly, the policy shock leads to a permanent rather than temporary surge in growth rates in Figure 1.4, whereas in Figure 1.2 the underlying long-run or permanent growth rate remained unchanged.

Three chapters in this volume, by Baldwin and Forslid (BF), Keuschnigg and Kohler (KK), and Rutherford and Tarr (RT), are concerned with the adoption of endogenous growth theory to applied trade policy models. In Chapter 3, BF examine the analytical aspects of trade policy in endogenous growth models, including discussion of practical implementation issues raised by the standard forms of these models. Their emphasis, like that of much of the theoretical literature on endogenous growth, is placed on long-run growth rates and steady-state growth paths. In contrast, the emphasis of both Chapters 4 and 9 is on the transition. They explicitly trace dynamic adjustment paths between steady states. Like the FNS chapter regarding neoclassical growth mechanisms, the RT chapter shows that, because of differences in dynamic adjustment paths, two policies with the same implications for the steady state can have dramatically different implications for welfare. A similar point is made in the KK chapter. In a model that includes accumulation of both physical and human capital, KK examine the implications of trade and education policy for countries in transition to the steady-state growth path. Taken as a group, the FNS, KK, and RT chapters all point to the importance of modelling adjustment paths and transition dynamics, especially for developing and transition economies.

3 Other dynamic issues

While roughly half of this volume is devoted to accumulation or innovation-based dynamic effects, the remaining papers address a more diverse set of dynamic issues. This set of issues includes the geographic location of factors and production, natural resource depletion and environmental degradation, and the implications of underlying macroeconomic trends for the definition of appropriate analytical baselines.

3.1 Open economy demographics

The literature on old growth, new growth, and trade policy generally assumes away underlying population dynamics. This reflects the emphasis placed on the dynamics of the capital stock. However, population dynamics also has interesting ramifications for trade and trade policy. Developing-country population growth has fuelled worries about trade-related wage erosion in the OECD countries (see Francois (1996)), while concern about the underlying demographics of the North African countries has prompted the European Union to promote economic stability in the region through regional trade agreements (WTO 1995).

Two of the chapters in this volume are concerned with the interaction of demographics with trade and trade policy. Chapter 12 by Roland-Holst examines internal migration and the possible effects these population movements may have on the production structure. An applied example is offered involving population movements within China, where internal migration rivals any contemporary cross-border movement of population.

Whereas Roland-Holst is concerned with internal migration, Francois and Nelson (FN), Chapter 10, are concerned with population growth and the incentives for cross-border migration. Their chapter develops stylized structural links between trade policy and the incentives for migration. This basic theoretical structure is then introduced to a stylized two-region computable model that includes population growth. The chapter highlights the importance of including migration mechanisms when examining the wage effects of trade policy. When viewed in a static model with regional capital and labour stocks, trade protection of labour-intensive industries can, under appropriate conditions, be an effective mechanism for raising wages. However, this depends critically on whether or not there is migration. With population dynamics (including the combination of population growth and migration), trade policy that raises wages in the short run may, over the longer term, induce migration through those same higher wages. This can undo the short-run wage gains. A related point involves the manipulation of terms of trade. Such manipulation can also induce migration, so that beggar-thy-neighbour policies prove to be, in a dynamic context with migration, invite-thy-neighbour policies.

3.2 Foreign investment and the location of industry

Another set of inherently dynamic issues relates to cross-border capital flows and the location of industry. The chapters by Venables and by Markusen and Venables emphasize the implications of modelling multinational firms and firm location. Chapter 6 points to important questions related to dynamic stability. In a dynamic setting, imperfect competition and input–output linkages between firms may lead to hysteresis effects, with the potential for commercial policy to induce significant regime shifts, including the collapse of regional industry. In this context, therefore, industry-wide externalities have implications for modelling not only the dynamics of industrial growth (the subject of many of the chapters in this volume) but also industrial location.

In Chapter 5, Markusen and Venables focus on a different set of firm-related questions. These involve the effects on employment patterns of a firm's decision to act as a multinational (i.e. with different activities carried out in different locations). The formation of multinationals may have important effects on the evolution of employment, the evolution of skilled and unskilled wages, and the effect of protection on wages.

3.3 Environment

Chapter 11 addresses linkages between the environment and trade. This has been an active area of research, and includes work on global warming (Jorgenson and Wilcoxen 1990, 1993, Piggot et al. 1993) and on linkages between trade flows and environmental degradation (Roland-Holst 1997). The chapter by Beghin, Roland-Holst, and van der Mensbrugghe (BRV) is concerned with the long-run modelling of linkages between trade and the environment. The paper addresses the question of whether or not trade liberalization induces developing countries to engage in pollution-intensive activities, and the relationship between piecemeal tariff reform and environmental policy. BRV illustrate the issues they identify through the application of a dynamic model of the Indonesian economy.

Notes

1. Haaland and Norman (1996) provide a number of numerical examples that nicely illustrate these points. The paper also shows that counterfactual exercises underestimate the gains to liberalization in cases where, absent the liberalization, levels of protection would have risen. The Uruguay Round, for example, is often cited as having avoided an important increase in US and European protection.

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