

## SHRINK THEORY: THE NATURE OF LONG RUN AND SHORT RUN ECONOMIC PERFORMANCE

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**Abstract:** Using annual data from the thirteenth century to the present, we show that improved long run economic performance has occurred primarily through a decline in the rate and frequency of shrinking, rather than through an increase in the rate of growing. Indeed, as economic performance has improved over time, the short run rate of growing has typically declined rather than increased. Explaining long run economic performance therefore requires a theory of shrinking as well as growing. A framework based on institutions is developed to explain episodes of shrinking as well as growing, with long run development requiring a transition from a world of identity rules to a world of impersonal rules. We also show how the model can be adapted to deal with the role of wars, financial crises and demographic factors in episodes of shrinking and growing.

## 1. INTRODUCTION

Understanding long run economic performance is a fundamental concern of economists, economic historians and social scientists more generally. To date, most work in this area has focused on “growing”, but recent work for the post-1950 period has suggested that economies vary as least as much in how they “shrink” as in how they grow (Easterly et al., 1993; Pritchett, 2000; Cuberes and Jerzmanowski, 2009). However, despite these findings on the volatility of GDP per capita in poor countries, there has been little research into why poor societies shrink so often or by so much. Furthermore, economic historians have not so far systematically investigated the possibility that improved long run economic performance since the eighteenth century could have been due to less shrinking rather than faster growing, despite the widespread acceptance of the idea that economic growth was slow during the Industrial revolution (Crafts and Harley, 1992; Broadberry et al., 2015). In this paper, we show that economic historians, growth economists and development specialists face a different problem from the one they normally address in seeking to understand improved long run economic performance: to explain a reduction in the rate and frequency of shrinking rather than an increase in the rate of growing.

It is possible to be more precise about the contributions of growing and shrinking to long run economic performance if we are careful about definitions. Long run economic performance can be measured by the rate of change of per capita GDP over periods of fifty years or longer. Economic performance over this time frame is the aggregation of short run changes measured at the annual level. Long-run economic performance,  $g$ , can be seen as a combination of 4 factors: (1) the frequency with which an economy grows,  $f(+)$  (2) the rate at which it grows when growing, or the growing rate,  $g(+)$  (3) the frequency with which an

economy shrinks,  $f(-)$  and (4) the rate at which it grows when shrinking, or the shrinking rate  $g(-)$ . Thus:

$$g = \{f(+)\ g(+)\} + \{f(-)\ g(-)\} \quad (1)$$

Since the frequency of growing is equal to one minus the frequency of shrinking, equation (1) can be rewritten as:

$$g = \{[1-f(-)]\ g(+)\} + \{f(-)\ g(-)\} \quad (2)$$

which reduces the number of independent factors to three. Using this identity, it can be shown that better long run economic performance occurred not so much because of an increase in the growing rate, but more because of a reduction in the rate and frequency of shrinking.

The key empirical findings reported here can be summarised as follows: (1) In most of the world since 1950, and historically for today's countries where data are available back to the thirteenth century, growing rates and shrinking rates have been high and variable. (2) When average growing rates have been high, average shrinking rates have also typically been high. Similarly, when average growing rates have been low, average shrinking rates have been low. (3) The improvement of economic performance over the long run has occurred primarily because the frequency and rate of shrinking have both declined, rather than because the growing rate has increased. (4) Indeed, as long run economic performance has improved over time, the short run rate of growing has normally declined rather than increased, but the frequency of growing has increased. To avoid misunderstanding, however, it is important to be clear that we do not dispute in any way that positive long run economic performance requires positive short run growing and that increases in short run growing rates contribute to positive long run economic performance. Rather, we draw attention to the under-appreciated

role that economic shrinking has played both in the period since World War II and over the last millennium.

To explain improved long run economic performance we therefore need a theory of shrinking as much as a theory of growing. The neoclassical growth model, with its emphasis on accumulation and technological progress, is not well suited to this. Indeed, it is hard to see why an economy would shrink by 5 to 10% per year over sustained periods in such a framework. We offer, instead, an alternative conceptual framework based on institutions and the nature of rule enforcement. A distinction is made between societies capable of enforcing “impersonal” rules and societies only capable of enforcing “identity” rules. In an impersonal rule society, a range of rules can be publicly enforced through the courts in a manner that treats everyone, or every citizen, the same. In an identity rule society, elites have better access to courts and disputes are often decided in court in favour of the more powerful elite, which can influence the court in a corrupt way. While identity rule societies have been documented repeatedly in the recent empirical literature on the quality of institutions and the rule of law, some of the incentives that identity rules create have gone largely unexamined. Identity rules limit the attractiveness for less powerful elites to enter into legal agreements with more powerful elites. Identity rules hamper the ability of more powerful elites to bind themselves by court enforced rules and, as a result, more powerful elites must rely on the value of relationships rather than rules to secure their agreements and contracts with other elites.

If we identify elites by their relative power within the elite hierarchy, we can construct an “elite matrix” that illustrates visually what elite relationships can be supported and enhanced by the provision of publicly enforced rules, either identity based or impersonal

rules. All societies have elites and in all societies the relative power of individual elites is always in flux, so that elites cannot be certain about their positions in the power hierarchy of elites. In an impersonal rule society, fluctuating elite identities do not impact the enforcement of impersonal rules, and thus the number of rule based elite relationships that can be sustained. But elite identity is crucial for the enforcement of identity rules. Impersonal rule societies differ in two ways from identity rule societies. Some elite relationships which would be viable in an impersonal rule society may not be viable in an identity rule society, simply because there is no mechanism for the most powerful elites to credibly commit to an agreement that could be enforced in the courts. Furthermore, changes in elite ordering will bring about shrinking episodes in identity rule societies as the number of rule based elite relationships decline, but this will not occur in impersonal rule societies. Anything that increases uncertainty about the relative identity of elites can potentially cause economic shrinking. Long run development thus requires a transition from a world of identity rules to a world of impersonal rules. We illustrate the logic of the elite matrix using a straightforward business contract, but we also show how the model can be adapted to deal with the role of wars, financial crises and demographic factors in episodes of shrinking and growing.

## **2. LONG- AND SHORT RUN ECONOMIC PERFORMANCE**

### **2.1 Economic performance in the contemporary world**

We know that today's high income countries have had a better long run economic performance than today's low income countries since at least the early nineteenth century (Maddison, 2001; 2010). That fact is the essential motivation for growth theory, with its focus on the rate of growing. On closer examination, however, high income countries do not grow faster during their episodes of positive growth than poor countries grow during their

episodes of positive growth. This can be demonstrated using information from the Penn World Table (PWT) for the period 1950-2011 (Feenstra et al., 2015). Table 1 from PWT 8.0 provides evidence on long run economic performance across groups of countries, broken down by level of income, and using the identity set out in the introduction. The sample underlying the table includes 141 countries, with all included countries having data available from at least 1970 onwards. The data are arranged in five groups, ranging from high income countries with per capita incomes in the year 2000 greater than \$20,000 (in constant 2005 dollars), to poor countries with per capita incomes of less than \$2,000.

In Table 1, we see from the third column that poor countries have not grown less rapidly than rich countries when they have been growing. Indeed, the average growing rate has actually been higher for poorer countries than richer countries. Similarly, we can see in the final column that the average shrinking rate has also been higher for poorer countries. However, the second column shows that the frequency of growing has been higher for countries with higher levels of per capita income. The richest countries grew in approximately 84 per cent of years, while the poorest countries grew in just 62 per cent of years. Since the frequency of shrinking is one minus the frequency of growing, the frequency of shrinking has to be higher for poorer countries: the poorest countries shrank in almost 38 per cent of years, while the richest countries shrank in just 16 per cent of years. So poor countries have grown less frequently than rich countries.

Table 2 shows the contributions of growing and shrinking to long run economic performance. The contribution of growing to long run economic performance is the growing rate multiplied by the frequency of growing years. We see that most poorer countries had a stronger contribution from growing than economies with per capita incomes above \$20,000,

since the higher average growing rate of poorer countries more than offset the lower frequency of growing years. The only exception to this was the poorest category of countries with per capita incomes below \$2,000. These very poor countries had a weaker contribution of growing than the richest group of countries, but this was due to their lower frequency of growing years rather than to a lower growing rate. The contribution of shrinking to long run economic performance is the shrinking rate multiplied by the frequency of shrinking years. All poorer economies had a bigger negative contribution from shrinking than economies with per capita incomes above \$20,000. This was due to both the higher frequency of shrinking among poorer countries and higher shrinking rates.

Long run economic performance is measured by the net rate of change in per capita incomes in the final column of Table 2. Poorer economies did not have a significantly better long run economic performance than the richest group of countries, which means that there was no systematic catching-up over the period as a whole. Middle income countries increased their per capita incomes at about the same rate as the rich countries, but poor countries increased their per capita incomes substantially more slowly, so that there was unconditional divergence rather than convergence as the poorest countries fell increasingly behind (Pritchett, 1997). This lack of long run convergence is explained mainly by differences between countries in the contribution of shrinking, as rich countries shrank less and in fewer years than poor countries.

The next two sections seek to explore the implications of these findings, based on the post-1950 period, for a longer sweep of economic history, encompassing the transition to modern economic growth in today's rich countries. To do this, we will make use of the Maddison Data Base for the nineteenth and twentieth centuries, and data on a sample of four

European countries for which annual data have recently become available, reaching back to the thirteenth century.

## **2.2 Economic performance in the nineteenth and twentieth centuries**

The final version of the Maddison Data Base contains annual data on 14 European countries starting between 1820 and 1870 and 4 New World economies starting in 1870. Annual data for most other economies begin only in the twentieth century, and in many cases after 1950 (Maddison, 2010). Table 3 shows data on the frequency of growing and shrinking for the 18 country sample as a whole, while figures are given for a number of individual countries in Appendix Table A1. The frequency of growing has increased very sharply in the period since 1950 in this group of rich countries in Europe and the New World, or to state it the other way round, there has been a sharp reduction in the frequency of shrinking, from about one third to one eighth.

Table 4 shows the average growth rate in all years, growing years and shrinking years, i.e. long run economic performance, the growing rate and the shrinking rate. Again the data in the text table are provided for the 18 country sample, with data on some individual countries in Appendix Table A2. Since 1950, the growth rate across all years has increased sharply in both Europe and the New World, and this has happened despite the fact that the growing rate (i.e. the growth rate in growing years) has actually fallen substantially almost everywhere.<sup>1</sup> Long run economic performance was able to improve despite the reduction in the growing rate because of an ever sharper decline in the shrinking rate.

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<sup>1</sup> The one exception among this sample of 18 countries is Spain, which experienced a faster growing rate during recovery from the catastrophic effects of the Civil War.



It should also be noted from Table 4 that during the period 1910-1950, covering the two World Wars and the Great Depression, the growing rate increased almost everywhere, in many cases substantially so.<sup>2</sup> However, this did not lead to any significant improvement in long run economic performance because there was an equally sharp increase in the shrinking rate. These changes in long run economic performance could be attributed simply to exogenous volatility due to wars and financial crises. We shall see later, however, that our elite matrix framework can also be used to shed some light on these episodes.

Table 5 shows how the frequency of growing and shrinking interacted with the growing and shrinking rates to produce the contributions of growing and shrinking to long run economic performance, as measured by the average rate of change of per capita income in all years. Again, data in the text table are presented only for the 18 country sample as a whole, with more detail provided in Appendix Table A3. This makes clear that the improvement in economic performance during 1950-2008 compared with earlier periods can be attributed mainly to a reduction in the contribution of shrinking, since the contribution of growing either stagnated or actually declined slightly in most countries.

### **2.3 Economic performance over the very long run**

Recent work in historical national accounting has extended annual estimates of GDP per capita as far back as the thirteenth or fourteenth century for a number of European countries (Broadberry, 2013; Fouquet and Broadberry, 2015). We also analyse this Very Long Run Data Base for Britain, the Netherlands, Italy and Spain (Broadberry et al., 2015; van Zanden and van Leeuwen, 2012; Malanima, 2011; Álvarez Nogal and Prados de la Escosura, 2013). The annual time series are plotted in Figure 1 for Italy and Spain, in Figure 2 for Britain and

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<sup>2</sup> Again the exception is Spain, as a result of the Civil War.

the Netherlands, and the four countries are brought together in Figure 3. Beginning with the Mediterranean economies in Figure 1, there was a clear alternation of periods of positive and negative growth, with growth booms typically followed by growth reversals, leaving little or no progress in the level of per capita incomes over the long run. Per capita GDP therefore fluctuated without trend before the mid-nineteenth century. For the cases of Britain and the Netherlands in Figure 2, however, although there were alternating periods of positive and negative growth until the eighteenth century, there was also a clear upward trend, with the gains following the Black Death being retained, and the growth reversals eventually disappearing with the transition to modern economic growth. As periods of negative growth became less frequent and as the rate of shrinking decreased in northwestern Europe, Britain and Holland overtook Italy and Spain, as shown in Figure 3.

It is useful to quantify the number of significant growing episodes (defined as at least consecutive three years of positive per capita GDP growth) and the number of shrinking episodes (defined as at least three consecutive years of negative per capita GDP growth). The results can be seen in Table 6, assessed over the whole period 1348-1870 and broken down by shorter periods of approximately 50 years. The most striking finding is that for the period as a whole, Britain and the Netherlands overtook Italy and Spain not because of any greater incidence of growing episodes, but rather because of much fewer shrinking episodes. Note further the performance of Britain, the first country to achieve modern economic growth, during its periods of significantly improved per capita GDP performance. Britain experienced fewer growing episodes than all other countries after the Black Death, 1348-1400, fewer growing episodes than Italy and Spain after the Civil War 1650-1700, and even after 1800, no more growing episodes than the Netherlands and Spain, and fewer than Italy. Britain's path to

modern economic growth and world economic leadership was not obviously the product of more growing episodes.

However, a complete analysis must cover all years rather than just those with at least three consecutive years of growing or shrinking. Tables 7 to 9 show the frequency, rates and contributions of growing and shrinking to long run economic performance over complete periods of roughly fifty years in the Very Long Run Data Base, as in the analysis of the Penn World Table and the Maddison Data Base. The first thing to note from Table 7 is that for all of the economies considered here, the frequency of shrinking was about one third in the nineteenth century, as in Table 3. For earlier centuries, by contrast, these economies grew and shrank in roughly equal proportions of years. A reduction in shrinking therefore played an important role in the improved long run economic performance of Western Europe. Second, turning to Table 8, we see that growing and shrinking rates tended to move together, so that high rates of growing were accompanied by high rates of shrinking and low rates of growing were accompanied by low rates of shrinking. Third, the transition to modern economic growth occurred first in Britain during the eighteenth century, where growing and shrinking rates were both low and the growing rate was significantly higher than the shrinking rate. Although there had been an earlier episode between 1450 and 1550 when the growing and shrinking rates were both low, the shrinking rate was higher than the growing rate. Fourth, Table 9 shows the contributions of growing (the frequency of growing multiplied by the growing rate) and shrinking (the frequency of shrinking multiplied by the shrinking rate) to long run economic performance (the average rate of change of per capita income in all years). In this table, the first transition to modern economic growth in Britain during the eighteenth century shows up in the low contributions of both growing and shrinking, combined with the greater contribution of growing than shrinking. Although there were earlier episodes between

1450 and 1550 when the contributions of growing and shrinking were both low, the contribution of growing was not significantly higher than the contribution of shrinking at this time.

Table 10 explores further the information set out in Tables 7 to 9 by examining the correlations between growing frequencies, growing and shrinking rates and long run economic performance. The first thing to note from this table is that for all four economies, the correlation between growing rates and long run economic performance is very low. Variations in the average rate of growing had surprisingly little effect on long run economic performance, with the correlation coefficient  $R$  ranging from 0.26 in the case of Spain to just 0.12 in the case of Britain and even a negative correlation of -0.09 in the case of the Netherlands. Second, for all four countries, long run economic performance was more correlated with the frequency of growing than with the rate of growing. This means that reducing the frequency of years of negative growth was more important for improving long run economic performance than increasing the average rate of growing. Third, the highest correlation was between the rates of growing and shrinking. High rates of growing tended to be offset by high rates of shrinking, so that there was little relationship between growing rates and long run economic performance. As a result, it was possible to have improved long run economic performance despite a reduction in the average rate of growing.

#### **2.4 A summary of the empirical results**

Before moving on to the theoretical section, it will be useful to summarise the main empirical results, which a framework for understanding long run economic performance needs to be able to explain:

- (1) Growing rates and shrinking rates have been high and variable throughout most of history and remain high and variable in less developed economies today
- (2) Improving long run economic performance has occurred because the frequency and rate of shrinking have both declined, rather than because the growing rate has increased
- (3) The rate of growing has typically declined rather than increased as long run economic performance has improved

### **3. EXPLAINING LONG RUN AND SHORT RUN ECONOMIC PERFORMANCE: THE ELITE MATRIX**

Explaining improved long run economic performance requires understanding why economies shrink less frequently and at lower rates. Neoclassical growth theory is not very helpful here, because it abstracts from periods of shrinking and seeks instead to explain an acceleration in the rate of growing (Solow, 1956; Barro and Sala-i-Martin, 2003). We therefore proceed by introducing an alternative framework from institutional economics which can be used to explain episodes of shrinking as well as growing. This framework suggests a way of understanding the process of economic development as a transition from a world of identity rules to a world of impersonal rules (North et al., 2009; Wallis, 2011; Burkett et al., 2015). Although introduced within this specific context, the elite matrix can also be applied more generally to encompass other phenomena that have sometimes been associated with episodes of rapid shrinking and growing during the seven centuries of economic history considered here. These phenomena include wars, financial crises and demographic shocks.

In the simplest version of the model, courts always enforce rules in favor of the elite with the most powerful identity. These are “identity rules” whose form and enforcement

depend on the identity of the elites involved in a dispute. Within this framework, we demonstrate the “paradox of privilege”: the more powerful an individual is, the less credibly he can bind himself by a rule, which closes off the ability of powerful elites to enter into rule based relationships with less powerful elites. Privilege therefore comes at a cost, since potential gains from trade cannot always be realized. We illustrate the principle with a simple business contract, the promissory note. The implications are much wider than business contracts, but obviously the ability of elite individuals and organizations to enter into commercial contracts is a critical part of economic capacity and performance.

### **3.1 The elite matrix with identity rules**

In a business relationship between two elites, assume that both partners contribute capital, but it is more efficient for one partner (#2) to undertake some activities on a regular basis that cannot be observed by the other partner (#1). Elite #1 can ensure that #2 does not shirk through bonding, by getting #2 to sign a promissory note in favour of #1, that #1 can execute at any time. Note that the promissory note must be larger than the gain to #2 from shirking, but smaller than the value to #1 of continuing the business relationship. The promissory note makes the arrangement between the two elites credible. Their expectation is that the promissory note will never be used, and it will only be used if their relationship breaks down, in which case the holder of the note may need to go to court to get the note enforced. If the courts always rule in favour of the more powerful elite, then the powerful elite cannot credibly issue a promissory note to the less powerful elite. We want to emphasise that the promissory note is just a stylised way of motivating the more general problem of credible commitment in a world of asymmetric information and identity rules, and should not be interpreted as a literal description of the way that business relationships are typically conducted.

Figure 1 represents a series of possible relationships between 6 elites, ranked from the most powerful (#1) to the least powerful (#6). The row player writes the promissory note, the column player holds it, and the X's mark the agreements that are credible. There are fifteen credible relationships out of a potential thirty. The most powerful elite (#1) cannot enter into any arrangements in which he writes the promissory note, which would not be credible. Similarly, none of the possible rule based agreements above the diagonal are credible in an identity rule regime.

### **3.2 The elite matrix with impersonal rules**

If the courts will always enforce the note as written, without bias in favour of the more powerful, then we are in a world of impersonal rules. The elite matrix in this case is shown in Figure 2. With impersonal rules, the full range of agreements can be reached. In a world where power no longer includes the ability to influence court decisions, promissory notes can be issued by more powerful elites to less powerful elites as well as vice versa. Of the fifteen new agreements made credible by impersonal rules, notice that five are relationships where #1 writes the promissory note (denoted by "1" rather than "X" in the matrix), so #1 gains the most. The smallest gain is to #6, since he was already able to bind himself to all other elites in the identity rule regime. This is important in understanding why powerful elites may be prepared to give up their ability to influence courts and move to an impersonal rule society.

### **3.3 The elite matrix with no courts**

If relationships between elites are so fraught that the network of elite organisations cannot agree to support the government courts, then there can be no rule-based agreements. This does not mean that there are no elite agreements and no economic activity, just that the

agreements are not rule-based. In these circumstances, the elite matrix is empty, as in Figure 3. The move from Figure 3 to Figure 1 would represent Smithian growth, facilitating trade and specialisation, as more business relationships are made possible (Kelly, 1997).

### **3.4 The elite matrix with coalitions**

Figures 1 and 3 are extreme cases of relationships supported (or not) by rule-based agreements under identity rules. Between these two extremes, it is possible to envisage coalitions of elites, such as the Guelphs and Ghibellines in medieval Genoa (Epstein, 1996). The two factions fought each other when there was no external threat, but came together when faced with an external enemy. When Guelphs and Ghibellines were at peace with each other, courts could enforce rules across groups. But if the two elites were fighting each other, courts could only enforce agreements between members of the same elite. These two possibilities are illustrated in Figures 4 and 5, respectively.

Figure 4 sets out the elite matrix with intra- and inter-coalition trade. Here, elites 1, 3 and 5 belong to coalition A while elites 2,4 and 6 belong to coalition B, X indicates inter-coalition trade and the A's and B's in the matrix indicate intra-coalition trade. While the two coalitions are at peace, the full set of identity rule relationships is possible. Some members of coalition A are more powerful than some members of coalition B, and this is recognised in all courts. Figure 5, by contrast, sets out the elite matrix with only intra-coalition trade. When the two coalitions are fighting, the set of agreements sustainable in an identity rule regime contracts. Agreements can only be sustained between members of the same coalition. Smithian growth occurs as a society moves from Figure 5 to figure 4, without the need for any factor accumulation, technological progress, or even any change in formal rules.



Similarly, Smithian shrinking occurs as a society moves in the opposite direction from Figure 4 to Figure 5.

### **3.5 Smithian growth and shrinking in the elite matrix**

Figure 6 brings together the 3 identity rule matrices. Smithian growth occurs as we move down the figure, while Smithian shrinking occurs as we move up the figure. Significant disruptive competition between elite coalitions is a prominent feature of the less developed world today, and was also important in the past in today's rich countries. We would argue that today's rich countries broke out of the long run stagnation caused by the alternation of growing and shrinking episodes, by moving from a world of identity rules to the impersonal rule matrix of Figure 2.

## **4. WARS, FINANCIAL CRISES AND DEMOGRAPHIC FACTORS: EXTENDING THE ELITE MATRIX APPROACH**

So far, we have used the elite matrix to show how episodes of growing and shrinking can result from elite re-orderings in an identity rule society, or from movement between identity rule and impersonal rule regimes. However, it would be difficult to give a convincing account of seven centuries of global economic history entirely in these terms. In this section, we consider other factors that have been linked to episodes of shrinking and growing, and show how they can be brought within the elite matrix approach.

### **4.1 Wars and economic shrinking**

Competition between elites can be disruptive in a world of identity rules, with a re-ordering of elites leading to the break-up of relationships that were previously supported by agreements. Similarly, wars can lead to a disruption of economic relationships that were

viable in peacetime. The outbreak of World War I, for example, created considerable difficulties for trans-national businesses, making it impossible, for example, for normal commercial relationships between Britain and Germany (Reader, 1970: 249-314; Broadberry, 1997: 210-291). The increase in rates of both shrinking and growing in the period 1910-1950 compared with 1870-1910, without any increase in the long run average rate of growth (Table 5) can be understood in this light.

The 1910-1950 period in Europe illustrates in the most dramatic fashion the perils of elite dynamics in identity rule societies. Even before World War I ended, a series of civil wars began in Europe (Payne, 2011). The 1920s were a bad economic period for the entire continent, and by the 1930s societies from Spain to Russia were experiencing internal uncertainty and division between elite coalitions. The historian Dan Diner (2008) has called the period one of “universal civil war.” Significantly, the societies that had attained and were able to maintain impersonal rules performed much better economically and politically, than the societies that slipped back into increasingly contested identity rules. [\[Should we provide more concrete data here?\]](#) In social or cultural terms, Hitler and the National Socialists in Germany looked nothing like the aristocratic elites of the late nineteenth century, but they nonetheless were the epitome of an elite coalition with the ability to affect economic, political, and social resources.

#### **4.2 Financial crises**

The period 1910-1950 was also affected by the Great Depression, following the financial crisis of 1929 (Kindleberger, 1973). Tightened credit conditions can break relationships that previously seemed viable in much the same way that a re-ordering of elites can do in an identity rule society. Furthermore, this can happen even in societies capable of some

impersonal rule enforcement. This surely added to the volatility of GDP per capita during the period 1910-1950, with a sharp period of shrinking after 1929 followed by rapid growing as most countries recovered from the Great Depression. Financial crises have also been important for other episodes of shrinking, including the Great Contraction after 2008, which again affected most countries (Reinhart and Rogoff, 2009). There have also been episodes affecting individual countries and regions, such as the Latin American crisis of the 1980s and the East Asian crisis of 1990s (Lindert, 1989; Radelet and Sachs, 1998).

To be clear, we are not suggesting that identity rules caused the Great Depression, or that they are the source of financial crises. We are suggesting, however, that the well documented fragility of developing societies to financial and trade sector shocks is consistent with the shrink theory we are proposing here.<sup>3</sup> Societies with impersonal rules have not eliminated financial crises or unanticipated shocks to important commodities like oil, but their ability to adapt and respond to shocks is markedly better in the twentieth century than it was in earlier eras when they were identity rule societies. North (1990) introduced the concept of “adaptive efficiency” as a long run concept describing how successful economies were able to adapt their institutions to new circumstances. We are suggesting that impersonal rule societies also acquire a short run adaptive capacity, in the sense that while events like financial crises still have adverse affects, they do not induce wider changes in elite relationships that result in Smithian shrinking.

### **4.3 Demographic factors**

The Malthusian approach explains long run stagnation of GDP per capita in the pre-industrial world with shorter episodes of growing and shrinking through demographic factors (Clark,

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<sup>3</sup> For examples from international finance see Aguiar and Gopinath (2007) and from development see Rodrik (1999).

2007). Malthusians assume feedback from GDP per capita to fertility (the preventive check) and mortality (the positive check) together with diminishing returns to land. Short run growing occurs in response to anything which reduces population (an increase in mortality or a decline in fertility) or increases the availability of land. Short run shrinking occurs in response to a decline in mortality, an increase in fertility or a reduction in the availability of land. In the Malthusian approach, however, any gain to GDP per capita will only be temporary because of the feedback from living standards to fertility and mortality. The growth in living standards in Italy after the Black Death of the mid-fourteenth century, and its subsequent reversal after the return to population growth from the mid-fifteenth century can be understood in this light.

However, this approach is not universally applicable, even to the post-Black Death period. Indeed, Spain saw a reduction rather than an increase in GDP per capita after the Black Death. This has been explained by Álvarez-Nogal and Prados de la Escosura (2013) as a result of the fact that Spain was a land-abundant region at the time, so a further decline in population density reduced the possibility of gains from specialisation and the division of labour. The Black Death shock therefore induced a bout of Smithian shrinking rather than Malthusian intensive growth. Similarly, it is worth noting that Britain and the Netherlands experienced the growing episode after the Black Death, but not the subsequent shrinking episode experienced by Italy, despite the return of population to pre-Black Death levels (Broadberry et al, 2015). Clearly, Britain and the Netherlands were able to break free during the early modern period from the Malthusian constraints that held Italy on a path of long run stagnation, despite similar demographic trends. This can be seen as a result of the institutional changes that allowed Britain and the Netherlands to move away during the early modern period from a world of identity rules to impersonal rules.

Another aspect of the Malthusian approach can be seen in the effects of the structural shift of the economy away from agriculture, which accounted for around 40 per cent of nominal GDP between the late fourteenth century and the end of the sixteenth century, declining to around 30 per cent during the seventeenth and eighteenth centuries, and around 20 per cent by the mid-nineteenth century (Broadberry et al., 2015: 194). Agriculture thus dominated short run fluctuations of real GDP during the medieval period, with weather related shocks leading regularly to bad harvests and years of shrinking. As the share of agriculture declined, however, industry and services played a larger role in cyclical fluctuations and agriculture contributed less to episodes of shrinking (Broadberry et al., 2012). Structural change thus reduced and eventually eliminated one major source of shrinking.

## **5. CONCLUSIONS**

We show with data reaching back to the thirteenth century that improved long run economic performance has occurred primarily through a decline in the rate and frequency of shrinking, rather than through an increase in the rate of growth during episodes of growing. Indeed, as economic performance has improved over time, the short run rate of growing has typically declined rather than increased.

We explain these developments primarily through a framework based on institutions. Episodes of growing and shrinking can occur within an identity rule society, as a result of disruptive competition between elite coalitions. To break away from regular episodes of shrinking, a society needs to make the transition from a world of identity rules to a world of impersonal rules. We also show how the elite matrix approach can be extended to encompass

other factors that have sometimes been seen as important in episodes of shrinking. These factors include wars and financial crises, which have particularly been seen as playing an important role in the increased volatility of GDP per capita during the period 1910-1950. These factors can play an important role in episodes of shrinking, even in societies where impersonal rules are the norm. Demographic factors can also be seen to have played a role in episodes of growing and shrinking after the Black Death of the mid-fourteenth century, but the different long run effects of the same shock in different societies can be linked to institutional difference highlighted by the elite matrix approach.

**Table 1: Penn World Table 8.0: Growing and shrinking, 1950-2011**

Per capita income in 2000	Frequency of growing years	Average growing rate	Frequency of shrinking years	Average shrinking rate
Over \$20,000	0.84	3.85	0.16	-2.22
\$10,000 to \$20,000	0.80	4.85	0.20	-4.25
\$5,000 to \$10,000	0.78	5.15	0.22	-4.89
\$2,000 to \$5,000	0.72	4.72	0.28	-4.29
Less than \$2,000	0.62	3.99	0.38	-4.32

Sources and notes: Penn World Table 8.0, <http://www.rug.nl/research/ggdc/data/pwt/pwt-8.0>. The “Real GDP per capita (Constant Prices: Chain series)” and their calculated annual growth rates for that series “Growth rate of Real GDP per capita (Constant Prices: Chain series)” were used to construct this table. Countries were first sorted into income categories based on their income in 2000, measured in 2005 dollars. Average annual positive and negative growth rates are the simple arithmetic average for all of the years and all of the countries in the income category without any weighting. The Penn World Table includes information on 167 countries. The sample runs from 1950 to 2011, although information is not available for every country in every year. Countries are included only where information is available at least as far back as 1970, resulting in a sample of 141 countries.

**Table 2: Penn World Table 8.0: The contribution of growing and shrinking to the economic performance of countries by income categories, 1950-2011**

Per capita income in 2000	Contribution of growing (frequency*rate)	Contribution of shrinking (frequency*rate)	Net rate of change of per capita income
Over \$20,000	3.23	-0.39	2.84
\$10,000 to \$20,000	3.82	-0.88	2.94
\$5,000 to \$10,000	4.00	-1.13	2.87
\$2,000 to \$5,000	3.30	-1.27	2.03
Less than \$2,000	2.47	-1.65	0.82

Source: Penn World Table 8.0, <http://www.rug.nl/research/ggdc/data/pwt/pwt-8.0>.

**Table 3: Frequency of growing and shrinking, 18 European and New World countries, 1820-2008**

	1820-1870	1870-1910	1910-1950	1950-2008
Growing	0.66	0.67	0.65	0.88
Shrinking	0.34	0.33	0.35	0.12

Source: Derived from Maddison (2010).

**Table 4: Average rate of change of per capita income in all years, growing years and shrinking years, 18 European and New World countries, 1820-2008**

	1820-1870	1870-1910	1910-1950	1950-2008
All years	1.40	1.31	1.23	2.55
Growing	3.88	3.16	5.20	3.06
Shrinking	-3.04	-2.30	-6.10	-1.23

Source: Derived from Maddison (2010).

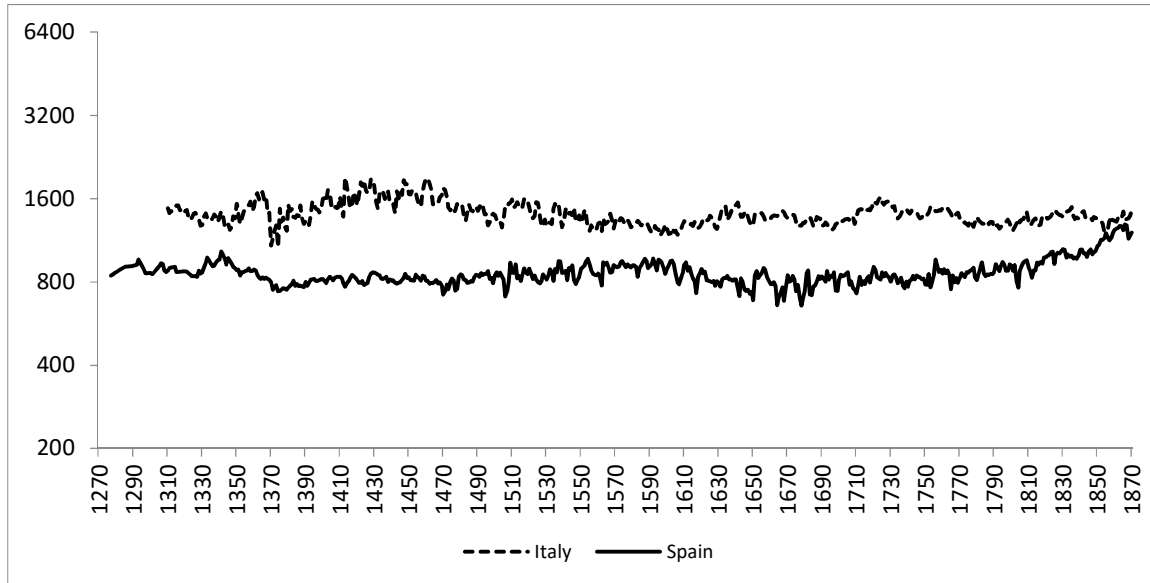
**Table 5: Contributions of growing (frequency\*rate) and shrinking (frequency\*rate) to long run economic performance (average rate of change of per capita income in all years), 18 European and New World countries, 1820-2008**

	1820-1870	1870-1910	1910-1950	1950-2008
All years	1.40	1.31	1.23	2.55
Growing	2.47	2.10	3.33	2.72
Shrinking	-1.08	-0.79	-2.09	-0.16

Source: Derived from Maddison (2010).

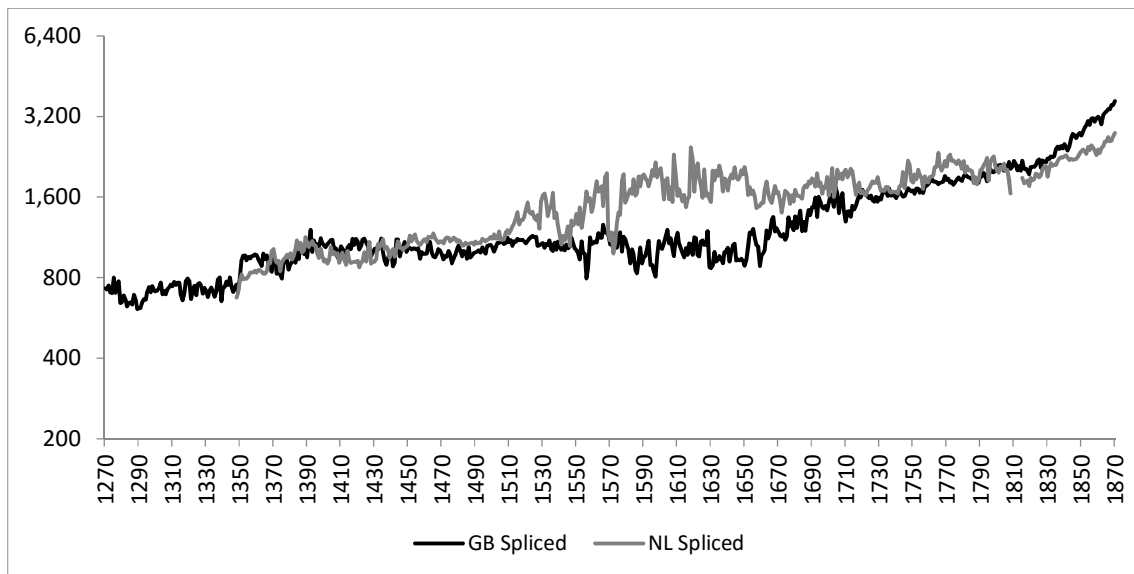


**FIGURE 1: Real GDP per capita in Italy and Spain 1270-1850 (1990 international dollars, log scale)**



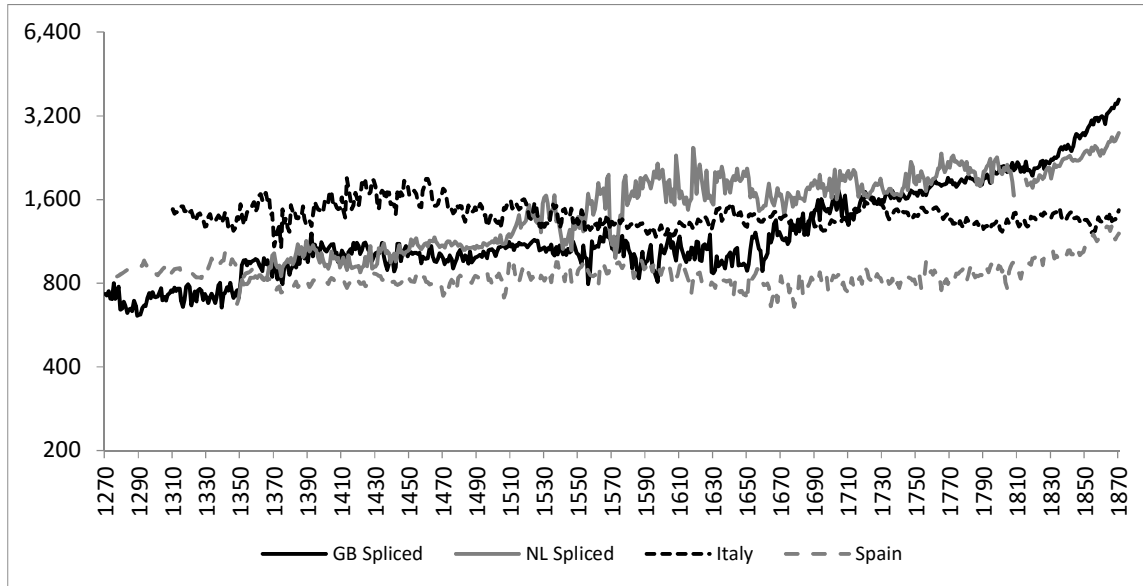
Sources: Malanima (2011); Álvarez-Nogal and Prados de la Escosura (2012).

**FIGURE 2: Real GDP per capita in Britain and the Netherlands, 1270-1870 (1990 international dollars, log scale)**



Sources: Broadberry et al. (2015a); van Zanden and van Leeuwen (2012).

**FIGURE 3: Real GDP per capita in Britain, the Netherlands, Italy and Spain 1270-1870 (1990 international dollars, log scale)**



Sources: Figures 1 ad 2.

**TABLE 6: Significant growing episodes ( $\geq 3$  consecutive years of positive per capita GDP growth) and shrinking episodes ( $\geq 3$  consecutive years of negative per capita GDP growth)**

**A. Number of growing episodes per period**

	Great Britain	Netherlands	Italy	Spain
1348-1400	3	5	4	5
1400-1450	6	4	0	3
1450-1500	4	3	3	2
1500-1550	3	5	3	2
1550-1600	1	4	4	4
1600-1650	3	1	5	3
1650-1700	3	1	5	4
1700-1750	2	2	4	2
1750-1800	4	3	4	3
1800-1870	6	6	8	6
1348-1870	35	34	40	34

**B. Number of shrinking episodes per period**

	Great Britain	Netherlands	Italy	Spain
1348-1400	2	2	1	2
1400-1450	3	0	2	3
1450-1500	2	3	5	4
1500-1550	1	1	2	2
1550-1600	4	1	4	3
1600-1650	2	1	3	5
1650-1700	3	3	4	1
1700-1750	0	3	1	4
1750-1800	2	2	4	0
1800-1870	0	1	3	1
1348-1870	19	17	29	25

Sources: Derived from Broadberry et al. (2015a); van Zanden and van Leeuwen (2012); Malanima (2011); Álvarez-Nogal and Prados de la Escosura (2013).

**Table 7: Very Long Run Data Base: The Frequency of Growing and Shrinking**

		1270- 1348	1348- 1400	1400- 1450	1450- 1500	1500- 1550	1550- 1600	1600- 1650	1650- 1700	1700- 1750	1750- 1800	1800- 1870
GB	Growing	0.58	0.50	0.58	0.54	0.56	0.42	0.50	0.56	0.50	0.54	0.61
	Shrinking	0.42	0.50	0.42	0.46	0.44	0.58	0.50	0.44	0.50	0.46	0.39
NL	Growing		0.58	0.64	0.50	0.62	0.62	0.46	0.46	0.54	0.56	0.66
	Shrinking		0.42	0.36	0.50	0.38	0.38	0.54	0.54	0.46	0.44	0.34
Italy	Growing	0.58	0.56	0.42	0.50	0.50	0.52	0.54	0.60	0.54	0.50	0.59
	Shrinking	0.42	0.44	0.58	0.50	0.50	0.48	0.46	0.40	0.46	0.50	0.41
Spain	Growing	0.66	0.56	0.50	0.46	0.48	0.46	0.46	0.56	0.48	0.52	0.66
	Shrinking	0.34	0.44	0.50	0.54	0.52	0.54	0.54	0.44	0.52	0.48	0.34

Sources: Derived from Broadberry et al. (2015a); van Zanden and van Leeuwen (2012); Malanima (2011); Álvarez-Nogal and Prados de la Escosura (2013).

**Table 8: Very Long Run Data Base: Average rate of change of per capita income in all years, growing years and shrinking years**

		1270- 1348	1348- 1400	1400- 1450	1450- 1500	1500- 1550	1550- 1600	1600- 1650	1650- 1700	1700- 1750	1750- 1800	1800- 1870
GB	All years	0.04	0.64	-0.04	0.02	-0.05	0.04	-0.31	1.07	0.23	0.43	0.79
	Growing	4.29	6.45	4.15	3.02	2.48	9.31	5.92	7.23	4.76	2.47	3.00
	Shrinking	-5.76	-5.16	-5.83	-3.51	-3.28	-6.66	-6.54	-6.77	-4.31	-1.98	-2.73
NL	All years		0.60	0.28	0.12	0.42	0.78	0.02	-0.49	0.22	0.21	0.46
	Growing		3.96	3.80	2.09	5.39	8.65	11.93	5.87	5.27	4.77	2.49
	Shrinking		-3.98	-5.99	-1.86	-7.68	-12.05	-10.13	-5.91	-5.70	-5.61	-3.43
Italy	All years	-0.18	0.28	0.08	-0.35	-0.14	-0.10	0.05	0.11	0.08	-0.23	0.23
	Growing	2.44	6.09	7.77	3.39	4.29	3.05	2.68	1.70	1.90	1.76	2.23
	Shrinking	-3.78	-7.05	-5.43	-4.08	-4.56	-3.51	-3.04	-2.28	-2.06	-2.23	-2.60
Spain	All years	0.10	-0.20	0.03	0.03	0.10	0.00	-0.52	0.34	-0.08	0.31	0.39
	Growing	1.35	1.30	1.72	2.80	5.14	3.58	3.55	5.40	3.52	4.18	2.65
	Shrinking	-2.35	-2.09	-1.66	-2.32	-4.54	-3.04	-3.99	-6.11	-3.40	-3.87	-3.93

Sources: Derived from Broadberry et al. (2015a); van Zanden and van Leeuwen (2012); Malanima (2011); Álvarez-Nogal and Prados de la Escosura (2013).

**Table 9: Very Long Run Data Base: Contributions of growing (frequency\*rate) and shrinking (frequency\*rate) to long run economic performance (average rate of change of per capita income in all years)**

		1270- 1348	1348- 1400	1400- 1450	1450- 1500	1500- 1550	1550- 1600	1600- 1650	1650- 1700	1700- 1750	1750- 1800	1800- 1870
GB	All years	0.04	0.64	-0.04	0.02	-0.05	0.04	-0.31	1.07	0.23	0.43	0.79
	Growing	2.48	3.22	2.41	1.63	1.39	3.91	2.96	4.05	2.38	1.34	1.85
	Shrinking	-2.44	-2.58	-2.45	-1.62	-1.44	-3.87	-3.27	-2.98	-2.15	-0.91	-1.05
NL	All years		0.60	0.28	0.12	0.42	0.78	0.02	-0.49	0.22	0.21	0.46
	Growing		2.28	2.43	1.05	3.34	5.36	5.49	2.70	2.85	2.67	1.64
	Shrinking		-1.69	-2.16	-0.93	-2.92	-4.58	-5.47	-3.19	-2.62	-2.47	-1.18
Italy	All years	-0.18	0.28	0.08	-0.35	-0.14	-0.10	0.05	0.11	0.08	-0.23	0.23
	Growing	1.41	3.40	3.23	1.69	2.14	1.59	1.45	1.02	1.02	0.88	1.31
	Shrinking	-1.59	-3.12	-3.15	-2.04	-2.28	-1.69	-1.40	-0.91	-0.95	-1.12	-1.08
Spain	All years	0.10	-0.20	0.03	0.03	0.10	0.00	-0.52	0.34	-0.08	0.31	0.39
	Growing	0.89	0.72	0.86	1.29	2.47	1.65	1.63	3.03	1.69	2.17	1.74
	Shrinking	-0.79	-0.92	-0.83	-1.25	-2.36	-1.64	-2.15	-2.69	-1.77	-1.86	-1.35

Sources: Derived from Broadberry et al. (2015a); van Zanden and van Leeuwen (2012); Malanima (2011); Álvarez-Nogal and Prados de la Escosura (2013).

**TABLE 10: Very Long Run Data Base: Correlations between growing frequencies, growing and shrinking rates and long run economic performance**

Variable 1	Variable 2	R
<b>Great Britain</b>		
Growing rate	Long run performance	0.12
Growing frequency	Long run performance	0.29
Growing rate	Shrinking rate	0.82
<b>Netherlands</b>		
Growing rate	Long run performance	-0.09
Growing frequency	Long run performance	0.77
Growing rate	Shrinking rate	0.88
<b>Italy</b>		
Growing rate	Long run performance	0.25
Growing frequency	Long run performance	0.34
Growing rate	Shrinking rate	0.88
<b>Spain</b>		
Growing rate	Long run performance	0.26
Growing frequency	Long run performance	0.50
Growing rate	Shrinking rate	0.88

**Figure 1: Elite matrix with identity rules**

	1	2	3	4	5	6
1						
2	X					
3	X	X				
4	X	X	X			
5	X	X	X	X		
6	X	X	X	X	X	

**Figure 2: Elite matrix with impersonal rules**

	1	2	3	4	5	6
1		1	1	1	1	1
2	X		X	X	X	X
3	X	X		X	X	X
4	X	X	X		X	X
5	X	X	X	X		X
6	X	X	X	X	X	



**Figure 3: Elite matrix with no courts**

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

**Figure 4: Elite matrix with intra- and inter-coalition trade**

	1A	2B	3A	4B	5A	6B
1A						
2B	X					
3A	A	X				
4B	X	B	X			
5A	A	X	A	X		
6B	X	B	X	B	X	

**Figure 5: Elite matrix with only intra-coalition trade**

	1A	2B	3A	4B	5A	6B
1A						
2B						
3A	A					
4B		B				
5A	A		A			
6B		B		B		

**Figure 6: Smithian growth in the elite matrix**

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

	1	2	3	4	5	6
1						
2						
3	X					
4		X				
5	X		X			
6		X		X		

	1	2	3	4	5	6
1						
2	X					
3	X	X				
4	X	X	X			
5	X	X	X	X		
6	X	X	X	X	X	

## APPENDIX 1: MORE DETAILED DATA ON THE PERIOD 1820-2008

**Table A1: Maddison Data Base: Frequency of growing and shrinking, 1820-2008**

		1820-1870	1870-1910	1910-1950	1950-2008
UK	Growing	0.73	0.60	0.70	0.86
	Shrinking	0.27	0.40	0.30	0.14
Netherlands	Growing	0.72	0.70	0.63	0.88
	Shrinking	0.28	0.30	0.37	0.12
Italy	Growing	0.78	0.63	0.58	0.93
	Shrinking	0.22	0.37	0.42	0.07
Spain	Growing	0.70	0.58	0.58	0.93
	Shrinking	0.30	0.42	0.42	0.07
14 European countries	Growing	0.68	0.68	0.66	0.89
	Shrinking	0.32	0.32	0.34	0.11
USA	Growing		0.65	0.63	0.83
	Shrinking		0.35	0.37	0.17
4 New World countries	Growing	0.66	0.64	0.60	0.82
	Shrinking	0.34	0.36	0.40	0.18
18 European & New World countries	Growing	0.66	0.67	0.65	0.88
	Shrinking	0.34	0.33	0.35	0.12

Sources and notes: Derived from Maddison (2010). The other included European countries are: Belgium, France, Switzerland, Austria, Germany, Portugal, Finland, Denmark, Norway and Sweden/ The other included New World countries are: Australia, New Zealand and Canada.

**Table A2: Maddison Data Base: Average rate of change of per capita income in all years, growing years and shrinking years**

		1820-1870	1870-1910	1910-1950	1950-2008
UK	All years	1.50	0.92	1.02	2.12
	Growing	2.72	2.37	3.17	2.61
	Shrinking	-1.70	-1.25	-3.99	-0.96
Netherlands	All years	0.81	0.79	1.15	2.44
	Growing	1.70	2.28	6.47	2.92
	Shrinking	-1.48	-2.67	-7.72	-1.06
Italy	All years	0.39	1.10	1.02	3.00
	Growing	2.22	3.54	6.27	3.31
	Shrinking	-6.00	-2.95	-6.09	-1.27
Spain	All years	0.56	1.13	0.36	3.79
	Growing	2.32	4.25	3.60	4.18
	Shrinking	-3.55	-3.10	-4.03	-1.46
14 European countries	All years	1.22	1.23	1.26	2.70
	Growing	3.51	2.83	5.35	3.18
	Shrinking	-2.80	-1.94	-6.78	-1.18
USA	All years		1.77	1.64	2.04
	Growing		4.30	6.49	2.77
	Shrinking		-2.93	-6.44	-1.49
4 New World countries	All years	3.69	1.62	1.29	1.92
	Growing	8.74	4.67	5.52	2.73
	Shrinking	-6.13	-3.88	-5.20	-1.68
18 European & New World countries	All years	1.40	1.31	1.23	2.55
	Growing	3.88	3.16	5.20	3.06
	Shrinking	-3.04	-2.30	-6.10	-1.23

Sources and notes: Derived from Maddison (2010). The other included European countries are: Belgium, France, Switzerland, Austria, Germany, Portugal, Finland, Denmark, Norway and Sweden/ The other included New World countries are: Australia, New Zealand and Canada.

**Table A3: Maddison Data Base: Contributions of growing (frequency\*rate) and shrinking (frequency\*rate) to long run economic performance (average rate of change of per capita income in all years)**

		1820-1870	1870-1910	1910-1950	1950-2008
UK	All years	1.50	0.92	1.02	2.12
	Growing	1.97	1.42	2.22	2.25
	Shrinking	-0.47	-0.50	-1.20	-0.13
Netherlands	All years	0.81	0.79	1.15	2.44
	Growing	1.23	1.59	4.04	2.57
	Shrinking	-0.42	-0.80	-2.90	-0.13
Italy	All years	0.39	1.10	1.02	3.00
	Growing	1.73	2.21	3.61	3.08
	Shrinking	-1.33	-1.11	-2.59	-0.09
Spain	All years	0.56	1.13	0.36	3.79
	Growing	1.63	2.45	2.07	3.89
	Shrinking	-1.07	-1.32	-1.71	-0.10
14 European countries	All years	1.22	1.23	1.26	2.70
	Growing	2.22	1.88	3.49	2.84
	Shrinking	-1.00	-0.65	-2.24	-0.14
USA	All years		1.77	1.64	2.04
	Growing		2.80	4.05	2.29
	Shrinking		-1.03	-2.42	-0.26
New World	All years	3.69	1.62	1.29	1.92
	Growing	5.77	3.01	3.31	2.24
	Shrinking	-2.08	-1.39	-2.03	-0.32
18 European & New World countries	All years	1.40	1.31	1.23	2.55
	Growing	2.47	2.10	3.33	2.72
	Shrinking	-1.08	-0.79	-2.09	-0.16

Sources and notes: Derived from Maddison (2010). The other included European countries are: Belgium, France, Switzerland, Austria, Germany, Portugal, Finland, Denmark, Norway and Sweden/ The other included New World countries are: Australia, New Zealand and Canada.

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