ABSTRACT: What, if anything, can a country today do to catch-up with the industrial leaders? This paper reviews a theory of the evolution of international income levels and examines its predictions for catch-up. The main policy implication of this theory is that a country will catch-up to the industrial leaders if it eliminates policies that constrain the choice of technologies and work practices of its citizenry. Most often these policies exist to protect specialized factor suppliers and corporate interests. We examine the record of catch-up over the twentieth century and conclude that joining a free trade club is an effective way by which a country can eliminate these constraints.

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1. Introduction

Today, differences in international incomes are huge. Even after adjusting for differences in relative prices and factoring in household production, the typical person living in a rich country, such as the United States, is twenty to thirty times richer than the typical person living in a poor country, such as Haiti. This is in stark contrast to the differences that existed prior to 1700. In 1700 and before, the living standard of the richest country was less than three times the living standard of the poorest country. Moreover, in the pre-1700 period theses living standards showed no significant increases over time.

After 1700 this all changed, as some countries started experiencing sustained increases in their living standards. England was the first country to develop, that is, to realize sustained increases in per capita income. Western European countries and countries that were ethnic offshoots of England began to develop shortly thereafter. At first, the increases in income experienced by these early developers were irregular and modest in size. However, after the start of the twentieth century, these increases have been larger and relatively regular with income doubling every 35 years in these countries—a phenomenon Kuznets (1966) labels modern economic growth.

Over time more and more countries started experiencing sustained increases in living standards, and today virtually all have accomplished this feat. On account of these later starts, the gap in incomes between early and late developers widened over time and huge differences in international incomes emerged. The implication of this evolution of international incomes since 1700 is shown in Figure 1 for the four major regions of the world.

What, if anything, can a late starter do to catch-up to the leaders? This paper provides an answer to this question. It begins by setting out a theory that accounts for the evolution of international income levels, and by examining the policy implications of that theory. The theory represents a unification of two theories: the Hansen and Prescott (2002) theory of economic development and growth, and the Parente and Prescott (2000) theory of relative efficiencies. The essence of this unified theory is that a country starts to experience sustained increases in its living standard when the efficiency at which it can use resources in modern technologies reaches a critical level. Countries reach this critical level of efficiency at different dates not because they have access to different stocks of
knowledge, but rather because they differ in the amount of constraints placed on the technology choices of their citizenry. These constraints, which are the result of explicit policies, exist in many instances to protect the interests of groups vested to current production processes. If these constraints are removed, the theory predicts that a late starter will catch-up to the leaders.

The paper follows this review with an examination of the record of catch-up in the world, and the reason for catch-up. As constraints typically are put in place to protect the interests of industry groups associated with current production processes, their removal is most likely to be contentious. For this reason, we examine the record on catch-up in greater depth for the purpose of determining the circumstances under which barriers to efficient use of technology were reduced in some countries and catching up with the efficiency leaders occurred. We conclude from this examination that membership in a free trade club is an important way by which a country can eliminate these constraints. This reason for this is that when a country belongs to a free trade club it is no longer in the interest of industry groups to prevent the efficient use of resources.

The paper is organized as follows. Section 2 presents the model economy and describes the equilibrium properties of the model. Section 3 then examines the record of catch-up in the world economy and the reasons for catch-up. Section 4 concludes the paper by discussing the prospects for catch-up for some individual countries that are not currently members of a free trade club.

2. A Theory of the Evolution of International Incomes

2.a The Model Economy

The theory is embedded in a dynamic general equilibrium model. In the model infinitely lived households determine how much of their incomes to consume and how much to invest each period. The representative household’s income in each period consists of three components: wage income, land rental income, and capital rental income. There is a single composite commodity in the economy that can be produced by means of two technologies: a traditional technology and a modern technology. The key difference between the two technologies is that the traditional one uses a fixed factor in the form of
land. In each period, firms decide which technology to use, and how much capital, land, and labor to hire.

The number of households in an economy varies over time. In the era prior to 1700 when incomes stagnated, the theory has an economy’s population vary so as to maintain a given level of households’ consumption. We do not see this relation resulting from the fertility decisions of individual households. Our modeling strategy reflects the fact that societies have devised social institutions and policies that give them their desired population size. In the pre-1700 era when land was an important input, countries set up social institutions that controlled population so as to maintain the highest possible living standard consistent with the ability to defend itself from outside expropriators. After 1700 when land became less important, societies did not need such a large population and set up social institutions that limited their population size. In modern China, for example, a law effectively limits many households to one child. In other periods and in other countries social norms that led to later marriage had the consequence of reducing fertility.

For reasons of space, we omit formal descriptions of the household side of the economy and of the model’s demographics. We refer the reader to Parente and Prescott (forthcoming) for a detailed description of these features of the model. For the points we wish to establish here it is sufficient to limit our description to the technology side of the model economy.

The Traditional Technology

The traditional technology is given by a Cobb-Douglas technology,

\[ Y_{Mt} = A_{Mt} K_{Mt}^\phi N_{Mt}^{\mu} L_{Mt}^{1-\phi-\mu} \]

In equation (1), \( Y_{Mt} \) is output, \( K_{Mt} \) is capital, \( N_{Mt} \) is labor, and \( L_{Mt} \) is land in period \( t \). \( A_{Mt} \) is a total factor productivity (TFP) parameter, \( \phi \) is the capital share parameter, and \( \mu \) is the labor share parameter. TFP is assumed to grow exogenously at a constant rate \( \gamma_M \); that is, \( A_{Mt} = (1 + \gamma_M)^t \) to reflect the fact that technology was not stagnant after 2000 B.C.\(^1\)

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\(^1\) See Mokyr (1990).
The Modern Technology

The modern technology is also given by a Cobb-Douglas production function. In contrast to the traditional technology, the modern technology includes no fixed factor of production. The modern technology is

\[ Y_{St} = E_{St} A_{St} K^{\theta}_{St} N^{1-\theta}_{St}. \]

In equation (2), output is \( Y_{St} \), capital is \( K_{St} \), and labor is \( N_{St} \). Capital’s share is given by the parameter \( \theta \), and a country’s TFP corresponds to \( EA_{St} \).

TFP in the modern technology is decomposed into the product of two components. The first component is an efficiency component, denoted by \( E \). The second component is a pure knowledge or technology component, denoted by \( A_{St} \). The technology component of TFP is common across countries. It is the same across countries because the stock of productive knowledge that is available for a country to use does not differ across countries.\(^2\) It is assumed to increase exogenously through time. The efficiency component, \( E \), is not common across countries. It differs across countries on account of economic policies and institutions. The efficiency component is a number in the \((0,1]\) interval. An efficiency level less than one implies that a country operates inside the production possibilities frontier, whereas an efficiency level equal to one implies that a country operates on the production possibility frontier. Differences in efficiency, therefore, imply differences in TFP.\(^3\)

Relative Efficiency

To see how a country’s policies and institutions determine its relative efficiency, consider a type of policy that effectively constrains firms as to how a given plant technology is operated. An example of this type of policy is a work rule, which dictates the minimum number of workers or machines that must be used when operating a plant technology. In particular, suppose constraints are such that a given plant technology

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\(^2\) Much of the stock of productive knowledge is public information, and even proprietary information can be accessed by a country through licensing agreements or foreign direct investment.

\(^3\) The efficiency parameter \( E \) can change as the result of a change in a country’s policies, but for now we will treat it as constant over time and index it by country only and not by time.
could be operated with $K$ units of capital and $N$ units of labor, but a law requires a firm to use $\phi_K K$ units of capital and $\phi_N N$ units of labor where $\phi_K$ and $\phi_N$ each exceed one. This rule implies that a particular technology, if operated, must be operated with excessive capital and labor. With these constraints, the aggregate modern technology is

$$Y_{si} = EA_{si} K^\theta_{si} N^{1-\theta}_{si}$$

where $E \equiv \phi_K^{\theta} \phi_N^{\theta-1}$. If the nature of the constraints were to double the capital and labor requirements, then the efficiency measure would be one-half. If the nature of constraints were to quadruple both the capital and labor requirements, then the efficiency measure would be one-fourth.

This is just one type of policy that affects a country’s efficiency. There are a numerous other types of policy that affect a country’s efficiency. For example, Parente and Prescott (1994) show how constrains on the choice of the plant technology that can be operated also affects a country’s relative efficiency. Any policy that serves to increase the amount of resources the production unit must spend in order to adopt a better technology is a constraint of this nature. Such policies and practices take the form of regulation, bribes, and even severance packages to factor suppliers whose services are eliminated or reduced when a switch to a more productive technology is made. In some instances, the policy is in the form of a law that specifically prohibits the use of a particular technology. For another example, Schmitz (2001) suggests a mapping from government subsidies of state-owned enterprises to aggregate efficiency.

The evidence strongly suggests that production units in poor countries are severely constrained in their choices, and the costs associated with these constraints are large. This prompts the question: Why does a society impose these constraints? A large number of studies, several of which are surveyed in Parente and Prescott (2000), suggest that constraints are imposed on firms in order to protect the interests of factor suppliers to the current production process. These groups stand to lose in the form of reduced earnings if new technology is introduced. These losses occur because either the input the

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4 In this theory the corresponding concept of capital also includes intangible capital.
5 See Parente and Prescott (2000) for a survey of this evidence.
group supplies is specialized with respect to the current production process, or because they were granted a monopoly over the supply of a factor input to the current production.\textsuperscript{6}

\textbf{2.b Equilibrium Properties of the Model}

The equilibrium properties of the model are quantitatively consistent with the process of economic development and growth and the evolution of international incomes over the last 2000 years.

\textit{Economic Development and Growth}

With respect to the process of economic development and growth, the model predicts a stagnant living standard in all countries up until some date. This stagnant era corresponds to the period of time where the economy uses only the traditional technology. As long as an economy specializes in the traditional technology, any increases in TFP in the traditional technology translate entirely into increases in population. Total output increases but these increases are offset by population growth. This is the result of both land being a fixed factor and that society must have a sufficiently large population to protect this fixed factor.

An economy specializes in the traditional technology as long as TFP associated with the modern technology is below some critical level. More specifically, an economy will specialize in the traditional technology if

\begin{equation}
EA_{St} < \left( \frac{r_M}{\theta} \right)^{\theta} \left( \frac{w_M}{1 - \theta} \right)^{1-\theta},
\end{equation}

where \(r_M\) and \(w_M\) are the rental prices of capital and labor when the economy specializes in the traditional technology. Equation (4) is the condition for the profits of a firm using the modern technology to be negative. The condition follows from profit maximization and the fact that capital and labor are not specific to any technology.

When TFP associated with the modern technology reaches the critical value given by the above inequality, the modern technology begins to be used. This marks the

\textsuperscript{6}Parente and Prescott (1999) show in a model with no capital how a monopoly right granted to factor suppliers can significantly lower a country’s efficiency. Herrendorf and Teixeira (2003) extend this model to include physical capital and show that these monopoly rights have even larger effects on a country’s efficiency.
beginning of a country’s industrial revolution, namely the long transition from a stagnating traditional economy to a modern industrial economy. At some date, inequality (4) must be violated, so eventually every economy will start using the modern technology no matter how small is its $E$. This is because as long as an economy specializes in the traditional technology, the rental prices of capital and labor are essentially constant. Consequently, the right hand side of (4) is a constant. The left hand side, however, is unbounded since TFP in the modern technology is assumed to grow forever at a rate bounded uniformly away from zero. This result is independent of the size differences in the growth rates of TFP associated with the traditional and modern production functions.

Once an economy starts using the modern technology it begins to realize increases in per capita output. The traditional technology will continue to be used, as only the traditional technology uses land as an input and the supply of land is inelastic. However, over time, its share of economic activity continually declines. In the limit, the equilibrium path of the economy converges to the constant growth path equilibrium of a model economy where only the modern technology is used. Asymptotically, per capita output, consumption, real wages, investment and the capital stock all grow at the same rate. This rate is independent of a country’s population growth rate and its relative efficiency. Along this equilibrium path, capital’s share of income and the real interest rate are constant. These are just the well known modern growth facts.

Hansen and Prescott (2002) find that the model is quantitatively consistent with the development and growth process experienced by today’s leading industrialized countries. They calibrate the parameters of the traditional technology to match pre-1700 observations and the parameters of the modern technology to match post-1900 observations for the United Kingdom and United States. The model predicts that an economy that begins the transition in 1700 will be approximately 28 times richer in 1990 than it was in 1700. This is consistent with the historical record, as shown in Figure 2, which plots period $t$ per capita output relative to 1700 per capita output for the model economy and the industrial leader as reported by Maddison (1995, Tables 1.1 and C.12). The model predicts a long transition period. Roughly 150 years elapse before 95 percent of the economy’s output is produced using the modern technology. The growth rate of per capita output rises slowly over the transition period. This is shown in Figure 3. The
growth rate of per capita output only reaches the 1 percent level 100 years after the start of the transition, and reaches the modern growth era level of 2 percent after 200 years have elapsed.

Evolution of International Income Levels

Parente and Prescott (forthcoming) show that the theory accounts well for the evolution of international income levels once differences in relative efficiencies across countries and differences in relative efficiencies across time within a given country are introduced into the model. The theory predicts that all countries will eventually switch to the modern technology, but that the exact date will vary depending on the relative efficiencies of countries in the modern technology. As inequality (4) suggests, countries with lower levels of relative efficiencies switch to the modern technology at much later dates. Thus, the theory attributes a delay in a country’s start to economic development to it having a lower efficiency in the modern technology relative to other countries.

Parente and Prescott (forthcoming) compute the relative efficiency of a late starter required to delay the start of its transition by a given length of time. They find that the required size of the required efficiency difference between the leader and the laggard to generate delays observed in the data are not implausibly large. In particular, they find that a factor difference in relative efficiencies of less than 5 is sufficient to give rise to a 250 year delay in the start of economic development.7

No Catch-Up After the Transition

A number of countries, particularly those located in Latin America, started to experience sustained increases in living standards in the nineteenth century, and yet failed to eliminate their income gap with the leader over the twentieth century. Is this observation consistent with the predictions of the theory? Parente and Prescott (forthcoming) analyze what happens to a country’s income relative to the leader after it switches to the modern technology, assuming that the country’s efficiency level does not

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7 The size of these required differences is shown to decrease as the size of the capital share parameter in the modern technology increases.
change subsequently. They show that there is no subsequent elimination of the income gap with the leader if the country’s relative efficiency does not change.

Figure 4 plots the path of per capita GDP predicted by the model for late starters relative to the leader over the 1700 to 2050 period. Asymptotically, the relative income of a late starter is just the constant growth path level associated with the neoclassical growth model and so asymptotically the factor income difference between two countries is just $(E_s^i / E_s^j)^{1/(1-\theta)}$. The theory does not predict any catch-up for late starters. In fact, the income gap with the leader continues to increase for a while even after the country starts using the modern technology. There are two reasons for this. First, the disparity continues to increase because the traditional production function is still widely used at the start of the transition and the growth rate of TFP associated with the traditional production function is lower than the growth rate of TFP associated with the modern production function. Second, the population growth in these countries tends to be higher compared to the leader over the comparable period. 8

The increase in an economy’s income gap with the leader once it starts using the modern technology is small relative to the increase in the gap with the leader while the country specializes in the traditional technology. The disparity with the leader stops increasing only after the modern production function starts being used on a large scale. For the 1800 starter, the income gap essentially shows no subsequent increase after 1850. This is effectively the case of Latin American. Since 1900, they have remained at about 25 percent of the leaders. For the 1900 starter, the gap effectively stops increasing after 1950. And for the 1950 starter, the disparity stops increasing around 2000. This is effectively the case of Africa. Most countries in sub-Sahara Africa only started to experience sustained increases in living standards after 1950. Their gap with the leader has increased over the 1950–2000 period.

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8 Ngai (forthcoming) also uses the Hansen and Prescott (2002) model of economic development to account for the evolution of international incomes. In contrast, to Parente and Prescott (forthcoming), Ngai examines the effect of policy on the starting date within Hansen and Prescott’s overlapping generations model. On account of this, she finds that some part of the income gap will be eliminated once poor countries start their transitions.
Catch-Up and Growth Miracles

A key feature of the evolution of international income levels is that many countries have been able to narrow the gap with the leader in the twentieth century, with some realizing large increases in output relative to the leader in a relatively short period of time. Botswana, China, Japan, South Korea, and Taiwan each doubled their living standards in less than a decade at some point in time over the post-1950 period. These growth miracles are a relatively recent phenomenon and are limited to countries that were relatively poor prior to undergoing their miracle. No country at the top of the income distribution has increased its per capita income by a factor of 4 in 25 years, and the leader has always taken at least 80 years to quadruple its income.

Does the theory account for the experience of these countries, and the record of catch-up in general. To account for catch-up, including growth miracles, the theory requires an increase in the efficiency of a country relative to the leader. In light of the Parente and Prescott (2000) theory, these changes in relative efficiency are easy to understand. Namely, they reflect policy changes. Following an improvement in policy that leads to a significant and persistent increase in efficiency, the theory predicts that the income of a late starter will go from its currently low level relative to the leader to a much higher level. As it does, its growth rate will exceed the rate of modern growth experienced by the leader countries, and the gap in incomes will be narrowed.

Parente and Prescott (forthcoming) consider a change in relative efficiency in the model economy and find that the model is quantitatively consistent with the growth miracle experiences of countries such as Japan. The theory is consistent with the fact that growth miracles are a relatively recent phenomenon and are limited to initially poor countries. Growth miracles are a relatively recent phenomenon because differences in relative incomes between a low-efficiency and a high-efficiency country widen over time before leveling off. This widening is due to growth in the stock of pure knowledge associated with the modern production function, which the high-efficiency country uses from a very early date. Thus, as one goes back in time, the gap that a low-efficiency country could close by becoming a high-efficiency country becomes smaller and smaller.

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9 Additionally, an increase in efficiency can hasten the start of the transition to modern growth for countries that have not already begun this phase of development.
Obviously, if the gap is less than 50 percent, the low-efficiency country cannot double its income in less than a decade. For the same reason, the unified theory is consistent with the fact that late starters have been able to double their incomes in far shorter times compared to early starters. Growth miracles are limited to the set of initially poor countries because a growth miracle in the theory requires a large increase in a country’s relative efficiency. A large increase in efficiency can only occur in a poor country with a currently low efficiency parameter. This rules out a rich country, which by definition uses its resources efficiently.

3. Catching-Up
The implication of the theory is that countries will be rich if they do constrain the choice of technologies and work practices of its citizenry. Currently poor countries will catch up to the industrial leaders in terms of production efficiency if existing barriers to efficient production are eliminated and an arrangement is set up to ensure that barriers will not be re-erected in the future. The removal of such constraints is a necessary condition for catching up. As discussed in Section 2, there is strong evidence that suggests that these constraints exist to protect the interests of industry groups vested in the current production process. As such, their removal is likely to be contentious. For this reason, it is instructive to examine the record on catch-up in greater depth for the purpose of determining the circumstances under which barriers to efficient use of technology were reduced and catching up with the efficiency leader occurred.

3.a Catch-Up Facts
Catching up is not uniform across regions, as can be seen in Figure 1. Latin America countries began modern economic growth in the late nineteenth century and this set has not subsequently closed the living standards gap with the industrial leader; the per capita income of this set remained at roughly 25 percent of the industrial leader throughout the twentieth century. In comparison, Asian countries with the exception of Japan began modern economic growth later. This set of countries, however, experienced significant catching up in the last half of the twentieth century.
The large Western European countries, namely, Germany, Italy, and France, caught up to the industrial leader in the post–World War II period after trailing the leader for 100 years. Modern economic growth in these countries began about 1840. At that time, their living standard was about 60 percent of the industrial leader, which at that time was the United Kingdom. For nearly 100 years, these countries maintained an income level that was about 60 percent that of the industrial leader. In the post World War II period, output per hour worked in these countries, which is a good measure of living standards because it recognizes the value of non-market time, increased from 38 percent of the U.S. level in 1950 to 73 percent in 1973 and to 94 percent in 1992. Per capita output in Western Europe is still lower compared to the U.S. level, but this difference is accounted for by differences in the fraction of time that people work in the market, and not in the efficiency with which resources are used.

Another important example of catching up is the U.S. development experience in the 1865–1929 period. In 1870, U.K. per capita GDP was nearly a third higher than that of the United States. By 1929, the United Kingdom’s per capita GDP was a third lower than that of the United States. The dramatic growth performance of the United States in this period is an important fact that needs to be explained.

3.b Reasons for Catching Up or Not Catching Up

The United States

We begin with the question of why the United States caught up with and surged past the United Kingdom in the 1865–1929 period. Our answer to this question is that the United States was and continues to be a free trade club, while the United Kingdom was not a member of a free trade club in this earlier period. Our definition of a free trade club is as follows. A set of states constitutes a free trade club if it meets two conditions. Member states cannot impose tariffs and other restrictions on the import of goods and services from other member states. In addition, member states must have a considerable degree of economic sovereignty from the collective entity. Just as no single state is able to block the movement of goods between states, the collective entity cannot block the adoption of a superior technology in one of its member states. Thus, a free trade club in our definition is far more than a set of countries with a free trade agreement.
The United States certainly satisfies these two conditions, and thus, is a free trade club. The individual state governments have a considerable degree of sovereign power over the federal government. Additionally, the interstate commerce clause gives the federal government the right to regulate interstate commerce, and prevent individual states from imposing tariffs and other restrictions on the import of goods and services. With the formation of NAFTA and the recent approval of the free trade agreements with Chile and Singapore, the set of states constituting the free trade club to which the U.S. belongs may be getting larger.\(^\text{10}\)

A free trade club, which prohibits individual states from discriminating against the goods produced in other member states and against producers from other member states operating within their borders, has the advantage that industry insiders in the various member states face elastic demand for what they supply. As a consequence, they are not hurt by the adoption of more efficient production methods as the increase in output leads to an increase in employment of the factor they supply in that industry. If demand were inelastic, an increase in efficiency would lead to a fall in employment, something that industry insiders do not like and would strongly oppose.\(^\text{11}\) Thus, a free trade club provides less incentive for groups of factor suppliers to form insider groups and block the adoption of more efficient technologies.

A free trade club need not be comprised of individual democratic states, as is the case with the United States. However, in a free trade club made up of democratic states with legislatures representing districts, vested interests in one district will be far more limited in their ability to block the adoption of technology in some other district if the citizens of the other district want that technology adopted. In the United States, for example, Toyota was able to locate an automobile plant with its just-in-time production in Kentucky in 1985. Those with vested interests in the less efficient technology in Michigan and other states with a large automotive industry were not able to prevent this

\(^{10}\) The United States was probably more of a free trade club in the 1865 to 1929 period compared to the post 1929 period. This is because the interstate commerce clause was interpreted in the earlier period to mean that states could not interfere with interstate commerce. After 1929, the interpretation changed when the meaning of the clause was broadened so as to allow federal government to regulate interstate commerce.

\(^{11}\) Dowrick and Spencer (1994) review empirical literature that finds union resistance to the adoption of labor-saving innovations occurs within an industry when employment and wages will fall as the result of the adoption of the innovation. They go on to establish conditions under which this will and will not occur.
from happening. The people in Kentucky wanted the large construction project in their state and the high paying jobs in the automobile factory. In 1995 political pressure mounted to block the import of luxury automobiles from Japan. Toyota responded by building plants in other state including Indiana and West Virginia in 1998 and Alabama and Texas in 2003. These location decisions were as much politically motivated as economically motivated and now Toyota is the third largest automobile producer in the United States.

**Western Europe**

The reason why Western Europe caught up with the United States in terms of labor productivity in the 1957–93 period, is the same. With the creation of the European Union, Western Europe has become an equally important free trade club. Its states enjoy even greater sovereignty than do U.S. member states. The German state cannot block the Toyota introduction of just-in-time production in Wales even though German politicians would if they could in response to domestic political pressure. If Toyota starts gaining market share, it will not be long before the auto industry throughout Europe adopts the superior technology, and productivity in the automobile industry increases. This is just competition at work.

The historical statistics lend strong empirical support to the theory that a trading club arrangement results in greater efficiency of production. Table 1 reports labor productivity defined as output per work hour for the original members of what became the European Union and the labor productivity of members that joined in the 1970s and 1980s. Productivities are reported for an extended period before the EU was formed as well as for the period subsequent to its creation.

The Treaty of Rome was signed in 1957 by Belgium, France, Italy, Netherlands, Luxembourg, and West Germany to form the union. In 1973 Denmark, Ireland, and the United Kingdom joined. In 1981 Greece joined, followed by Portugal and Spain in 1986. The most recent additions are Austria, Finland, and Sweden in 1995.

One striking fact is that prior to forming the European Union, the original members had labor productivity that was only half that of the United States. This state of affairs persisted for over 60 years with no catching up. However, in the 36 years after forming what became the EU, the Treaty of Rome signers caught up with the United
States in terms of labor productivity. The factor leading to this catch-up is an increase in the efficiency with which resources are used in production. Changes in capital/output ratios are of little significance in accounting for the change in labor productivity.  

Also reported in Table 1 is the productivity of the EU countries that joined the union in 1973. These countries experienced significant productivity catch-up subsequent to joining the union. It will be interesting to see if Greece and Portugal, the two EU countries that have significantly lower productivity than the other EU members, continue to improve their relative productivity performance.

Another interesting comparison is between the productivity performance of the set of original EU members and the set of Western European countries that either joined in 1995 or still have not joined the EU. This latter set consists of Switzerland, Austria, Finland, and Sweden. We label this set of four countries The Others. Table 5 reports labor productivities of The Others to the original EU countries.

The important finding is that the original EU countries and The Others are equally productive in the pre World War II period. In the 36 years from 1957 to 1993, The Others fell from 1.06 times as productive as the original EU countries to only 0.81 as productive in 1993. This constitutes strong empirical evidence that membership in the EU fosters higher productivity.

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12 See Prescott (2002).

13 Norway is not included in this set of countries because of the large size of its oil industry.
Table 1. Labor Productivities of European Union Members as a Percentage of U.S. Productivity$^a$

<table>
<thead>
<tr>
<th>Year</th>
<th>Original Members</th>
<th>Members Joining in 1973</th>
</tr>
</thead>
<tbody>
<tr>
<td>1870</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>1913</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>1929</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>1938</td>
<td>57</td>
<td></td>
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<td>1957</td>
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<td>76</td>
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<td>83</td>
</tr>
<tr>
<td>2002</td>
<td>101</td>
<td>85</td>
</tr>
</tbody>
</table>

$^a$ The prewar numbers are population weighted labor productivity numbers from Maddison (1995). The postwar numbers are also population weighted and were obtained from Maddison’s Web page, http://www.eco.rug.nl/GGDC/index-series.html#top.
Table 2. Labor Productivity of Other Western European Countries as a Percentage of Original EU Members

<table>
<thead>
<tr>
<th>Year</th>
<th>Others / Original</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>103</td>
</tr>
<tr>
<td>1913</td>
<td>99</td>
</tr>
<tr>
<td>1938</td>
<td>103</td>
</tr>
<tr>
<td>1957</td>
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<td>1983</td>
<td>85</td>
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<tr>
<td>1993</td>
<td>81</td>
</tr>
</tbody>
</table>

The prewar figures are from Maddison (1995). For this period, GDP per capita is used as a proxy for productivity. The postwar numbers are also population weighted and were obtain from Maddison’s Web page, http://www.eco.rug.nl/GGDC/index-series.html#top.

**Latin America**

Latin America failed to catch up because it has failed to develop into a free trade club. For this reason, Latin America per capita income has remained at the same level relative to the leader for the last century. There was no free movement of goods and people between the set of relatively sovereign states. A consequence of this is that often industry insiders in the sovereign states faced inelastic demand for their products or services, and this led them to block the adoption of more efficient production practices. If Latin American countries were to decentralize and restrict the authority of their central governments to be like the United States in the 1865–1929 period, then they too would quickly become as rich as Western Europe and the United States, or maybe richer.

**Southeast Asia**

The reasons for catch-up in Asia are slightly more involved. Countries such as South Korea, Taiwan, and Japan were forced to adopt policies that did not block efficient production as a condition for support from the United States. Further, the need to finance
national defense made protecting those with vested interests in inefficient production too expensive for South Korea and Taiwan. These development miracles along with the Hong Kong and Singapore growth miracles made it clear to the people of the democratic states in the region that the policy that their elected representatives followed mattered for their living standard. Their elected representatives had no choice but to cut back on protecting industry insiders with vested interests in inefficient production or be voted out of office.

The recent catching up done by China is primarily a result of it becoming a free trade club. The rapid development of China began in 1978 when the Chinese government became more decentralized, with much of the centralized planning system dismantled. Although the central government gave more power to regional governments, it did not give the regional governments the right to restrict the flow of goods across regions. In fact, when individual regions attempted to erect trade barriers in the late 1980s and early 1990s, the central government immediately took steps to restore the free flow of goods and services. The resulting competition between businesses in different provinces led to rapid growth in living standards.

While China’s performance since its transition to capitalism has been spectacular, the same cannot be said for Russia’s performance since its transition to capitalism. Whereas China has closed some of its income gap with the leader, Russia has fallen further behind the leader. Between 1985 and 1998, Russia’s per capita GDP fell from 30 percent to 22 percent of the U.S. level. Why has Russia failed to catch-up to the leader following its switch to capitalism?

Russia in contrast to China does not belong to a free trade club, as it still remains economically isolated from Western Europe. It is large enough both in terms of population and land where its regions could make up a free trade club. However, this is not the case. Local and regional governments in Russia have the power to discriminate against producers from other member states operating within their borders, and to restrict the flow of goods and people into and out of their region. For example, in response to the financial crisis of August 1988, regional governments prohibited exports of food goods from their regions and put in place price ceilings for many of those items.

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14 See Young (2000).
Regional governments further have the discretion to use federal funds for purposes they see fit. Often, these funds are used to keep inefficient industries afloat. Local governments also have control over the use and privatization of land. There are essentially no land and real estate markets. In general, the purchase of land and the conversion of non-industrial structures for new commercial activity are not possible. During the privatization phase, local governments refused to lease any property that had not been used commercially.\(^\text{15}\)

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\textbf{4. Concluding Remarks}
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Will the whole world be rich by the end of the twenty-first century? The implication of the theory reviewed in this paper is that a country will catch up to the leading industrial countries only if it eliminates the constraints relating to the use of technology. Saying this is one thing, but accomplishing it is a very different matter. Removal of the constraints to the efficient use of resources is bound to be contentious, because such constraints typically exist to protect specialized groups of factor suppliers and corporate interests.

The historical record of catch-up suggests that joining a free trade club is an important way by which a society can eliminate barriers that were erected to protect specialized groups of factor suppliers and corporate interests, and reduce the likelihood that such groups will seek similar protection in the future. The European Union has and continues to be an important free trade club. The European Union is schedule to expand from 15 to 25 members in March of 2004. The new countries include the Czech Republic, Hungary, Poland, and the Slovak Republic, which are all former Communist sates located in Central Europe. If history is any guide, these countries will narrow the productivity gap with the original European Union members and the United States.

Three of the ten scheduled joiners, namely Cyprus, Malta and Slovenia, already have relatively high GDP per capita and have little catching up to do. They are all small countries that are highly economically integrated with Western European states and have

\(^{15}\) Parente and Riós-Rull (2001) document the greater prevalence of specialized groups of factor suppliers in Russia compared to China, and the successful efforts by local governments in Russia to prevent the adoption of better technologies.
been de facto members of the Western European trading club for a number of years. Countries that are economically integrated with other sovereign states can be rich. Australia and New Zealand are additional examples of rich countries that are not a member of a formal free trading club. These countries, of course, are members of the British Commonwealth, which was a trading club before the United Kingdom joined the European Union in 1973. Poor countries in the world would be wise to heed the lessons of these countries.
References


Figure 1: Evolution of International Incomes: 1700–1990
(Fraction of Leader)

Figure 2: Per Capita Output Relative to 1700
Figure 3: Growth Rate of per Capita Output

Figure 4: Late Start (Output Relative to the Leader)