A short outline of European economic history from the post-Roman recovery to the Industrial Revolution

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A Short Outline of European Economic History from the Post-Roman Recovery to the Industrial Revolution

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1. Introduction.

Plagues, migration, political and institutional disorder characterized the centuries after the decline of the (western part of the) Roman Empire. The trading networks, which not only included the different parts of the Roman Empire but the ' barbarian world' (that's us) as well, deteriorated as the 'barbarians' attacked Roman strongholds with swords manufactured and traded by the Roman smiths. Although the intruders soon learnt and adopted the local language and culture, the unity and cohesion of the Roman world had vanished. Population declined where disorder and epidemics reigned even though we are not sure about the extent of that decline. There are those who argue - but this is not a well-established result - that the population of Roman England was not attained again until just before the outbreak of the Black Death, c.1350.

How can we settle a dispute about the size of ancient populations when we do not have written records? Archeologists struggle to measure the extent of the cultivated land at different points in time and then make assumptions about the number of people that could be supported by, say, each cultivated acre. Needless to say these estimates have a wide margin of error.

The decline in population was accompanied by diminishing specialization, and the absence of the rule of law fostered a tendency in the weak to abdicate rights and/or property in exchange for protection. Europe entered a long phase of technological retardation and a decline in per capita income. Central power was not very efficient, giving local (war) lords a bigger say. Furthermore, the Mediterranean world became split into religious spheres, a split which remains to this very day. Paradoxically the Post- Roman period of economic decline was the formative period of two emerging world religions, Christianity and Islam, of which the latter had its humble roots in a nomadic economy. The extent to which this split affected mutual trade has been researched and debated intensely but the traditional view that it delivered a deadly blow to long distance trade does not stand up to scrutiny. However, written documents from this period are rare. Trade relations are inferred from archeological finds of coins and goods and are not always easy to interpret.

By the end of the first millennium A D, perhaps as early as around 700, things began to change. Cities, that had been abandoned attracted people again. In fact most of the urban regeneration occurred in old Roman settlements. Often cities were linked to administrative and religious nodes but they attracted merchants and skilled workers as well. Political order

was about to be restored in Europe. When Charlemagne was crowned in Rome by the Pope in the year 800, he ruled a territory not much different from the West Roman Empire, but it was ruled from German lands, from Aachen, (Aix). Political order stimulated coinage and money circulated easier. After the first attempts at the reunification of Europe, a pattern of nations emerged which has shown considerable continuity to this very day. Most importantly population began to rise and trade and city life regained some of its former vigour. This is when our story begins.

2. Population and Resources.

2.1. The traditional view exposed and challenged.

The traditional view of pre-industrial growth and stagnation has been inspired by the classical economists, Ricardo and Malthus, and discusses the interplay between population growth and limited land resources, but ignores technological progress. It is also based on the implicit belief that the economy is exploiting its resources efficiently at all times.

Before proceeding we should dwell a little on why there is a tradition of talking about pre-industrial as opposed to industrial or modern growth? To start with it is a question of magnitude. Not until the 19th century do we have growth rates in terms of GDP/capita above one half of a per cent per year over long periods. Pre-industrial economies are predominantly agrarian, growth is slow and sometimes absent over long stretches of time. Although the rural population in the Netherlands was as low as 40 per cent of total population around the year 1500, in most other European economies that share was closer to 80 per cent. That means that unlike modern economies, pre-industrial economies were dependent on a factor of production, *land*, that was only available in fixed supply. [1] Not only could modern economies diversify out of agriculture and relax their dependence on land, they increasingly relied on a multitude of *produced* production factors, and the increasingly important one was *non-exclusive:* knowledge. Knowledge is non-exclusive because A's use of it does not exclude

[1] To say that a factor is in fixed supply is, however, particularly ambiguous when land is concerned because land can be used at widely different intensities over time. At one extreme, slash and burn agriculture uses land for a few annual harvests after which land remains in fallow for decades. At the other extreme, you can have several crops per year in rice cultivation in subtropical areas and in the cultivation of vegetables in the temperate zone. Fixed supply is always defined relative to a given technological level.

B's use of it, even though B's use of it can be prevented for a limited period if the knowledge is protected by patent law. Patents link private and social gains from innovative labour and therefore give innovators an incentive to devote resources to research and experiments. Patent protection developed as early as 17th century but became widely practiced after the industrial breakthrough. Technological progress in the pre-industrial period was, however, not based on scientific inquiry in the modern sense but mainly of trial and error and learning by doing. Despite the fact that patent law is more closely monitored in modern economies It seems as if the *diffusion* of new knowledge is much faster in modern economies than in the pre-industrial era.

Pre-industrial economies also made use of knowledge as expressed in the state of *know how.* Knowledge was embodied in tools, in methods of land improvements and rotation of crops, which affected the fertility of land, but the growth of knowledge, i.e. technological progress, was less rapid than in the industrial era. Furthermore, pre-industrial economies were characterized by population dynamics, which differ from that of a modern developed economy. Today we recognize a negative correlation between income per capita and population growth in most advanced economies. Pre-industrial economies differed. The traditional Malthusian view (named after the classical economist and David Ricardo's contemporary, Thomas Malthus) suggests a positive relationship between income and population growth but as we will see, the pattern is much more complicated.

In the analysis of long-term growth one is usually inclined to believe that supply forces are what really matters. The implicit assumption is that available resources are efficiently used, a doctrine, to quote George Grantham, that all opportunities are currently exhausted or exploited. However, economic historians disagree about the extent to which resource constraints were actually binding, because they disagree about whether resources and technology were efficiently used or not. The view defended by the present author suggests that the institutional conditions for the efficient use of resources and technologies were not always present. In the real world, market imperfections and market failures can prevail for long periods and traditional economic analysis does not pay sufficient attention to the institutional requirements for economic development, such as political and legal order. I will show that pre-industrial economies often operated below their capacity, given resources and technology.

However, before we consider these problems we have to look more closely at the traditional view. A dominant tradition2 suggests that the fate of the pre-industrial world was narrowly constrained by limited resources i.e. primarily land in economies that had 80-90 percent of the population in agriculture, because of slow or non-existing technological change. When land became scarce after a period of population growth diminishing returns became a serious obstacle to continued growth because land of inferior quality had to be cultivated or because the existing land was now shared by a larger population. The population profile of an economy with a given technology was assumed to look like the schedule in Figure 1 below. Per capita income is falling from *high* of the left hand part of the horizontal axis to *subsistence* . High income stimulates population growth but only to the point at which diminishing returns had reduced income to subsistence level, that is a level which can only sustain the population at its existing size. When population *growth* approached zero, the population had reached its absolute limit. Any population increase above that level must be transitory and bring income below subsistence level and increase mortality or decrease the birth rate, or both. What would happen if we allowed for a positive technological shock, that is a shift to a permanently higher level of technological knowledge? A technological shock, as opposed to a permanent rate of technological change, will only generate a *transitory* increase in income per head and a period of positive population growth after which the economy will again converge to the subsistence wage but now at a higher constant population. This mechanism is illustrated by a shift from the low level to the high level technology in Figure 1. Poverty induced mortality is what Malthus referred to as the *positive checks* on population growth. Moral or other deliberate constraints on fertility were referred to as *preventive checks*. The population theory we have just sketched is normally referred to as *Malthusian* and has survived to the present day, now with the prefix *neo*-. It is worth noting that his theory was refuted by history most dramatically in the years when Malthus lived and worked - during the Industrial Revolution - which transformed the British economy and permitted a rate of population growth never seen before or after on the British Isles. It is unclear to what extent rising income was driving this spurt in population. In fact, the distribution of income might have become more unequal, hurting the poor and populous classes in this period, but

2 H. J. Habakuk, 'The economic history of modern Britain', *Journal of Economic History*, 18,1958, pp.1484-501.

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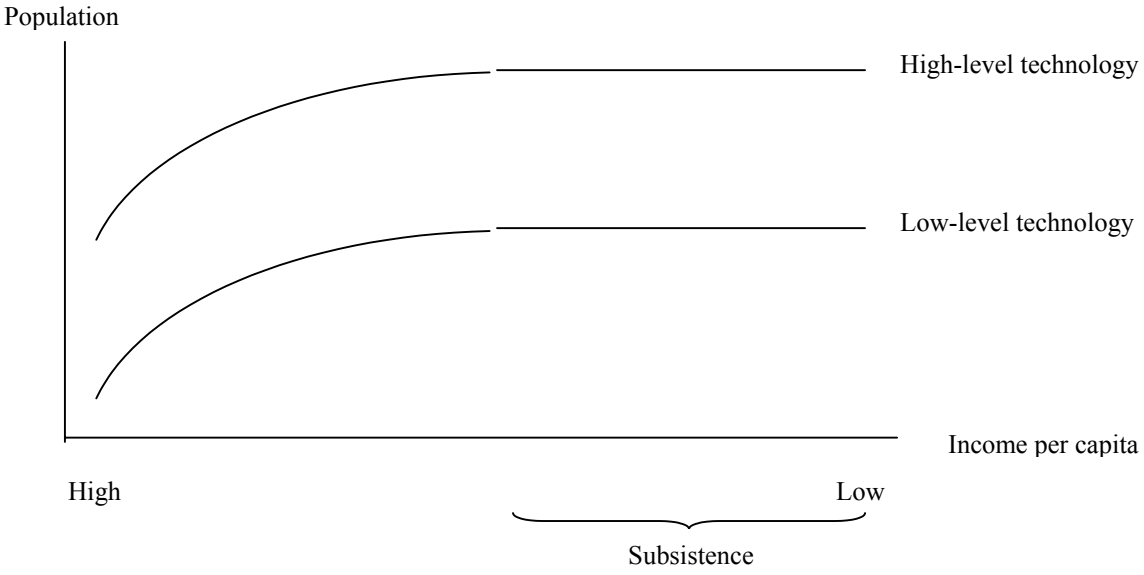
nevertheless sustained population growth turned out not to hit a resource constraint because available resources were more efficiently used.

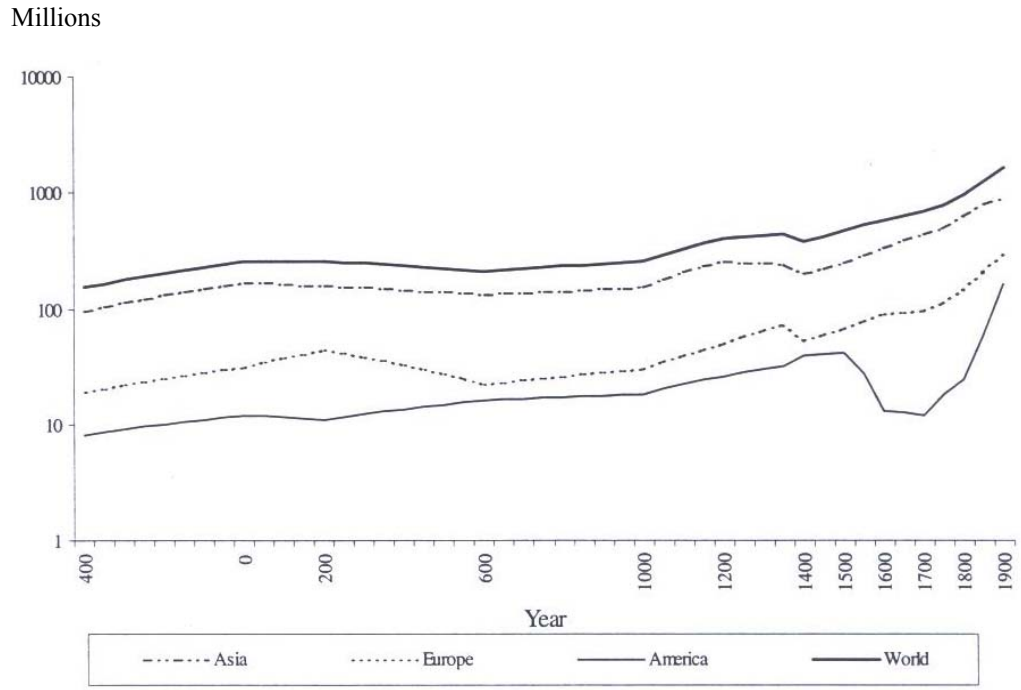
Figure 1. The Malthusian population profile in an economy with limited resources and in two technological regimes.



The fact that the Industrial Revolution refuted Malthus does not in itself imply that the Malthusian world outlook is irrelevant as a theory of the conditions and constraints *for pre-industrial growth.* But the twin ideas that societies converge to a stable population level and a subsistence per capita income do not fit available data as we will see below in Figure 2.[3] Population growth does not occur in spurts. It seems as if we have long periods of population increase followed by periods of dramatic population decline which then leave population at levels far below the carrying capacity of resources and technology for long periods.

[3] It is true that Malthus admitted the possibility of deliberate restraints on population growth, that is some sort of birth control, for example, mediated by nuptiality and fertility, so that the positive (mortality) checks never came into operation. However, this makes his theory tautological, that is, whatever happens, it is consistent with the theory, as pointed out by Mark Blaug long ago.

Figure 2. World population 400 BC to 1900. Log. scale.



Source: J.N. Biraben, 'Essai sur l'évolution du nombre des hommes', *Population,* 34, 1979, p.16.

Some neo-malthusians maintain that they do not (and/or that Malthus did not) exclude technological change. As is demonstrated in Appendix 1, the introduction of a permanent positive rate of technological change (as opposed to a single one-off technological shock as described above) fundamentally alters the predictions of the theory: The economy will not revert to a subsistence level of income and can maintain a positive rate of population growth if there is a constant and permanent rate of technological progress despite (constant) diminishing returns.

This analytical framework fits much better to the pattern of population growth in Europe if you add the fact that the periods of dramatic population decline are caused by exogenous, meaning largely non-economic, forces. There was, see Figure 2 above, a long phase of population increase fostered by the emergence of the Roman empire and economic prosperity to be followed by political disruption and population decline setting in around 200 AD. Centuries of political disorder and epidemics followed and that phase was broken around 800 AD, after which population increased steadily to the middle of 14th century. The population

numbers in Roman Europe were not attained until around 1200. The mortality effect of the Black Death, a plague[4] that entered Europe through Sicily in 1347, having been more or less absent from Europe since around 600 AD, is enormous. Following this devastating outbreak, the plague had a series of minor re-occurrences over the next 100 years. The immediate impact is disputed and varied a little from region to region but an estimated third, perhaps even more, of the European population died of the disease. Population did not really recover until well into the 15th century. We then have a period of slow growth until the beginning of the 18th century, somewhat later in some countries, somewhat earlier in others, until growth suddenly breaks away to much higher rates that remain until the middle or end of the 19th century when growth again slows down.

The Malthusian view links limited resources and population growth to declining income, which triggers off positive checks on population growth. Therefore, when a population has reached its steady state for a given technology as described in Figure 1, only transitory movements around the constant population level would be expected. However, the large negative shocks to population were not transitory and they were not endogenous (i.e. triggered off by poverty) but were driven by exogenous factors such as epidemics and/or political collapse and chaos. Not until the 19th century did man succeeded, to some extent, in controlling the disease environment by improved hygiene and vaccination. In fact, the role of hygiene was little understood until the 19th century. Before that time civilizations were practically unable to control the plagues and epidemics and as a rule, political disorder increased disease mortality because human migration increased and spread diseases. This contributed to the fall in Post-Roman population. The main reason for the drastic decline of the native populations of the Americas between 1500 and 1600, see Figure 2, was the fact that the Europeans had acquired limited immunity to infectious diseases unknown to the original population in the Americas (or Australia). Europe exported economic and political domination, Christianity and smallpox. A mixed blessing, indeed.

[4] The bacillus (yersina pestis) that causes the plague is carried by fleas, which use rats, mice or humans as their host. 75 to 80 percent of infected humans died.

The traditional idea that the immediate pre-1350 period represented a type of Malthusian population maximum with income at subsistence levels as in Figure 1, suggests that population had ceased to grow before the Black Death. This view, known as the Postan-Titow view, and developed with reference to England, suggests that centuries of uninterrupted population growth changed the balance between arable land and pasture. When pasture gave away to arable farming, agriculture was deprived of an indispensable source of natural fertilizer, animal dung. Thus land quality deteriorated as a consequence, taking yields and income down with it. Opponents of this view doubt the interpretation of the English evidence of declining yields in arable agriculture.5 In continental Europe yield data indicate huge regional variations. Furthermore, precise aggregate population data on the pre-1350 period are not available, as opposed to local data, where the record, on balance, does not lend itself to strong conclusions. The population disasters both after the Roman disintegration and in the hundred years after 1350 cannot easily be described as transitory and are much too large to be interpreted as a Malthusian positive check. A possible line of defence for the Malthusian view could be to argue that the reason why the Black Death had such a profound impact was that income and nutritional levels had become so low when population finally hit the resource constraint that people were very vulnerable to diseases. However, the Black Death was not, like some other communicable diseases such as TB (tuberculosis), a 'poor devils' type of disease. It took away rich and poor in equal proportions.

As will be examined below, there is evidence that there was great regional diversity in yields, which indicates prospects of productivity gains for those following the productivity leader, and more importantly, this evidence suggests that the postulate of markets 'exhausting all available opportunities given by technology and resources' might not be valid. Surprisingly, at least from a Malthusian perspective, the regions in pre-industrial Europe with the highest per capita income, such as the 'Low countries', the Paris basin and Southeast England, were also the most densely populated, which indicates that the land constraint was not as rigid as often argued. As suggested in Appendix 1, the most advanced regions had a much more intensive use of land, that is, more crops per unit of land and time, substituted land for labour and diversified production. Human ingenuity helped to ease the constraints of limited land. The Malthusian model disregards this because it is a *closed one good* model. If we introduce

5 M. Desai, 'The agrarian crisis in medieval England: A Malthusian tragedy or a failure of entitlements?' *Bulletin of Economic Research*, 43, 3, 1991, pp. 223-58.

trade and specialization, we clearly see the scope for interregional specialization, also in agricultural production. The foreign exchange that England gained from wool exports could pay for the claret (red wine from the Bordeaux area) that England imported. Land scarce areas developed urban skills and labour intensive food products that could be exchanged for land intensive products from remote areas where land constraints were less of a problem. Regions in Europe were good at exploiting the comparative advantages from differences in resource endowments.

Summing up*: The fundamental prediction of the Malthusian view is that economies converge to a steady state of constant population at subsistence income. However income has, for most regions during most of the pre-industrial era (for which we have population estimates), been above subsistence level and has permitted population growth interrupted only by strong exogenous negative shocks.*

2.2. Short and long run population dynamics: further doubts concerning the Malthusian story.

Does the importance of exogenous mortality shocks in population dynamics deprive economic forces, real income, of a role? Not necessarily. We need to recognize, however, that population growth is determined by nuptiality, fertility and mortality. Fertility was affected both by marital fertility, that is fertility within a given household, as well as by nuptiality, which is the timing and proportion of a cohort actually getting married. In difficult times the age of marriage was postponed, for some indefinitely, and this influenced fertility. These preventive checks on population growth have, by and large, been more important than the Malthusian positive checks, i.e. economically induced mortality. Unlike fertility, mortality is not the subject of human choice. There is not much you can do about the fact that, ' in the long run we are all dead' (J.M.Keynes). However until the last two centuries there was little man could do to influence even the timing of death, that is *life expectancy*. The fact that the expected length of life has doubled over the last two centuries is associated with improved welfare such as better housing and food, government sponsored public health and sanitation policies, such as compulsory health controls and vaccinations, and deliberate life style choices enhancing health, such as giving up smoking and/or excessive drinking. 6 In the analysis of

6 R. A. Easterlin, 'How beneficial is the market. A look at the modern history of mortality', in *European Review of Economic History,* 3,3, 1999, pp. 257-94.

pre-industrial population *trend* growth it is therefore meaningful to concentrate on fertility and nuptiality decisions since they were taken given the exogenously determined life expectancy.

We need to look at this issue in a long, i.e. *trend*, and a short run, i.e. *transitory deviations from trend,* perspective. First the long run. We usually assume that there is a positive impact of per capita income on trend population growth in the pre-industrial period. There are two very different motivations for the positive association of population growth and income. The Malthusian positive check variety suggests that there is a tendency to attain some reproductive maximum and only economic hardship will keep actual population growth below that target. Any easing of economic conditions would generate a spurt in population growth through declining mortality. This view, looking at man as a copulating machine, has been discredited by sober scholarship, and, before that, by common sense. Modern research stresses that non-exogenous changes in population growth are mediated by nuptiality induced fertility variations. The other view uses the fundamental insights from consumption theory, which indicate that demand for a good or service is *increasing* with income, the so-called income effect, and *declining* with the price of the service, the so-called substitution effect. Now, you may argue that this view degrades the motives of human beings in that it neglects that love and affection can be strong motives for families raising children, but there is not a contradiction between the two views. Consumption theory does not deny that love and affection form the preferences for children but humbly suggests that the *number* of children might be influenced by economic factors such as income and the costs of raising a family, which does not strike me as surprising or morally offensive.7 From this perspective an increase in income - the cost of children unaffected - would stimulate family size. Indeed, we would be inclined to interpret at least some changes in trend growth of population as determined by income. It turns out that nuptiality and fertility rates respond in the predicted way to changes in economic variables, - wheat price increases cause fertility and nuptiality to decline.8 But this simple explanation goes fundamentally astray when we get to the late 19th and 20th centuries, where sustained income growth is associated with a decline in family size and population growth, not only in Europe but in other parts of the world. In the 20th century

7 You can see the demand for children as derived demand for food, since children do not produce, which makes the consumption theory approach attractive.

the most certain predictor of a decline in family size is rising income and increased educational level. However, we should not be too quick to turn against the simple insights from consumption theory. Although family size is stimulated by income growth, the income-effect, we also suggested that family size is negatively correlated with the cost of raising children, the substitution effect. That cost is related to the education of children and the opportunity cost of having children, i.e. the labour supply of the adult members of the family is negatively affected by raising children. In pre-industrial economies the *opportunity cost* of having children was quite low, there were no schools to attend and children were soon put to work or tool care of the small ones. These conditions changed with the advent of the industrial economy. Child labour was eventually prohibited or restricted and educational standards had to improve for children to be able to enter the labour market. Hence despite the fact that family size declined with income, the income spent on raising a smaller family increased in the 20th century.

8 See for example R. Schofield's 'Short-run and secular demographic reponses to fluctuations in the standard of living in England', in T.Bengtson and O.Satio (eds) *Population and Economy,From Hunger to Modern Economic Growth.* Oxford University Press, Oxford:2000, pp. 49-71.

This is a simple endogenous explanation of income and substitution effects in population growth, suggesting that income effects dominated substitution effects until the 19th century, but we still encounter a series of empirical puzzles which tend to play down its explanatory power. Going back to the historical record it is possible that the slower population growth in the 17th century was the effect of the falling income. The demographic mechanism, it must be added, was not a Malthusian positive, i.e. mortality, check but rather voluntary restraints on fertility, so-called preventive checks.[9] When earnings were depressed the age of marriage was

[9] The existence of voluntary restraints is, to some extent, surprising because there is the temptation of 'demographic free riding'. An *externality* actually lies at the heart of the matter. If there are diminishing returns when an increasing population chases existing land, it is not only the income of the marginal labourer that is affected. When a family which decides to raise another child, it will demand more resources from the common, making it harder not only for themselves but all others to feed the cattle that graze on the common, to collect wood for fuel and to hunt and fish. Their behaviour will also have future effects on the market for day-labour. This is the simple economics of overpopulation seen as a sub-optimal state of affairs in which each individual household is guided by a calculus of private costs and gains, but neglects the social costs associated with these actions. And there is no simple solution because why should one family exhibit constraint and risk that others do not. However, pre-industrial societies accommodated this predicament in different ways. In Russia there was a leaning towards an equitable distribution of village resources and there was, therefore, no attempts to internalize the externality. There was, as a consequence, few constraints on population growth. On the contrary, in the extreme case where the family could get land in

usually delayed or postponed infinitely for some, which lowered birth rates per fertile woman, as noted above.

Was the 18th century increase in European population growth determined by the fact that the hardships experienced in the 17th century were overcome? This issue is presently the subject of intense debate and research. We are still not sure about the causes behind the radical shift that occurred in the 18th century. From a purely demographic point of view, we suspect that the immediate cause was that the number of live births and children reaching mature age per fertile woman increased and that the life expectancy also rose for those reaching adult age. But why? Was it because of improved pre-natal nourishment of mothers and better post-birth hygiene? If so, we would expect to see rising income, and the evidence is mixed on that point, or that a portion of the constant family budget was redirected towards mothers. The increased life expectancy of adults is often related to the chances of surviving the first crucial years, in that those generations that suffered frequent spells of epidemics at young ages often experienced lower life expectancy as adults.

There might be exogenous forces at work as well, such as a less hostile disease environment. The reason why we cannot always identify shifts in trend growth as generated by economic conditions is that some short run demographic processes might be unintended. The probability of a live birth actually reaching a mature age was very low. And we would expect that households took that fact into account. However small changes in child mortality might not affect fertility strategy immediately. It might take some time before the new information sinks in and family strategies might rely on rule of thumb rather than deliberate and frequent reconsideration of family size strategy. Rules of thumb are, however, subject to change when

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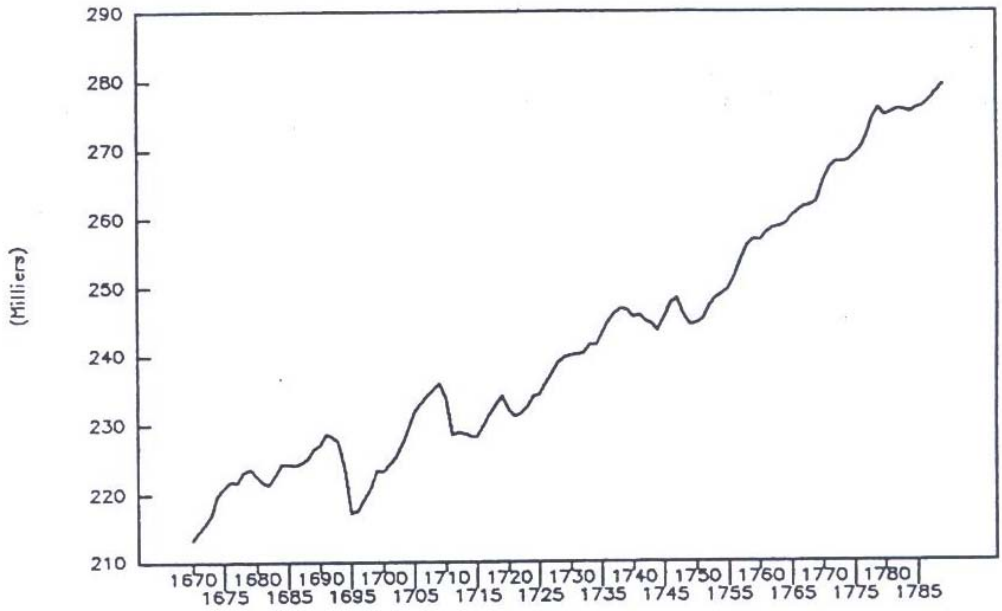
proportion to its size, the entire social cost was assumed by the others. In Western Europe the inheritance and marriage pattern generated constraints on population growth, such as delaying marriage age or increasing the proportion of non-married males and females. Inheritance rules might favour the oldest son thereby diminishing marriage prospects of younger sons and daughters, which in turn would affect population growth. Restricted access to the common property could also contain population since it is a way of internalising the externalities associated with population growth.

the conditions that generated them have changed.

But even if the immediate cause behind the 18th century population increase was partly non-economic a Malthusian interpretation would predict increased competition for available resources and falling income. But there is no evidence of a *decline* in income as population growth picks up. This suggests that the resource constraint assumed by the Malthusians was not rigid. There are two possible and not mutually exclusive explanations for this. First Malthusians might have underestimated the opportunity for technological change and second the population increase might have triggered off the enclosure (privatisation) of common land, a phenomenon that was sweeping Europe as population grew. There is evidence from rising land rentals data that the common, when and if privatised, was used more efficiently.

There is an additional reason why we have reason to be sceptical about the Malthusian stress on resource constraints on population movements. Short term economic distress had , as we have already observed, an impact on short term population movements, mainly through fertility and nuptiality but also through mortality. The mortality response was often indirect and occurred with a time-lag. A series of poor harvests, the causes of which again, in most cases, were exogenous (poor weather, plant diseases, war etc.) caused income for practically all groups in society to decline. But few people died of outright starvation. They died of communicable diseases that followed famines, often with a time-lag. First, because famines triggered off migration, groups that had not been exposed and acquired immunity to certain diseases now became vulnerable. Second because the famine lowered the nutritional status of people and made them more susceptible to those diseases, which unlike the plague , were of the 'poor devils' variety. However, the short run effects can hardly be interpreted as Malthusian positive checks, i.e. as corrections of 'overpopulation' and a reversion to a lower level of population (growth) as demonstrated in the typical pattern of population response in Figure 3 below.

Figure 3. Population growth in France 1670- 1785.



Source: J-M. Chevet, Les crises démographique en France à la fin du XVIIe siècle et au XVIIIe siècle: un essai de mesure, *Histoire & Mesure*, 1993, pp. 117-144.

In Figure 3 we show an important characteristic of short run population movements in France. As you can see, the troubled 1690s were a famine period with disastrous effects on population, but this was followed by a fast adjustment of the population back to its historical trend growth. The same pattern is repeated after the subsequent subsistence crises in the 18th century. In technical jargon it seems as if population is trend *growth* stationary rather than stationary around a Malthusian maximum. Behind this patterns are two forces. The elderly and the young are particularly vulnerable in a famine crisis but the age specific mortality of these groups declines for a short period after the crisis has been overcome. Fertility decisions are often postponed in a crisis just to be compensated for after the crisis. Thus excess mortality and under-fertilty during the crisis are replaced by under-mortality and excess fertility after the crisis.

Summing up: *Economic forces influenced long run population growth through fertility variations. Malthusian positive, i.e. mortality, checks were transitory, a spell of excess mortality in crisis was followed by low mortality in a post-crisis period.*

3. Pre-industrial institutions. Money, markets and property relations.

3.1. Money, credit and banking.

Economists do have, and rightly so, a natural inclination to look for some efficiency characteristics in stable institutions. This follows from a world outlook that conceptualises man as a fairly rational creature which forms institutions in an implicit or explicit contractual process in which each party bargains in its own interest, which under some conditions can generate the common good or mutual benefits. The elementary institutions in economic life can easily be shown to generate efficiency gains. Money was already in general use before time that our story begins. Some well-defined medium of exchange - but not necessarily coins of precious metals - has been used since the dawn of civilization. But why did money replace direct barter of goods? There are several reasons which all relate to the fact that in the real world there are asymmetric information, transaction costs and uncertainty. In a barter economy we have to solve the problem of 'coincidence of wants', i.e., the matching of, say, a seller of cloth who wants iron and a seller of iron who wants cloth. The matching is time-consuming and often involves future deliveries, that is all exchange is not spot exchange. For example the seller of cloth might want to postpone the purchase of iron to some future date. It is of course possible to enter a contract for future delivery but such contracts immediately open up the risk of the supplier not honouring the contract unless costly contract enforcement mechanisms are present. This uncertainty can be detrimental to exchange because producers will not attain the desired level of exchange. Money solves both the 'coincidence of wants' and uncertainty problems because a seller of cloth now does not need to find a seller of the good she wants to buy who also happens to need cloth. By changing cloth for money, the cloth-producer can buy iron on the spot market if and when it is required, or some other good if the cloth-producer changes her mind. Money becomes a convenient store of value because it is accepted by all as a means of payment.

The money used in the pre-industrial period had an intrinsic value since coins were made of gold, silver or copper. Paper money convertible to gold was used from time to time in the 18th century but had a turbulent history up to the 19th century when it became widespread and backed by private or national banks. The issuing monopoly of national banks occurred during the last two centuries. Another advantage of the intrinsic value of money is that its true value is easily detected by almost everybody unlike most other goods. The frequent use of a given monetary instrument is one reason for this. If many competing means of payment

were in use, the public would not gain the same profound knowledge about their values. Let us now leave this brief discussion of money for that basic institution that uses money daily: the market.
(This section will be extended on credit and banking in a future version of this note)

3.2. Market performance in history.

Money greatly helps market transactions because it is a store of value, but rudimentary markets can be based on barter since the essential instrument, price, is also present in barter, i.e. being the ratio at which one unit of one good is exchanged for x units of another. Markets using money have a history starting early but even when money helped the transactions markets remained imperfect and inefficient in the pre-industrial period because goods and information travelled slowly.

Two factors dominate short term price movements in pre-industrial economies: a random element driven by new information about supply generated by natural accidents and a significant auto-correlation. Auto-correlation means that prices today contain information about prices tomorrow. This contradicts the *efficient market hypothesis* which maintains that all available information is contained in the present price. If consumers know today that prices are expected to rise tomorrow consumers, will be expected to purchase their goods today thus forcing prices up immediately. Price changes tomorrow should be generated *only* by new information. But this does not seem to be the case in actual markets for a large class of commodities. There are several reasons for this. Most consumers have cash-constraints and little access to credit so they cannot actively speculate or hoard goods. With limited storage of goods it is also difficult to postpone purchases even if prices are expected to fall. An additional factor worth mentioning is that many goods were perishable and could only be stored for very limited period of time.

Let us first discuss the magnitudede of the random element, i.e. is the price change driven by new information about supply shocks. If that magnitude is small there is no need to worry. However, until the middle of the 19th century, price volatility was high, much stronger than the underlying shocks in local harvest outcomes, which implies that real wages also varied a lot since nominal wages changed little in the short run. What is true for wage earners is not

necessarily true for producers of food. When harvests failed, prices exploded, but for the majority of peasants there was little comfort from that because they did not have any food to bring to the market.

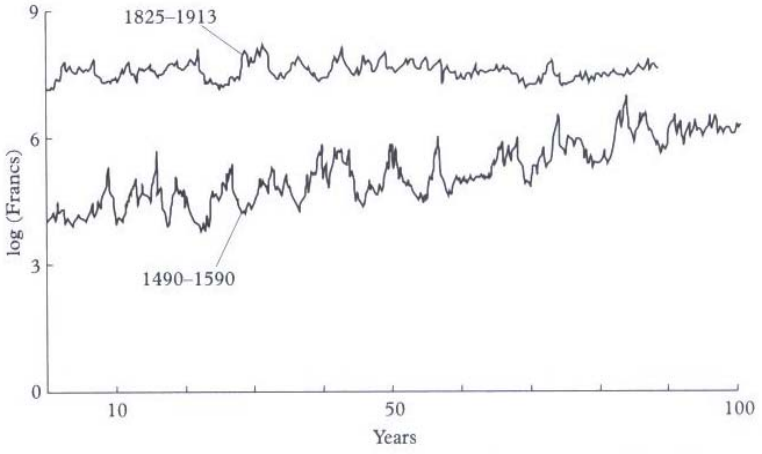
A sceptic might argue that large real wage variations are not worse than small ones. Even if it is true, the sceptic admits that large variations trigger off an occasional sharp decline in consumption and this can be compensated by the occasional sharp increases. Contemporaries disagreed on these matters as witnessed by the endless pamphlets written and the concern rulers have shown for calming price volatility since Roman times. The conventional argument for the desirability of stable prices rather than variations around a constant price is that man, or most men, are risk averse. I would rather say that there seems to be a good case for arguing that man is *loss averse*, which is not exactly the same thing as being risk averse. The rationale for concentrating on loss aversion is a real one: there is an asymmetry in the effects of spells of deficient and abundant consumption. You cannot simply make up for spells of deficient consumption by future abundant consumption. In other words, there are serious welfare losses in real wage variations. It has been demonstrated that price stability generates an increase in survival chances in a population. This is now a well established result in the economics of famine literature.10 Stable consumption as opposed to variability also saves the population from the irreversible effects of spells of poverty, which can manifest themselves in permanent stunting, which is also known to be correlated with life expectancy. I deliberately focus on local harvest shocks because throughout most of history, markets were segmented and driven by supply shocks rather than demand shocks. Demand for food was income inelastic: changes in income had little effect on demand. Small supply shocks generated large price movements because demand for food is price inelastic, i.e. small changes in harvest generate large inverse reactions in prices.

In food markets local shocks, if unmediated by the global economy, were often a much greater problem than global shocks, simply because the latter were small, at least in proportional terms. Since antiquity observers have demonstrated the point that the global economy eases the impact of local natural accidents. Aristotle made the point in reference to the Mediterranean economy indicating that local shocks cancelled out in this vast area because natural accidents were not common to the entire area, that is climatic variations were

10 See M. Ravallion, *Markets and Famines*, Oxford: Clarendon Press,1988.

inter-regionally independent. Hence global supply was not much affected although local output varied a lot from region to region. Others have since refined this argument. The French Physiocrats made it the cornerstone of their spirited defence for free inter-regional and international trade in grain in the 1760s.11 Even if they were not proven right in their own lifetime their analysis was essentially correct. Look at this grain price series from the city of Toulouse, in southern France.

Figure 4. Price (in logs) of wheat, Toulouse, 1490-1590 and 1825-1913.



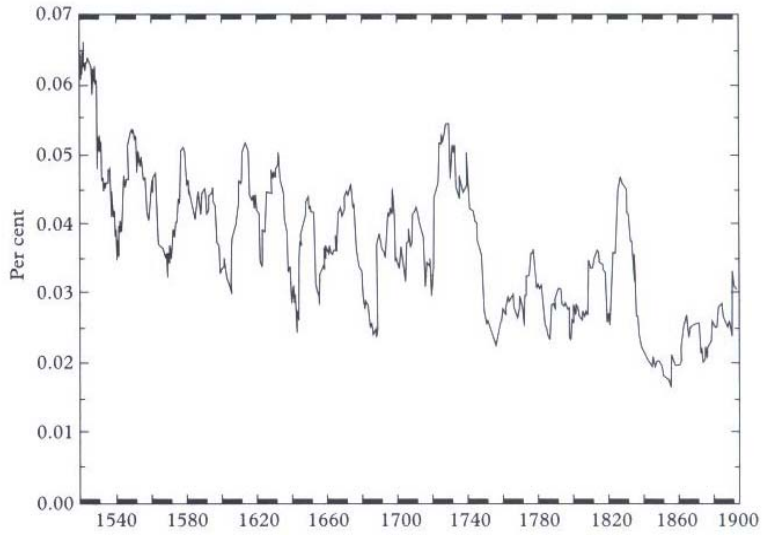
Source: K.G. Persson, *Grain Markets in Europe1500-1900, Integration and Deregulation*, Cambridge: Cambridge University Press, 1999, p. 107

Figure 4 shows the prices of wheat for an early modern period and for the industrial breakthrough in the 19th century. Prices are expressed in logs so you see proportional variations in price. This seems to be the right way of expressing price volatility. Assume for simplicity that nominal wages have increased – probably with a lag - with the trend increase in food prices so that real wages remain the same. If so what we should look at is proportional changes in price because, say, a ten per cent change in price will have the same effect on real wages independently of the nominal level of prices and wages. What you see is a dramatic decline in price volatility of prices from the hundred-year period starting at the end of the 15th century compared to the hundred-year period starting in the beginning of the 19th century. In Figure 5 we trace the decline in variance expressed as the standard deviation of

11 This section draws heavily on my *Grain Markets in Europe1500-1900, Integration and Deregulation*, Cambridge: Cambridge University Press, 1999.

the residual in a random walk model. There is a steady decline from the late Middle Ages until the end of the 19th century. Variance declines almost to a third of its initial level over the years. This pattern is not unique for Toulouse in France but is seen in most of Europe in this period.

Figure 5. Standard deviation of the residual in a random-walk model of monthly wheat prices, Toulouse, 1500-1900, recursive estimation. Per cent = 100 times the number on the vertical axis.



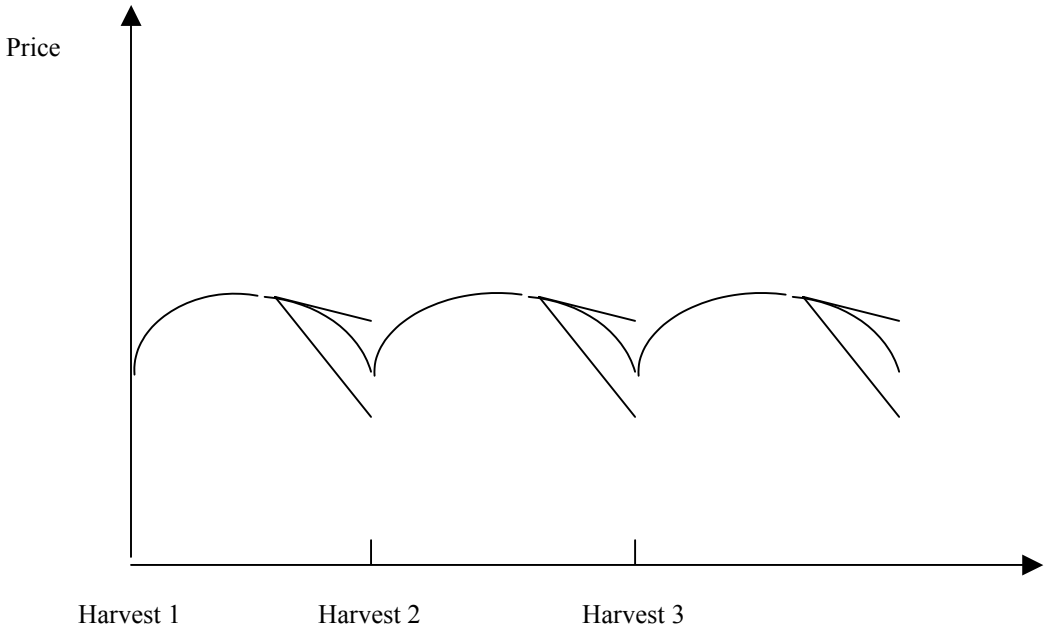
Source: K.G. Persson, *Grain Markets in Europe1500-1900, Integration and Deregulation*, Cambridge: Cambridge University Press, 1999, p. 109.

What's driving this improvement in market performance (it is an improvement because price volatility causes distress and social hardship) is not that *local* harvest shocks were becoming smaller over time but that the Toulouse market had been integrated in the national and international market so that the effect of local supply shocks had been neutralized.

There are two aspects of price volatility worth discussing at some length: the seasonal pattern and the long term evolution and the two aspects will be discussed in that order.
There is one peculiar thing with most agricultural goods that stands out in a comparison with other commodities and that is that grain or potatoes or apples are produced once a year and consumed over the entire year. We know that these goods were held as stocks over the year and we would expect that markets honoured those who invested in inventories by allowing an

economic return. Let us for a moment abstract from carry-over from one harvest to another. If so, the price of grain should increase at a constant rate over the year reflecting the interest rate and rental cost for storage.12 However, the seasonal pattern looks more like that in Figure 6 below. Prices are at a low point immediately after the harvest and then rise until the end of the year. After that price patterns are less predictable as suggested by the graph indicating a variety of trajectories.

Figure 6. Observed seasonal pattern of grain prices.



Is there an explanation for this paradoxical pattern? Yes, there is.

There were probably imperfections in the capital market forcing cash hungry peasants to sell prematurely at harvest when supply was abundant to pay back loans. The moneylender was typically also involved in the grain trade and could exploit the market power in his own interest. However after the sharp recovery during the autumn months, prices ceased to increase. The rate of return of storing grain from August to next summer is hardly covering the prevailing interest rate. However we are in no doubt that, apart from crisis years, granaries were filled to supply the needs for the current year and a small carry over. This behaviour seems to defy economic logic in the sense that investments in inventories were not yielding an appropriate economic return. However, that conclusion might be too strong. There is an

12 P. A. Samuelson, Intertemporal price equilibrium: a prologue to the theory of speculation,

obvious parallel here to the habit of holding money as cash. Cash does not yield any return. But people hold cash and non interest bearing cashable deposits. The reason they do that is of course that the liquidity services provided by cash are greater than the interest forgone by holding money as cash. Stocks of grain provide the holder a sort of precautionary service, that of being able to maintain a stable consumption level independently of future prices. It is perhaps reasonable to invoke loss aversion behind the precautionary sentiment and there is probably some customary element in this behaviour as well.

Let us now turn to price volatility from one harvest year to another. Following the argument suggested by Aristotle and the Physiocrats just reviewed, there were great prospects for price stabilizing intererregional and international trade between excess and deficient markets. However, if transport costs were high, markets were necessarily segmented locally or regionally, so price had to rise significantly before the costs of long-distance supply were covered. The fall in transport costs and in marketing costs contributed to the decline in price volatility in the long run. But with high transport costs and inefficient marketing, local shocks were necessarily associated with large price movements in the absence of inter-temporal speculative storage, so called carry-over. Carry-over storage, which in a sense is an inter-temporal 'transport' of commodities from one year to another, can reduce price volatility but there are natural constraints to the storage of food. Potatoes, for example, cannot be carried over from one year to another and grain has a storage life limited to a few years, the precise length depends on climate and the sophistication of granary technology. A humid climate, like that prevailing in northern Europe, made distilling grain to aquait a safe way of storing the caloric content, although there were some side-effects of excessive intake of these calories of course.

Economic historians have debated the extent and nature of grain storage and whether markets provided efficient storage or not. The precise documentation is very unreliable or lacking altogether so scholars have relied on indirect evidence. The fact that underlying harvest shocks seem to be uncorrelated over time, while there is significant autocorrelation of prices, has led quite a few historians to the premature conclusion that profit maximizing grain storage

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*Weltwirtschaftliches Archiv,*79,181-219, 1957.

ruled the grain markets.13 The idea is that inventory adjustments generated auto-correlation in supply, and hence in price, despite uncorrelated harvest outcomes. However, it turns out that an element of auto-correlation is present in practically all price series of storable as well as non-storable goods. I am sceptical about attempts to derive profit-maximizing storage strategies from price behaviour and observed price patterns. Most attempts are based on poor econometrics. If you argue that there was profit-maximising storage you have to decide what expectations traders held about future prices. Some economic historians suggest that people somehow implicitly know the true or best model available to a modern econometrician. The problem is, however, that there is not a satisfactory model available. A trend-stationary representation of the price movements, meaning that prices varied but reverted to trend, can motivate inventory adjustments if prices are *expected* to revert to trend. (Fill the granary when the price is below trend in the expectation that prices will increase. Sell when the price is above trend in expectation that prices will fall). But it turns out that a trend stationary model has poor predictive power. An obvious alternative, a random walk model - price today is equal to price tomorrow - is not much better. However, profit-maximizing carry-over storage has no economic rationale in a random walk model since the innovations in the series are random with a zero mean suggesting zero profits from speculative hoarding. I am inclined to suggest that carry-over was directed by some rule of thumb – or customary precautionary motive – such that you carry over in good years and use the stored grain when the harvest is insufficient. This is not to say that the rule of thumb strategy is irrational. In fact you save both effort and time by not trying to predict future price movements and readjust your inventories in line with endless reassessments of future prices. A rule of thumb strategy, as just outlined, also generates autocorrelation in prices.14

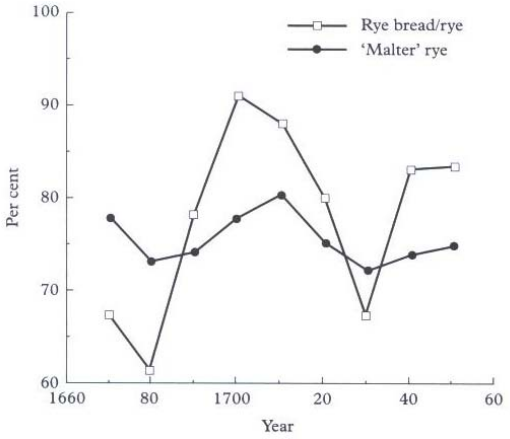
Some specialised traders were involved in speculative carry over but my impression is that it was not sufficient to generate the desired level of price stability. It can be argued that there is an intrinsic market failure involved here. Price volatility generates negative externalities such as increased incidence of epidemics, petty crime and social disintegration. You can rephrase

13 An influential but not very convincing paper in this tradition is D.N. McCloskey and J. Nash, Corn at an interest: the extent and cost of grain storage in Medieval England, *American Economic Review*, 74, 1, pp. 174-87,1984.See also R. Nielsen, Storage and English government intervention in early modern grain markets, *Journal of Economic History,*57,1,1-33,1997.

14 See M. Ejrnæs and K.G .Persson, Grain storage in Early Modern Europe, *Journal of Economic History*, l 59,.3, 1999, pp.762-72.

this insight by stating that there is a public good nature in price stability. While private storage might stabilize prices, speculators are motivated and rewarded by private gains. However, there is no way they can capture privately the social gains from price stability and therefore markets will not be sufficient. Whether the public authorities were better providers of price stability than markets is a controversial issue To settle the issue of the efficiency of pre-industrial grain market regulation regulated and a non-regulated markets need to be compared while hoping that all other things were equal. The French Physiocrats suggested that the unregulated 18th century English market was less volatile than regulated Continental markets. A closer analysis does not support their claim, however. I looked into a number of late 17th and early 18th century Continental markets and compared price volatility with London. It turned out that London was the most volatile with only one Continental market, Toulouse having the same level of volatility while Pisa, Vienna and Cologne had lower levels of price disturbances. Not only was price volatility lower in Cologne, but bread price volatility was lower than the volatility of the main input as is demonstrated in Figure 7. This was the result of deliberate public policy by which bakers, who were probably less vulnerable than the very poor, were not permitted to increase bread prices in line with the increase in prices of inputs. What they lost in crises years they gained in affluent years by not lowering prices proportionally to the fall in grain prices.

Figure 7. Residual variation of bread prices as a percentage of the residual variation in rye prices, Cologne, 1660-1760. Variance of the price of rye =100.



Source: K.G. Persson, The seven lean years, elasticity traps and intervention in grain markets in pre-industrial Europe, *Economic History Review,* XLIV, 4, 1996, p.707.

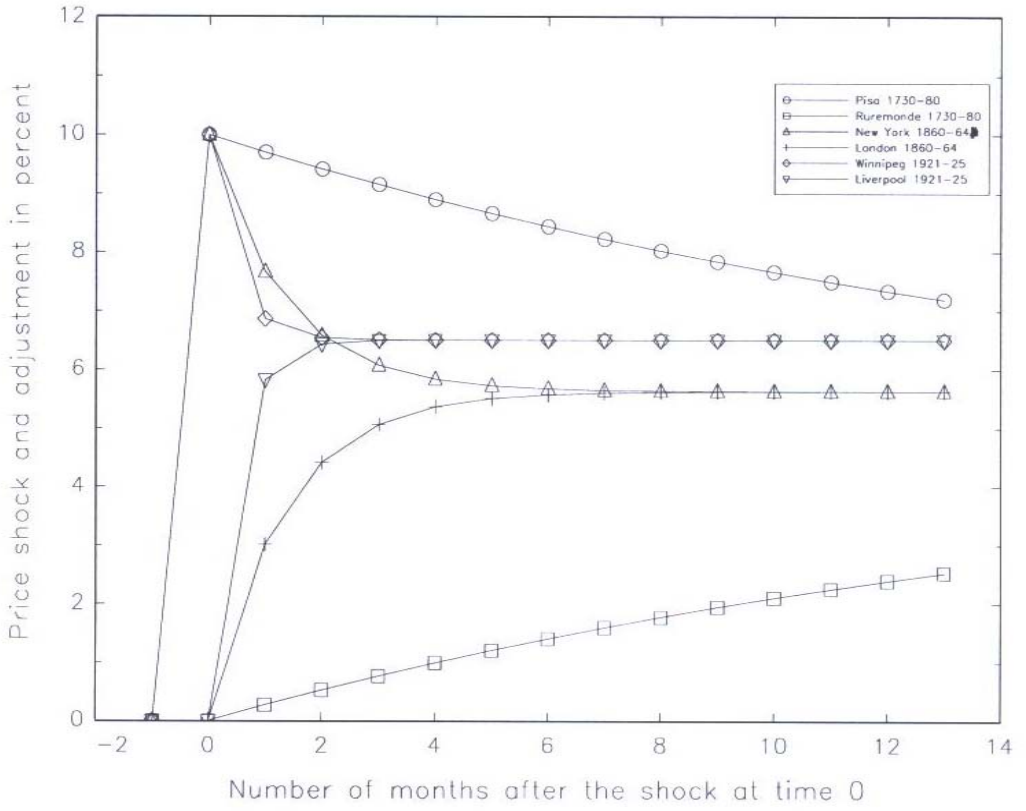
Before leaving the discussion of price volatility it is worth pointing out as a way of summing up, that market performance has improved considerably by reducing price volatility in the very long run. There is no doubt that the spatial integration of markets has been the prime mover but it has not only been the integration of single commodities but also the increase in the available close substitutes as diets have become more varied. Governments retreated gradually from intervention in European grain markets from the late 18th century or early 19th century, and wisely so. Market integration had reduced price volatility to levels not experienced before. Government intervention had become obsolete.

Let us now widen the discussion concerning an appropriate standard of market performance. In a single market we are concerned about the extent to which local outcomes, local market power and harvest shocks drive prices and hence consumption possibilities. But the extent of local independence is a matter of market integration. A local monopoly will dwindle if the local market is integrated in the larger economy. And as pointed out already, the impact of local harvest shocks will be small. The spatial relationship between markets therefore tells us a lot about the nature of the local market. The basic standard by which spatial exchange is evaluated is the transport and transaction cost adjusted law of one price, the *law of one price*

for short. 15The equilibrium price differential between two markets for a homogenous good must not exceed the transport and transaction costs involved in moving the goods between them. If price differentials are larger there are profit opportunities not exploited by traders so markets cannot be efficient. It is sometimes but not always possible to estimate a stable price differential between markets as far back in history as the early modern period. The fact that there is an equilibrium price differential does not prove that it is efficient. In fact it is not until comparatively late in history that equilibrium price differentials between markets also become efficient ones. **Market efficiency seems to be a fairly recent phenomenon in history.** The other important issue is to investigate how often pairs of markets are out of their particular equilibrium, efficient or not. The short answer to that question is: **most of the time.**
However, that does not make this equilibrium concept a meaningless one. But it should not be understood as a state in which economies actually rest rather as an *attractor*. An attractor absorbs deviations from the law of one price, that is, it ensures that shocks do not become permanent but just transitory. There are two aspects of great importance here. First, the strength of the attractor, which can be measured by the speed at which a shock is neutralized. And the second aspect is related to the nature of the equilibrium. Is the equilibrium really compatible with the transport and transaction cost adjusted law of one price? If it is, we can say that the equilibrium is an efficient one in the sense that all opportunities for gains from trade and arbitrage have been exploited. If not, markets are imperfect. I will discuss the nature of these equilibria in due course. First, however, I will look at adjustment speed back to equilibrium and how it has developed over the centuries.
The basic idea and the dramatic change over time is shown in Figure 8.

15 See M. Ejrnæs and K.G. Persson, Market integration and transport costs in France 1825-1903: A threshold error correction approach to the law of one price*, Explorations in Economic History*, 37,2000, pp149-73, for a discussion of the stability and adjustment to the law of one price.

Figure 8. The evolution of adjustment speed between long-distance markets, 1730-1925



Source: M. Ejrnæs and K.G. Persson, work in progress, price data from K. G. Persson *"Mind the gap": Transport cost and price convergence in the 19th century*, mimeo Institute of Economics, University of Copenhagen, 1002:02. See footnote 16 for a reference to method and measurement.

We are looking at pairs of markets in the 18th, 19th and 20th centuries, of which the 18th century pair is typical for the Early Modern Period. Each pair is initially in an attractor type equilibrium in the sense that deviations, so-called errors, are corrected for.16 But we cannot yet say whether that equilibrium is an efficient one, that is whether it is actually the transport cost adjusted law of one price equilibrium. Price differences are, however, at some stable long term ratio. Imagine now a shock to the price in one of the markets of, say, ten per cent. The two markets are now in dis-equilibrium. Since the equilibrium is interpreted as an attractor, prices will adjust, possibly in both markets, although not necessarily at the same speed. The equilibrium will be attained but at a different level of prices than before the shock. The figure

shows that the speed of adjustment is increasing significantly and dramatically over time. A convenient way of expressing speed of adjustment is to measure the half-life of a shock, that is the time it takes for markets to get half way back to equilibrium. It is about 18 months in the 18th century, the Pisa (Italy) and Ruremonde (Netherlands) pair of markets, but is reduced to about a week in the 20th century, cf. the Winnipeg and Liverpool pair. By the middle of the 19th century – before the Atlantic cable - the adjustment speed between New York and London corresponds to a half life of the shock of a little less than a month. You can now easily see the link between price volatility and segmentation of markets. If markets are poorly integrated, local shocks can have strong and long lasting effects on prices as demonstrated by the long half-life of the shock. In an integrated market local shocks can only have short transitory effects. On the other hand the integrated economy is more vulnerable to global shocks. If global shocks are fairly small in proportional terms relative to local shocks, integration of markets helps to stabilize prices over time. When price volatility decreased in Toulouse, cf. Figures 4 and 5 above, it was accompanied by faster adjustment to shocks, including global shocks.

What forces generated the spectacular increase in the speed of adjustment to shocks? The main factors are developments in information and transport technology. Before the telegraph, which was introduced in the middle of the 18th century, goods and information travelled at about the same speed. After that information travelled by the hour and the commercial press diffused the information within 24 hours. A much more sophisticated and transparent trading network developed as a consequence. Unexploited profit opportunities did not remain unexploited. In an economy with inventory adjustments the news of a price increase in London was enough to send prices up in New York and Chicago instantaneously. In that sense commodity markets began to behave very much like asset markets.

We have talked a lot about equilibrium without saying much about what that equilibrium really is, apart from suggesting that the transport cost adjusted law of one price must serve as a standard with which to judge it. The question now must be posed whether the estimated equilibrium is an efficient one, that is, whether it is compatible with the transport cost adjusted law of one price. Let us look at the price of a well specified variety of wheat, say

16 The analysis generating the results in Figure 8 is an error correction model, which indicates that the prices in the pair of markets are co-integrated. That means, roughly speaking, that prices in the two markets are

Red Western, in two markets, for example New York (exporter) and London (importer). The following identity states the problem precisely:

Residual = Price in London – (Price in New York + T&T)

T&T means transport and transaction costs between and in ports, including insurance, port charges etc. In efficient trade the *residual* should be zero. Please, note that the word *residual* differs from the word residual (meaning error) in Figures 2 and 5 and the discussion relating to these figures. The *residual* is, in a sense, a measure of the extent of market inefficiency or poor market performance. In history a zero *residual* seems to have been attained as a consequence of a very long historical process of improved market performance as is indicated in Table 1 below.

Table 1. *Residual* price difference in transatlantic wheat trade, 1855-1925. Per cent of New York price.

Period	1855-1858	1860-1864	1878-1885	1892-1900	1921-1925
Price differential in percent	8.15	13.05	3.15	3.35	-0.1

Note: Price difference refers to New York – London, except for 1921-1925, which refers to Winnipeg-Liverpool

Source: M. Ejrnæs and K. G. Persson, work in progress, price data from K. G. Persson *"Mind the gap": Transport cost and price convergence in the 19th century*, mimeo Institute of Economics, University of Copenhagen 2002:02 and 'Price spreads and shipment costs in the wheat export trade of Canada*, Wheat Studies*, 2, 5, 1926, pp.177-202. The estimates are transport cost adjusted equilibria from which port charges and insurance costs have been subtracted.

The estimates are based on price and T&T costs for transatlantic wheat markets and we find a considerable reduction in the *residual* from some 15 per cent in 1855-64 to 3.5 per cent by the end of the 19th century and finally zero only in 1921- 25. In all cases it has been possible to establish the existence of an equilibrium attractor but it has not been a law of one price

'shadowing' each other, i.e. that they are related by some constant ratio.

equilibrium until the *residual* price differential was down to zero, that is by the 1920s. So the law of one price has not really been the rule in the long history of the market economy until recently. It is clear that the decline in the *residual* is of a non-trivial magnitude and it compares well with the decline in tariffs and transport costs. The 15 per cent residual for the 1855-58 period can be taken as a reasonable approximation of pre-telegraph long distance trade. However the economic benefits of the improvements in market efficiency, as demonstrated by the reduction in the *residual,* have been ignored, probably by the presumption of economists and historians alike that markets, if they exist, perform fairly well. History shows, however that institutions can be stable and long-lived without being efficient.

3.3. Property relations and land holding

As the market case indicated, we should not rush to strong conclusions about the efficiency characteristic of an institution just because it is stable and has a long history. When it comes to the market institution we are inclined to think that it thrives, despite its shortcomings, because it is better than conceivable alternatives. However when we analyse property relations we are more pessimistic. The contractual setting where parties define and defend their own interests can entail different bargaining strengthes and the institutional outcome will reflect that. We noted in the Introduction that the social disorder in the post Roman world fostered institutions that were not necessarily helpful to economic growth. Security was a precious thing and the common people were willing to give up rights, including personal freedoms and property rights, to get protection from armed men. Now this means that the *future* bargaining power of groups differed and it might influence the institutional evolution and growth potential of the economy. In the early medieval period, up to 1200, serfdom was widespread in Europe, although not as widespread as believed previously.17 Along with the manorial sector manned by serfs there were independent peasants as well as leaseholders working the land. Markets in land and labour therefore co-existed in the early medieval period alongside customary relations, although the latter were gradually replaced by market relations.

Serfdom differs from slavery in that serfs were not traded as goods, as slaves were. Rather

17 The relative size of the tenant farmed agriculture is difficult to assess precisely, because we mostly have records relating to the seigniorial sector, that is the land directly managed by landlords or their representatives. However in England already by 1086 about 2/3 of the area was cultivated by tenants and a small free peasantry

serfs were tied to a lord, a landowner or someone who had land owned by the crown as a fief. The latter case reflected the fragility of the central authority in the medieval period. The King had difficulties in collecting taxes and rent and delegated it to lords. Since land was the major taxable property and since it could not be physically moved, we understand easily that territorial conflicts were endemic in these centuries. Lords became *war*lords. The distinguishing characteristic of serfdom was the limitation to labour mobility and the labour services the serf owed to the lord. The serfs typically lived with others in villages were they cultivated land on a family basis. The lord was entitled to a rent for the use of that land which was paid in terms of labour services performed at the estate, the manor of the lord. This practice had its problems. Work motivation on the manor was low as often is the case with forced labour, so work effort had to be supervised. Maintenance of tools was often neglected, and lords reacted by demanding that peasants use their own draught animals and ploughs when working at the manor. Furthermore work sometimes had to be performed when labour was needed on the plots of land that the serfs cultivated on their own and since village and estate were separated physically, much time was spent in moving between village and estate, sometimes with draught animals. So why do we have this peculiar institution of paying rent? There is one argument that stresses the poorly monetized economy in this period, which made payments in labour services convenient. But this argument is not really valid. If money was scarce and if transactions were often direct barter, the rent could obviously be paid in kind, say, as an amount of rye or wheat or butter. The clue to the understanding of serfdom lies elsewhere.

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but that proportion increased over time. See ch.3 in B.M.S. Campbell, *English seigniorial agriculture,1250-1450*, Cambridge University Press, Cambridge: 2000.

The origin of the institution can be traced back to the Post-Roman world when land was plentiful and labour was scarce. In a sense it was an *open frontier* type of situation.18 Since rent is the scarcity premium on land, it did not have one given the abundance of land in that historical period. Labour could move towards the frontier and escape from rent, that is it could earn the entire product of its labour being at least as productive as labour on the lord's estate. If labourers were free to move, they could bargain credibly with lords and bid up wages so that landowners could not extract rent from free labour. However, by restricting the freedom of mobility, labour could not exploit its bargaining power. There is an obvious parallel here to slave labour in pre-civil war North-America. Southern land-owners could not attract free labour from Europe, since immigrants could get land almost free at the western frontier. They therefore had to use 'un-free' labour.

This brings us to the issue in the introductory remarks, that is : was the labour service -estate organization of agricultural production really efficient? To answer that question we must have some plausible alternative which can serve as a standard. In fact, that alternative developed when population increased and increased demand for land. Land now got a scarcity premium. The balance of bargaining power had shifted to landowners, who could bargain a rent from land hungry peasants and they could do it through market transactions without relying on force. Free labour was willing to pay a rent to use land, because the there was no more free land at the frontier or because the available free land was of low quality and generated low yields. With the increase in demand for land, serfdom disappeared in most parts of Western Europe beginning in the 12th and continuing in the 13th centuries. Landowners could rely on markets to extract land rent. Peasants now valued rights to remain on the land they tilled and asked for and often got hereditary rights to lease land. Rents were increasingly paid in cash instead of hard to monitor labour dues.

Did this type of agriculture perform better? We believe so. There are *a priori* grounds for this belief apart from empirical evidence. Household production or self-employment in general saves on costs of supervision since labour is self-monitoring. Legal contracts also developed so that leaseholds became hereditary, which stimulated leaseholders to invest in land improvements, buildings and equipment. The abolition of serfdom first developed near the cities were land was scarce and rents high and in areas where land-reclamation was possible

18 The theory outlined in the next paragraphs can be traced back to Turgot but a modern coherent formulations is found in E. Domar,The causes of slavery or serfdom, *Journal of Economic History*,1970, pp.18-32.

and landlords had little or weak authority. This fact makes it difficult for us to disentangle the growth promoting effects of the vicinity of markets and the 'pure' effects of freedom. What we can register, however, is that the peasantry was quick to exploit market opportunities, when free to do so, in terms of product differentiation and specialization. Cities demanded not only a wide variety of food and vegetables but also crops for industrial use, such as flax and plants for dying cloth. This helped to intensify land use and stimulated more sophisticated rotation schemes, i.e. the order of crops grown on a piece of land over a sequence of years. Rotation schemes should ideally restore the quality of land and the vicinity of cities made human nightsoil a much valued fertilizer and a substitute for animal dung. There is a clear correlation between freedom and sophistication in Pre-Black Death agriculture, for example, there is evidence that the superior traction power provided by horses, as compared to oxen, was first tried by free peasants and that also provided them with the means to get to market towns at a faster speed.

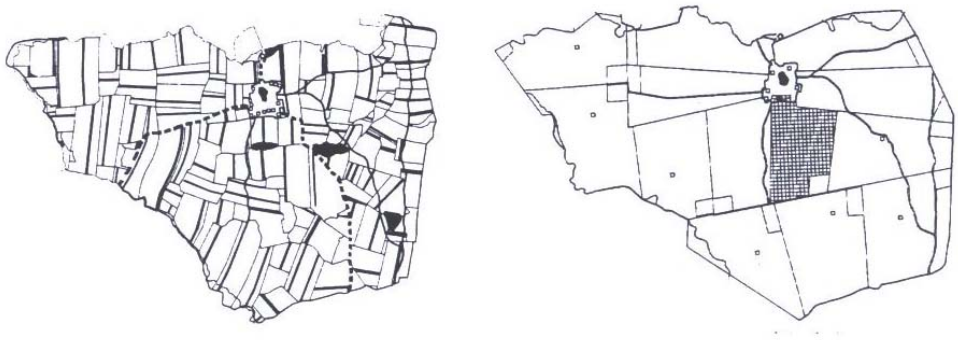
Predictably the dramatic labour scarcity after the Black Death when a third or more of population vanished, made landlords try to re-introduce serfdom, without much success this time since peasants had now gained a legal position they were not prepared to surrender if not forced to. There were exceptions, the so-called second serfdom in Eastern Europe, much discussed but little understood. Some look at it as the inevitable outcome of increased commercialization when Eastern Europe, where the second serfdom prevailed, began to supply Western Europe with grain. However, the highly commercialized Western European agriculture did not see a similar development - with the exception of the introduction of *vornedskab* in Denmark, which incidentally was triggered off by labour shortages after the disastrous wars with neighbouring Sweden. Labour shortages and the bargaining power of the peasantry seem to have been the decisive factors, with shortages combined with a weak peasantry signalling the reinstitution or persistence of serfdom. Where markets in land and labour were already well developed, there was little chance for landlords to re-introduce serfdom. Furthermore, there is no case where sophisticated, high-yielding agriculture has developed with serfdom in Europe. Where it remained, such as was the case in Russia until the mid 19th century, it was associated with technological stagnation and extreme poverty. The emanicipation of the peasantry in Germany and Denmark the late 18th and early 19th centuries was also linked to significant labour productivity growth. The important lesson from the Medieval transition from serfdom to freedom seems to be that long-lasting institutions can

actually prevent resources and opportunities being fully exploited, not permanently but for centuries.

Let us now turn our attention to another puzzling institution in pre-industrial agriculture which many observers have looked at as inherently inefficient. Up until the end of the 18th century peasants cultivated land on a family basis but the organisation of household production was highly dependent on the other members of the village. Members of the village community shared common land used for collecting wood for fuel, hunting - if the lord permitted- and for grazing livestock. The cultivated land was organized according the so-called open field system in which each household had strips of land scattered around the village. These narrow strips ran alongside strips of other households with no fences separating the land of different families. The structure of landholding imposed restrictions on the use of land, what to grow, when to harvest, when to put the land in fallow. Open-field agriculture was widespread in Europe and was not abolished until the 18th and 19th centuries when households could consolidate their holdings and privatize and split the common.[19] In Map 1 below, the lay-out of holdings in the Danish village of Årslev is shown before and after the enclosure. There were 14 households in all and the strips of one of them is marked by bold lines scattered all over the village in 108 strips. After enclosures and consolidation of holdings, half of the households remain at the centre but with direct access to the consolidated land. The size of the chequered holding was 26 ha. The remaining households moved to their holdings on the outskirts of the village.

Map 1 Årslev before and after consolidation of the scattered fields.

[19] There are a few exceptions. In the early 1960s I spent a week at a farmhouse near Chartres, west of Paris,where the farmer complained bitterly about the fact that he had his holdings scattered all around the village in what looked like an old-fashioned open field village.



Source: *Danmarks historie,1700-1800*, pp. 73, 271.

What was the rationale for this organization of landholding? Economic historians, unlike historians who look for the *origin* of the system believing that it explains it, thereby revealing an extreme belief in the importance of *path dependence,* try to look for some efficiency characteristic in what seemingly is a very inefficient system: think about the time it takes to transport men and equipment from one strip to another. There is no consensus about the rationality of open field agriculture but most explanations see it as a way of coping with risk. If natural accidents, which were difficult to control and sometimes affected agriculture disastrously, were local, the scattering of holdings made it likely that a household with bad luck in one part of the village had better luck in some other part. So the consequences of natural accidents were more evenly spread among village members. Furthermore the quality of land might differ and scattering of land then made an equitable distribution of land qualities possible. But this interpretation is open to intriguing questions. There is not an inevitable drift in societies towards equitable distribution of resources, rather the other way around. So why should these villages necessarily try to accomplish it? One possible answer lies in what we can call *team externalities*. Villages were typically rather small and isolated. The smallness and isolation mean that there is great mutual dependence between members. If someone is shirking or performs poorly, it has great consequences for others. Village members were all dependent on each other because markets were poorly integrated. If your own fate depends on the efforts of others, and vice versa, then strong cohesion in the group might be necessary. This type of mutual dependence or solidarity is easier to accomplish in

groups, that share economic conditions.[20] Depriving some members in the village access to portions of the best land might not be in the long run interest of members. This interpretation incidentally helps to explain the system of scattered holdings. In a village in which your own fate is dependent on the behaviour of others, you would typically encounter *moral hazard*. Village members might make claims for support from others but you need to know whether they are legitimate or not. Is, for example, the failed crop of a household due to negligence or to natural accidents? You need to know, because it is important in the long run that only legitimate claims on resources, i.e. crop failures not controlled by the household, are met. If not the village will find itself in a situation in which those who work hard support those who shirk, and given the unyielding environment, this is not compatible with the long run survival of the village members. Generally speaking, in small economies poorly integrated into the larger economy, the mutual dependence of fellow members is greater and by implication the need for control of individual behaviour is also greater. This is a clue to why freedom seems to be prevailing in large organizations: the potential impact of a single individual on your welfare is very small. Open-field agriculture actually provides a solution to the moral hazard problem because it provides the members in the village with a supervision strategy: The lay-out of holdings make supervision a by-product of work since a high degree of simultaneity in activities are called for.

The other potential inefficiency in open field agriculture is the role of the common. In the literature this is known as the alleged " tragedy of the common". Economic theory suggests that common property is over exploited because the single user only equates marginal benefits in its use with private marginal costs and neglects the social costs or the costs to others. We encountered this problem when discussing overpopulation above, see footnote 8. The logic is

[20]By contrast, in a large modern society you can be indifferent, and often are, to the fate of your neighbour because her fate does not have an impact on your economic well-being. If your neighbour is laid off and is eligible for welfare benefits you will not be worried as a taxpayer because the effect on your tax bill is negligible. You might be emotionally attached to your neighbour and worry about her being unemployed, well you should, but that is another matter.

this: if an extended household needs more wood for fuel, it has to increase it marginal effort to find a given amount of fuel because a phase of deforestation is eventually reached. Now this increased marginal effort forms part of the household's constraints and might in fact restrain its appetite for wood somewhat. Nonetheless, that particular household will neglect that it has also imposed a higher marginal effort (cost) on other households in their use of the common property. This is the simple story of over-exploitation of common resources, that is the neglect of the external effect and we face it currently in the depletion of our fishing waters.

Was the tragedy of the common a major problem in pre-industrial economiesBy estimating rents and land values Greg Clark (of Davis-California) suggests that pre-enclosure land had a very low price but when land became scarce it was simply privatized.

Other reasons for the long life of common property might be that access to the common was restricted by rules and conventions which stopped overexploitation. Howver, when or if these conventions break down or are not adhered to serious problems occur as can be seen from the deforestation in some parts of Africa where the free access to forests for fuel has had and continues to have serious negative external effects.

The set of institutions discussed in the preceding paragraphs were transformed from the 18th century onwards. The enclosure movement in England privatized the common and land holdings became consolidated all over Europe by the late 18th and early 19th century in Scandinavia. Why was the old system abolished? We will return to that question in the next section.

4. A new interpretation of pre-industrial growth.

Let us now suggest a foundation for an interpretation of the long term evolution of income and population in Europe. This new view acknowledges diminishing returns in agriculture as population grows but we also explicitly acknowledge technological change, new knowledge, and furthermore there are Smithian forces of division of labour stimulated by 'the extent of the market'. If we have fixed resources but technological change (which Malthus sometimes did not exclude), the story will become fundamentally different. Technological growth is present if we can produce more goods today than were produced yesterday, with resources used in production held constant. If we stick to the Malthusian idea that the rate of population growth is positively associated with per capita income, then the existence of technological

growth suggests the possibility of regimes that combine a specific rate of technological change and a specific constant level of income. A higher rate of technological change would enable the economy to leap to a higher level of permanent income and population growth despite diminishing returns. (The argument is developed in Appendix 1). The intuition here is that the effects of diminishing returns is offset by technological change This view seems compatible with what we see in the period, say 800 to 1350, and after 1450. But it is obvious that we have a regime change during the Industrial Revolution, which, in this perspective, must be interpreted as being driven by a shift in the rate of permanent technological progress and generating income on a higher permanent level. As will be argued in section 7 income growth in the early phase of the Industrial Revolution was quite modest.

Can we also explain why societies remain in low income equilibrium despite not seeming to be constrained by limited natural resources, for example, after the decline of the Roman empire? To do this we must introduce the (Adam) Smithian vision of a specific force of productivity growth, the division of labour, increasing returns to market. The division of labour is limited by the extent of the market, as Adam Smith expressed it. The extent of the market is basically the number and purchasing power of buyers whose demand sellers can satisfy. The larger the extent of the market,the finer can the division of labour become. The social saving in division of labour rests on indivisibilities in training (learning) and equipment. If you devote some time to training, you can increase your efficiency but some minimum level of demand for the product is needed so that the time spent in training can be paid off. A similar argument applies to indivisibilities in tools and equipment needed to enhance productivity in a specialized activity. The very concentration of a producer on a limited number of tasks will enhance learning of perfection, but again, of course, these economies of repetition will depend on the size of the market. The extent of the market might differ at any point in time among sellers depending of what they sell. Luxuries can travel far, heavy goods with low prices cannot. The extent of the market is dependent on population density, and from that perspective population growth is a good thing as long as it does not reduce income due to strong diminishing returns. It is also stimulated by falling transport cost but if law and order breaks down, then transport and trade become too risky and costly and the extent of the market shrinks. That is why political and legal order matter since without order, market networks cannot operate. It now turns out that the Post-Roman decline involved both population decline and the break-down of law and order. Despite the fact there

were no resource constraints in agriculture, that is no diminishing returns, an economy nevertheless got down into a cumulative declining income spiral only because the gains from division of labour were lost when the extent of the market shrunk. This is, we suggest, what happened in the troubled centuries before the resurgence of Europe in the 8th, 9th and 10th centuries.

The forces that got the European economy out of its low-level equilibrium with non-exhausted opportunities were mainly exogenous, such as the fact that the disease environment became less aggressive, permitting population to increase again. But we also need to stress the fact that the re-establishment of social and political order diminished transaction costs in economic intercourse and more generally by extended market networks. Both factors permitted the extent of the market to increase. As long as diminishing returns in agriculture were weak, growth could continue forever because of the ever-increasing division of labour. But the fate of this economy is that it will ultimately encounter diminishing returns. Continued population growth is then possible only if there is technological change. The intuition here is that while technological growth is a permanent factor, the division of labour only generates a one off effect on labour productivity, which eventually will be eroded by diminishing returns. The perspective outlined here can discern different trend growth rates of population.[21] The Malthusian stagnation with a zero rate of population growth with income at subsistence level is just a special case. More in line with the historical record are regimes combining a specific rate of population growth and an associated above subsistence income. However, the observed periods of stagnating population need not be 'Malthusian' at all. In fact, after the decline of the Roman empire one cannot speak about binding constraints at all, yet the income remained at lower levels than before the decline. However the combination of low population density and social disorder made transactions so risky and expensive that it did not invite people to risk investments in skills or trade, given the fact that these investments have an element of indivisibility. There were, in other words, non-exhausted opportunities because of institutional failures.

In the simple framework outlined above, the higher the rate of growth of technological change, the higher the constant per capita income and the rate of population growth, diminish-

[21] This section relies heavily on my book *Pre-industrial Economic Growth*, Oxford:Basil Blackwell,1988.

ing returns held constant. Smithian division of labour alone cannot, however, assure sustained economic growth if limited resources generate diminishing returns. Technological change is essential for sustained growth but Smithian forces might be decisive for taking an economy out of its low-level equilibrium. But what about that decisive component in sustained growth, technological progress, is it exogenous or endogenous? The conditions that generate new path breaking knowledge, as opposed to applied scientific research, are still little known.

It is worth pointing out that innovations are not just about technologies but also about the organization of production and its institutional setting. The transformation of land-use is one Important example. What caused it?

We have hinted at one explanation already : the increasing population from the 18th century increased land prices and the common became a valuable asset. Poor peasants often opposed this transformation because they relied more on common resources but to little avail because now the equitable drift we identified in Mediaeval and Early modern villages was under stress. Again a WHY? is warranted. Here is a possible answer: Markets had now became much more integrated and sophisticated, and offered opportunities and insurance against risk if not for all at least for some, and among the "some" we find those with economic and political resources. For example, crop differentiation became a way of coping with natural accidents because different crops reacted differently to the same exogenous shock. But crop differentiation is possible only in well integrated economies. Furthermore market integration also means more competition in credit markets, and credit markets now offered help when income failed but with non-usurious interest rates, although there was probably differential access to credit with the poor still facing higher interest rates. The important general lesson is this: market integration makes the economy larger and by consequence, the importance of any single individual becomes smaller. You are permitted larger freedom because your actions do not have significant effects on others. The peculiar redistribution, control and supervision structure of the old order has become redundant and the integrated large economy permits much more freedom for individuals. Liberalism is about to enter centre stage.

5. Growth of output and per capita income in the pre-industrial economy.

Aggregate output varied with population and labour productivity. There is a belief that per capita income was largely stagnant during long stretches of pre-industrial history. That implies that technological change was insignificant or just about matched the forces of

diminishing returns. However, as was suggested above, a technological shift to a permanently higher rate would make it possible for an economy to reach a higher steady state level of per capita income. Can we actually say anything about the pace of economic growth before the industrial revolution? And is it possible to show that there was systematic technological progress? Yes, we can but we need to be cautious. In fact, output and productivity estimates before 1900 are quite fragile and it is only after 1945 that a large number of countries adopted modern national income accounting. But even today with sophisticated data collection methods, real output estimates are subject to large margins of uncertainty because there is no ideal way of constructing price deflators and to account for new goods and quality improvements. Different methods used currently can give results that suggest deviations from the standard estimate of, say, a third.

Traditional growth accounting has not been used much in analysis of pre-industrial economies. Growth accounting tries to estimate the residual growth interpreted as a measure of technological progress. The simple version of estimating the (Solow) residual or the so-called total factor productivity (tfp) or r is:

$$r = Q^* - [a L^* + bT^* + (1-a-b) K^*] \qquad \{1\}$$

where Q^* is growth of output, L^* is growth of labour input and T^* is growth of land and K^* growth of capital, a is elasticity of output with respect to labour, b is elasticity of output with respect to land and 1-a-b is consequently (assuming constant returns) the output elasticity with regard to land. The interpretation of this equation is straightforward. Output growth that cannot be accounted for by (weighted) input factors must be explained by technological change, i.e. better use of the inputs. The elasticity parameters are usually determined by factor shares assuming a link between share and productivity.

Now the equation above seems to be very demanding in terms of information and it does not appear likely that you could get reliable information on all variables, however serious a researcher you were. The most problematic variable is Q, output. In pre-industrial times we did not have any estimates of aggregate output, so an inference was usually made on the basis of population size or labour force, the latter assumed to be a constant fraction of population. That is, growth of output was linked to growth of population. However, if it is estimated that way, the whole growth accounting exercise becomes shaky since labour force growth is already included in the growth accounting formula on the input side. Persson and

Hoffman have tried different ways of getting around a direct estimate of output. Under simplifying assumptions, Persson showed that there are two basic pre-industrial regimes. If all factors of production have equal growth rates, which would be the case during the first centuries of the post-Roman recovery and well into the second millennium, the formula above , equation (1) can be reformulated as:

$r = w^* + (1+s)^* - p^*$ {2}

where r as before is total factor productivity (tfp) growth, w* is wage growth, s is the ratio of rents to wages and p* is change in price, the asterisk * signifies the proportional change in a variable.

When land shortage sets in, the growth formula becomes:

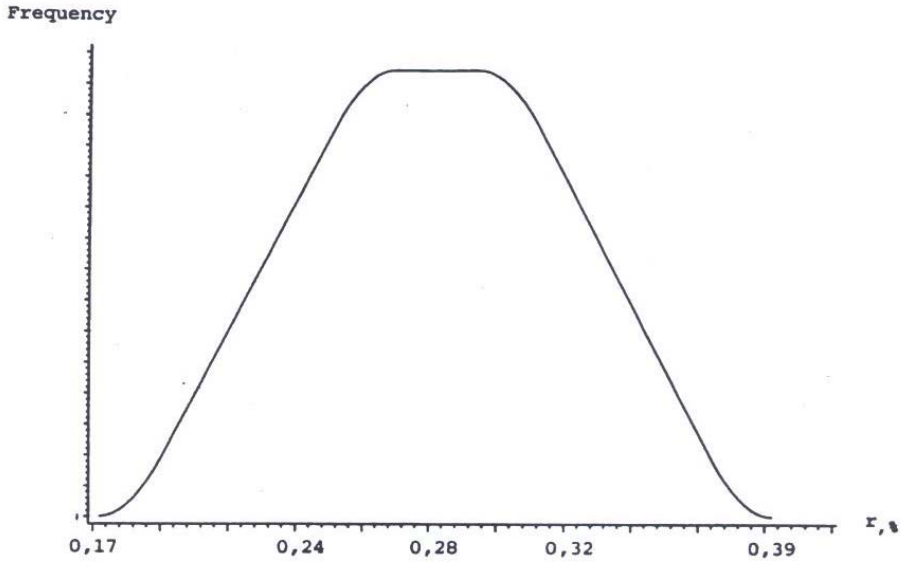
$r = w^* + (1+s)^* - p^* + b(K^* - T^*)$ {3}

The advantage with the latter formulation is that not only can you get an estimate of r without a direct estimate of output but you can infer growth of K from the growth of the population, assuming that the amount of capital per capita does not change much or at all, and that growth of land is smaller than the growth of the population. Medieval sources are quite good in supplying information about prices and wages and population growth can be indirectly estimated from scattered records with some accuracy. However, information is not very precise. It would be desirable to work with a margin of error. That is, instead of saying that growth of wages is 10 percent over a specified period we would prefer to include the standard deviation of that estimate. Persson did exactly that in estimating equation (3) using English data.

The analysis was applied to the agrarian sector in the pre-plague period in England, that is 1250-1347, which, in traditional historiography, has been described as the prelude to a Malthusian crisis. A reiterative procedure, in which the equation was estimated 1000 of times, was adopted in which you entered values on all variables but the actual value of a variable was picked randomly from an interval of values given by the expected value and its standard deviation. For example the annual growth in nominal wages had an expected value of 0.32 per cent per year in 1250 to 1347 and the standard deviation was 0.037 percent. That implies that the random selection of a value was from an interval of 0.283 to 0.357 percent. A similar procedure was adopted for the other variables. It is obvious that a precise number of for tfp growth is not obtained but rather a bell shaped distribution, as in Figure 9 below, where the estimated tfp-growth is around 0.17 to 0.39 percent per year with the most likely results being

around 0.25 to 0.3 per cent per year for the century before the Black Death.

Figure 9. Probability distribution of total factor productivity in English agriculture, 1250-1347.



Total factor productivity per cent per year

Source: K.G.Persson,Total factor productivity growth in English agriculture 1250-1450, Discussion paper, 1993:11, Institute of Economics,University of Copenhagen.

Similar estimates were made for the post-plague period, 1350-1450, and indicate lower growth despite the fact that land was then plentiful due to the drastic decline in population. It is obvious that these results do not lend support to a Malthusian interpretation of Medieval economic history but indicate a depressive impact of the fall in aggregate demand due to the drastic decline in population. The scope for division of labour and the gains therein declined. More importantly the results indicate that even in the case when the resource constraint was manifest, as it was in the pre-plague period, technological change did offset that constraint.

P. Hoffman has made tfp- estimates of French early modern and *ancién regime,* (1522-1789*)* agriculture and the pattern is not very different from the results discussed in the preceding paragraph. He reveals, however, periods of growth and stagnation and large regional differences. The Paris basin, which you would expect to be the most dynamic region, is surpassed by the Southeast, as indicated by Table 2 below. Growth averages around 0.13 per cent per year in the Paris basin and increases to 0.31 in the late 18th century. One major region, the West had negative growth and one, Normandy, was characterized by stagnation

throughout the *ancién regime*, tfp growth was a mere 0.01 per cent per year. Hoffman argues that exogenous shocks, wars and disorder severely interrupts the growth process and yields the low long run averages. The results referred to above in the analysis of medieval English growth are primarily based on data from the south eastern part of England, quite close to London and which in many respects is similar to the Paris basin.

Table 2. Total factor productivity in French agriculture, 1522-1789. Major regions. Per cent per year.

		TFP Growth Rate (Percent/Year)	
Region	Years Covered	Overall	Late Eighteenth Century
Paris Basin	1520-1789	0.13	0.31
Northeast (Lorraine)	1550-1789	0.13	0.13
Normandy (near Caen)	1520-1785	0.01	0.01
West	1611-1790	-0.16	-0.16
Southeast	1580-1790	0.21	0.21

Source: P.Hoffman, *Growth in a Traditional Society, The French Countryside 1450-1815,* Princeton University Press ,Princeton, 1996*,* Table 4.8, p. 130.

Summarising these attempts to measure pre-industrial growth leaves us with the impression that tfp growth was around 0.1 to 0.3 per cent per year in the pre-industrial era provided there was an absence of exogenous shocks and if resources and opportunities were reasonably well exploited. The results highlight great regional differences. As in the modern world, growth was not shared by all.

Needless to say, these estimates are subject to great uncertainty. Can we find some other alternative method of estimation? If so, that alternative method could serve as an independent check. There is another way of indirect estimation which is based on the following common sense observation. To simplify the exposition, consider a closed economy with an agrarian sector feeding its own workers and an urban population, that is a non-food producing population. Now it seems obvious that if we observe an increase in the non-food producing population relative to the agrarian population and without noting a decline in the per capita consumption of food, then the increase in the relative size of the urban population must have to do with a productivity increase in the agrarian sector. Each farming household produces

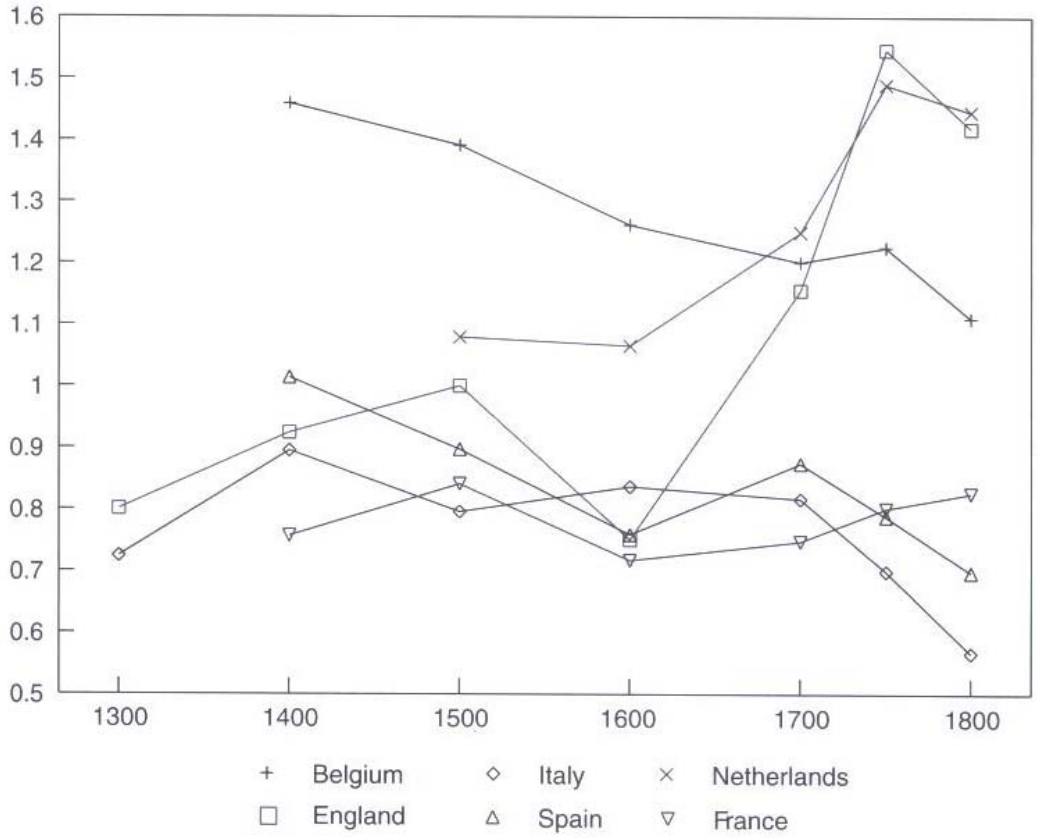
food for a larger number of townspeople. This common sense argument can easily be formalized to include foreign trade, changes in the propensity to consume food and non-food, income differences between town and countryside etc. One should be able to understand intuitively why it is necessary to control for import of food, for example. If we observe that the proportion of urban occupations increases in total population, it might, in principle, only depend on the fact that the urban manufacturers export their goods against foreign food, and if so, this increase in the relative size of the urban sector need not reveal a productivity change in the economy's own agricultural sector. Likewise, relative wages must be controlled for. Again urban growth might depend on the fact that wages and agrarian consumption in cities decline and therefore the inference that urban growth always implies agrarian productivity growth is not correct. On the other hand, if urban wages and food consumption increase relative to agrarian wages, and controlling for foreign trade, that fact in itself reveals productivity advances in the agrarian sector without any change in the relative size of the urban professions. Finally, the impact of changes in the share of occupational groups, urban versus agrarian, crucially depends on the marginal propensity to consume agrarian goods. The higher it is, the higher will be the implied productivity change in the agrarian sector caused by a given increase in the relative size of the urban occupations.

Do the results from an analysis along these lines lend support to the previously reported estimates? By and large the answer is yes. K.G. Persson investigated agricultural labour productivity changes (which is identical to tfp-growth if it is defined as in equation (2) above and approximately equal but larger than labour productivity if tfp is estimated from (3)) in Tuscany (Italy) and the historical Low Countries, now Northern France and Southern Belgium.22 Both areas were fairly advanced and similar to the Paris basin and Southeast England. Estimates for the period 1100 to 1300 ranged between 0.1 to 0.25 per cent per year. It is worth stressing that these results do not imply that growth was equally strong in all parts of Europe. On the contrary, remote areas poorly integrated into urban networks probably fared less well. P. Hoffman's research also suggests that variations in growth were very sensitive to social disorder. Wars and social unrest had a negative impact. A stable institutional framework is a prerequisite for growth.

Bob Allen has used a method similar to the one just reviewed, see footnote 20, but for the period 1300-1800. He confirmed Hoffman's results of different growth patterns in different regions using a method of analysis similar to Persson . The results are summarized in Figure 10. Belgium, at that time not a nation state, but part of the highly urbanised Low Countries region starts out as an early leader but with negative growth in the period. Unlike the Netherlands, Belgium cannot free itself from the stifling political domination and religious intolerance of the Spanish crown which harms growth. Belgium loses one precious resource, human capital and skilled labour, which migrated to the Netherlands because of persecution. Not surprisingly the Netherlands which combined political independence around 1600 with religious tolerance and growth promoting institutions became, in the words of Jan de Vries, the first *modern* economy. The first *industrial* nation, England, with an institutional set up similar to that in the Netherlands, also advanced in terms of agrarian labour productivity, almost doubling its output per agricultural worker in 150 years.

22 K.G-Persson, 'Labour productivity in medieval agriculture: Tuscany and the Low Countries' in B.M.S.Campbell and M.Overton, *Land,Labour and Livestock, Historical Studies in European Agricultural Productivity*, Manchester University Press, Manchester 1991, pp. 124-43.

Figure 10. Output per worker in agriculture, 1300-1800. Various countries relative to England 1500 = 1.



Source: R.C. Allen, 'Economic structure and agricultural productivity in Europe, 1300-1800' *European Review of Economic History*, 4, 1, 2000, pp. 1-26.

Other results are less optimistic. For example, France, stagnates which seems to contradict Hoffman's results. However, Allen's choice of large territorial states as units is averages the different growth performance in subregions. In fact, Hoffman reported regions with negative and zero growth. This highlights the idea advanced previously that regions and nations might operate below their technological capacity and resource constraints. There is little evidence that resource endowments or access to technology were fundamentally different in, say England and France to the extent that a 2:1 difference in labour productivity could be explained. In other words, we should look elsewhere for an explanation for why France was left behind. Growth inhibiting institutions, and periods of internal disorder, are probably part of the answer.

What were the sources of pre-industrial growth? It is clear that radical changes in agrarian techniques were not experienced, but rather the slow accumulation of new superior knowledge. Such knowledge referred to improved rotation schemes, and other improvements in soil and crops. A possible source is also increased specialization and the intensification of the use of time and soil. In the vicinity of urban areas where agrarian growth was most pronounced, there was both specialization and possibly longer hours when farmers could add industrial plants, eg. flax or vegetables and poultry, to traditional crops. Strictly speaking that would not necessarily increase labour productivity as measured by output per labour hours. However it increased income per household and per labourer. We can also suspect that when households took the opportunity to work more it was because seasonal unemployment was considered undesirable. We encounter here again the idea that a low level equilibrium might exist because of co-ordination failures which did not encourage the optimal level of specialization and work effort.

Are labour productivity or tfp growth rates of a magnitude of say 0.15 per cent per year over a long period, say from 1000 to 1750 plausible? [23] Yes! The implication is a threefold increase in income per capita, to be compared with a twelvefold increase over 100 years if we take the average yearly growth rate to be some 2.5 per cent between 1900 and 2000.

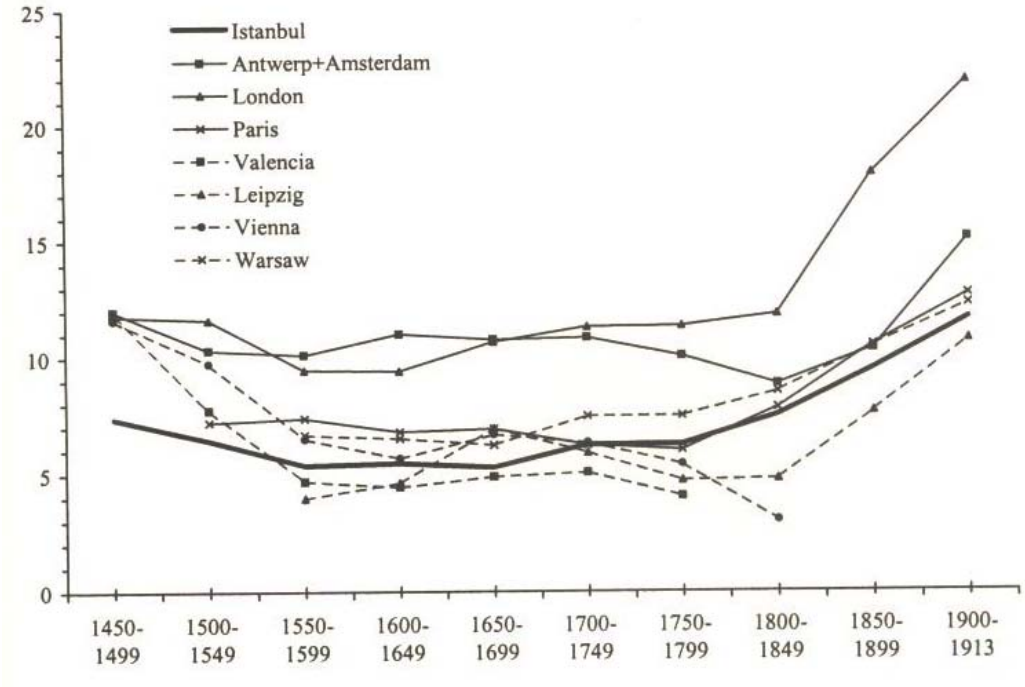
6. Wages and Income distribution.

Can the general view of slow and sometimes interrupted productivity growth be corroborated by evidence concerning the evolution of real wages? Since most of the productivity measurements concern agriculture, we would need agrarian wages. And even if we had that we could not immediately interpret such a series if we do not possess data on the way total agrarian income was divided between workers, peasants and landowners. A decline in rural wages might reflect unchanged labour productivity but with landlords increasing their share of total income. By and large the wages series that are available are urban wages of building workers, which is a sector that is not known for spectacular productivity growth, not even during and immediately after the Industrial Revolution. Real wages of urban workers have in fact a rather ambiguous relationship to agrarian income because, to obtain real wages, one

[23] In some manufacturing activities, such as spinning, labour productivity probably increased with a factor of four between 1400 and 1700.

deflates nominal wages with the a cost of living index largely composed of food prices. If urban real wages decline it might be because of an increase in food prices, which increased income for food producers. Since part of rural income is spent on urban goods and since urban goods' prices fell relative to food, the effect would be that real wages in the urban sector fell while rural real income increased. The terms of trade of the rural sector would have improved. In the very long run one would expect that relative urban and rural wages revert to a stable (equilibrium) relationship. Urban wages are often found to be slightly higher than rural wages. However, it is useful at this point to remember the use of the concept equilibrium we introduced in section 3. Look at it as an attractor, that is, at any single point in time the relative wage relationship might be out of its equilibrium although it is reverting to it.
Real wages were at a historical high by the mid 15th century, driven by the general labour shortage as a consequence of a century of declining population after the first outbreak of the Black Death. Workers not only negotiated higher wages and shorter hours, they were also benefiting from low agricultural prices. As the labour shortage eased from 1450 to 1600, real wages generally dropped. However, urban labourers, probably adjusted to that by changing their diet, which was high in meat in the 15th century and ate more bread and porridge in the 16th century. As can be seen from Figure 11, the regional/national differences in real wage levels largely reflect the differences noted above across nations in terms of agrarian labour productivity with cities in England and the Low Countries leading the wage league.
Despite the differences in levels, it is worth stressing the similarity in movements across cities located in all parts of Europe. The similarities of movements in, for example, London and Istanbul, are noteworthy, both entered a phase of slow increase some time in the 17th century which speeded up in the 18th century. However, the synchronization of wage movements between different parts of Europe must not be interpreted as a sign of integration in the European labour markets. The phenomenon is rather the effect of a combination of fairly rigid nominal wages and rudimentary integration of European food markets.

Figure 11. Real wages of skilled construction workers in European cities 1450-1913. Wages in grams of silver divided by a consumer price index.



Source:S. Özmucur and S. Pamuk, 'Real wages and standards of living in the Ottoman Empire, 1489-1914' *Journal of Economic History*, 62, 2, 2002, pp. 277-321.

In turns out that our suspicion that falling or stagnating real wages of workers might have to do with changes in the distribution of income away from workers and in favour of the rich, whose income originates from property. Figure 12 shows a more unequal distribution of income accompanying the fall in real wages in the 16th and early 17th centuries in England but the same pattern are is apparent in the Netherlands and France. In fact, there seems to be an inverse relationship between changes in real wages and changes in inequality, i.e. a fall in real wages is associated with a rise in inequality and vice versa.

Figure 12. Movements in the cost of living in top income groups, relative to the cost of living in the bottom 40 percent or in workers' households, England 1500-1986.

Source: P. T. Hoffman, D.S. Jacks, P.A. Levin and P. Lindert, 'Real inequality in Europe since 1500', *Journal of Economic History,* 62, 2, 2002, pp.322-55.

Conclusion*: A comparison between agrarian labour productivity and building wages confirms differences in levels across nations and regions in both series in the order of roughly 2 to 1. We should be careful in interpreting real wages as shadowing GDP/capita however, since wages are sensitive to changes in income distribution.*

7. Was there an Industrial Revolution?

The concept of revolution suggests a radical and sudden transformation of economic life. It is part of the folklore of the Industrial Revolution that it was associated with rapid growth and the widespread introduction of new technologies and energy sources such as steam. While anybody living through the French Revolution, say, the period 1789- 95, could not miss it, and quite a few lost their heads, most contemporaries of the Industrial Revolution were unaware of it. In fact, the concept was not invented until around 1850. We have already mentioned one of the contemporaries, Malthus, whose main concern was the inherent stagnation in an economy with limited resources and for whom the possibility of sustained growth was impossible or exceptional.

Economic historians have, in recent years, become increasingly dissatisfied with the traditional view of the Industrial Revolution. Some suggest that the concept itself is a misnomer. It is true that there were new technologies introduced but the pace at which they were adopted was much slower than previously believed and these technologies were not as quickly and widely diffused as first believed. Many of these technologies took a long time to develop. Although the introduction of heat (and steam) as a source of energy and power (motion) had revolutionary implications, it took about two hundred years before the energy waste in early steam engines which was based on reciprocating motion, i e the back and forth motion of the piston, became energy saving through the steam turbine and rotary motion. During the Industrial Revolution the major energy source for industry remained water power, and that is why the industries were called *mills,* i.e. machines were driven by water *mills.* Not until the mid 19th century did steam engines have an impact on transport but sail, which continued to increase in speed and efficiency, remained the dominant mode of sea transport until the late 19th century. What has been recognized now is that Industrial Revolution was limited to a revolutionary change in isolated sectors, specifically the textile industries, and to be more precise in the spinning and weaving of cotton cloth. In that process cotton replaced linen, which was a fibre not as easily adaptable to mechanized spinning as cotton. However spinning had been developed continuously since Medieval times. With hindsight some of the pre-industrial innovations might seem simple, such as introducing the foot treadle to drive the spinning wheel, which released one hand previously used to set the wheel in motion, or the mechanical winding of the yarn with a flyer. The reinterpretation of the Industrial Revolution also indicates that the technological changes that occurred were the result of trial and error rather than scientific discoveries. The innovators were skilled craftsmen rather than scientists and again it was not until the end of the 19th century, 100 years after the Industrial Revolution in England, that science entered as a major innovative force in production processes and in the development of new products.

All this seems to stress the continuity rather than the revolutionary impact of the economic changes in the period from 1770 to 1830. And, indeed, growth accounting has revised growth figures considerably. Table 3 below lists the conventional view represented by the pioneering work by Cole and Dean and also the new results from the work of ´revisionist´economic historians such as Crafts and Harley. The results from recent revisions actually stress the

fairly small difference between pre-industrial and early industrial growth in the early phase of the Industrial Revolution.

Table 3. Harley and Crafts versus Dean and Cole. Estimates of national product growth in Britain. Per cent per year.

	Harley & Crafts		Dean & Cole	
	National product	Per head	National product	Per head
1700-1760	0.69	0.31	0.66	0.45
1760-1780	0.7	0.01	0.65	-0.04
1780-1801	1.32	0.35	2.06	1.08
1801-1831	1.9	0.52	3.06	1.61

As can easily be seen, the major revisions concern the alleged industrial breakthrough period, i.e. 1780 to 1830, where per capita growth rates have been reduced to about 1/3 of the previous estimates. The main reasons why the new results differ from the old are (i) that previous estimates gave a much too high weight to the new and fast growing industries in aggregate industrial output, for example cotton and iron as compared to old industries and (ii) that the size of the industrial sector in the total economy was exaggerated. Since only a few new industrial sectors actually experienced a radical transformation and fast growth, the weights attached to different industries will have an important impact on overall growth. Not knowing the exact relative size of the modern industries, authors made different assumptions, usually overstating the actual weight of the new sectors. Another source of confusion over growth rates has to do with the familiar index problem. Using base year weights, as in a Laspeyres index, understates growth relative to an estimate based on end year weights, a Paasche index. Today authors tend to stick to Divisia index, which in some sense is an average of Laspeyres and Paasche indices. For example if you use sectorial value-added proportions from 1770, overall industrial growth would be 1.6 per cent per year up to 1801, but if you instead use 1801 value added shares, growth almost doubles to 3 per cent per year. The reason is, of course, that by 1801 the sectors that were relatively unimportant, but fast growing, in the late 18th century are increasing their share of industrial output. Attributing a too large share to a modern sector has then the obvious effect of overstating growth.

Is it reasonable then in view of these radical revisions of growth rates to speak about an industrial *revolution?* If you mean a quick and sudden change to higher growth rates, 'a sharp upward turn [in growth rates]' as Ashton put it, the answer is *No*. Modern economic growth, say at levels of 1.5 to 3 per cent in per capita terms per year, prevailed in Britain from around mid 19th century and only by the end of the century in the rest of industrializing Europe. However, if by Industrial Revolution one means *great and profound change,* the concept is more adequate but partly because the standards you apply in measuring *great* and *profound* are rather vague. The concept has now become so firmly established that it is not worth the effort to abolish it. It needs to be re-cycled and given a slightly different meaning than was implied by early scholars. Here is one, admittedly vague, attempt: The Industrial Revolution introduced changes with profound long run implications . For example, the factory became the typical production unit in which human energy to a large extent was replaced by external sources of energy, first water mills and later steam. Furthermore, machines replaced or replicated human skills to an extent not seen before. Machines, the modern robot being the ultimate extension, were something different to tools which humans have known some 30-40 thousand years. All in all, a radically new way of organizing work emerged. Factories had existed before but they were *manu*facturing factories rather than *mills*. New institutions that were helpful to economic growth developed, such as the limited liability company, the modern firm and a whole array of financial intermediaries that helped to channel resources from lenders to borrowers.24 The new organization of work greatly facilitated the introduction of new inventions, simply because management of factories became a new specialized profession and because of the increased competitive environment following the destruction of the traditional manufacturing organization, the guilds, which restricted competition.

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24 Was the particular ownership relation in the capitalist firm which characterized the industrial epoch also necessary for growth? Workers were hired to work at a fixed wage and owners claimed the residual income, if any. Why did this become the prevailing mode of organizing production? Why did capital hire workers and not the other way round? Was it because capitalist firms were more efficient in their authoritarian leadership, and in their adaptability to a competitive environment which imposed instantaneous changes in the size and organization of the workforce and which the labour managed firm might have had difficulties in enacting? Or did the imperfection of early capital markets practically exclude workers from borrowing capital and setting up firms excluding them from learning management skills? As you can see these issues are not easily settled but the owner managed (capitalist) firm is one of the innovations of the Industrial Revolution.

So to some extent the Industrial Revolution must be remembered, not for what it did accomplish in terms of growth but for what it promised to do in the future.

Appendix 1.

A note on Malthus, technological change and long term population growth.

Standard model: One good, food, two factors of production, land in fixed supply and labour. There are diminishing returns to the variable factor, labour. Population growth is a positive function to income per head, henceforth called wage. No technological change.

Prediction:. As long as the land constraint is not binding wages are above subsistence and population growth is positive. When diminishing returns set in, wage and population growth decline until wages hit subsistence level and population growth stops.

Steady state: Constant population at subsistence wage.

Standard model with positive technological shock: A single technological shock will lead to a transitory rise in wages above subsistence but the story from the Standard model repeats itself.

Steady state: Constant - higher than before the shock - population and wages at subsistence level.

This population pattern does not fit European population history.

Characteristics of European population history over the last 1000 years: *Variable rates of positive population growth interrupted by exogenous negative population shocks, for example the Black Death.* Short run population dynamics: population reverts to trend growth.

How do we explain that pattern?

First introduce positive (possibly low) and *permanent* technological progress into the model as done in K.G Persson, *Pre-industrial Economic Growth*, Oxford 1988, chapter 3, and rigorously proved in the Appendix to that chapter.

Steady state: There are a number of steady states, **1,2,3...n**, of positive population growth and wages above subsistence, such as for a given rate of diminishing returns there is a steady state **1** characterized by a constant rate of technological progress **a** and a constant, above subsistence wage **b** and a positive constant rate of population growth **c**. There is a steady state **2** that for the same rate of diminishing returns as in **1** exhibits the following characteristics: a constant rate of technological progress **d** higher than **a**, a constant wage **e** higher than **b,** and a constant population growth **f** higher than **c.** There is a steady state **3,** etc**.**

Prediction: Economies typically attain different steady states defined by a combination of positive population growth and above subsistence income level depending on the rate of

technological progress.

Although this model has a Ricardian element - diminishing returns to the variable factor - and a Malthusian - population growth as a positive function of wage level - it is manifestly anti--Malthusian in spirit and in its prediction of continuing positive population growth throughout history.

An empirical anomaly: Several modern economic historians (R. Allen, P. Hoffman and K.G. Persson) have demonstrated growing wage or income per head in the pre-industrial period for selected regions/nations over long periods, say centuries. How do these findings fit into the model just presented?

One argument maintains that these economies have a positive (possibly slow) rate of technological progress and as long as the land constraint is not binding, diminishing returns are absent: income per head will grow. The problem with this explanation is that there is a clear inverse relationship between the land/labour ratio on the one hand and growth and income on the other. The most advanced regions in pre-industrial Europe were the Low countries (northern France, Belgium, Netherlands), south east England, northern Italy and they had high urbanization proportions in total population , around 25% and low land/labour ratios.

Is there a solution to this puzzle? Try this!

First: Forget about the one good, closed economy model. Advanced regions in pre-industrial Europe exploited gains from inter-regional and international trade and specialization. (Parmesan cheese was available in Brussels in the 15th century). Diminishing returns were held at bay by land-scarce regions specializing in labour intensive agriculture, labour intensive soil improvements and intensive use of land: more crops per year and unit of land made possible by animal dung and nightsoil from nearby cities. Specialization increased the number of cultivated plants which permitted rotation schemes that was less exhausting on soil.

But why was the whole of pre-industrial Europe not as rich as the advanced regions? This is an important question and the answer is perhaps not different from the answer to the question: Why is the whole world not developed today?

Suggestions for further reading:

The references listed below are by no means meant to be exhaustive. Only a few major studies have been quoted but any one of them will give the interested reader an overview of the relevant literature and further references.

On pre-industrial economic growth and institutions:
The modern restatement of the Ricardian and Malthusian interpretation of pre-industrial economic growth is H.J. Habakuk, The economic history of modern Britain, *Journal of Economic History*, 18, 1958, pp. 1484-501.
A forceful critique is found in G. Grantham, Contra Ricardo: On the macroeconomics of pre-industrial economic fluctuations, *European Review of Economic History*, 2, 1999 with useful references.
See also K.G. Persson, *Pre-industrial Economic Growth. Social Oorganization and Technological Progress in Europe,* Oxford: Basil Blackwell, 1988 and P. Hoffman, *Growth in a Traditional Society. The French Countryside 1450-1815*, Princeton: Princeton University Press, 1995.
On demographic change:
Massimo Livi-Bacci, *A Concise History of World Population*, Oxford: Basil Blackwell, 1992.

On the reinterpretation of the Industrial revolution:
N.F.R. Crafts, *British Economic Growth during the Industrial Revolution*, Oxford: Oxford University Press, 1985.
N.F.R. Crafts, Exogenous or endogenous growth?The Industrial revolution reconsidered, *Journal of Economic History*,55, 1995, pp. 745-72.
J. Mokyr (ed.) *The Economics of the Industrial Revolution*, 2nd Edition, London: Allen & Unwin, 1998.