

Ora et labora? Did the Cistercian work ethic contribute to economic development in the Netherlands?’



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# 1. Introduction

## 1.1. Background

The subject of economic growth and well-being is always on an economist's mind and research on the causes of economic growth and prosperity is both vast and diverse. The most familiar research is on the factors often found in growth accounting: human and physical capital, total factor productivity and technological progress. Whilst research with this focus remains prominent, in the last decades research focused on the cultural and religious aspects of economic performance has gained prominence.

The research on religion and economics has a long history and especially prominent in this respect is *The Protestant Work Ethic and the Spirit of Capitalism*, a book written in 1905 by the renowned German sociologist Max Weber. The book argues that Protestantism largely invented the work ethic that brought forth capitalism. The work ethic was aptly named the Protestant Work Ethic (PWE) by Weber. Weber surmised that work ethic arose because of the Protestant opposition to church authority in favour of individual salvation through divine grace. Since Protestants (especially Calvinists) believe in predestination and since it is impossible to know if God 'predestined' you for salvation, a Protestant would look for signs of divine favour. Economic success was such a sign and it was actively sought by working hard, which is exactly what the Protestant Work Ethic entails. As main elements of the Protestant Work Ethic individualism (through aforementioned individual salvation) and rationalism are mentioned. Even though this 'Weber hypothesis' enjoys wide support, this support is by no means universal. Researchers have noted that Protestantism's main contribution to capitalism may have been Protestants' comparatively high literacy, acquired through Bible reading (Becker & Woesmann, 2007). Even though Weber made a strong case for the PWE as a main contributor to capitalist growth, he did not completely rule out other contributions to the capitalist work ethic and recognised medieval impulses towards rationalisation and thrift predating the Reformation. Indeed we see proto-Protestant sects (often condemned as heresies) emerging, like the Lollards (England), the Hussites (Bohemia) and Bogomils (Bosnia) which condemned the pompous corruption of the late medieval Roman Catholic Church and longed for a simpler lifestyle resembling that of the Early Christians. These sects reveal the first presence of a Puritan ascetism that proved to be so important in informing the Calvinist work ethic.

Weber considered monastic ascetism within mainstream Catholicism as a precursor to Puritan ascetism. Ever since the early days of Christianity monasteries have been places where Christians have sought God through solitude, away from the toils and temptations of the world. Weber, however, makes a distinction between Eastern (Orthodox) monasticism and Occidental (Western, Latin and Catholic) monasticism. The latter form evolved into a systematic spiritual ascetism that combined a desire for contact with God with sober living and the formation of a rationalist mindset in which hard work in the midst of the surrounding community was important. Weber especially mentions the concept of monastic reform (Weber, p. 118), where the eradication of 'lax practices' amongst the brothers of monastic houses provide a new impulse for hard work.

He explicitly mentions the Rule of Benedict and the Cluniac and Cistercian practical reforms of this Rule as important contributors to the rationalisation of medieval life (Weber, p. 72). A paper by Andersen *et al.* (2011) latches onto this statement and investigates the role of the English Cistercians in bringing about the new 'Protestant' work ethic through long term cultural change in pre-Industrial England, which came to full fruition in the centuries after.

The Rule of Benedict promotes hard work combined with praise and prayer to God (popularly

summarised by the well-known Benedictine phrase *ora et labora*, Latin for 'pray and work'). To be able to spend more time in church praising God, the monks of the Cistercian Order sought to make work (the Cistercians were mainly involved in agriculture) more efficient and quick to execute. Though perhaps not as geared towards economic success *per se* as the Puritans, the Cistercians used the goal of praising God as a 'rationale' for working hard. The paper notes another possible contribution of the Cistercians to economic growth beside their ethics. To actually achieve efficiency gains the Cistercians had to be resourceful in their production process. To that end they became a driving force behind technological progress as well. The Andersen paper mentions the Cistercian involvement in developing and spreading the watermill. Wikipedia also mentions the work the English Cistercians did in the field of metallurgy, creating powerful furnaces by the 16<sup>th</sup> century. The article even goes as far as saying that Henry VIII's Dissolution of the Monasteries may have stalled an Industrial Revolution that may have been initiated by Cistercians. The Andersen paper however concludes however that it was the ethics of the Cistercians rather than their technological prowess that influences economic performance.

### **1.2. Aim of the master thesis**

In my master thesis I wish to investigate a possible Cistercian contribution to economic performance through their work ethic by replicating the research done by Andersen *et al.* in the Netherlands, using the variation in the Netherlands' municipalities. The Netherlands makes for a fertile area of study because like England it is known for the strong influence the Reformation had on its national psyche. Unlike England, the Reformation was only partially successful as far as its spread across modern-day Dutch territory is concerned. In fact in North Brabant and Limburg the Catholic Counter-Reformation was more successful than the Reformation and both regions have retained a strong Roman Catholic identity. Compared to England this makes the analysis a bit more complicated but has the added advantage that the presence of a capitalist work ethic (be it Cistercian or Protestant) can be tested against both Protestantism and Cistercian presence (which does not coincide with religious boundaries, with all modern-day Cistercian monasteries in the Netherlands originating no earlier than 1800). As in England the Cistercians in the Netherlands were technologically very active, most notably in land reclamation (with a significant Cistercian contribution in Friesland). This master thesis aims to test the Cistercian theory against the Protestant theory (even though, as Andersen *et al.* stress, they may coexist).

The research question that this thesis seeks to answer is:

**What contribution, if any, did the Cistercian work ethic make to economic growth and development in the Netherlands?**

The following auxiliary questions may help:

1. What are the elements of the Protestant work ethic?
2. What are the elements of the Cistercian work ethic?
3. What is the empirical evidence related to the effects of a Cistercian or Protestant work ethic?

### **1.3. Structure of the thesis**

Now I will lay out the structure of the master's thesis. In chapter 2, I will present the two theories, the Cistercian theory and the Weber theory. Both theories will be discussed in some detail, but since the Weber theory is well known and well read I will focus more on giving a detailed description of the Cistercian theory. In chapter 3, I will present an overview and description of the data used and I will discuss the methodology. In chapter 4 the empirical evidence will be presented and analysed through regressions and finally, in chapter 5, I will draw conclusions from the previous chapters.

## **2. Theory**

As indicated in the introductory chapter, in this chapter the Protestant Work Ethic from Max Weber will be discussed along with the alternative theory I am going to test and which was first suggested by Andersen *et al.*, namely the theory that the Cistercian Order has had a lasting influence on economic development through its work ethic.

### **2.1. Max Weber's Protestant work ethic**

Max Weber starts his 1905 book *The Protestant ethic and the spirit of capitalism* by making a few observations on a phenomenon he finds intriguing: namely that in the Germany of his day the Protestants are overrepresented amongst the business class and factory owners and that Catholics remained underrepresented, even when their status of a persecuted minority made advancement in any other area but commerce difficult or impossible. Weber is quick to dismiss the idea that Protestant economic success is due to a desire for wealth or a *bon vivant* mentality as opposed to a Catholic mentality favouring risk-free contentment with the little blessings that accrue to them in their worldly lives. Instead he finds that people of Reformed (Calvinist) faith seem to combine their strident piety with a well-developed capitalist spirit. But rather than big spenders, Calvinists are noted for their thrift, their aversion towards outward displays of wealth and their inclination to work hard. Whilst defining the spirit of capitalism, Weber notes that characteristic for this spirit is that making money is an end by itself and that it is a duty to engage in making money and, most important, not waste it. Weber makes a sharp distinction between frugality and unscrupulous greed. Greed by itself is not at all helpful for the spread of economic development, because virtues like honesty, industriousness and punctuality are necessary to turn the impulse of making money into a tool of economic progress. The combination of the two duties of making money and possessing virtues like the ones described previously is according to Weber the definition of the spirit of capitalism.

Ascetic Protestantism contributes to this spirit because of the importance it attaches to work. Work was considered to be a calling from God, and not responding to this calling was sinful and to be condemned. Any business opportunity that presented itself was to be considered a sign of divine favour that had better not be refused. What was sinful was not making money and becoming rich, but the idleness that might follow as well as pomp and ostentation. This was a marked shift from the Middle Ages, where making money was the actual sin regardless of any consequence. Calvinism deserves a special mention because, unlike Lutheranism, it did not just simply accepted life as it was but considered the pursuit of profit without hurting anyone to be pleasing to God<sup>1</sup>. Accepting God-given business opportunities and bringing these to fruition all served the purpose, most noticeably in Calvinism, of knowing that one belonged to God's elect.

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<sup>1</sup> Matthew 25:14-28. King James Version.

## **2.2. The asceticism of the Rule of Benedict: the work ethic of the Cistercians**

Weber recognised that elements of asceticism were already present in Western Christianity in the form of monasticism. The main element in monasticism that made it an instrument in economic development was the Rule of St Benedict, written in the 7<sup>th</sup> century AD. Through its combination of prayer, manual labour and intellectual study, the Rule made the Benedictine monasteries a unique presence in medieval society. The importance placed by St Benedict on manual work meant that work became dignified and was seen in a positive light. It also meant that Benedictine monks were called upon to serve the wider community (and monasteries often gave rise to secular communities themselves). Important principles of the Benedictine Order were humility, obedience, personal poverty and moderation, but as the centuries passed the Benedictines surrounded themselves with more splendour to such an extent that many considered the Order to have abandoned some of the more important principles of St Benedict. In 1098 dissatisfied Benedictines looked for a deserted place in Burgundy to found a new community of monks. Their new monastery was based in Cîteaux, in Latin called Cistercium, and soon they applied for and obtained Papal permission to split from the Benedictines and form their own order: the Cistercian Order.

Even though in principle not much different from their Benedictine forbears, the one element that set them apart was an avowed devotion to simplicity as a principle. This principle is comparable to the aversion felt by the ascetic Protestants towards the abuse of wealth. As with the Calvinists the Cistercian focus on simplicity created a community which valued hard work and which was thrifty. It is for that reason that Andersen *et al.* (2011) make a case that Protestant values have pre-Reformation roots.

The difference between the Protestant work ethic and the Cistercian work ethic is motive. Whereas medieval Catholicism, to which the Cistercians belonged, was sceptical towards earning money for its own sake, the Protestant reformers more or less embraced the profit motive. It could be said that the Cistercians did not contribute to the spirit of capitalism in the Weberian sense since they did not accept this motive. However, this does not mean that Cistercians have not contributed to an entrepreneurial vision that enhances economic development. On whether this was due to their liturgy, which too was simple and relatively brief (Bouchard, 1991), or due to their desire to allocate more time to prayer instead of labour (Ovitt, 1986) the sources disagree, but in any case their entrepreneurial ethics allowed the Cistercians to work more efficiently and also to think of ways to produce more efficiently.

Another marked difference between the Cistercian hypothesis and the Weber hypothesis is the manner in which the work ethic spread. The spread of the Protestant work ethic is plain and simple; the ethic is a consequence of the spread of (Reformed) Protestantism itself, and Protestantism spread through preaching, printing and trade. The Cistercian ethic took longer to materialise and was instead facilitated through their operations, which were mainly agricultural. Cistercians had a distinctive preference to found monasteries in remote areas, which in the Netherlands meant that they settled in marshlands. Both in England and in the Netherlands the Cistercians brought land to cultivation. This attracted new economic opportunities and labourers were needed to till the new land. Cultivated land was organised into farmsteads or granges (*uithoven* in Dutch). Even though monastic life at the start of the second millennium was flourishing, the number of monks was but a small percentage of the population and not all people could attain the standard necessary for full monastic life. Therefore the Cistercians worked with lay brothers, so called *conversi*, who had taken vows but were not clerics themselves. This led to a distinction between these more secular *conversi* and the clerical choir monks, with lay brothers being involved in working on and managing much of the landed assets

the monasteries possessed. It is through these lay brothers, and the arrival of secular settlements later on, that the ethics could spread through the wider population.

### 3. Methodology, hypotheses and data

In this chapter the dataset and its properties will be discussed and the methodology will be outlined. The methodology will feature the hypotheses derived from the theories in the previous chapter and a short description of the empirical research strategy. The section on data will provide a detailed discussion on the variables and a description of trends observed during the research. Finally some predictions will be made derived from the properties of the data concerning the instrumental variables.

#### **3.1. Methodology and hypotheses**

In this subsection I will explain the methodology of empirical research. In the previous chapter I discussed two theories which could explain the influence of religious ethics on economic development: the theory of the Protestant work ethic first laid down by Max Weber and the relatively new theory that the Cistercians influenced the ethics of medieval society prior to the Reformation, providing Western Europe with the first impetus towards rationalisation and a capitalistic economic order. Even though our main interest is in the Cistercian theory we cannot ignore the substantial literature on the Protestant work ethic. As a consequence this thesis actually features four hypotheses based on the Weberian literature and the research by Andersen *et al.*: two null hypotheses and two alternative hypotheses.

The first set of hypotheses concerns the Protestant work ethic.

*Null hypothesis 1: The Protestant work ethic does not have a positive effect on economic development.*

*Alternative hypothesis 1: The Protestant work ethic does have a positive effect on economic development.*

The second set concerns the Cistercian work ethic:

*Null hypothesis 2: The Cistercian work ethic does not have a positive effect on economic development.*

*Alternative hypothesis 2: The Cistercian work ethic does have a positive effect on economic development.*

At first OLS regressions will be used to test both hypotheses, but considering the fact that there is possible endogeneity (i.e. Cistercians and Protestants may influence economic development, but economic development may also influence Cistercians and Protestants) two stage least squares (2SLS) regressions will also be performed. To this end I will include instrumental variables designed to explain the origins of a Cistercian or Protestant presence in a municipality. In the first stage of 2SLS these instrumental variables will be included and in the second stage measures for Cistercian and Protestant presence will be included. Furthermore, an OLS regression will be run to ascertain the strength of the instruments. In the next subsection I will discuss the variables used and their role in the upcoming regressions.



### 3.2. Data

In this subsection I will introduce the different variables which I have assembled for research and which make up the dataset. The dataset consists of 402 Dutch municipalities located in Holland, North Brabant, northern Friesland and the Veluwe area of Gelderland. The municipalities are all from the year 1840, when the first detailed census featuring religious affiliation was conducted<sup>2</sup>. The properties and peculiarities of the dataset and its variables will be described below in detail. A quick summary of the descriptive statistics can be found in Table 1 of the appendix.

#### 3.2.1. Dependent variable: population growth between 1500 and 1840

Our main variable of interest and target variable in the regressions is population growth between the 16<sup>th</sup> century and 1840, which serves as a proxy for economic growth as stated above. The assumption behind this is that population growth reveals the relationship between the population of a region or country and the income levels required to support such a population, the so called Malthusian theory of population. In Malthusian terms positive population growth suggests that the income level is sufficiently high for the population to expand (i.e. income levels are above subsistence level). A population growth near zero indicates that income levels are at or near subsistence level. Population decline suggests that income levels are below the level needed for subsistence. In Malthusian thought negative population growth (i.e. a 'Malthusian catastrophe') is a logical consequence in order to re-establish equilibrium<sup>3</sup>. This concludes the short summary of the Malthusian theory of economic growth and provides the reason for the use of population growth as a proxy in this thesis.

Population growth in the dataset was obtained by deriving it from the population in 1840 and in the early 16<sup>th</sup> century.

The population per municipality in 1840 has been directly obtained from that year's population census. The population in the early 16<sup>th</sup> century has been obtained from early 16<sup>th</sup> century provisional censuses conducted on behalf of the feudal lords (*de facto* the Habsburgs) for tax assessment. In the year 1508 the so called *Aanbreng* was conducted for Friesland (Friesch Genootschap van Geschied-, Oudheid- en Taalkunde, 1880), in 1514 the *Informacie* was conducted for Holland (Fruin, 1866) and a similar census was conducted in 1526 for Brabant (Cuvelier, 1912). For the Veluwe quarter of Gelderland, population data have been obtained from a study on the number of cattle which also happens to list the estimated population of the different villages in the area (Roessingh, 1964).

With the exception of the study by Roessingh, no actual or estimated population figures are mentioned in the censuses. Rather, as was the norm in those times, the number of hearths or homes was counted and assessed. From these numbers we need to estimate the number of people resident in the different towns and villages. Faber (1972, p. 23) estimates, using Mols (1954) as a reference, that the number of people per hearth was 5 in the cities and 5.5 in the countryside for both Holland and Friesland. Van der Woude (2000) arrives at similar estimates

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<sup>2</sup> This is relevant for the measure for Protestants

<sup>3</sup> Malthus assumed that the growth of a sustainable income level in an agrarian economy was arithmetic (due to constraints on available land) and population growth was geometric, which means that population growth would cause diminishing returns on income. These diminishing returns would depress income back to subsistence levels in the long run. Next to diminishing returns on income the 'Malthusian catastrophe' is the other necessary ingredient for long run equilibrium. Some economists disagree on the prevalence of a Malthusian equilibrium prior to 1800 and posit that it is an exceptional and hypothetical possibility (Persson, 2008).

for Holland.

The situation in Friesland is more complicated. Here the census does not list hearths, but reported persons and their landed assets. Faber (1972, p. 22) notes that for rural area's in Friesland the number of persons recorded does not match the total, since only farmsteads have been recorded. Using the example of Faber on Idaarderadeel, along with his estimate of people per hearth and an examination for census data on Leeuwarden, I assume that the ratio of hearths per reported person is 1.22 in the cities (of Leeuwarden and Dokkum) and 0.322 in the rural areas of Friesland. A final complicating factor for Friesland is that the census is not complete, with several municipalities facing severe underreporting of their 1508 population.

I have not found literature to establish assumptions on the number of persons per hearth for Brabant but after consulting several online resources<sup>4 5 6</sup> I can conclude that it is likely that in Brabant the estimate for both cities and countryside should be 5.

When we look at the geographical distribution of population growth it becomes apparent that there was near universal population growth in the Netherlands. In only 25 municipalities there was negative population growth. In terms of their geographical spread no clear pattern is visible, except that most of these municipalities are either rural or remote. In about half of the municipalities in the dataset population has more than doubled. High population growth is concentrated in the large cities like Rotterdam and Amsterdam, which registered a population increase of 1569 per cent. Smaller towns in Holland near the large cities are also overrepresented in this group of high growers. Friesland too seems to be a region with very high population growth and includes the two municipalities with the highest population growth, Menaldumadeel and Wonseradeel (with a growth of no less than 10000 per cent!). The large population growth registered in Friesland is probably biased due to the fact that the census data from Friesland suffers from underreporting issues. How large this effect is, is not verifiable. It is clear however that Menaldumadeel and Wonseradeel should be treated as outliers.

### **3.2.2. The key independent variables: Cistercian share and Protestant share**

The next variables I will discuss are the key variables pertaining to the Cistercian hypothesis and the Weber hypothesis. Since a work ethic consists of a set of immeasurable ideas, measures for Cistercian presence and Protestant presence have been created. I have established a measure of Cistercian presence by using a database from the Free University of Amsterdam's Arts Faculty<sup>7</sup> listing all the monasteries on modern-day Dutch territory extant in the early 16<sup>th</sup> century. This database is based on the *Monasticon Batavum* by Schoengen (1941, 1942). This is a secondary source, but by cross-referencing it with the *Oorkondenboek van Holland and Zeeland* by Kruisheer (1986, 1992, 1997) as well as from looking at samples from the *Informacie* I have been able to ascertain that the database is fairly accurate for the period<sup>8</sup>. The Cistercian presence is measured by the share of religious houses in a town or village that is Cistercian. It must be noted

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<sup>4</sup> [http://nl.wikipedia.org/wiki/Antwerpen\\_\(stad\)](http://nl.wikipedia.org/wiki/Antwerpen_(stad))

<sup>5</sup> <http://www.dhondtinwaas.be/Leefwereld/Geografie/Rijkevorsel.html>

<sup>6</sup> <http://www.deplaets.nl/geschiedenis.html>

<sup>7</sup> <http://www2.let.vu.nl/oz/kloosterlijst/kres.php>

<sup>8</sup> The aldermen of the cities of Holland were meticulous in listing monasteries when questioned by the *Informacie* censurers. Fruin (1866) features the tally of monasteries for Amsterdam (pp. 80-81). Comparison with the Free University database shows that all can be found therein. Tallies with similar levels of accuracy are found for Leiden (pp. 243-244), Delft (p. 336), Gouda (p. 384), Rotterdam (p. 467) and Schiedam (p.475). A rural reference is the island of Texel (p. 151), where the censurers find only a single monastery (devoted to St Agnes). The database indeed shows one monastery dedicated to said saint. Rural aldermen often reported the absence of monasteries with 'geen cloosters die aldaer lant bruycken'

that many small villages in the dataset do not have any monasteries at all. Dummy variables have also been created for the presence of a monastery and of a Cistercian monastery in particular.

An review of the Cistercian monasteries in the dataset reveals that 17 Cistercian monasteries are present in the dataset, with 6 of these being located in Friesland, 1 in Brabant (Helmond) and the remaining 10 in Holland. Most Cistercian monasteries are located near other monasteries. In Holland they are found in smaller towns, such as Heusden, Monnickendam, or on land ceded by nobles (the Cistercian abbey of Wateringen was located in the 'Hof van Wateringen', a castle), whereas in Friesland Cistercian abbeys were located in and very much dominated the countryside. A review of all Cistercian monasteries in the Netherlands, including those located in a municipality not included in the dataset<sup>9 10</sup>, shows that other hotbeds of Cistercian activity were Groningen and, to a lesser extent, Zeeland. It should be noted that all of the provinces of the Netherlands contained at least one Cistercian monastery.

Accessing data on the spread of 16<sup>th</sup> century Protestantism has proven to be impossible. The turmoil surrounding the Eighty Years War made many people weary of reporting their true religious affiliation. Whilst it is known that there were many sympathizers of the Reformed religion (Knippenberg, 1992, p. 23), quantifying them has proven to be difficult and the records of actual members (*lidmaten*) are either non-existent or in poor shape (Bergsma, 1999, p. 99). Unsatisfactory as it may be, I have been forced to rely on absolute and relative numbers of Protestants reported in the 1840 census. I assume that in the centuries between 1600 and 1840 the relative shares of the Protestant and Catholic population have not changed much, even though this may not be so in certain regions.

The strongholds of Protestantism in the 1840 were the municipalities of the Alblasserwaard, where all residents registered themselves as Protestants. Areas where over 95 per cent of the population registered as Protestant are located in the Veluwe area and northeastern Friesland. When we take a look at the municipalities where over 80 per cent of the population registered themselves as Protestants the pattern barely changes, except that municipalities in the Land of Heusden and Altena<sup>11</sup>, the Zaanstreek and some larger towns such as Vlaardingen, Apeldoorn and Dordrecht are now listed. It is striking that the most Protestant municipalities are located in the area where the *Nadere Reformatie*, an orthodox Protestant movement of religious awakening, drew a lot of support. Many of these municipalities have remained strongholds of orthodox Protestantism well into the 21<sup>st</sup> century.

### **3.2.3. Possible exogenous instrumental variables for Cistercians**

Another set of variables are the exogenous instrumental variables for a Cistercian or Protestant presence, which will feature prominently in the 2SLS regressions and in the OLS regressions ascertaining the strength of these instruments.

For the Cistercians I have been kindly forwarded data used in a study by Bosker & Buringh (2010) on the origin and development of cities in medieval Europe. They distinguish two sets of factors that explain the development of European cities. So called 1<sup>st</sup> nature geography variables

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<sup>9</sup> Due to lack of census data

<sup>10</sup> Cistercian monasteries which are part of the dataset were located in the 1840 municipalities of Achtkarspelen; Alblas; Dantumadeel; Eethen, Meeuwen en Heesbeen; Ferwerderadeel; Haarlem; Helmond; Heusden; Monnickendam; Monster; Noordwijk; Oostdongeradeel; Oudheusden, Elshout en Hulten; Warmond; Wateringen; Wonseradeel and Wymbritseradeel.

<sup>11</sup> An area of North Brabant located between Maas and Merwede which, unlike the rest of North Brabant, has a distinctly Protestant character

and so called 2<sup>nd</sup> nature geography variables. 1<sup>st</sup> nature variables involve characteristics found in the natural environment that were instrumental in the foundation of cities in the Early Middle Ages such as the location near a river (*rivier*), the location near a Roman road (*romanroad*), whether a locality is located at sea or not (*sea*), elevation (*hoogte (m)*) and the cultivation potential of the land (*cultivationpotential*).

2<sup>nd</sup> nature variables include the influence of early urban development on subsequent urban development and help explain the growth of the early medieval settlement during the High Middle Ages. 2<sup>nd</sup> nature data are not part of the dataset and this thesis will focus on the 1<sup>st</sup> nature variables, which I will now discuss in detail.

During the Migration Period (5<sup>th</sup> century AD) urban civilisation in northwestern Europe collapsed, only at the crossroads of major Roman roads were settlements able to maintain a semblance of urban culture. It were these surviving settlements that would form the backbone of urban resurgence at the dawn of the second millennium and many of those settlements are the oldest towns in the Netherlands<sup>12</sup>. In this dataset *romanroad* is a dummy variable that takes the value 1 when a municipality is located near or on an ancient Roman road according to the Barrington Atlas.

Not to be underestimated is the importance of seaborne activity to the continued survival and growth of early medieval towns. As the main Roman roads decayed through lack of maintenance, waterways became the only means of quick transport and the main conduit for trade. *Sea* in the dataset is a dummy variable that takes the value 1 if a municipality is at the North Sea or Zuiderzee. *Rivier* is a dummy variable as well, which takes the value 1 if a municipality is located near any river (this includes major waterways like the Maas or Rhine, but also small brooks and streams like the Linge, the Mark or the Dommel).

Elevation is included because of the conventional wisdom that agriculture is more difficult at higher altitudes, but whether elevation has any effect in a low-lying area like the Netherlands is doubtful. Elevation is measured by elevation in metres from sea level, which means that due to Dutch geography elevation below sea level is present in the dataset. These municipalities are mainly located in the coastal areas of Friesland and in Holland. Municipalities with higher elevation are found in the Veluwe area.

The final 1<sup>st</sup> nature variable to be described is *cultivationpotential*. This variable captures the agricultural potential and quality of the soil, which depends on the kind of soil and the impact of climate and weather on it. *Cultivation potential* is measured on a scale of 0.000 to 1.000, with 0.000 being soil with a low cultivation potential and 1.000 being soil with high cultivation potential. Municipalities with high cultivation potential are mainly found in areas where the soil consists of marine clay, which is highly fertile due to the fact that this soil is sturdy and can easily retain water. The utmost north of Holland (near Alkmaar and Den Helder) and coastal Friesland have marine clay soil and have the highest cultivation potential in the dataset. Brabant's soil is very sandy, which makes it difficult for plants and crops to take root. It is no surprise that the municipalities of Brabant have the lowest cultivation potential in the entire dataset. A map of the cultivation potential is shown in appendix section C<sup>13</sup>.

The theory connecting the Cistercians to the 1<sup>st</sup> nature variables of Bosker and Buringh is as follows. The Cistercian Order was founded at the dawn of the High Middle Ages. The monks of the order strived for a communal life in relative isolation from the hustle and bustle of daily life

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<sup>12</sup> Leiden, Utrecht, Nijmegen and Maastricht all have their origins in the Roman era and their location along the militarized border (with its road system) contributed greatly to their survival

<sup>13</sup> For maps showing the composition of Dutch soil, I refer to Wolters-Noordhoffs Grote Bosatlas, 53<sup>rd</sup> edition (pp. 44-45)

whilst at the same time seeking to live of the work of their own hands. As it were the Cistercians were already predisposed to settle *away* from the towns and the elements in the landscape that would contribute to urban development. The settlement away from high measures of 1<sup>st</sup> nature variables is further compounded by the fact that the cities had indeed sprung up by the year 1100 (as Bosker and Buringh suggest) near 1<sup>st</sup> nature variables, forcing the Cistercians to settle on marginal and lower quality lands.

### **3.2.4. Possible exogenous instrumental variables for Protestantism**

Possible instruments for Protestantism can be discerned by studying relevant literature. Specialist literature by MacCulloch (2005) as well as a study on European book production by Buringh & Van Zanden (2009, p. 435) suggest that literacy and book production are closely related to Protestantism. Some risk for endogeneity exists, especially for literacy (see Becker & Woessmann, 2009), but it can be safely assumed that Protestantism is hardly the only or even the main mechanism through which literacy developed. Equally important is the role of trade. Trade is also one possible exogenous variable and seems plausible given that Duke (1990) posits that Protestantism's appeal in the Low Countries was strong in industrialised towns and very small in the relatively poorly industrialised and poorly connected countryside.

Data on literacy is rare and difficult to find for the Low Countries before 1600. Some data has been found through Ackomak, Webbink & Weel (2011). In their study on the effects of the Brethren of Common Life (another religious order) on the development of literacy, they use data on the literacy of 34 cities in the Dutch Republic from the year 1600 onwards. The primary source is the Amsterdam marriage archives and literacy has been defined as the ability to sign marriage certificates with one's own name. 17 out of 34 towns are also in my dataset. The downside of this variable in the context of this thesis is that this measure lies 100 years too much into the future and the small number of observations relative to the total dataset (17 out of 402). Unfortunately, expanding the variable with more observations is extremely difficult because of the paucity of the data and the fact that literacy was very much an urban phenomenon.

The latter disadvantage also applies to our measure of book production in the Netherlands, which is the number of printers active between 1440 and 1520. 11 towns in my dataset have early printing activity, most of them located in the large towns of Holland (Leiden, Gouda, Delft, Haarlem and Amsterdam). It can be safely assumed that in the rest of the country there was no meaningful printing activity.

### **3.3. Predictions regarding instruments**

Based on the description of the data in the previous subsection I will make the following predictions on the correlation of instruments with a Cistercian or Protestant presence.

*Prediction 1: The correlation between Cistercian presence and 1<sup>st</sup> nature variables is both significant and negative with the exception of hoogte (m), which is positive.*

*Prediction 2: The correlation between Protestant presence on the one hand and literacy, early printing activity and population density in early 16<sup>th</sup> century is significant and positive.*

## **4. Regressions**

In this chapter I will provide the results of the empirical analysis by means of regressions. Four main series of regressions will be discussed.

The first series features several ordinary least squares regressions in which population growth between the 16<sup>th</sup> century and 1840 is regressed on the share of Cistercian monasteries and the share of Protestants. The results of these regressions can be found in Table 2 in the appendix.

The second series features ordinary least squares regressions in which the share of monasteries which are Cistercian (*cistercianshare*) is regressed on instrumental variables which are composed of Bosker's 1<sup>st</sup> nature variables and dummies for the different jurisdictions (Holland, Brabant, Gelderland and Friesland). It must be noted that Holland has not been included in the regression to prevent collinearity errors from stopping the execution of the regressions in SPSS. The results of these regressions can be found in Table 3 in the appendix.

The third series of regressions features ordinary least squares regression in which the share of Protestants (*protestantshare*) is regressed on the instruments for Protestantism: population density in the early 16<sup>th</sup> century (*popdens1500s*), the number of printers in the period between 1440 and 1520 (*numberofprinters14401520*). These dates are the advent of printing and the start of the (Lutheran) Reformation respectively. The final instrumental variable underpinning Protestantism is literacy in 1600 (*literacy1600*), which will not be featured in all the regressions in this series. The results of the regressions with the share of Protestants as a dependent variable can be found in Table 4 in the appendix.

The final series of regressions features two stage least squares regressions with population growth as a dependent variable, the share of Cistercian monasteries and the share of Protestants as explanatory variables and the instrumental variables of both as instruments (which will not all be included as will be explained in further detail below). The results of these regressions can be found in Table 5 in the appendix.

I will discuss the different (series of) regressions and their results in further detail in the following paragraphs.

#### **4.1. OLS regressions: population growth regressed on Cistercian share and Protestant share**

Table 2 in the appendix lists the results and other relevant specifics of three distinct regressions, all featuring population growth between the 16<sup>th</sup> century and 1840 as a dependent variable and the share of Cistercian monasteries and the share of Protestants as independent variables. Regression (1) shows the results when all 402 observations in the dataset are taken in to account. The results show that both *cistercianshare* and *protestantshare* are significant, at a 5 % and 10 % level respectively, with population growth increasing by around 670 percentage points when the share of a monastery which is Cistercian increases by 1 percentage point. When the share of Protestants increases by 1 percentage point, population growth increases by around 3.4 percentage points. The explanatory power of the model is not very strong, however, with only 18.5 % of all variation in the data being explained by the model. Furthermore, this regression includes the municipalities of Menaldumadeel and Wonseradeel in the underlying dataset, both of which are considered outliers.

Regression (2) is run without these two outliers and the number of observations is reduced to 400. The results are affected by this reduction. Now *cistercianshare* is no longer significant, whereas *protestantshare* is still significant at a 10 % level. If the share of Protestants increases by 1 percentage point, the population increases with roughly 2 percentage points. The explanatory power of the model is increased, with 26.8 % of all variation explained by the variables entered.

To make these results even more robust, regression (3) shows the results for the same variables if only the locations with religious houses are included and the aforementioned outliers excluded. The number of observations is reduced to 94. The variable *cistercianshare* is insignificant and *protestantshare* remains significant at the 10 % level. If the share of Protestants

increases with 1 percentage point, population growth between the early 16<sup>th</sup> century and 1840 increased with about 3 percentage points. By reducing the number of observations to include only towns with religious houses, the explanatory power of the model is further increased with about 31.8 % of the data variation being explained by the entered variables.

The conclusion of this series of regressions is that a link between Cistercians and population growth (and thus economic development) is very tenuous and only present when all observations, including outliers, are taken into account. When the two outliers, Wonseradeel and Menaldumadeel, are excluded the positive relationship disappears. This is likely due to the fact that Wonseradeel was home to a Cistercian monastery as well as it having had abnormal population growth (hence its status as an outlier). Reducing the number of observations further to include only religious houses does not cause large changes in the conclusions reached in regression (2), but reducing the number of observations does reinforce the explanatory power of the model, first from 18.5% to 26.8% and then even further to 31.8%.

The positive relationship between Protestants and economic development is established throughout and lends further credence to the hypothesis of Max Weber that Protestantism cause economic development. However, it should be noted that only 31.8% at best is explained by the variables entered, which means that Protestantism is not amongst the factors with the highest influence on population growth.

#### **4.2. OLS regression: Cistercian share on exogenous instrumental variables**

It is also necessary to ascertain the power of the exogenous instrumental variables used in order to exclude endogeneity from the analysis. I will first do this with the exogenous instruments used to explain the presence of the Cistercians. The results of three regressions are found in Table 3 of the appendix. This includes the 1<sup>st</sup> nature data forwarded by Bosker as well as the 'jurisdiction' dummies. Regression (1) once again includes all 402 observations and shows that all of the exogenous instrumental variables are insignificant with the exception of the proximity to an ancient Roman road and the jurisdiction dummy of Friesland. The Roman road is significant at the 5 % level and shows that when a location is located near an ancient Roman road *cistercianship* increases by 7 % points. Note that the sign is contrary to prediction 1 in the previous chapter. A reason for this may be that several Cistercian monasteries in Holland are located relatively close to Voorburg, which was an old Roman town known as Forum Hadriani in ancient times and thus the focal point of a Roman road. A location in Friesland is even more significant (at the 10 % level) and being located in Friesland increases *cistercianship* by 16.2 percentage points. This relationship is hardly surprising considering the fact that most Cistercian monasteries in the Netherlands prior to the Reformation were located in Friesland. It is not clear why this is the case, but it may be due to the fact that the power of the nobility was weaker in Friesland than elsewhere in the Netherlands, considering the fact that Friesland did not have a single feudal lord (such as a Count of Duke). Also contrary to the modern image of the province, medieval Friesland was wealthy and rich in agricultural land. This too runs counter to the idea that Cistercians settled on marginal lands. The explanatory power of regression (1) is moderately strong, with about 29 % of the data variation explained by the variables.

Regression (2) once again excludes the familiar outliers and reduces the number of observations to 400. Changes in the coefficients are minimal with Friesland's coefficient increasing slightly and with the explanatory power slightly reduced (to 28%).

When we reduce the number of observations further by including only religious houses in the sample (regression (3)), being located in Friesland is no longer significant, whereas the relationship between a Roman road and *cistercianship* has not grown more significant but has increased in strength. Now a location on a Roman road increased the *cistercianship* with 20

percentage points. Explanatory power has increased to 35.9 %. This is substantial but still 64.1 % of all variation in the data is explained by other variables than those included in the regression. The conclusion from this series of regressions is that the results are not consistent with prediction 1 and that the variables included are not the best possible instruments for the exogenous causes of Cistercian presence. Unfortunately this also means that we need to reckon with the presence of considerable endogeneity when drawing conclusions.

#### **4.3. OLS regressions: Protestant share on exogenous instrumental variables**

The third series of regressions seeks to ascertain the power of the exogenous instrumental variables that seek to explain the presence of Protestantism. The results are presented in six regressions in Table 4. Regressions (1) and (2) do not a priori exclude any observations, regressions (3) and (4) exclude the familiar outliers (resulting in 346 observations) and regressions (5) and (6) only include locations with religious houses (90 observations). Regressions (1), (3) and (5) feature *popdensity1500s*, *numberofprinters14401520* and *literacy1600*. Regressions (2), (4) and (6) exclude *literacy1600* as a variable because of the low number of observations associated with regressions (1), (3) and (5). Regression (1) yields exactly the same results as regressions (3) and (5), due to the fact that only 16 observations are included all of which are towns with monasteries and no outliers. For the sake of thoroughness these regressions have been included in the table. The result is that the conclusions of regression (1) can be directly applied to regressions (3) and (5). Regression (1) included 348 variables, which is due to the fact that *popdensity1500s* has been included<sup>14</sup>. Because the first data on surface area have only been available since 1899<sup>15</sup>, several municipalities (mainly in South Holland) have missing values for this variable due to municipal redistricting since 1840. Regression (1) does not yield any significant variables which is a disappointment from the perspective of eliminating endogeneity from the analysis. Even so from an empirical point of view the results are still intriguing. Buringh & van Zanden (2009) emphatically state that a strong link between Protestantism on the one hand and literacy and book production on the other hand exists, but this regression finds strong negative relationships between Protestantism and literacy and printers. However, this result does not in any way invalidate the statement of Buringh & van Zanden because of the small number of observations involved. There are many missing values in the dataset for *literacy1600* because of the lack of data from rural areas (which composed around 85 to 90 percent of all the data). For the number of printers the exact distribution is confidently established with all printers concentrated in the towns of Holland and in 's-Hertogenbosch in Brabant. There are no missing values here but variation outside of the towns is virtually non-existent, which leads me to suspect that with a more coherent and geographically diverse dataset the expected signs and significance may have been revealed. There is also no significant link between Protestantism and population density in the early 16<sup>th</sup> century and the insignificant link is very weak.

One important difference of regression (2) with respect to regression (1), which also carries over to regressions (4) and (6), is that the sign on the (insignificant) relationship between the number of printers and Protestantism has changed into a positive sign. This is consistent with the established consensus that a positive relationship between Protestantism and printing exists, but the level of significance established does not enable us to treat this as an accepted fact in

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<sup>14</sup> Population density has been computed by dividing the (estimated) population by the surface area in square kilometers

<sup>15</sup> The data on 1899 surface area per municipality can be found at:  
[http://www.volkstelling1899.nl/t\\_aanh.htm](http://www.volkstelling1899.nl/t_aanh.htm)



the context of this thesis.

Regressions (4) and (6) are very similar to (2), except that the coefficient on printers varies in size, but not in sign.

In terms of explanatory power regressions (1), (3) and (5) are very strong (51.3 % of all variation is explained by variables entered), but the ability to infer credible conclusion from these is severely diminished by the small number of observations reported. Explanatory power of regressions (2), (4) and (6) is low (between 6% and 7.4 %).

The conclusion with regard to this series of regressions is that results are not consistent with prediction 2 and that once again, as far as Protestantism is concerned, endogeneity has not been satisfactorily eliminated. This means that we need to thread carefully when inferring conclusions on Protestantism and economic development through population growth.

#### **4.4. 2SLS regressions**

The final series of regressions, found in Table 5 of the appendix, consists of two stage least squares regressions to take the impact of *cistercianshare* and *protestantshare* into account as well as any exogenous instruments that may cause Cistercian or Protestant presence. All instruments mentioned in tables 3 and 4 are present except when indicated otherwise. Once more there are six regressions and again regressions (1) and (2) include all 402 observations, regression (3) and (4) all observations minus the familiar outliers and (5) and (6) include only towns with religious houses present. In regressions (2), (4) and (6) *literacy1600* has again been excluded on account of the impact it has on the number of observations.

Regression (1), again identical to (3) and (5), shows that there is a large but insignificant negative relationship between *cistercianshare* and population growth between the early 16<sup>th</sup> century and 1840. An extremely small positive relationship between Protestantism and population growth has been detected, but it is insignificant. The number of observations in this regression is 16 and the explanatory power is small with only 4 % of variation explained by the variables entered into the regression.

Regression (2), which excludes *literacy1600* and increases the number of observations to 348, shows a positive and strong relationship between the Cistercians and population growth which is significant at the 1 % level. An increase of *cistercianshare* by 1 % increases population growth by no less than 9700 percent, which is without a doubt due to the presence in the sample of the two familiar outliers. The relationship between Protestantism on the one hand and population growth on the other is negligible and insignificant. The explanatory power of the model is relatively weak with 6.1% of all variation explained by the model.

In regression (4) the exclusion of the outliers leads to a relationship between Cistercians and population growth that is still strongly positive and significant at the 1 % level. An increase of *cistercianshare* causes population growth to increase with 2700 %. The main difference with regression (2) is that the relationship between Protestantism and population growth is now positive and significant at the 10 % level. An increase in the share of Protestants by 1 percentage point leads to increase in population growth of 1.7 percentage points. The explanatory power remains small with 8.6 % of the variation explained by the model.

Regression (6), which includes only towns with religious houses and features 90 observations, reveals that the strong positive relationship between Cistercians and population growth that existed in regression (2) and (4) is no longer significant. The relationship between Protestantism and population growth is now significant at a 5 % level. An increase in Protestantism by 1 percentage point leads to an increase of 3.8 percentage points on average. The explanatory power of this regression is relatively high compare to regression (2) and (4), with 15.4 % of all variation in the data explained by the model. This is still quite small and leaves plenty of room

for a relationship between population growth and other factors than Cistercians or Protestants, for example the early development of rural industry in Holland due to high agricultural wages as suggested by Van Bavel & Van Zanden (2004).

It has become clear that the regressions have not been able to take away the concern of endogeneity in the data either, because there are large discrepancies between the OLS regressions in Table 2 and the 2SLS regressions in Table 5. The reason that endogeneity concerns have proven unable to be eliminated is due to the relatively poor instruments for the exogenous variables that ought to explain the presence of Cistercians and Protestants. In both instances, but especially concerning the Protestants, the instruments have not been sufficiently able to explain their presence. Better instruments may be necessary in potential subsequent research and it may also be advisable to extend the geographical spread of the research to increase the amount of data (variation) available.

## 5. Conclusions

In this section I seek to answer the questions posed in the introductory chapter of this thesis. First I will briefly summarise the theories by answering the first two auxiliary questions.

### **What are the elements of the Protestant work ethic?**

The elements of the Protestant work ethic that make it an important contender as a factor of economic development is its unique religious perspective on the profit motive. Unlike in mainstream medieval Catholicism, there was no stigma attached to making money. Rather an important spiritual concept such as a calling from God turned profit into an aspect of moral good. Paying heed to the call from God and excelling in it were, to a Protestant, signs of divine grace and signals that one was part of God's elect. The Protestant work ethic guarded against greed and extravagance by invoking God's displeasure at waste, which ensure that making money was to the benefit of not only the rich.

### **What are the elements of the Cistercian work ethic?**

The Cistercians' devotion to the Rule of St Benedict had little to do with making profit for its own sake. Indeed, the Cistercians were very much part of mainstream medieval Catholicism. Rather through the focus on the combination of hard work and prayer and contemplation does the Benedictine mantra of *ora et labora* become a serious contender as a factor of economic development. Through their desire to work more efficiently and to spend more time in prayer and meditation as well as their system of lay brothers and granges the Cistercians had set up a system through which their ethics could penetrate surrounding society.

### **What is the empirical evidence related to the Cistercian or Protestant work ethic?**

Null hypothesis 1 (on the effect of Protestantism) is rejected in most regressions, which provides evidence and support for Weber's hypothesis on the effects of a Protestant work ethic. In OLS robustly positive and highly significant coefficients are found and in 2SLS only when outliers are not controlled for (regression 2) and when the number of observations was low (e.g. when literacy was included), did a significant and positive coefficient not appear. When not controlled for outliers both OLS and 2SLS regressions show large positive and

significant coefficients for Cistercian presence. However, when controls are imposed on outliers and for religious houses, the coefficients become insignificant even though in most of the regressions the substantial positive effect remains. The only exception to this occurs when literacy is included in 2SLS regressions, but since the number of observations (16) is rather low, these coefficients can be safely dismissed. The conclusion is that null hypothesis 2 (on the Cistercian work ethic) cannot be safely rejected.

With regards to the strength of the conclusions it should be noted that the problem of endogeneity has not been satisfactorily resolved, as is revealed by the large discrepancies between OLS and 2SLS regressions. It is therefore possible that a Cistercian or Protestant presence is itself caused by population growth.

I now conclude this master thesis by answering the main question of this thesis, which reads:

**What contribution, if any, did the Cistercian work ethic make to economic growth and development in the Netherlands?**

From the empirical evidence presented in the previous paragraph, it must be concluded that no evidence of any Cistercian contribution to economic growth and development in the Netherlands has been found, be it positive or negative. This means that this thesis can neither confirm nor decisively deny, for the Netherlands, the hypothesis that a Cistercian work ethic has a positive influence on economic development as proven for England by Andersen *et al.* (2011). This thesis does confirm the positive influence of Weber's Protestant work ethic on economic growth and development. The inconclusive evidence on the influence of the Cistercians on economic development does still offer the prospect of further macroeconomic research into the matter, either by studying a different geographical area and/or by enhancing the dataset used in the analysis.

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## Appendix

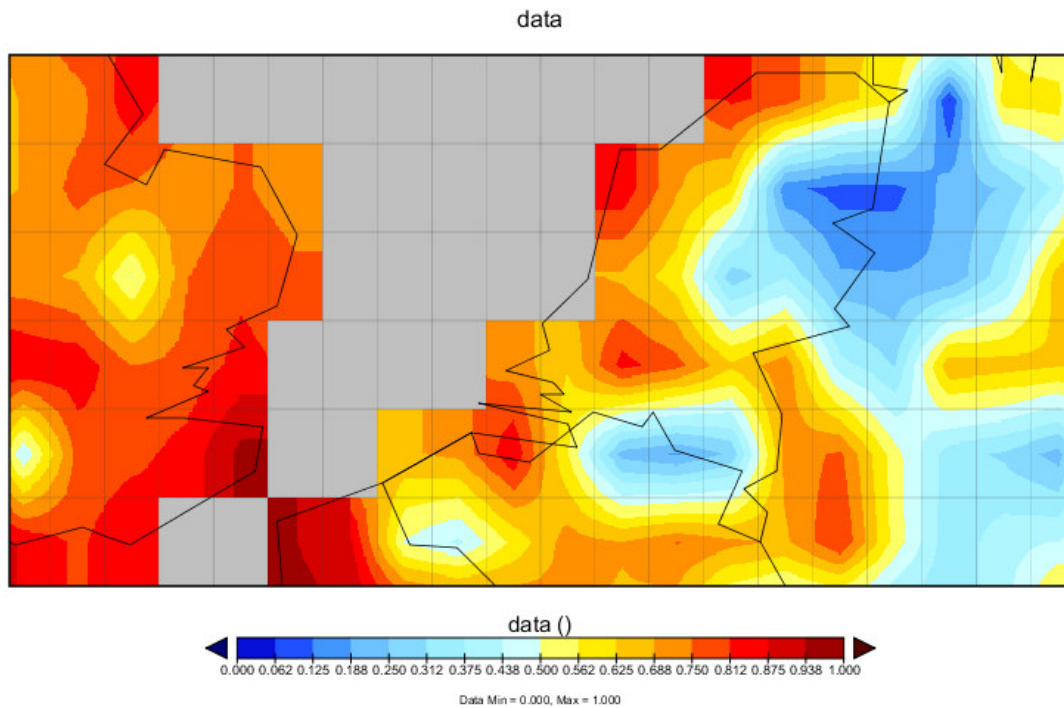
### A. Descriptive statistics

**Table 1: Descriptive statistics**

|                                              | N   | Minimum | Maximum  | Mean     | Std.<br>Deviation |
|----------------------------------------------|-----|---------|----------|----------|-------------------|
| <i>holland</i>                               | 402 | 0       | 1        | 0.66     | 0.473             |
| <i>friesland</i>                             | 402 | 0       | 1        | 0.04     | 0.190             |
| <i>brabant</i>                               | 402 | 0       | 1        | 0.25     | 0.432             |
| <i> gelderland</i>                           | 402 | 0       | 1        | 0.05     | 0.223             |
| <i>rivier</i>                                | 402 | 0       | 1        | 0.34     | 0.476             |
| <i>romanroad</i>                             | 402 | 0       | 1        | 0.06     | 0.232             |
| <i>zee</i>                                   | 402 | 0       | 1        | 0.16     | 0.364             |
| <i>hoogte (m)</i>                            | 402 | -5      | 62       | 3.74     | 8.736             |
| <i>cultivationpotential</i>                  | 402 | 0.281   | 0.844    | 0.66867  | 0.137006          |
| <i>number of religious houses</i>            | 402 | 0       | 23       | 0.76     | 2.550             |
| <i>number of cistercian religious houses</i> | 402 | 0       | 1        | 0.04     | 0.201             |
| <i>cistercianshare</i>                       | 402 | 0.000   | 1.000    | 0.02347  | 0.128596          |
| <i>surfacearea</i>                           | 349 | 0.33    | 341.25   | 30.4194  | 38.57342          |
| <i>numberofhearths1500</i>                   | 382 | 6       | 3921     | 209.62   | 406.683           |
| <i>population1500s</i>                       | 402 | 33      | 19605    | 1108.65  | 1998.654          |
| <i>population1840</i>                        | 402 | 16      | 211349   | 3311.57  | 12019.745         |
| <i>protestants1840</i>                       | 402 | 0       | 143123   | 1932.60  | 8170.404          |
| <i>catholics1840</i>                         | 402 | 0       | 44858    | 1278.80  | 3149.016          |
| <i>protestantshare</i>                       | 402 | 0.00    | 100.00   | 53.0764  | 37.75224          |
| <i>catholicshare</i>                         | 402 | 0.00    | 100.00   | 46.1191  | 37.91940          |
| <i>populationgrowth15001840</i>              | 402 | -93.39  | 12915,15 | 286.2858 | 861.55640         |
| <i>literacy1600</i>                          | 17  | 0.44    | 0.79     | 0.6459   | 0.08375           |
| <i>popdensity1500s</i>                       | 349 | 0.42    | 6106.06  | 123.8223 | 472.64673         |
| <i>numberofprinters14401520</i>              | 402 | 0       | 8        | 0.10     | 0.715             |
| <i>religioushousesdummy</i>                  | 402 | 0       | 1        | 0.24     | 0.428             |
| <i>cisterciandummy</i>                       | 402 | 0       | 1        | 0.04     | 0.201             |
| <i>printerdummy</i>                          | 402 | 0       | 1        | 0.03     | 0.163             |
| Valid N (listwise)                           | 14  |         |          |          |                   |

Source: SPSS

**B. Figures**



**Figure 1:** a map showing cultivation potential in the Netherlands.

[http://www.sage.wisc.edu/iamdata/grid\\_data\\_sel.php?grid\\_format=image&done=Select+Dataset](http://www.sage.wisc.edu/iamdata/grid_data_sel.php?grid_format=image&done=Select+Dataset)

### C. Regressions

**Table 2: OLS estimations, hypotheses and population growth**

|                                                      | (1)                    | (2)                  | (3)                  |
|------------------------------------------------------|------------------------|----------------------|----------------------|
| Dependent variable: <i>populationgrowth1500s1840</i> |                        |                      |                      |
| <i>cistercianshare</i>                               | 671.643**<br>(329.775) | 143.111<br>(115.873) | 116.393<br>(134.121) |
| <i>protestantshare</i>                               | 3.409***<br>(1.123)    | 2.092***<br>(0.393)  | 2.954***<br>(0.981)  |
| <i>Constant</i>                                      | 89.596<br>(73.140)     | 115.993<br>(25.552)  | 80.365<br>(64.899)   |
| Observations                                         | 402                    | 400                  | 94                   |
| $R^2$                                                | 0.185                  | 0.268                | 0.318                |

Notes: Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance at the 1, 5 or 10 % respectively

**Table 3: OLS estimations, Cistercians and their instruments**

|                                            | (1)                    | (2)                 | (3)                |
|--------------------------------------------|------------------------|---------------------|--------------------|
| Dependent variable: <i>cistercianshare</i> |                        |                     |                    |
| <i>friesland</i>                           | 0.162***<br>(0.034)    | 0.165***<br>(0.036) | 0.131<br>(0.088)   |
| <i>brabant</i>                             | -0.024<br>(0.024)      | -0.024<br>(0.024)   | -0.111<br>(0.100)  |
| <i>gelderland</i>                          | -0.033<br>(0.037)      | -0.032<br>(0.037)   | -0.121<br>(0.139)  |
| <i>rivier</i>                              | -0.00004136<br>(0.014) | 0.000<br>(0.014)    | -0.052<br>(0.053)  |
| <i>romanroad</i>                           | 0.071**<br>(0.028)     | 0.071**<br>(0.028)  | 0.202**<br>(0.100) |
| <i>zee</i>                                 | 0.016<br>(0.018)       | 0.013<br>(0.018)    | -0.010<br>(0.064)  |
| <i>hoogtem</i>                             | 0.001<br>(0.001)       | 0.001<br>(0.001)    | 0.003<br>(0.005)   |
| <i>cultivationpotential</i>                | -0.002<br>(0.090)      | 0.001<br>(0.090)    | 0.015<br>(0.357)   |
| <i>Constant</i>                            | -0.016<br>(0.067)      | 0.016<br>(0.067)    | 0.110<br>(0.271)   |
| Observations                               | 402                    | 400                 | 94                 |
| $R^2$                                      | 0.290                  | 0.280               | 0.359              |

Notes: Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance at the 1, 5 or 10% respectively.  
The dummy variable 'Holland' has been excluded to prevent collinearity problems



**Table 4: OLS estimations, Protestants and their instruments**

|                                            | (1)                 | (2)               | (3)                 | (4)               | (5)                 | (6)               |
|--------------------------------------------|---------------------|-------------------|---------------------|-------------------|---------------------|-------------------|
| Dependent variable: <i>protestantshare</i> |                     |                   |                     |                   |                     |                   |
| <i>popdensity1500</i>                      | 0.001<br>(0.002)    | 0.002<br>(0.005)  | 0.001<br>(0.002)    | 0.003<br>(0.005)  | 0.001<br>(0.002)    | 0.001<br>(0.005)  |
| <i>literacy1600</i>                        | -41.820<br>(41.544) | -                 | -41.820<br>(41.544) | -                 | -41.820<br>(41.544) | -                 |
| <i>numberofprinters14401520</i>            | -1.541<br>(1.211)   | 1.995<br>(3.016)  | -1.541<br>(1.211)   | 2.005<br>(3.016)  | -1.541<br>(1.211)   | 1.469<br>(2.765)  |
| <i>Constant</i>                            | 99.310<br>(27.985)  | 49.924<br>(2.120) | 99.310<br>(27.985)  | 49.679<br>(2.126) | 99.310<br>(27.985)  | 55.370<br>(3.999) |
| Observations                               | 16                  | 348               | 16                  | 346               | 16                  | 90                |
| $R^2$                                      | 0.513               | 0.060             | 0.513               | 0.062             | 0.513               | 0.074             |

Notes: Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance at the 1, 5 or 10% respectively.

**Table 5: 2SLS estimations**

|                                                      | (1)                      | (2)                       | (3)                      | (4)                      | (5)                      | (6)                  |
|------------------------------------------------------|--------------------------|---------------------------|--------------------------|--------------------------|--------------------------|----------------------|
| Dependent variable: <i>populationgrowth1500s1840</i> |                          |                           |                          |                          |                          |                      |
| <i>cistercianshare</i>                               | -3636.804<br>(17894.186) | 9783.571***<br>(2371.869) | -3636.804<br>(17894.186) | 2765.405***<br>(738.479) | -3636.804<br>(17894.186) | 693.635<br>(426.553) |
| <i>protestantshare</i>                               | 0.03<br>(12.149)         | -0.086<br>(3.039)         | 0.03<br>(12.149)         | 1.734*<br>(0.914)        | 0.03<br>(12.149)         | 3.820**<br>(1.445)   |
| <i>Constant</i>                                      | 250.460<br>(896.513)     | 33.932<br>(157.190)       | 250.460<br>(896.513)     | 69.814<br>(47.234)       | 250.460<br>(896.513)     | -23.669<br>(83.643)  |
| Observations                                         | 16                       | 348                       | 16                       | 346                      | 16                       | 90                   |
| $R^2$                                                | 0.04                     | 0.061                     | 0.04                     | 0.086                    | 0.04                     | 0.154                |

Notes: Standard errors in parentheses. \*\*\*, \*\*, \* indicate significance at the 1, 5 or 10% respectively.

In regressions (1), (3) and (5) all instrumental variables in table 3 and 4 have been entered. In regressions (2), (4) and (6), literacy1600 has been excluded.

In regressions (1), (3) and (5) the software package (SPSS) removed the dummy variable 'brabant' from the analysis.