

Economic Growth and the Economic Historians

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Abstract

The problem of explaining the causes of modern economic growth looms large in the economic history literature. The twelve-fold increase in the material standard of living since the industrial revolution, but that is only enjoyed by a small fraction of the world's population, is the central observation in the field. Since the pioneering work of Colin Clark and Simon Kuznets, empirically and theoretically informed economic historians have attempted to measure, locate, and explain the causes of modern economic growth. The results have been mixed. This paper is a survey of the various methods employed. The literature is characterized by the failure of empirical studies grounded in neoclassical theory to explain the mechanism by which growth occurs. This failure has resulted in a shift to searching for the necessary conditions required for growth to occur.

1 Introduction

This paper is a review of the ways in which empirically oriented economic historians have contributed to our understanding of economic growth. That is, to explain the sustained increase in output per capita that has been caused largely by the use of continuously improving technology in all aspects of production. The contribution of theorists, classical and neoclassical, are well known. The contributions of economic historians, with a few exceptions, are much less well known in the mainstream. In a survey of growth theorists, W. W. Rostow (1990),

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an economic historian, makes no mention of either the new economic historians or the institutional economic historians.¹ This is unfortunate, as economic historians have, in the main, remained closer to the data that they are trying to explain than mainstream theorists.

Explaining the causes of economic growth is perhaps the most important problem. As Deane and Cole observe:

Clearly, the character of the initial acceleration and its preconditions are of particular interest, not only to those who are seeking an explanation of the industrial revolution, but also to those who are concerned with policies which may launch modern pre-industrial economies into a path of sustained growth. (Deane and Cole 1962, p. 278)

But explaining the causes is only one of three ways in which economists can contribute to our understanding of economic growth. In addition to explaining the causes of growth, economists can also provide quantify and measure the evidence of economic growth, and demonstrate the mechanism by which economic growth takes place. The studies discussed in this paper are primarily those concerned with the problems of cause and process.

There is no reason to suppose that the two goals that Deane and Cole cite as motivation for studying the causes of the industrial revolution. Our understanding of the causes has grown over time, but this has not been matched in an increased rate of industrialization by underdeveloped countries. It may well be that we are able to explain the causes of growth without being able to replicate it.

Within the economic history literature, the causes of the industrial revolution loom large. The main emphasis is on Britain, but a large part of the literature is comparative. Explaining why the industrial revolution occurred where and when it did also requires an explanation of why it did not happen earlier and/or elsewhere. Beyond the beginnings are concerns over the spread, both the success of a small number of countries in industrializing, and the failure of the majority to do so. The focus on the industrial revolution is based on an implicit, and sometimes explicit, assumption that the causes of modern economic growth are the same as the causes of the industrial revolution.

Following this, the discussion is centred around three questions:

¹Omitting the former group is perhaps understandable, their contribution was largely negative in demonstrating what did not cause growth, rather than any theories of what did. The latter omission is surprising. Institutional economic historians, led by Douglass North, were writing theories of the causes of economic growth.

1. Is modern economic growth an extension of the growth process that began with the industrial revolution? Are the causes of modern economic growth the same as the causes of the industrial revolution?
2. Was the industrial revolution a revolution, did it represent a discontinuity in any dimension, or was it the continuation of an ongoing process? Or, did it result from a shock to a system in a stationary, non-growing equilibrium to a new, non-stationary, growing equilibrium?
3. To what extent can we explain the ability of a small number of countries to industrialize, while so many fail to do so?

A difficulty that is captured by the quote from Deane and Cole, and that relates to the link between industrialization and modern economic growth, is the separation of changes in level of output and changes in the rate of change of output. It is unusual to find, in the works that follow, a discussion of the difference in character between level effects and rates of change, with McCloskey's discussion of so-called dynamic effects is a notable exception.² A typical definition of modern economic growth is a sustained increase in output per capita. But the process of shifting from an agricultural pre-industrial to a modern industrial society also involves changes in the level of output. Holding technology and all else constant, a shift of labour from agriculture to manufacturing, from a sector with constant returns to scale to one with increasing returns to scale, will result in a one-off increase in total output. But this is not the same as an increase in output for constant inputs, over time. It is this latter that is at the heart of modern economic growth.

This is not to suggest that these level changes are not related to modern economic growth. In Britain, it is likely that the underlying causes of the rural to urban migration are also the causes of modern economic growth. Economic historians concerned with the causes of the industrial revolution implicitly, and sometimes explicitly, make this connection. Elsewhere in the literature there appears to be a divide. Growth theorists write models to describe countries that have made the transition to industrialization, while development economists are concerned with the causes of the initial transitions, and how underdeveloped countries can replicate the experiences of the industrialized.

The discussion is divided into three sections, that roughly match the chronology of methods employed in explaining economic growth. The first section deals with the contributions of Colin Clark, Simon Kuznets, and Phyllis Deane and W. A. Cole. These writers are best known for their quantification and measurement of growth, whether

²John Gould (1972) was typically perceptive on this point, while Sir John Hicks held that growth theory was about theory, while the study of development was fundamentally empirical and intellectually closest to trade.

from original sources or in compiling data from disparate secondary sources. Beyond quantification, they all commented on the causes, and to a more limited extent the process of economic growth. It is these last comments, on the process and causes that are of interest here. Of particular interest is the extent to which their explanations of the causes of growth followed directly from the study of the data.

The second group of writers are the new economic historians, or cliometricians. While they did not propose any theories of economic growth, they introduced formal theory and applied econometric techniques to test the claims of historians that a variety of sectors and industries, the railways, slavery and so forth, either caused or retarded economic growth. While their contributions are best remembered for claiming that no individual sector was an important cause, they also made important contributions in explaining the spread of innovation, and measuring the productivity growth of industries.

The third section is concerned with studies that are general theories explaining the cause, or some aspect of the cause of economic growth. Of these, the study of institutions is the best developed. Within the discussion of institutions, the focus is on three particular studies that reflect materially different ways of incorporating concern with institutions into explaining the causes of economic growth. The central theme of the institutional approach is the development of institutions that facilitate impersonal exchange. Of the remaining studies, Gregory Clark's controversial thesis that there is a genetic component to being middle class is important, at least in part because of the response that it has attracted. Other studies discussed relate to the importance of primary school education, and the transition from organic to inorganic sources of energy. These last have been less controversial, and so have attracted less attention. Even where they are not complete or general theories, they are important in adding to the aspects of growth that a successful model would need to account for. The remaining studies are "big theories" that attempt to explain either the whole of, or a significant aspect of, the history of economic growth.

I conclude the paper with two modest proposals for focus in economic studies on growth. The first relates to the role of uncertainty in decision making uncertainty, the second relates to the basis of individual choice. With respect to the latter, a common theme through much of what is discussed is the role of culture. Aside from the genetic arguments of Clark, the heart of every industrialized country is its middle class. I would like, at the outset to raise the differing views of the middle classes in literature, and a suggestion that the common view is misguided. Perhaps the most famous work of the type that I have in mind is William Golding's *Lord of the Flies*. In it, a group of English school boys are stranded, and in short order revert a murderous tribal society. The suggestion is that society, manners, and being middle class, are a veneer, pasted on, and that will peel off at the slightest provocation.

The evidence from the economic literature is somewhat different. Here I have in mind R. A. Radford's *Economic Organization of a P.O.W. Camp*. Aside from the demonstration of monetary economics, with a normal good instead of *fiat* currency, what is most noticeable to Radford is the spontaneity of economic activity. The prisoners, of which he was one, had all of their basic needs catered for, and no *need* to engage in economic activity. And yet they did; with a sophistication that matched the size of the camp, goods and services were traded, in spot and future markets. As Adam Smith noted long ago, "it is in human nature to truck and barter." It may be that it was this, rather than increasing returns to pin manufacture, that explain the causes of the wealth of nations.

Continuing this theme, there is a growing literature in Biology and the natural sciences that is concerned with our fundamental nature and motivation for action. Prominent among these, Richard Dawkins has argued that we are motivated entirely by self interest, and that apparent acts of compassion are instead calculated acts with future expected benefits. Arguing against this are writers including Frans De Waal, who has argued that we share a genetic heritage with apes that makes us fundamentally social, that we cooperate without the expectation of reward. If Clark is at least correct that human behavioral has changed over time, it would be as well to begin with what we know about our genetic heritage as social animals.

The paper is organized as follows. In section two I discuss the theoretical contributions of those economists best remembered for their contributions to constructing national accounts. In the third section I discuss the contribution of the new economic historians in particular in debunking a number of proposed causes of economic growth. The institutionalists and other general theories of economic growth are discussed in section four. The paper concludes after two proposals for focus in section five.

2 Clark, Kuznets, and Growth Accounting

The earliest analytical contribution of economic historians was the construction of national accounts.³ Of these, the best known is Simon Kuznets. Kuznets constructed historical national accounts for

³There is always the concern that work of this type is simply measurement without theory, the charge that Koopmans (1947) levelled at Mitchell and Burns' study of business cycles. But this criticism is without substance. First, accounting in itself is an abstract construct. While the earliest and most important advances in the field may predate political economy, the value of the double entry bookkeeping system as a means of measuring transactions should not be overlooked. While it may not be economics in the sense of

the USA on the basis of mainly census data, and then globally.⁴ Similar work was done for the United Kingdom by Colin Clark (1932, 1934), and later, and for a longer period by Phyllis Deane and W. A. Cole (1962). Clark also wrote a cross-country comparison in *The Conditions of Economic Progress* (1957). Their contribution was not simply one of measurement and the considerable thought that went into the logical construction of the accounts. In all cases the authors also discussed the causes of economic growth.

In this section I review their discussions on the causes of growth, first Clark, then Kuznets, and then Dean and Cole. The order reflects the shift in focus that can be seen in Dean and Cole. More so than Clark and Kuznets they make statements for which there is a theoretical basis, and their reading of the data becomes an exercise in hypothesis testing. In this regard they are something of an intellectual bridge to new economic historians discussed in the next section.

It should be noted that the data series that they presented were in no cases definitive. The question of the true course of the British and American economies during industrialization is ongoing.⁵ What is of interest here is the interpretation that the historians of long-run aggregates offered to explain the causes and process of economic growth.

Colin Clark had the least to say about the causes of economic growth, but clearly saw the construction and interpretation of national accounts as the starting point. In the first chapter of *National Income and Outlay* (1937) he writes that:

it is only by historical methods that we can assemble all the necessary facts for making a true judgement of any economic question, taking into account also the relevant facts

formal modelling, it is certainly science in the general sense of abstract thinking applied to a problem of measurement. Second, it is not clear that Koopmans was correct in his assertions, either on philosophical or theoretical grounds. Vining (1949) argued in response to Koopmans that in exploration, substance takes precedence over style, and that Koopmans had not demonstrated the superior substance of the methods that he proposed. Empirically, the original methods employed by Mitchell and Burns that were subject to Koopmans' criticism, remain empirically robust and the sophistication of the techniques of "measurement without theory" have expanded (Auerbach 1982). Third, even with *a priori* theory, establishing the facts is not a trivial. Even after a long period of scholarly investigation, there is still debate over the course of real wages during the industrial revolution.

⁴The list is too long to cite here; his main quantitative contribution is probably best summarized by the ten part study, *Quantitative Aspects of the Economic Growth of Nations*, published in *Economic Development and Cultural Change* between 1956 and 1967.

⁵To take a specific example, the question of the progress of real wages during the industrial revolution has been the subject of current debate. Among the more recent contributions are Clark (2005) and Allen (2008). The latter cited paper provides some background to the current debate, that probably began with Lindert and Williamson (1983).

of political, cultural and religious history. (Clark 1937a, p. 2)

Aside from the emphasis on the importance of data, at least part of the answer to what causes growth lies beyond the market for goods, and growth cannot be explained without those additional components. Within the market for goods, Clark emphasizes increasing returns to scale in industry as a cornerstone of increasing output per capita (Clark, 1937, 1937b, 1949, 1957).

In describing the process of industrialization, Clark (1949) begins by describing the shifts that accompany industrialization. The demand for industrial output rises rapidly as incomes rise, and this causes a shift of labour from agriculture to manufacturing. Agriculture is subject to constant returns to scale in all factors, with decreasing returns in labour, while manufacturing is characterized by increasing returns to scale. The shift to manufacturing increases the scale of manufacturing output, and so the economy benefits from increasing efficiency of production. Past a certain point the demand for manufactured goods becomes a replacement demand, and the wealthy shift their consumption to services. The problem for industrialized countries then becomes one of efficiency in the service sector, as "these industries can never yield increasing returns on so striking a scale as manufacture" (p. 114).

The claims about the returns to scale in agriculture as against manufacturing are supported with reference to the fact that in both underdeveloped and developed countries, the share of labour in agriculture is less than agriculture's share of the value of total output. What separates the developed, the U.S.A., from the underdeveloped, China and India, is the share of labour in agriculture.

Clark returns to the importance of increasing returns in the preface to the second edition of *The Conditions of Economic Progress*. In response to the ongoing discussion of the relative merits of socialism and capitalism, Clark writes that:

What breaks down the *laissez-faire* argument is that economic fact which has also been one of the principal source of the world's enrichment - namely the existence of Increasing Returns. This fundamental concept needs precise definition. Increasing Returns is the state of affairs in which the net quantity of real product obtained per unit of effort expended increases as a consequence of an increased scale of production (in one business, or in any specified group of businesses). This definition, it will be seen, excludes the effects of improvements due to better scientific knowledge, better education, better organization, better use of natural resources or any such cause; except where such

scientific knowledge, etc., itself became available, or became capable of application, as a consequence of the increased scale of production, and would not have been available or could not have been applied if the scale of production had been smaller. (Clark 1957, p. x)

He then goes on to demonstrate the existence of increasing returns to scale in a number of (non-agricultural) sectors. What Clark does not develop further, and that is unfortunate, is the separation of technological change into changes induced by the increase in the size of the market, and changes in technology from other sources. There are natural parallels between this idea, and Mokyr's separation of inventions into planned and intentional microinventions, and unpredictable macroinventions (discussed in greater detail below). Clark's final contribution is to dispute the notion that the accumulation of capital is not the cause of increasing output per capita:

I have stated above a positive view of the conditions dominating the long-term possibilities of an increase in productivity, because I believe that the facts have destroyed the view up till now generally prevalent, i.e. the rate of economic growth was primarily dependent upon the rate at which capital was accumulated. Without new investment the replacement of obsolete capital, for which a high obsolescence allowance is properly claimed, appears to give all the necessary scope for the introduction of technical and organizational improvements, and to bring about the rapid increase in productivity under which we are now living. (Clark 1937a, p. 272)

He repeats the claim a page later, and after noting that the laws of economic growth were "yet to be discovered," he adds that the "amount of capital invested seems to be an effect rather than a cause" (Clark 1937a, p. 273). The unimportance of capital investment as a cause of growth may seem obvious today, but for an example of the extent to which growth was believed to follow from capital investment consider Frank Knight's comments in *Risk, Uncertainty, and Profit*. Knight argues that increases in output per capita result from unconsumed capital created by previous generations, and not increases in technology and scientific knowledge. *Risk, Uncertainty and Profit* was not an unimportant work, Robbins prescribed it as a textbook at the London School of Economics during the 1930s.

Moving to Simon Kuznets, and given the magnitude of his contribution, an alternative approach to this essay would have been to ask what we know about economic growth that he did not.⁶ As Robert

⁶This idea is obviously taken from William Baumol's (2000) paper on twentieth century contributions to economic knowledge, that he framed as an answer to the question, what do we know that Marshall did not?

Fogel notes in his biographical memoir, a striking feature of Kuznets' work is how well it has stood up, and how many of his initially controversial predictions have subsequently been correct (Fogel 2001, p. 226). But the magnitude of the contribution makes a brief summary all the more difficult. The discussion that follows is from Kuznets' later work, and his discussions of growth rather than its quantification. Even so, there is a large volume of work to choose from, and so the main emphasis is on two papers, *Towards a Theory of Economic Growth* and his Nobel lecture, and a book *Modern Economic Growth*.

We can divide Kuznets' contribution into three parts. First is the nature and process of economic growth. The second is the reasons for the failure of economic growth to spread more widely than it has. The third is the reason why the industrial revolution happened in Britain and not elsewhere.

In his Nobel lecture Kuznets made six points about modern economic growth. The first two relate to economic output; first, output per capita and population increase together, and second, high rates of productivity growth are experienced for all factors of production. The third and fourth relate to the institutional demands of modern economic growth; modern economic growth is associated with structural transformation of the economy, including a shift from agriculture to manufacturing, and then from manufacturing to services, in addition are closely related social changes, including secularization and urbanization. The last two are relate to the spread of modern economic growth; modern countries spread geographically in their influence, and the spread of modern economic growth has been limited to a quarter of the world's population.

Kuznets defines economic growth more broadly than is typical in the economics literature. Economic growth is the increase in the quantity and scope of goods available, and this is inseparable from the attendant social and institutional change:

We identify the economic growth of nations as a sustained increase in per capita or per worker product, most often accompanied by an increase in population and usually by sweeping structural changes. (Kuznets 1966, p. 1)

In his Nobel speech he offers a similar, although perhaps more complete, definition:

A country's economic growth may be defined as a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments it demands. (Kuznets 1973, p. 247)

Even more so than the institutionalists (discussed below), Kuznets was concerned not only with the institutional preconditions for growth to occur, but on the ongoing institutional and social change induced by economic growth:

In that modern economic growth has to contend with the resolution of incipient conflicts continuously generated by rapid changes in economic and social structure, it may be described as a process of controlled revolution. (Kuznets 1973, p. 252)

It is perhaps best to begin with Kuznets' ideas about the nature of growth theory, and the possibility of ever having a complete theory. In *Towards a Theory of Economic Growth*, Kuznets (1965) writes that:

it is hardly an exaggeration to say that since the mid-nineteenth century, when the Classical and Marxian schools had already formulated their economic theories of the long run, no significant theoretical work has been done in this field, excepting attempts to revise Marxian theory in the light of subsequent events. Meanwhile, with the passage of time, our experience in the economic growth of nations has broadened and empirical records have accumulated, but no significant attempt has been made either to utilize these within a theoretical framework or even to organize, extend, and test them preparatory to theoretical analysis. (Kuznets 1965b, p.)

The title of the paper was deliberately chosen. Kuznets did not believe that he knew enough to write a theory of growth, so instead he was writing material preliminary to such a model. If such a model is ever forthcoming, it will need to incorporate the preliminary material discussed. But the possibility of such a model existing is not obvious:

Can we hope to formulate a theory of economic growth that would indicate the factors in the development of the industrially advanced nations and thus illuminate the problem of possible secular stagnation; to frame the factors so that a testable analysis of obstacles to the economic growth of underdeveloped nations and hence a basis for intelligent development policy become possible; to consider the operation of these factors under a system of free enterprise, as well as within the authoritarian system, so that potentialities in both and their interplay become clear; and to distinguish the factors that make for peaceful and warlike behavior, so that the bearing of each on economic growth

can be perceived? To put the question in this way is to pre-determine a negative answer-provided that by a theory we mean a statement of testable relations among empirically identifiable factors, such relations and factors having been found relatively invariant under diverse conditions in time and space. Such a theory of economic growth of nations may never be within our reach. (Kuznets 1965b, p. 4)

The process of economic growth is the adoption of new technology in production. But technology is a necessary, not sufficient, condition for growth, a "*permissive*" source (Kuznets 1973, p. 247, author's italics.). Periods of economic production can then be divided into epochs, where the epochs are defined by the dominant technology in production.

Having established a definition of modern economic growth, and argued against the possibility of complete theory of economic growth, Kuznets moves on to the features of modern economic growth, to the nature of the changes that have accompanied industrialization. The changes are in the way that things are done.

On the failure of so many countries to experience modern economic growth, the cause is social and institutional. After considering that the expansion and modern countries may have inhibited economic growth in currently underdeveloped countries, Kuznets concludes that:

we find it difficult to avoid the judgement that the orientation of the underdeveloped countries of today, their systems of views and scales of values...must contain many elements that are inconsistent with, hence obstacles to, modern economic growth. (Kuznets 1966, p. 459)

He goes on to note that the adoption of some aspects of modern economic growth are easier to copy than others. So that the elite in underdeveloped countries are able to adopt the consumption habits from industrialized countries, while replicating the modern production practises has been less successful (Kuznets 1966, p. 460).

The process of economic growth, given an adequate social and institutional environment, is self sustaining. Using technology creates positive feedback effects; improved technology not only provides an increasing surplus with which to fund further research, but also improved tools and data for scientists to find the next set of innovations (Kuznets 1973, p. 250).

As to the origins of industrialization, Kuznets views Britain as exceptional for a number of related reasons. First, building on the institutional themes, Kuznets notes that institutions that sustained large

and stable states in the pre-modern era (epoch) were very likely not conducive to the changes and social disruption associated with economic growth. Europe was more likely to be the site of the industrial revolution because it was politically fragmented, in contrast to China that was not (Kuznets 1966, p. 464 and 467). Within Europe, Britain's separation from the mainland kept Britain out of the major wars that occupied France, Russia, and the states of modern Germany. The spark for Britain was bottlenecks created by the existing technology, and the presence of alternatives that required new technology. In particular, Britain had "deep mines and scanty forests" and so the industrial revolution occurred there. Holland had neither forests nor mines, while Sweden had abundant forests. And so the industrial revolution, were it to occur, was always to be a British phenomenon:

It is reasonable to contend that in this combination of noninvolvement in ambitious European politics of size, in the accumulation of long experience with the older economic civilization of Europe, and in the access to the fruits of the preceding geographic expansion, Great Britain was a unique case, unmatched by any European country of the day. If the situation was as indicated as above, the Industrial Revolution could not have occurred concurrently in other countries of Europe, let alone in the rest of the world. (Kuznets 1966, p. 465)

Deane and Cole (1962) present data on the long-run performance of the U.K. economy from 1688 - 1959.⁷ The structure of their study is illuminating on two points. First, the second chapter is entitled *The Eighteenth Century Origins of Economic Growth*, while growth first took hold during the industrial revolution, its origins were earlier. The second is that industrialization and population change are discussed in the same chapter.

Within the chapter on the eighteenth century origins of economic growth, they make the interesting observation that there appear to be two inflection points. In the 1740s, measured by a number of indicators, there was an increase in economic activity. This was followed in the last two decades of the century by an increase not only in the rate of output, but also in the rate of output per capita.⁸ They are unable to conclude that the increase in economic activity in the first part of the eighteenth century was in fact a first stage of long-run economic

⁷While the choice of 1688, the year of the Glorious Revolution, as the starting year is not significant to Deane and Cole other than for the availability of data and the need for a starting point, it is given renewed emphasis in the work of the institutional economists discussed below.

⁸Evidence for a two-step process in the modernization of Britain is consistent with Wrigley's notion of an organic/ inorganic divide that is discussed below.

growth; the absence of data for the seventeenth century means that the possibility that it was simply the reversal of an earlier downturn cannot be eliminated.

In discussing the mechanics of growth, they focus on three sectors, population, harvests, and overseas trade. A considerable emphasis is placed on overseas trade:

There can, of course, be no doubt of the central importance of overseas trade in the expansion of the economy during this period. Apart from the intangible, but nonetheless vital, part which commercial contracts played in widening man's economic horizons, the possession of extensive overseas markets and comparatively low costs of sea transport in the early stages of economic growth enabled Britain's export industries to enjoy economies of scale. (Deane and Cole 1962, p. 83)

The discussion of the impact of international trade emphasizes the limits to the benefit from trade:

We shall argue here that the expansion of the British export trade was limited by the purchasing power of Britain's customers, and that this in its turn was limited by what they could earn from exports to Britain. (Deane and Cole 1962, p. 83, with similar on p. 86)

The early eighteenth century expansion in trade offered opportunities for exploiting existing increasing returns to scale, but the global economy was still fundamentally bound by static technology and this limited output per capita and thus the extent and potential benefits from trade. Britain and her trading partners could produce and trade, but the terms of trade were driven by short-term fluctuations in the supply of mainly agricultural commodities, and not by the increases in output per capita that is modern economic growth, and that was responsible for later changes in the terms of trade.

This line of discussion concludes by noting the limits, and the means by which the limits were undone:

Until technological change began to exert a decisive influence on manufacturing costs, the rate of expansion of the combined totals of imports and exports mainly depended on Britain's demand for imports, which seems to have been fairly elastic in the eighteenth century. (Deane and Cole 1962, p. 88)

The technological change caused prices to fall exogenously of trade, and so the terms of trade changed, shifting against Britain for the first time for reasons other than short-run fluctuations in output.

They say less about population, except to note the rapid population growth that accompanied the growth in total output. They respond negatively to claims that this was driven by labor shortages around the turn of the eighteenth century; the required lag of 16 to 18 years is not evident in the data. Still, they note that the close relationship between the growth of output and the growth of population leads naturally to the question of whether there was a causal relationship between them (p. 89).

As to the effects of harvests, they find that the evidence supports an argument of Habbabuk (as cited on p. 90) that is not unlike the one made with respect to the terms of trade. While good harvests during the first half of the eighteenth century raised real wages elsewhere, they depressed agricultural incomes, and, indirectly, the demand for industrial goods. The increase in the prices of agricultural goods that began in the 1740s, and that appears to have been the result (initially) of increased population rather than poor harvests, raised agricultural incomes and so stimulated demand for industrial goods. Those in the industrial goods sector, facing what amounted to an adverse change in the terms of trade, would need to increase their output in order to maintain their standard of living (pp. 90-93). Deane and Cole place some emphasis on this last point. In the early part of the eighteenth century, they argue, the demand for industrial goods was inelastic, and so in times of low agricultural prices, industrial workers were able to meet their, presumably fixed, demand for goods and then expended their remaining time in leisure. If, on the other hand, agricultural prices rose, the industrial workers would have to work longer and harder in order to earn the fixed bundle of consumption that they desired. This, Deane and Cole (p. 93) argue, is consistent with the evidence from the eighteenth century, right down to the changing attitudes towards the labouring classes and comments on their work ethic.⁹

Deane and Cole conclude their discussion of the eighteenth century origins of modern economic growth by noting first that the recent emphasis on the relationship between on demographic factors is probably justified, in particular to the relationship between population and land. The overseas expansion was important, but limited by the slow growth of British incomes. There was no great shortage of capital, and innovation was slower than invention (p. 96).

They conclude with a final comment on the impact that different

⁹Deane and Cole, to an extent, represent a transition from the writers described in this section to those described in the next. Models constructed to represent formally the relationship between the agricultural and industrial sectors, to take the example from the current discussion, were standard fare for the cliometricians.

sources of labor scarcity can have on technological progress. The write that:

labour scarcity is more likely to induce rapid technological progress in an expanding economy than in one where demand is limited and output virtually stationary. It was not until economic expansion was well under way, in the 1760's and seventies, when the pressures of a growing population were beginning to stimulate investment in measures designed to economize other resources, such as land (enclosures) and coal (canals), that the great labour-saving inventions of the eighteenth century laid the basis for the industrial revolution in the textile industries and the introduction of the factory system. (Deane and Cole 1962, p. 97)

This concludes their discussion of the eighteenth century origins of the industrial revolution. They then turn to the industrial revolution itself. They draw a clear distinction between level effects and long-run growth. The level effects, one time shifts, include a decline in the proportion of labour in agriculture, an increase in the specialization of labour with an attendant broadening of the scope of types of employment, and an increase in the proportion of the population engaged in economic activity. In doing so they clearly held a separation of one-time effects associated with industrialization as distinct from long-run growth (p. 136). The discussion in the chapter concerned with the changes that occurred during the industrial revolution is a discussion of the industries most famously associated with the industrial revolution: textiles, mining, iron, and transport. In the preamble to the discussion they write that: "(T)o take the next step and to explain the process of change or to locate the crucial turning-points we require a finer industrial classification and a less widely spaced set of benchmark years" (p. 182). The key to understanding the process of growth lies, they claim, in an understanding of the individual industries that contributed most to the observed growth.

In summarizing, they return to international trade as the root cause:

there was evidently a close relationship between the changing rate of Britain's economic growth and the volume of her international trade.....The existence of exploitable international markets at the end of the eighteenth century and the beginning of the nineteenth century was probably crucial in initiating the process of industrialization and the growth of real incomes associated with it. (Deane and Cole 1962, p. 3112)

2.1 Growth Accounting

A natural extension to the measurement of national accounts was suggested independently by Moses Abramovitz (1956) and Robert M. Solow (1957).¹⁰ The extension was the decomposition of changes in production into changes in the quantity of labour and capital, plus a residual. Solow, working from an aggregate production function, interpreted the residual as a measure of technological change. Abramovitz was less inclined to speculate as to causes, and described the residual as "a measure of our ignorance."

Abramovitz's contribution is of greater interest here; his original paper was an attempt to describe the American economic growth since the Civil War (Abramovitz 1993, p. 217). Employing data compiled by John Kendrick and Simon Kuznets at the NBER, Abramovitz compared the change in the quantity of output to the quantities of inputs. His first observation was that output per capita had quadrupled. The second is that changes in output per capita could not be explained by either an increase in labour input or capital input per capita. The most important part of the explanation was the residual: "(I)ts source must be sought principally in the complex of little understood forces which cause productivity, that is, output per unit of utilized resources, to rise" (p. 6).

The method of national accounting became important in a variety of areas; the new economic historians used it to compute efficiency gains in specific industries, while McCloskey (1981) used the difference between factor productivity in industries for which estimates had been made and the whole economy as a basis for estimating the productivity growth in sectors for which productivity estimates have not been made. Abramovitz's estimates have been refined since in Abramovitz and David (1973) and by Kendrick and Denison (Abramovitz 1993, p. 219), with a corresponding decrease in the size of the residual, and, apparently an increase in our understanding of the location of economic growth.

Despite the widespread use of total factor productivity estimates, Abramovitz has become increasingly critical of the interpretation of the results. Even from early in its development Abramovitz expressed concerns over the interpretation of the residual as a measure of technological progress, and even of the change in factor contributions as meaningful in a discussion about the causes of growth. Instead, argued that: "(G)rowth accounting measures the effect of the proximate, not the underlying, sources of growth" (Abramovitz 1983, p. 114)"

¹⁰McCloskey (1994, p. XX) notes that the method employed in INSERT REF can be shown to be identical to the national accounting methods popularized by Ambramovitz and Solow.

But even on the capturing of the relative contribution of the proximate sources, Abramovitz becomes increasingly critical:

the old primitive Residual is really an understatement, a lower-bound measure of our ignorance about the sources of growth. By this I do not mean that beneath the growth-accounting sources lie deeper causes that govern the proximate causes, and below them still deeper ones, and so on. That goes without saying...I mean that we know less about the proximate sources than even a complete growth account...may suggest. (Abramovitz 1993, p. 219)

Abramovitz states his fundamental concern succinctly:

Standard growth accounting is based on the notion that the several proximate sources of growth that it identifies operate independently of one another. The implication of this assumption is that the contributions attributable to each can be added up. And if the contribution of substantial source other than technological progress has been estimated, whatever growth is left over-that is has not been accounted for by the sum of the measured sources -is the presumptive contribution of technological progress. (Abramovitz 1993, p. 220)

But for Abramovitz, economic growth is rife with feedback processes, "two-way connections" between physical capital, technological progress, economies of scale, and human capital:

We should have seen the contradiction between such interactive connections and the standard growth accounts at once. (Abramovitz 1993, p. 221)

Abramovitz concludes:

the interdependence of the proximate sources runs both ways. Although technological progress (actual and prospective) supports capital accumulation, both tangible and intangible capital accumulation also influence technological progress- in the shorter term through the embodiment process, in the longer term by investment in R&D, through learning by doing and by using, and by the contribution of education to the absorption of new products and processes and through other channels. (Abramovitz 1993, p. 237)

2.2 Generalizations and Conclusions

While they were mainly occupied with the construction of national accounts, the work of Kuznets, Clark, and Deane and Cole extended beyond the construction of national accounts. In all cases they made general statements about the content of the accounts, and considered the implications of the content both for academic interest and as a basis for policy advice to underdeveloped countries. Fogel (2001) points, in the particular case of Kuznets, to this willingness to generalize as the aspect of his work that extended beyond Mitchell and the other early NBER researchers.

Of the four writers involved in the early construction of national accounts, Clark remained closest to the data, and consequently had the least to say. Observing increasing returns to scale in production, he pointed to this as a principal cause of the increase in per capita countries experiencing modern economic growth. In describing the phases of industrialization, he is perceptive. Industrialization has to date yielded the greatest returns to scale when compared to agriculture and services, and the shift of consumption from manufactured goods to services has continued as Clark described.

Kuznets, having measured economic growth, leaves the data in attempting to explain growth. To Kuznets, modern economic growth is largely a social phenomenon. His definitions of modern economic growth are qualified by social concerns, and his emphasis is firmly on the institutions and cultural values that contained the disruption that naturally accompanied growth. The causes of economic growth, as Kuznets describes them, are not observable in the data. The data measuring growth is, as Douglass North was later to emphasize, growth itself, and not a cause.

In this regard Kuznets was interesting because his observations on the necessary conditions for modern economic growth went beyond the data that he compiled in his national accounts. He gave four requirements for modern economic growth to take place,

- (1) a minimum level of efficiency in some major sectors of the economy, *other* than the industry; (2) a supply of labor and capital suitable for modern industry; (3) adequate demand for the products of industry; (4) a supply of entrepreneurial talent capable of decisions on labor and capital involved in both modern industry and in other requirements for it, and of innovations necessary within the changing framework of an industrializing country. (Kuznets 1965a, p. 197, author's italics)

Notably, none of these relate to the technical detail; savings and capital investment are absent. Rather, Kuznets focuses on non-measurable

causes, that to a large extent are missing from mainstream growth modelling. Elsewhere Kuznets has noted the social disruption that accompanies the transition to modern economic growth. Part of this is the creation of a supply of labor suitable for modern industry. As to the supply of entrepreneurial talent, Kuznets has argued for the benefit of widespread education lying both in the creation of suitable supply of labor, but also of ensuring that potential entrepreneurial talent is not wasted for want of formal schooling.

Dean and Cole differ from Clark and Kuznets in one important respect. They asked theoretical questions with a precision that exceeded that of either Clark or Kuznets. Their discussion shows clear general equilibrium thinking. Unlike Kuznets, their arguments remain closely tied to the data. The causes of the industrial revolution can be found in the increase in trade, population, and pattern of harvests in the eighteenth century. Understanding the process of growth itself requires a detailed study of changes in the industries that were primarily responsible for the growth.

If we trace intellectual development, then Clark, and Deane and Cole in particular, had the most in common with the later new economic historians. The causes of growth are to be found in the measured data of output, and increasingly clear theoretical statements lend themselves to formal testing. Kuznets, on the other hand, reads as link between Adam Smith and Douglass North in the development of institutional economics. For Kuznets, the data is evidence of the existence of growth, the successful adoption of new technology is the process of growth, but the causes of growth are largely social. In describing modern growth as a continuous revolution, with constant shifts in relative winners and losers, competing both by force of arms and politically, Kuznets focusses on social factors and institutions in explaining the causes of growth, and the failure of growth to spread beyond a small group of countries representing less than a third of the world's population.

3 The New Economic Historians

The new economic historians differed from earlier economic historians primarily in their use of economic theory.¹¹ But for the purposes of explaining the causes of economic growth, their differences lay in the scope of the studies and the sources of their inspiration. Where the national accountants sought growth by digging from the top down in the aggregate data, the new economic historians typically studied sectors and industries that non-economic historians had claimed were causes

¹¹McCloskey has argued that it was the use of theory rather than the more typically claimed use of data that set them apart.

of growth. The beginnings of the new economic history were distinctly American, and so it is no surprise that the early focus was on slavery, the railways, and land, all staples of the American history literature.

The beginning of the new economic history, or *cliometrics*, is typically dated to a pair of papers by Conrad and Meyer (1957, 1958).¹² The first was a methodology paper, arguing for the use of theory in the study of economic history. The second was a study of the profitability of slavery, which set the tone of much of what was to follow. The motivation came largely from the claims of historians that slavery was unprofitable and the slave based economy of the *antebellum* South was on the verge of collapse when the Civil War broke out. The method of analysis came from economics. They employed a model with two production functions to describe the slave economy of the antebellum South. The first production function was for the production of slaves by mainly eastern states with poor land, the second was for output produced by slave labour. With estimated life expectancy, reproduction rates, gender productivity differences, and time off for childbearing, they discount the lifetime value of slaves, an exercise in capital theory. The final output of the exercise was an estimate of rate of return to slave ownership, and the conclusion that investing in slaves was not unprofitable, although part of the profitability of slavery in the East was concealed by a distaste for breeding slaves for on sale. The euphemistic language in diaries and reports of the time drew attention away from the rate and price at which young slaves were shipped West.

In a review of the methods and results of the new economic history, Fogel (1966) identified four approaches taken to explaining productivity growth. The first is to assign the growth in productivity to factor inputs. This is in essence a sectorial level exercise in growth accounting. The second category of study attempts to explain the growth of individual sectors of industries. These studies expand on those in the first group by considering changes in both supply and demand. On the supply side, the focus on changes in factor inputs as explanations of growth remains similar to that described in the first category. Fogel's third category is the diffusion of technological innovation, how and why machinery spread as it did in both industry and agriculture. The fourth category includes attempts at estimating the social savings associated with individual sectors and industries.

The methods of the new economic historians were controversial. Their use of explicit counterfactual statements resulted in disagreements with historians (Elton and Fogel 1983). Despite this the most

¹²Conrad and Meyer argue not only for the use of economics in history, but also for the use of history in economics:

Instead, we shall assert simply that economics as a science deals with historical processes and is dependent upon historical research. (Meyer and Conrad 1957, p. 524)

vigorous debate was internal, too some extent over model construction, but to a greater extent methodological. In particular, the use of social savings calculations were controversial among the new economic historians. Writing later, McCloskey (1994), maintains that the method withstands "a lot of shaking out in the details." But this glosses over a significant methodological debate. The essence of the calculation is to multiply the cost savings from an innovation by the industries share of all output by the share of the industry impacted by the innovation. The most famous example is Fogel's calculation for the railways in the U.S.A.. Broadly, a 50% increase in efficiency for a method of transport that was used for 50% of all goods for an industry that accounted for 10% of GDP yields a social saving of $50\% \times 50\% \times 10\% = 2.5\%$.

The extent of the internal debate over can be seen in Fogel's (1979) presidential address to the economic history society. He cites O'Brien as a source for works on the subject, and then lists studies published since O'Brien. The list is long, and includes a wide range of objection, including the measurement of the opportunity cost, whether the counterfactual was G.D.P. in the absence of railways or the with railways built but not used, and whether the calculations made sense as they were interpreted. Fogel addressed his critics by presenting a formal model, that resolved many of the early misunderstandings. But what remains is the interpretation of the calculation. The result is static, it tells us how much smaller GDP would be in the absence of the innovation in question. But this does not include the impact that the innovation has on business decision making and opportunities. Paul David cuts to the heart of the matter:

we should insist on knowing whether this particular innovation afforded opportunities for utilizing resources in a manner that yielded higher rates of return than those obtainable through investment in other directions. (David 1969, p. 521)

McCloskey (1994) views the social saving calculation as the end of any arguments for the particular importance of a sector, industry, or innovation. But following David, there are grounds for hope. Describing entrepreneurs as planning production has fallen out of favour in modern economics. Orthodoxy follows Ricardo in revealing demand before production takes place (Smith and Knight dissenting), and it is a small step to treating the firm as a black box that is able to convert inputs into outputs in predictable fashion. In their ex-post descriptions of industry performance, economic historians focus on averages, average wage rates, average material input prices. But these models allow no place for predictability and reliability of supply. For an entrepreneur planning production, the cost of the inputs is only part of the problem. I return to this point later, with two examples of how the social saving calculation may mislead.

While Mokyr's calculation demonstrates the unimportance of individual sectors, in particular on the aggregate statistics, this fact was known to earlier writers. Deane and Cole (p. 294) express it slightly differently: the value added in the cotton sector in the late eighteenth and early nineteenth centuries was "probably appreciably less than the incomes earned by employees of the government (including the armed forces) or the interest on the national debt."

3.1 Temin and McCloskey Reflect

The contributions of the new empirical economic history are surveyed, by Peter Temin (1975) for the USA and by D. N. McCloskey (1981, 1994?) for the Britain. In both cases the answer is that our best empirical evidence is unable to explain more than a small fraction of observed growth. We can explain very little, and our prospects for ever explaining using our current tools are subject to the tyranny of social savings calculations.

From a general methodological perspective, the approach taken by the new economic historians was to look for the causes of economic growth in the data. When compared to the economists discussed in the first section, this has the greatest resonance with the approach taken by Clark and Deane and Cole. The theoretical statements of causality were made explicit, and were tested with data.

I believe that the two most important criticisms of much of the work in this field are those of Paul David, and Moses Abramovitz. When David asked what was made possible by the creation of the railways, it was not a simple matter of estimating the cost of transporting the goods that actually flowed as if they had been transported by alternative means, and the backward linkages of track manufacture to the steel industry. It is possible that characteristics other than price, such as the speed and accuracy of delivery, were more important to Midwest entrepreneurs than can be captured with a social saving calculation.

Beyond this are the concerns raised by Abramovitz with respect to national accounting calculations. The criticisms that apply to national level calculations apply equally to sector and industry calculations. While we can compute a narrow measure of the productivity growth within an industry by observing the decline in price, we cannot observe the interrelationships between the productivity gains and the related industries. The linear sum of individual factors makes no sense at the aggregate level when we expect feedback effects, it makes less sense in summing the growth of individual industries in an attempt to explain growth.

I employ two specific examples to highlight what I believe to be the inherent weaknesses of the social savings calculations as they have been

applied in economic history. Both examples are of changes in transport technology, and of the entrepreneurial response to them. The first is the shipping of sheep meat from New Zealand to Britain. In the late 1800s freezing technology was improved to the point where meat and dairy could be frozen and shipped internationally. New Zealand, as a major wool exporter (at least relative to population) had large flocks and ample grazing land relative to population that would allow for rapid expansion of the flocks. Enjoying the small advantage over Argentina that whole sheep carcasses could be frozen rapidly enough to preserve rather than destroy the meat where cattle carcasses could not, New Zealand became a major exporter of sheep meat. No doubt the system of colonial preference helped. The question is then how we measure the social saving from the improvement in the freezing technology.

The second is example relates to the construction of canals in New York state. The canals made market gardening profitable relative to home production of cotton. In response to the building of the canals, households began the (very) slow switch from cotton to gardening. The benefits of the canals lay not in the savings from shipping vegetables by canal rather than by wagon, but by the change in what was produced (Coleman, ref). As with the New Zealand meat industry, the most important impact of the innovation was the nature of what was transported, and this cannot be captured by expenditure on shipping, when the counterfactual was clearly impossible, meat could not ship without refrigeration, and vegetables could not be transported long distances by wagon.

4 In Search Of Necessary and sufficient Conditions for Growth: Institutions, Cul- ture, and People - General Theories of Eco- nomic Growth

The final strand of the economic history literature, and the focus of this discussion, is writers who have taken a step back from the mechanics and measurement of growth, and asked what conditions are necessary or sufficient for modern economic growth to occur. The studies discussed to this point have been concerned with long-run data series, and the contributions of individual sectors and industries to economic growth. The studies that follow are typically of a more general character. They differ from the *cliometric* contribution in that the modelling is typically less formal, more general, and less targeted at specific industries and sectors. Where much of the literature discussed to this point has focussed on the US economy, *cliometrics* began in America and has not always travelled well, what follows is mainly concerned with the British economy and the industrial revolution. The discussion is

broken into three parts. The first deals with the claim that institutions cause economic outcomes. The second part deals with Gregory Clark's recent claims that there is a genetic component to being middle class, and the response. The third part is a smorgasbord of alternatives that do not fit into a neat category, are frequently partial, but that offer insight into some dimension of either the industrial revolution.

Paralleling the pioneering work of Oliver E. Williamson, and beginning with Douglass North, institutional economic historians have sought to explain the causes of economic growth in the institutional frameworks within which economic activity takes place. An early statement of this research agenda was North and Thomas' *Rise of the Western World*. More recent contributions from Avner Greif have included game theoretic models. The focus of this research is on the relationship between institutions, the formal rules of interaction as well as informal societal norms, on economic growth. In discussing the institutionalists, I focus on three studies that reflect different approaches to dealing with institutions. The first is Douglass North and Barry Weingast's paper claiming the Glorious Revolution as the cause of the key institutional change that led to the industrial revolution taking place in Britain. The second is a set of studies by Avner Greif that employ game theory to demonstrate the stability of behavior within culturally distinct trading groups. The last study is by Acemoglu et al that employs data on shipping and urbanization to argue that the cause of the industrial revolution was institutional change that accompanied the growth of Atlantic shipping. They are less specific on the detail of the institutional change, but do include the Glorious Revolution within the set of important drivers of institutional change.

More recently, Gregory Clark has proposed that economic growth has resulted from the rise of the middle classes. The values of the middle classes, prudence, thrift, and hard work, are the causes of modern economic growth. The change followed the development of settled agriculture, was gradual but fastest in Britain, and as a result the Industrial Revolution took place in Britain. While there may be grounds for including Clark's thesis with what follows, there has been considerable response to it, and so a fuller treatment including the responses is warranted.

The final group of studies propose primary education, the use of inorganic energy, and macroinventions as the cause of economic growth. To an extent they are both general and partial. They are focussed on particular aspects of growth, without measurement or quantification, but that suffer in their inability to explain the failure of modern economic growth to spread.

The theories discussed in this section are all "big theories", they attempt, typically, to explain a wide range of very large changes with the minimum of inputs. Models of this type are not to everyone's

taste (Margo 2008). The idea of "big theories" is naturally controversial, particularly if the focus is on the industrial revolution, because there are no degrees of freedom with which to work. There are a number of ways in which to characterize the industrial revolution, and the likelihood of it happening at any given place and time. Suppose the industrial revolution was the result of a stochastic process with trend, some attributes of the underlying economy made an industrial revolution more or less likely plus an element of chance, then it may be that it was more likely to have occurred 1,000 years earlier in China, or 100 years earlier in Holland. But our sample is the single observation that it occurred in Britain. Alternatively, we can think of a deterministic set of necessary or sufficient conditions and Britain, having achieved the sufficient conditions first, was on a path that led inevitably to the Industrial Revolution. But again it, only occurred once, and so we have a single observation and no degrees of freedom, and no clear empirical base on which to choose between different models of causality.

So, how do we choose between the models? Do we need to choose, or can we accept bits of many of them? The most obvious route, taken by most, is to consider the ability of the explanation to exclude countries other than Britain. But that is susceptible to the criticism just discussed, we only have one data point.

It should be noted that "Big theories" are the exception, not the norm. Most economic history is conducted, if not using the methods described above, at least at the level of generality. A reading of the surveys of the literature in the *Journal of Economic History* from recent years will confirm this. Even when the discussion is broader, it is frequently in line with the work of Kuznets and Clark - an attempt to describe and quantify, rather than an attempt to impose theoretical structures. : "There are no general or conceptual studies of industrialization...." R. C. Nash, discussing the 2002 literature in the *Journal of Economic History* (Britnell, Hindle, Nash, Bowden, and Higgins 2003, p. 159).

As a debate, the competing claims of Clark and the institutionalists are interesting because they offer sets of sufficient conditions for economic growth to occur, without any explanation of the mechanism of growth, or the magnitude.

In proposing his thesis, Clark treats institutions as the natural alternative, and then argues that they are irrelevant. A number of reviewers note the lack of attention to North and the institutionalists (Solow, 2007). It is not clear that Clark's thesis is sufficiently proved as to warrant equal treatment to institutional analysis. Nonetheless, Clark offers important criticisms of the institutionalists, while leaving himself open to the charge that he pays to little attention to them.

The appeal of this approach is not universally felt. In his review of Clark's *A Farewell to Alms*, Robert Margo (2008) expresses a personal dislike for "Big Idea" explanations of the Industrial Revolution. McCloskey (1981, 1994) is similar in considering only the contributions of quantitative studies in explaining the Industrial Revolution. The closest that McCloskey comes to "Big Idea" thinking is a brief discussion about Israel Kirzner's (1973) emphasis on profits and alertness as the causes of economic activity. But this comes only at the end of a detailed review of empirical studies. Notably, McCloskey does not mention institutional economics, in particular the work of Douglass North.

4.1 Institutional Economic History and Economic Growth

Early statements of the importance of institutions can be found in the discussions of the creators of the national accounts series. Kuznets (1965) placed considerable emphasis on the cultural and social aspects of economic growth. As a field of study, institutional economic history traces its origins to Douglass North and Robert Thomas' *Rise of the Western World* (1973). Their main thesis is that good institutions cause economic growth and bad institutions prevent growth. They then describe European history from 700AD to the industrial revolution in terms of alterations to the institutional arrangements. The most important exogenous forces driving the changes are Malthusian population pressures, and the relief from them brought by widespread pestilence, and the funding of the warmongering of the political elite. The study is comparative to the extent that it considers the varying fortunes of different countries within Europe, but does not extend as far as enquiring about the contemporaneous performance of the Chinese economy, or the failure of earlier empires to achieve modern economic growth.

A large part of the motivation for the shift in focus from price and production data to institutions was the incorporation of historical time into the analysis of economic growth. In a review of the contributions of the cliometric school, he noted a general dissatisfaction with the limits imposed by the neoclassical theory that was most typically employed in *cliometric* work. In turning to institutions, North was primarily concerned with introducing the element of time to historical analysis. His focus was on not only on the static performance of institutions, but on the ways in which they evolved over time.

A problem that is immediately encountered is defining what is meant by an institution. Certainly formal rules of conduct are institutions, but only to the extent that they are adhered to and enforced.

Avner Greif (2006(Greif 2006)) offers perhaps the most complete definition in a wide ranging discussion that deals with previous interpretations. In particular, he emphasizes the fact that institutions are not the formal rules of the game, rather they are external, man-made restraints on behavior.

There is certainly ample evidence of positive relationship between institutions and economic growth. As Robert Solow notes, in reviewing Clark's claims that institutions do not cause economic growth:

The most his examples can show is that a collection of the "right" institutional practices is not a sufficient condition to cause an industrial revolution and subsequent economic growth. It may still be a necessary condition: there may be instances where secure property rights and open markets have failed to generate sustained, rapid economic growth; but there are no instances of sustained, rapid economic growth without those basic institutional prerequisites. This is not a negligible fact. (p. 3)

But this observation raises difficulties for the institutionalists. First, there is not one set of institutions that is associated with economic growth, Germany substituted bank finance for the stock markets of the U.S.A. So a number of possible sets of institutions may be necessary for economic growth. Second, if institutions are necessary but not sufficient, then what are the sufficient conditions? Because if they exist they are surely where our focus should be.

I survey three studies, two papers and a book, that provide greater insight in to the application of institutional analysis to the question of economic growth. The first, by Douglass North and Barry Weingast (1989), is typical of the early institutional studies; the rhetoric takes the form of narrative, describing cause and effect in the relationship between the Crown and parliament in the events surrounding the Glorious Revolution. They argue that the institutional changes that accompanied the Glorious Revolution were necessary for the Industrial Revolution and subsequent economic growth.

The second study is a book by Avner Greif (2006), containing five studies, a definition of institutions, and a chapter of closing thoughts on the role of institutions. The studies are concerned with the institutions developed by traders to facilitate long-distance trade. Employing records of trades and letters between traders, Greif constructs a picture of the nature of the trading relationships, and then employs game theoretic models to demonstrate their stability and efficacy as institutions.

The final study (Acemoglu, Johnson, and Robinson 2005) combines empirical observation with institutional analysis to argue that in the period immediately prior to the Industrial Revolution the significant change in the world economy was the rise of Atlantic trade. Their main evidence suggesting the importance of the Atlantic is the fact that almost all changes in rates of urbanization were caused by changes in Atlantic port cities. Those countries with access to the Atlantic and nonautocratic government, Britain and the Netherlands, were best able to benefit. Spain and Portugal suffered because the benefits of Atlantic trade were captured by the political elite, with France providing the intermediary case. European countries with nonautocratic government but without access to the Atlantic did not benefit from the rise of the Atlantic trade.

This is followed by a discussion of the role of culture. While it would fall under Greif's definition of institutions, it is at least distinct from the institutions as rules that suffices for describing institutional studies that follow. But this partly reflects the possible overwhelming importance of culture. Any country can pass laws that create the appearance of the necessary conditions that are the focus of much of what follows. But the enforcement of these rules is a matter of political will and popular support. This is not to suggest, either, that culture is separable from the formal rules. As Douglass North emphasizes, the study of institutions is the study of changes in variables over time. It is hard to imagine that there are not feedback effects between culture and the formal rules, even if the latter are immediately more malleable than the former.

A point of frequent emphasis of institutional studies is early arrangements for long distance trade, and in particular the rise of impersonal exchange. This is the case for North and Greif, although they are approached in different ways. Greif's book opens with a description of the transfer of trading debt between two parties living in different cities, owed to a counterparty in a third city. Similarly, North and Thomas focus on the rise of the medieval trade fairs. What unifies these studies, and perhaps links them to Clark's (see below) more than either side would like, is the rise of a middle class made wealthy by trade rather than land ownership. For Acemoglu et al this process is most importantly associated with the gains to the British and Dutch middle classes in the growth of the Atlantic trade, gains that were captured by the political elite in Portugal and Spain. North and Weingast (1989) summarize:

There exists neither a definitive theory of economic growth which would define for us the necessary and sufficient conditions nor the evidence to reconstruct the necessary counterfactual story. But we are convinced from the widespread contemporary Third World and historical evidence that *one* necessary condition for the creation of modern economies

dependent on specialization and division of labor (and hence impersonal exchange) is the ability to engage in secure contracting across time and space. That entails low transaction costs per exchange. The creation of impersonal capital markets is the single most important piece of evidence that such a necessary condition has been fulfilled. And we have told a story of how these institutions did come about in England. (North and Weingast 1989, p. 831)

North and Weingast are concerned with the changing role and power of the Crown in Britain before, during, and after the Glorious Revolution of 1688. A common feature of autocratic rule, including absolute monarchy, is the coincidence of the incentive and the ability to renege on agreements. The Glorious revolution imposed on the Crown the need to seek parliaments permission before unilaterally altering the terms of any agreement. As parliament was made up of the wealthy, they were in effect in a position to protect themselves from expropriation by the Crown. They draw their evidence on the changing institutional environment not only from changes in the rules, but more importantly from changes in the ease with which the Crown was able to raise capital in the financial markets. As they note, the Crown went from a position under the Stuarts of needing to impose forced loans, to a situation where not only were loanable funds freely available, but they were available at steadily declining interest rates.

Beginning with Elizabeth, the Crown had begun relying on land sales to fund revenue shortfalls. At the beginning of the Stuart period revenues from land rents generated half of all Crown revenues. Elizabeth began the land sales, James I continued them, and the last remainder were largely sold during the reign of Charles I. North and Weingast present data for 1617; expenses exceed revenue by approximately ten percent (North and Weingast 1989, p. 809). Other sources of revenue included the sale of monopolies and peerages. The former created rents for the purchaser, the latter devalued existing peerages. The ability to raise revenues in this way relied on the extent of Crown power. Judges were appointed and could be removed by the Crown, and the Stuarts did so in direct response to unfavorable rulings. Although the Crown did not have the power to tax directly without Parliaments approval, but could demand forced loans. By characterizing them as loans, the Crown could bypass parliament, even though there was no intention to repay them.

The revolution introduced the beginnings of a separation of the functions of the state. The Crown could propose spending, Parliament could authorize but not propose spending, and the judiciary became independent. North and Weingast describe it thus:

The new constitutional settlement endowed several actors with veto power, and thus created the beginnings of a

division or separation of powers....A balance of power between the Crown and Parliament significantly limited publicly supplied private benefits. (North and Weingast 1989, p. 818)

We then arrive at the above quote; Britain's industrialization relied at least in part on the necessary institutional changes that resulted from the Glorious Revolution. These changes were significant, had they not occurred Britain would have been institutionally more similar to Spain and Portugal, with rent capturing autocratic rulers.

Carruthers (1990), in a reply to North and Weingast, notes that the history of the period is heavily tied up in the creation of political parties. While not significant for North and Weingast's argument, their creation was nonetheless an important cause of change in itself. In addition, while North and Weingast focus exclusively on the contractual issues surrounding the use of Crown prerogative, the reality is that the sentiment against the crown was as much a religious as financial. This last point is important, James II's support for Catholicism resulted in his supporters, the Tory Party, turning against him: "it was his Catholicism more than his absolutism that turned his supporters against him"(Carruthers 1990, p. 697).

But even if we accept the core accept North and Weingast at face value, there is still the difficulty that the model is difficult to test; the exclusive use of narrative in the exposition leaves the significant problems in comparison. Why did Spain and Portugal not experience revolutionary induced institutional change, given that it was, by North and Weingast's description, no merely an improvement, but a universal improvement. The significant loser, the Crown, was amply compensated with cheaper and more plentiful capital. Other economic historians have not been convinced by the case for the importance of the Glorious Revolution. In replying to Clark's criticism of institutional economics generally, Allen (2008) agrees that Clark is almost certainly correct that North and Weingast are incorrect in their focus on the Glorious Revolution.

The second set of studies, Avner Greif, deals with at least part of the criticism of North and Weingast by introducing explicit models. Avner Greif, in a series of studies collected in *Institutions and the Path to the Modern Economy* employs formal game theory models to demonstrate the stability of institutions that supported early long-distance. In the best known of these studies, Greif uses documentary evidence of trading rules and institutions to construct an understanding of the trading institutions particular to the Maghribi traders, an identifiable group of Jewish traders who had migrated West to the Mediterranean during the tenth century. In order to facilitate long distance trade at low cost, the Maghribi traders both employed agents and acted as agents. While trade within the Mediterranean region was largely free,

there were no legal devices that could support contract enforcement, and so the Maghribi could only overcome the problem of dishonest agents with a set of rules that all Maghribi traders were bound to adhere to. The main institution was a refusal by any Maghribi trader to trade with any agent who had been accused of dishonesty by a Maghribi trader. Having established the way in which the Maghribi traders overcame the problems of uncertainty and poor information flows in international trade, Greif constructs a game theoretic model, and demonstrates the conditions under which the outcome in which all traders adhere to the coalition rules is stable.

There are at least three important criticisms of Greif's work, that warrant attention. First is the idea that long distance trade is in fact a fragile thing that requires institutional support. Second is the demonstration of the empirical significance of the change in the level of efficiency of trade that resulted from the improved institutions. Third is the problem of tying the institutions that Greif describes to the institutions that underpin modern industrial societies. As Gregory Clark (2007b) notes in his review, fundamental to Greif's argument is the belief that long distance trade is "fragile." But this ignores evidence of long distance trade that predates the Neolithic revolution. Long distance trade pre-dates settled agriculture, and is a sufficiently common feature of history, that claims of the difficulties in sustaining long distance trade are almost certainly overstated.

Second, Clark argues that inefficient levels of trade have been with us for as long as trade has been taxed. But this has not prevented some countries from growing. The important question that Greif does not address, that is beyond the scope of his data, is a quantification of the importance. But this reflects a difference in methodology and rhetoric. As Clark notes, Greif's method of exposition, the analytic narrative, naturally encounters the problem of demonstration by example. The choice of the example (as in Carruthers criticism of North and Weingast) is then critical to the case that is otherwise difficult to evaluate.

Third is the problem of tying the institutions that Greif describes to modern industrialization. In all cases Greif was dealing with small communities that sustained institutions at least in part through some sense of community identity. As he discusses, the Maghribi trading coalition and its rules for trade disappeared when the Maghribi lost their particular cultural identity. Surely the point of modern institutions is that they do not rely on any particular cultural identity, that they transcend cultural subgroups. In this sense, Greif is writing a history of institutions that failed to cause modernization.

A final point of disagreement with Greif is perhaps not directly relevant, but relates to the earlier quote from Radford. Greif (p. 389) asserts that the institutions that he has described were privately and consciously developed, in contrast to the "spontaneous order" of

Friedrich von Hayek and Milton Friedman. But what Greif appears to miss, in his focus on a particular set of institutions, is that institutions that permit long distance trade have resulted in spontaneous order on numerous occasions in history; trade pre-dates the Neolithic revolution. Radford describes in detail the institutions of trade within P.O.W. camps particular and specific, but still describes the trade that he observes as spontaneous. On this point it is hard to disagree with Hayek, Friedman, and Radford.

The last study is a return to the particularity of the institutional changes that occurred in Britain during the period that includes the industrial revolution. Acemoglu et al begin with the rates of urbanization in Europe from 1500, noting that there is a break beginning in 1500 that is driven entirely by Atlantic port cities.¹³ They argue that the changes that occurred in the rise of the Atlantic trade were "quite different in nature from the European growth that took place before 1500." The rates of growth that result from the increased Atlantic trade are largely the result of differing institutions. The Spanish and Portuguese had absolute monarchies, and the rents from the increased trade were largely captured by insiders. In Britain and the Netherlands the monarch was not absolute, and the rents from the increased trade were spread more widely. The result of this widespread increase in wealth was greater, more effective opposition to the monarchy, that in turn induced further institutional innovation (including the Glorious Revolution). This final set of institutional changes created the necessary conditions for industrialization in Britain and the Netherlands, but not in Spain or Portugal (France is throughout the intermediate case).

What is of greatest interest in Acemoglu et al is the methods employed. Where North and Weingast rely on analytical narrative, and Greif on game theoretic models, Acemoglu et al pay relatively little attention to the specifics of the institutional change. Instead, they focus on the long-run evidence of Atlantic exceptionalism, and then rely on institutional differences between Atlantic states to separate between differing degrees of institutional innovation and economic success. They test, within the confines of concern with Atlantic urbanization, claims that Roman heritage, Protestantism, and wars influence growth. On the grounds that they were not significantly related to Atlantic trade, they are found to not be causes of economic growth.

They conclude that it was the interaction between the potential offered by Atlantic trade, and initial institutional preconditions that caused the divergence that ultimately resulted in the industrial revolution. Italy did not have access to the Atlantic, and Spain and

¹³They use Angus Maddison's data to corroborate their findings from urbanization, at the same time acknowledging that Maddison's data are no more than educated guesses for all period before 1820. See also Clark (2008) on the reliability of a non-linear interpolation between an estimate and an educated guess.

Portugal had institutions not conducive to growth, and so Britain and the Netherlands became the leaders of European exceptionalism.

These studies offer some insight into the varying methods of institutional economics. In all cases there is heavy reliance on analytical narrative, with the problems that it brings. On the other hand, the use of first game theory and then, perhaps more importantly quantitative data and formal testing, offer new avenues to avoid at least some of the outstanding criticisms. It is worth noting at this point that there is some disagreement with the basic idea of institutional analysis as a means to explaining economic growth, particularly from Gregory Clark. He writes, of North and Thomas' *Rise of the Western World*:

North and Thomas were wrong in most specifics in their interpretation of preindustrial institutions and their effects. They relied mainly on the untested prejudices of earlier generations of historians. (Clark 2007b, p. 727)

Clark then goes on to cite the example of the enclosure of the commons; despite its importance to the institutionalists in explaining the agricultural revolution of the eighteenth century, subsequent empirical research has robbed it of most of its quantitative significance. Despite this, is difficult to escape the observation that all currently industrialized countries have institutions that encourage and support impersonal exchange. It then becomes a question of necessary versus sufficient conditions for growth, and North and Weingast are clear that they regard institutional arrangements as being part of the former rather than the latter.

Culture as distinct from institutions It is unclear to me how

we should categorize culture. Most likely it is part of the set of informal institutions, hence its location as a subset of a larger discussion of institutions. Nonetheless, culture may supersede formal institutions, and may overlap with the discussion of Clark's thesis. The idea that culture matters to economic performance dates to Max Weber's Protestant Work Ethic, in which the bourgeois virtues are identified as Protestant, rather than Catholic alternative (check Temin on this). What is notable about culture is that it is raised as cause of growth by economists and historians who do not all follow from the New Institutional school of Oliver Williamson and Douglass North.

In particular, Peter Temin (Temin 1997) and David Landes (Landes 1998). Without wanting to categorize writers, it is at least notable that Peter Temin's contributions have come mainly in modelling American

economic growth. Landes, on the other hand, has maintained focus on technological change as the cause modern economic growth. But, just as North views institutions as the primitive, underlying cause of growth, Landes , after a long discussion of the importance of technological change, offers culture as the primitive, root cause of economic growth.

This topic is, of course, not absent in the work of modern institutionalists. Avner Greif has proposed a culture based model to explain why Britain, and not China, experienced the first industrial revolution. Greif's model is based on the extent of the control over children exerted by parents. The model is based on the differential control that parents were able to exert over their children in China versus Britain, and the belief that old people are more conservative. Thus, as in McCloskey's (1994) discussion of rhetoric, the young in Britain were relatively free to contract and persuade. Chinese children, even as adults, were expected to obey.

While the meaning and location of control within the family differed between Britain and China, it also differed within Europe. Whether a reflection of culture, religious influence, or climate, Protestant British families were different from Catholic Mediterranean families. The former were more narrowly defined as the nuclear group of parents and children, and more likely to live away from immediate family not part of the nuclear group.

4.2 The Clark Thesis

In a recent, and highly controversial book, Gregory Clark (2007) has offered a genetic explanation for the rise of the middle classes. The middle classes are the cause of modern economic growth, they are thrifty, prudent, hard working, non-violent, and jealous of their neighbors. The response from among economists and economic historians has been negative (Allen 2008, Bowles 2007, McCloskey 2008, Persson 2008, Solow 2007, Voth 2008) . Clark (2008) has replied to the reviews published in the *European Review of Economic History*.

In describing Clark's thesis I use both the original book and the response to reviews published in the *European Review of Economic History*. Clark's thesis is the following:

1. Before the Industrial Revolution, the world was subject to a Malthusian population trap.

2. Somewhere between the Neolithic and industrial revolutions reproductive success came to be associated with production, exchange, and trade rather than extortion and theft as a means of becoming wealthy.
3. The cause of this success is underlying attributes of the middle classes: thrift, prudence, and hard work.
4. All countries with settled agriculture experienced these changes to some extent.
5. The characteristics of the economically successful, thrift, prudence, and hard work, are transmitted genetically.¹⁴
6. Between 1200 and 1800 AD the British population was roughly constant, while the Chinese grew. As a result of this the transmission of middle class genes was quicker in Britain than China.
7. The result is that Britain became middle class first, and so experienced the first Industrial Revolution.

Whether or not the world was subject to a Malthusian population trap before the Industrial Revolution depends not only on who you ask, but also which version of the Malthusian model you are testing. Before moving to the detail of the debate, it is worth noting the ultimate role that the implications of the Malthusian model play in Clark's thesis. For Clark it is simply a way of describing a world with no long run trend in output *per capita*. While he goes to great lengths to explain the model, and how subsistence can be societally determined, for his purposes it would be adequate to demonstrate empirically that there was no observable trend in *per capita* output before 1780. This point is much less controversial among reviewers of Clark's book than the specific claim of a Malthusian trap.

If we date the Neolithic revolution to 5300 B.C. with the rise of cities in Sumeria, and apply a small positive growth rate, then uninterrupted growth since then would have made us immeasurably wealthier today, even without an industrial revolution: at a growth rate of 0.05% for 7,000 years, living standards would have been 33 times larger on the eve of the industrial revolution than in ancient Sumeria.¹⁵ While the historical evidence is extremely limited, it is unlikely that we would have failed to notice the 14 fold increase in the standard of living from the Neolithic revolution to 1 AD, by 1994 our own advantage over the living standards at the start of the industrial revolution is only a

¹⁴This point in particular relies on the paper. The book offered the possibilities, genetic transmission or learned behavior, without suggesting which was more likely. While Solow takes Clark to task for raising the possibility of genetic transmission when transmission by learning is possible, Clark's initial decision to simply list the possible mechanisms does not appear unreasonable.

¹⁵Of course this calculation is incredibly sensitive to the rate of growth; a decrease to 0.01% and living standards double, increase it to 0.1% and it balloons to a more than thousand fold increase.

twelve fold increase (McCloskey 1994). So much for an average growth rate of 0.05% since the Neolithic revolution. How about the Greeks or the Romans? Taking the Romans, at say 100 AD during Trajan's rule, we have 1,760 years to the start of the Industrial Revolution. Again, with a growth rate of 0.05% per annum, the result is a 240% increase in output per capita. Would we notice that difference? Could incomes in 1780 be more than double those at the height of Rome? Possibly, although not likely. That increase is similar in magnitude to the one experienced during the industrial revolution (McCloskey 1994 and Harley and Crafts). Voth (2008) argues that there were permanent gains in the period between the Neolithic and industrial revolutions, but agrees that the rate of permanent growth was necessarily low.

Given the time frame, even a very small average rate of growth would have produced large gains in living standards. Whether we would be able to identify those changes is debatable. The more basic point is that there is no evidence of a long run trend in economic growth before 1780 (or the 1500s depending on your dating). Any earlier, short-run changes were largely reversed by 1780. It is then

hard to disagree with Grantham's (2008, p. 158) assessment that:

(T)he uncontested fact is that real per capita income must have been roughly constant over the nine to ten millennia of the agricultural epoch. No other hypothesis is compatible with the level prevailing at the end of the eighteenth century.

The dissenting opinion on the stationary nature of per capita incomes before the industrial revolution is Voth (2008). Voth uses the widespread ownership of chairs and candlesticks, and expenditures on coal and wood for heating as evidence that the British of the middle ages had higher standards of living than earlier periods. Clark (2008) responds with the historical counter - when British sailors found Tahiti, sans chairs, candlesticks and heating bills, they stayed. Of course there are difficulties in comparing standards of living across different consumption bundles, but it is hard to escape the conclusion that if the British enjoyed a higher standard of living than the rest of the world as a result of something resembling modern economic growth, then either the rate of growth was very slow, or the change was very recent.

As to the to the responses to Clark's claim that the world was subject to the Malthusian trap, opinions are more varied. Solow (2007) and McCloskey (2007) agree that it was, and McCloskey is surprised that Clark spends as long as he does detailing the model and the supporting evidence. Solow writes that "(O)ther economic historians have come to the same conclusion, though you might not realize that from reading Clark's text" (p. 2). Allen (2008) agrees that there appears to

be support for Clark's claim in the long run data, but ultimately argues that the empirical relationship evidence of a relationship between fertility and incomes is weak both in the short and long runs, and that the long run data are misleading and there was no Malthusian trap. Finally, Voth and Persson disagree with the claim that there was a Malthusian trap, but Persson's objections appear to be at least in part a misunderstanding of the form of the Malthusian model that Clark presents ((Clark 2008)).

The second point is critical to the argument, and less well supported empirically than some of the others. If it can be shown that the wealthy testates in Clark's sample became wealthy by acts of theft and deception rather than prudence and hard work, then the thesis collapses. But we know enough about Britain in the middle ages to consider the alternative unlikely. Crime rates, particularly murder rates, were falling. The wealth of the Suffolk testates rested on taking. Certainly, the institutionalists hold similar beliefs, in particular about Britain (Acemoglu et al 2005, and North and Weingast 1989).

The remainder of Clark's argument follows if we accept the starting propositions. Solow and McCloskey as whether there was time for the required genetic change, and McCloskey adds to this an appeal to reversion to the mean. Clark (2008) points out that reversion to the mean is not applicable with selective breeding and that there was ample time, pointing to the change in the shape and size of domestic animals. On another front, that he does not respond to, is that 600 years is in fact too long to be the deciding factor, that genetic selection is faster than Clark believes.

In concluding his reply, Clark notes that while it is true for transnational migrants that the destination has more impact on individual economic outcomes than the origin, he notes that the migrants from a small number of regions, Western Europe, the Indian subcontinent, and China, have economically dominated all indigenous peoples that they have encountered. The changes that he described are not unique to North Western Europe; they occur in all societies that experience settled agriculture, but middleclassness is a matter of degree, and the more middle class societies dominate the less middle class. Even if Clark is completely wrong in all that he proposes, we still need an explanation for this uncomfortable fact.

Clark is not the first economist to weigh in on the virtues of the middle classes. Buchanan (1994) has done so from a theoretical perspective; the middle classes work harder and save more, expanding the size of the market and thus the gains from specialization. McCloskey (2006) has approached the characteristics of the middle classes as virtues, at least in part as a response to the general dislike that doctors of philosophy express towards them. Both Buchanan and McCloskey argue for the benefits of living in a middle class society. Clark will not be

drawn on this; his thesis leads him to the conclusion that the jealous have inherited the earth. And that as long as we are jealous of our neighbors, we will be unhappy in precisely the ways that Richard Easterlin (2001) has demonstrated. Similarly, David Landes (p. 516, 523), while expressing his views in terms of culture, writes that : "If we learn anything from the economic history of development....what counts is work, thrift, honesty, patience, tenacity."

Part of the problem in measurement goes beyond quantities. Allen asks whether Moll Flanders would trade places with a caveman, and in a similar vein Voth uses the widespread ownership of candlesticks to demonstrate higher living standards in Britain on the eve of the Industrial Revolution than in earlier societies. It is true that earlier societies did not face the same range of goods that was available to the British in the mid-eighteenth century, but this raises the question of substitution and what people value. Allen (2008) debates Clark's weight on pepper and spices in a cost of living index, Clark placing greater emphasis on the imported luxuries than the staple, bread.

The proposals of Clark and the institutionalists are not as far apart as the public disagreements would suggest. Clark's thesis hinges on the importance of hard work, rather than rent capture being the source of wealth at death. Those who died wealthy were prudent and efficient in their use of resources, but more than that they were very likely drawn from the traders, merchants, and tenant farmers. The landowners were not a new phenomenon, nor were the indentured peasants, and the literature on the gains following the enclosure of the commons is testimony to their high levels of efficiency, even in the face of less than optimal institutions. Thus, the growing class of traders and merchants, the focus of the institutionalists were very likely the origin of the growing middle class.

Beyond this, it is precisely the institutions that allowed the middle, trading classes to emerge that are central to the institutionalist case. Acemoglu et al (2005) argue that the difference between Britain and the Iberian peninsula was precisely that the British middle classes reaped the benefits of increasing trade. If we accept that the creation of a middle class can impact economic growth through more than one channel, then the argument over the relative claims of institutions and genetics, to which we may add culture, is simply an argument over the relative importance of the channels through which the middle classes imposed their values on British society.

4.3 Technology

The largest omission to date is the role of technology. While specific inventions have been found to have not caused the industrial revolution, or nineteenth century growth in the U.S.A., new technology is

at the heart of the increase in living standards since the start of the Industrial Revolution. Joel Mokyr (1990) has been at the forefront of research into the nature, causes, and impact of innovation. His interpretation of historical changes in technology is that, contrary to the beliefs of Darwin and Marshall, change is not continuous and gradual. Rather, the most important inventions are macroinventions, discontinuous changes that could not be predicted from the slow incremental changes (microinventions).

The microinventions are the cause of measure growth, the ongoing refinement of existing technology. But these inventions rely on prior macroinventions, eureka moments that have no precedence, but that in a number of instances reinforced earlier macroinventions. The ordering of the process is from macro- to microinventions:

Radical advances in the manipulation or understanding of physical processes are usually the beginning, not the end, of a prolonged process of improvement and modifications. (Mokyr 1990b, p. 352)

The middle ages saw a large number of macroinventions, but that could not be exploited because of labour and structural constraints. But by 1750 these had been overcome, and so the industrial revolution could take place. But again, the social environment is important:

The clustering phenomenon of radical innovations is widely observed in all cultural processes, and represents a combination of a conducive environment and interactions between agents themselves. (Mokyr 1990b, p. 353)

Mokyr continues by arguing that "we know relatively little about the causes of macroinventions...Whereas microinventions largely result from the responses of research and development to market forces and opportunities, the original events creating those opportunities are less readily explained" (p. 345). While he does not link it to political diversity, Mokyr notes that in biology, small and isolated environments are more conducive to speciation. This raises the possibility that macroinventions are more likely to result in a region of greater diversity rather than one with less, Europe rather than China. But Mokyr does not extend his argument this far. He simply notes that some environments are more conducive to macroinvention than others. But this raises two issues. The first is that the rate of macroinvention declined in the buildup to the industrial revolution. How can we link them if the environment conducive for the industrial revolution was increasingly not conducive to invention. The second, more important issue for the purposes of this discussion, is that if macroinventions can be induced, to at least some extent, then European exceptionalism is again a matter of social rather than technological exceptionalism.

4.4 Education

The idea that education, and widespread literacy in particular, is a cause of economic growth is not new. Kuznets argued for widespread basic education on two grounds. The first was as training for an industrialized workforce. The second was to minimize the likelihood that individuals capable of invention were not lost to science for want of a basic education. McCloskey (1994, p. 266) argues that literacy was not a cause of growth, but repeats Kuznets' argument in favour of literacy on the grounds of not missing out on those capable of invention.

In his presidential address to the Economic History Society, Richard Easterlin (1981) approached the problem of economic growth by asking why all countries did not experience it. His answer was that modern economic growth is a social phenomenon, centred on the adoption of new technology, and the differences in technology between developed countries is slight. Even in agriculture, where regional conditions matter, similar ideas of irrigation and fertilizing are used. If we want to understand the process of economic growth, we should start by explaining the diffusion of technology.

Easterlin then cites evidence that the view of transmission by blueprint is almost certainly wrong; technology is spread primarily by personal contact. The question is then which part of education matters? Can high levels of education for a small elite substitute for widespread basic education? Easterlin argues not. Education is a learning process, Easterlin does not say this explicitly, but it is implied, part of what is learned is how to learn. Educated people are more receptive to learning, and "raising productivity levels involves active participation in new methods of production by large numbers of the population" (Easterlin 1981, p. 10). This last point is certainly consistent with the evidence describe by Kenneth Arrow (1962) in describing increasing returns in aircraft manufacture.

Easterlin then plots the introduction of widespread primary education against economic growth and argues for a large relationship between growth and the introduction of formal schooling. The exception is Spain, but this is a result of the nature of the education offered in Spain, that perhaps strengthens Easterlin's case. As to the question of cause and effect, Easterlin, while acknowledging feedback effects between education and economic development, argues that there is evidence that in many instances the introduction of widespread education was independent of economic causes (p. 7). But if the causes are political, then the decision to introduce mass education is a political outcome that has resulted from institutional shifts that are more permissive of upward mobility. This leads Easterlin to the conclusion that:

Major advances in mass education are thus likely to signal sizable changes both in incentive structures and aptitudes favorable to modern economic growth. At the same time they are symptomatic of powerful new political and ideological forces at work in the cultures of the various countries. The educational system is therefore a key link between modern economic growth, on the one hand, and a society's culture on the other; study of the evolution of mass education provides an important clue as to when the net balance of the principal cultural forces in a society shifts in a direction favorable to economic growth. (Easterlin 1981, p. 14)

4.5 The First Inorganic Society

E. A. Wrigley (2000) proposes a view of the Industrial Revolution as a discontinuity based on the nature of production. Before the Industrial Revolution, production was limited by organic inputs dependent on photosynthesis. The limits of production lay in the limits of exploitation of photosynthesis. The start of the Industrial Revolution was similar to the rise of Holland from the middle of the sixteenth century. Agricultural output increased, changes to crop rotation and the planting of nitrogen fixing legumes increased the output of land, freeing resources to other, non-agricultural pursuits. At this point Britain was in a similar position to the one that Holland had been in at the peak of the Dutch golden age in the late seventeenth century.

What occurred next was unprecedented. Where Holland's peak of organic output was followed by a 150 year stagnation, Britain entered a period of economic growth at an even higher rate. This second spurt was based on the exploitation of non-organic sources of energy, mainly coal. In describing the magnitude of the energy input from coal, Wrigley (p. 138) writes that producing energy from wood to match Britain's coal output in 1800 would require a 15 million acre plantation. There were no substitutes for inorganic energy, and it fired the modern machinery associated with the Industrial Revolution.

In assigning causes, Wrigley argues that the first part of the Industrial Revolution was based on institutions. The British made better use of organic inputs than the countries of continental Europe, and the institutions on which this advantage rested were hard to copy. The second half, the exploitation of inorganic sources of energy, was purely technological, and that was easier to copy.

Having set the scene in some detail, Wrigley does less to explain his assignment of causes. Why was Germany, unable to match Britain's

mastery of the organic, able to overtake Britain in so many areas of inorganic production? Nothing is provided to suggest that the exploitation of inorganic sources of energy does not rely on institutions, let alone that they can be exploited with a weaker institutional setting.

Further, there is at least one important contradiction in Wrigley's argument. He argues throughout that the Classical model of Smith, Ricardo and Malthus is true for the organic world, that there were limits to growth imposed by natural energy sources, and that in the absence of the inorganic revolution Britain would have been subject to the forces described by the Classical writers. But he then goes on to note that the Dutch experience was very different. Having arguably reached the limits of organic production more than a century before Britain, the tendencies shift in income from wages to rents did not occur. Rather, the Dutch economy entered a period of slow decline. At least some aspect of the Classical model is wrong if we accept that Holland was the most economically successful country within the bounds of the organic. If the limits of organic production had been reached, why did what follow diverge from the predictions of the Classical writers. Wrigley notes this fact, and that it contradicts the predictions of the classical model, but this does not lead him back to a reconsideration of the model.

5 Two Modest Proposals

I offer two proposals, modestly because it is easier to criticise than to do. The proposals relate to uncertainty and the underlying causes of choice.

First, the role of uncertainty has been emphasized by institutionalists with respect to contract enforcement. Less attention has been given to market price uncertainty, and the uncertainty of delivery even where there is a desire to perform. Studies of the process of growth can benefit from a greater awareness not only of the opportunities that improving transport technology offered, but also the reduction in uncertainty about the likelihood and timing of delivery. Further, the notion of planning as an economic activity has almost disappeared in the literature. The heterodox position of Adam Smith and Frank Knight in placing production before the revealing of final demand created a natural need for planning that does not exist in the Walrasian general equilibrium system. This omission is important if we wish to understand changes in the nature of the production given improving technology.

Second, the choice underpinnings of economic history models are typically poorly specified, if at all. The question of the inheritance

that we share with the apes, the social characteristics that are part of our very long-run genetic heritage, warrant attention. The institutional view is pessimistic about human nature. It is assumed that we will cheat if given the opportunity. But this is very far from the observed truth. What is surprising is not how much, but rather how little crime we observe given the opportunities that we face for stealing without being observed.¹⁶ If we have an innate desire to cooperate, but that is balanced by a desire for personal glory, then understanding these forces will enrich our understanding of the past. The absence of discussion of the behavioral content is particularly surprising given the widely recognized demographic transition that has accompanied industrialization.

Beyond this, there every industrialized country has experienced a demographic transition of some description, and it is increasingly clear in the case of Britain that the transition was led by an increase in fertility, with changes in mortality lagging. This change in fertility reflected individual choice.¹⁷ If we have no insight into the causes of this change, then it is difficult to believe that we have any great understanding of the forces underlying industrialization.

6 Conclusion

It is hard to conclude a survey of this type without some sense of disappointment. As McCloskey has pointed out, the success of explaining historical economic growth should be compared against the resources expended. On this perhaps we should be more satisfied with the state of our knowledge. Nonetheless, it is somewhat disconcerting that after decades of reasonably intensive growth, there is still debate over what we should be measuring, and where we should be looking for the answers.

The sector level studies have reached the limit of their potential using current techniques. Better production data will not stop the relentless (il)logic of the social savings calculations, and there is as yet no answer to Abramovitz's problem with summing over industries in the presence of feedback effects.

¹⁶ Axelrod, in *The Evolution of Cooperation*, invites academics to submit algorithms for playing a repeated prisoner's dilemma. The winning strategy is tit for double tat. That is, defect only if the other person has defected twice. Contrary to theoretical predictions, academics, almost certainly with prior knowledge of the Nash equilibrium, chose algorithms that allowed them to begin by trusting, and in doing so obtained superior outcomes.

¹⁷ As Persson (2008) is at pains to point out, the Malthusian model does not work, nor does any analogy to natural forces, precisely because people choose their level of fertility while animals do not.

On the other hand, it is not clear what we purchase in the "Big theories." Even if we were to accept any one of, or a combination of the Bigs, there would always be the question of what lies deeper than that theory. If Clark is correct, then our next point of enquiry is the shift in reproductive success from skill at killing to skill at making and negotiating. Perhaps it was institutional, perhaps it was induced by population change.

To summarize:

1. Sectoral and industry studies are limited by their inability to incorporate the linkages between the industry in question and related industries.
 - (a) Even the most persuasive studies are unable to measure the effect of within industry change on the choices faced in other industries as a result of the change. This goes beyond simple backward linkages in demand.
 - (b) Continuing and related to point (a), explanations of the role of the reduction in uncertainty, the plans that were made possible not just because of the decline in costs, but because of the reliability of supply and on-shipment to the market in a timely fashion, remain open.
2. "Big theory" studies are limited by the impossibility of their ever providing quantitative estimates of the contributions of the various causes of growth.
 - (a) The institutional theories are weakened by the persistence of poor (for the purposes of wealth creation) institutions, despite being able to observe the institutions that have (allegedly) made the wealthy wealthy.
 - (b) Clark's thesis, if taken as accurate as far as it goes, is weakened not by the fact of the recent economic growth in China and India, but by the fact that economic growth was hampered for so long by poor institutions, and that it is recent institutional change and not recent change in the nature of the population that has driven their recent growth.¹⁸
 - (c) The "Big theory" single variable models rely too heavily on incorrect history. While demographers may have overdone their study of Malthusian population dynamics, their basic findings about the nature of the fertility transition that accompanied the Industrial Revolution contradicts a least some of the models. (Contrast for example the assumptions about the nature of the demographic transition in Galor and Moav 2002 with the detail of the demographic transition Mokyr 1990.)

¹⁸This is the point that I believe Solow (2007) was making in his review of *Farewell to Alms*.

3. With respect to the Industrial Revolution, the fine focus on growth and economic variables has shifted attention away from the associated fertility transition and mass migration. Further, the fertility response to modern economic growth - rapid population growth (whether by fertility increase or mortality decline), followed in the long run by fertility decrease and absolute population decline - remains unexplored both in its behavioral content and its implications for economic growth.
 - (a) The lead/ lag relationship between innovation and population growth remain relatively unexplored. Particularly given the evidence that innovation may have been induced by population change.

The debate is not linear; even the simple matters of getting the data straight are not settled. Beyond this, none of the answers that have been discussed are definitive. Dean and Cole (1962) emphasized international trade as an engine of growth. Later, McCloskey was able to argue that foreign trade could not have been an engine of growth; if foreign markets had not existed, domestic demand would have substituted. And regardless, by social savings calculations, no individual sector could have been a driver or engine of growth. Yet more recently, foreign trade reemerges in a slightly different context, as the cause of changes in the distribution of wealth in Britain, leading to the institutional change necessary for the industrial revolution to take place (Acemoglu, Johnson, and Robinson 2005).

If we are to choose between explanations for the causes of the industrial revolution, then the main criterion, beyond plausibility, empirical support, and internal consistency, must be the ability to deal with the countries that did not experience an industrial revolution. The most important potential candidates were probably China and Holland.

China is a likely alternative in the sense that Chinese technology was advanced relative to Britain; the pre-industrial use of coal in China peaked in the eleventh century (Wrigley, 2000), gunpowder was available in China centuries before Western Europe. The failure of China to experience an industrial revolution is then treated as a question of institutions. An avenue of research with some promise on this regard is the differing nature of family. Greif (2007, seminar presentation) constructs a model comparing China and Britain with respect to family hierarchy and control. This approach would interact with McCloskey's (1994) emphasis on persuasion in economic growth, the young in China lacked the means to persuade. In Britain before virtually any other society family was defined in the narrow, nuclear sense, with married children typically living in villages other than the one that they grew up in or that their parents lived in (Kussmaul 1994). In China, by contrast with Britain, the idea of family was broader, and parents exerted greater influence over their married, adult children than was the case in Britain. This was true to the extent that a father could enter

disobedience by a child as a reason for killing them, following which there would be no prosecution for murder.

But the exclusion of Holland is more difficult. Even if the evidence that Holland was the first modern economy is not accepted, it was undoubtedly institutional more advanced than Britain, in particular with regard to the development of finance and capital markets. There were no large technological differences, and they had similar experiences with respect to North Atlantic trade. Why did Holland fail to take the final step to inorganic sources of energy? Was it, as Kuznets suggested, that the Dutch, without resources of their own, had not faced the bottleneck of sources of energy?

But this simply brings us back to the problem of having only one data point. It may be that the model that demonstrates British exceptionalism is ultimately wrong but, as Britain may well have been, simply lucky. So, returning to Deane and Cole's original motivation. Do we have much to tell underdeveloped countries? Probably not. Do we know more about the industrial revolution than Simon Kuznets did? A qualified yes, but qualified because we are discovering new channels through which old ideas may have operated. Where should

we look for the causes of growth? Easterlin was clear:

Some may object that the study of educational systems and the forces that shape them leads away from the traditional concerns of *economic* history. To this, one may reply that if this is what the problem demands, then traditional orientations have to go. In a broader sense, however, it can be argued that such study is, in fact, a return to traditional economic history, to economic history in the spirit of scholars like Marx, Sombart, Weber, and Tawney. (Easterlin 1981, p. 14-15)

Finally, McCloskey points out that in reading Clark's book, the non-economic historian is likely to be repulsed by the genetic/ racial explanation for economic success. This is very likely true. However, it is not clear that discussions of cultural superiority with respect to economic performance is any less repugnant. Yet Landes and Temin, approaching economic history from very different philosophical backgrounds - a cliometrician and an historian - both arrive at Weber's conclusion that culture matters. Not in the immediate Calvinist sense, and in Temin's case with musings on the limits to individually centred Western culture.

A point that has not been raised explicitly in this study is the nature of the interactions that drive modern economic growth. For most of human history the greatest uncertainty has derived from nature, today

it derives from human interaction.¹⁹ Where success for the hunter gatherer lay in hunting and foraging, success in the age of modern economic growth lies in the ability to sell, negotiate, and compromise. The transition in reproductive success should probably not come as a surprise. Settled agriculture, with specialization, raises opportunities for and benefits from trade, and shifts the characteristics required for economic success from physical prowess to human interaction. (note book on civilization and the arrow head factories)

While Gregory Clark has almost uncertainly not discovered the whole of the truth, he may well have pointed us in a useful direction. What is missing from many of the models discussed in this paper, and that is true for the Classical growth model, are fully specified behavioral assumptions. There is a growing literature in experimental economics that people are social, that they cooperate, trust, and punish theft even when it is costly to them. Beyond this is an evolutionary literature that is debating the origins of fairness, trust, and reciprocity. While Dawkins, most prominently in the popular literature, has argued that we are ultimately selfish, and that civilization is as Golding implied simply a veneer, there are alternative views. Frans De Waal (2005) has provided strong evidence that notions of fairness and reciprocity, and the idea of a conscience, are not uniquely human, but that we share them with our nearest evolutionary neighbors. These concerns extend beyond the variables that Kuznets, Clark, and Deane and Cole measured and analyzed. But the potential output of research in the study of economic growth is almost certainly less than the early writers would have hoped. There appears less and less belief that modern economic growth can be imposed²⁰. The history of economic growth, understood deeply, may offer no policy or prescription, no reproducible insight into the mechanism.

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¹⁹This point was important to Hayek, who noted that the European legal tradition, in dividing the events into acts of god and acts of man, and treating the latter as intentional, ignores the problem of unintentional outcomes of human action.

²⁰Cipolla: development economics always has and always will fail.

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