Immiserizing Growth in Expanding Economies

by

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1. Introduction

In one of the most influential papers in the theory of commercial policy, Bhagwati (1958a, 1958b) demonstrated formally the possibility of immiserizing growth: An open economy experiencing an expansion in its productive capacity (caused by economic growth or/and technological progress) can become worse off if its terms of trade deteriorate sufficiently and offset the beneficial effects of economic growth. This path-breaking example set up the stage for the development of the generalized theory of distortions and welfare which constitutes the analytical framework for the modern theory of commercial policy: Johnson (1967) produced another example of immiserizing growth according to which a small open economy facing an exogenously imposed tariff could become worse off as a result of economic expansion; Bhagwati (1968, 1971) related formally the three fundamental theoretical ingredients of commercial-policy theory: welfare, distortions and growth. To put it loosely, his analysis established that in the presence of economic distortions, economic growth might cause deterioration in the level of social welfare.

The purpose of the present note is not to highlight the significance of this fundamental insight, which is an elegant application of the theory of second best and

can be readily viewed as the equivalent of the "unification theory" in the field of Physics. This has been described very elegantly by Srinivasan (1996). The purpose of this note is to describe how the new growth theory can readily established cases of immiserizing endogenous growth.

2. How is Growth Modeled?

Typical studies of immiserizing growth utilizes the standard two-by-two static analytical framework and treats economic growth as an exogenous increase in the economy's productive capacity measured by an expansion in the production possibility frontier. Viewed from the lenses of formal neoclassical growth theory (which was the dominant one on these days), this treatment of economic growth is consistent with two possible interpretations: First, the analyst has in mind a comparison of steady-states of a growing economy where the initial equilibrium refers to a per-capita production possibility frontier and the final equilibrium corresponds to a higher per-capita growth steady-state (caused by an acceleration in the rate of technological progress); Second, the researcher might have in mind steady-state level effects of a growing neoclassical economy which are associated with transitional per capita growth. For instance, a decline in the subjective discount rate or in the rate of population growth generates a higher steady-state capital labor ratio and transitional changes in the rate of economic growth.

In either case, if one were to cast the analysis of immiserizing growth within the neoclassical growth-theoretic framework, then the analysis would have to consider the effects of distortions during the transitional path from the initial to the final steady-state equilibrium. A branch of literature addressed this issue by analyzing the possibility of immizerizing neoclassical growth. More specifically, during the 1970's several researchers addressed the question of deadweight loss caused by a move from autarky to free trade in growing economies (see Deardorff (1973), Smith (1976), and Samuelson (1975) among others). These studies demonstrated that a move from autarky to free trade could lower permanently the per-capita steady state consumption expenditure, in the presence of a fixed savings ratio.

This result is consistent with the generalized theory of distortions and welfare, because the assumption of a fixed savings ratio can be interpreted as being equivalent to a domestic distortion. Starting from this conjecture, Srinivasan and Bhagwati (1980) demonstrated that removing this domestic distortion, by assuming that the savings rate is optimally determined and taking into account the welfare gains during the transition, a move from autarky to free trade is intertemporary efficient.

Despite this novel finding, once could readily see the analytical difficulties in applying the theory of distortions and welfare to the dynamic framework of the neoclassical growth model: The existence of transitional dynamics coupled with exogenous per-capita long- run growth constituted two barriers for the development a dynamic theory of distortions, growth and welfare. The former makes any corrective policy time dependent and therefore difficult to implement; and the second does not leave a lot of room for the presence of distortions and no room at all for policies to affect welfare by changing the level of long-run growth. The development of endogenous growth theory in the early 1990s removed, at least partially, these two barriers and highlighted several new links between the existence of endogenous distortions, long-run growth and intertemporal efficiency.

3. Immiserizing Endogenous Growth

The development of the new growth theory placed the presence of externalities and economic distortions at the heart of long-run economic growth. This section use the insights of Schumpeterian growth theory which concentrates on the analysis of a particular type of economic growth, namely growth based on the endogenous introduction of new products and/or processes. The endogenous generation of new innovations is governed by the process of creative destruction described by Joseph Schumpeter (1942). The presence of endogenous distortions, associated with temporary monopoly power and positive economic profits, creates strong incentives for firms to engage in R&D investments in order to discover new products and/or processes. And assuming that the economy is populated with profit-maximizing single-product firms, economic profits generated by temporary monopoly power are necessary to finance the upfront costs of R&D investments. In other words, the

presence of economic externalities and endogenous distortions (associated with imperfect competition) are necessary for the existence of endogenous long-run growth. Romer (1990) has elaborated on the role of non-convexities and imperfect competition in the generation of long-run endogenous Schumpeterian growth.

We are now ready to describe how the new growth theory can readily generate cases of immiserizing growth. For that purpose, we will use the quality-ladders model of endogenous growth developed by Grossman and Helpman (1991a, 1991b chapter 4). Similar considerations apply to endogenous growth models based on expanding product variety developed by Grossman and Helpman (1991b, chapter 3). Consider then a global economy consisting of a continuum of structurally identical industries producing final consumption goods. The quality of each product can be improved through endogenous innovations. Each innovation is the outcome of a stochastic R&D race and the arrival of innovations in each industry is governed by a stochastic Poisson process whose intensity is denoted by I and is identical to the level of R&D services utilized by profit-maximizing firms in a particular industry. Under the assumption that the continuum of industries is of measure one, the industry- wide level of R&D investment is equal to the economy- wide level of R&D investment.

Labor is the only factor of production and one worker produces one unit of output or α units of R&D services. Following the standard practice we use labor as the model's numeraire and set up the wage equal to unity. The winner of each R&D race becomes the sole producer of the state-of-art quality product in each industry and enjoys global temporary monopoly profits for a random time interval until further innovation occurs in that particular industry. Furthermore, assume that the global economy consists of two structurally identical countries to simplify the analysis and exposition.

Even if the productivity of labor does not differ across the two countries, at each instant of time half of the industries are populated by firms that discovered the state-of-the-art products in one country and the rest are populated by monopolists located in the other country. Therefore, there is a lot of innovation-based trade in this global economy. Moreover, the assumption of a continuum of industries eliminates the presence of aggregate uncertainty. And because firms choose the level of R&D

services and consumers choose the level of consumption expenditure, the economy does not have transitional dynamics.

It turns out that the steady-state equilibrium of this Schumpeterian global economy is characterized by the following equations: The long-run growth of a quality-weighted consumption index (i.e., the growth rate of total factor productivity) is endogenous and given by

$$g = I \ln \lambda \tag{1.1}$$

where I is the steady-state level of industry and economy-wide R&D services and equals the rate of innovations (the intensity of the Poisson process that governs the arrival of innovations; and $\lambda > 1$ is the magnitude of quality increment generated by an innovation (i.e., the magnitude to each innovation). Any policy-related parameter change that affects the allocation of labor between manufacturing and R&D services has an impact on long-run Schumpeterian growth.

In the absence of aggregate uncertainty and transitional dynamics, the aggregate discounted welfare of this global economy -which is proportional to per-capita welfare- is given by

$$U = \frac{1}{\rho}\left(\ln C + \frac{g}{\rho} \right) \tag{1.2}$$

where C is the industry (or economy)-wide global quantity consumed; and $\rho > 0$ is the subjective discount rate, which is equal to the steady-state market interest rate. Equation (1.2) states that global welfare is an increasing concave function of aggregate consumption and the discounted rate of long-run growth. Two more equations define the steady-state market values of global R&D services I and global aggregate consumption level C:

$$\frac{g}{\alpha \ln \lambda} + C = L, \tag{1.3}$$

$$\frac{(\lambda - 1)C}{\rho + \frac{g}{\ln \lambda}} = \frac{1}{\alpha}. \tag{1.4}$$

Equation (1.3) is the *full-employment of labor* (resource) condition and states that the demand for labor engaged in R&D ($I / \alpha = g / \alpha \ln \lambda$) plus the demand for labor in

manufacturing of final consumption goods (C) must equal the global supply of labor (L). Equation (1.4) is *the R&D condition* and states that the expected discounted profits associated with R&D in each industry must be equal to zero; that is, the flow of monopoly profits [$(\lambda - 1)C$)] of a winner of an R&D race discounted by the market interest rate (ρ) plus the probability of default due to further innovation ($I = g / \ln \lambda$) must equal to the unit cost of R&D services ($1/\alpha$).

Equations (1.3) and (1.4) provide the following closed-form solutions for the long-run market values of long-run growth and aggregate consumption:

$$g(\overset{+}{\alpha}, \overset{+}{L}, \overset{+}{\lambda}, \overset{-}{\rho}) = \frac{\ln \lambda}{\lambda}\left[\alpha(\lambda - 1)L - \rho\right] \tag{1.5}$$

$$C(\overset{-}{\alpha}, \overset{+}{L}, \overset{-}{\lambda}, \overset{+}{\rho}) = \frac{1}{\lambda}\left[L + \frac{\rho}{\alpha}\right] \tag{1.6}$$

The sign above each parameter on the left-hand-side in the above two equations indicates the direction of comparative statics exercises. Substituting the steady-state value of aggregate consumption from the resource condition (1.3) into the expression of welfare in (1.2) yields the following expression for the discounted welfare:

$$U = \frac{1}{\rho}\left[\ln(L - \frac{g}{\alpha \ln \lambda}) + \frac{g}{\rho}\right]. \tag{1.7}$$

The socially optimal level of long-run Schumpeterian growth maximizes equation (1.7) (i.e., is the solution to $\partial U / \partial g = 0$) and is given by

$$g_m = \alpha L \ln \lambda - \rho\,. \tag{1.8}$$

The socially-optimum long-run Schumpeterian growth is an increasing function of the productivity of labor in R&D services, the global endowment of labor and the size of innovations. It is also a declining function of the subjective discount rate.

It is well known that the presence of distortions creates a deviation between the socially-optimum and the market-equilibrium rate of innovation and long-run growth in quality ladder models of economic growth. The presence of monopoly power which is necessary to finance the R&D investment and to pay the wage bill of R&D researchers prior to manufacturing of newly discovered goods creates a positive price cost mark-up equal to $\lambda - 1$ in each industry. This distortion does not result in misallocation of resources across industries because all industries in the economy are

symmetric by assumption, but creates an incentive for over investment in R&D and excessive market-driven growth: Each innovation contributes to social welfare by raising the instantaneous utility by an increment equal to $\ln\lambda$ which is strictly less than the price cost mark-up $\lambda-1$, which serves as the market incentive for firms engaged in R&D. In addition, firms discount profits by a discount factor equal to the market interest rate plus the probability of default due to further innovation, $\rho+I$ because their lives are finite (due to creative destruction effect); whereas the social planner discounts the contribution of each innovation using the equilibrium market interest rate ρ. This difference in the market and socially optimal discount factors creates an intertemporal distortion which generates a tendency for underinvestment in R&D by profit-maximizing finite-lived firms. As a result one cannot rank the socially-optimum and the market-equilibrium rates of long-run innovation and growth in this global economy.

Since long-run growth is endogenous, we are interested in parameter changes that accelerate long-run economic growth and reduce the level of economic welfare in this global Schumpeterian expanding economy. In order to illustrate the role of economic distortions and generate immiserizing endogenous growth, denote with $\theta\in(\alpha,\lambda,L,\rho)$ a typical parameter that affects long-run growth and obtain the following standard decomposition of discounted welfare:

$$\frac{dU}{d\theta}=\frac{\partial U}{\partial\theta}+\frac{\partial U}{\partial g}\frac{dg}{d\theta}=\frac{\partial U}{\partial\theta}+\frac{1}{\rho}\left[\frac{1}{\rho}-\frac{1}{\alpha L\ln\lambda-g)}\right]\frac{dg}{d\theta} \qquad (1.9)$$

Immiserizing growth can arise from parameter changes that accelerate the rate of long-run endogenous economic growth (i.e., an increase in the productivity of R&D α, the economy's labor endowment L, or the magnitude of innovations λ) but reduce the discounted welfare (i.e., $dU/d\theta<0$).

Consider first the case in which there is a corrective domestic policy (in the present model this policy can take the form of an R&D tax or subsidy) which achieves the socially optimum level of economic growth. This means that the term in square brackets of (1.9) is equal to zero, and therefore $dU/d\theta=\partial U/\partial\theta$. It is obvious, then, from inspection of (1.5) and (1.7) that a marginal increase in α, L, or

λ raises the levels of long-run growth and welfare: In the presence of a corrective policy, the possibility of immiserizing growth does not arise. This result is consistent with the theory of distortions and welfare.

In the absence of a corrective policy, one could demonstrate readily the possibility of immiserizing growth. A necessary condition for this possibilty is that the market rate must exceed the socially optimum level of long-run growth, which implies that the term in square brackets in (1.9) is negative. Because an increase in any of these parameters increases both the discounted value of welfare for any given level of growth and the level of long-run growth (i.e., $\partial U / \partial \theta > 0$ and $\partial g / \partial \theta > 0$ for $\theta \in (\alpha, \lambda, L)$) the sign of (1.9) is ambiguous. However, if the magnitude of the negative term $(\partial U / \partial g)(dg / d\theta)$ is sufficiently large, that is larger in absolute value than the positive term, then higher growth is associated with lower welfare: An increase in the economy's labor endowment L, the magnitude of innovations λ, or the productivity of R&D services α, raises the level of long-run Schumpeterian growth but reduces the level of discounted welfare. The intuition for this seemingly paradoxical result comes from the theory of welfare and distortions: In the presence of distortions and increase in the productive capacity of this global economy increases the difference between the market and socially optimal rates of innovation and long-run growth. This affects negatively the level of welfare and can dominate the direct welfare enhancing effect of these capacity-augmenting parameter changes. Therefore, even when the presence of economic distortions generates endogenous long-run growth, the main insights of immeserizing-growth theory apply with equal clarity and force to a growing expanding economy as it applied to a static setting more than 45 years ago.

4. Conclusions

Bhagwati (1958) discovered the possibility of immiserizing growth using a static analytical framework. This discovery set up the stage for the development of the theory of distortions and welfare which constitutes the backbone of the modern theory of commercial policy. The insights of the latter as well as the possibility of immiserizing growth apply to formal neoclassical or endogenous growth dynamic

settings. In the absence of distortions, an expansion in an economy's productive capacity enhances growth and dynamic efficiency; however the presence of distortions might create the conditions for a negative correlation between long-run economic growth and welfare. Using the theory of distortions to identify policies that affect the level of long-run growth and welfare and prevent the possibility of immeserizing growth is an important and relatively unexplored area in the new generation of Schumpeterian growth models which constitutes an avenue for further research.[1]

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[1] See Dinopoulos and Sener (2004), Dinopoulos and Thompson (1999) and Jones (1999) for overviews of these models.

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