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## ABSTRACT

We examine the long-run economic impact of the Dissolution of the English monasteries in 1535, which is plausibly linked to the commercialization of agriculture and the location of the Industrial Revolution. Using monastic income at the parish level as our explanatory variable, we show that parishes which the Dissolution impacted more had more textile mills and employed a greater share of population outside agriculture, had more gentry and agricultural patent holders, and were more likely to be enclosed. Our results extend Tawney's famous 'rise of the gentry' thesis by linking social change to the Industrial Revolution.

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There is consensus amongst economists and economic historians about the significance of the British Industrial Revolution. They agree that it was a broad movement which featured technological innovation in key areas such as textile manufacture and metals, in new forms of inanimate power such as the steam engine, in novel methods of the organization of production, such as the introduction of the factory system, and new methods of transportation, such as the railway.

There is less agreement about why the Industrial Revolution happened when it did and why it happened in Britain first and not elsewhere.[1] There is little discussion about why it happened in some parts of Britain but not others. This is possibly because scholars take it for given that this can be explained by obvious things, like the presence of coal, or streams which had potential for water power (Crafts and Wolf, 2014). Yet some of the larger hypotheses about Britain's distinctiveness, such as those about its institutional quality, might be plausibly applied to explain variation within Britain. For example, a prominent class of theories (such as those of North and Thomas, 1973, North and Weingast, 1989, Acemoglu, Johnson and Robinson, 2005, Pincus, 2011, and Pincus and Robinson, 2014) explain British divergence as a consequence of various shocks, such as the Black Death or Atlantic trade expansion, which led to changes in social structure, political conflict in the 17th century, in particular the English Civil War of the 1640s and the Glorious Revolution of 1688, and ultimately institutional change. Yet these shocks may well have impacted some parts of Britain more than others.

This literature has also so far neglected one of the most significant shocks in early modern Britain studied by Tawney (1941a,b). Tawney proposed that the demand for institutional change and the English Civil War were an outcome of a large change in the rural social structure which he characterized as the "rise of the gentry",[2] the rise of a new class of commercially minded rural entrepreneurs. Several processes linked up to lead to the rise of this new class, but the most significant factor was the shock created by Henry VIII's dissolution of the monasteries between 1532 and 1540. After Henry's break with Rome and the founding of the Church of England, he expropriated the monastic lands in England and Wales. This land was then rapidly sold off, 2/3 by 1547 and most of the rest by 1554 during the reign of Edward VI (Clay, 1984, p. 145). Clay (1984, p. 144) notes about the period from 1500 to 1640

> "The pattern of landownership ... was to undergo a profound change ... The single most

[1] Explanations include that of Allen (2009) who argues for the importance of high real wages which stimulated labor saving technological innovation; Mokyr (2010), who emphasizes the Enlightenment and intellectual and scientific change; Voth (2001) and de Vries (2008) instead argue that changes in tastes and preferences and the creation of a 'consumer society' were critical to stimulating labor effort and incentives; Rosenthal and Wong (2011) follow Tilly (1990) in arguing that warfare was a driving force behind institution building in Western Europe leading to urbanization and technological change.

[2] Heal and Holmes (1994, p. 7) define the gentry as "all non-noble landowners with some claim to exercise lordship or jurisdiction" and significant landownership or wealth appear to be the key criteria. Though there is something of a subjective dividing line between richer yeomen and gentlemen, the holding of local offices, such as justice of the peace, has often been used to make the distinction. The possession of a coat of arms has also been used empirically to determine gentry status.

> important factor in bringing this about was the partial dismantling of the enormous estates of the Church ... from the 1530s onwards"

Existing data strongly suggests that the gentry increased greatly in numbers and in the amount of land they controlled. Table 1, from Overton (1996, Table 4.8), shows that while in 1436 the Church held around 20-30% of land with the Crown holding 5%, the sum of these two numbers declined to 5-10% by 1688. Though the Crown did sell off its own land, this fall mostly represented the impact of the Dissolution. In the same period the landholdings of the middling and lesser gentry, the people relevant for Tawney's hypothesis, went from 25% to 45-50% of the total. Overton (1996, p. 169) concludes "it seems clear that the gentry class ... did grow considerably in numbers from the mid-sixteenth century."

In this paper we provide to our knowledge the first systematic investigation of the link between the Dissolution and long-run English economic growth (since we have data only on English monasteries we now switch to England), in particular changes in social structure and the Industrial Revolution. Though Tawney's original work was focused on the Civil War, not the Industrial Revolution, the institutional literature suggests that there ought to be a reduced form relationship between the extent to which monastic lands were expropriated and the subsequent spread of industrialization at a regional level. In particular, in parishes or counties where the gentry rose more, and where commercial farming was more advanced, we hypothesize that the gentry would be involved in other activities which would ultimately coalesce into the Industrial Revolution.

The gentry could have been connected to industrialization through various mechanisms. Firstly, they were enfranchised and able to sit in Parliament to get legislation favorable to their economic interests. As Heal and Holmes put it (1994, p. 204)

> "In the Tudor period the gentry 'swarmed' into Parliament. Not only the county seats, but those of the old parliamentary boroughs, and those of towns newly enfranchised by the Crown, were taken by gentlemen. Some 80% of the 372 so-called 'burgesses' in the late Elizabethan House of Commons were country gentlemen."

Gentry were not just in a good position to sit in Parliament, they could also lobby it. For example, Daunton (1994, p. 13) notes how Birmingham industrialist Matthew Boulton enlisted the support of local gentry to lobby for a new assay office (see also Robinson, 1964). Second, it is plausible that there was a connection between the rise of the gentry and proto-industrialization which is often argued to have been a critical step to the Industrial Revolution. That there were such local connections is suggested by the large case study literature both on the gentry and on the Industrial Revolution which we discuss in section 3 of

the Appendix. Finally, to the extent that the gentry were entrepreneurial commercial farmers they would have been more innovative and productive and this 'agricultural revolution' could have directly stimulated the Industrial Revolution.

Our claim is not that Manchester was Manchester because it had a lot of gentry and some extraordinary concentration of monastic lands in the 16th century. Obviously Manchester had many things going in its favor. Our claim is more modest: the change in social structure identified by Tawney as a consequence of the Dissolution is plausibly a significant determinant of the location of English industrialization. A corollary of this is that institutionalist type hypotheses may be fruitfully used to study the location of the Industrial Revolution, not just it's national origins or timing.

To investigate whether or not such conjectures are plausible we use several sources of data. Most important we digitized the 1535 Valor Ecclesiasticus (henceforth Valor), the great survey of monastic and more broadly ecclesiastic (non-monastic Church) incomes implemented by Henry VIII prior to the Dissolution. Though selected numbers from this survey have been presented and interpreted by scholars in the past, for example Schofield (1965) and Knowles (1979), to our knowledge this data has never been used systematically before. We describe the process via which the Valor was collected and the data it contains in section 3 and in section 4 of the Appendix. The Valor does not contain systematic evidence on the amount of land or property the Church held, but it does give the total value of income which was generated by these assets at the time of the Dissolution. We use this total as our basic measure of the impact of the Dissolution at the parish level. We hypothesize that in places where monastic assets generated more income, conditional on parish size, the Dissolution had a bigger impact, either in terms of redistributing more productive lands or greater amounts of land.

For outcome variables we use two main sources of information. The first is the 1838 Mill Survey commissioned by the British Parliament (and also recently used at the county level by Crafts and Wolf, 2014). The second is the 1831 British Census which gives us data on the structure of employment, in particular the proportion of the labor force in manufacturing, retail and agriculture.

Our first main set of results show that there is a very robust reduced form relationship between monastic income in 1535 and our measures of industrialization. (In the empirical analysis we use the logarithm of (1+monastic income) as the explanatory variable since some parishes have zero monastic income, for brevity we refer to this as 'monastic income'). Monastic income is positively and significantly correlated with a dummy variable for the presence of a textile mill in a parish, a count variable which measures the total number of mills in a parish, and total mill employment. We also find that monastic income is positively and significantly correlated with the proportion of the labor force in manufacturing and retail, but negatively

so with the proportion in agriculture.

The effects we estimate are quantitatively important. For example, a one standard deviation increase in monastic income as recorded in the Valor increases the number of mills by 0.09. The mean number of mills in a parish in our sample is 0.17. A one standard deviation increase in monastic income, therefore, increases the number of mills by about half its mean. Similarly, the average probability of having a mill, as recorded by the mill dummy is 0.04. A one standard deviation increase in monastic income increases the probability of having a mill by 0.013, or about a third of its mean. When we consider the number of people employed in industrial mills, we find that a one standard deviation increase in monastic income increases employment by 8.3 people, or about half its mean.[3]

Trying to interpret these findings as causal faces a number of challenges. Most obviously, the location of monastic land was not randomly assigned in 1535 and it could be that monasteries just happened to hold land in places which were attractive for industrialization for other reasons, thus creating potential omitted variable bias, at least to the extent we cannot control for these other factors.

We use five main strategies to address these concerns. First, we show our results are robust to a number of covariates which are plausible candidates for such omitted variables. These include measures of slope to capture suitability for water power, and the presence of coalfields, both potentially critical elements in the Industrial Revolution. We also control for distance to the coast, distance of a navigable river and distance the nearest market town. Second, our results hold when we use a variety of fixed effects to control for omitted variables. Most stringently we are able to get down to a very low geographical level (below county) with the use of hundred fixed effects (in our sample there are 16243 parishes, 965 hundreds and 43 counties) so that we estimate our main effects using only within hundred and within county variation. Third, we digitized the Lay Subsidy of 1524/25, a mildly progressive tax on various types of income and matched the returns to our units of observation. The total amount of tax levied per parish gives us a useful pre-control for differences in productivity which are not an outcome of the Dissolution.[4] Our results are all robust to this pre-control. Fourthly, we show that our baseline results are robust to the use of a nearest neighbor covariate matching estimator which allows us to identify similar control parishes to compare with those where the Dissolution took place. Finally, while the location of Church lands had been fairly constant

[3]We find smaller effects for the employment data from the 1831 census. For the share of males over 20 employed in agriculture we find that a standard deviation increase in monastic income decreases this share by 0.02, compared to a mean of 0.62. For employment in manufacturing the effect is, expressed as a fraction of the mean of the dependent variable, twice as large. Increasing monastic income increases the share by 0.002, compared to a mean of 0.03. For employment in retail, increasing monastic income increases the share by 0.007, compared to a mean of 0.18.

[4]These returns have been widely used by historians, see Schofield (1965, 2004), Glasscock (1975), Darby, Glasscock, Sheail, Versey (1979), Husbands (1987), and Nightingale (2004).

since the Anglo-Saxon period,[5] therefore for at least 500 years prior to the Dissolution, the distribution of prosperity was not. Analyses by Schofield (1965) and Darby, Glasscock, Sheail and Versey (1979) suggest that between the Doomsday Book of 1086 and the Tudor period there was a large change in the regional distribution of income in England. It cannot be true therefore that our results can be explained by the fact that the distribution of prosperity within England was highly persistent with the monasteries occupying the most productive lands where ultimately the Industrial Revolution took place. It also seems hard to imagine that the monastries, whose location was determined 1,000 years prior to the Industrial Revolution and before the urbanization or commercialization of English society, just happened to be located in places which were subsequently attractive for industrialization.[6]

We then examine in more detail some of the channels via which the Dissolution might have impacted industrialization and which can shed some light of some of the mechanisms we discussed above. First, we use a unique census from 1700 which records the number of gentry in each of 24,000 of the largest towns/cities and villages in England and Wales. To our knowledge, this data has never previously been analyzed systematically. We show that monastic income is positively and significantly correlated with the number of gentry in a parish in 1700. We also show, using data recently compiled by Dowey (2013), that monastic income is positively correlated with the number of agricultural patents registered in a parish between 1700 and 1850, suggesting that the Dissolution might indeed have led to greater innovation, at least in the rural sector. Finally, we can examine directly one policy channel by using data compiled by Heldring, Robinson and Vollmer (2015) on the extent of parliamentary land enclosures at the parish level (Heal and Holmes, 1994, argue that the gentry were heavily involved in enclosing, see pp. 108-113). Using their data we show that monastic income is positively and significantly correlated with whether or not land in a parish was enclosed between 1750 and 1840.

Figures 1 and 2 present two of our basic results using binned partial residual plots, which provide a convenient way of visually presenting correlations in large samples. After partialing out parish area and fixed effects at the level of the hundred, we use a linear fit to summarize the relationship between monastic income and the presence of a textile mill in 1838. We then divide the sample into 40 equal sized bins,

[5]Though the Norman conquerors expropriated the lands of the Anglo-Saxon elite (Fleming, 1991) the lands of the Church were only marginally affected. Thomas notes (2007, p. 68) that in 1066 "The Church collectively held about one quarter of the land in England. The Church's share remained largely unchanged." The quarter share is similar to that in 1436 in Table 1. Though there certainly was some change and Anglo-Saxon bishops were replaced by Norman bishops, Barlow (1979a) (see also Barlow, 1979b and Cownie, 2005) puts it like this "The great abbeys of the Anglo-Danish kingdom remained the great abbeys under the Normans and Angevins" (p. 315).

[6]It is also true that there seem to have been a large number of idiosyncratic shocks to the distribution of Church properties during the Anglo-Saxon period. Barlow (1999, p. 21) notes that during this period of political instability "In Britain the dioceses had perforce to coincide with the areas ruled by the local kings, and the sees to be situated in any convenient settlement. This expedient caused the area of the bishoprics to fluctuate as the boundaries of the petty kingdoms changed" (see also Blair, 2005). Such fluctuations also give one further confidence that we might be able to interpret our findings as causal.

average the residualized monastic income and presence of a mill dummy within these bins, and plot the resulting reduced sample. The size of each scatter point is proportional to the average number of gentry within the relevant bin. Figure 1 shows a positive relationship between monastic income and the presence of a textile mill, and for higher monastic income we observe more members of the gentry. Figure 2 shows a binned scatterplot using the share of adult males employed in agriculture from the 1831 census. For higher monastic income, we observe a smaller share in agriculture, but a greater number of gentry.

Why did the Dissolution of the monasteries have such large effects? The most obvious explanation is that the land held by the Church was initially utilized inefficiently. Though North (1981, p.125) argued that "Monasteries were often the most effective farming centers in the Middle Ages" (see also Ekelund, Hébert, Tollison, Anderson and Davidson, 1996), whether or not this is true empirically is controversial. The Church was the most sustained and strongest defender of feudal privileges in England in the wake of the Black Death.[7] Swanson lists numerous incidents where monasteries fought to retain feudal privileges.[8] The Church was also under pressure to adhere to non-economic practices. For example, marketing products was thought to be inappropriate and that monastic properties aimed for self-sufficiency (Swanson, 1989, pp. 229-230). While not denying that there are examples where the Church was an agricultural innovator (Bolton, 1980; Hare, 1985) the evidence that feudal agricultural practices lasted longer on Church land is certainly consistent with them being less efficient economically. Moreover, canon law forbade the selling of Church lands while following the Statue of Mortmain in 1279 transfers of land to religious control had to have a royal license (Raban, 1974). This freezing of Church land stymied the emergence of a land market and might be thought naturally to lead to land being held by those who would not be able to use it best. To some extent tenancy might be able to mitigate this problem, but the entire modern theory of the firm stemming from the research of Williamson (1985) and Grossman and Hart (1986) suggests that when contracts are incomplete, ownership is of critical importance for incentives and productivity.[9]

If the gentry could not expand by buying Church land could they not have purchased land from elsewhere? They did do so from the Crown, but the most important alternative was the aristocracy (in Table 1 we see that the amount of land held by the aristocracy and greater gentry stays constant at about 15-20% between 1436 to 1688). Yet the Tudor aristocracy, like the Church, was still embedded in non-

[7]Swanson (1989) notes how the Church was more aggressive in opposing the changes which were forced on landowners by the collapse in their labor supply arguing that after the Black Death there was a "gradual decline (but not total abolition) of serfdom. Here again, ecclesiastics faced the same forces as their lay counterparts, but were seemingly less willing to give way" (Swanson, 1989, pp. 201-202).

[8]For example, Durham priory was drawing up lists of serfs until well into the 15th century, in 1497 Tavistock abbey was collecting servile dues and enforcing labour services and in 1502-3 the bishopric of Lichfield and Westminster abbey demesne leases were still demanding customary labor services from serfs. See MacCulloch (1988) on the widespread persistence of serfdom into early Tudor England.

[9]See Kosminsky (1961), Campbell (1983, p. 397) and Campbell (2006, pp. 179, 421) for other arguments about the relative efficiency of the church.

market social relations and maintained large armies of 'liveried retainers'. As late as the civil war of the 1640s aristocrats used such traditional loyalties to mobilize military forces (Holmes, 1974).

Our paper is related to quite a few other contributions in addition to those we have discussed above. Our results strongly support Tawney's bold hypothesis. To see this visually, Figure 3 presents a binned scatterplot which shows the strong conditional positive correlation between monastic income in 1535 and the number of gentry in 1700.[10] Though few would now agree that the Civil War was a conflict of gentry against traditional elites, and Jha (2015) finds no evidence that being a member of the gentry predicts the propensity of a person to side with parliament in the Civil War,[11] this is not crucial for our research. Even if the newly rising gentry's interests were not different enough from traditional elites to create a war, it could still be true that the gentry were more likely to modernize their commercial practices and more prone to get involved in the operation or financing of industry.

Our paper is related to research on the geographical location of the Industrial Revolution. What consensus there is on this issue appears to suggest that this was a simple matter of geography, proximity of natural resources such as coal, or the closeness of markets (see the essays in Hudson ed., 1989, and Hudson, 2002, and Jones 2010). Crafts and Wolf (2014) for example, only examine geographical determinants of the location of textile mills within Britain. Yet institutional explanations are not entirely missing. Daunton (1995), for example, suggests that the Industrial Revolution occurred in the north of England because it was outside the control of craft guilds who were organized better in the historically more prosperous south of the country.

Also relevant is the large and heterogeneous literature on the impact of religion on economic development. Various arguments have been advanced for why the Medieval Church might have played positive roles in economic growth (Schumpeter, 1954, Berman, 1983, Moore, 2000, North and Gwin, 2010). More recently Andersen, Bentzen, Dalgaard and Sharp (2013) find that the presence of Cistercian abbeys in the Medieval period is positively correlated with long-run economic growth at the county level. When we break our monastic data into different denominations we in fact find no correlation between the dissolution of Cistercian properties and our outcome variables suggesting that indeed their properties were more efficiently utilized as these authors hypothesize. It is possible that the Reformation influenced economic

[10] Tawney's papers generated a large literature. This focused on a plethora of issues; whether or not the aristocracy had really declined in favor of a rising class of gentry (Stone, 1965a); whether or not gentry really were more commercial or efficient than large landowners (Heal and Holmes, 1994, Chapter 3 for this literature); and whether or not the gentry were the group who led the rebellion against Charles I. The consensus view of historians on these issues, as expressed by Clay and Overton above, now seems to be that indeed there was a big change in the distribution of land in 16th century England as a result of the dissolution and, moreover, it makes sense to talk about the rise of the gentry.

[11] On the nature of the English Civil War, see Hughes (1998) and Richardson (1998) for good overviews. Stone (1972), Russel (1990) and Morrill (1993) are influential interpretations. Blackwood (1978) and Cliffe (1969) are detailed studies of the role of the gentry in the Civil War in the important cases of Lancashire and Yorkshire.

growth other than through the channels we examine here. Becker and Woessmann (2009), for example, show in the German case that the Reformation led to educational expansion, though Cantoni (2014) found no impact on city growth and urbanization. Our emphasis is very different since we do not examine the impact of changing religious beliefs after the English Reformation on subsequent economic growth, but the impact that the Reformation had on social structure and the distribution of land holdings.[12]

The paper proceeds as follows. The next section provides some important historical background including a discussion of the process of the Dissolution of the monasteries and what happened to monastic lands afterwards. Section 2 discusses the data in detail, particularly the collection of the Valor, and how we compiled this data. We also discuss the other variables we use in the analysis and present some of the descriptive statistics. In section 3 we describe our econometric model and the basic results. Section 4 presents results on the channels. Section 5 concludes.

# 1 Historical Background

In 1530 there were around 825 monasteries in England and Wales, housing around 10,000 people.[13] Overall, the Church is thought to have held between a quarter and a third of all land in England and Wales, as Table 1 suggested (see further Mingay, 1976, p. 44; Woodward, 1966, p. 33).

In two acts passed in 1532 and 1534 Parliament made Henry VIII, who had become king in 1509, head of the Church. At first, Henry's objective was to redirect the revenues that the monastries paid to the Pope to himself. In order to calculate the size of income generated on which these revenues were based, and know how much he was likely to gain, Henry ordered an assessment of the yearly income of all ecclesiastical possessions in England. The resulting reports are published in 1535 as the *Valor Ecclesiasticus*.[14]

[12]Our paper is further related to studies which have examined the long-run impact of agrarian reforms. There is a general argument that agrarian reform in East Asia was important in stimulating agricultural productivity (see Griffin, Khan and Ickowitz, 2002, for an overview, and Bramall, 2004, for skepticism). A lot of this literature resonates with Tawney's analysis, in particular Dore (1959, 1965) argues that the beneficial impact of land reform in Japan was because land was redistributed from absentee landlords to more efficient commercially minded farmers. There is even revisionist research on the impact of 'Fast-Track Land Reform' in Zimbabwe (Scoones, Marongwe, Mavedzenge, Mahenehene, Murimbarimba and Sukume, 2010) which makes a similar case.

[13]Woodward (1966, p. 2) cites the number 825. There were many types of monastic religious establishments, such as nunneries, friaries, abbeys and priories. We use the term monasteries throughout this paper. The monks, aside from maintaining property and collecting rents, engaged in prayer and singing for the local community, were active in education, were expected to provide food and lodging to travelers and to distribute alms to the poor. Many monasteries also provided social insurance or retirement schemes in the form of annuities. The abbots of the larger abbeys generally had a seat in Parliament (Woodward, 1966, Ch. 2.). Much has been written on the dissolution and the reformation more generally, see for instance Gasquet (1899), Woodward (1966), Youings (1971), Knowles (1979) and Duffy (2005). Savine (1909) deals exclusively with the *Valor Ecclesiasticus*. See Haigh (1993) and Bernard (2007) on the Reformation more broadly, Scarisbrick (1968) on Henry VIII and Elton (1953) on Henry's government.

[14]The titles and specifics of the relevant acts, the state of the surviving Valor records, the methods of the Valor enumerators as well as our method of coding the Valor data are all described in Sections 3 and 4 of the Appendix. Section 4 also includes a description the Valor records for the manor of Helton, Lolbroke and Bell as an example.

In 1536, however, parliament passed the Dissolution of the Lesser Monasteries Act. This act expropriated monasteries that had 200 pounds yearly income or less, and transferred their ownership to the Crown.[15] By the end of 1536, over two hundred monasteries had been 'dissolved'. Between 1537 and 1540 all remaining monastic houses, large or small, in England and Wales were expropriated. The Act for the Dissolution of the Greater Monasteries, passed in 1539, provided the legal basis for this effort.

The government sent around commissioners who would, together with locally appointed officials, who as we discuss in Section 3 of the Appendix often turned out to be local gentry, visit a monastery and record its possessions and dependants. This resulted in an official Act of Dissolution, detailing what was to happen to all possessions and dependants of the monastery. Valuables, such as church bells and precious metals were shipped to the Tower of London. Most importantly, the land the monasteries owned was first transferred to the Crown and subsequently sold (Woodward, 1966). These lands, as we show in the Appendix section 3, became disproportionally owned by a new class of commercial farmers, the gentry.

# 2 Data and descriptive statistics

For our empirical specifications, we use parishes from the *GIS of the Ancient Parishes of England and Wales*, based on the work of Roger Kain and Richard Oliver (Kain and Oliver, 2001), as our unit of observation. Parish boundaries have changed very little between the Dissolution and the Industrial Revolution, but place names of individual villages within our parishes sometimes change considerably over time. Section 4 in the Appendix describes the procedure we followed to assign observations in different datasets to the appropriate parish.

## 2.1 The Valor Ecclesiasticus

We obtain our main independent variable, monastic income (the log of (1 + Monastic Income)), from the Valor. We use a transcript of the surviving original returns made by the British Record Commission in the first half of the nineteenth century as our source (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). We exploit the fact that each individual revenue generating unit, such as a manor or an individual tenant, is located in a village and a parish and, therefore, has a place name (see the example return in Section 4 of the Appendix). This enables us in principle to identify each unit and attributed it to a parish,

[15] Dissolution of church property was not without precedent in England. During the Hundred Years War and throughout the later Middle Ages, the alien priories, priories that were dependent on a monastery in France, were dissolved. In 1520, Cardinal Wolsey, dissolved some twenty monasteries to pay for the foundation and endowment of an Oxford college and a school in Ipswich. On the continent, Swedish, German and Swiss rulers had successfully dissolved several catholic monasteries in the early sixteenth century (Woodward, 1966, p. 49).

even though the owner of the unit, such as a monastery, may be located elsewhere. This way we attribute income to the location where it is generated instead of to the location to where it accrues. Figure 4 maps the spatial distribution of Monastic properties across England. Not all income can be attributed to a geographical location. The Valor records sources of temporal income, income derived from physical assets such as land, which can be geographically located and spiritual income, income derived from holding a particular ecclesiastical office, such as a tithe, for which we cannot locate the location because it is recorded where it is received. We therefore restrict our measure to temporal income.

The Valor also records non-monastic church income and in fact the monasteries were not the only ecclesiastical units to be dissolved. Chantries (private chapels) and shrines were also dissolved, as were hospitals and religious guilds (Youings, 1971, p. 90). Moreover, by the middle of the 17th century most of the non-monastic Church land was expropriated or effectively transferred into private hands (Heal, 2008). One might hypothesize that this would have similar long-run effects as monastic lands. In the main text however we keep these separate and investigate empirically whether monastic and non-monastic lands have different consequences. In the Appendix we show our results are robust to aggregating the two types of land.

Locating each entry in the Valor this way yields a dataset of ecclesiastical income that covers modern England almost entirely. We record zero income for parishes not mentioned in the Valor.

## 2.2 Outcome variables

Section 2 of the Appendix reports binned scatterplots for each outcome variable in this section.

### 2.2.1 The Mills

In 1838 Parliament ordered a return of the 'number of persons employed, of the description of the manufacture, and of the nature and amount of the moving power in all the Factories...' (Parliament, 1839, p. 3). The return records each industrial mill in England indicating its manufacture (cotton, wool, worsted, flax or silk), whether it was water or steam powered and the number of people employed. For employment we take total employment which includes not just adults of both sexes but also children.[16] Figure 5 below maps the distribution of the number of mills. As one would expect there are a large number of mills in Lancashire and northwest England. Comparing with Figure 4 we see that this is not an area where monastic incomes were concentrated. Nevertheless, as we noted above, many factors shaped where the Industrial

[16]For example in the 1838 data children aged 0-9 made up 0.4% of total employment. Children aged 9-13 were 8.3%. Children aged 13-18 were 38.4% hence children aged 0-18 made up 47.1% of total mill employment.

Revolution happened and we use a variety of empirical methods (such as county and hundred fixed effects) to control for these differences. Hence the presence or absence of raw correlation in these maps is not the object of most interest.

#### 2.2.2 Occupational structure

We use the digitized version of the 1831 Population Census (Gatley, 2005) to compute shares of adult male population above twenty employed in different occupational categories.[17] We focus on the share employed in agriculture which, on average, equals 62 percent across our dataset of parishes, the share in manufacturing which is only around 3 percent on average and the share employed in retail which, on average, equals 18 percent. Other categories that are distinguished are people employed as laborers, people employed as bankers or in other skilled professions and a category for those not fitting one of these categories.

#### 2.2.3 The Gentry

The data on the presence of the gentry come from John Adams' *Index Villaris, or an Alphabetical Table of all Cities, Market-towns, Parishes, Villages, Private Seats in England and Wales* (Adams, 1700) which is a systematic survey of the 24000 largest cities/towns/villages in England published originally in 1680. We use the total number of gentry living in a particular locality from the most up to date version published by Adams, from 1700. Figure 6 maps the distribution of the gentry.

#### 2.2.4 Enclosures

We use data on the location of parliamentary enclosures from *A Domesday of English enclosure acts and awards* by William Tate (Tate and Turner, 1978) as compiled and analyzed by Heldring, Robinson and Vollmer (2015). We record parishes mentioned in each enclosure act and code a dummy that is equal to one if land in a parish was enclosed between 1750 and 1840.

#### 2.2.5 Agricultural Patents

We compute the number of patent holders from the returns of patent holders in Woodcroft (1854) and previously used by Dowey (2013). These returns record the place of residence of the patent holders and we used this place to geographically locate the patents. We use the count of patents in a particular place,

[17] The 1831 census is the first proper complete census in England, earlier returns in 1801, 1811 and 1821 are both incomplete and were collected indirectly (for example by asking local priests).

not the count of patentees (there can be multiple patentees on one patent). The variable we construct is the total number of patents that were registered to people living in a parish between 1700 and 1850.

## 2.3 Control Variables

### 2.3.1 The Tudor Lay Subsidies

As discussed above, we exploit the fact that we have a proxy for income from just before the Dissolution of the monasteries to control for pre-existing differences. The source for this measure are the Tudor lay subsidies analyzed by John Sheail (Sheail, 1968, see Hoyle, 1994, for a useful introduction to interpreting Tudor tax subsidies). The original Lay Subsidy was carried out in 1524/25 and records tax raised and the number of taxpayers by parish or village. It taxed, for each household, the most important source of income of the head of a household, defined as either personal property, landed incomes, or wages (Sheail, 1968, p. 111).[18] Tax rates were: a flat rate of four pence per pound if the primary source of income was wage income, one-fortieth (six pence per-pound) on goods and one-twentieth (one shilling per pound) on landed incomes. If the goods were valued at more than twenty pounds, the rate increased to one-twentieth as well. Hence taxation was to some extent progressive. If the household did not earn at least one pound in wages per year, had one pound in landed income per year, or possessed two pounds worth of goods, it was not recorded in the survey. In practice, most people were taxed on the goods they possessed.[19] We use total tax raised per parish as our measure of pre-existing differences in prosperity.

## 2.4 Other Covariates

Since our main explanatory variable is the level of monastic income reported in the Valor in all regressions we control for the area of the parish to provide a flexible way of normalizing monastic income.[20]

Throughout our analysis we use several geographical covariates. Using ArcGIS we compute the distance to London, the distance to the sea or the border with Scotland (whichever one is nearest) and the distance to the nearest river (we include here all rivers with year round water flow (perennial) since we care more about water as a source of power than transport). From the Food and Agricultural Organization we got

[18]The returns cover the entire country except the counties Northumberland, Durham, Cumberland, Westmorland and Cheshire (all in the North). The Cinque Ports (Hastings, New Romney, Hythe, Dover and Sandwich) are also omitted. If there were several returns available (such as one for 1524 and one for 1525) we averaged over the available returns.

[19]For instance, in the Earsham hundred of Norfolk, 70 percent of all people were taxed on goods. Furthermore, taxes on goods accounted for 90 percent of the total tax paid in this hundred. For Happing hundred in Norfolk, 90 percent of taxes were levied on goods (Sheail, 1972, p. 112).

[20]An alternative normalization would be population. Though the Lay Subsidy does give one measure of population it is highly incomplete given that poor people were not taxed so we prefer the area of the parish as a normalization. For an attempt to estimate total population figures from the 1524/25 Lay Subsidy see Campbell (1981).

data on wheat suitability and soil type.[21] In ArcGIS we then measure for each of our parishes the soil type and wheat suitability under the centroid in this parish. Ideally, we would like to average over the shape, but the granularity of the suitability and soil type grids is too coarse to enable us to do this. We also control for elevation and slope, again measured under the centroid. To obtain the distance to the nearest coalfield for each parish we digitized a map of the coalfields in England and Wales in 1912 (Strahan, 1912) and computed the distance in ArcGIS. Finally, we control for distance to the nearest market town in 1680. This measure controls for proximity to an urban center (see more on the influence of urban units below). The data come from John Adams' *Index Villaris* which is described above.

## 2.5 Descriptive Statistics

Table 2 contains the descriptive statistics of our main variables. The first two columns give the means and standard deviations of the variables.

The next two sets of columns break down the data by coding a dummy variable which is 1 if a particular parish had at least one monastic property and zero otherwise. The third column presents the means of the variables for parishes which do contain monastic properties and the fifth column does this for parishes with no monastic properties. Columns four and six present the respective standard deviations. Column 7 then presents the difference in the means between monastic and non-monastic municipalities while the last column gives the t-statistic of a two-sided t-test of this difference.

For example, in the first row we report the log of 1+ monastic income. This has a mean of 0.71 for the whole sample with a standard deviation of 1.28. The mean for those parishes with monastic properties is 2.18 while that for non-monastic parishes is 0.00 by construction. In the second row we record the means of '1+non-monastic' Church income (henceforth non-monastic income) which is significantly higher in monastic parishes. In the third row we aggregate monastic and non-monastic incomes into Valor incomes since we use this sum for robustness checks in the Appendix.

The raw data shows some interesting patterns. Considering the main outcome variables, we can see that the textile mill variables are higher in monastic parishes, even if not highly significant (and even

[21] The FAO has classified the earth's land surface into 32 reference soil groups, based on observable characteristics such as accumulation of organic matter and porosity (for a full description, see IUSS, 2014). These classification has been published as a GIS raster file. The most common soil types in our dataset are Cambisols ("Soils with at least the beginnings of horizon differentiation in the subsoil, evident from changes in structure, colour, clay content or carbonate content", p. 143), Gleysols ("Soils with clear signs of groundwater influence", p. 150), Luvisols ("Soils with a pedogenetic clay differentiation (especially clay migration) between a topsoil with a lower and a subsoil with a higher clay content, high-activity clays and a high base saturation at some dept", p. 156) and an "Urban, mining, etc." group. Soil groups differ in irrigation and drainage requirements, salinity, and fertility, and are therefore differentially suitable for agriculture. Cambisols, for instance, "generally make good agricultural land and are used intensively" (p. 144). For Gleysols, on the other hand, "the main obstacle to utilization is the necessity to install a drainage system to lower the groundwater table" (p. 150).

insignificant in the case of total mill employment). The census data do not show an obvious pattern. While the share of employment in agriculture is the same in monastic and non-monastic parishes, and the share in retail is higher in monastic parishes, the share in manufacturing is in fact significantly lower in monastic parishes. In terms of the mechanisms the raw data are more supportive of the hypotheses. The average number of gentry, enclosures and patents are all significantly higher in monastic parishes than in non-monastic parishes.

However, caution is required. The issue of balance between monastic and non-monastic parishes is particularly important. Here we see a complex pattern. For example, though the monastic parishes are on average further from a coalfield, have lower elevation and slope, so less suitable for steam or water power, and further from the nearest river, they are also closer to London and the nearest market town and have higher wheat suitability. Monastic parishes also had significantly higher Lay Subsidy revenues prior to the Dissolution. These mixed findings make the matching approach we take in section 3.2 even more valuable since they allow us to construct a better control group. We revisit the issue of balance then.

# 3 Main results

## 3.1 Reduced Form Results

We now turn to examine the reduced form relationship between monastic income and our main outcome variables, starting with the 1838 Mill Census and then moving to the 1831 Population Census. The econometric model we use here is simple and of the form

$$y_p = \gamma_f + \alpha_M \cdot M_p + \mathbf{X}'_p \cdot \alpha_X + \varepsilon_p \tag{1}$$

Here $y_p$ is our dependent variable of interest in parish $p$ which could be, for instance, the number of mill employees in 1838 or it could be the proportion of the labor force employed in agriculture. $M_p$ is log of 1+monastic income in parish $p$ so that $\alpha_M$ is the main coefficient of interest. $\gamma_f$ is a fixed effect which will be either at the county or hundred level, $f \in \{c, h\}$. The vector $\mathbf{X}'_p$ always includes the physical area of parish $p$ and in extended specifications also includes all our other control variables, for example distance to London, terrain slope or the geographic suitability for wheat. Finally $\varepsilon_p$ is the error term. We estimate (**??**) with Ordinary Least Squares. For our baseline results, we compute two types of standard errors, heteroskedasticity robust standard errors, which we report in parentheses, and Conley (1999) standard errors, that are adjusted for arbitrary spatial correlation in our data, which we report in square brackets.

In section 3.2 we compare our OLS results to results from a matching estimator.

### 3.1.1 Using the 1838 Mill Data

Table 3 presents the most parsimonious way of estimating (**??**). There are three sets of columns with different dependent variables. The first two, (1) to (2) use a dummy variable =1 if parish $p$ has at least one mill, =0 otherwise. The second two, columns (3) and (4), use the number of textile mills as the dependent variable. Columns (5)-(6) use instead use the total number of mill workers in a parish. The main difference between the two columns within each subset is the level at which the fixed effects are. The first set of columns ((1), (3) and (5)) just uses county fixed effects, the next three ((2), (4), and (6)) use hundred fixed effects. All specifications control for the area of the parish as a normalization. The first row records the coefficient on $\log M_p$. For example in column 1 we see that $\hat{\alpha}_M = 0.00876$ with a heteroskedasticity robust standard error of 0.0016 and highly significant. Column (2) uses hundred fixed effects instead of the county fixed effects which is a much lower level of aggregation. The coefficient increases somewhat and is as precisely estimated and so is still highly significant. It is interesting to note in all the specifications that the use of hundred fixed effects significantly increases the $R^2$ of the regression as one would expect.

In columns (3) and (4) we then estimate the same model but with the total number of mills as the dependent variable. The findings here are very consistent across specifications with the use of hundred fixed effects again increasing the size of the coefficient when we use this more fine way of accounting for unobservables. For example, in column (4) when we use hundred fixed effects we find $\hat{\alpha}_M = 0.0671$ (robust s.e.=0.0249) and significant at the 1% level.

The final two columns then use the total number of people employed in mills as the dependent variable. Columns (5) and (6) show that there is a robust positive correlation between the monastic income and this variable and neither the estimated effects nor the standard errors vary much across specifications.

Comparing the Conley (1999) standard errors to the heteroskedasticity robust errors suggests that spatial correlation is not a potentially important issue and all the results discussed above are identical with the Conley standard errors.

These results suggest that there is a robust and positive correlation between the importance of monastic income in a parish in the 1530s and the subsequent extent of industrialization. As we noted in the introduction these effects are quantitatively important. A one standard deviation increase in monastic income as recorded in the Valor increases the number of mills by one 0.09. The mean number of mills in a parish in England in our sample is 0.17. Increasing monastic income by one standard deviation increases the number of mills by about half its mean when we use the specification with county fixed effects (column

(4)).

Table 4 examines further the robustness of our main results. As in Table 3 there are three sets of columns corresponding to the different dependent variables. We use hundred fixed effects in all specifications in the table. The three sets of columns have a similar structure. In the first column of each ((1), (4) and (7)) the only covariate is the log of Lay Subsidy revenues raised in that parish in 1524/25. In the second set of columns ((2), (5) and (8)) we control instead for non-monastic Church income. As we noted above, by 1650 most of this had also been expropriated so despite Tawney's hypothesis being about monastic incomes, it is interesting to examine the impact of this variable. Columns (3), (6) and (9) instead control for a set of geographical variables: terrain elevation and slope and wheat suitability, distance to nearest river, market town, to the border, to London and to the nearest coalfield and a vector of soil type dummies.

The main point of this table is to show that the results of Table 3 hold when we control for our proxy for pre-existing income differences across the parishes, non-monastic incomes and for the geographical variables. These could be picking up several things, for instance factors which might be influencing the intrinsic income of an area, perhaps through agricultural productivity, or alternatively factors that might influence industrialization, perhaps because they facilitate the use of water or steam power. They also capture transportation costs and proximity to large centers of demand, which again likely influenced the location of textile mills. We see that the Lay Subsidy in 1524/25 variable is typically positive and significant, but does little to alter the robustness of our basic results and the estimated coefficient and statistical significance of monastic incomes are very similar to Table 3. An interesting result is that the impact of non-monastic incomes on the mill outcomes tends to be positive and statistically significant and moreover is quantitatively larger than the monastic income. This is plausible since some of the choicest lands were held not by the monasteries but by cathedrals and bishops. For our purposes the most interesting finding is that controlling for non-monastic income has little impact on the coefficient of interest except that monastic income is not longer significant when the dependent variable is total mill employment.

Though they do little to alter the main coefficient of interest some of the estimated coefficients on the controls are interesting. For example, there are significant negative relationships between distance to market towns and coalfields and industrialization, precisely as one would hypothesize.

All in all the conclusion from Table 4 is that the basic results of Table 3, that there is a strong positive conditional correlation between the impact of the Dissolution of the monasteries in the 1530s and the presence of the Industrial Revolution in the early 19th century, are robust.

### 3.1.2 Using the 1831 Census

We now re-work Tables 3 and 4 with different dependent variables taken from the 1831 Population Census. In Table 5 we reproduce Table 3 where there are again three sets of columns, the first uses the proportion of the labor force in agriculture, the second the proportion of the labor force in manufacturing and the final set uses the proportion of the labor force employed in retail. The columns differ within these sets by the different type of fixed effect as before. In column (1) we use county fixed effects and find that $\hat{\alpha}_M = -0.0139$ (robust s.e.=0.00174) and these results are unchanged when we use hundred fixed effects. In all cases there is a significant (at the 1% level) negative relationship between monastic income and relative employment in agriculture. In columns (3) and (4) we change the dependent variable to the share of the labor force employed in manufacturing. Here there is no significant relationship when we use county fixed effects, but with hundred fixed effects, a more attractive strategy for controlling for unobservables, we find a significant positive correlation at the 5% level. In the final set of columns we again find robust and highly significant correlations. For example, in column (6) when we use hundred fixed effects we find $\hat{\alpha}_M = 0.00879$ (s.e.=0.000918) so there is a positive and highly significant correlation between monastic income and the proportion of the labor force in retail. The results in Table 5 therefore seem to be very consistent with those of Table 3. Examining the Conley standard errors in Table 5 we also find, as with Table 3, that our basic results are robust to allowing for spatial correlation in the errors.

We find smaller quantitative effects for the employment data in the 1831 census. For the share of males over 20 employed in agriculture we find that a one standard deviation increase in monastic income decreases this share by 0.02, compared to a mean of 0.62. For employment in manufacturing the effect is, expressed as a fraction of the mean of the dependent variable, twice as large. Increasing monastic income increases the share by 0.002, compared to a mean of 0.03. For employment in retail, increasing monastic income increases the share by 0.007, compared to a mean of 0.18.

Table 6 then probes the robustness of the results of Table 5 using exactly the same strategy and structure as Table 4. For the share of the labor force in agriculture and retail the addition of covariates has little effect on the magnitude of the estimated coefficients or the significance. However, for the manufacturing share, the results are now more significant and robust. There is also some evidence here that Lay Subsidy revenues is associated with less of the labor force in agriculture and more in retail, which is also true of non-monastic income. Neither variable is significantly correlated with the share of the labor force in manufacturing however. As before the geographical covariates have little impact of the estimated coefficient on monastic income or its standard error.

Taken together these last two tables suggest that in places which had more monastic lands in the 1530s and where the Dissolution of the monasteries had a bigger relative impact, there was subsequently more of a movement out of agriculture and into manufacturing and retail, a process which is clearly linked to structural change and the Industrial Revolution.

## 3.2 Matching

We have argued so far that we find it unlikely that, conditional on our set of covariates, there are unobservables that are correlated with the location of monasteries as well as the location of subsequent industrial activity. To further assess the validity of this claim, we now use these covariates to implement a matching exercise.

We define a monastic presence dummy which is equal to one if parish $p$ has at least one monastic property in the Valor Ecclesiasticus, and equal to zero if parish $p$ has church property in it, but no monastic property. This implies that we lose observations having neither, but enables us to construct a control group that is plausibly more similar to our monastic treatment group.

To match monastic parishes to church parishes, we implement a nearest neighbor match.[22] We start by computing the Mahalanobis distance, $D_{ij}$, for every monastic parish $i$ to each parish $j$ without monastic presence. The Mahalanobis distance is defined as:

$$D_{ij} = \sqrt{(\mathbf{X}_i - \mathbf{X}_j)' \mathbf{S}^{-1} (\mathbf{X}_i - \mathbf{X}_j)} \tag{2}$$

Where $\mathbf{X}_k$ for $k = i, j$ is a vector of covariate data and $\mathbf{S}^{-1}$ is the variance covariance matrix of $\mathbf{X}_j$. We then proceed to match every parish $i$ with monastic property to the parish $j$ without monastic property that has the lowest Mahalonobis distance. Finally, we compute the average difference in outcomes across the matched samples for those parishes with monastic presence. In other words, we compute the average treatment effect on the treated (ATT), where treatment is defined by monastic presence.

Table 7 Column (2) reports results of our matching approach using presence of textile mills and occupational structure as dependent variables. Column (1) reports differences in means for these variables for the subsamples defined by the monastic presence dummy, and column (3) reports results from an OLS regression including the set of matching variables as covariates. As expected, the matching results are

[22] We match, with replacement, on the following set of variables: ln(1 + non monastic income), area, slope, elevation, distance to the nearest river, distance to the nearest coalfield, distance to the nearest market town, and distance to London. For area, slope, elevation and distance to the nearest river, we include squared terms as well. Because we match on positive values of non-monastic property, we use a subsample of our data consisting of parishes with positive values for monastic property, non-monastic church property, or both.

qualitatively similar to our previous regression results reported in Tables 3 and 5. The monastic presence dummy is positively correlated with the presence of a textile mill, the number of mills and mill employment. It is negatively correlated with the share of employment in agriculture, and positively correlated with the share of employment in manufacturing and retail trade, and all effects are significantly different from zero.

Columns (1) and (3) provide useful comparisons to our matching results. Comparing columns (1) and (2) is informative about selection into monastic presence. For a given outcome variable, if the raw difference in means is very different from the matching result, this means that there could be selection into monastic presence that is correlated with the outcome of interest. For instance, the raw difference for mill employment is close to zero and insignificant. Yet when we match we obtain a positive and significant result. For mill employment, therefore, there is potentially selection into treatment along one (or more) of our matching variables. Perhaps surprisingly, the results for occupational structure indicate that there is little selection bias for these outcomes. Comparing columns (2) and (3) provides a check on the matching procedure. Angrist and Pischke (2009) show that the key difference between matching and OLS is weighting. Matching puts most weight on observations with the highest probability of receiving treatment whereas OLS puts most weight on observations with a probability of treatment closest to 1/2. They argue that since both approaches are in essence weighted differences of means, OLS and matching estimates should not be too dissimilar. Comparing columns (2) and (3), this is what we find. Our OLS results are the matching results, both in size of estimated effects as well as in significance, though the OLS results are estimated with less precision.

Matching gains its legitimacy as a technique for causal inference from the idea that if there is no selection into treatment, conditional on covariates, differences in means across treatment and control groups have a causal interpretation (Imbens and Wooldridge, 2009). We now assess the extent to which our matching approach has been successful in moving towards conditional independence of monastic presence.

Table 8 reports covariate balance before and after matching, for our vector of matching covariates, as well as for two covariates we do not match on. Column (1) reports means for those parishes with monastic presence in the Valor Ecclesiasticus (i.e. those parishes for which the monastic presence dummy is equal to one). Column (2) reports the mean for parishes without monastic presence, but with church presence (i.e. those parishes for which the monastic presence dummy is equal to zero) . Column (4) report means across the subset of control observations that has been matched at least once using our nearest neighbor matching procedure. The columns of interest in this table are (3) and (5) where we report p-values from a two sided t-test of the differences of the means in columns (1) and (2), and columns (1) and (4), respectively. Column (3), therefore, compares covariate balance before matching. Aside from distance to the nearest river and

distance to the nearest market town none of the covariates balance. After matching, column (5), virtually all covariates balance within the set of matching variables. For illustration, we also report balance on two covariates not in our matching set: Our measure of pre-dissolution economic differences, taxation recorded in the Lay Subsidy revenues and soil suitability for growing wheat. Both covariates do not balance before matching, but do balance after.[23]

The matching results in this section have focused on the distinction between monastic and non-monastic church property. Confirming our earlier results, we find that parishes where monastries held income generating assets in 1535, display more industrial activity, employ fewer workers in agriculture and more in manufacturing and retail trade, relative to those parishes that are similar in terms of our set of observable covariates but which did not contain monastic assets. A weakness of the matching approach is that matching by definition relies only on observables. Section 3.5 discusses a sensitivity test of our results to the omission of unobservables.

### 3.3 Results for different Monastic Orders

Recent work by Andersen et al. (2013) has argued that the Cistercian monastic order had a positive long-run effect on English economic growth, through the order's emphasis on thrift and hard work. We compare the Benedictines, who were established in England before the Danish conquest, to the Augustinians and the Cistercians, who arrived in England in the 12th century (Gasquet, 1899). We use the share of monastic properties in parish $p$ (such as individual manors, or fields in villages) that were owned by a particular monastic order as independent variables and we use the non-monastic income as a covariate. By considering the share of properties belonging to different orders for a similar level of non-monastic income, we focus on the identity of the owner of a particular property rather than on the size of the properties or the size of the ecclesiastical sector in that particular parish.

Table 9 reports results for the location and scale of the textile industry. A greater share of properties owned by the Cistercians does not correlate significantly with presence of a textile mill, the number of textile mills, nor with total employment in textile mills. This finding supports the idea that the Cistercians were operating their lands efficiently before the Dissolution, consistent with Andersen et al. (2013). A greater share owned by the Benedictines or Augustinians, on the other hand, is positively correlated with industrial development. This finding suggests that these orders were farming inefficiently before the Dissolution.

[23]Two covariates' post-matching means are closer to the treatment mean, but do not balance. First, the log of non-monastic income does not balance. This is unsurprising since treatment status is defined by the relative absence of non-monastic property. Second, parishes generating monastic income are also 0.4 square kilometers larger, on average, than those that do not. Forcing balance on (a discretized measure of) parish area reduces balance across other covariates (results not reported). Note that we include parish area in all specifications in this paper.

## 3.4 Further Robustness Checks

We now conduct some more robustness tests to further probe our findings.

### 3.4.1 Alternative Ways of Coding the Valor

So far we have measured the impact of the Dissolution in a particular parish by the income which accrued to monastic properties in that parish according to the Valor or by a dummy variable equal to one when a parish had a monastic property, equal to zero when it had only non-monastic church property, and missing otherwise. These are of course imperfect proxies for what we would really like to measure since we can observe neither the proportion of the land area nor the amount of property of a parish owned by the Church, nor how productive particular pieces of land were. We now investigate the robustness of our results using three alternative appealing ways of measuring the impact of the Dissolution in a parish. We first constructed total ecclesiastical income, adding monastic and non-monastic income in each parish. Second, we built a count variable which is equal to the number of monastic properties in a parish. Our final approach is to code a dummy variable which equals 1 if parish $p$ contains at least one monastic property, and zero otherwise.

The results of using these other three measures of impact are recorded in the Appendix. Table A-1 shows results using the log of 1+Valor income for our main dependent variables from the 1838 Mill Census (Panel I) and the 1831 Population Census (Panel II). All results show a positive and significant correlation, save for share in manufacturing using hundred fixed effects. Table A-2 panel I shows the conditional correlation between the number of monastic observations in the Valor and our main dependent variables from the 1838 Mill Census (results from the 1831 Population Census are similar and available upon request). Panel II instead uses the dummy variable distinguishing between the presence or absence of monastic property. The interesting finding in these tables is that we find that our basic results are very robust to these different ways of measuring the impact of the Dissolution.

### 3.4.2 Dropping urban parishes

One might be concerned that our results are driven by the fact that monastic orders owned properties in urban areas and that these were also places where industrialization took place (obviously the Industrial Revolution was associated with very rapid urbanization). We tried to address this issue so far by using various types of covariates, but here we take a more direct strategy and check that our results are robust to dropping urban parishes. Table A-3 in the Appendix shows two sets of results, which differ in the

way urban is defined. The first three columns consider parishes urban if they are coded as urban in the 1831 Census. The second set of results uses post-1832 reform parliamentary constituencies. Parliamentary constituencies were either county constituencies or borough constituencies. For these columns we treat all parishes falling in a borough constituency as urban. Using our main dependent variables from the 1838 mill census as dependent variable, and controlling for hundred fixed effects, this table shows that our main results are insensitive to dropping urban parishes.

### 3.4.3 North-West England

As a final robustness check, we restrict our sample to North-West England. We have argued that monastic presence increased local industrial activity and agricultural productivity. We would therefore expect our results to hold within any subdivision of the country, and especially in the industrial North. Table A-4 in the Appendix presents results for this exercise, using our main dependent variables from the 1838 Mill Census. In panel I, the sample is restricted to observations from the Northwestern counties Cumberland, Westmorland, Lancashire, Yorkshire West Riding, Cheshire, Derbyshire, Nottinghamshire and Staffordshire. In Panel II, the sample is further restricted to Lancashire, the heart of the Industrial Revolution. In both restricted samples, our results are similar to our main results. Some of the estimated coefficients lose some precision, which is most plausibly driven by the smaller sample size. However, the size of the coefficients goes up as we restrict the sample. Using observations in Lancashire, the estimated coefficient for the mill dummy using hundred fixed effects is ten times larger than when we use the full country sample.

We have shown in the previous sections that our main result is robust to a large set of observable covariates, both in our OLS estimates as well as in our matching approach. As a final robustness exercise, we consider the sensitivity of our results to the omission of unobservables.

## 3.5 Selection on unobservables

This section assesses the sensitivity of our results to selection on unobservables, following Altonji et al. (2005) and Bellows and Miguel (2009). The idea is to use the reduction in an estimated coefficient resulting from including covariates (selection on observables) to get an estimate of the potential bias introduced by the omission of unobservables. To implement this idea, consider estimating equation (**??**) twice, using two sets of covariates. In the first regression, we include parish area and hundred fixed effects, and in the second we use an extended set of covariates.[24] Let the estimated coefficients on the the log of monastic income be

[24] We include parish area, elevation, slope, soil suitability for wheat, distance to the nearest river, distance to the nearest market town, distance to the border and distance to London as covariates, as well as soil type dummies and hundred fixed effects.

$\hat{\alpha}_{baseline}$ and $\hat{\alpha}_{extended}$, respectively. Using these coefficients, we compute the ratio $b = \frac{\hat{\alpha}_{extended}}{\hat{\alpha}_{baseline} - \hat{\alpha}_{extended}}$. If $b = 1$ selection on unobservables will explain our result away if the bias introduced by omitting unobservables is at least as large as selection on observables, measured by the difference in estimated coefficients between the baseline and extended regressions. For $b > 1$, selection on unobservables would have to be stronger than selection on observables to explain away the result.

Table 10 reports estimates of $b$ using our set of dependent variables. The lowest ratios are for employment in retail (6.12) and agriculture (6.7), and the median ratio is 11.2. What does this mean for our results? Taking employment in retail as an example, $b = 6.12$ indicates that selection on unobservables would have to be 6.12 times as strong as selection on observables to explain away our results. Since we have included the Lay Subsidy revenue to control for pre-existing income differences, several measures of potential agricultural yield, direct measures of competing explanations for the location of industrial activity (such as proximity to coal), as well as restrictive fixed effects, we believe it is unlikely that there are unobservables that, when included, would reduce our estimated coefficient to zero.

# 4 Examining the Channels

We now move to examine three of the channels via which the dissolution of the monasteries might have influenced the Industrial Revolution following our discussion in the introduction. Our econometric strategy is to re-estimate (**??**) by OLS letting $y_p$ be one of our intermediate variables. Table 11 reports the basic results where we just control for fixed effects at different levels.

In columns (1)-(2) we use the number of gentry in a parish in 1700 as the dependent variable. We see that there is a robust and positive correlation between monastic income and the number of gentry in 1700. In column (1) $\hat{\alpha}_M = 0.0908$ (s.e.=0.00741) and highly significant. This result changes little when we use fixed effects at the hundred level.

The next two regressions examine the impact of monastic income on parliamentary enclosures between 1750 and 1840. We find very robust and significant effects. Since the dependent variable is a dummy one can interpret this model as a linear probability model so what we find is that the greater was monastic income the higher was the probability that land within a parish would be enclosed by an act of parliament. This is consistent with the evidence we cited in the introduction that the gentry were very active in parliament and promoted legislation that furthered their economic interests.

The final two columns examine the impact of monastic income of agricultural innovation as measured

by the total number of patents registered to inhabitants of a particular parish between 1700 and 1850. We find that there is a significant and positive relationship which changes little when we use fixed effects at different levels. For example, with the hundred fixed effects in column (6) we find an estimated coefficient of $\hat{\alpha}_M = 0.0183$ (s.e.=0.00377) which is significant at the 1% level.

We now turn to the magnitude of the effects for the various channels we consider in Table 11. We consider again the specifications with fixed effects at the hundred level. In 1700, there were on average 0.66 members of the gentry in a parish our sample. Increasing monastic income by one standard deviation we see an increase of 0.12 members of the gentry, or around one fifth of the mean. Similarly, the mean probability of having land enclosed is 0.37. Increasing monastic income by a standard deviation increases the probability of being enclosed by 0.03, or about one twelfth of the mean, using column (4). Finally, the mean number of agricultural patents is 0.02, and increasing monastic income by one standard deviation increases this number by 0.02, or the size of its mean using column (6).

Table 12 then reproduces our basic robustness checks with very similar findings to those from before. Lay Subsidy revenues does somewhat reduce the size of the estimated coefficient on monastic income with any of the three dependent variables (in columns (1), (4) and (7)) and it is positively and significantly correlated with the dependent variable in all columns. The story with respect to non-monastic incomes in columns (2), (5) and (8) is similar. Nevertheless, monastic income remains highly significant. Our baseline results here are also robust to all of the geographic covariates which do little to change the magnitude of the coefficient or the standard error. Again, some of these are of independent interest. For example, the further away from a market town a parish is, the less likely there are to be gentry in it, the less likely it is to have had land enclosed, and the less patenting there is.

The results of this section then give credence to all the channels we suggested. First, and most important they show that Tawney was indeed correct that there was an association between the Dissolution and the rise of the gentry. Since the empirical evidence for this has been very controversial (see the essays in Stone, 1965b, and Cooper, 1983), this finding is interesting in itself. It also shows that places where it is likely that the Dissolution had more impact tended to have more enclosures, a policy which favored the construction of infrastructure and the rationalization of farming practices and the same places also tended to have more innovation in agriculture.

# 5 Conclusions

In this paper we conducted what to our knowledge is the first empirical investigation of the long-run economic impact of the Dissolution of the monasteries in England between 1536 and 1540. Tawney (1941a,b) first proposed that the Dissolution and subsequent sell off of church land, representing around 25-30% of land in England, created a huge shock to the social structure. In particular, he argued that it precipitated the rise of the gentry, a new commercially oriented class of farmers who played a leading role in the political conflicts of 17th century England. Though historians now do not believe that the evidence which Tawney presented supports his original arguments about the connections between the gentry and the Civil War or Glorious Revolution, we argued that nevertheless both theory and case study evidence leads one to hypothesize that there might be a reduced form relationship between the Dissolution, the rise of the gentry and the location of the Industrial Revolution.

The bulk of this paper investigates precisely this. To measure the impact of the Dissolution at the parish level we digitized the Valor Ecclesiasticus, the survey of church incomes that Henry VIII commissioned just prior to the Dissolution. We showed that the greater was monastic income according to the Valor, the more industrialization there was in 1838 in terms of the presence and number of textile mills and the number of mill employees. We also showed that greater levels of monastic income in 1535 were associated with a smaller proportion of the labor force employed in agriculture according to the 1831 Census, and a larger share of the labor force employed in manufacturing and retail. We further argued that there are grounds for believing that these correlations can be interpreted causally.

In addition to this reduced form evidence we explored some of the likely channels via which the Dissolution might have impacted industrialization. We showed that parishes which had higher levels of monastic income had more gentry in 1700, consistent with Tawney's original thesis. We also showed that they were more likely to have land enclosed, consistent with the notion that the gentry influenced policy via their large influence on Parliament. Finally, we also showed that higher levels of monastic income were associated with a greater number of agricultural patents, suggesting that the rise of the gentry was associated with greater agricultural innovation.

All in all, our findings support Tawney's hypothesis that the rise of the gentry was associated with the Dissolution of the monasteries and our evidence further suggests that it was also connected to perhaps an even more momentous event, the Industrial Revolution.

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Figure 1: Binned scatterplot for Monastic income and mill dummy. **X** includes parish area and hundred fixed effects.

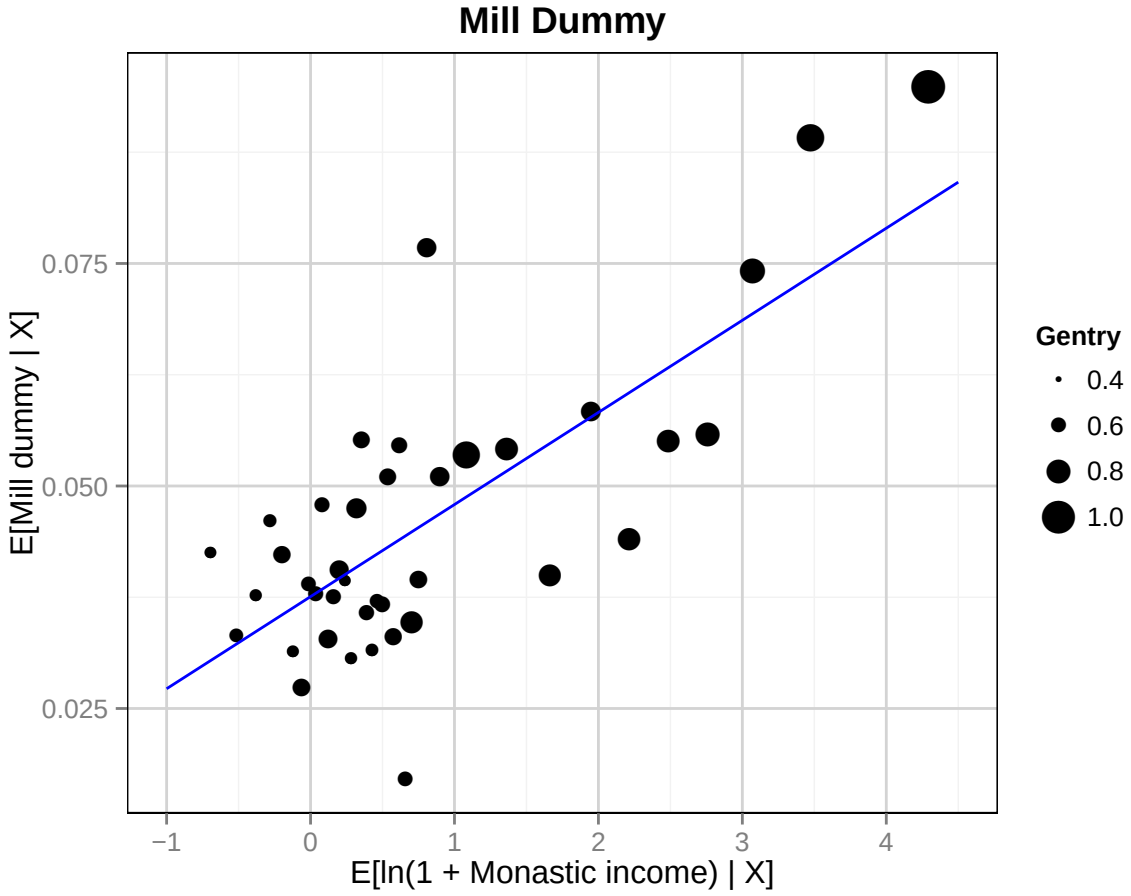


Figure 2: Binned scatterplot for Monastic income and share in agriculture. **X** includes parish area and hundred fixed effects.

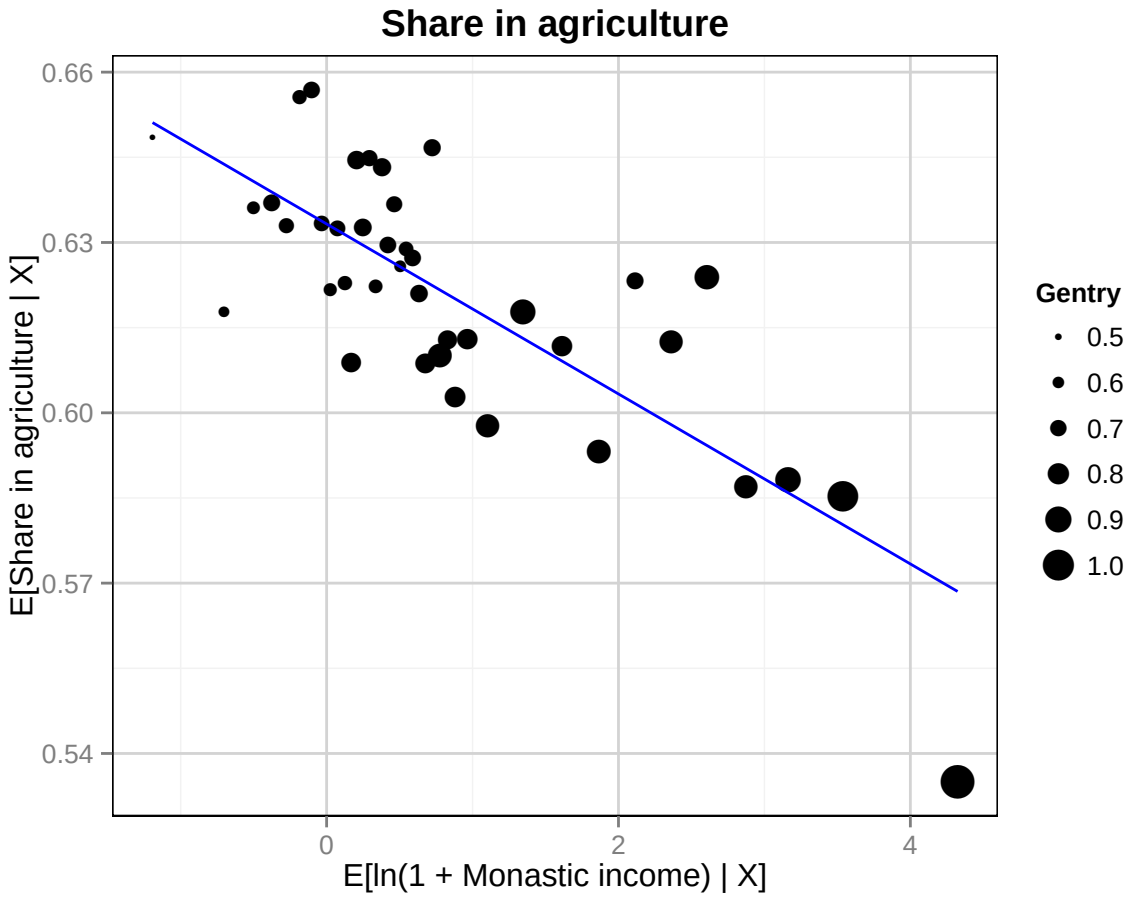
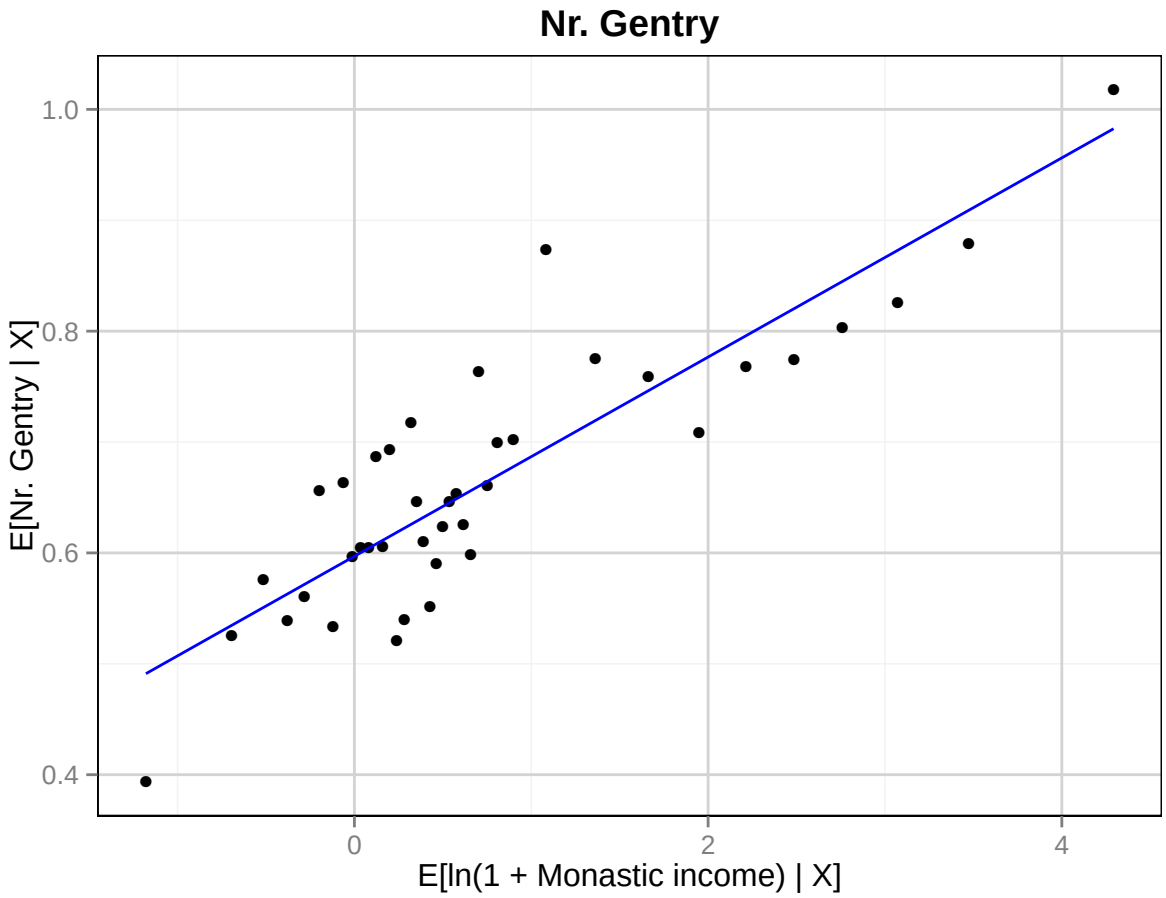


Figure 3: Binned scatterplot for Monastic income and Number of Gentry. **X** includes parish area and hundred fixed effects.



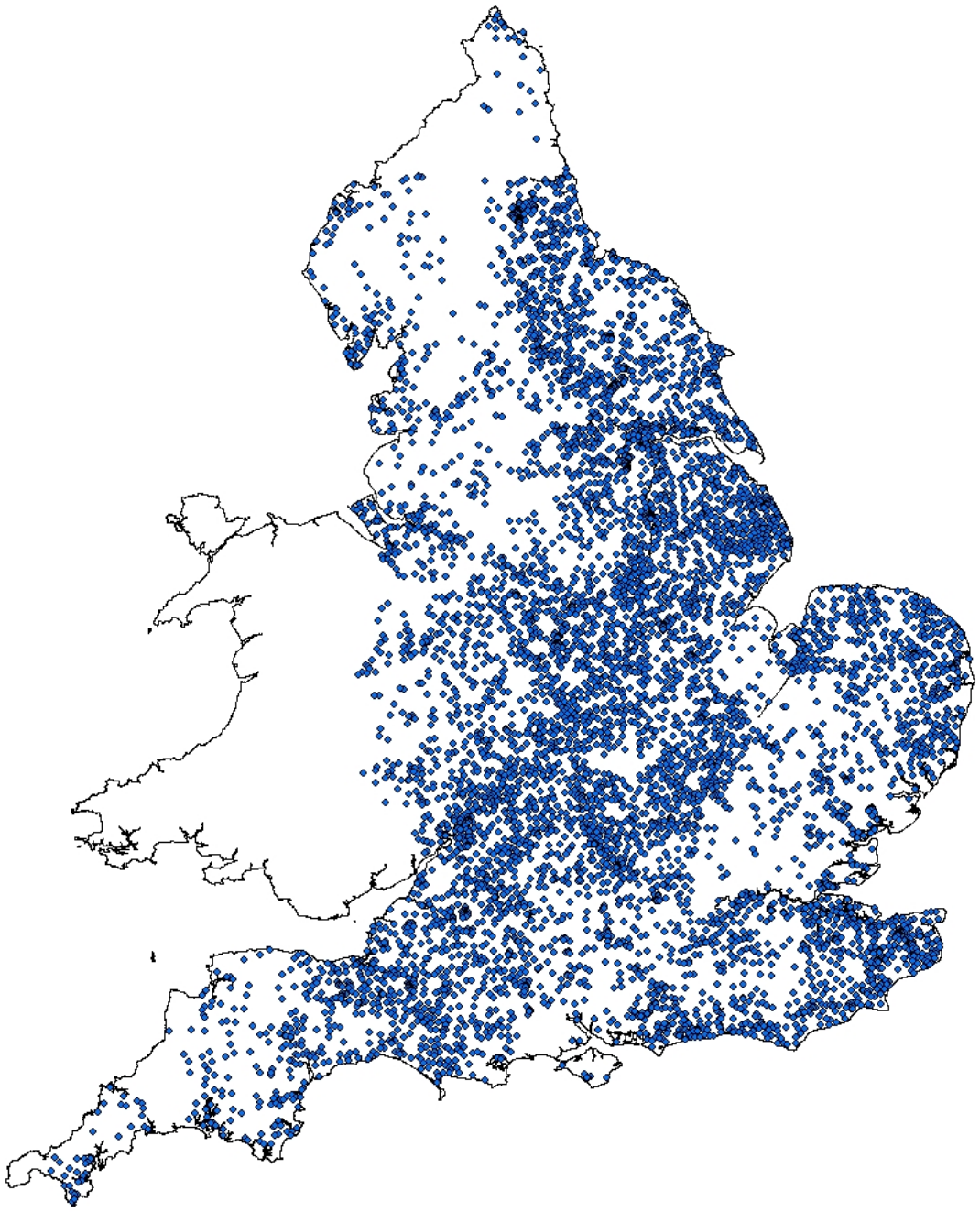


Figure 4: Spatial distribution of Monastic property. One dot indicates at least one monastic property in 1535.

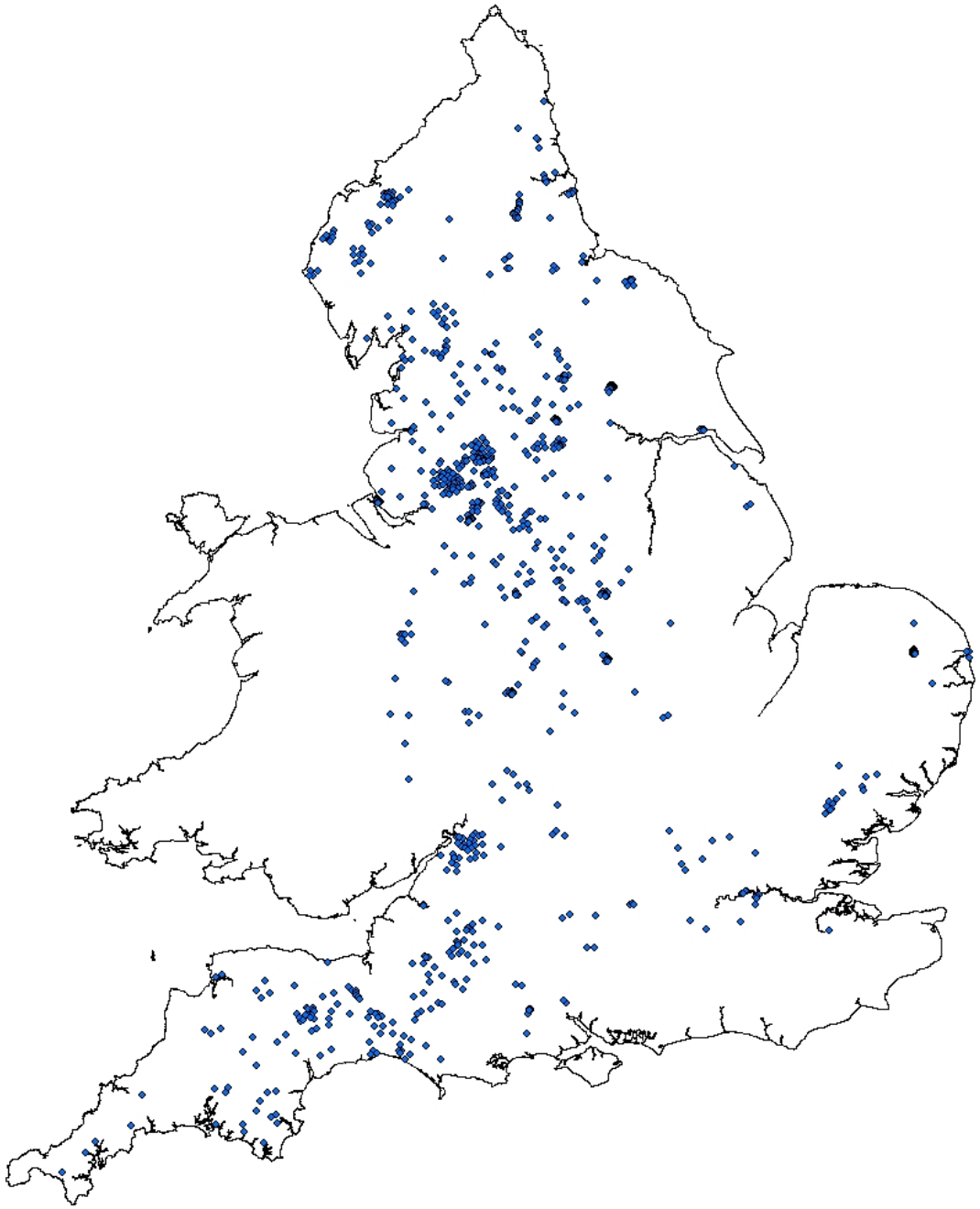


Figure 5: Spatial distribution of mills in England. One dot indicates at least one mill in 1838.

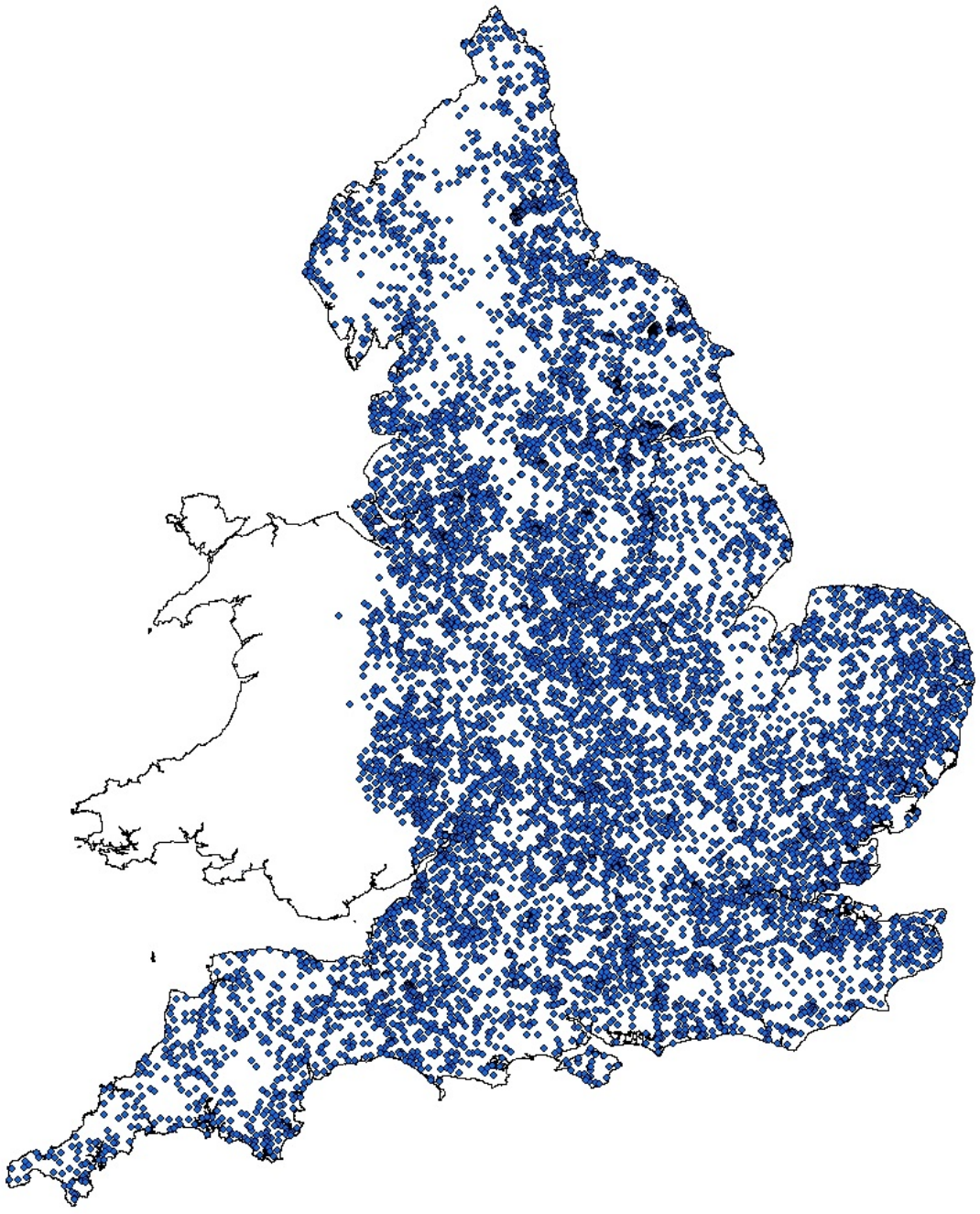


Figure 6: Spatial Distribution of Gentry presence. One dot indicates at least one member of the gentry in 1700.

Table 1: Distribution of Landownership in England in 1436 and 1688: Percentages of cultivated land owned

| | 1436 | 1688 |
|---|---|---|
| Aristocracy and greater gentry | 15-20 | 15-20 |
| Middling and lesser gentry | 25 | 45-50 |
| Yeomen, family farmers and other small owners | 20 | 25-33 |
| Church & Crown | 25-35 | 5-10 |

Notes: Adapted from Clay (1986, p. 143)

Table 2: Summary statistics for selected variables

| | Full sample | | Monastic dummy = 1 | | Monastic dummy = 0 | | Difference of means | |
|---|---|---|---|---|---|---|---|---|
| | mean | sd | mean | sd | mean | sd | difference | t-stat |
| ln(1 + Monastic Income) | 0.71 | 1.28 | 2.18 | 1.34 | 0.00 | 0.00 | 2.184*** | (170.78) |
| ln(1 + Non Monastic Income) | 1.05 | 1.36 | 1.57 | 1.44 | 0.79 | 1.24 | 0.778*** | (35.55) |
| ln(1 + Valor Income) | 1.46 | 1.56 | 2.84 | 1.23 | 0.79 | 1.24 | 2.043*** | (98.75) |
| ln(1 + Lay Subsidy Income) | 3.16 | 3.34 | 4.08 | 3.34 | 2.72 | 3.24 | 1.363*** | (24.86) |
| Mill dummy | 0.04 | 0.20 | 0.05 | 0.21 | 0.04 | 0.20 | 0.00769* | (2.26) |
| Nr. of Mills | 0.17 | 4.05 | 0.27 | 6.68 | 0.13 | 1.70 | 0.136* | (2.01) |
| Mill Employment | 15.68 | 279.71 | 18.70 | 328.64 | 14.23 | 252.91 | 4.471 | (0.95) |
| Share of males in Agriculture 1831 | 0.62 | 0.25 | 0.62 | 0.24 | 0.62 | 0.25 | -0.00831 | (-1.82) |
| Share of males in Manufacturing 1831 | 0.03 | 0.11 | 0.03 | 0.09 | 0.04 | 0.11 | -0.00867*** | (-4.46) |
| Share of males in Retail 1831 | 0.18 | 0.13 | 0.19 | 0.13 | 0.17 | 0.13 | 0.0183*** | (7.86) |
| Nr. of Gentry in 1700 | 0.67 | 1.00 | 0.87 | 1.11 | 0.58 | 0.92 | 0.291*** | (17.61) |
| Parliamentary Enclosure 1750-1840 | 0.37 | 0.48 | 0.48 | 0.50 | 0.32 | 0.46 | 0.161*** | (20.25) |
| Nr. of Agricultural Patents 1700-1850 | 0.02 | 0.28 | 0.04 | 0.37 | 0.02 | 0.23 | 0.0253*** | (5.33) |
| Terrain elevation | 88.41 | 75.54 | 78.37 | 63.62 | 93.23 | 80.19 | -14.86*** | (-11.80) |
| Terrain slope | 2.63 | 1.96 | 2.36 | 1.65 | 2.76 | 2.08 | -0.395*** | (-12.11) |
| Wheat suitability | 37.68 | 15.45 | 40.32 | 14.33 | 36.41 | 15.81 | 3.917*** | (15.24) |
| Distance to nearest river | 2.47 | 2.12 | 2.58 | 2.16 | 2.42 | 2.10 | 0.158*** | (4.45) |
| Distance to nearest market town | 6.12 | 3.41 | 5.88 | 3.16 | 6.24 | 3.51 | -0.354*** | (-6.21) |
| Distance to the border | 26.26 | 21.44 | 27.00 | 22.02 | 25.90 | 21.15r | 1.107** | (3.09) |
| Distance to London | 199.18 | 107.16 | 178.81 | 90.02 | 208.95 | 113.18 | -30.14*** | (-16.95) |
| Distance to nearest coalfield | 42.51 | 41.06 | 43.53 | 40.13 | 42.02 | 41.49 | 1.513* | (2.20) |
| Observations | 16291 | | 5281 | | 11010 | | 16291 | |

Notes: Monastic dummy is an indicator variable that is equal to one if parish $p$ contains at least one property in the Valor Ecclesiasticus that belonged to a monastery. If parish $p$ contains no monastic properties, the monastic dummy is zero. The difference of means columns report the difference between the means of the subsamples defined by the monastic dummy and the significance of this difference, obtained from a two-sided t-test. * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 3: Monastic Income and the Location and Scale of the Textile Industry

| | Mill dummy | | Number of Mills | | Mill Employment | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(1 + Monastic Income) | 0.00876*** | 0.0106*** | 0.0492** | 0.0671*** | 5.095** | 6.519** |
| | (0.00160) | (0.00155) | (0.0210) | (0.0249) | (2.291) | (2.538) |
| | [0.00159] | [0.00149] | [0.0209] | [0.0241] | [2.288] | [2.4612] |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Mean dep. var. | 0.04 | 0.04 | 0.17 | 0.17 | 15.68 | 15.68 |
| Observations | 16243 | 16243 | 16243 | 16243 | 16243 | 16243 |
| $R^2$ | 0.053 | 0.334 | 0.011 | 0.743 | 0.022 | 0.128 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Conley (1999) standard errors adjusted for arbitrary two-dimensional spatial correlation are reported in square brackets. These errors are constructed assuming weights equal to one for observations less than four decimal degrees apart, and weights equal to zero for observations further apart. Mill dummy is an indicator variable equal to one if there was a mill in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 4: Textile mills and controls

| | Mill dummy | | | Number of Mills | | | Mill Employment | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ln(1 + Monastic Income) | 0.0100*** | 0.00829*** | 0.0102*** | 0.0600** | 0.0416** | 0.0622*** | 5.517** | 3.204 | 5.927** |
| | (0.00154) | (0.00152) | (0.00153) | (0.0241) | (0.0208) | (0.0232) | (2.392) | (2.463) | (2.410) |
| ln(1 + Lay Subsidy Income) | 0.00238*** | | | 0.0308*** | | | 4.338*** | | |
| | (0.000657) | | | (0.00975) | | | (1.526) | | |
| ln(1 + Non Monastic Income) | | 0.0125*** | | | 0.139*** | | | 18.05*** | |
| | | (0.00160) | | | (0.0409) | | | (5.598) | |
| Terrain elevation | | | -0.000150*** | | | -0.000799 | | | -0.000618 |
| | | | (0.0000533) | | | (0.00106) | | | (0.0910) |
| Terrain slope | | | 0.00755*** | | | 0.0149 | | | 0.507 |
| | | | (0.00179) | | | (0.0175) | | | (1.721) |
| Wheat suitability | | | -0.0000273 | | | 0.00421* | | | 0.102 |
| | | | (0.000169) | | | (0.00230) | | | (0.331) |
| Distance to nearest river | | | -0.00486*** | | | -0.0114 | | | -1.549* |
| | | | (0.000775) | | | (0.00747) | | | (0.791) |
| Distance to nearest market town | | | -0.00273*** | | | -0.0212** | | | -3.935*** |
| | | | (0.000698) | | | (0.00963) | | | (1.421) |
| Distance to the border | | | -0.000303 | | | 0.00708* | | | 0.417 |
| | | | (0.000352) | | | (0.00388) | | | (0.434) |
| Distance to London | | | 0.000643** | | | -0.000598 | | | -0.135 |
| | | | (0.000301) | | | (0.00385) | | | (0.545) |
| Distance to nearest coalfield | | | -0.000477* | | | -0.00636** | | | -0.822* |
| | | | (0.000290) | | | (0.00265) | | | (0.426) |
| Control for Parish area | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Soiltype dummies | No | No | Yes | No | No | Yes | No | No | Yes |
| Mean dep. var. | 0.04 | 0.04 | 0.04 | 0.17 | 0.17 | 0.17 | 15.68 | 15.68 | 15.68 |
| Observations | 16243 | 16243 | 16228 | 16243 | 16243 | 16228 | 16243 | 16243 | 16228 |
| $R^2$ | 0.334 | 0.338 | 0.341 | 0.743 | 0.744 | 0.744 | 0.129 | 0.133 | 0.131 |

Notes: All regressions are estimated using OLS and include fixed effects at the hundred level. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535. ln(1 + Non Monastic Income) is the natural log of non monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). ln(1 + Lay Subsidy Income) is the natural log of taxable income from the 1524/5 lay subsidy returns (Sheail, 1968). Elevation is the average elevation of the terrain measured in meters. Slope is the average slope of the terrain measured in degrees. Wheat suitability is the average value of an index of soil suitability for growing wheat ranging from 0 to 100. Distance to the nearest river, the nearest market town, the sea and London are based on our own calculations in GIS and are measured in kilometers. The database of market towns comes from Adams (1700). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 5: Monastic Income and Occupational Structure

| | Share in agriculture | | Share in manufacturing | | Share in retail | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(1 + Monastic Income) | -0.0139*** | -0.0152*** | -0.000849 | 0.00127** | 0.00935*** | 0.00879*** |
| | (0.00174) | (0.00156) | (0.000571) | (0.000530) | (0.000968) | (0.000918) |
| | [0.00173] | [0.00148] | [0.000569] | [0.000505] | [0.000964] | [0.000878] |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Mean dep. var. | 0.62 | 0.62 | 0.03 | 0.03 | 0.18 | 0.18 |
| Observations | 12831 | 12831 | 12831 | 12831 | 12831 | 12831 |
| $R^2$ | 0.104 | 0.428 | 0.236 | 0.528 | 0.029 | 0.279 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Conley (1999) standard errors adjusted for arbitrary two-dimensional spatial correlation are reported in square brackets. These errors are constructed assuming weights equal to one for observations less than four decimal degrees apart, and weights equal to zero for observations further apart. Share in agriculture is the share of males aged 20 and above employed in agriculture in the 1831 census. Share in manufacturing is the share of males aged 20 and above employed in manufacturing in the 1831 census. Share in retail is the share of males aged 20 and above employed in retail in the 1831 census. ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 6: Occupational structure and controls

| | Share in agriculture | | | Share in manufacturing | | | Share in retail | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ln(1 + Monastic Income) | -0.0142*** | -0.0128*** | -0.0133*** | 0.00123** | 0.00126** | 0.00126** | 0.00797*** | 0.00716*** | 0.00756*** |
| | (0.00155) | (0.00155) | (0.00149) | (0.000529) | (0.000527) | (0.000523) | (0.000911) | (0.000918) | (0.000892) |
| ln(1 + Lay Subsidy Income) | -0.00617*** | | | 0.000236 | | | 0.00476*** | | |
| | (0.000835) | | | (0.000306) | | | (0.000480) | | |
| ln(1 + Non Monastic Income) | | -0.0155*** | | | 0.0000977 | | | 0.0106*** | |
| | | (0.00155) | | | (0.000515) | | | (0.000914) | |
| Terrain elevation | | | 0.000470*** | | | 0.0000274 | | | -0.000326*** |
| | | | (0.0000668) | | | (0.0000278) | | | (0.0000359) |
| Terrain slope | | | -0.0168*** | | | 0.00270*** | | | 0.00370*** |
| | | | (0.00201) | | | (0.000834) | | | (0.00114) |
| Wheat suitability | | | 0.000337 | | | -0.000235** | | | 0.000254* |
| | | | (0.000249) | | | (0.0000938) | | | (0.000137) |
| Distance to nearest river | | | 0.00525*** | | | -0.00127*** | | | -0.00183*** |
| | | | (0.00112) | | | (0.000385) | | | (0.000611) |
| Distance to nearest market town | | | 0.0123*** | | | -0.00103*** | | | -0.00546*** |
| | | | (0.000826) | | | (0.000290) | | | (0.000479) |
| Distance to the border | | | 0.000420 | | | 0.000324* | | | -0.0000267 |
| | | | (0.000425) | | | (0.000194) | | | (0.000232) |
| Distance to London | | | -0.0000412 | | | -0.000149 | | | 0.0000205 |
| | | | (0.000344) | | | (0.000153) | | | (0.000185) |
| Distance to nearest coalfield | | | 0.00143*** | | | -0.00104*** | | | -0.0000134 |
| | | | (0.000404) | | | (0.000139) | | | (0.000215) |
| Control for Parish area | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Soiltype dummies | N | N | Y | N | N | Y | N | N | Y |
| Mean dep. var. | 0.62 | 0.62 | 0.62 | 0.03 | 0.03 | 0.03 | 0.18 | 0.18 | 0.18 |
| Observations | 12831 | 12831 | 12819 | 12831 | 12831 | 12819 | 12831 | 12831 | 12819 |
| $R^2$ | 0.431 | 0.433 | 0.459 | 0.528 | 0.528 | 0.536 | 0.286 | 0.289 | 0.306 |

Notes: All regressions are estimated using OLS and include fixed effects at the hundred level. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Share in agriculture is the share of males aged 20 and above employed in agriculture in the 1831 census. Share in manufacturing is the share of males aged 20 and above employed in retail in the 1831 census. Share in retail is the share of males aged 20 and above employed in retail in the 1831 census. ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535. ln(1 + Non Monastic Income) is the natural log of non monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). ln(1 + Lay Subsidy Income) is the natural log of taxable income from the 1524/5 lay subsidy returns (Sheail, 1968). Elevation is the average elevation of the terrain measured in meters. Slope is the average slope of the terrain measured in degrees. Wheat suitability is the average value of an index of soil suitability for growing wheat ranging from 0 to 100. Distance to the nearest river, the nearest market town, the sea and London are based on our own calculations in GIS and are measured in kilometers. The database of market towns comes from Adams (1700). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 7: Matching estimates

| | Difference in means (1) | Nearest Neighbor match (ATT) (2) | OLS (3) |
|---|---|---|---|
| *Mill dummy* | | | |
| 1 vs. 0 Monastic presence dummy | 0.0088* | 0.0246*** | 0.0171*** |
| | (0.0483) | (0.0061) | (0.0049) |
| *Number of Mills* | | | |
| 1 vs. 0 Monastic presence dummy | 0.1229 | 0.2114** | 0.293* |
| | (0.2892) | (0.1038) | (0.176) |
| *Mill Employment* | | | |
| 1 vs. 0 Monastic presence dummy | -0.9569 | 14.62** | 10.45 |
| | (0.8995) | (5.043) | (8.171) |
| *Share in agriculture* | | | |
| 1 vs. 0 Monastic presence dummy | -0.0272*** | -0.0294*** | -0.0277*** |
| | (0.0000) | (0.0072) | (0.00524) |
| *Share in manufacturing* | | | |
| 1 vs. 0 Monastic presence dummy | 0.0085*** | 0.0053* | 0.00316 |
| | (0.0000) | (0.0029) | (0.00188) |
| *Share in retail* | | | |
| 1 vs. 0 Monastic presence dummy | 0.0108*** | 0.0147*** | 0.0161*** |
| | (0.0001) | (0.0043) | (0.00296) |
| Observations | 7961 | 7961 | 7961 |

Notes: Monastic presence dummy is an indicator variable that is equal to one if there is at least one monastic property in parish $p$, equal to zero if there is at least one non-monastic church property in parish $p$ but no monastic property, and missing otherwise. In our matching sample, the monastic dummy equals one for 4713 parishes and zero for 3248 parishes. Column (1) reports the difference in means across treatment status. Stars indicate the significance of the difference in a two-sided t-test. Column (2) reports the average treatment effect on the treated using a one-nearest neighbor match, where the nearest neighbor is found using the Mahalanobis distance described in the text. Standard errors are Abadie-Imbens robust standard errors for nearest neighbor matching (Abadie and Imbens, 2006). Column (3) reports coefficients and robust standard errors from an OLS regression of the relevant dependent variable on the set of matching variables. The set of matching variables includes ln(1 + Non Monastic income), area, area squared, slope, slope squared, elevation, elevation squared, distance to the nearest river, distance to the nearest river squared, distance to the nearest coal field, distance to the nearest market town, and distance to London. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). Share in agriculture is the share of males aged 20 and above employed in agriculture in the 1831 census. Share in manufacturing is the share of males aged 20 and above employed in retail in the 1831 census. Share in retail is the share of males aged 20 and above employed in retail in the 1831 census. * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 8: Covariate balance

| | | Before Matching | | After Matching | |
|---|---|---|---|---|---|
| | Treatment group Mean (1) | Control Group Mean (2) | p-value difference in means (3) | Control Group Mean (4) | p-value difference in means (5) |
| *Treatment variable: Monastic presence dummy* | | | | | |
| **Matching covariates** | | | | | |
| Area | 9.7587 | 8.9921 | 0.000 | 9.3544 | 0.000 |
| ln(1 + Non Monastic income) | 1.6372 | 2.4981 | 0.000 | 1.8905 | 0.000 |
| Slope | 2.3639 | 2.6086 | 0.000 | 2.3132 | 0.121 |
| Elevation | 78.329 | 83.178 | 0.001 | 76.832 | 0.234 |
| Distance to nearest river | 2.5878 | 2.5804 | 0.877 | 2.5303 | 0.179 |
| Distance to nearest coalfield | 44.577 | 58.154 | 0.000 | 44.171 | 0.626 |
| Distance to nearest market town | 5.8787 | 5.9881 | 0.126 | 5.88 | 0.134 |
| Distance to London | 175.57 | 168.75 | 0.001 | 174.39 | 0.515 |
| **Other observables** | | | | | |
| ln(1 + Lay Subsidy tax) | 4.3175 | 4.6175 | 0.000 | 4.3559 | 0.568 |
| Wheat suitability | 40.653 | 41.811 | 0.001 | 40.863 | 0.482 |
| Observations | 4713 | 3248 | | 1833 | |

Notes: Column (1) reports the mean of the relevant variable for those observations that have at least one monastic property as well as no missing observations in any of the matching variables. Column (2) reports the mean of the relevant variable for those observations that have no monastic property, but do have at least one church property. Columns (3) reports the p-value of a two-sided t-test of the difference between the means reported in columns (1) and (2). Column (4) reports the mean of the relevant variable for those observations that have been matched at least once using the procedure described in the text. Columns (5) reports the p-value of a two-sided t-test of the difference between the means reported in columns (1) and (4).

Table 9: Different Monastic orders and textile mills

| | Mill dummy | | Number of Mills | | Mill Employment | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| **Share of number of Monastic properties** | | | | | | |
| Benedictine | 0.0160* | 0.0174* | 0.192 | 0.207** | 7.862 | 25.35* |
| | (0.00895) | (0.00954) | (0.125) | (0.0970) | (7.905) | (13.34) |
| Augustinian | 0.0282*** | 0.0344*** | 0.308** | 0.294*** | 16.83** | 31.03*** |
| | (0.0102) | (0.0102) | (0.140) | (0.0944) | (8.239) | (11.19) |
| Cistercian | 0.00635 | -0.00401 | -0.148 | -0.189 | -18.84 | -39.64 |
| | (0.0137) | (0.0145) | (0.309) | (0.304) | (28.45) | (44.29) |
| Control for ln(1 + Non Monastic Income) | Y | Y | Y | Y | Y | Y |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Observations | 8808 | 8807 | 8808 | 8807 | 8808 | 8807 |
| $R^2$ | 0.069 | 0.346 | 0.030 | 0.806 | 0.057 | 0.212 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). Each variable for a monastic order is the share of properties in parish $p$ in the Valor owned by a monastery of that order. ln(1 + Non Monastic Income) is the natural log of non monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 10: The potential effect of unobservables

| | $\frac{\hat{\alpha}_{extended}}{\hat{\alpha}_{baseline}-\hat{\alpha}_{extended}}$ |
|---|---|
| Mill dummy | 26.6 |
| Nr. of Mills | 12.4 |
| Mill employment | 10.0 |
| Share in Agriculture | 6.7 |
| Share in Manufacturing | 90.8 |
| Share in Retail | 6.12 |

Notes: Every line presents two regressions for the dependent variable listed in that row, summarized by the ratio $\frac{\hat{\alpha}_{extended}}{\hat{\alpha}_{baseline}-\hat{\alpha}_{extended}}$ where $\hat{\alpha}_{baseline}$ is the coefficient on ln(1 + Monastic Income) in a regression that includes Parish area as a control as well as a set of hundred fixed effects (and robust standard errors). $\hat{\alpha}_{extended}$ is the coefficient on the same variable of interest in a regression that includes Parish area, elevation, slope, soil suitability for wheat, distance to the nearest river, distance to the nearest market town, distance to the border, distance to London as controls, as well as soil type dummies and hundred fixed effects (and robust standard errros). Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). Share in agriculture is the share of males aged 20 and above employed in agriculture in the 1831 census. Share in manufacturing is the share of males aged 20 and above employed in retail in the 1831 census. Share in retail is the share of males aged 20 and above employed in retail in the 1831 census.

Table 11: Monastic Income and Intermediate Variables

| | Nr. of Gentry in 1700 | | Parliamentary Enclosure | | Nr. of Agricultural Patents | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| ln(1 + Monastic Income) | 0.0908*** | 0.0943*** | 0.0243*** | 0.0240*** | 0.0159*** | 0.0183*** |
| | (0.00741) | (0.00746) | (0.00305) | (0.00310) | (0.00374) | (0.00377) |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Mean dep. var. | 0.66 | 0.66 | 0.37 | 0.37 | 0.02 | 0.02 |
| Observations | 16243 | 16243 | 16243 | 16243 | 16243 | 16243 |
| $R^2$ | 0.111 | 0.228 | 0.177 | 0.287 | 0.008 | 0.103 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Nr. of Gentry in 1700 is the number of gentry in 1700 in parish $p$, recorded in Adams (1700). Parliamentary Enclosure is an indicator variable equal to one if an act of parliamentary enclosure between 1750 and 1840 included part of parish $p$ (Tate and Turner, 1978). Nr. of Agricultural Patents is the total number of agricultural patents that were registered to people living in parish $p$ between 1700 and 1850 (Woodcroft, 1854, 1862). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 12: Intermediate variables and controls

| | Nr. of Gentry in 1700 | | | Parliamentary Enclosure | | | Nr. of Agricultural Patents | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| ln(1 + Monastic Income) | 0.0835*** | 0.0747*** | 0.0860*** | 0.0191*** | 0.0164*** | 0.0221*** | 0.0176*** | 0.0174*** | 0.0178*** |
| | (0.00742) | (0.00732) | (0.00735) | (0.00306) | (0.00309) | (0.00311) | (0.00375) | (0.00373) | (0.00380) |
| ln(1 + Lay Subsidy Income) | 0.0468*** | | | 0.0212*** | | | 0.00306** | | |
| | (0.00355) | | | (0.00157) | | | (0.00145) | | |
| ln(1 + Non Monastic Income) | | 0.107*** | | | 0.0415*** | | | 0.00471* | |
| | | (0.00741) | | | (0.00317) | | | (0.00258) | |
| Terrain elevation | | | -0.00148*** | | | -0.000417*** | | | -0.000109*** |
| | | | (0.000209) | | | (0.000106) | | | (0.0000399) |
| Terrain slope | | | 0.00814 | | | -0.0123*** | | | 0.00550** |
| | | | (0.00681) | | | (0.00329) | | | (0.00215) |
| Wheat suitability | | | 0.00154 | | | 0.000662 | | | -0.000410 |
| | | | (0.00105) | | | (0.000501) | | | (0.000253) |
| Distance to nearest river | | | -0.00260 | | | 0.00192 | | | -0.00203** |
| | | | (0.00434) | | | (0.00213) | | | (0.000894) |
| Distance to nearest market town | | | -0.0329*** | | | -0.00428*** | | | -0.00310*** |
| | | | (0.00309) | | | (0.00144) | | | (0.000743) |
| Distance to the border | | | -0.00210 | | | 0.00277*** | | | 0.000233 |
| | | | (0.00162) | | | (0.000842) | | | (0.000424) |
| Distance to London | | | -0.000929 | | | 0.00268*** | | | -0.0000757 |
| | | | (0.00130) | | | (0.000661) | | | (0.000244) |
| Distance to nearest coalfield | | | -0.00325** | | | 0.00226*** | | | -0.000436 |
| | | | (0.00155) | | | (0.000794) | | | (0.000289) |
| Control for Parish area | Y | Y | Y | Y | Y | Y | Y | Y | Y |
| Soiltype dummies | No | No | Yes | No | No | Yes | No | No | Yes |
| Mean dep. var. | 0.66 | 0.662 | 0.66 | 0.37 | 0.37 | 0.37 | 0.02 | 0.02 | 0.02 |
| Observations | 16243 | 16243 | 16228 | 16243 | 16243 | 16228 | 16243 | 16243 | 16228 |
| $R^2$ | 0.239 | 0.242 | 0.244 | 0.297 | 0.296 | 0.294 | 0.104 | 0.104 | 0.107 |

Notes: All regressions are estimated using OLS and include fixed effects at the hundred level. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Nr. of Gentry in 1700 is the number of gentry in 1700 in parish $p$, recorded in Adams (1700). Parliamentary Enclosure is an indicator variable equal to one if an act of parliamentary enclosure between 1750 and 1840 included part of parish $p$ (Tate and Turner, 1978). Number of Agricultural Patents is the total number of agricultural patents that were registered to people living in the parish between 1700 and 1850 (Woodcroft, 1854, 1862). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535. ln(1 + Non Monastic Income) is the natural log of non monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). ln(1 + Lay Subsidy Income) is the natural log of taxable income from the 1524/5 lay subsidy returns (Sheail, 1968). Elevation is the average elevation of the terrain measured in meters. Slope is the average slope of the terrain measured in degrees. Wheat suitability is the average value of an index of soil suitability for growing wheat ranging from 0 to 100. Distance to the nearest river, the nearest market town, the sea and London are based on our own calculations in GIS and are measured in kilometers. The database of market towns comes from Adams (1700). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

# Appendix for Monks, Gents and Industrialists: The Long-Run Impact of the Dissolution of the English Monasteries For Online Publication

This appendix contains supplementary material for the paper Monks, Gents and Industrialists: The Long-Run Impact of the Dissolution of the English Monasteries.

## 1: Extra Results

Table A-1: Monastic and Non-Monastic income in the Valor Ecclesiasticus

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| *Panel I* | | | | | | |
| *Dependent variable:* | Mill dummy | | Number of Mills | | Mill Employment | |
| ln(1 + Valor Income) | 0.0106*** | 0.0134*** | 0.158** | 0.127*** | 14.06*** | 16.11*** |
| | (0.00143) | (0.00138) | (0.0631) | (0.0335) | (3.661) | (4.343) |
| Observations | 16243 | 16243 | 16243 | 16243 | 16243 | 16243 |
| $R^2$ | 0.055 | 0.337 | 0.014 | 0.744 | 0.027 | 0.133 |
| *Panel II* | | | | | | |
| *Dependent variable:* | Share in agriculture | | Share in manufacturing | | Share in retail | |
| ln(1 + Valor Income) | -0.0136*** | -0.0182*** | -0.00143*** | 0.000713 | 0.0106*** | 0.0116*** |
| | (0.00159) | (0.00141) | (0.000549) | (0.000495) | (0.000867) | (0.000821) |
| Observations | 12831 | 12831 | 12831 | 12831 | 12831 | 12831 |
| $R^2$ | 0.105 | 0.432 | 0.237 | 0.528 | 0.034 | 0.287 |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). Share in agriculture is the share of males aged 20 and above employed in agriculture in the 1831 census. Share in manufacturing is the share of males aged 20 and above employed in manufacturing in the 1831 census. Share in retail is the share of males aged 20 and above employed in retail in the 1831 census. ln(1 + Monastic Income) is the log of total monastic income in parish $p$, measured in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). Parish area is measured in square kilometers. * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A-2: Alternative measures of the Valor

| | Mill dummy | | Number of Mills | | Mill Employment | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Panel I* | | | | | | |
| Nr. Monastic obs. in Valor | 0.00767*** | 0.00857*** | 0.0407*** | 0.0448*** | 3.631** | 4.696** |
| | (0.00182) | (0.00191) | (0.0144) | (0.0143) | (1.626) | (1.950) |
| Observations | 16243 | 16243 | 16243 | 16243 | 16243 | 16243 |
| $R^2$ | 0.053 | 0.334 | 0.011 | 0.743 | 0.022 | 0.128 |
| *Panel II* | | | | | | |
| Monastic Dummy | 0.0129*** | 0.0246*** | 0.230* | 0.174*** | 13.42** | 17.63** |
| | (0.00381) | (0.00360) | (0.126) | (0.0640) | (6.377) | (6.967) |
| Observations | 16243 | 16243 | 16243 | 16243 | 16243 | 16243 |
| $R^2$ | 0.051 | 0.333 | 0.012 | 0.743 | 0.022 | 0.128 |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Mean dep. var. | 0.04 | 0.04 | 0.17 | 0.17 | 15.68 | 15.68 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). Nr. Monastic obs. in Valor is the number of properties in the Valor Ecclesiasticus that are in parish $p$. Monastic Dummy is an indicator variable equal to one if there is at least one property in the Valor in parish $p$. * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A-3: Dropping urban parishes

| | Drop urban parishes from 1831 census | | | Drop borough constituencies | | |
|---|---|---|---|---|---|---|
| | (1) Mill Dummy | (2) Nr. of Mills | (3) Mill employment | (4) Mill Dummy | (5) Nr. of Mills | (6) Mill employment |
| ln(1 + Monastic Income) | 0.0429** | 0.00761*** | 3.985** | 0.0591** | 0.00983*** | 5.653** |
| | (0.0215) | (0.00143) | (2.025) | (0.0259) | (0.00156) | (2.589) |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Mean dep. var. | 0.04 | 0.17 | 15.68 | 0.04 | 0.17 | 15.68 |
| Observations | 15817 | 15817 | 15817 | 13254 | 13254 | 13254 |
| $R^2$ | 0.088 | 0.348 | 0.124 | 0.077 | 0.236 | 0.102 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. In columns (1) to (3) parishes that were classified as urban in the 1831 census were removed from the sample. In columns (4) to (6) parishes that were located in a borough constituency were removed from the sample (Cannon, 1973). Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A-4: Monastic Income and the Textile Industry in North West England

| | Mill dummy | | Number of Mills | | Mill Employment | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Panel I sample: North West England* | | | | | | |
| ln(1 + Monastic Income) | 0.0273*** | 0.0304*** | 0.258* | 0.347** | 29.76** | 36.72** |
| | (0.00613) | (0.00606) | (0.132) | (0.146) | (14.43) | (14.85) |
| Observations | 3661 | 3661 | 3661 | 3661 | 3661 | 3661 |
| $R^2$ | 0.036 | 0.288 | 0.008 | 0.746 | 0.017 | 0.123 |
| *Panel II sample: Lancashire* | | | | | | |
| ln(1 + Monastic Income) | 0.0810*** | 0.102*** | 1.659* | 1.864* | 224.5** | 226.7** |
| | (0.0210) | (0.0203) | (0.907) | (0.989) | (104.0) | (107.6) |
| Observations | 683 | 683 | 683 | 683 | 683 | 683 |
| $R^2$ | 0.044 | 0.315 | 0.006 | 0.825 | 0.029 | 0.160 |
| Control for Parish area | Y | Y | Y | Y | Y | Y |
| Fixed Effects | County | Hundred | County | Hundred | County | Hundred |
| Mean dep. var. | 0.04 | 0.04 | 0.17 | 0.17 | 15.68 | 15.68 |

Notes: All regressions are estimated using OLS and include fixed effects at the level indicated in the table. The unit of observation is a parish. Heteroskedasticity robust standard errors are reported in parentheses. In panel I, the sample is restricted to observations from the northwestern counties Cumberland, Westmorland, Lancashire, Yorkshire West Riding, Cheshire, Derbyshire, Nottinghamshire and Staffordshire. In Panel II, the sample is further restricted to Lancashire. Mill dummy is an indicator variable equal to one if there was a mill in in parish $p$ in 1838. Number of Mills is the total number of cotton, wool, flax and worsted mills in parish $p$ in 1838, and Mill Employment is the total number of people employed in mills in parish $p$ in 1838 (Parliament, 1839). ln(1 + Monastic Income) is the natural log of monastic income generated in parish $p$ in 1535 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

## 2: Scatter plots of main variables

This section contains scatter plots of the main estimated relationships in this paper. After partialing out parish area and fixed effects at the level of the hundred, we use a linear fit to summarize the relationship between the log of monastic income and the presence of a textile mill in 1838. We then divide the sample into 40 equal sized bins, average the residualized log of monastic income and every outcome variable within these bins, and plot the resulting reduced sample. The size of each scatter point is proportional to the average number of gentry within the relevant bin. All outcome variables are described in section 2 of the paper.

Figure A–1: Binned scatterplot for Monastic income and mill dummy

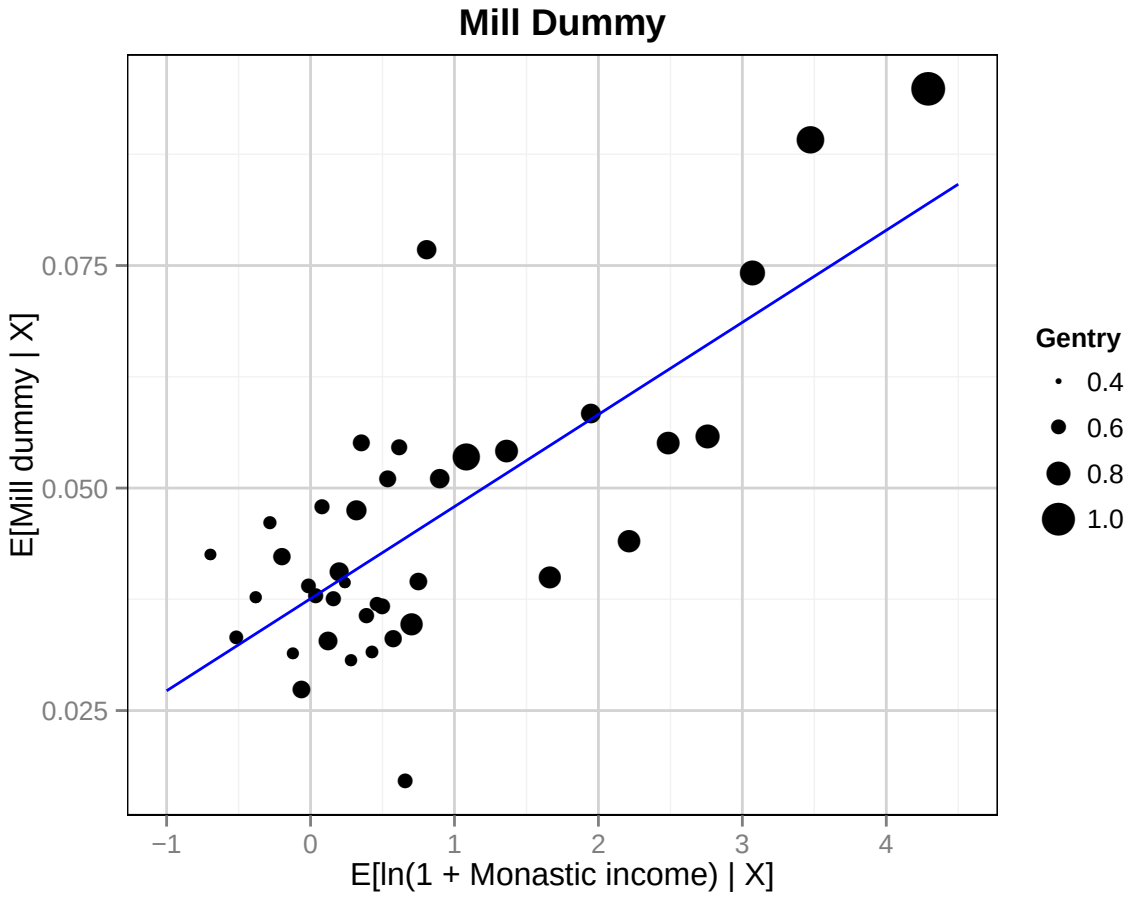


Figure A-2: Binned scatterplot for Monastic income and number of mills

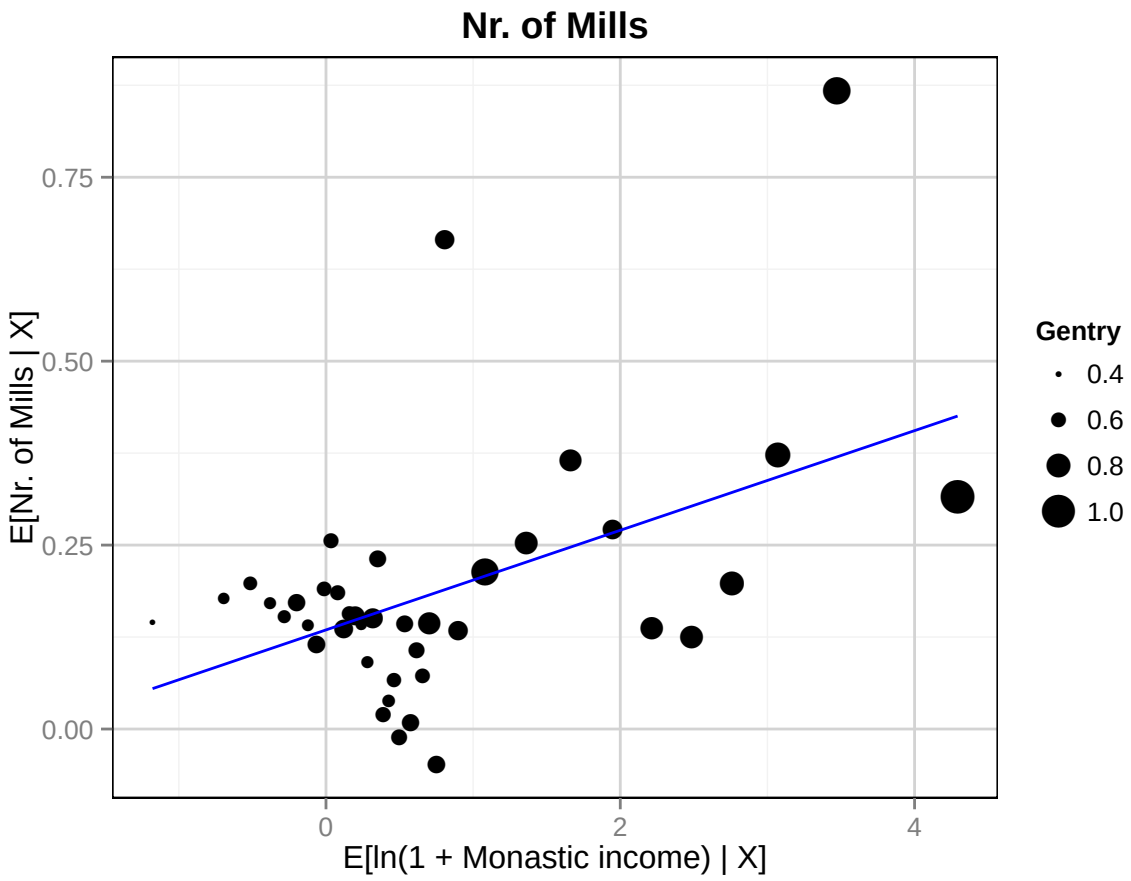


Figure A-3: Binned scatterplot for Monastic income and mill employment

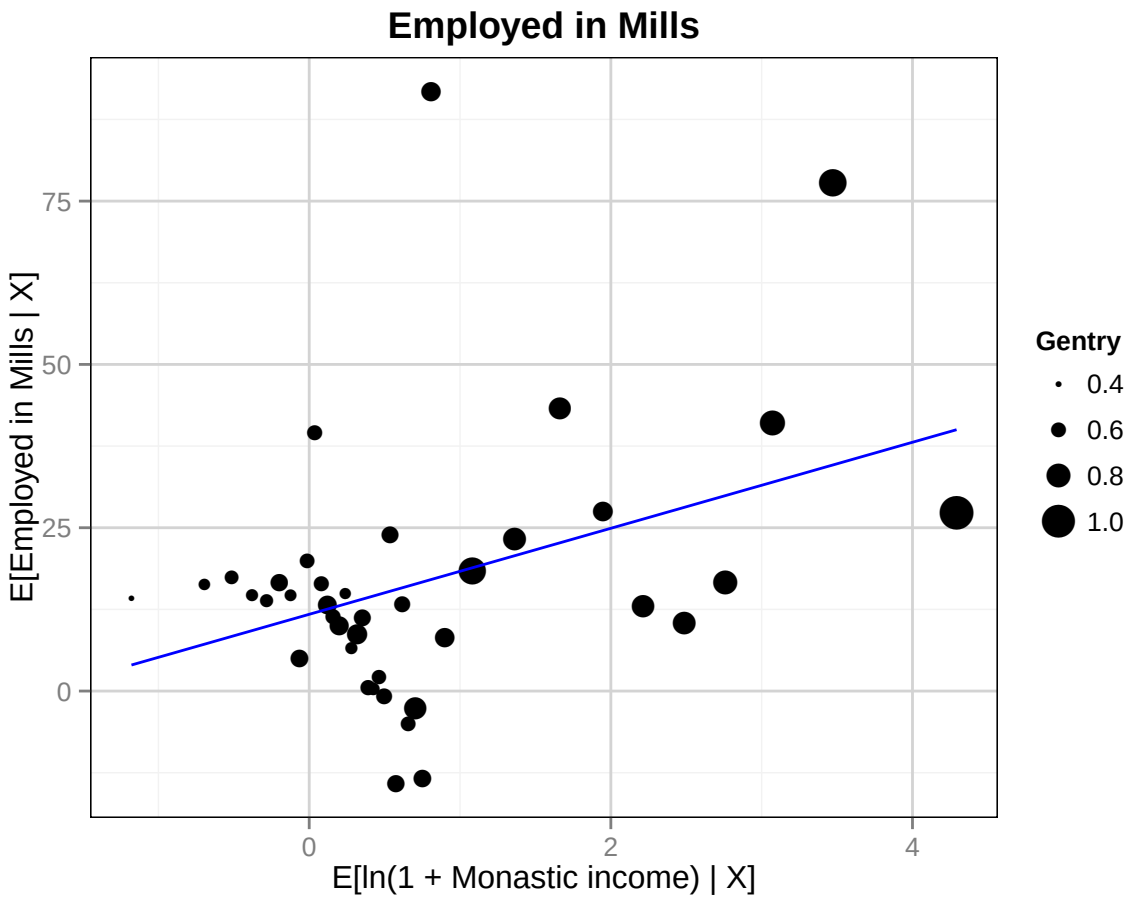


Figure A-4: Binned scatterplot for Monastic income and share in agriculture

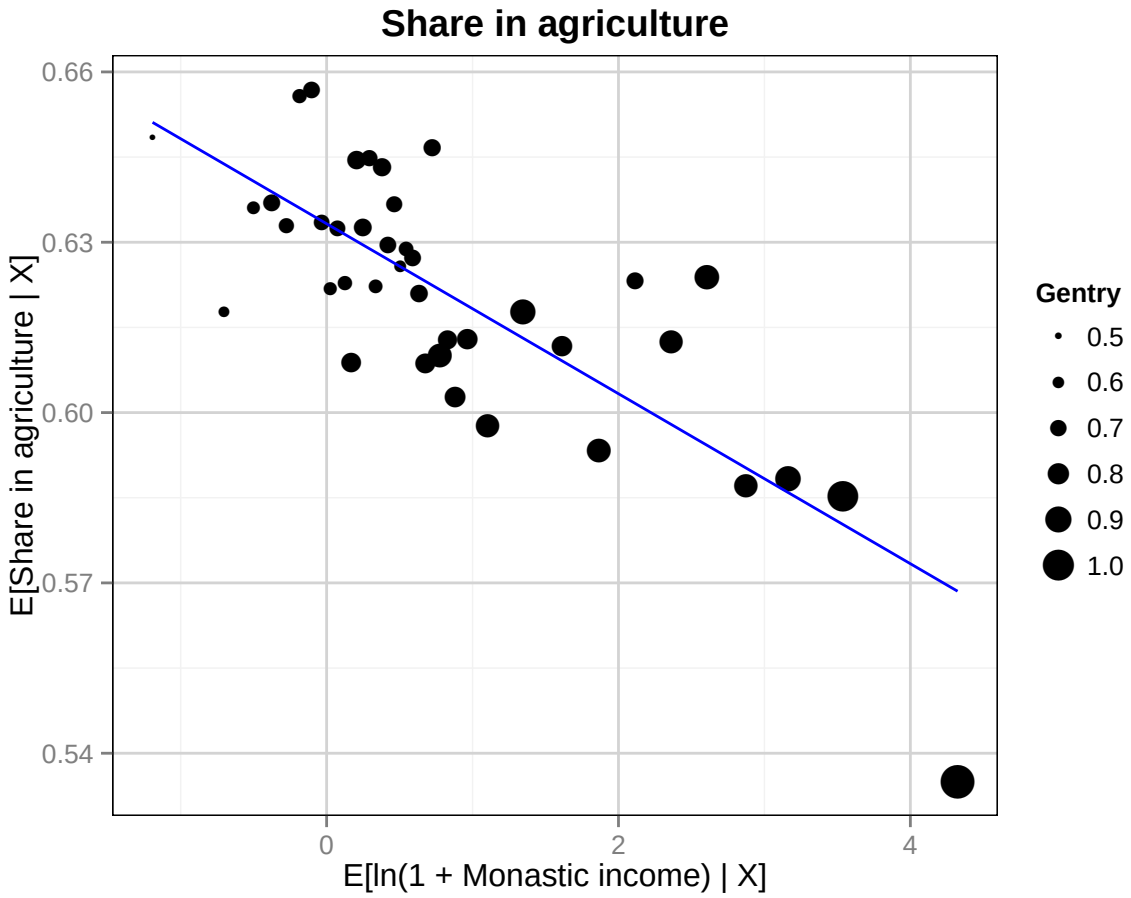


Figure A-5: Binned scatterplot for Monastic income and share in manufacturing

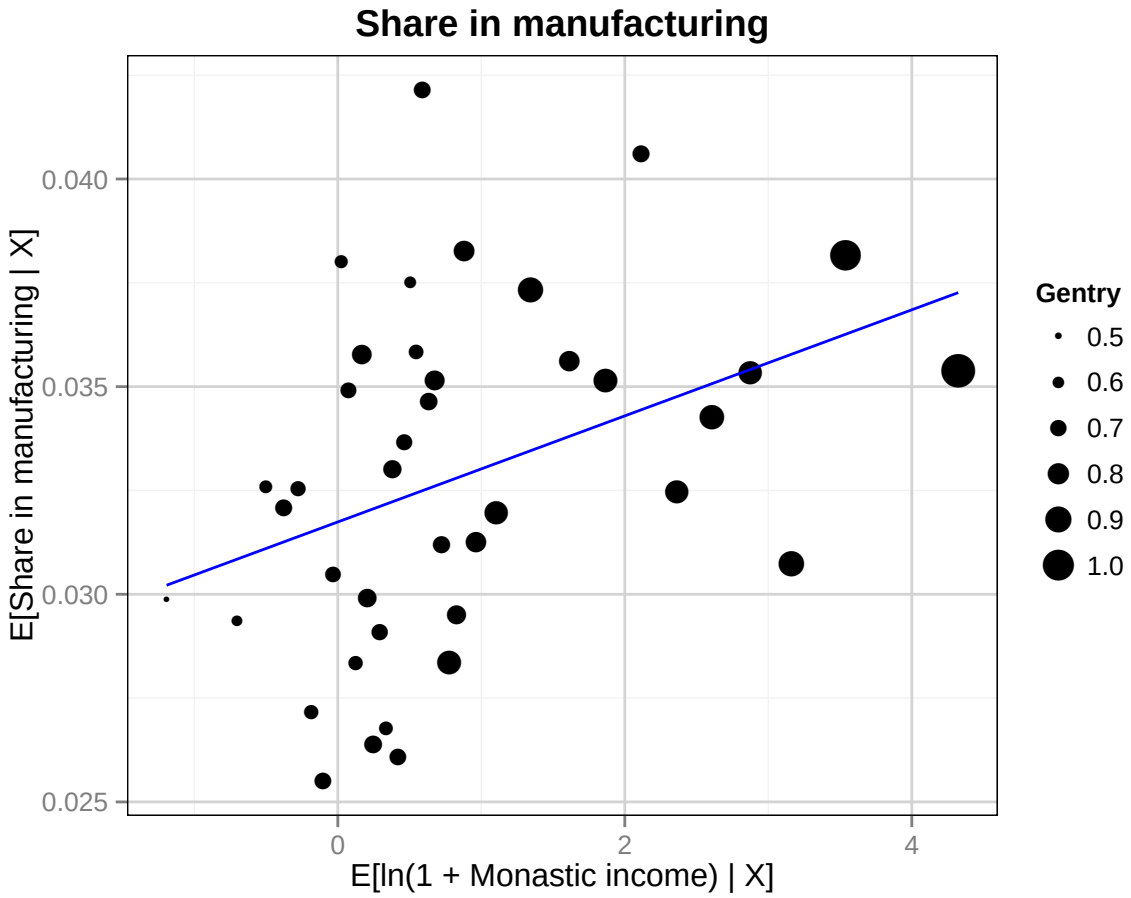


Figure A-6: Binned scatterplot for Monastic income and share in retail

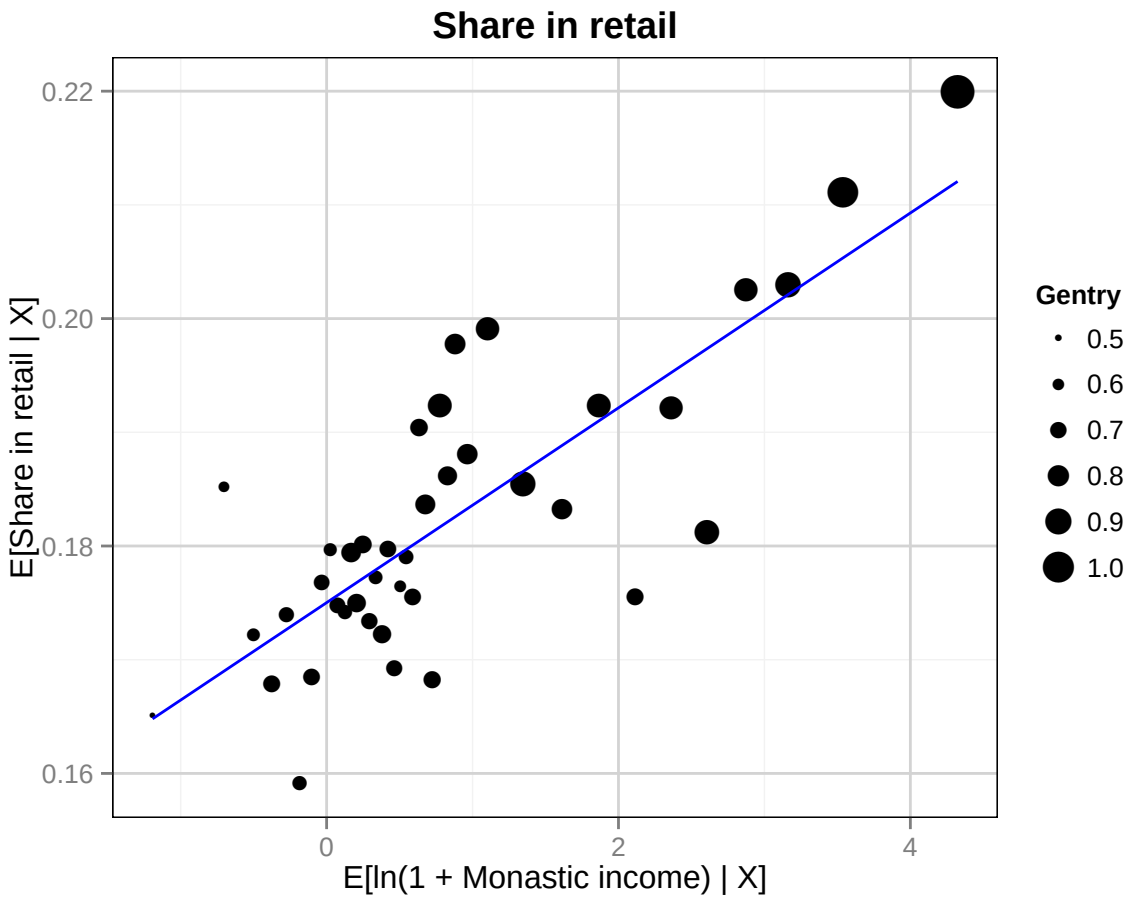


Figure A-7: Binned scatterplot for Monastic income and Number of Gentry

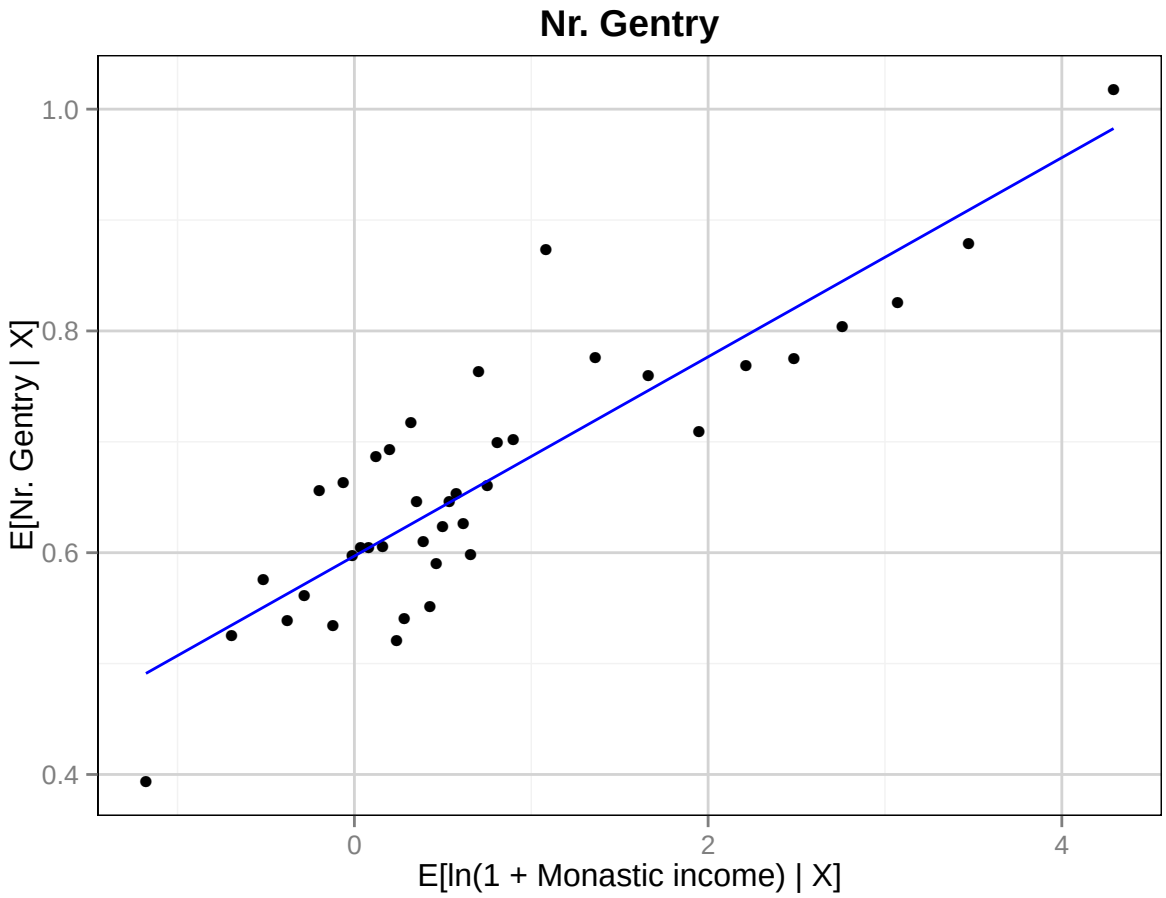


Figure A-8: Binned scatterplot for Monastic income and Enclosure

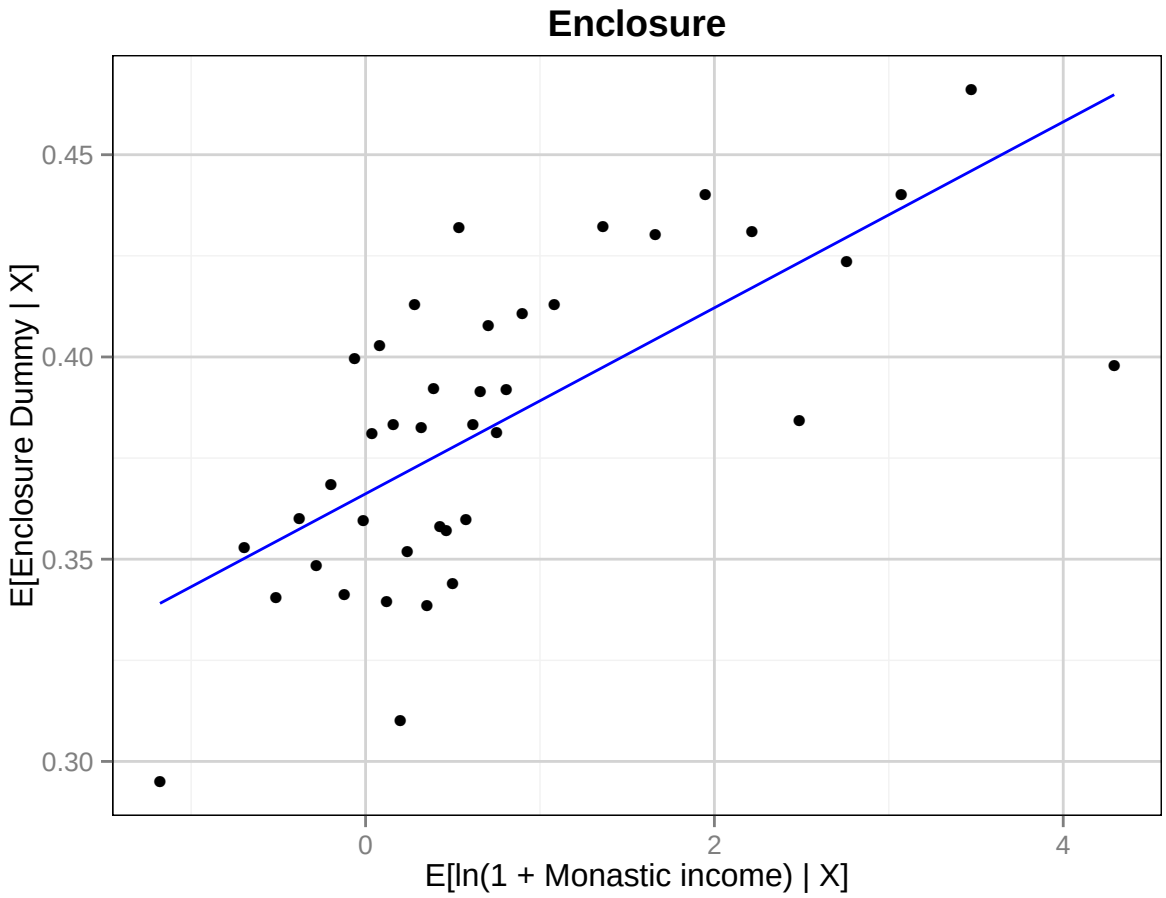
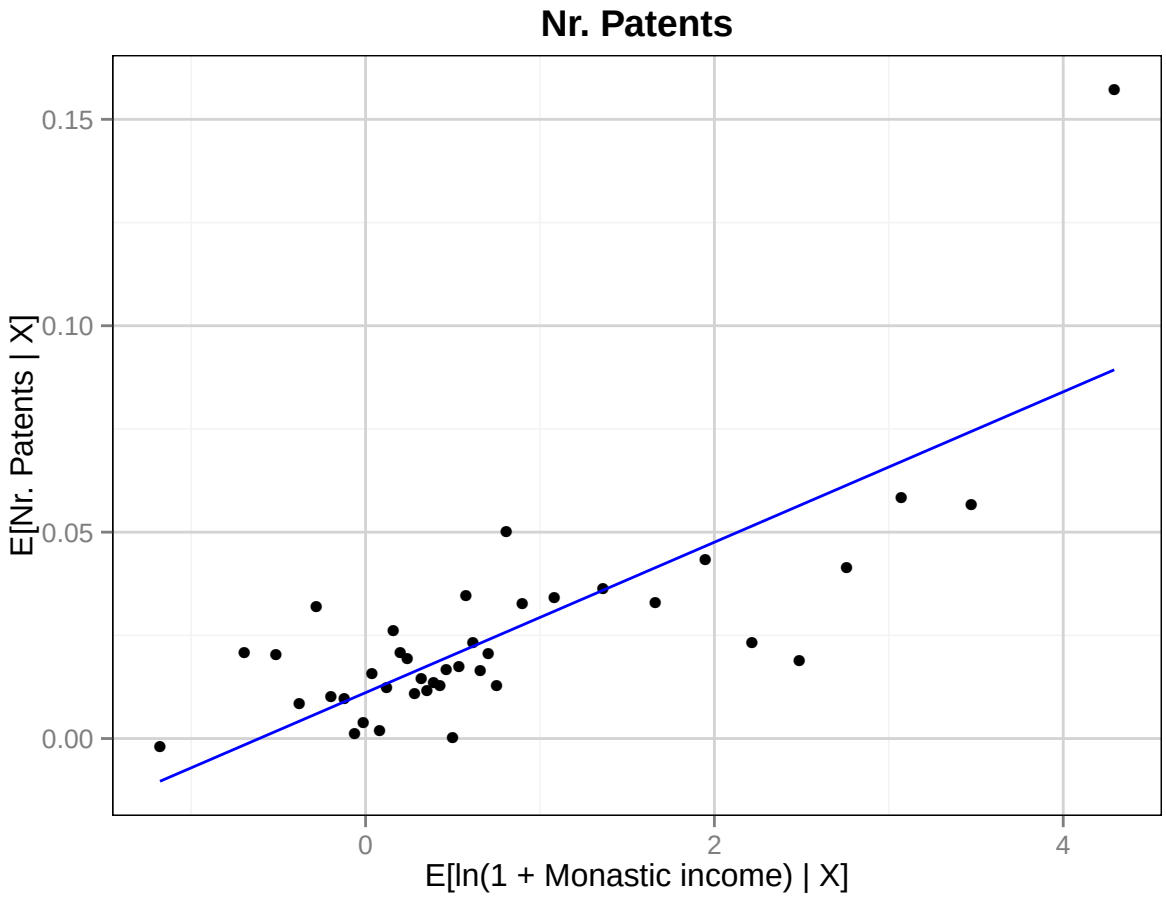


Figure A-9: Binned scatterplot for Monastic income and Number of Patents



# 3: Historical background to the Dissolution of the Monasteries

This section reviews the historical background to the Dissolution of the monasteries and the Valor Ecclesiasticus, the relationship between the expropriation of the monastic lands and the rise of the gentry and provides case study evidence linking the gentry to the Industrial Revolution.

## Acts of parliament leading up to the Dissolution of Monasteries

In 1532 Parliament passed 'An Acte concernynge restraynt of payment of Annates to the See of Rome'.[25] This act diverted the Annates payed by anybody with the rank of bishop or higher from the Pope to the Crown. Hunter (1834) argues that this act was meant to strengthen the kings bargaining position with the Pope. A second act was passed in the parliament that sat from January 15th 1534. This act made it 'unlawful to make any payment on any pretence to the See of Rome, and severing the connection which had existed between the two states' (Hunter, 1834, p.13).

Parliament next decided that all payments to the Pope were now to be paid to the king instead. This passed in the parliament that sat from November 3rd 1534 in the act titled 'An Acte Concerninge the payment of Firste Fruites of all dignities benefices and promocyons spirituall, and also concerning one annuell pencyon of the tenthe parte of all the possessions of the Churche, spirituall and temporall, graunted to the Kinges Highnes and his heires'. This act also named the king as the head of the Church of England for the first time. In order to assess how much revenue Henry VIII could expect he sent out surveyors, called commissioners, to record the value of incomes generated by ecclesiastical property in England. The Valor Ecclesiasticus is the summary report of these commissioners.

## How the survey underlying the Valor Ecclesiasticus was carried out

Every diocese received commissioners, at least three, that were to assess the value of all ecclesiastical possessions in that diocese. The survey started on January 30th 1535 and was to be finished by the Octaves of Holy Trinity (usually the 8th Sunday after Easter; Knowles (1979) cites the 1st of May). All commissioners were to be local notables, below the rank of Baron (Hunter, 1834, p. 19). These notables were ususally the justices of the peace, mayors, sherrifs and the local gentry (Savine, 1909, p. 17). The oath of the commissioners can be found in the second volume of the Valor. The commissioners then split up into parties of at least three, divided the diocese among them and administered the survey. The subsequent

[25] This section builds mostly on Hunter (1834). See also Youings (1971) and Knowles (1979). Annates are synomymous with first fruits or first year's profits of every benefice, to be collected when the benefice changed occupier. A benefice is an ecclesiastical position, such as a parish priest.

collection of the incomes was left to the bishops who were expected to collect the amount due by Christmas and deliver it to the Exchequer by April of the following year (Savine, 1909, p. 3).

After the survey, Henry decided to expropriate the English monasteries, rather than simply re-directing their income streams. He started with the monasteries that were valued under 200 pounds. In 1536, parliament passed an act popularly known as the Dissolution of the Lesser Monasteries Act, which expropriated 453 monasteries (Jack, 1970, p.1). In 1539, The Second Act of Dissolution followed, expropriating all remaining monasteries.[26]

## The local Gentry and the disposal of the monastic lands

There were three broad ways in which the Crown obtained ownership of a monastery. The first was outright expropriation. This method was most commonly used when dealing with smaller monasteries. The abbot would sign a 'deed of gift' transferring ownership to the Crown. A second way was surrender. After the initial wave of dissolution, larger monasteries were charged with some crime and were given the choice to surrender and receive pensions or to be tried in court. The third way was dissolution by negotiation. Some of the larger abbeys managed to secure favorable arrangements for themselves before signing the deed of gift. The full procedure of dissolution is given in Youings (1971, p. 73).

Some of the expropriated lands were given away as gifts by the King. Even before the first commission for the sale of lands was established in 1539 a total of 234 grants had been made (Youings, 1971, p. 117). Not coincidentally, one of the first grantees was the Chancellor of the Court of Augmentations (the government body in charge of the dissolution), Richard Rich.[27] Other grantees included Henry's Chief Minister Thomas Cromwell and several members of the aristocracy. The total amount of land granted appears to have been small. For Devon, it was about 25% of the expropriated monastic land and for Leicestershire around 15% (Youings, 1967, p. 343).

The remaining land was initially leased out by the Crown. Although selling of the lands started as early as 1539, it was not until 1543, when war with France broke out, that the Crown started selling large swathes of monastic lands. Between 1543 and 1547 the Court of Augmentations oversaw the sale of two thirds of all expropriated land. By 1558 virtually land had been sold (Habakkuk, 1958). The sale of the monastic land was in hands of the Court of Augmentations.[28] Most sales of monastic land were concluded

[26]For an exact chronology of the dissolution of the lesser monasteries see Jack (1970) and Hoyle (1995). Gasquet (1899) includes in appendix I a list of monasteries that paid the Crown to not be dissolved.

[27]Richard Rich was originally a lawyer with no noteworthy background. He would be knighted and be styled Baron Rich during his lifetime. For three centuries his descendants would be part of the English peerage (Carter, 2004).

[28]The process of obtaining land was as follows: Prospective buyers would need to obtain an updated assessment of the income of the lands they desired from the local augmentations officer. The request and the updated *valor* would then be submitted to the Court in London. If approved, the sale would be concluded. The prices were initially set at twenty years'

at the fixed price of 20 years income, with the rent being a tenth of annual income. A pervasive pattern is that:

> "Most purchasers came from landed stock, even if at the time of making their purchase they happened to be engaged in trade or following a profession." (Woodward, 1966, p. 131).

In other words, the ecclesiastical land was disproportionately sold to members of the gentry.[29] Families such as the Knatchbulls from Kent and the Cholwichs from Devon were yeomen at the beginning of the sixteenth century but rose to be among the gentry over the course of the century, rising to the peerage later. The Levesons of Staffordshire invested profits from wool trading to buy the former Augustinian priory at Trentham. Other members of the gentry used their positions of power in London to obtain lands in their home parishes. Samuel Whitbread used proceeds from the brewing business to set up an estate in Bedfordshire, where his family lived. The three sons of Ronald Barkley, a clothier's apprentice in London, established themselves as members of the minor gentry in the country side (examples from Mingay (1976, pp. 8, 9, 41, 59)). Famously, Sir Nicholas Bacon rose from being a lawyer to Lord Keeper of the Great Seal and was granted a substantial estate by Henry (Simpson, 1961). Overall, as noted in Table 1 in the paper, the proportion of land owned by the gentry increased from 25% in 1436 to 45-50% by 1688. The Church and Crown's share went from 25-35% in 1436 to 5-10% in 1688.[30] The shares of land owned by great landowners and the yeomanry were relatively stable. The numbers in this table square with a great deal of other evidence. For example, the 1524 Lay Subsidy suggests that there were 200 knightly families and 4,000 to 5,000 esquires and gentlemen in England at that time. Thomas Wilson, in his book The State of England Anno. Dom, 1600, estimated that these numbers had increased to 500 and 16,000 respectively (Wilson, 1936). Gregory King's calculations of the social structure of England in 1688 (King, 1810) suggest there were 620 knights, 3,000-3,500 esquires and between 12,000 and 20,000 gentlemen (see Thirsk and Cooper, 1972, pp. 755, 766-8, Cooper, 1983, pp. 20-42). Even though the population of England approximately doubled over this period this suggests that the gentry were indeed relatively rising. Micro estimates for different counties tell a similar story, for instance in Yorkshire heraldic evidence suggests that there were 557 gentry families in 1558, 641 in 1603 and 679 in 1642 (Cliffe, 1969, pp. 5f). For Warwickshire a similar measure increases from 155 families in 1500 to 288 in 1642 (Carpenter, 1992, p. 90, and see Heal and

rent. Around 1560 the price had gone up to the equivalent of 30 year's rent and by 1600 it was 40 (Habakkuk, 1958).

[29]For instance, in Devon, well over 50% of monastic lands were bought by local gentry (Kew, 1970). In Norfolk, the gentry possessed 70% of 1527 manors by 1545; by 1565 this was 76% (Swales, 1969). Not all these gentry were established before and merely expanded their possessions. Of the leading gentry families in Hertfordshire in 1642 less than 10% had been settled there before 1485. In Essex this figure stood at 18%, in Norfolk 42% and in Suffolk 13% (Mingay, 1976, p. 9). For Monmouthshire, see Gray (1987). For evidence that monastic land sales around 1600 were still mainly local and that the gentry was still heavily involved in these, see Outhwaite (1971).

[30]For a detailed study of these patterns in Huntingdonshire, see Bedells (1990).

Holmes, 1994, pp. 11-12, for more discussion).

Why was the gentry so disproportionately represented among those buying the monastic land? First, the local gentry were intimately associated with monastic life. Almost all religious houses had a steward, who would officially represent the monastery, acting as an ambassador, and one or more receivers, who would collect rents and other dues. Most houses also employed bailiffs, associated with the manor courts.[31] Often, these positions were filled by local gentlemen.[32] Second, the gentry were granted many new leases on monastic land before the dissolution when the monasteries anticipated expropriation and sought to entrench their positions. After the Dissolution, the gentry renewed these leases with the Court of Augmentations (Woodward, 1966, p. 328; Jack, 1965). Third, the gentry were part of almost every commission involved in the dissolution procedure. The Valor commissioners were by and large members of the local gentry and the higher clergy (Woodward, 1966, p. 59). When dissolution was decided, the surrender documents were signed in the presence of the local knights and gentry (Youings, 1971, pp. 67, 70). After the dissolution, the same gentlemen would be employed as auditors for the Court of Augmentations. As the gentry had previous claims on monastic property as either employee or lessee, were well informed about what to ask for, had often been employed by the Court, and often actively campaigned for dissolution, it is not a surprise that the Court of Augmentations favoured the local gentry when selling the land.

After the dissolution of the monasteries there were three remaining categories of church landholders: bishops, cathedrals, and colleges (both ecclesiastical and Oxford/Cambridge). Yet as Heal (2008) documents, by 1650 the lands of the bishops and cathedrals were sold off as a consequence of them siding with Charles I in the Civil War. Though after the Restoration the bishops got their land back it was generally leased out to the new occupant in very long leases (typically 99 years). At the end of this process, the only remaining lands in the hands of the Church were held by Oxford and Cambridge colleges and some cathedrals, and parish churches which owned the plot of land they were on.

## Connecting the Dissolution and the Industrial Revolution

In the introduction to the paper we suggested that even though this connection has not been explored much before, there is a great deal of case study evidence that suggests that the gentry played important roles in the Industrial Revolution. For example, in his seminal study of the history of the British coal industry Nef pointed out the intensity with which gentry were involved not just in mining the coal under their own lands but also renting other lands with coalfields. In Lancashire and the West Riding of Yorkshire there

[31] For a description of the various offices associated with a early modern manor, see Levett (1927).

[32] In the Valor, the gentry are referred to as *miles*, *armiger* or *magister*. The office of Bailiff is *Ballius* and the office of steward is called *Seneschallus*. Savine (1909, p. 358) provides lists of gentry mentioned in the Valor.

were

> "the Andersons of Lostock, who had pits in Leeds and the surrounding manors, the Ashtons, a well-known Lancashire family with many branches who had pits in the lands around Oldham, the Hultons of Preston, who had pits near Bolton, the Listers, a West Riding family with colliery interest about Halifax and also at Colne, the Gascoignes of Gawthorpe, with colliery interests at Kippax and Barwick-in-Elmet, the Mallets of Normanton, who worked coal in the adjoining manor of Rothwell, and many others. Among the Lancashire families, the Listers alone appear to have been on yeoman extraction. In Durham and Northumberland many of the prominent local gentry became interested during the sixteenth and seventeenth century in the coal industry" (Nef, 1966, p. 9).

The central role of the gentry in the Lancashire coal mining industry is amply documented by Langton (1979a,b). He notes for the period 1590 to 1689 that in the coal industry "the landed gentry provided most of the investment and ability" (1979a, p. 74). Though the gentry suffered financial problems after this, his data indicates that for the period between 1690 and 1739 almost 50% of the collieries in central Lancashire were both owned and operated by landed gentry while more were leased and operated by gentry (1979a, Figure 28, p. 124).[33]

A fascinating case which brings together many of our arguments is that of the Hesketh family. The Hesketh family had lived in Rufford in Lancashire from around 1250. On the eve of the Dissolution, the family owned several manors around Rufford and leased lands from Chester Abbey. After the Dissolution, these lands were leased from the king. One member of the Hesketh family, Thomas, was knighted in 1553 and in 1561 he purchased the manor of Hesketh-with-Becconsall (around five miles from Rufford) that had until recently been part of the Priory of St. John of Jerusalem in England. His son, called Sir Robert Hesketh, was elected a member of parliament for Lancashire. His will indicates that he had the right to 'dig and delve for coal and other materials'. Indeed, by the middle of the seventeenth century we find the Hesketh partnering with four local gentlemen and a yeoman to open a mine in Wrightington, some six miles from Rufford. Many years later, in 1761, a Thomas Hesketh acquired the title of baronet. The baronetcy is called 'the Hesketh baronetcy, of Rufford in the county palatine of Lancaster'. By this time, the Hesketh were not only regular members of parliament but they were financing the Industrial Revolution, being involved in several mines in Shevington, a mere eight miles from Rufford (Farrer, 1908; Langton, 1979a, pp. 76, 126; Hasler, 2006).

[33]Swain (1986, p. 197) concludes his study of Lancashire by noting "Thus we find that the gentry predominated amongst colliery entrepreneurs." See Jenkin (1983) for a similar conclusion in the case of South Wales.

This hypothesis is of course rather inconsistent with the notion that economic revolutions are always initiated by 'new people', an idea going back at least to Pirenne (1914) and Schumpeter (1954). Crouzet (1985) in his detailed study of the social background of the industrialists of the British Industrial Revolution argued that it was the 'middling sort' that led the way. For example, in his sample of the fathers of 226 founders of large industrial undertakings between 1750 and 1850 only 16 were gentry (see also Rabb, 1999). Yet Crouzet used a very narrow definition of 'founder' which ruled out partners if they were not directly involved in the running of businesses and people who financed such enterprises. The importance of the gentry was not simply that they themselves were involved in industry, but that they also played an important role in forming partnerships and financing the main entrepreneurs - for example the relationship between the gentleman Thomas Bentley and Josiah Wedgewood (McKendrick, 1964) (see Hudson, 2002, for more examples).

# 4: Construction of our dataset

This section describes the sources and the method of coding for the variables used in the main body of the paper, focusing on the Valor Ecclesiasticus (Valor). We include a short introduction to the Valor, a description of its structure, an outline of our method of coding the data and an example of applying this method. We conclude by discussing the quality of the data. Since all our variables of interest, including monastic and non-monastic income in the Valor, vary at a geographical level, we choose our unit of observation to be the lowest unit of geographical aggregation for which we have a reliable database.

## Unit of observation

Our unit of observation is an area from the *GIS of the Ancient Parishes of England and Wales*, which is based on the work of Roger Kain and Richard Oliver (Southall and Burton, 2004; Kain and Oliver, 2001). The GIS consists of an ArcGIS shapefile with an underlying database.[34] Since areas may consist of several disjoint shapes[35], we collapse the shapefile to collect these into one shape. The resulting database has 17898 unique shapes. Having created our unit of observation this way, we then merge each data source to this database using either one of two methods:

[34]Each area in the underlying database has a type, which corresponds to an administrative unit that was used in the nineteenth century. The most common type is the ecclesiastical parish. Other types of units are townships, hamlets, boroughs, chapelries or divisions. Around fifty percent of areas are parishes, out of a total of 22729 areas. Townships and parishes together make up eighty percent of the areas. For sub parish units, there is a parish identifier as well.

[35]For instance, a parish can consist of a main portion where the parish church is and a smaller detached portion.

1. We directly match an observation in a data source based on its name to a corresponding area in the database underlying the shapefile of the GIS of Ancient Parishes.

2. We record Ordnance Survey grid references[36] for each unit we want to match, map these units in ArcMAP and spatially join them to the shapefile in the GIS of Ancient Parishes database. Grid references are found using third sources such as Vision of Britain through time project at http://www.visionofbritain.org.uk/, the gazetteer of British places names maintained by the association of British Counties at http://www.gazetteer.org.uk/map.php and the gazetteer of British placenames maintained by the Genuki project at http://www.genuki.org.uk/big/Gazetteer/. We only use this method if method 1 is unavailable.

Using either method, we assign an area number to the observations in each data source. We then proceed to match each data source to the collapsed database. For our main variables the exact assignment method is described below. If it was impossible to assign an area number to an observations using either of the above methods, we have not used it in our analysis.

The GIS of Ancient Parishes database uses the administrative structure of England around 1850 whereas we use data that is from before 1850. This creates a problem since in 1844 parliament passed the *Counties (Detached Parts) Act* that reassigned several detached parts of counties (exclaves) to formally be under their 'mother' county instead of the county they were physically in. Since we matched names within counties to minimize confusion resulting from repetition of names, this could create a problem. However, the GIS of ancient parishes database records in the commentary category whether a part was transferred. Using this information we matched within county/parish composition as it was before 1844.

## The Valor Ecclesiasticus

This section describes the state of the Valor Ecclesiasticus archival records, our method for coding the data and an example from the manor of Helton, Lolbroke and Bell.

[36]The Ordnance Survey, a government mapping agency, has divided England, Wales and Scotland up into hundred by hundred kilometer squares (the 'grid') and assigned a two letter identifier to each grid square. A grid reference then records a place within each square by adding an even number of digits, measuring east and north distance within the grid square, measured from the bottom left corner. For instance, the Tower of London is located at TQ3350080599 which means that it is in square TQ and then 33 kilometers and 500 meters to the North and 80 kilometers and 599 meters to the East, measured from the bottom left corner of the square.

**The state of the Valor Ecclesiasticus records**

The original returns of the Valor are held in the National Archives at Kew Gardens in London and consist of 22 volumes and 3 portfolios.[37] The Record Commission published a transcription of the records titled *Valor ecclesiasticus temp. Henr. VIII. : Auctoritate regia institutus*, consisting of six volumes that were published, respectively, in 1810, 1814, 1817, 1821, 1825 and somewhere between 1831 and 1834 (Caley and Hunter, 1810, 1814, 1817, 1821, 1825, 1831). One of the editors, Joseph Hunter, wrote a historical introduction to the survey (Hunter, 1834). He reports that some parts of the survey are lost. The most important ones are:

- The diocese of Ely.
- A substantial part the diocese of London.
- The counties Berkshire, Rutland, Northumberland.
- A substantial part of the diocese of York, including the whole of the deaneries of Rydal and Craven.[38]

Smaller parts that were lost (such as an individual rectory, or some manors) were taken from third sources and printed in the Record Commission edition. The most important third source is the Liber Valorum (Ecton, 1711) which is a compilation of abstracts of the original records that were made for Henry VIII. These abstracts are usually referred to as the King's Book (or Liber Regis). These compilations, however, record the total (net) taxable income for an ecclesiastical unit and don't specifiy the geographical source where the components of the income was generated which precludes us from getting a clean measure of the income of a unit, see below. When recording the data, we have tagged the observations that are taken from third sources. Excluding them from the anaysis does not change the results (not reported).

**The organization of the Valor**

The Valor is recorded in a very systematic way. The main geographical unit by which the survey can be broken down is the diocese. Within every diocese there is a clear order in which the lower level units are coded, with the monasteries featuring most prominently. The exact order is given below. Next to this ordering of units, there is an ordering of the income data within each unit. All income is first of all divided into temporalities and spiritualities. Temporalities are all incomes that the monks/benefice holders receive from activities, like farming, that are not theirs by virtue of holding the specific benefice.

[37] The dedicated website is at http://www.nationalarchives.gov.uk/records/research-guides/dissolution-of-the-monasteries.htm.

[38] A deanery is an ecclesiastical administrative division, comparable to the hundred.

The most important parts of the temporal income are the incomes from demesnes in manu (farmed by the benefice holder) and from payments of tenants on Church lands (Savine, 1909, p. 85). Spiritualities are those incomes to which benefice holders are entitled by virtue of holding the benefice. It also includes income from glebe lands (lands designated to support the benefice holders) and from oblations (another church tax). The second distinction in the returns for individual ecclesiastical units is between gross and net income. Gross income represent total income, and net income represents income (*valet clare* or *Et remanclare* (clear value remaining) in the returns) over which incomes (*Xa inde* in the Valor) payable to the king would be determined. The following deductions from gross income were allowed (Hunter, 1834):

1. Rents resolute to the Chief Lords, and all other annual and perpetual rents and charges.
2. The alms which were due to the poor, according to any foundation or ordinance.
3. Fees to stewards, receivers, bailiffs and auditors.
4. Synodals and procurations,[39] with which most abbeys and benefices were charged.

Monetary values in the Valor are are recorded in *l.s.d.* or *£.s.d* notation. This refers to pounds (*librae*), shillings (*solidi*) and pennies (*denarii*). There are 12 pennies in a shilling and 20 shillings in a pound. Particular details regarding the notation of income are in Lindley (1957).

Within the Valor, there is a fixed order in which ecclesiastical units appear (taken directly from Hunter, 1834): per diocese we have

1. The See of the bishop or archbishop.
2. The endowments on the various offices in the cathedral church.
3. Archdeaconries/Deaneries with their claims, and per entry the following:
   (a) Monasteries and colleges.
   (b) Parsonage, vicarages, chantries and free chapels.

If a deanery is home to a monastery, this monastery is listed before the other benefices in the deanery and has a specific ordering, namely:

1. Income of the precincts (i.e. any land immediately surrounding the monastery).
2. Income from lands in the county in which the house stood.

[39] Synodals and procurations are ecclesiastical fees.

3. Income from lands in other counties

4. Income from impropriate rectories (rectories for which the proceeds went to a layman).

**Our main explanatory variable: Monastic income**

The entries for individual ecclesiastical properties generating income, such as manors, have their income broken down into temporal/spiritual income and gross/net income, as outlined above. Both spiritual income and the deductions, being mainly customary church taxes, do not reflect the economic value of the assets of the surveyed property. Therefore, we use as our main measure of monastic income the gross income accruing from temporal possessions, for those assets that are classified as monastic. We similarly obtain our measures for non-monastic income, and total income.

**An example: the manor of Helton, Lolbroke and Bell**

The manor of Helton, Lolbroke and Bell was a possession of Abbotsbury abbey and was located in Bridport deanery (in the Valor it is called *Byrport*) in Dorset. Figure A-10 is a photograph of the entry as it appears in the Record Commission edition of the Valor. Note that we omitted any deductions from this picture, it just lists temporal and spiritual income.[40]

The first entry is an assize rent (*reddit assis'*, a fixed rent) in Helton, which gives an annual income of £: xl s: xvii d: vii. The next entry is a part of the demesne (*tr'daicaliu*) that is not farmed by the rector (*firma dimiss'*) for which he receives a rent. The next entry is another assize rent in Lolbroke & Bell. Then we have an entry that records proceeds from the manor court (*pficuis cur'*) and several other incomes (*al' pquisit'*) taken for an average year (*coibs annis*).

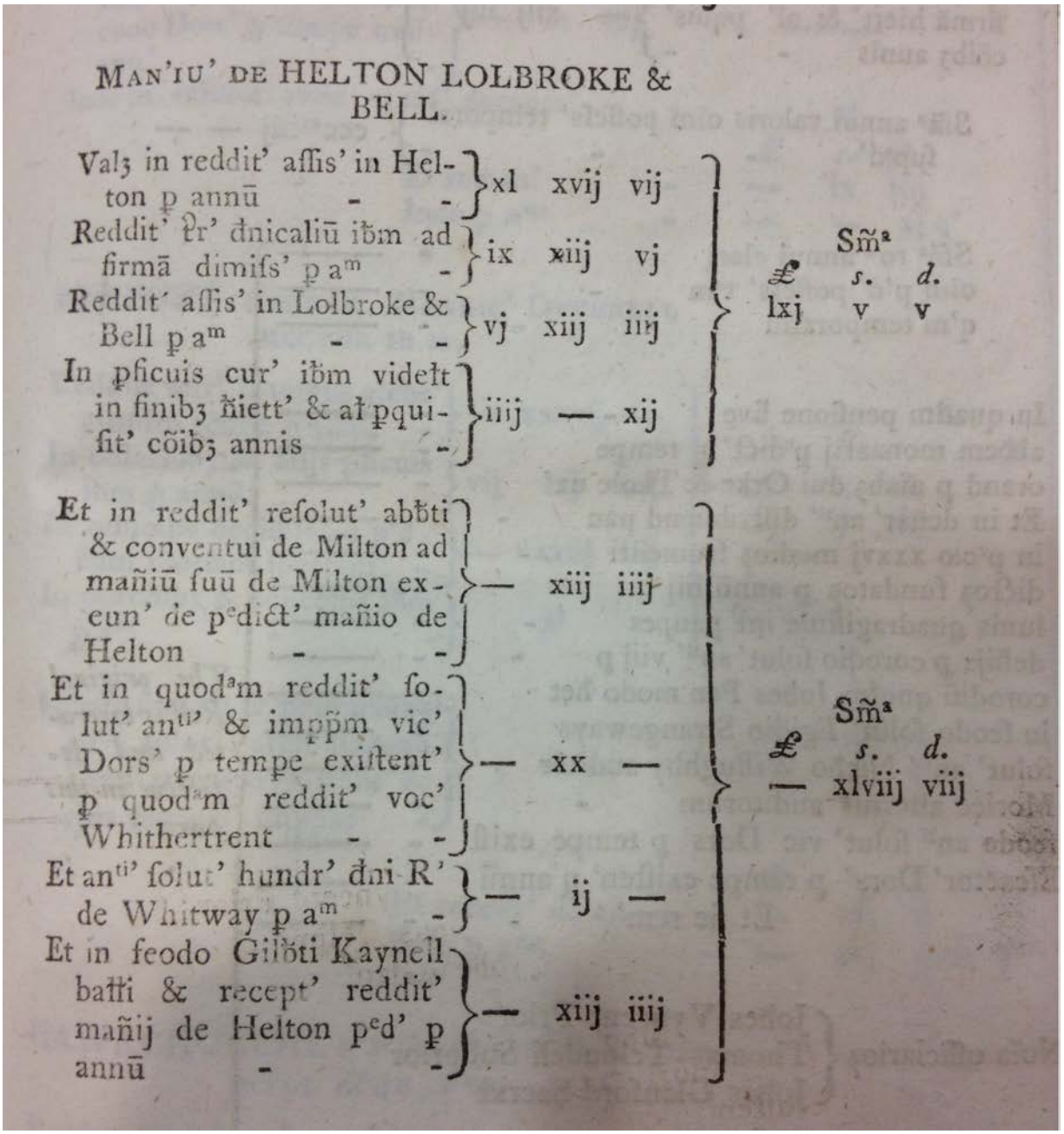
The next two entries are two rents resolute (*reddit'resolut*) that are owed to an abbott and payable to his manor (*abbti & conventui de Miltonad maniu suu*). The second figure is payable to the vicar of archdeaconry of Dorset (*vic'Dors'*). The third entry is payable to the master of the hundred Richard de Whitway (*hundr dni R de Whitway*). The last entry is payable due to the local bailiff of the manor Gilbert Kaynell (*Gilbti Kaynell balli*).

We are interested in the income from assets, or temporal income. For this manor, these are the assize rents from lands held by the manor, or the first three entries in figure A-10. We therefore coded three

[40] In order to distinguish these sources of income in the text a knowledge of the scribal Latin in which the Valor is recorded is required. A valuable introduction to this as well as a glossary of terms and scribal abbreviations can be found in Martin (1949).

entries into our database for this manor, two in Helton and one in Lolbroke and Bell. The next step is to assign Ordnance Survey grid references to each of the three places. To find these we followed the method outlined above. Going through every entry in the six volumes of the Valor this way created the database we used for the analysis in our main paper.

Figure A-10: The manor of Helton, Lolbroke and Bell in the Valor Ecclesiasticus



MAN'IU' DE HELTON LOLBROKE & BELL.

| | | | | Sm̃a £ | s. | d. |
|---|---|---|---|---|---|---|
| Valz in reddit' assis' in Helton p annū - - | xl | xvij | vij | | | |
| Reddit' ꝑr' dnicaliū ibm ad firmā dimiss' p am - | ix | xiij | vj | | | |
| Reddit' assis' in Lolbroke & Bell p am - - | vj | xiij | iiij | | | |
| In pficuis cur' ibm videlt in finibz ñiett' & alt pquisit' cōibz annis - | iiij | — | xij | lxj | v | v |
| Et in reddit' resolut' abbti & conventui de Milton ad mañiū suū de Milton exeun' de p^edict' mañio de Helton - - | — | xiij | iiij | | | |
| Et in quod^am reddit' solut' ant^i' & imp̄pm vic' Dors' p tempe existent' p quod^m reddit' voc' Whithertrent - - | — | xx | — | — | xlviij | viij |
| Et ant^i' solut' hundr' dni R' de Whitway p am - | — | ij | — | | | |
| Et in feodo Gilbti Kaynell batti & recept' reddit' mañij de Helton p^ed' p annū - - | — | xiij | iiij | | | |

# 5: Data sources

| Variable | Source | Comment |
|---|---|---|
| | **Main Variables** | |
| The Valor Ecclesiasticus | Caley and Hunter (1810, 1814, 1817, 1821, 1825, 1831) | For coding method, see above. |
| Textile mill variables | Parliament (1839) | |
| Occupational structure variables – 1831 census | Gatley (2005) | |
| | **Channels and the Lay Subsidies** | |
| Number of Gentry in 1700 | Adams (1700) | |
| The number of agricultural patent holders | Woodcroft (1854) | The data were transcribed and made available to use by James Dowey, see Dowey (2013) |
| Enclosure dummy | Tate and Turner (1978) | |
| The Tudor Lay Subsidies | Sheail (1968) | |
| | **Covariates** | |
| Coal deposits | Strahan (1912) | Digital copy available through www.davidrumsey.com |
| Elevation | CGIAR consortium at http://srtm.csi.cgiar.org/ | |
| Slope | Earth Resources Observation and Science Center of the USGS at http://eros.usgs.gov | |
| Inland rivers and water bodies | Digital Chart of the World available through www.diva-gis.org | Distances computed in ArcGIS |
| Distance to London | | Computed in ArcGIS |
| Distance to national border | | Computed in ArcGIS |
| Distance to market town | List of Market towns from Adams (1700). Distances computed in ArcGIS | |
| Suitability for wheat | FAO at http://webarchive.iiasa.ac.at/Research/LUC/GAEZv3.0/ | We used the rain-fed, low intensity, baseline period settings |
| Soil type | FAO at http://webarchive.iiasa.ac.at/Research/LUC/GAEZv3.0/ | |

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