The dynamics of technology, growth and trade: A

Schumpeterian perspective

by

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Abstract

Why do some countries, such as, for instance, Japan and some other Asian economies in the second half of the twentieth century, grow much faster, and have much better trade performance, than most other countries? Is superior trade performance, what is often termed “competitiveness”, a condition for faster growth, or is it of only minor importance compared to other factors? Although long run economic change, what he termed “development”, was Schumpeter’s favourite topic, he did not enter into the discussion of why some countries succeed better in this respect than others, and how trade interacts with such outcomes. However, it might be argued that his perspective would be highly relevant for the analysis of this topic. This paper outlines a synthetic framework, based on Schumpeterian logic, for analysing what shapes differences in growth and competitiveness. The framework is shown to encompass many of the applied models that have been suggested in the literature.

Introduction

Why do some countries, such as, for instance, Japan and some other Asian economies in the second half of the twentieth century, grow much faster, and have much better trade performance, than most other countries? Is superior trade performance, what is often termed “competitiveness”, a condition for faster growth, or is it of only minor importance compared to other factors? Although long run economic change, what he termed “development”, was Schumpeter’s favourite topic, he did not enter into the discussion of why some countries succeed better in this respect than others, and how trade interacts with such outcomes. However, it might be argued that his perspective would be highly relevant for the analysis of this topic (Fagerberg 2002, Introduction). In fact, as we shall see in the next section, Schumpeter’s theory of innovation-based growth, with technological competition as its driving force, has been quite influential in shaping the research agenda in this area. But although many contributions in this area did, to some extent, embrace Schumpeter’s dynamic outlook, applied work in this area has often failed to take innovation properly into account. Section three of the paper outlines a synthetic framework, based on Schumpeterian logic, for analysing what shapes differences in growth and competitiveness with particular emphasis on the role played by innovation and diffusion of technology. This
framework is shown to encompass many of the points that have been raised in the applied literature.

**Schumpeterian renaissance**

The decades that followed Schumpeter’s death (1950), constituted a low tide for his ideas and evolutionary economics more generally (Fagerberg 2003). Instead economists gradually adopted formal, mathematical equilibrium-models of the type that Schumpeter admired but had found to be of little value for understanding long-run economic and social change. In spite of this, Schumpeterian ideas soon started to emerge in applied work. The reason for this was, as Schumpeter would have expected, that the formal equilibrium models had very little to say about many real world phenomena. Hence applied researchers were forced to look elsewhere for guidance in interpreting observed developments in, for instance, economic growth and international trade.

The starting point for many of these efforts was the finding by Leontief (1953) that actual patterns of trade seemed to deviate from what the equilibrium approach would predict. As a response to this challenge several authors (Posner 1961, Hirsch 1965 and Vernon 1966) came up with the suggestion that the reason had to do with the

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2 We mention Leontief’s contribution primarily because it influenced the subsequent literature on growth and trade, not because we wish to discuss what shapes specialization patterns in international trade. For overviews that also covers the latter, see Fagerberg (1996) and Wakelin (1997, ch. 2-3).
fact that innovation constantly disrupts the equilibrium forces, so that the observed pattern of international trade reflects the interaction between innovation and diffusion of technology at a global scale, rather than a given distribution of natural and/or man-made assets across different countries or regions. A particularly clear and influential account of this dynamics was the one presented by Posner (1961). The essence of his reasoning can be captured by a two-country model, in which one country is more innovative than the other (and consequently has a technological lead), while the other (the technological laggard) relies more on imitation. New technologies emerge in the technologically leading country, which for a period has a temporary monopoly. However, in the course of time, the technological laggard will learn to cope with these technologies as well, and competition between producers from the two countries will arise. Generally, the level of income will be higher in the leading country, with the size of the income gap depending on the size of the technological gap. Just as increased innovation in the leading country would tend to increase the income gap, intensified technological catch-up (increased speed of imitation) by the laggard would contribute to its reduction. Krugman, one of the contributors in this area, put it well when he draw the following consequence of this logic: “Like Alice and the Red Queen, the developed region has to keep running to stay in the same place.” (1979, p. 262)

The spread of Schumpeterian ideas among applied researchers resulted in the decades that followed Posner’s seminal contribution in
a large number of empirical studies focusing on innovation-diffusion, growth and trade in various sectors/industries. While a lot of the empirical literature that followed was quite eclectic, during the 1980s a number of contributions emerged based more explicitly on Schumpeterian arguments. Much of this work initiated from the Science Policy Research Unit” (SPRU) at the University of Sussex (UK). Researchers at SPRU attempted expand and generalize the existing work in this area to a more full-fledged theory of the dynamics of technology, growth and trade, and to back it up with solid empirical evidence based on extensive use on data on technological activities, particularly R&D and patent statistics (Pavitt and Soete 1982, Dosi and Soete 1983, Dosi, Pavitt and Soete 1990). In this literature innovation was assumed to be the primary factor behind long-run differences in specialization patterns, trade performance and economic growth. Other, more “conventional” factors, while relevant, were relegated to secondary position or assumed to be of a more short-term nature.

However, the “SPRU approach” was not the only current that gained popularity as a result of the apparent failure of the standard neoclassical approach to cope with observed economic phenomena. For instance, the economic historian Gerschenkron (1962) had, on the basis of his studies of European catch-up processes, suggested that the technological gap between a frontier and a latecomer country represented “a great promise” for the latter, since it provided the latecomer with the opportunity of imitating more advanced
technology in use elsewhere. However, because of the stringent requirements for successful imitation of advanced technology, Gerschenkron argued, the fulfilment of this promise would require sustained efforts by the latecomers to be realized. This perspective, which arguably has a strong Schumpeterian flavour, was adopted by among others Abramovitz (1979, 1986, 1994) in a series of analyses of differences in cross-country growth performance over the long run, emphasizing in particular the scope for catch-up and the various “capabilities” that late-comers needed to generate in order to avoid “falling behind”. A similar argument, emphasizing in particular the crucial role played by investment for technological catch up, was made by Cornwall (1977), in an analysis that probably was the first attempt to present econometric tests of what has since been dubbed “conditional convergence”. ³ These ideas were later taken up by Baumol et al. (1989), focusing in particular on the of education in catch up, and since then there has been a plethora of empirical exercises of this type (see Fagerberg 1994, 2000 for overviews). However, although many of the contributions discussed so far did place emphasis on technological change, their modelling approach and subsequent empirical testing did not explicitly take innovation (or R&D) into account. Hence, it might be argued that these contributions failed to take into account a vital aspect of the evolutionary dynamics (Fagerberg 1987, 1988a). We discuss this in more detail in the next section.

³ See Fagerberg and Verspagen (1999) for a discussion of Cornwall’s approach (including its relevance for the
Still another approach to “why growth rates differ”, more Keynesian in flavour (Thirlwall 1979, Kaldor 1981), put emphasis on the growth world demand, and on the “income elasticities of demand” for a country’s exports and imports, in determining a country’s growth performance.\(^4\) This way of reasoning was based on the Keynesian view of export demand as an “autonomous” force that propelled growth through various multipliers (Beckerman 1962, Kaldor 1970). However, as pointed out by Thirlwall, projections based on such an approach might lead to a growth path that would not be sustainable, for instance because it might imply an ever-increasing foreign debt. This, he suggested, could be remedied by introducing a restriction on the balance of trade assuming, for instance, that governments would adjust fiscal and monetary policies towards this end (Thirlwall 1979). In this model the growth of an open economy was shown to depend on growth of international trade, changes in relative prices (price competitiveness) and the ratio of the income elasticity of exports to that of imports. Thus, everything else assumed constant, the higher the income elasticity of exports relative to that of imports, the higher the rate of growth, and vice versa. However, as pointed out by Kaldor, these elasticities, allegedly reflecting the importance of so-called “non-price factors”, were themselves in need of explanation.\(^5\) He argued “in a growing world economy the growth of exports is mainly to be explained by the income elasticity of foreign countries for a

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\(^4\) The income elasticity of exports is the growth in exports resulting from a 1% increase in world demand, holding relative prices constant (and ignoring cyclical factors). Similarly for imports.
country’s products; but it is a matter of the innovative ability and adaptive capacity of its manufacturers whether this income elasticity will tend to be large or small" (Kaldor 1981, p. 603). Consistent with this argument Fagerberg (1988b), in a contribution to be discussed in more detail in the next section, suggested including indicators of technological competitiveness (or innovative ability and adaptive capacity) directly in the equations for exports and imports.

As is evident from the above discussion, the Schumpeterian emphasis on innovation-diffusion as the source of growth (and technological competition as the mechanism through which this happens) came to have a strong influence on the research agenda in this area from the 1960s onwards, particularly among empirically oriented researchers. The influence on “high theory” – the highly mathematized formal equilibrium models that Schumpetered admired but found of little use in his endeavours – came much later, around 1990, and although it had a big impact in that particular field, the resulting theoretical models have had surprisingly little impact on the applied agenda. We will for the sake of space not discuss the contribution from this modeling tradition in detail here, although we will visit it briefly later in the paper.6 What we will do in the following is to present a synthetic framework for empirical analysis, based on

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5 There are, of course, many factors that could be considered potentially relevant, and it is beyond the purpose of this paper to discuss all of these in great detail. See McCombie and Thirlwall 1994, Ch.4.

earlier work by Fagerberg (1988a,b), that encompasses a number of the points raised by the contributions discussed so far.

**A synthetic framework**

We will start by developing a very simple growth model based on Schumpeterian logic, which we will subsequently extend and refine. Assume that the GDP of a country \((Y)\) is a multiplicative function of its technological knowledge \((Q)\) and its capacity for exploiting the benefits of knowledge \((C)\), and a constant \((A_1)\):\(^7\)

\[
(1) \quad Y = A_1 Q^\alpha C^\beta \quad (\alpha, \beta > 0)
\]

Its knowledge, in turn, is assumed to be a multiplicative function of knowledge diffused to the region from outside \((D)\) and knowledge (or innovation) created in the region \((N)\) and, again, a constant \((A_2)\):

\[
(2) \quad Q = A_2 D^\gamma N^\lambda \quad (\gamma, \lambda > 0)
\]

Assume further, as common in the literature, that the diffusion of external knowledge follows a logistic curve. This implies that the contribution of diffusion of externally available knowledge to economic growth is an increasing function of the distance between the level of knowledge appropriated in the country and that of the country

\(^7\) Instead of seeing the model (1)-(6) as a model of GDP growth, one might consider it as a model of GDP per capita (worker) growth, in which case all variables would enter on a per capita (worker) basis. The first applications of the model was based on the former assumption, applied here, while later applications, for instance on regional growth, have generally assumed the latter. The relationship between the two versions of the model is straightforward. Note, however, that if the latter assumption is chosen, population (or labour force) growth would enter into the determination of GDP growth.
on the technological frontier (for the frontier country, this contribution will be zero by definition). Let the total amount of knowledge, adjusted for differences in size of countries, in the frontier country and the country under consideration, be $T^*$ and $T$, respectively:

\[(3) \quad d = \phi - \phi \frac{T}{T^*} \quad (\phi > 0)\]

By differentiating (2), using small case letters for growth-rates, and substituting (3) into it, we arrive at the following expression for the growth of a country’s technological knowledge:

\[(4) \quad q = \gamma \phi - \gamma \phi \frac{T}{T^*} + \lambda n\]

By differentiating (1) and substituting (4) into it we get the country’s rate of growth:

\[(5) \quad y = \alpha \gamma \phi - \alpha \gamma \phi \frac{T}{T^*} + \alpha \lambda n + \beta c\]

Since our primary interest is in “why growth rates differ” it may be useful to express the rate of growth of the country in relative terms (growth relative to the world average), $y_{rel}^8$:

\[(6) \quad y_{rel} = y - w = -\alpha \gamma \phi \frac{T - T_w}{T^*} + \alpha \lambda (n - n_w) + \beta (c - c_w)\]

Hence, following this perspective the rate of growth of a country may be seen as the outcome of three sets of factors:

- The potential for exploiting knowledge developed elsewhere,
- Creation of new knowledge in the country (innovation), and

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8 This is based on the assumption that the two countries face the same competitive conditions (elasticities) but vary in other respects.
• Complementary factors affecting the ability to exploit the potential entailed by knowledge (independently of where it is created).

The above model, simple as it is, encompasses many of the empirical models found in the literature. For instance, the empirical models used in the “catching-up” – literature (see e.g., Baumol et al. 1989) can be seen as a version of (5)-(6) in which the innovation term is ignored. Fagerberg (1987, 1988a) applied this model to a sample of developed and medium-income countries, and showed that all three factors, innovation, diffusion and complementary capabilities, mattered for growth. It was shown that countries that caught up very fast, also had very rapid growth of innovative activity. The analysis presented in Fagerberg (1988a) suggested that superior growth in innovative activity was the prime factor behind the huge difference in performance between Asian and Latin-American NIC-countries in the 1970s and early 1980s. Fagerberg and Verspagen (2002) likewise found that the continuing rapid of the Asian NICs relative to other country groupings in the decade that followed was primarily caused by the rapid growth in its innovative performance, emphasizing the importance of including this factor into the empirical analysis.

Estimations of the model for different time periods (Fagerberg 1987, Fagerberg and Verspagen 2002) have shown that while imitation has become more demanding over time (and hence more costly to undertake), innovation has become a more powerful factor in
explaining observed differences in growth performance. This suggests

that there may have been an important shift taking place in the returns to different types of strategies pursued by countries, and raises questions of what the explanations and the likely long-term consequences of this shift may be. The model has also been used to analyse the differences in growth performance across European regions, illustrating among other things the differences in technological dynamics across different parts of Europe (Cappelen, Fagerberg and Verspagen 1999), and the growth-retarding character of some continuing structural and social challenges (Fagerberg and Verspagen 1996, Fagerberg, Verspagen and Caniels 1997). Arguably, the ability to identify such issues is one of the great advantages of this type of modelling, which by being flexible, open and close to the data-generating process (including an important element of inductive reasoning), attempts to avoid the fate, common for many formal contributions, of being trapped in a highly abstract, mathematized discourse based on far-reaching but highly dubious assumptions (that are usually not tested or even testable). Following Nelson and Winter (1982), who coined the concept “appreciative theorizing” for such attempts to identify causal relationships, we may perhaps call at the modelling strategy applied here for “appreciative modelling”.

The model discussed above opens up for international technology flows but abstracts from flows of goods and services. We will now introduce the latter. For simplicity we do this in a two-
country framework, in which the other country is labelled “world”. Define the share of a country’s exports (X) in world demand (W) as $s_x = \frac{X}{W}$, and similarly the share of imports (M) in its own GDP (Y) as $s_m = \frac{M}{Y}$. For the sake of exposition we will assume that the market shares of a country are unaffected by the growth of the market, but we will relax this assumption later. Following the Schumpeterian logic outlined in the previous section, we will assume that, apart from a constant-term, a country’s market share for exports depends on three factors; its technological competitiveness (its knowledge assets relative to competitors), its capacity to exploit technology commercially (again relative to competitors) and its price (P) competitiveness (relative prices on tradables in common currency).

\[
S_x = A_x \left( \frac{Q}{Q_w} \right)^\rho \left( \frac{C}{C_w} \right)^\mu \left( \frac{P}{P_w} \right)^\pi \quad (\rho, \mu, \pi > 0)
\]

Since, by definition, imports in this model are the “world”’s exports, we may model the import share in the same way, using bars to distinguish the coefficients of the two equations:

\[
S_m = A_x \left( \frac{Q_w}{Q} \right)^\bar{\rho} \left( \frac{C_w}{C} \right)^\bar{\mu} \left( \frac{P_w}{P} \right)^\bar{\pi} \quad (\bar{\rho}, \bar{\mu}, \bar{\pi} > 0)
\]

By differentiating (7) and substituting (4) into it, and similarly for (8), we arrive at the dynamic expressions for the growth in market shares:

\[
s_x = -\rho \phi \frac{T - T_w}{T_s} + \rho \lambda (n - n_w) + \mu (c - c_w) - \pi (p - p_w)
\]

\[
s_m = -\bar{\rho} \phi \frac{T_w - T}{T_s} + \bar{\rho} \lambda (n_w - n) + \bar{\mu} (c_w - c) - \bar{\pi} (p_w - p)
\]
We see that the growth of the market share of a country depends on four factors:

- The potential for exploiting knowledge developed elsewhere, which depends on the country’s level of technological development relative to the world average.
- Creation of new knowledge in the country (innovation) relative to that of competitors.
- Growth in the ability exploit knowledge, independently of where it is created, relative to that of competitors.
- Change in relative prices in common currency (price competitiveness).

Following Thirlwall (1979) and Fagerberg (1988b) we now introduce the requirement that trade in goods and services has to balance (if not in the short, so in the long run). Note that this requirement does not rule out that countries may have foreign debts (or assets). As is easily verified we may multiply the left or right hand side of (11) with a scalar without any consequence for the subsequent deductions. Hence an alternative way to formulate the restriction might be that the deficit (surplus) used to service foreign debt (derived from assets abroad) should be a constant fraction of exports (or imports).

\[ XP = MP_w \]

By differentiating (11), substituting \( s_A \) and \( s_M \) into it and rearranging we arrive at the dynamic form of the restriction:
(12) \[ y = (s_X - s_M) + (p - p_w) + w \]

This assumption, it might be noted has been extensively tested on data for developed economies, and found to hold good (Fagerberg 1988b, Meliciani 2001).

By substituting (9)-(10) into (12) and rearranging we get the reduced form of the model:

\[
(13) \quad y_{rel} = -(\rho + \bar{\rho})\phi \frac{T - T_w}{T} + (\rho + \bar{\rho})\lambda (n - n_w) + (\mu + \bar{\mu})(c - c_w) + [1 - (\pi + \bar{\pi})](p - p_w)
\]

By comparing this with the similar reduced form of the growth model (6) we see that, apart from the last term on the right hand side, the model has the same structure. The only difference is that the coefficients of the basic growth equation now are shown to be sums of coefficients for the similar variables in the market-share equations (for the domestic and world market). Hence, the sensitivity of the markets (or “selection environments”) for new technologies clearly matters for growth. The final term is the familiar Marshall-Lerner condition which states the sum of the price-elasticities for exports and imports (when measured in absolute value) has to be higher than one if deteriorating price-competitiveness is going to harm the external balance (and – in this case – the rate of growth of GDP).

We have modelled the market share equations on the assumption that, when not only price, but also technology and capacity have been taken into account as competitive factors, demand may be assumed to have a unitary elasticity. This means, for instance, abstracting from other factors, that if export demand grows by a certain percentage,
exports will do the same, so that the market share remains unaffected. However, there are reasons to believe that this assumption, although appealing in its simplicity, does not necessarily apply in all cases. If a country has a pattern of specialization geared towards industries that are in high (low) demand internationally, the argument goes, its exports may grow faster (slower) than world demand, quite independently of what happens to other factors. Arguably this possibility might be expected to be of greatest relevance for small countries, since these are likely to be more specialised in their economic structure than large ones. To take this possibility into account we, following Fagerberg (1988b), introduce demand in the market shares equations:

\[
S_x = A_x \left( \frac{Q}{Q_w} \right)^\rho \left( \frac{C}{C_w} \right)^\mu \left( \frac{P}{P_w} \right)^{-\pi} W^{r-1} \quad (\tau > 0)
\]

\[
S_m = A_m \left( \frac{Q_w}{Q} \right)^\gamma \left( \frac{C_w}{C} \right)^\eta \left( \frac{P_w}{P} \right)^{-\pi} y^{r-1} \quad (\tau > 0)
\]

By, as previously, differentiating and substituting we arrive at the following expression for the reduced form:

\[
y_{rel} = -\left( \frac{\rho + \overline{\rho}}{\tau} \right) \phi \frac{T - T_w}{T_r} + \left( \frac{\rho + \overline{\rho}}{\tau} \right) \lambda (n - n_w) + \left( \frac{\mu + \overline{\mu}}{\tau} \right) (c - c_w) + \frac{1 - (\pi + \overline{\pi})}{\tau} (\rho - \rho_w) + \frac{\tau - \overline{\tau}}{\tau} w
\]

The first thing to note is that the higher the demand elasticity for imports, the lower the effect on growth of all other factors. This has to do with the requirement to keep external balance: the more import-intensive growth is, the harder it is to keep the balance in order. The
second is that while, as before, the first three terms on the right hand side resemble the basic growth model (6), the two last terms in (13’) concur with the model suggested by Thirlwall (1979). Hence, both the basic model (6) and Thirlwall’s model can be seen as special cases of a more general, open-economy model.9

The open-economy model, outlined above, has been applied to empirical data for developed economies by Fagerberg (1988b). The empirical results, based on data for fifteen OECD countries from the early 1960s to the early 1980s, generally confirmed the importance of growth in technological and productive capacity for competitiveness. The impact of cost factors was found to be relatively marginal, consistent with the earlier findings by Kaldor (the so-called Kaldor paradox, see Kaldor 1978). 10 Recently, Meliciani (2001) has applied the model to a longer time series, including a more recent time period, with broadly similar results.11

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9 If the demand elasticities are the same in both markets and the Marshall-Learner conditions is exactly satisfied (or relative prices do not change), the two last terms vanish, and we are back in a model that for all practical purposes is identical to (6). If, on the other hand, the country’s technological level is exactly average and both relative technology and relative capacity keep constant, the three first terms vanish, and only Thirlwall’s model remains.

10 Kaldor (1978) showed for a number of countries that over the long term market shares for exports and relative unit costs or prices tend to move together, i.e., that growing market shares and increasing relative costs or prices tend to go hand in hand. This was, of course, the opposite of what you would expect from the simplistic though at the time widely diffused approach focusing exclusively on the (assumedly negative) impact of increasing relative costs or prices on market shares, hence the term “paradox”. Fagerberg (1996) has shown that this finding also applies to a more recent time period.

11 She also added a “specialization” variable, reflecting the extent to which countries were specialized in technologically progressive sectors, to the market share equations, for which she found empirical support.
Reflections

The framework developed here is purposely flexible. It has a hard core, based on Schumpeterian logic, to which other variables may be added to give a consistent picture and realistic, unbiased estimates of the impacts of the central variables. The framework may be developed in various ways, depending on the interests of the researcher. For instance, Verspagen (1991) has added a more complex modelling of the diffusion process that enhances the possibility for divergence in performance and “lock-in” to inferior paths. There have also been attempts to endogenize the “capacity”-variable, by linking it to investment, taking into account the possible feedback on the latter from demand (GDP) growth (Fagerberg 1988b). However, this is at best a very partial explanation of such differences in the capacity to exploit technological advance, and a broader framework, including differences in financial systems, support systems etc., would clearly be preferable. Similarly, one might wish to question the alleged exogenity of the price variable, noting, for instance, its relationships to costs, and the dependency of the latter variable on factors such as wages and labour productivity. Initially, one reason for not pursuing this further was the view that labour markets, and systems of wage determination, differ a lot across countries and hence might difficult to fit into the framework of a general model. Moreover, going further in this direction would most likely require endogenization of labour
productivity,\textsuperscript{12} which arguably increases the complexity of the task (Verspagen 1993). Despite these challenges this is certainly an issue that deserves serious attention.

We have left to the end, what in light of the most recent addition to the literature on growth, so-called “new growth theory” (Romer 1990, Grossman and Helpman 1991, Aghion and Howitt 1992), may be seen as the most burning issue, namely the possibility of endogenizing innovation. Basically, “new growth theory” explains growth much in the same way as traditional (neoclassical) economic theory would explain any economic phenomenon, e.g., as the result of interaction between “rational” actors, endowed with “perfect information”, and reacting to well known economic incentives in the accustomed way. The difference between this “new growth theory” and its (neoclassical) predecessor(s) consists mainly of taking on board the facts that (a) IPRs (intellectual property rights) give some limited protection to innovators (and that markets for new technology therefore exist), and (b) that, in spite of IPRs, some of the benefits from innovation cannot be privately appropriated, but continue to spill over to other activities or agents and contribute to increased

\textsuperscript{12} An easy way to endogenize labour-productivity would be to let it depend on demand, through the incorporation into the model of the so-called “Verdoorn’s law, in the fashion suggested by Kaldor (1967). By doing so one might eliminate GDP growth and arrive at reduced form with growth of labour productivity as the dependent variable. Such an equation would have a structure roughly similar to the growth equations presented above. However, as is probably obvious to the reader, this would imply that also employment growth would be determined by the model, and without any relationship whatsoever to factors such as labour supply and the working of labour markets. This would in the view of the present author be too simplistic. Hence, a broader framework appears necessary in order to deal with these challenges.
productivity/profitability there (and hence growth). While, in this approach, the partial protection offered by IPRs is important for explaining why innovations occur, it is the spillover-part that secures that growth does no cease (due to decreasing returns). However, these spillovers are – as in earlier vintages of neoclassical growth theory – basically seen as a “public good”, i.e., something that is freely available for everybody (independent of location) and which consequently should have the same effects everywhere. Thus while, arguably, this approach correctly identifies some important features behind global growth, it does not provide us with much insight into why growth differs across contemporary developed economies and has, to the best of our knowledge, yet to generate any serious attempt to explain such differences. To do that one would probably have to dig much deeper into how innovation-diffusion is embedded within national economies, i.e., in firms, networks, institutions etc., and interacts with other variables there. While a very profitable undertaking, and highly complementary to the analysis presented in this paper, it is not something that can be pursued further here.
References


