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Accounting for the 'Little Divergence' What drove economic growth in pre-industrial Europe, 1300-1800?

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What drove economic growth in pre-industrial Europe, 1300-
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Abstract

We test various hypotheses about the causes of the Little Divergence, using new data and focusing on trends in GDP per capita and urbanization. We find evidence that confirms the hypothesis that human capital formation was the driver of growth, and that institutional changes (in particular the rise of active Parliaments) were closely related to economic growth. We also test for the role of religion (the spread of Protestantism): this has affected human capital formation, but does not in itself have an impact on growth.

JEL classification: N13, N33, O40, O52

Keywords: Europe, Economic growth, Little Divergence, Human capital formation

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INTRODUCTION

The Industrial Revolution is arguably the most important break in global economic history, separating a world of at best very modest improvements in real incomes from the period of ‘modern economic growth’ characterized by rapid growth of GDP per capita. The debate about this phenomenon has recently been linked to the study of long-term trends in the world economy between 1300 and 1800. One of the issues is to what extent growth before 1750 helps to explain the break that occurs after that date; the idea of a ‘Little Divergence’ within Europe has recently been suggested as part of the explanation why the Industrial Revolution occurred in this part of the world. This ‘Little Divergence’ is the process whereby the North Sea Area (the UK and the Low Countries) developed into the most prosperous and dynamic part of the Continent. Studies of real wages – the classic paper is by Robert Allen (2001) – and of GDP per capita (e.g. Broadberry et al 2015, Van Zanden and Van Leeuwen 2012, Alvarez-Nogal and Prados de la Escosura 2012; Malinowski and Van Zanden 2016) charting the various trajectories of the European countries in detail, demonstrated that the Low Countries and England witnessed almost continuous growth between the 14th and the 18th century, whereas in other parts of the continent real incomes went down in the long run (Italy), or stagnated at best (Portugal, Spain, Germany, Sweden and Poland). This ‘Little Divergence’ is also quite clear from data on levels of urbanization (De Vries 1981), book production and consumption (Buringh and Van Zanden 2009) and agricultural productivity (Slicher van Bath 1963a, Allen 2000). The idea of a comparable divergence in institutions (in the functioning of Parliaments) has also been suggested (Van Zanden et al 2012). In sum, the ‘Little Divergence’ between the North Sea area and the rest of the continent is now a well-established fact, which is also relevant for debates about the ‘Great Divergence’ (it is not Europe as a whole that diverged from the rest of EurAsia, but ‘only’ the north-western part of it), and obviously for understanding the roots of the Industrial Revolution (which was to some extent a continuation of trends going back to the late Middle Ages).

The question about the causes of this divergent development of north-western part of Europe is therefore highly relevant for our interpretation of its specific growth path. Why were the Low Countries and England already long before 1800 able to break through Malthusian constraints and generate a process of almost continuous economic growth? In 1750, at the dawn of the Industrial Revolution, the level of GDP per capita of Holland and England had increased to 2355 and 1666 (international) dollars of 1990 respectively, compared with 876 and 919 dollar in 1347 (just before the arrival of the Black Death), and 1454 and 1134 in 1500 (Bolt and Van Zanden 2013). What made possible this doubling or nearly tripling of real incomes in the pre-industrial world? Various hypotheses have been suggested: institutional change (two versions: socio-political institutions such as Parliaments, demographic institutions such as the European Marriage Pattern), the impact of the growth of overseas – in particular – transatlantic trade (Acemoglu et al 2005), and the effect of human capital formation (Baten and Van Zanden 2008).

The most comprehensive test of these various hypotheses was published by Robert Allen (2003). He set out to explain the Little Divergence in terms of real wages (of skilled workers),

comparing the performance of a set of 9 countries (Spain, England and Wales, Italy, Germany, Belgium, the Netherlands, France, Austria-Hungary and Poland) in the period 1300-1800. Real wages, agricultural productivity, urbanization, proto-industrialization, and population growth are explained by each other and six exogenous variables: land-labour ratios, enclosure movements, trade levels, representative governments, rates of literacy and productivity in the manufacturing industry. The reported regression results explaining the development of real wages show a positive effect of land-labour ratios (according to Malthusian expectations), and also generally positive coefficients for urbanization and agricultural productivity. But neither growing literacy nor the expansion of international trade appears to contribute directly to real wage growth. The international trade boom and agricultural productivity do however help to explain trends in the rate of urbanization, and via this link also affect real wages. Finally, by combining regression results into one simulation model, Allen finds a large effect of international trade on the development of north-western Europe, whereas representative governments and rates of literacy are unable to explain economic success: ‘The intercontinental trade boom was a key development that propelled north-western Europe forwards’ (p. 432), but ‘the establishment of representative government has a negligible effect on government in early modern Europe’ (p. 433) and ‘likewise, literacy was generally unimportant for growth’ (p. 433). This conclusion – the rise of the North Sea area is due to international trade and not caused by human capital formation and/or institutional change – has moreover been the starting point of his analysis of the causes of the Industrial Revolution (Allen 2009).

The aim of this paper is to test the various hypotheses explaining the process of differential growth in early modern Europe on the basis of new data that have become available recently. We first of all focus on the explanation of trends in GDP per capita of the countries concerned, which is we argue a better proxy of economic performance than the real wage estimates (see the discussion below). However, because these GDP estimates are subject to margins of error, we do the same regressions with the urbanization ratio as the dependent variable. Moreover, we also have more detailed estimates of the various independent variables used in the regression analysis. This includes new data for human capital formation, the quality of political institutions, overseas trade, and agricultural productivity. On top of this, more countries are added to the analysis (i.e. Sweden, Norway, Denmark, Portugal, Switzerland and Ireland). We apply Random-Effects/Two-Stage least-square regression techniques to explore the effect of the independent variables on per capita GDP. The empirical results lead to different conclusions. GDP growth (where it occurs) is basically driven by human capital formation: a factor that was not contributing to real wage growth in the Allen (2003) regressions.

THE LITTLE DIVERGENCE: PER CAPITA GDP

The starting point is that we try to explain patterns of GDP growth in Western Europe between 1300 and 1800. Recently, much new research charting the long-term evolution of GDP per capita in various parts of Europe has been carried out, which now makes it possible to systematically analyse patterns of real income growth. Moreover, we think that GDP is a

better proxy of economic performance. Real wages, an alternative proxy, are affected by systematic changes in income distribution, and trends between 1400 and 1800 are strongly influenced by the ‘Black Death bonus’, the sudden increase in real wages after 1348, due to increased labour scarcity. As a result, in most countries the trend in real wages between 1400 and 1800 is downward, whereas GDP per capita is stagnant or growing (see Figures 1 and 2). A similar situation of labour scarcity is affecting real wages in Eastern Europe as a result of which, for example, the highest real wages in the Allen dataset are found in Vienna in 1400, not the region that comes to mind first as being highly successful (Allen 2003, p. 407).

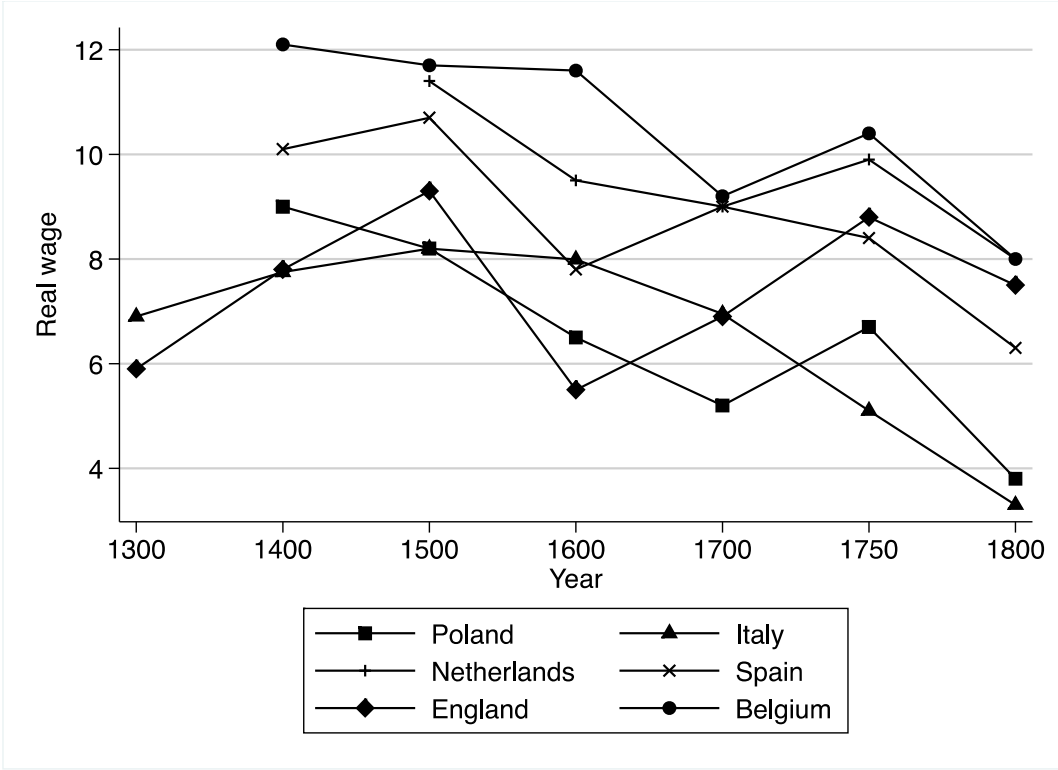


Figure 1. Real wages, 1300-1800
Notes and sources: Allen (2003).

We prefer to use the GDP estimates made within the framework developed by Angus Maddison (2001), which links all series of GDP per capita to the 1990 benchmark (all estimates are therefore presented in 1990 GK dollars). This has important drawbacks as in principle the GDP estimates are expressed in 1990 prices, but this approach has developed into the common standard of historical national accounting.¹ Thanks to studies carried out by Broadberry et al (2015) (England/Britain), Van Zanden and Van Leeuwen (2012) (Holland), Buyst (Belgium), Schön and Krantz (2012) (Sweden), Pfister (2011) (Germany), Malanima (2011) (Italy), Alvarez-Nogal and Prados de la Escosura (2012) (Spain and France), Reis, Martins and Costa (2011) and Palma and Reis (2014) (Portugal), Pamuk and Shatzmiller (2011) (Ottoman Empire) we now have a set of estimates of GDP per capita for those countries. To complete the dataset, we used previous estimates by Maddison for Austria,

¹ See Maddison (2001) and Bolt and van Zanden (2013) for overviews of this approach, and Prados de la Escosura (2000) for an alternative.

Switzerland, Ireland, Denmark and Norway, but we also carried out a robustness check for the inclusion of these data by assuming that these countries grew at the same rate as their closest neighbours (see next section). The pattern that emerges from this is the well-known ‘Little Divergence’: Figure 2 shows the development of real per capita GDP for six European countries between 1300 and 1800. No advances in levels of GDP were made in southern and central Europe between 1500 and 1800 – although income levels were high in Italy between 1300 and 1500, there was no growth after the 15th century. By contrast, per capita GDP in England and Holland grew after 1500, such that it more than doubled between 1300 and 1800. The timing of the Little Divergence is dependent on the country. The Netherlands already has a much higher level of GDP than the rest of the continent at about 1600. England only distances itself from the other European countries during the 18th century, but it is also the country that grows consistently during the whole period.

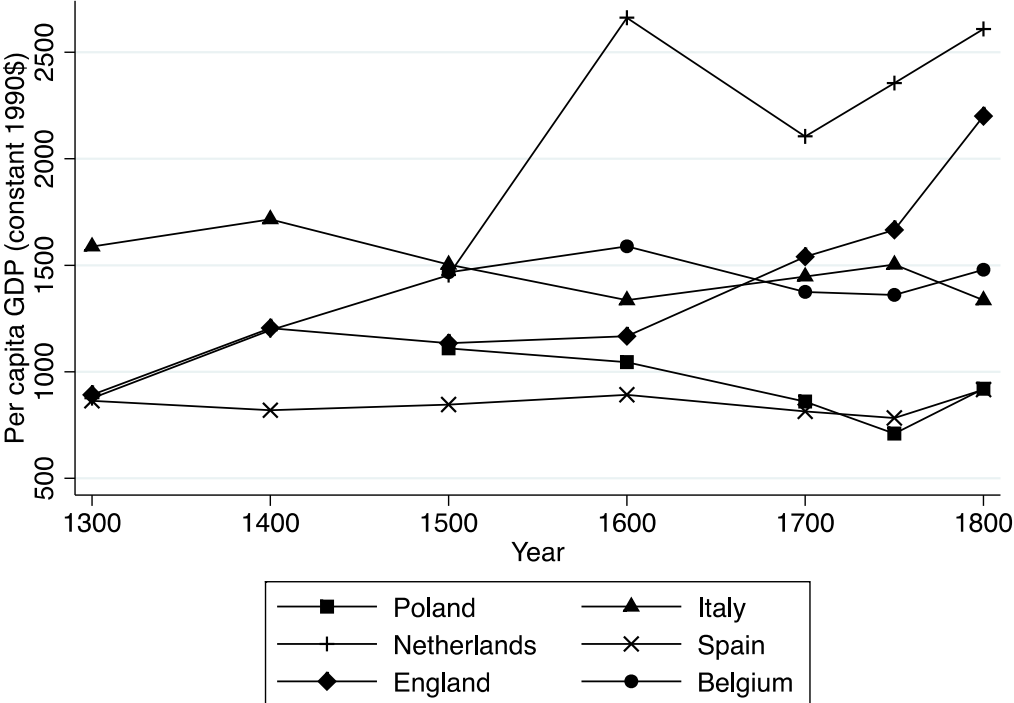


Figure 2. Gross Domestic Product per capita, 1300-1800
Notes and sources: See main text.

To explain these trends we test a number of alternative (or to some extent supplementary) theories and ideas about why certain parts of Western Europe experienced relatively rapid pre-industrial economic growth. The hypotheses we test are derived from institutional economics (stressing the importance of political institutions constraining the executive), and new/unified growth theory (focusing on human capital formation). Moreover, we link GDP growth to international trade (the Smithian dimension), to agricultural productivity, and finally we try to establish if Protestantism had a significant effect on growth (indirectly via its effect on human capital formation). We will now review these various explanations and discuss the various improved datasets we have collected to test them.

EXPLANATIONS OF THE LITTLE DIVERGENCE

Intermediate causes

International trade has often been identified as the main driver of the growth of north-western Europe (Acemoglu et al 2005). Reliable data on the growth of international trade are however not available. Allen's (2003) conclusion was based on estimates of the value of imports and exports of the countries active in the Atlantic trade that were however highly 'tentative'. Thanks to the research by Unger (1992) and others, we have relatively good estimates of the size of the merchant fleet of various regions and Europe as a whole, which can be used as a proxy of the growth of overseas trade. Table 1 shows these estimates, converted into tonnage per capita. The size of merchant fleets captures more general trade flows, and it is for that reason a better measure of international trade. Moreover, it is available for more countries and a longer period.²

Year	1500	1700	1800
England	5.9	18.7	84.0
Netherlands	55.6	210.0	198.9
Italy	5.0	6.9	16.4
Iberia	5.2	12.0	21.9
Germany	5.0	8.1	8.6
France	1.7	5.3	25.2
Scandinavia	-	21.0	158.0

Table 1. Per capita size of the merchant fleet, 1500-1800

Notes and sources: See appendix II. Iberia: Spain and Portugal; Scandinavia: Sweden, Norway and Denmark.

Although the Italian fleet dominated the Mediterranean area during the 15th century, its per capita size was equal to that of Spain, England and Germany. The Dutch fleet was ten times as large by then, and it kept this leading position until the 18th century. After 1500 stagnation occurred in Venice and Genoa, whilst the Dutch managed to quadruple per capita tonnage between 1500 and 1700. Rapid expansion in English and French shipping started after 1670s, although the French fleet was rather small compared to England and Holland by the 18th century. Increases in European shipping were even faster after 1750, since the Scandinavian and English fleet managed to catch-up with the Dutch. By the year 1800, tonnage in Europe's merchant fleet not only surpassed anything seen before, but the rise of north-western Europe in shipping was obvious too: the Dutch, English and Scandinavian fleets were by far the leading ones.

² The size of the merchant fleet is available for the following countries and periods. Germany, France, Italy, England: 1300-1800; Netherlands, Spain and Portugal: 1500-1800; Ireland, Norway, Sweden and Denmark: 1700-1800. There is no data for Austria, Switzerland, Poland, and Belgium. Austria and Switzerland are landlocked, and it is for that reason assumed to have had no merchant fleet. Belgium and Poland are set fixed at zero, because both countries did not engage in shipping during the early modern period (shipping services for both Gdansk and Antwerp were carried out by German and Dutch skippers).

Agriculture was the most important input in the process of economic development before the 19th century, as it produced by far the largest share of GDP. Population growth, and especially the increase in urban demand, raised the demand for food, which required higher levels of agricultural production. Increases in production were possible by expanding (arable) land use, but the amount of land that can be used was limited in the long run. Rising agricultural productivity was therefore necessary to feed a growing population. It worked in the opposite direction as well: productivity growth in agriculture contributed to development, because it supplied the manufacturing industry with raw materials and labour (Overton 1996).

To find out how important increases in agricultural productivity were for explaining the Little Divergence Allen uses an index of agricultural productivity to compute gains in efficiency (Allen 2000). This measure of technological progress however depends on the process of urbanization, real wages and the land-labour ratio, which means that it is already correlated with these variables. We therefore prefer another indicator, the yield ratio, of which Slicher van Bath has collected a large dataset in the 1960s, which was updated with more recent evidence by Van Zanden (1998). The yield ratio is the ratio between the gross yield of a certain crop (in this case, wheat or rye, the two dominant crops of European agriculture) divided by the amount of seed used. It varies from about 3 in agricultural systems with low levels of productivity, to (in our dataset) 10 for highly efficient agricultural systems. Slicher van Bath (1963a, 1963b) collected a large dataset of yield ratios from the available literature, and demonstrated that it is a good proxy of the efficiency of farming.

Figure 3 presents the yield ratios for different parts of Europe. Levels of productivity in Western and Southern Europe were more or less similar until the 17th century. The yield ratios of Central and Eastern Europe were much lower and almost constant over time, which indicates little advances in productivity levels. Agricultural productivity stagnated in Southern Europe after the 17th century, whilst efficiency significantly increased in Western Europe. The countries bordering the North Sea were characterized by having the highest yield ratios of Europe by the end of the 18th century. By contrast, productivity levels in Eastern and Central Europe were as high as those in Western Europe during the middle ages.

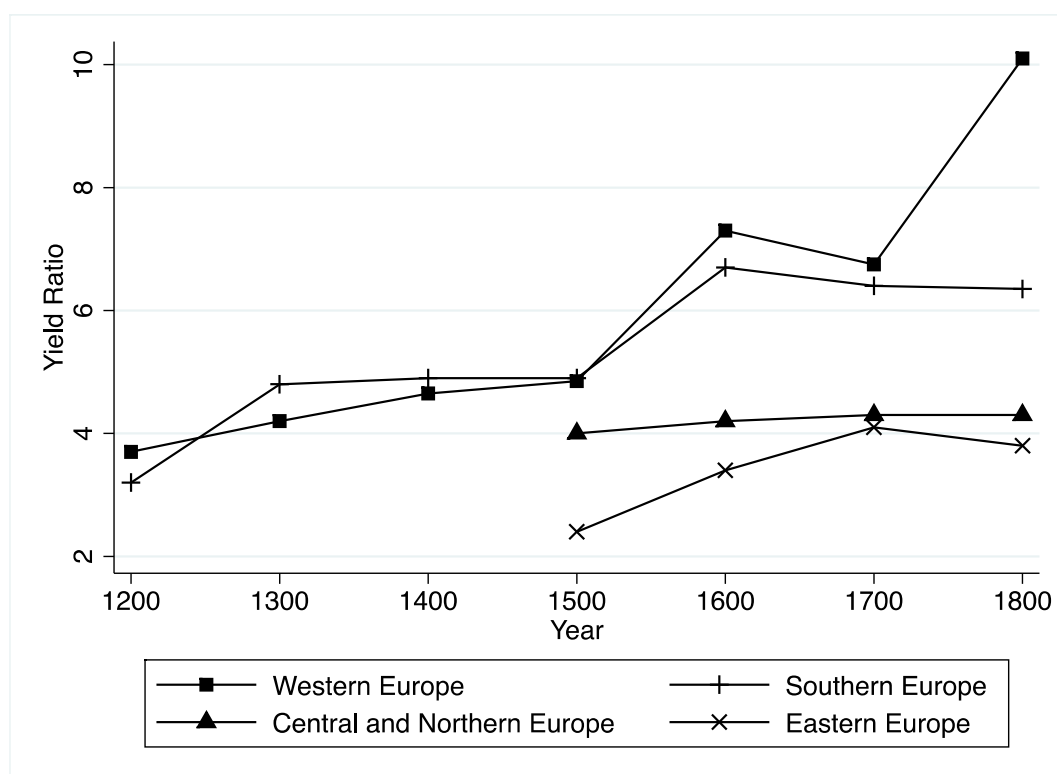


Figure 3. Yield ratios, 1200-1800

Notes and sources: Slicher van Bath (1963a, 1963b); Van Zanden (1998). Observations concern unweighted averages of wheat, rye and barley. See appendix II for the construction of this series. Western Europe: Great Britain, Ireland, Belgium and the Netherlands; Southern Europe: France, Italy, Spain and Portugal; Central and Northern Europe: Germany, Switzerland, Austria, Denmark, Sweden and Norway; Eastern Europe: Poland. Central, Northern and Eastern Europe enter the dataset in 1500.

The variables considered so far, the size of the merchant fleet and agricultural productivity, can be considered as ‘intermediate’ causes of the Little Divergence. We now turn to a number of ‘ultimate’ causes, such as the quality of political institutions, demographic changes (resulting into more human capital formation) and religion, which in the literature play an important role as root causes of economic growth.

Ultimate causes

An influential body of literature argues that it is the specific political economy of Western Europe and in particular the balance of power between sovereigns and societal interests represented in Parliaments that created the right institutional conditions for Europe’s specific growth pattern. Two versions of this hypothesis can be distinguished. The first one stresses the Glorious Revolution as the watershed between ‘absolutism’ and some form of ‘parliamentary’ government, and sees this event as the main cause of the Industrial revolution of the 18th century (North and Weingast 1989, Acemoglu and Robinson 2012). The other one argues that these institutions that resurfaced in 1688 has a much longer history and that forms of power sharing between the Prince and his (organized) subjects go back to the Middle Ages and are rooted in the feudal power structures of that period (Van Zanden et al 2012). The general idea shared by this literature is that the sovereign had to be constrained in order to

protect the property rights of citizens. In republican systems with a strong Parliament property rights were more secure than in states ruled by absolutist kings. This translated itself into, for example, lower interest rates at the capital market (Hoffman and Norberg 1994).

Previous research (e.g. Allen 2003) used a dummy variable derived from De Long and Shleifer (1993) to distinguish states governed by ‘Princes’ and those without (absolute) monarchs, the ‘Republics’. Poland is however classified as a ‘Republic’ which may help to explain why this variable turned out to be insignificant in the regressions (see Allen 2003, p. 415-416). We use the activity index of the various Parliaments (defined as the number of years they were in session during a century) as the proxy for the quality of political institutions. As demonstrated by Van Zanden et al (2012) this measure varies from zero when no Parliament is convened to close to 100 for post-Glorious Revolution England and the Dutch Republic. The averages of the south, central and north-western parts of Europe show a clear ‘institutional divergence’ within the continent: after the 15th century parliamentary activity grew strongly in the north-west, but declined due to the rise of absolutism in the south, but also in the central parts of Europe (with the exception of Switzerland) (see Figure 4). The question we address therefore is to what extent this institutional divergence within Europe helps to explain the growing economic disparities observed.

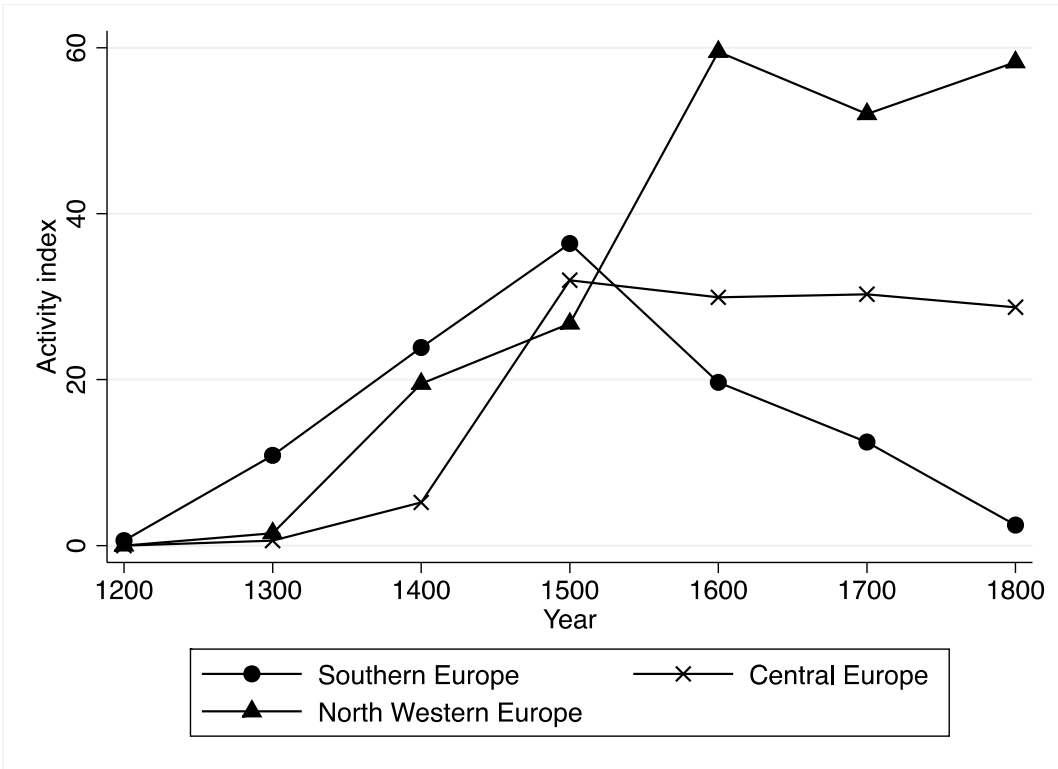


Figure 4. Parliamentary activity, 1200-1800
Notes and sources: Variable taken from Van Zanden et al 2012. Southern Europe: Portugal, Spain and France; Central Europe: Poland, Switzerland, Austria and Germany; Northern Europe: England, Netherlands, Belgium and Sweden. Observations include century averages (e.g. 1300 refers to activity between 1200 and 1300).

An additional institutional variable can be derived from information of the self-government of cities. The communal movement that started in the Middle Ages (the first communes date from the 11th and 12th centuries) has been seen as an essential precondition for the rise of

parliaments in the late Middle Ages, and important in its own right, as it created stable systems of property rights in the cities concerned (see Stasavage 2014 for an overview). In another study the number of self-governing cities (with more than 10,000 inhabitants) and the share of cities with communal status have been quantified (Bosker et al 2012). Cities can gain ‘independent’ status, which they do on a large scale between 1100 and 1500, but can also lose it again, as a result of conquest by another city (as happened on a certain scale in Italy), or by the abolishment of city right by absolutist rulers. We use this information in two ways: the share of cities with self-government is used as an index of the ‘republican’ nature of the polity, similar to the activity index of the parliaments, because strong self-government clearly constrains the sovereign. Moreover, we use the number of communes (per capita) between 1200 and 1300 as a proxy of the institutional starting point of the country concerned. The latter variable has the advantage of being clearly exogenous to the economic growth between 1300 and 1800.

An equally influential body of literature suggests that the root causes of ‘modern economic growth’ should be found in an interplay of demographic and economic changes, affecting the ‘quality-quantity’ trade off (Becker 1981, Galor 2011), and resulting in on the one hand, limitations on fertility and population growth, and on the other hand in increased human capital formation. The emergence of the European Marriage Pattern in the North Sea area in the Late Middle Ages has been hypothesized as the crucial demographic change, which also resulted in increased investment in education of the (less) children (Hajnal 1965, De Moor and Van Zanden 2010a, Voigtländer and Voth 2013). An important part of the mechanism was the increase in the average age of marriage of women (and men), which both limited fertility and increased opportunities for human capital formation. Ideally, we would like to have a dataset of the spread of the European Marriage pattern to test this hypothesis, but data limitations are particularly severe here.³ Instead, we focus on the results of the switch from quantity to quality, that is on developments in human capital formation. Allen used highly tentative estimates of literacy as measures of the increase in human capital that occurred. For 1500, for example, his ‘guestimates’ were directly based on the urbanization ratio, assuming that 23% of the urban and 5% of the rural population was literate (Allen 2003, p. 415); and most of the estimates between 1500 and 1800 were then based on intrapolation. Instead, we use much more robust estimates of book consumption per capita as our measure of human capital formation. This measure has already proven itself as a reliable guide to changes in human capital (Baten and Van Zanden 2008), and the underlying data (of actual book production) are, especially for the earlier period, much better than the proxies for literacy. Moreover, book consumption also measures more advanced reading and writing skills than literacy rates do.

Human capital formation is obviously not an entirely ‘exogenous’ factor. The literature on the European Marriage Pattern argues that it is rooted in social and cultural institutions which can

³ We are of course aware of the recent contribution by Dennison and Ogilvie (2014), but for reasons we will explain elsewhere their work does not make it possible to test the EMP-hypothesis systematically (Carmichael, De Pleijt, De Moor and Van Zanden 2016).

be considered exogenous but help to explain the divergent development of different parts of Europe. However, endogenous processes such as the growing demand for skills in the more successful economies also play a role, implying that human capital should to some extent also be seen as an intermediate factor. To take this into account, we will instrument it with a ‘truly’ ultimate factor, the rise of Protestantism.

Table 2 shows book consumption for European countries and underlines differences between the regions. During the middle ages, Flanders and Italy, the two core areas of Western Europe, had relatively high levels of book consumption. The Netherlands, Germany, France and Switzerland approximated or even surpassed Belgian and Italian levels of consumption by the early 16th century, whereas England, Ireland, Spain, Poland and Sweden lagged behind. The picture is different for the 18th century. Levels of book consumption were highest in Holland, followed by England and Sweden, whilst Belgium and Italy fell behind. The large increases of book consumption per capita presented in Table 2 are the results of two changes, the growth of human capital (resulting in a shift of the demand curve) and the decline of book prices, following, amongst others, the invention of movable type printing (resulting in a move along the demand curve).

Year	1300/99	1500/49	1750/99
England	0.3	18.0	196.4
Netherlands	0.2	19.5	501.5
Belgium	0.8	35.4	45.3
Iberia	0.4	5.7	29.0
Italy	0.8	29.3	88.7
Sweden	-	1.1	214.1
Ireland	-	-	79.5
Switzerland	0.1	71.6	33.6
France	0.3	40.3	120.8
Germany	0.3	28.6	125.3
Poland	-	0.3	23.1

Table 2. Book consumption per thousand inhabitants, 1300-1800

Notes and sources: Book consumption is taken from Buringh and van Zanden (2009) and Baten and van Zanden (2008). England refers to Great Britain and Iberia to Spain and Portugal. Ireland enters the sample in 1600. There are no observations for Norway and Denmark.

A third ‘ultimate’ cause of growth is possibly religion. Since Max Webers writings on ‘The Protestant ethic and the spirit of capitalism’ (1905/1930) the link between religious change and economic development has been much debated. Recently this debate has received new attention as a result of econometric research trying to confirm such a relationship. Becker and Woessmann (2009) have tested this relationship for early 19th century Prussia, and concluded that Protestantism may have had a strong positive effect on human capital formation. In our approach such an effect would be included in the book production estimates (which are

indeed strongly correlated with Protestantism). We will test for this indirect effect, by including, starting in 1600, dummies for Protestantism.⁴

EMPIRICAL ANALYSIS

What accounts for the process of differential economic growth in pre-modern Europe? To find out, we explain per capita GDP by the ‘candidates’ discussed above: agricultural productivity, the quality of political institutions, international trade, and human capital formation. The unit of observation are countries at intervals of approximately a century. The years include 1300, 1400, 1500, 1600, 1700, 1750 and 1800. Observations on per capita GDP in 1300 and 1400 are only available for Spain, Italy, England and the Netherlands. Germany, France, Austria, Poland, Belgium, Switzerland, Denmark, Ireland and Norway enter the dataset in 1500; Sweden and Portugal enter the sample in 1600.

An important concern with our analysis is endogeneity. Relative successful economies such as Holland and England might have had higher levels of productivity in agriculture, larger merchant fleets and/or more human capital formation, as rich countries may have been able to afford those higher levels. Another endogeneity issue is related to the omission of other important determinants of per capita GDP that may correlate with our independent variables. Finally, the estimates might be biased due to measurement error in the independent variables. For instance, our indicator of human capital formation, book consumption, captures only part of the ‘true’ human capital formation that occurred.

The independent variables are lagged for one period in the regressions to somewhat limit the reverse causality problems, e.g. agricultural productivity in 1600 refers to the average level of productivity between 1500 and 1600.⁵ We furthermore include a set of control variables to alleviate the bias stemming from the omission of variables. Finally, we report on the Random-Effects / Two-Stage least-squares (RE/2sls) estimation results where we treat productivity in agriculture, international trade and human capital as endogenous. A Random-Effects (RE) specification is preferred here, as it enables us to say something about the time-invariant, mostly geography-related, country-specific variables in our regressions.

To estimate the effect of the endogenous variables on per capita income levels, we introduce a set of instruments. To start with, we use Protestantism as an instrument for book consumption per capita. We follow Becker and Woessmann (2009) and hypothesise that Protestantism had a strong and positive effect on human capital formation, and van Zanden et al (2012), who have shown that Protestantism had no direct effect on economic development between 1300 and 1800. Secondly, we measure the maximum land area that could potentially be used for agricultural production for the 15 countries in our dataset. This variable is derived from Buringh et al (1975) who classified the landmass of the world according to soil quality,

⁴ The variable takes values 1 for countries that were more or less fully protestant (England, Netherlands, Denmark, Sweden, Norway) and 0.5 for Germany and Switzerland which were about 50% protestant.

⁵ For the size of the merchant fleet we have only point estimates: see the discussion in appendix II.

vegetation and climate conditions. We adjust it to the lag of the population level to proxy land scarcity in the counties concerned.⁶ Our hypothesis is that this is correlated with productivity in agriculture. Broadberry et al (2015), for example, has shown that yield improved as the population grew and the arable area expanded.⁷ Finally, we follow the literature (e.g. Sachs and Warner 1997) that uses the coastline-to-area ratio as an instrument for international trade.

Ideally we would like to introduce an instrument for the parliamentary activity index, but it is difficult to find a convincing one. We have considered several instruments for parliamentary activity that are suggested by the (empirical) literature. For instance, we have related the index to the Meersen-line and to the absolute size of the countries involved as suggested by Stasavage (2011). But all these instruments are however not independent from the left-hand side variables and can therefore not be used in the regressions. As a solution, we introduce two supplementary proxies of political institutions: the share of cities (with more than 10,000 inhabitants) which had self-government, and the number of communes per capita between 1200 and 1300. The argument for the latter variable is that this is the starting point of our analysis and that this variable reflects the strength of the movement on which the parliamentary movement of the late Middle Ages builds (Van Zanden et al 2012). In this way we find out to what extent the communal movement had a long-term impact on economic development (directly or via the strength of parliaments). In the regressions the number of communes per capita in the 13th century is directly related to per capita GDP. Reverse causality issues are less likely, because economic growth in the centuries following the Black Death cannot have influenced the number of medieval communes. It should be stressed here that the results of the economic development and Parliamentary activity relationship cannot be interpreted as causal, but it is however possible to interpret the correlations between the variables.

We estimate the simple linear regression model given in (1). To estimate the effect of our endogenous variables on per capita income levels, we introduce the set of instruments discussed at the beginning of this section. The first stage regressions are given in (2) – (4).

$$\ln Y_{it} = \alpha_i + \alpha_t + \gamma_1 Z_{it} + \gamma_2 \ln par_{it} + X_{it} \beta + \varepsilon_{it} \quad (1)$$

$$\ln yield_{it} = \alpha_i + \alpha_t + \eta_1 \ln LS_{it} + X_{it} \beta + \varepsilon_{it} \quad (2)$$

$$\ln book_{it} = \alpha_i + \alpha_t + \eta_2 prot_{it} + X_{it} \beta + \varepsilon_{it} \quad (3)$$

⁶ Another potential instrument for productivity in agriculture is the ratio of productive land to total land. Unfortunately, however, this variable is not correlated with the yield ratio and can therefore not be used as an instrument in the regression analysis.

⁷ It is important to take population levels into account: for England Broadberry et al (2015) demonstrate that population growth clearly drove up yields of crops, while population decline led crop yields to fall. The maximum land area is a time-invariant geographical characteristic of the country and is therefore not directly linked to economic outcomes. Similarly, the population estimates used here to calculate land scarcity refer to the population level in the preceding century and is for that reason unrelated to per capita GDP.

$$\ln fleet_{it} = \alpha_i + \alpha_t + \eta_3 \ln coast_i + X_{it} \beta + \varepsilon_{it} \quad (4)$$

$\ln Y_{it}$ denotes the log of per capita GDP of country i in century t , and Z_{it} is a vector that includes the endogenous variables of interest: the yield ratio ($\ln yield_{it}$), the size of the merchant fleet ($\ln fleet_{it}$), and book consumption ($\ln book_{it}$). γ_2 captures the effect of the activity index of parliaments ($\ln par_{it}$) on per capita GDP and X_{it} is a vector including several confounding factors that we will introduce below. Unless otherwise noted, we include a full set of century dummies in our estimations. ε_{it} captures all other unobserved (or unmodelled) variables related to economic development. The logarithm of the variables is used in the regressions to ensure that extreme values do not play a disproportionate role.⁸

η_1 , η_2 , and η_3 in equations (2), (3) and (4) capture the effect of the instruments on the endogenous variables. The log of land scarcity ($\ln LS_{it}$) serves as an instrument for the yield ratio; Protestantism ($prot_{it}$) for book consumption; and, finally, the log of the coast-to-area ratio ($\ln coast_i$) for the size of the merchant fleet. The exclusion restriction is that the instruments do not appear in the second stage regression as given in (1). We first of all estimate the effect of each endogenous variable separately. Thereafter we integrate the various candidates in one model to find out what was the main driving force of the Little Divergence.

The first control variable that is included in X_{it} is average years of war. Research stresses the importance of war-making for state building and subsequent economic development (e.g. Tilly 1990). We therefore control for the average number of years at war during the previous period (a century or half-century) (Acemoglu et al 2005). We furthermore include latitude (absolute distance to the equator) in our regressions to control for geography.

The GDP estimates used in this paper of Denmark, Norway, Austria and Switzerland are taken from Maddison (2001). For the remaining countries in the sample we use the updated estimates of Bolt and van Zanden (2013). The latest series, which are based on more and better information, show that per capita GDP must have been higher than the previous estimates of Maddison suggest: he estimated the average income of Western Europe in 1500 at 771 dollars, whilst the updated database suggest that it must have been around 1200 dollars. We therefore evaluate our conclusions by assuming that economic growth in Denmark, Norway, Austria and Switzerland was at a similar rate as their neighbouring countries: per capita GDP of Austria and Switzerland is set equal to the average of Italy and Germany and that of Denmark and Norway to Sweden. As a result, average income levels of these four countries are slightly higher than the original estimates of Maddison. This approach allows us to re-estimate the models using this alternative dataset on per capita GDP (denoted $\ln GDP^\ddagger$ in the regressions).

⁸ Exceptions are the variables for which we use rates.

Previous studies have also shown a close association between urbanization and per capita GDP (e.g. Acemoglu et al 2002).⁹ Figure 5 indeed demonstrates relatively high urbanization rates in Italy and Belgium during the middle ages. After the 15th century, however, the Netherlands became the most urbanized country in Europe. More people moved to cities in England after 1700, so that it approximated Holland by the end of the 18th century. Other parts of Europe, such as Poland, had no growth in the share of people living in cities. The Little Divergence is thus quite evident from the evidence on urbanization patterns as well. As a second set of robustness checks, we re-estimate the models using urbanization rates as left-hand side variable (denoted Urb in the regressions).

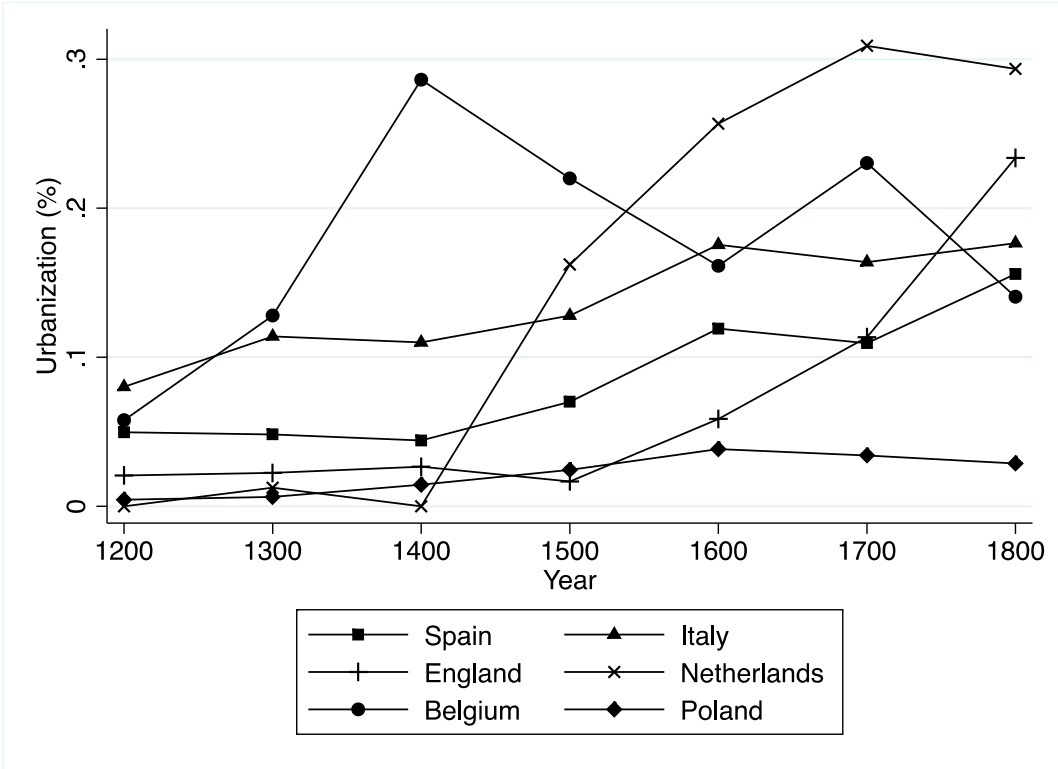


Figure 5. Urbanization rates, 1200-1800

Notes and sources: Cities are defined as settlements with more than 10,000 inhabitants. Absolute number of people living in cities is taken from Bosker et al (2012). Population levels are taken from the same source. Belgium includes Luxemburg and observations for England refer to the United Kingdom.

Table 3 reports the first regressions measuring the effect of productivity in agriculture on per capita GDP (Columns (1) to (3)), the alternative per capita GDP estimates (Column (4)) and the urbanization rates (Column (5)). The results in Column (1) show a strong correlation between per capita GDP and productivity in agriculture. In Column (2) we introduce the control variables for war making and geography. We have also included a variable capturing the proportion of agricultural land that was enclosed (Allen 2003). The enclosure movement enhanced efficiency in agriculture, which would be reflected by higher yield ratios. The enclosure movement may have also directly contributed to economic outcomes. More specifically, the effect of enclosures on productivity levels in the agricultural sector may have

⁹ The correlation between per capita GDP and urbanization rates in our dataset is 0.81.

released labour that promoted the development of other sectors of the economy (e.g. the growth of cities) (Brenner 1976). The introduction of the set of control variables reduces the coefficient on average yield, as expected, but it is still found to be significant. Column (3) tests for the causal relationship between agricultural productivity and economic development by instrumenting the yield ratio with our measure for land scarcity. The first stage results are indicative of a large negative effect of land scarcity on the yield ratio: higher yields occurred when agricultural land became scarcer. This finding supports our hypothesis that growing populations reduced the availability of land suitable for agricultural production, which in turn created the right incentives to intensify and rationalise the use of existing resources to improve yields. The coefficient on the yield ratio in the corresponding second stage is significant, suggesting that increases in agricultural productivity did contribute to early modern economic growth. The results are robust to using the alternative GDP estimates and the urbanisation ratios (Columns (4) and (5)).

	(1)	(2)	(3)	(4)	(5)
	Log GDP	Log GDP	Log GDP	Log GDP [‡]	Urb
	RE	RE	RE/2SLS	RE/2SLS	RE/2SLS
Log of Yield Ratio	0.431*** (2.79)	0.327** (2.12)	0.867** (2.00)	1.022*** (2.77)	0.195** (2.01)
Share of Country Enclosed		0.558*** (2.76)	0.429 (1.44)	0.511 (1.20)	0.0672 (1.45)
Absolute Latitude		-1.711* (-1.83)	-1.114 (-0.80)	-0.756 (-0.29)	-0.281 (-1.32)
Average Years at War		0.00425 (0.08)	-0.0187 (-0.31)	-0.00996 (-0.17)	0.0196 (1.58)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	6.230*** (19.78)	7.157*** (11.31)	5.824*** (4.46)	5.235*** (3.02)	-0.151 (0.58)
<i>First Stage Results</i>					
Log Land Scarcity			-0.298*** (-3.73)	-0.305*** (-3.74)	-0.298*** (-3.73)
Control Variables			Yes	Yes	Yes
Time Fixed Effects			Yes	Yes	Yes
First Stage F-Statistic			13.91	13.98	13.91
R2	0.36	0.40	0.33	0.36	0.52
Number of Observations	81	81	81	79	81

Table 3. Agricultural productivity and economic development, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The z-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively. The F-statistics report on the strength of the instrument.

Table 4 reports the set of regressions explaining the impact of political institutions on the three measures of economic development. The results in Column (1) show that there is a strong positive association between the parliamentary activity index and our estimates of per capita GDP. In Column (2) we have included our set of control variables on European wars and geography, and as an additional control variable we also add the absolute size of the country. Previous studies have argued that relatively small states were more likely to develop democratic institutions than relatively large ones (e.g. Stasavage 2011). The size of a country may therefore be negatively related to the Parliamentary activity index. The coefficient on the log of Parliamentary activity remains significant. In Column (3) we add the share of cities with self-government and the number of medieval communes per capita. Both enter the regression with the expected sign and are highly significant. The coefficient on our Parliamentary activity index decreases a bit, but stays statistically significant at the 1% level. The results are again robust to switching to other left-hand side variables: our alternative GDP estimates and the urbanisation ratio. Although, for reasons discussed above, we are not able to say anything about causality here, the overall regression results suggest that there was a strong positive relationship between different forms of political institutions and economic outcomes between 1300 and 1800.

	(1)	(2)	(3)	(4)	(5)
	Log GDP	Log GDP	Log GDP	Log GDP [‡]	Urb
	RE	RE	RE	RE	RE
Log Parliamentary Activity Index	0.117*** (5.31)	0.115*** (4.92)	0.0800*** (4.62)	0.0739*** (3.83)	0.0107** (1.96)
Log Size of Country		-0.0417 (-0.48)	0.0789 (1.33)	0.0299 (0.48)	-0.00703 (-0.67)
Absolute Latitude		-0.687 (-0.87)	3.356*** (3.61)	2.523** (2.44)	0.478*** (2.73)
Average Years at War		-0.0187 (-0.36)	-0.0373 (-0.86)	-0.0417 (-0.71)	0.0218** (2.45)
Share Cities Self-Government			0.821*** (5.58)	0.792*** (3.90)	0.0919* (1.92)
Log of Initial Political Institutions			0.492*** (5.59)	0.347*** (3.17)	0.0974*** (6.87)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	6.817*** (82.67)	7.712*** (7.69)	3.090*** (3.41)	4.258*** (4.19)	-0.256 (-1.17)
R2	0.60	0.60	0.71	0.59	0.75
Number of Observations	81	81	81	79	81

Table 4. Political institutions and economic development, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The z-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively.

Table 5 captures the impact of international trade on economic development. Column (1) of the table again present the bivariate regression results of the relationship between the log of the size of the merchant fleet (per head of the population), and Column (2) report the results including the set of control variables. In addition to this, we have included in Column (2) ‘Colonial realm’, which is measured as the size of the colonial population compared to the population of the colonizing country (Bosker et al 2012). Colonial realm therefore measures the contribution of (or perhaps dependency on) the growth of overseas colonies after 1600 to the domestic economy. It can also be argued that smaller states have a greater tendency towards openness and are more likely to engage in international trade and shipping than larger ones. We therefore control for this possibility by including the absolute size of the countries in our sample. The results Columns (1) and (2) are indicative of a strong positive association between international trade and levels of per capita GDP. When instrumenting the size of the merchant fleet with the log of the coast-to-area ratio its coefficient however becomes insignificant (Column (3)). These results remain when switching the other indicators of economic development in Columns (4) and (5).

	(1)	(2)	(3)	(4)	(5)
	Log GDP	Log GDP	Log GDP	Log GDP [‡]	Urb
	RE	RE	RE/2SLS	RE/2SLS	RE/2SLS
Log Size of Merchant Fleet	0.0241*** (3.19)	0.0251*** (3.22)	0.0172 (0.81)	-0.00544 (-0.18)	0.00493 (1.41)
Colonial Realm		0.0892 (1.20)	0.102 (1.22)	0.196** (2.04)	0.0454*** (3.02)
Log Size of Country		-0.0947 (-1.52)	-0.0817 (-1.20)	-0.0825 (-0.84)	-0.0293*** (-2.63)
Absolute Latitude		-0.726 (-0.84)	-0.713 (-0.88)	-0.358 (-0.29)	-0.203 (-1.53)
Average Years at War		0.00596 (0.10)	0.0138 (0.24)	-0.000999 (-0.01)	0.0215** (2.03)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	6.906*** (71.49)	8.303*** (9.24)	8.176*** (9.05)	7.983*** (5.91)	0.466*** (3.12)
<i>First Stage Results</i>					
Log Coast to Area			1.96*** (4.03)	2.11*** (4.37)	1.96*** (4.03)
Control Variables			Yes	Yes	Yes
Time Fixed Effects			Yes	Yes	Yes
First Stage F-Statistic			16.2	19.12	16.2
R2	0.39	0.40	0.40	0.26	0.69
Number of Observations	81	81	81	79	81

Table 5. International trade and economic development, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The *z*-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively. The *F*-statistics report on the strength of the instrument.

The regressions in Table 5 thus indicate that we cannot find positive evidence for an independent role of the merchant fleet explaining the Little Divergence. As a robustness-check we have also introduced the log of the volume of Atlantic trade of Acemoglu et al (2005) in the regressions, where we have used the log of the Atlantic coast-to-area as an instrument.¹⁰ The results can be found in Table 6 and show that there is no significant relationship between international trade and economic development. This difference in findings may be related to the hypothesis under consideration. Acemoglu et al hypothesized that international trade worked via the channel of institutions (measured as ‘constraints on the executive’), whereas we are interested in the direct effect of trade on economic development. Moreover, Allen (2003) treated international trade (measured as per capita non-specie trade) as exogenous in his regressions. Similarly to the empirical findings of Allen, we find a positive association (Columns (1) and (2) of Tables 5 and 6). However, our instrumental variable estimates clearly indicate that there is no causal relationship between international trade and economic development (Columns (3) to (5) of Tables 5 and 6).

¹⁰ We have also tested the trade hypothesis using per capita non-specie trade of Allen (2003). This gives similar outcomes, but neither the log of the coast-to-area nor the log of the Atlantic coast-to-area was significantly correlated with the independent variable. Since we were only able to report on the correlations we decided not to include the regression results. They are however available upon request.

	(1)	(2)	(3)	(4)	(5)
	Log GDP	Log GDP	Log GDP	Log GDP [‡]	Urb
	RE	RE	RE/2SLS	RE/2SLS	RE/2SLS
Log Volume of Atlantic Trade	0.219*** (3.29)	0.237*** (2.68)	0.079 (0.23)	-0.0681 (-0.19)	0.00266 (0.04)
Colonial Realm		-0.0141 (-0.15)	0.0805 (0.45)	0.217 (1.15)	0.0479 (1.47)
Log Size of Country		-0.0803 (-1.28)	-0.0554 (-0.44)	-0.0806 (-0.61)	-0.0203 (-0.86)
Absolute Latitude		0.109 (0.12)	-0.516 (-0.24)	-0.695 (-0.31)	-0.207 (-0.52)
Average Years at War		-0.0135 (-0.23)	-0.0211 (-0.35)	-0.0103 (-0.15)	0.0195* (1.78)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	6.930*** (75.33)	7.838*** (8.69)	7.872*** (4.59)	8.132*** (4.55)	0.392 (1.24)
<i>First Stage Results</i>					
Log Atlantic Coast to Area			1.965*** (5.87)	2.091*** (5.77)	1.965*** (5.87)
Control Variables			Yes	Yes	Yes
Time Fixed Effects			Yes	Yes	Yes
First Stage F-Statistic			8.41	8.51	8.41
R2	0.4	0.41	0.37	0.27	0.66
Number of Observations	81	81	81	79	81

Table 6. International trade and economic development, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The z-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively. The F-statistics report on the strength of the instrument.

Finally, Table 7 estimates the contribution of human capital formation to early modern growth. To control for advanced levels of human capital, we have added the number of universities per capita to the regressions. It is expected that the number of universities is positively correlated with book consumption, but also to economic growth in the broader sense as it proxies the upper tail of the knowledge distribution. Column (1) shows a strong and positive correlation between book consumption per capita GDP, and the results in Column (2) suggest that this is robust to the inclusion of our set of control variables. To test for causality, we instrument the log of per capita book consumption with our Protestantism variable. The first stage results in Column (3) show a positive association between Protestantism and book consumption, which adds support to the empirical findings of Becker and Woessmann (2009) that are indicative of a similar link between these variables. The estimation results of the second stage indicate that book consumption contributed to per capita

GDP, as its coefficient is significant at the 1% level. The results are again robust to using the alternative GDP dataset (Column (4)) and the urbanization ratios as dependent variables (Column (5)).

	(1)	(2)	(3)	(4)	(5)
	Log GDP	Log GDP	Log GDP	Log GDP [‡]	Urb
	RE	RE	RE/2SLS	RE/2SLS	RE/2SLS
Log Book Consumption	0.0599*** (2.66)	0.0524** (2.42)	0.182*** (3.00)	0.191*** (3.67)	0.0353*** (3.06)
University		0.131*** (2.60)	0.122* (1.94)	0.151*** (2.61)	0.0258** (2.29)
Absolute Latitude		-0.258 (-0.23)	-0.524 (-0.43)	-0.435 (-0.47)	-0.285 (-0.98)
Average Years at War		-0.00494 (-0.08)	0.00839 (0.09)	0.00551 (0.06)	0.0162 (0.87)
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes
Constant	6.451*** (24.92)	6.545*** (10.05)	5.293*** (5.91)	5.094*** (7.04)	-0.144 (-0.74)
<i>First Stage Results</i>					
Protestantism			2.78*** (4.48)	2.78*** (4.48)	2.78*** (4.48)
Control Variables			Yes	Yes	Yes
Time Fixed Effects			Yes	Yes	Yes
First Stage F-Statistic			20.06	20.06	20.06
R2	0.37	0.44	0.21	0.24	0.49
Number of Observations	69	69	69	69	69

Table 7. Human capital formation and economic development, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The z-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively. The F-statistics report on the strength of the instrument.

Overall the regression results of Tables 3 to 6 show strong and significant correlations between political institutions, productivity in agriculture, international trade and human capital formation, and per capita GDP in the centuries leading up to the Industrial Revolution. The 2SLS regression results have furthermore established that increases in human capital formation and agricultural productivity caused higher levels of per capita incomes. The effect of international trade, however, was not found to be causal: increases in the size of the merchant fleets cannot account for differences in economic performance of the countries observed.

As a final step we have integrated all endogenous variables, all control variables and all instruments in one single model to find out what was the main driving force of the Little Divergence. The regression results are given in Table 8. The top panel reports the Second-Stage results and the bottom panel shows the First-Stage results explaining the endogenous variables: the yield ratio (Column (a)), the size of the merchant fleet (Column (b)), and, finally, book consumption (Column (c)). The First-Stage results in Column (a) are indicative of a positive association between agricultural productivity and political institutions; stronger and more active parliaments have beneficial effects on productivity in agriculture. It also shows a correlation between the yield ratio and the log of the coast-to-area variable: openness also enhances agricultural productivity. Column (b) shows that there is also a weak correlation between the size of the merchant fleet and political institutions, in particular the importance of communes. Finally, the results in Column (c) illustrate a negative relationship between book consumption and land scarcity: densely populated countries apparently consume more books, perhaps due to scale economies in publishing and printing. There however was a positive association between human capital and political institutions at the start of our period.

The Second-Stage results show that book consumption per capita significantly contributed to per capita GDP between 1300 and 1800 (Columns (1) and (2)). The coefficient on book consumption in the regression explaining urbanisation in Column (3) has the correct sign, but is only significant at the 15% level. On the other hand, however, the results in Column (3) indicate a positive relationship between political institutions and urbanisation. In sum these findings therefore highlight the importance of human capital formation for early modern growth. Via this channel, Protestantism has an indirect effect on growth, and land scarcity appears to have a negative effect on GDP, but this is only a weak link. It also highlights the close association of institutional changes and economic development.

	(1)	(2)	(3)
	Log GDP	Log GDP [‡]	Urb
	RE/2SLS	RE/2SLS	RE/2SLS
Log Book Consumption	0.130** (2.51)	0.166* (1.93)	0.0142 (1.44)
Log Size of Merchant Fleet	0.00713 (0.37)	0.00277 (0.09)	-0.00106 (-0.29)
Log of Yield Ratio	-0.242 (-0.16)	-2.173 (-0.85)	-0.246 (-0.85)
Log Parliamentary Activity Index	-0.0208 (-0.32)	0.0509 (0.47)	0.0161 (1.31)
Share Cities Self-Government	0.0636 (0.29)	-0.0831 (-0.23)	0.0693* (1.68)
Log of Initial Political Institutions	0.287 (0.76)	0.528 (0.84)	0.146** (2.03)
Control variables	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Constant	5.787** (2.33)	10.24** (2.48)	0.0384 (0.08)
<i>First Stage Results</i>	Endogenous variable is:		
	(a) Yield Ratio	(b) Fleet	(c) Book
Log Land Scarcity	-0.0206 (-0.35)	0.308 (0.37)	-1.341*** (-4.40)
Log Coast to Area	0.0789** (1.97)	2.658*** (5.96)	-0.457* (-1.85)
Protestantism	-0.0838 (-0.65)	-0.0843 (-0.05)	1.991*** (2.68)
Log Parliamentary Activity Index	0.0431** (2.06)	0.274 (0.90)	0.078 (0.58)
Share Cities Self-Government	0.121 (0.84)	3.697* (1.87)	1.201 (1.38)
Log of Initial Political Institutions	0.218*** (3.37)	0.934 (0.92)	1.088*** (2.63)
Contol Variables	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
Constant	0.46 (0.71)	-21.29** (-2.43)	5.024 (1.27)
First Stage F-Statistic	0.12	35.49	7.20
R2	0.30	0.03	0.63
Number of Observations	69	69	69

Table 8. Accounting for the Little Divergence, 1300-1800

Notes: Standard errors are clustered at the country level to control for serial correlation in the unobservables. The z-scores are reported in parentheses. *, **, *** denote significance at the 10%, 5%, 1% level respectively.

CONCLUSION

We return to the question: what were the causes of the Industrial Revolution? It is one of the key questions of economic history that is debated intensely. Almost all recent interpretations however take as their starting point an economy that is already highly developed, and characterized by a high level of urbanization, a well-developed commercial infrastructure, a skilled labour force, by international standards high real wages, low interest rates and relatively ‘modern’ institutions, although they may identify different factors which lead to the real industrial break through (Allen 2009, Mokyr 2009). The issue of this paper was to explain how the relatively advanced economy of the 18th century North Sea area came about. This explanation focuses on the Little Divergence, and in particular the strong performance of the North Sea region that drove this process. For the first time in recorded history, levels of GDP per capita surpassed the 1500 dollars (of 1990) threshold, thanks to a process of consistent growth that began in the 14th century. The Industrial Revolution of the late 18th century can be seen as a culmination of this development path (Van Zanden 2009).

We have tested various hypotheses about the causes of the Little Divergence, using new data of, amongst others, human capital formation and the quality of political institutions, and focusing on the explanation of trends in GDP per capita. The results are that we find evidence to confirm hypotheses stressing the importance of human capital formation as the primary driver of the growth that occurred. We were able to find instruments – i.e. Protestantism for human capital formation, the scarcity of land for agricultural productivity, and the coastline-to-area ratio for international trade – to control for measurement error in the independent variables. In addition to this we have shown that the regression results are robust to the use of urbanization as a dependent variable.

The most surprising and perhaps contentious result is that we did not find a strong relationship between our proxy for the development of international trade – the size of the merchant fleet – and economic growth (or urbanization). Only the ‘colonial realm’ variable (estimating the size of the colonized population in relation to the population of the colonial power) had a relatively weak effect on economic development and urbanization. This weak correlation between international trade and growth may of course be due to either weaknesses of the used data (what we really need are systematic and reliable data on international trade flows of this period), or to the fact that trade mattered much less than we usually assume. Until we have the improved data, it will not be possible to answer this question satisfactory.

Concerning the role of international trade our conclusions remain tentative, but we can be firm about the other factors contributing to growth before 1800. Our conclusion that human capital formation contributed to pre-modern growth contrasts with previous research on the topic that argue for an insignificant relationship (e.g. Mitch 1993, Allen 2003 and Reis 2005).

These studies however focussed on using literacy as a proxy of human capital, which is likely to measure only very basic skills (reading and writing abilities). Indeed, our results lend ample support to recent research using proxies for more advanced skills: i.e. book production (Baten and van Zanden 2008) and secondary schooling (Boucekkine et al 2007, 2008). Increases in human capital formation, which were linked to the emergence of the EMP after the Black Death, contributed to the rise of the North Sea region; we also demonstrate that Protestantism was strongly correlated with human capital formation and was via this channel indirectly affecting economic growth. This conclusion moreover supports growth theories that stress the importance of human capital formation for the onset of modern growth (Nelson and Phelps 1966, Schultz 1975, Galor 2011).

APPENDIX I: DATA

Table 9 lists the descriptive statistics of the main variables used in the regression analysis.

	Mean	Standard deviation
Ln per capita GDP	6.97	0.34
Ln per capita GDP, robustness	7.02	0.33
Urbanization ratio	0.09	0.07
Ln Parliamentary activity	2.52	1.66
Share cities self-government	0.66	0.32
Ln Medieval communes p/c	0.95	0.73
Ln Yield ratio	1.65	0.30
Ln Size of the Merchant fleet p/c	5.68	4.95
Ln Book consumption p/c	9.57	2.22
Years at war	0.59	0.51
Latitude	0.56	0.07
Ln Area	11.9	1.04
Enclosures	0.41	0.32
Colonial realm	1.20	0.46

Table 9. Descriptive statistics

APPENDIX II: DATA CONSTRUCTION

Per capita GDP

Observations for Germany, Spain, Italy, Belgium, the Netherlands, England, Sweden, Poland, and Portugal are taken from Bolt and van Zanden (2014). GDP estimates of France, Austria, Switzerland, Ireland, Denmark and Norway are derived from Maddison (2001). The dataset of Maddison gives per capita GDP in 1700 and 1820. The observation for 1750 is interpolated.

Yield ratios

Data is available with intervals of 50 years in Slicher van Bath (1963a, 1963b) and supplemented with data for the 18th and early 19th century by Van Zanden (1998). Observations in the sample thus refer to century averages (e.g. the average yield ratios for 1200-49 and 1250-99 gives the observation for 1300). It was required to make several assumptions. Western Europe: There is no evidence for the period 1700-49. Data for the year 1800 is therefore based upon the yield ratio of 1749-99; Southern Europe: Most assumptions

were necessary for this sub-set of countries, since data is missing for periods 1350-99, 1450-99 and 1550-1649. The observation for 1300 refers to the average yield ratio between 1300-49, 1400 to 1400-49, 1500 to 1400-49, 1600 to 1500-49 and 1700 to 1650-99. Yield ratios of these countries do not vary much over time, which makes these assumptions plausible in our view; Central, Northern and Eastern Europe: Evidence for 1500 is based upon average yield between 1500 and 1549.

Merchant fleets

Estimates of the growth of the European merchant fleet between 1500 and 1800 are taken from Van Zanden (2001). The size of the total fleet (in thousand tons) was 200-250 in 1500, 600-700 in 1600, 1.000-1.100 in 1700 and 3.372 in 1800. The estimates of Unger (1992) are slightly higher, as he approximates its total tonnage at 1.000 in 1600 and 1.500 in 1670. It is decided to choose the lower bound estimates of van Zanden and to take averages (i.e. the size of the total fleet was 225 in 1500). Van Zanden gives regional and national shares of the fleet, which can be found in table 10. These shares are used to calculate individual century observations:

Year	c. 1500	c. 1600	c. 1670	1780
Southern Europe	40?	25?	20?	15
Netherlands	16	33	40	12
Great Britain	10-12	10	12	26
France	?	12	8-14	22
Hanseatic towns	20?	15	10	4
Unspecified	-	5	10-4	21

Table 10. Regional and national share of the merchant fleet, 1500-1800

Notes and sources: Van Zanden (2001). Southern Europe: Spain, Portugal and Italy.

1800: Observations are taken from Romano (1962) that was also the original source of van Zanden (2001). It refers to the year 1786-7. There were no individual observations for Norway and Denmark. These countries are assigned to have had the same amount of tonnage per capita; 1700: Estimations for the Netherlands, Great Britain, France, Germany and southern Europe are based upon the shares in table 7. This is compared with the estimates of Vogel (1915) for the year 1670. Vogel estimates the Dutch fleet around 600 tons, which is too high as 420 tons is more likely. To calculate tonnage of the French fleet, the average of Van Zanden's estimate is taken (i.e. 11%). The share of the fleet in Southern Europe is assumed to be 20% (210 ton in absolute terms). The Venetian fleet increased from 20 tons in 1450 to 60 tons in 1780. The observation for 1700 is linearly interpolated. Unger (1992) assigns the Venetian fleet to 32 tons in 1567, which is in line with the interpolation exercise. Unger measures the fleet of Genoa at 30 tons in 1450 and Romano estimates it at 42 tons in 1786-7, which makes it possible to interpolate the years in-between. Combining the fleet of Venice and Genoa gives the observation for Italy for 1700. Subtracting this from the total fleet of southern Europe offers the estimates for Spain and Portugal. Nonetheless, it should be noted that there are no individual estimations, although it is adjusted to their population levels. 7% of the European fleet is unspecified, of which 5% is assigned to Scandinavia (taking a 2% margin of error into account). Taking the ratio of 1800 for division of tonnage between

Sweden at the one hand, and Denmark and Norway on the other hand, provides the total tonnage of Sweden. The rest is attributed to Denmark and Norway; 1600: Observations are conducted in a similar way by using the shares given in table 7. Unger gives the observation for Venice, and Genoa is interpolated. Taking these two together, gives the observation for Italy. The part that remains (94 tons) is distributed between Spain and Portugal according to their population level. To follow Unger, the Scandinavian fleet increased remarkably after 1670. Since its tonnage was still relatively low at the end of the 17th century, it is assumed that there was no Scandinavian fleet before 1700; 1500: Observations for Germany, southern Europe and Britain are calculated with the help of table 7. In doing so, it is decided to take an average for Britain (11%). Vogel estimates the Dutch fleet around 60 tons by the 1470s, which is too high according to van Zanden. Holland went through a deep recession at the end of the 15th century, and it is therefore likely that the size of the merchant fleet decreased. As this study works with century averages, it is decided to take the average (50 tons) to correct for the depression. Unger provides estimates of the Italian fleet. This is subtracted from the total southern European share and the remaining is assigned to Portugal and Spain. Subtracting all individual observations from the total European tonnage gives the estimate for France (25 tons); 1400 and 1300: Evidence for the Middle Ages is relatively scarce. Unger however gives estimates on trade that produces the observations for England, France and Germany.

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