The Long-Run Impact of the Dissolution of the English Monasteries*

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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.

Keywords: Church land, Industrial Revolution, Agriculture, Gentry.

JEL classification: N43, N63, N93, O14, Q15.

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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.

A large class of theories has been advanced to explain these facts (see Mokyr, 2010, Clark, 2014 for overviews). The most venerable hypothesis is that Britain was blessed by an advantageous resource endowment, particularly the presence of coal, iron ore, and streams that had potential for water power (Pomeranz, 2000, Clark and Jacks, 2007, Crafts and Wolf, 2014, Fernihough and O'Rourke, 2014). Allen (2009) added to this by arguing that Britain's uniquely high real wages stimulated labor saving technological innovation. Other theories make causal connections between the Industrial Revolution to other complementary events such as the slave trade and globalization (Williams, 1944, Inikori, 2002, Findlay and O'Rourke, 2009) or an agricultural revolution (Overton, 1996).

An alternative set of theories focus on institutions. For example, North and Thomas (1973), North and Weingast (1989), Acemoglu, Johnson and Robinson (2005), Pincus (2011), and Pincus and Robinson (2014) emphasize how political conflict in the 17th century, in particular the English Civil War of the 1640s and the Glorious Revolution of 1688, ultimately led to a variety of institutional changes (for example more secure property rights and a more developed financial system). The variety of institutional hypotheses is much broader than this, however. In many of the above accounts it is taken for granted that Britain, and often Western Europe, had gone through a long slow process of institutional change that was a prerequisite for a particular type of theory to apply. Allen (2009), for example, takes it for granted that mass labor coercion and serfdom did not characterize the labor market (even if it lingered until after the Industrial Revolution, see Naidu and Yuchtman, 2013). Often implicitly assumed are the spread and integration of markets and the break-down in traditional forms of economic relationships (Polanyi, 1944) and the intensification of the 'money economy' (Postan, 1973, Hicks, 1969, Coleman, 1977, Britnell, 1996, Bailey and Hatcher, 2001).

In this paper, we argue that while most of these theories attempt to explain cross-national facts, such as why did the Industrial Revolution happened first in Britain, some of them can be evaluated using sub-national variation. This is obviously not true of Allen's theory (2009) of high wages, or of arguments about

national political institutions.[1] It is true however about geographically based theories that emphasize the availability of natural resources and those that focus on other types of institutions, particularly economic institutions, at least to the extent that these vary within England.

Our main contribution is to propose a test of the effect of the modernization of one sub-set of economic institutions on the Industrial Revolution. In the late medieval period the preponderance of land in England was held by the Crown, the Aristocracy and the Church. A great deal of evidence suggests that there was no effective land market. In the 1530s however, the expropriation of the Monastic lands by Henry VIII threw about 1/3 of agricultural land in England onto the market. 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 important factor in bringing this about was the partial dismantling of the enormous estates of the Church ... from the 1530s onwards"

The Dissolution of the Monasteries (henceforth Dissolution) effectively created a much thicker market for land where previously there had been none (Habbakuk, 1958). Importantly, the impact of the Dissolution varied spatially within England since the Monasteries held lands in some places but not others. We therefore argue that the Dissolution can be regarded as a natural experiment that created exogenous variation in economic institutions, specifically land markets. We hypothesize that ultimately these improved economic institutions should be connected to industrialization and that there should be a positive reduced from relationship at a sub-national level between the extent of land released by the Dissolution and industrialization.

Though we cannot measure economic institutions directly (except to the extent that our measure of the Dissolution captures the 'thickness' of land markets), we investigate several channels that may potentially link the change in economic institutions induced by the Dissolution to the Industrial Revolution. The first and most obvious connection is to agriculture and the English Agricultural Revolution. As we discuss in the next section, a great deal of evidence suggests that monastic lands were inefficiently used so the first-order

[1] Other prominent theses which are difficult to test in this way include Mokyr's (2010) emphasis on the role of the Enlightenment and intellectual and scientific change; Voth (2001) and de Vries' (2008) argument that changes in tastes and preferences and the creation of a 'consumer society' were critical to stimulating labor effort and incentives; and Rosenthal and Wong's (2011) thesis, which follows Tilly (1990) in arguing that warfare was a driving force behind institution building in Western Europe leading to urbanization and technological change.

effect of freeing up such lands by creating a land market ought to have been to move land into the hands of people who would use it more efficiently and to facilitate and encourage investment and innovation. Relatedly, though much land was leased out, it was done so initially via various forms of archaic tenures such as copyhold (see Youings, 1967, French and Hoyle, 2007, for overviews). The Dissolution allowed for the renegotiation of these archaic forms of tenure which likely impeded productivity (as discussed in the Appendix). These productivity improvements were plausibly connected to industrialization because they freed up labor, a conjecture our data supports.

A second and complementary mechanism, first proposed by Tawney (1941a,b), is that the Dissolution led to a large change in the rural social structure that he characterized as the "rise of the gentry",[2] the rise of a new class of commercially minded rural entrepreneurs. Overton (1996, p. 169) concludes "it seems clear that the gentry class ... did grow considerably in numbers from the mid-sixteenth century."[3] The gentry could have been connected to industrialization both because they were directly involved in improving agricultural productivity, but also in two other ways. Firstly, through a cultural mechanism such as that proposed by Doepke and Zilibotti (2008) who stress how the emergence of capitalism endogenously led to a divergence between the preferences of the middle classes and the aristocracy. In our context the creation of a land market changed the incentives for parents to socialize children in different ways, encouraging the emergence of people with 'capitalists' preferences who in the pre-industrial period would be precisely those that historians call the gentry.[4] Secondly, the gentry were enfranchised and able to sit in Parliament to get legislation favorable to their economic interests.

To investigate the effect of the Dissolution and the various mechanisms we use several sources of data. Most importantly, 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 (see e.g. Schofield, 1965, and Knowles, 1979), to our knowledge this data has never been used systematically before. The Valor does not contain systematic evidence on the amount of land or property

[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.

[3]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.

[4]This can also help explain the connection between the rise of the gentry and proto-industrialization that 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 that we discuss in section 3 of the Appendix.

the Church held, but it does give the total value of income which was generated by these assets at the time of the Dissolution, which we use as our basic measure of the impact of the Dissolution at the parish level. We describe the process via which the Valor was collected and the data it contains in more detail in the Appendix. 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.[5]

As outcome variables measuring the Industrial Revolution we use the 1838 Mill Survey commissioned by the British Parliament (and also recently used at the county level by Crafts and Wolf, 2014). 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.[6] 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 then examine the channels via which the Dissolution might have impacted industrialization and which can shed some light on some of the mechanisms we discussed above. First, we look at whether or not the Dissolution was associated with an agricultural revolution. We measure the latter in three ways. First, we use data on the structure of employment, in particular the proportion of the labor force in manufacturing, retail and agriculture from the 1831 British Census. Second, we use data on wheat yields per acre in 1836 from Kain (1986). Finally, we use data recently compiled by Dowey (2013) on the number of agricultural patents registered in a parish between 1700 and 1850. Second, we use a unique census from 1700 that records the number of gentry in each of 24,000 of the largest towns/cities and villages in England and Wales. Finally, we can directly examine one policy channel by using data compiled by Heldring, Robinson and Vollmer (2017) on the extent of parliamentary land enclosures between 1750 and 1840 at the parish level (Heal and Holmes, 1994, argue that the gentry were heavily involved in enclosing, see pp. 108-113).

We find that monastic income is positively and significantly correlated with wheat yields and with patenting. These results are consistent with the idea that the Dissolution created a more efficient alloca-

[5]All our results are robust to instead using a dummy for whether or not a parish included Monastic properties, and alternatively a count variable of the number of Monastic properties in a parish.

[6]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'.

tion of resources in rural England and this helped to stimulate the Agricultural Revolution. The connection to the Agricultural Revolution is further supported by our results with the 1831 Census data where we find that monastic income is negatively correlated with the share of the labor force in agriculture, but positively correlated with the share in manufacturing and retail. The traditional account of the Agricultural Revolution stresses that one of the impacts was to shed labor and substitute it with capital, which is consistent with what we find. We also find that monastic income is positively correlated with the number of gentry in a parish, consistent with Tawney's hypothesis and the emphasis of Doepke and Zilibotti (2008) on social change. Finally, we also find evidence for the public policy channel and the possible role of the gentry in parliament since we find that monastic income is positively correlated with whether or not land was enclosed in a parish.

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. Consistent with our empirical approach, we use a linear fit to summarize the relationship between monastic income and the presence of a textile mill in 1838.[7] Figure 1 shows a positive relationship between monastic income and the presence of a textile mill. Figure 2 shows a binned scatterplot using wheat yields instead. For higher monastic income, we observe higher levels of wheat yields.

Taken together we believe these results support a rather traditional hypothesis that the spread of markets, specifically land markets, had a significant impact of the efficiency of resource allocation and incentives and had a first-order effect on the Industrial Revolution.

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 omitted 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

[7] After partialing out parish area and fixed effects at the level of the hundred we then divide the sample into 40 equal sized bins, average the residualized monastic income and presence of a mill dummy within these bins, and plot the resulting reduced sample. The linear relationship is fitted on the underlying full sample.

Industrial Revolution. We also control for distance to the coast, distance of a navigable river and distance the nearest market town. These results are of independent interest since they are related to an important class of theories and in this sense they complement and extend Crafts and Wolf (2014) and Fernihough and O'Rourke (2014). 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 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.[8] Our results are all robust to this pre-control suggesting that the Dissolution is not simply picking up the fact that parishes which were more productive agriculturally had more monastic properties and tended to experience greater industrialization. We provide further evidence for this view by showing that while there is a strong positive correlation between Lay Susidy tax revenues and exogenous characteristics such as crop suitability or distance to the nearest river, that ought to predict productivity, there is no such correlation with our measure of the Dissolution. 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, the location of Church lands had been fairly constant since the Anglo-Saxon period.[9] It seems difficult to believe that our results can be explained by the fact that the monasteries, whose location was determined prior to the urbanization or commercialization of English society, just happened to be occupying the land that ultimately had the unobserved potential to host the Industrial Revolution.[10]

Our paper is related to quite a few other contributions in addition to those we have discussed above. Our findings are consistent with the literature on the Agricultural Revolution which has stressed that this was due to changes in economic institutions, particularly the spread of markets often in connection with

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

[9]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).

[10]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.

enclosures (Jones, 1974, Overton, 1996). Though our evidence does not speak to the issue of the extent to which the Agricultural Revolution helped to cause the Industrial Revolution (see Clark, 2014) they are consistent with them being connected. Our results are also consistent with Tawney's hypothesis.[11] 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. We too find significant and systematic relationships between geographic variables and industrialization. Institutional arguments have also appeared in this context, with Daunton (1995), for example, suggesting 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.

It is possible that the Reformation influenced economic 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 (2015) found no impact on city growth and urbanization. In the English case, however, there is no evidence that the incidence of the Reformation in terms of religious belief is correlated with the Dissolution, so we believe that it is unlikely that our results reflect some process of differential religious change.[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

[11] 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.

[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.

presents results on the channels. Section 5 concludes.

1 Historical Background

In 1530 there were around 825 monasteries in England and Wales.[13] These monasteries, together with cathedrals and parish churches owned between a quarter and a third of all land in England and Wales (see table 1, Mingay, 1976, p. 44 and Woodward, 1966, p. 33).

Henry VIII, who had become King in 1509, declared himself head of the Church in 1534. His initial objective was to appropriate all taxes that churches and monasteries traditionally paid to the Pope. In order to assess the revenue potential of the Church, 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] Between 1536 and 1540, however, parliament passed several acts that transferred their ownership of all monasteries in England to the Crown, effectively expropriating all assets of the entire monastic sector.[15] The consensus in the historical literature is that the main effect of this expropriation and the subsequent sale of the monastic lands, which happened rapidly in the years following the Dissolution, was to create a large land market where there was none (see Habakkuk, 1958).

Before the Dissolution, as much as two thirds of all land was held in customary tenure, known as copyhold (Youings, 1967, p. 308). Leases were long - indefinite or 99 year leases were common -, and rents were fixed by historical custom. Low rents and long contracts did not facilitate allocation of land to its most productive use, nor did it provide incentives to landlords to increase productivity by capital investment.[16] Under customary tenure, the landlord was responsible for productivity-increasing investment, which was unlikely to happen if rents are fixed and the tenant is therefore the residual claimant on output. Aside

[13] See Woodward (1966, p. 2). There were many types of monastic religious establishments, such as nunneries, friaries, abbeys and priories. We use the term monasteries throughout this paper. 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 includes a description the Valor records for the manor of Helton, Lolbroke and Bell as an example. The Appendix also describes the process of Dissolution followed by the Crown.

[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).

[16] These incentives of course fluctuate with agricultural output prices. For the strategies that landlords employed in times of high prices, see Youings (1967, pp. 676, 683).

from customary tenure relations that prevailed more broadly, the most obvious explanation for any impact of the Dissolution is that the land held by the Church was initially utilized inefficiently. The Church was the most sustained and strongest defender of feudal privileges in England in the wake of the Black Death.[17] Swanson (1989) lists numerous incidents where monasteries fought to retain feudal privileges,[18] and Bailey (2014, p. 49) notes ""[labour] services tended to feature more prominently on major monastic and episcopal estates."[19] 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). Monastic incentives to invest were even weaker since investment decisions were usually entrusted to one monk, the *obedentiary*, whose task was to ensure adequate food supplies for the monks rather than raise profitability of monastic agriculture (he/she had only a very small claim, if at all, on any potential profits from agriculture).

While not denying that there are examples where the Church was an agricultural innovator (Bolton, 1980; Hare, 1985) the evidence that feudal agricultural practices and archaic forms of tenure lasted longer on Church land is certainly consistent with them being less efficient economically. To some extent tenancy might be able to mitigate this problem, but not only were tenancy relations heavily restricted by the aforementioned copyhold relations prior to the Dissolution, 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.[20] Finally, and in addition to the absence of investment incentives, there were outright bans on sale and transfer of ecclesiastical land, such as the Statute of Mortmain (Raban, 1974).

The Dissolution changed these patterns. Although at the time of Dissolution many tenants were still on long leases, lapsing leases were now renegotiated because the new owners of land had an outside option: sale on the land market. The new owners of the land likely bought it with a profit motive in mind, and they were able to renegotiate land tenure in order to claim part of the agricultural surplus which had, before

[17]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).

[18]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.

[19]He further observes "Monastic houses dominated the list of landlords who listed serfs, because their bureaucratic administrators were doggedly committed to preserving the ancient rights and endowments of their institutions" (2014, p. 306).

[20]See Kosminsky (1961), North (1981), Campbell (1983, p. 397), Ekelund, Hébert, Tollison, Anderson and Davidson (1996), and Campbell (2006, pp. 179, 421) for other arguments about the relative efficiency of the church.

the Dissolution, accrued to tenants under customary land relations. The empirical evidence is scarce, but whatever evidence there is points to a dramatic shift out of copyhold into modern forms of tenure, such as leasehold and freehold, in the period between 1570 and 1600 such that by the end of the sixteenth century, land was being sold (more) freely and was therefore being allocated to its most productive use. In 1603, one commenter remarks: "In these days there go more words to a bargain of ten-pound land a year than in former times were used in the grant of an earldom" (Youings, 1967, p. 304). By 1600, the land market had developed, and many buyers had consolidated small pieces of lands into small estates. One commenter remarks in 1610: "lands pass from one to another more in these latter days than ever before" (Youings, 1967, p. 303).

The patterns laid out in this section represent of course only the average effects. There are examples of rational estate management before the Dissolution, but the consensus among historians is that the Dissolution pushed land onto the market and modernized land tenure. In the remainder of this paper we empirically examine the impact of this arguably exogenous shock to England's institutions on industrialization, and we trace several channels of impact, such as changes to agricultural productivity and innovation and social change.

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. Parishes are the relevant local ecclesiastical and civil administrative unit for much of England's history, and their boundaries have changed very little between the Dissolution and the Industrial Revolution. Names of individual villages and manors within our parishes sometimes change considerably over time however and section 4 in the Appendix describes the procedure we followed to assign observations in different datasets to the appropriate parish. The Appendix also contains an overview of all data sources for this paper.

2.1 The Valor Ecclesiasticus

We obtain our main independent variable, monastic income, from the Valor (specifically, we compute the log of (1 + Monastic Income), where Monastic Income is the total amount of income generated by a monastic unit in Pounds). 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, 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 3 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. Since we link the impact of the Dissolution to outcomes by location, it is important that the monastic lands were sold to individuals who lived close to the monastic property, rather than absentee landlords. The case study evidence on the sale of monastic land strongly supports this assumption. We give an overview of the evidence in the Appendix.

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.[21] Figure 4 below maps the distribution of the number of mills. As one would expect there are a large number of mills in Lancashire and North West England. Comparing with Figure 3 we see that this is not an area where monastic incomes were concentrated. Nevertheless, as we noted above, many factors shaped where the Industrial 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.[22] We focus on the share of adult males over 20 years of age 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 Agricultural Productivity

We use agricultural wheat yield from the 1836 tithe surveys, digitized by Kain (1986), as our measure of productivity. As part of the tithe commutation act of 1836 which commuted the tithe into money payments, agricultural statistics were collected for large parts of England. After assigning parishes to individual yield observations in this dataset we obtain a sample of 4148 parishes for which we have wheat yield, measured in bushels per acre.

[21] 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.

[22] 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).

2.2.4 Agricultural Patents

We compute the number of patent holders from the returns of patent holders in Woodcroft (1854), which were 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, 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.

2.2.5 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 24,000 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.

2.2.6 Enclosures

We use data on the location of parliamentary enclosures from *A Domesday of English enclosure acts and awards* by 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.

2.3 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 unobservable differences in agricultural productivity or other factors that might have induced prosperity. 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 the amount of tax raised and the number of taxpayers in each 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).[23] Tax rates were: a flat rate of four pence per pound if the primary source of income was wage

[23]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) were also omitted. If

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.[24] We use total tax raised per parish as our measure of pre-existing differences in prosperity.

2.3.2 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.[25]

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 data on wheat suitability and soil type.[26] 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.

there were several returns available (such as one for 1524 and one for 1525) we averaged over the available returns.

[24]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).

[25]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).

[26]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 depth", 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).

2.4 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 parishes 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 the log 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 insignificant in the case of total mill employment). In terms of the mechanisms the raw data are more supportive of the hypotheses, although 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. 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 channels. 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 α_M is the main coefficient of interest. γ_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 Lay Subsidy revenues. The latter 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. It might also capture transportation costs and proximity to large centers of demand, which if persistent, could again influence the subsequent location of textile mills. In extended specifications it also includes all our other control variables, for example distance to London, terrain slope or the geographic suitability for wheat. Finally ε_p is the error term. We estimate (1) 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 (1). 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 and Lay Subsidy revenue. The first row records the coefficient on $\log M_p$. For example in column 1 we see that $\hat{\alpha}_M = 0.00894$ 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 $\hat{\alpha}_M = 0.0621$ (robust s.e.=0.0239) 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. These effects are quantitatively important. 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 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 (3)).

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, but we now report standardized coefficients to facilitate comparisons across point estimates. The three sets of columns have a structure similar to table 3. In the first column of each ((1), (3) and (5)) the only covariate is 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 (2), (4) and (6) 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. To facilitate comparison across variables, all coefficients are measured in standard deviations.

The main point of this table is to show that the results of Table 3 hold when we control for our proxy for non-monastic incomes and for the geographical variables. 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 findings from Table 4 confirm the basic results of Table 3, that there is a strong positive and robust 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.

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. The broad idea of this section is to compare parishes that generated ecclesiastical income, some monastic and some not, to parishes that generated the same non-monastic income but had no monastic presence.

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.[27] 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 $\mathbf{X}$. 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).

Table 5 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, Column (2) reports the ATT and column (3) reports results from an OLS regression of the relevant outcome on the monastic dummy, including the set of matching variables as covariates. The main take away from this exercise is that the matching results yield a similar conclusion as the regression results reported in Tables 3 and 4. The monastic presence dummy is positively correlated with the presence of a textile mill, the number of mills and mill employment, 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. Comparing columns (2) and (3) provides a check on the matching procedure.

[27] 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.

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 close to 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 6 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 for 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, reports 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 returns and soil suitability for growing wheat. Both covariates do not balance before matching, but do balance after.[28]

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 monasteries held income

[28]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). Motivated by this results, we include parish area in all specifications in this paper.

generating assets in 1535, display more industrial activity relative to those parishes that are similar in terms of our set of observable covariates but which did not contain monastic assets.

3.3 Further Robustness Checks

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

3.3.1 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 fraction 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, which we call Valor income, by 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 table A-1 in the Appendix. All results show a positive and significant correlation. We find that our basic results are very robust to these different ways of measuring the impact of the Dissolution.

3.3.2 Relaxing the fixed effects

In our results so far we included fixed effects at the county level (n=43) and at the hundred level (n=965). We believe that these fixed effects can account for unobservables at the county and hundred level that would confound our estimated relationships when not included. Restricting to within-county and within-hundred variation, however, precludes drawing conclusions about the pattern of industrialization across England. Although we believe that our estimation strategy is not particularly well suited to speak to these patterns, we nevertheless relax our fixed effects and report results from re-estimating equation 1 in table A-1 in the Appendix. Specifically, we report results for our main dependent variables from the 1838 Mill Census without any fixed effects and with a North-South fixed effect, which splits England in two parts,

one formed by Cheshire, Cumberland, Derbyshire, Durham, Lancashire, Lincolnshire, Nottinghamshire, Northumberland, Staffordshire, Westmorland, Yorkshire: West Riding, Yorkshire: East Riding, Yorkshire: North Riding and one formed by all other counties. We find a positive and significant effect for the mill dummy, and no consistent positive effect for the number of mills and mill employment. Given that between the Dissolution in 1535 and 1838, when we measure the presence of mills, economic activity shifted from the South to the North (Darby, Glasscock, Sheail, Versey, 1979), it is no surprise that the number of mills and mill employment, measuring the intensive margin of economic activity, are no longer significant when relaxing the fixed effects (although the estimated effects are still positive).

3.3.3 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 (1) twice, using two sets of covariates. In the first regression, we include parish area, Lay Subsidy revenue and hundred fixed effects, and in the second we use an extended set of covariates.[29] Let the estimated coefficients on the log of monastic income be $\hat{\alpha}_{baseline}$ 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 A-2 in the Appendix reports estimates of b using our set of dependent variables. The ratio is lowest for Mill Employment (10.89), and the median ratio is 14.1. What does this mean for our results? Taking Mill employment as an example, $b = 10$ indicates that selection on unobservables would have to be ten 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.

[29] 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.

3.3.4 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.

3.3.5 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. 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.

3.3.6 Lay Subsidy revenues versus Monastic incomes

Before turning to channels, we present evidence supporting our claim that our Lay Subsidy revenue data is a useful control for the underlying productivity and prosperity of a parish and the monastic income is not simply picking up the same thing. This being the case it is not simply that the Dissolution threw onto the land market more good land in places which perhaps already had good land, but rather that our monastic

income variable is picking up something different, most likely the creation of a land market. To show this we examine in Table 7 the correlations between Lay Subsidy revenue and monastic income and measures of wheat, barley and oats suitability, and the distance to the nearest river. All columns also control for parish area and hundred fixed effects. The table shows that while Lay Subsidy revenue is strongly and significantly correlated with all three measures of crop suitability and proximity to the nearest river, monastic income is uncorrelated with all four variables. We interpret these results as showing that monastic lands were not, on average, in places which were highly suited to agriculture, implying that it was the change in economic institutions that the Dissolution induced that played the major subsequent role.

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 (1) by OLS letting y_p be one of our intermediate variables.

4.1 Occupational structure

We now re-work Tables 3 and 4 with different dependent variables taken from the 1831 Population Census. In Table 8 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 $\hat{\alpha}_M = -0.0143$ (robust s.e.=0.00173) 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 $\hat{\alpha}_M = 0.00854$ (s.e.=0.000915) so there is a positive and highly significant correlation between monastic income and the proportion of the labor force in retail.

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 9 then probes the robustness of the results of Table 8 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 non-monastic income is associated with less of the labor force in agriculture and more in retail, but it is not significantly correlated with the share of the labor force in manufacturing. As before the geographical covariates have little impact on 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.

4.2 Agricultural yield and patents

In this section we focus on changes in agriculture, and how these are impacted by the Dissolution. Specifically, we look at agricultural productivity, measured by wheat yields and innovation in agriculture, measured by the number of agricultural patents filed by residents of parish p in the period 1700-1850. As in the previous section, we repeat the basic structure of Tables 3 and 4.

Table 10 reports the basic results where we just control for fixed effects at different levels. In columns (1)-(2) we use wheat yield as the dependent variable. We see that there is a robust and positive correlation between monastic income and wheat yield, when using county fixed effects. When including hundred fixed effects, we lose power due to the limited availability of the yield data, which is available for about one quarter of all parishes in England. The estimated effect using hundred fixed effects, although insignificant, is positive. 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 (4) we find an estimated coefficient of $\hat{\alpha}_M = 0.0180$ (s.e.=0.00375) which is significant at the 1% level.

We now turn to the magnitude of the effects for the various channels (Table 10). We consider again the specifications with fixed effects at the hundred level. Relative to a mean of 21.86 bushels per acre, a one standard deviation increase in monastic income increases yield by about 2.1 bushels. 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 (4).

Table 11 then reproduces our basic robustness checks with very similar findings to those from before, again standardizing every coefficient. Non-monastic income is positively and significantly correlated with the dependent variable in columns (2) and (5). 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 patenting there is.

4.3 The rise of the Gentry and parliamentary enclosure

We now examine the impact of monastic income on the Rise of the Gentry and parliamentary enclosure between 1750 and 1840. We use the number of gentry present in parish p in 1700 (Adams, 1700) and a dummy = 1 if a parish is mentioned in a parliamentary enclosure act between 1750 and 1840 in the same empirical framework used in the previous section.

Table 12 reports results varying fixed effects across columns. For both the presence of the gentry and parliamentary enclosure, we find very robust and significant effects. Since in columns (3) and (4) 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.

Turning to quantitative effects, 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). Table 13 repeats the robustness exercises of Table 11. The patterns of Table 12 are robust and stable throughout all estimations.

The results of this section then give credence to all the channels we suggested. First, we find that places that were impacted more by the Dissolution are more productive and innovative in agriculture while employing more people outside agriculture. We also 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.

4.4 Results for different Monastic Orders

Recent work by Andersen et al. (2017) 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.

Table A-5 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.

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 land market with profound consequences. We argue that this can be viewed as a natural experiment in the modernization of economic institutions and we hypothesized that the subsequent emergence of a land market would have had a major positive impact on resource allocation and incentives. To investigate this we digitized the 1535 Valor Ecclesiasticus, the census that Henry VIII commissioned on monastic incomes.

Using monastic incomes at the parish level as our main explanatory variable we showed that the Dissolution had significant positive effects on agricultural productivity and innovation, and was associated with structural change in the sense that it was also significantly associated with the movement of labor out of agriculture and into manufacturing and retail. Perhaps more interesting, the Dissolution was ultimately associated with industrialization which we measured using data from the 1838 Mill Census, the first time the British government collected systematic data on this driving sector of the Industrial Revolution. We further argued that there are grounds for believing that these correlations can be interpreted causally.

We also investigated potential channels via which the Dissolution might have impacted agricultural productivity and industrialization. In particular, we provided evidence that Tawney was correct when he argued that the Dissolution precipitated the rise of the gentry, a new commercially oriented class of farmers.[30] A complimentary finding is that the greater the impact of the Dissolution in a parish, the more it was to be enclosed, consistent with the notion that the gentry influenced policy via their large influence on Parliament.

All in all, our findings support a quite traditional theory of the industrial, and perhaps agricultural revolution; that it was at least partially caused by the increasing marketization and commercialization of the economy. Our findings are consistent with other channels being significant, however, indeed we find evidence supporting the more resource based results of Clark and Jacks (2007), Crafts and Wolf (2014)

[30]Could the gentry not have expanded by buying 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-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).

and Fernihough and O'Rourke (2014).

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

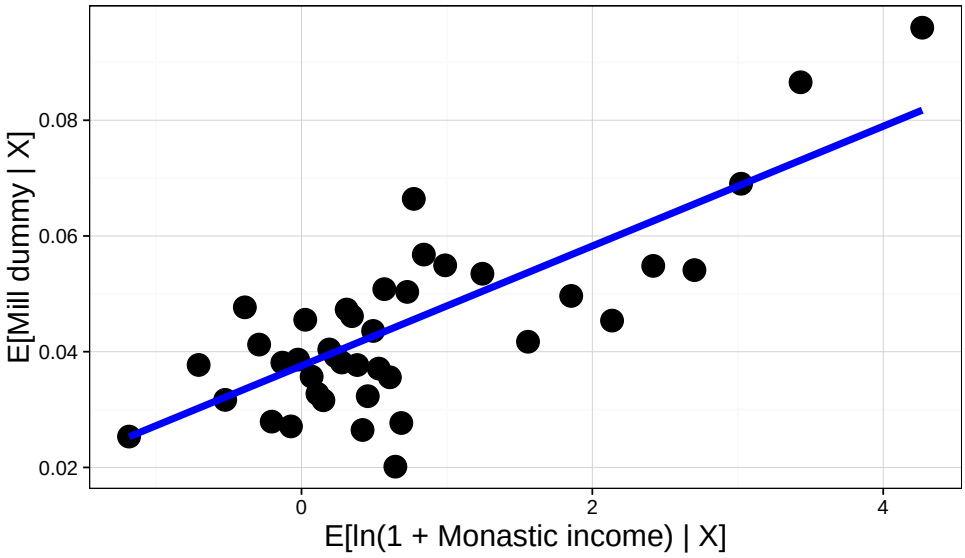
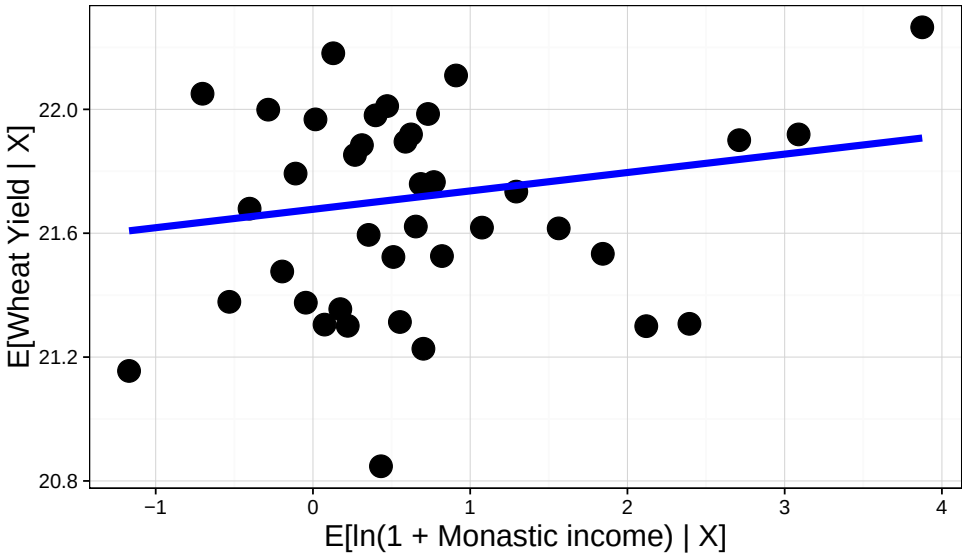


Figure 2: Binned scatterplot for Monastic income and Wheat Yield. **X** includes parish area and hundred fixed effects.



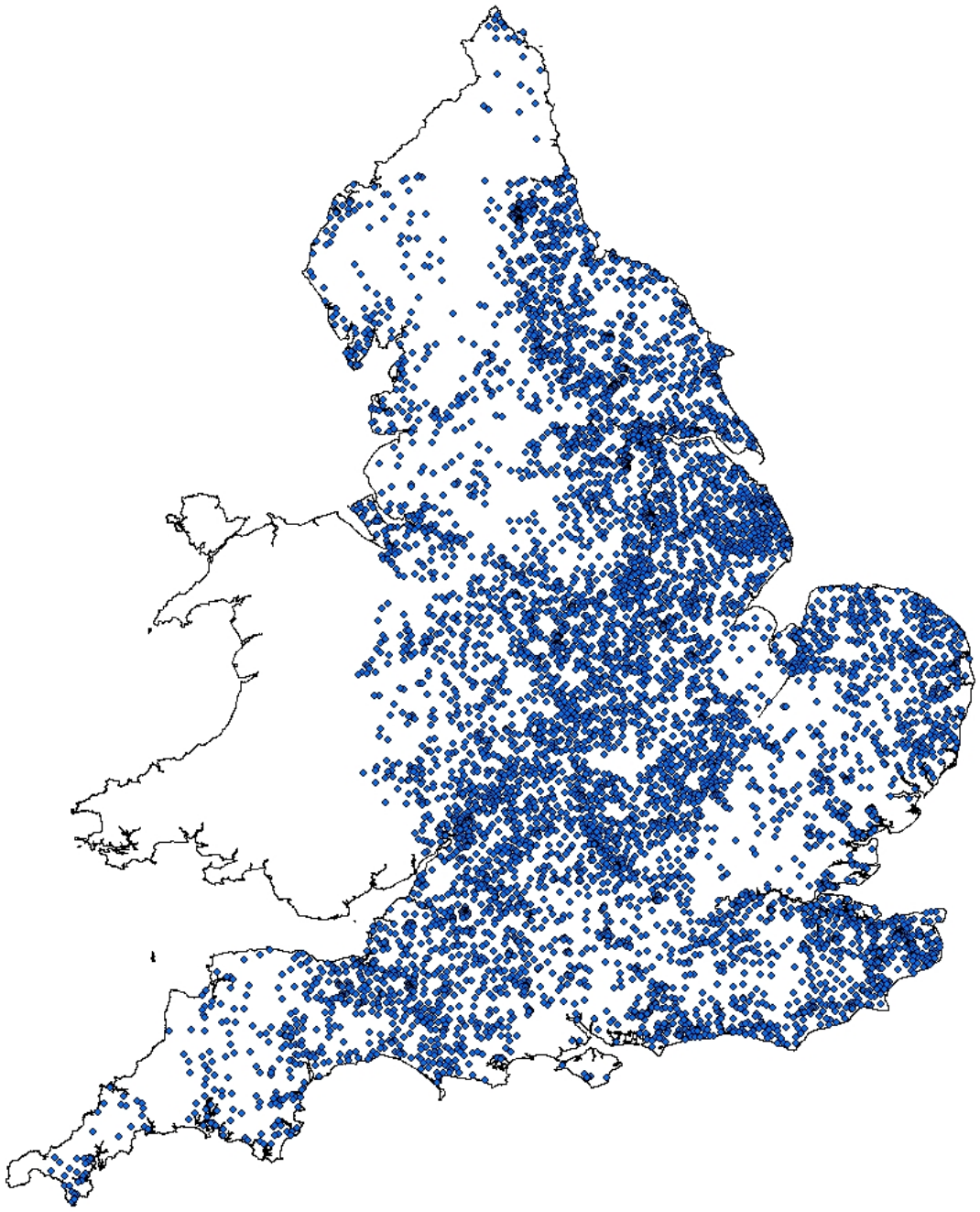


Figure 3: Spatial distribution of Monastic property. One dot indicates at least one monastic property in 1535.

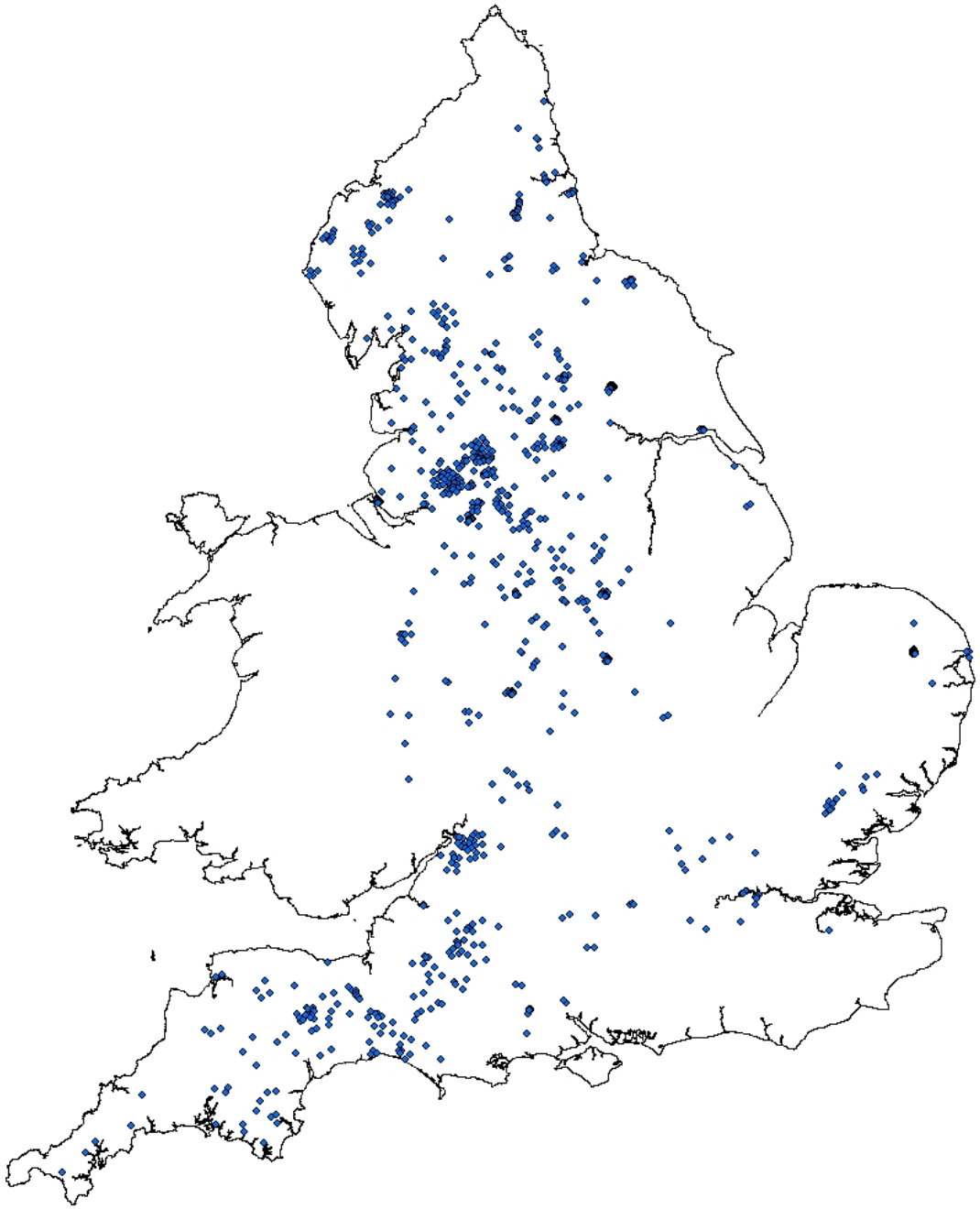


Figure 4: Spatial distribution of mills in England. One dot indicates at least one mill in 1838.

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 Revenue)	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)
Wheat Yield	21.68	4.49	21.83	4.45	21.61	4.51	0.218	(1.47)
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)	0.00894***	0.0103***	0.0426**	0.0621***	4.596**	5.853**
	(0.00159)	(0.00154)	(0.0208)	(0.0239)	(2.195)	(2.399)
	[0.00158]	[0.00149]	[0.0207]	[0.0231]	[2.192]	[2.326]
Control for Lay Subsidy Revenue	Y	Y	Y	Y	Y	Y
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	0.012	0.743	0.024	0.129

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)
ln(1 + Monastic Income)	0.0521***	0.0642***	0.0131**	0.0196***	0.0146	0.0270**
	(0.00957)	(0.00959)	(0.00655)	(0.00729)	(0.0112)	(0.0110)
ln(1 + Non Monastic Income)	0.0837***		0.0465***		0.0876***	
	(0.0107)		(0.0137)		(0.0272)	
Terrain elevation		-0.0558***		-0.0149		-0.000167
		(0.0198)		(0.0198)		(0.0246)
Terrain slope		0.0727***		0.00718		0.00355
		(0.0173)		(0.00844)		(0.0120)
Wheat suitability		-0.00207		0.0160*		0.00565
		(0.0128)		(0.00876)		(0.0183)
Distance to nearest river		-0.0507***		-0.00597		-0.0117*
		(0.00809)		(0.00390)		(0.00599)
Distance to nearest market town		-0.0458***		-0.0178**		-0.0479***
		(0.0117)		(0.00809)		(0.0173)
Distance to the border		-0.0320		0.0374*		0.0320
		(0.0371)		(0.0205)		(0.0333)
Distance to London		0.339**		-0.0158		-0.0516
		(0.159)		(0.102)		(0.209)
Distance to nearest coalfield		-0.0964*		-0.0644**		-0.121*
		(0.0586)		(0.0268)		(0.0626)
Control for Parish area	Y	Y	Y	Y	Y	Y
Soiltype dummies	N	Y	N	Y	N	Y
Observations	16243	16228	16243	16228	16243	16228
R^2	0.338	0.341	0.744	0.744	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. All coefficients are standardized. 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). 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: 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)
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). * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table 6: 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 7: Monastic Income, Lay Subsidies and geography

	Suitability for:				Suitability for:			
	Wheat (1)	Barley (2)	Oats (3)	Distance to nearest river (4)	Wheat (5)	Barley (6)	Oats (7)	Distance to nearest river (8)
ln(1 + Lay Subsidy Revenue)	0.139***	0.130***	0.155***	-0.0115*				
	(0.0307)	(0.0298)	(0.0365)	(0.00587)				
ln(1 + Monastic Income)					0.0780	0.0507	0.0482	-0.0106
					(0.0610)	(0.0589)	(0.0718)	(0.0117)
Control for Parish area	Y	Y	Y	Y	Y	Y	Y	Y
Observations	16228	16228	16228	16243	16228	16228	16228	16243
R^2	0.721	0.718	0.719	0.401	0.720	0.718	0.718	0.401

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. Suitability measures are he average value of an index of soil suitability for growing the relevant crop 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. ln(1 + Lay Subsidy Revenue) is the natural log of taxable income from the 1524/5 lay subsidy returns (Sheail, 1968). 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 8: Monastic Income and Occupational Structure

	Share in agriculture		Share in manufacturing		Share in retail	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(1 + Monastic Income)	-0.0143***	-0.0150***	-0.000809	0.00128**	0.00948***	0.00854***
	(0.00173)	(0.00155)	(0.000571)	(0.000529)	(0.000967)	(0.000915)
Control for Lay Subsidy Revenue	Y	Y	Y	Y	Y	Y
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	0.107	0.429	0.236	0.528	0.030	0.281

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. 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 9: Occupational structure and controls

	Share in agriculture		Share in manufacturing		Share in retail	
	(1)	(2)	(3)	(4)	(5)	(6)
ln(1 + Monastic Income)	-0.0656***	-0.0678***	0.0151**	0.0151**	0.0715***	0.0755***
	(0.00793)	(0.00762)	(0.00632)	(0.00628)	(0.00917)	(0.00891)
ln(1 + Non Monastic Income)	-0.0842***		0.00125		0.112***	
	(0.00841)		(0.00657)		(0.00971)	
Terrain elevation		0.142***		0.0195		-0.193***
		(0.0202)		(0.0198)		(0.0212)
Terrain slope		-0.131***		0.0497***		0.0567***
		(0.0157)		(0.0153)		(0.0175)
Wheat suitability		0.0209		-0.0341**		0.0307*
		(0.0155)		(0.0136)		(0.0166)
Distance to nearest river		0.0446***		-0.0254***		-0.0303***
		(0.00954)		(0.00766)		(0.0101)
Distance to nearest market town		0.168***		-0.0330***		-0.145***
		(0.0113)		(0.00928)		(0.0128)
Distance to the border		0.0361		0.0653*		-0.00448
		(0.0365)		(0.0390)		(0.0390)
Distance to London		-0.0177		-0.151		0.0172
		(0.148)		(0.154)		(0.155)
Distance to nearest coalfield		0.236***		-0.402***		-0.00432
		(0.0665)		(0.0538)		(0.0692)
Control for Parish area	Y	Y	Y	Y	Y	Y
Soiltype dummies	N	Y	N	Y	N	Y
Observations	12831	12819	12831	12819	12831	12819
R^2	0.433	0.459	0.528	0.536	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. All coefficients are standardized. 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). 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 10: Monastic Income and Agriculture

	Wheat Yield (bushels/acre)		Nr. of Agricultural Patents 1700-1850	
	(1)	(2)	(3)	(4)
ln(1 + Monastic Income)	0.157***	0.0666	0.0158***	0.0180***
	(0.0494)	(0.0515)	(0.00376)	(0.00375)
Control for Lay Subsidy Revenue	Y	Y	Y	Y
Control for Parish area	Y	Y	Y	Y
Fixed Effects	County	Hundred	County	Hundred
Mean dep. var.	21.68	21.68	0.02	0.02
Observations	4148	4148	16243	16243
R^2	0.307	0.543	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. Wheat Yield is the agricultural yield in bushels per acre of plots growing wheat in parish p (Kain, 1986). Number 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 11: Agriculture and controls

	Wheat Yield (bushels/acre)		Nr. of Agricultural Patents 1700-1850	
	(1)	(2)	(3)	(4)
ln(1 + Monastic Income)	0.0427***	0.0254*	0.0785***	0.0800***
	(0.0141)	(0.0133)	(0.0168)	(0.0171)
ln(1 + Non Monastic Income)	0.0452***		0.0226*	
	(0.0146)		(0.0124)	
Terrain elevation		-0.331***		-0.0290***
		(0.0273)		(0.0106)
Terrain slope		-0.0230		0.0379**
		(0.0240)		(0.0148)
Wheat suitability		-0.00586		-0.0224
		(0.0193)		(0.0138)
Distance to nearest river		0.0231*		-0.0152**
		(0.0132)		(0.00669)
Distance to nearest market town		-0.0852***		-0.0373***
		(0.0152)		(0.00893)
Distance to the border		0.118***		0.0176
		(0.0287)		(0.0321)
Distance to London		0.173**		-0.0286
		(0.0751)		(0.0921)
Distance to nearest coalfield		0.0708**		-0.0632
		(0.0355)		(0.0419)
Control for Parish area	Y	Y	Y	Y
Soiltype dummies	N	Y	N	Y
Observations	4153	4148	16243	16228
R^2	0.306	0.392	0.104	0.107

Notes: All regressions are estimated using OLS and include fixed effects at the county level in columns (1)-(3) and at the hundred level in columns (4)-(6). The unit of observation is a parish. All coefficients are standardized. Heteroskedasticity robust standard errors are reported in parentheses. Wheat Yield is the agricultural yield in bushels per acre of a plot growing wheat in parish p (Kain, 1986). Number 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. 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). 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 12: Monastic Income, Gentry and Enclosure

	Nr. of Gentry in 1700		Parliamentary Enclosure	
	(1)	(2)	(3)	(4)
ln(1 + Monastic Income)	0.0858***	0.0883***	0.0220***	0.0213***
	(0.00739)	(0.00743)	(0.00302)	(0.00307)
Control for Lay Subsidy Revenue	Y	Y	Y	Y
Control for Parish area	Y	Y	Y	Y
Fixed Effects	County	Hundred	County	Hundred
Mean dep. var.	0.66	0.66	0.37	0.37
Observations	16243	16243	16243	16243
R^2	0.119	0.234	0.185	0.293

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). 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 13: Intermediate variables and controls

	Nr. of Gentry in 1700		Parliamentary Enclosure	
	(1)	(2)	(3)	(4)
ln(1 + Monastic Income)	0.0958***	0.110***	0.0434***	0.0584***
	(0.00938)	(0.00943)	(0.00818)	(0.00823)
ln(1 + Non Monastic Income)	0.145***		0.117***	
	(0.0101)		(0.00894)	
Terrain elevation		-0.112***		-0.0653***
		(0.0158)		(0.0165)
Terrain slope		0.0160		-0.0499***
		(0.0134)		(0.0133)
Wheat suitability		0.0239		0.0212
		(0.0162)		(0.0160)
Distance to nearest river		-0.00554		0.00844
		(0.00924)		(0.00937)
Distance to nearest market town		-0.113***		-0.0302***
		(0.0106)		(0.0102)
Distance to the border		-0.0451		0.123***
		(0.0350)		(0.0374)
Distance to London		-0.0999		0.595***
		(0.140)		(0.147)
Distance to nearest coalfield		-0.134**		0.193***
		(0.0639)		(0.0676)
Control for Parish area	Y	Y	Y	Y
Soiltype dummies	N	Y	N	Y
Observations	16243	16228	16243	16228
R^2	0.242	0.244	0.296	0.294

Notes: All regressions are estimated using OLS and include fixed effects at the hundred level. The unit of observation is a parish. All coefficients are standardized. 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). 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). 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: The Long-Run Impact of the Dissolution of the English Monasteries
For Online Publication

This appendix contains supplementary material for the paper The Long-Run Impact of the Dissolution of the English Monasteries.

1: Extra Results

Table A-1: Robustness of Mill results

Dependent variable:	Mill dummy		Number of Mills		Mill Employment	
	(1)	(2)	(3)	(4)	(5)	(6)
			Different measures of Valor impact			
			Panel I-A: ln(1 + Valor Income)			
ln(1 + Valor Income)	0.0113***	0.0131***	0.147**	0.120***	13.27***	15.26***
	(0.00142)	(0.00138)	(0.0571)	(0.0320)	(3.470)	(4.161)
R^2	0.055	0.337	0.014	0.744	0.027	0.133
			Panel I-B: Nr. Monastic obs. in Valor			
Nr Monastic obs. in Valor	0.00775***	0.00839***	0.0374***	0.0415***	3.377**	4.277**
	(0.00183)	(0.00190)	(0.0131)	(0.0137)	(1.574)	(1.860)
R^2	0.053	0.334	0.011	0.743	0.022	0.128
			Panel I-C: Monastic dummy			
Monastic Dummy	0.0136***	0.0236***	0.204*	0.156***	11.37*	15.29**
	(0.00377)	(0.00357)	(0.113)	(0.0600)	(5.945)	(6.421)
R^2	0.051	0.333	0.012	0.743	0.022	0.128
Observations	16243	16243	16243	16243	16243	16243
Fixed Effects	County	Hundred	County	Hundred	County	Hundred
			Different fixed effects			
ln(1 + Monastic Income)	0.00700***	0.00755***	0.0192	0.0261	2.171	2.807
	(0.00153)	(0.00153)	(0.0205)	(0.0200)	(1.889)	(1.927)
Observations	16246	16246	16246	16246	16246	16246
Fixed Effects	None	North-South	None	North-South	None	North-South
Control for Lay Subsidy Revenue	Y	Y	Y	Y	Y	Y
Control for Parish area	Y	Y	Y	Y	Y	Y

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). 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). The North-South dummy is equal to one if parish p is in one of the following counties: Cheshire, Cumberland, Derbyshire, Durham, Lancashire, Lincolnshire, Nottinghamshire, Northumberland, Staffordshire, Westmorland, Yorkshire: West Riding, Yorkshire: East Riding, Yorkshire: North Riding or . * indicates statistical significance at the 10 percent level, ** at the 5 percent level, *** at the 1 percent level.

Table A-2: The potential effect of unobservables

	$\frac{\hat{\alpha}_{extended}}{\hat{\alpha}_{baseline}-\hat{\alpha}_{extended}}$
Mill dummy	29.9
Nr. of Mills	14.1
Mill employment	10.89

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 and ln(1 + Lay Subsidy Revenue) 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).

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)	0.0418*	0.00751***	3.929*	0.0556**	0.00979***	5.289**
	(0.0222)	(0.00143)	(2.083)	(0.0265)	(0.00158)	(2.618)
Control for Lay Subsidy Revenue	Y	Y	Y	Y	Y	Y
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	15830	15830	15830	13265	13265	13265
R^2	0.088	0.344	0.123	0.077	0.231	0.102

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. 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)	0.0280***	0.0289***	0.196	0.308**	25.13*	31.41**
	(0.00612)	(0.00605)	(0.131)	(0.138)	(13.46)	(13.71)
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)	0.0757***	0.0893***	0.980	1.539*	179.4*	180.1*
	(0.0208)	(0.0200)	(0.919)	(0.903)	(92.39)	(96.59)
Observations	683	683	683	683	683	683
R^2	0.044	0.315	0.006	0.825	0.029	0.160
Control for Lay Subsidy Revenue	Y	Y	Y	Y	Y	Y
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.

Table A-5: 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.

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. All outcome variables are described in section 2 of the paper.

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

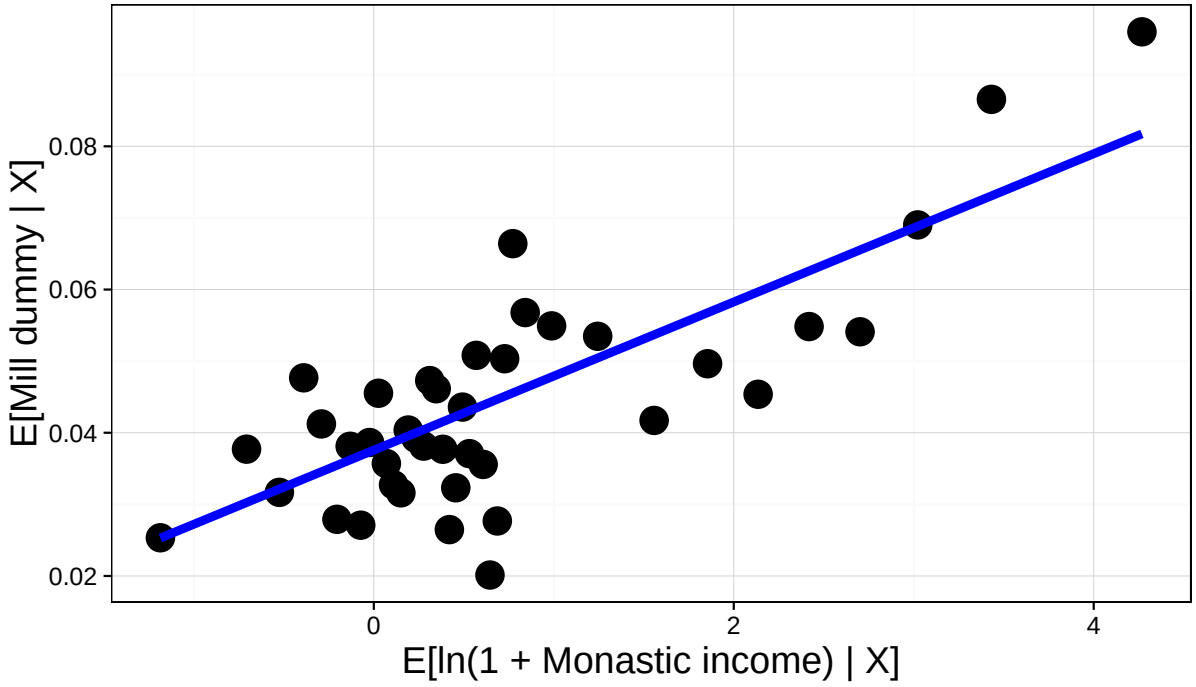


Figure A-2: Binned scatterplot for Monastic income and number of mills

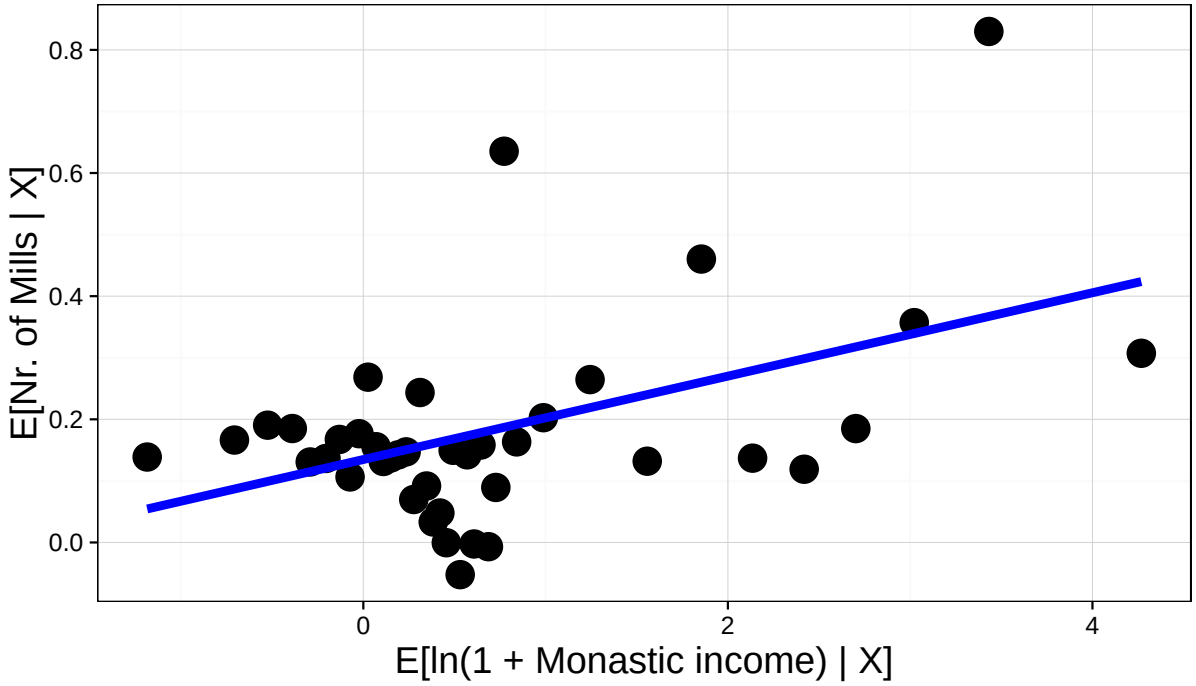


Figure A-3: Binned scatterplot for Monastic income and mill employment

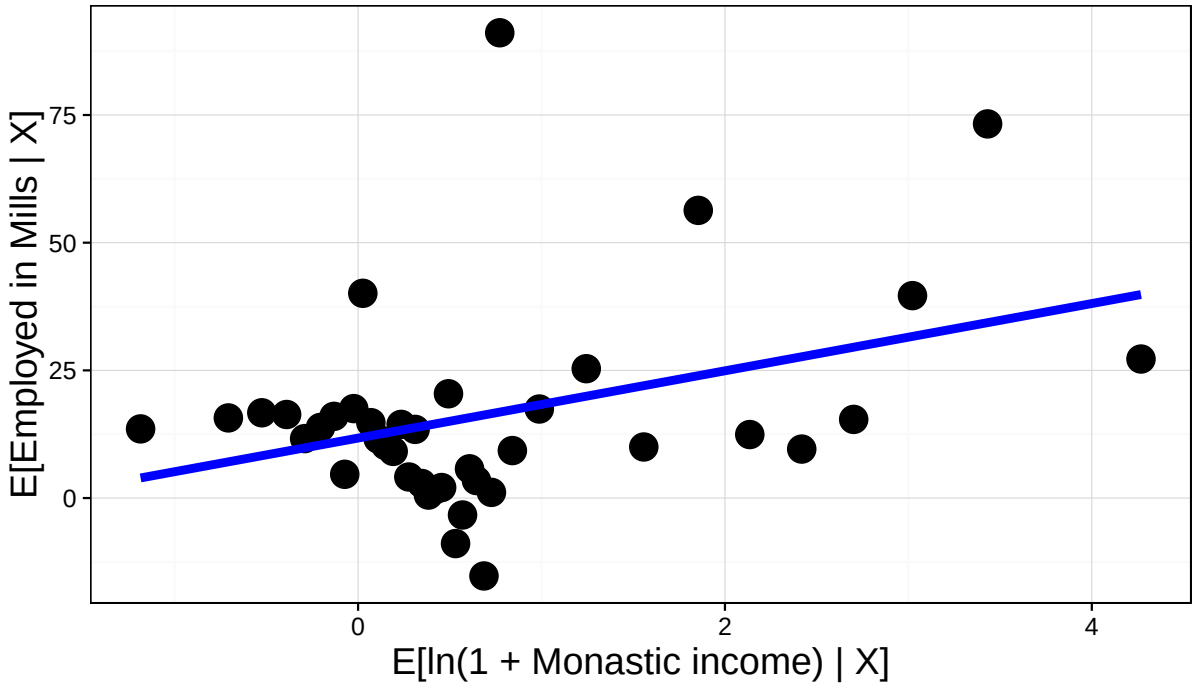


Figure A-4: Binned scatterplot for Monastic income and share in agriculture

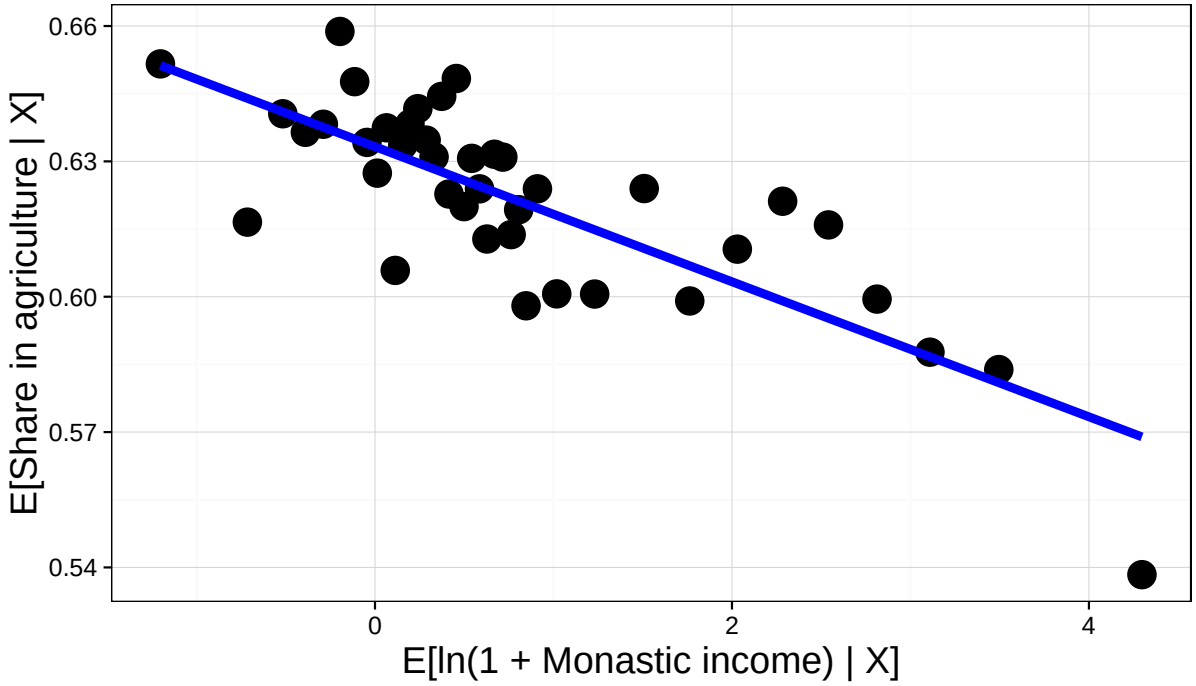


Figure A-5: Binned scatterplot for Monastic income and share in manufacturing

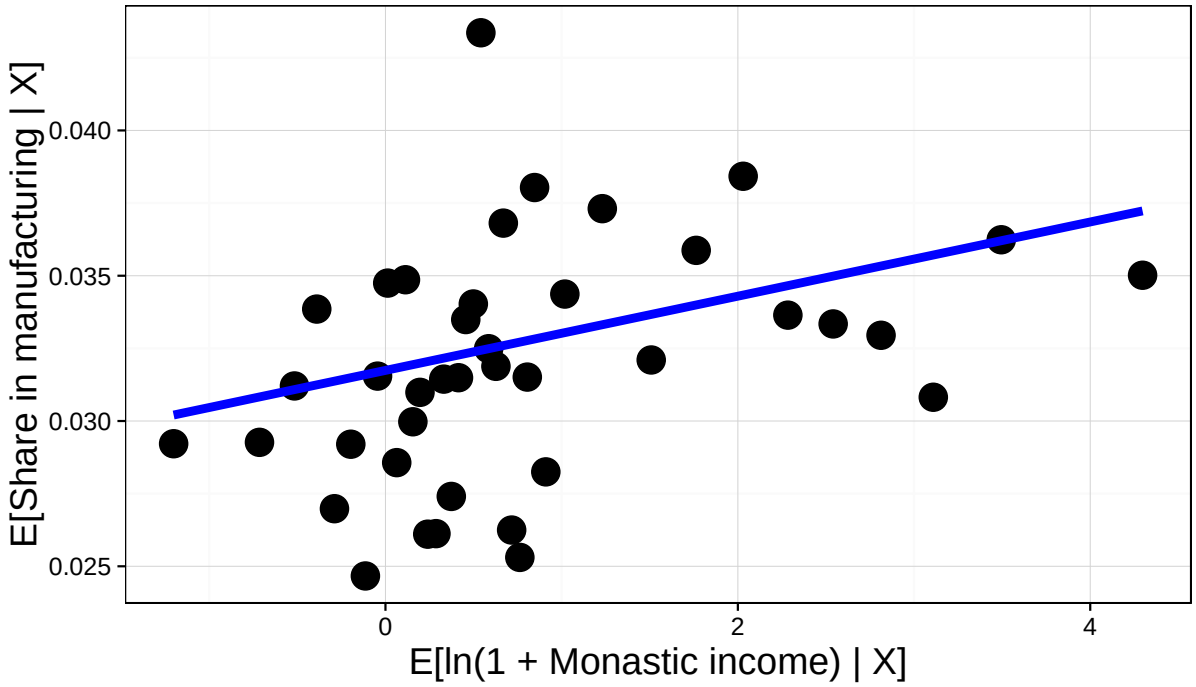


Figure A-6: Binned scatterplot for Monastic income and share in retail

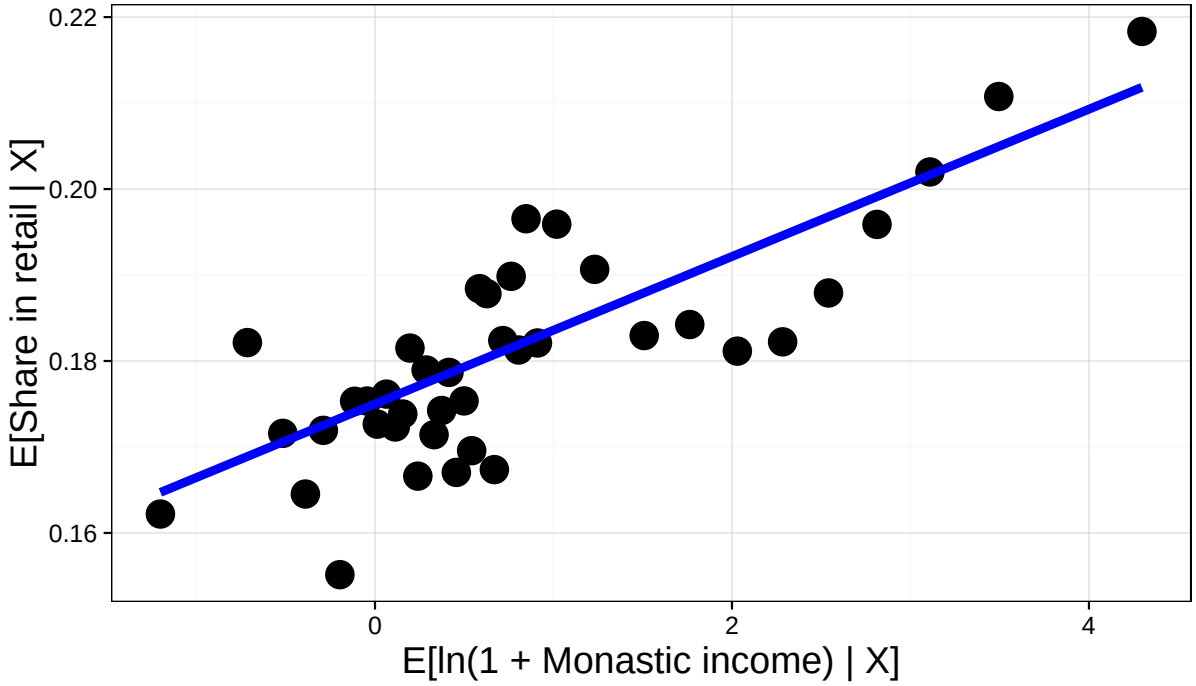


Figure A-7: Binned scatterplot for Monastic income and wheat yield

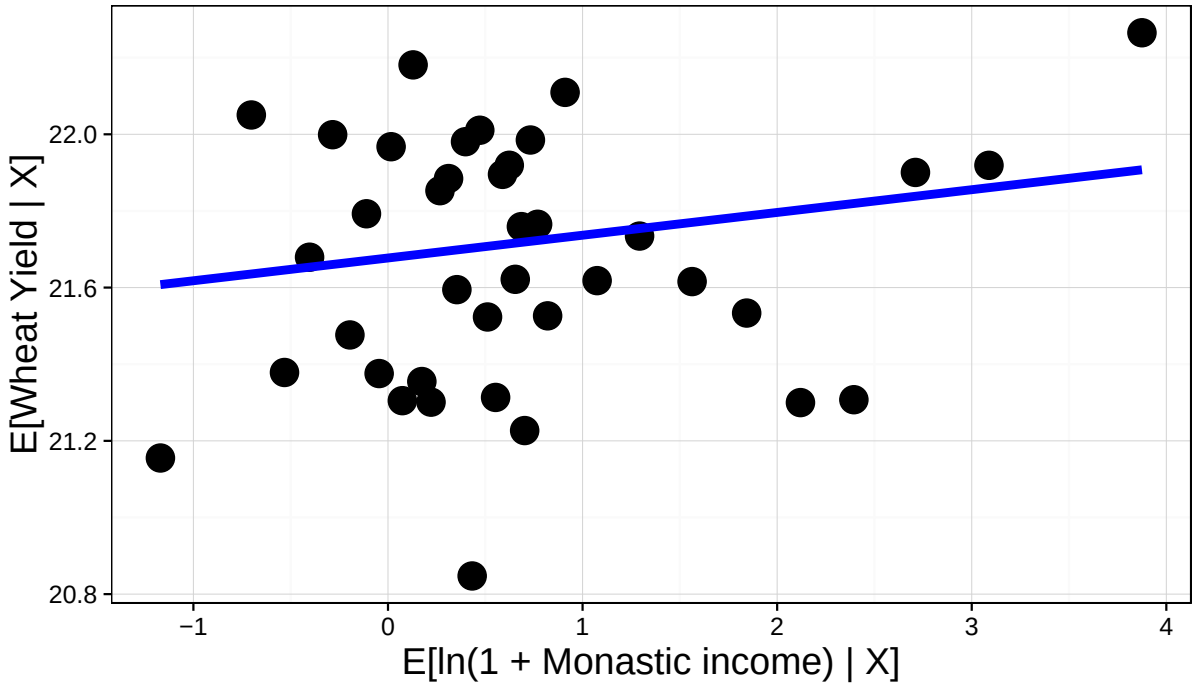


Figure A-8: Binned scatterplot for Monastic income and Number of Patents

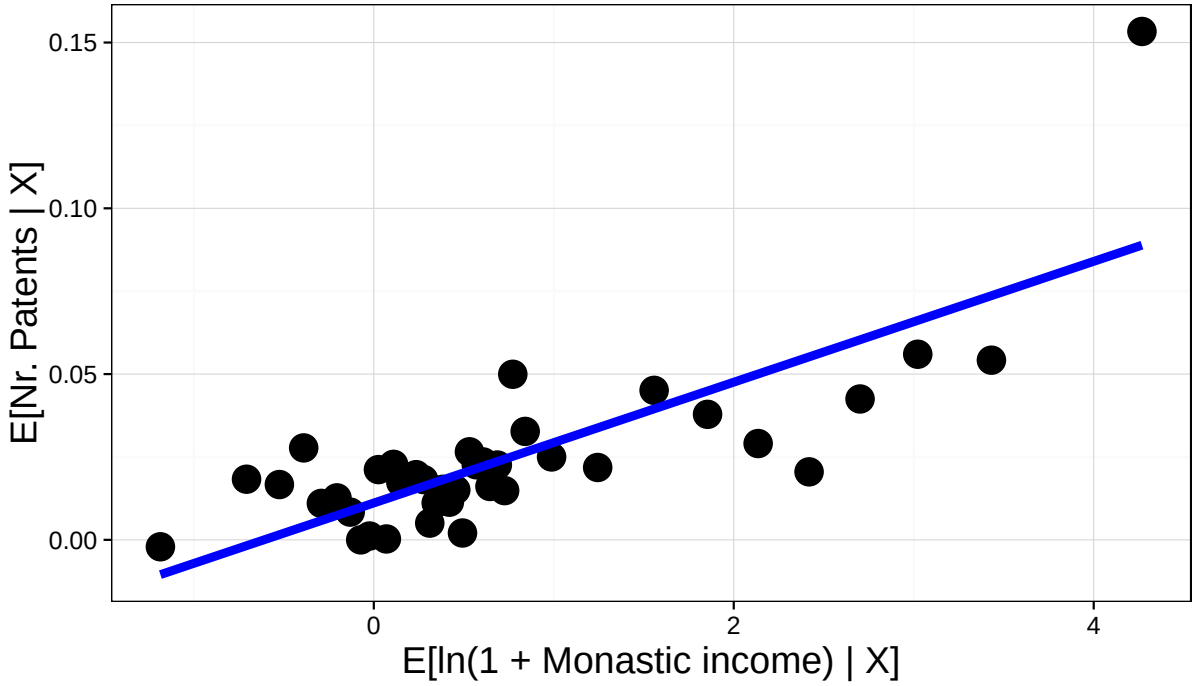


Figure A-9: Binned scatterplot for Monastic income and Number of Gentry

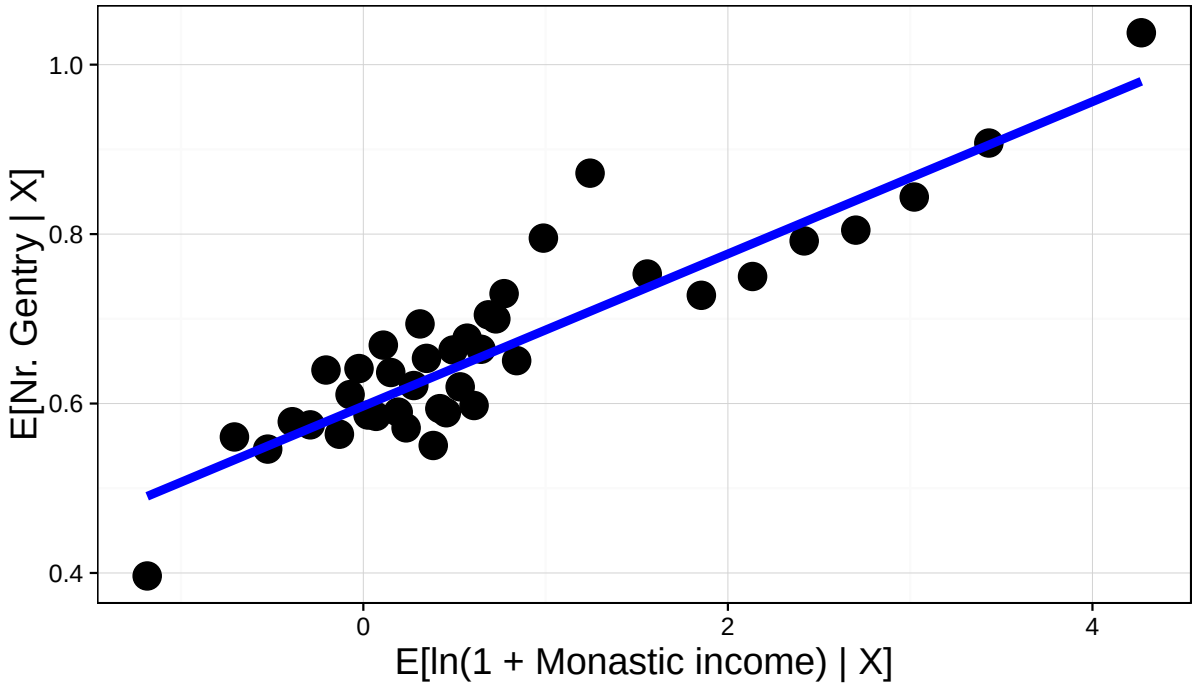
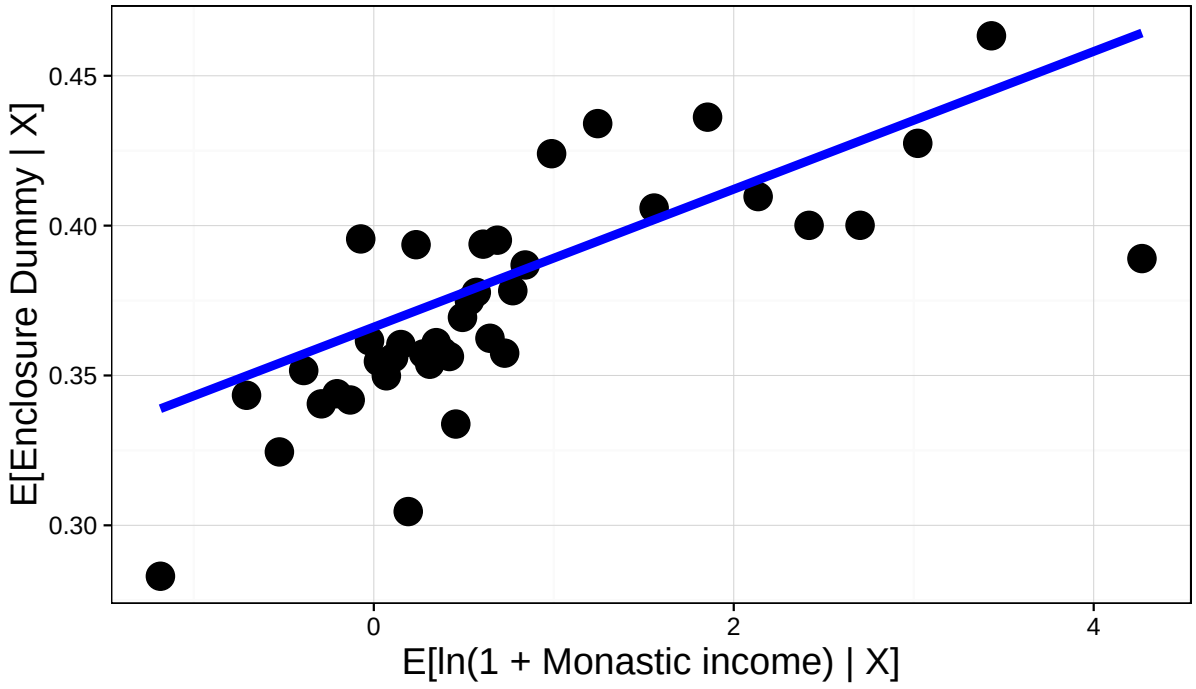


Figure A-10: Binned scatterplot for Monastic income and Enclosure



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. institutional change in the land market, the main impact of the Dissolution, is discussed in the main text. This section also 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'.[31] 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 usually the justices of the peace, mayors, sheriffs 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

[31] This section builds mostly on Hunter (1834). See also Youings (1971) and Knowles (1979). Annates are synonymous 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.

parties of at least three, divided the diocese among them and administered the survey. The subsequent 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. 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.[32]

The process of dissolution

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 outlined in Youings (1971, p. 73).

After the Dissolution, 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.[33] 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).

Although the Crown initially intended to lease out the remaining land, it quickly decided to sell the land because the task of managing vast tracts of land was beyond the bureaucratic capacity of the government. Additionally, in 1543 a war with France broke out which left the Crown in need of quick cash. It is therefore no surprise that although selling of the lands started as early as 1539, between 1543 and 1547

[32] 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.

[33] 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).

a newly formed government ministry tasked with the Dissolution - the Court of Augmentations - oversaw the sale of two thirds of all expropriated land. By 1558 virtually land had been sold (Habakkuk, 1958).[34] Most sales of monastic land were concluded at the fixed price of 20 years income.

Who were the people that bought the monastic land? Although no comprehensive data source exists, the case study evidence suggests that monastic lands were often sold to people who were associated with the monasteries, either as employees or as tenants (Youings, 1971). This meant that monastic land was sold locally. From the perspective of the Court of Augmentations, under pressure to sell land fast, selling to local people was the expedient manner to dispose of the land. For instance, 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.[35] Once the Dissolution started, these officials often secured new leases on monastic land seeking to entrench their positions. After the Dissolution, they renewed these leases with the Court of Augmentations (Woodward, 1966, p. 328; Jack, 1965). Local people were also involved in the Dissolution as short-term employees of the court of augmentations. After the Dissolution, they were often the first to acquire former monastic lands (Youings, 1971, pp. 67, 70).

There is a large body of case study evidence that suggest that the people who bought the monastic land became members of the gentry later on. For instance, 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).[36] 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. 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.[37] 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

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

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

[36]For additional evidence for Monmouthshire, see Gray (1987). For evidence on sales of monastic land around 1600, see Outhwaite (1971).

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

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

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 Gentry 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 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 of 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).[38]

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).

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

[38]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.

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.[39] Since areas may consist of several disjoint shapes[40], 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:

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[41] for each unit we want to match, map these units in ArcGIS and spatially join them to the shapefile in the GIS of Ancient Parishes database. Grid references

[39]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.

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

[41]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.

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 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 a parish to the observations in each data source. 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.

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.[42] 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.

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

- The counties Berkshire, Rutland, Northumberland.
- A substantial part of the diocese of York, including the whole of the deaneries of Rydal and Craven.[43]

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 specify 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 analysis 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. 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.

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

4. Synodals and procurations,[44] 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.
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.

[44] Synodals and procurations are ecclesiastical fees.

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-11 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.[45]

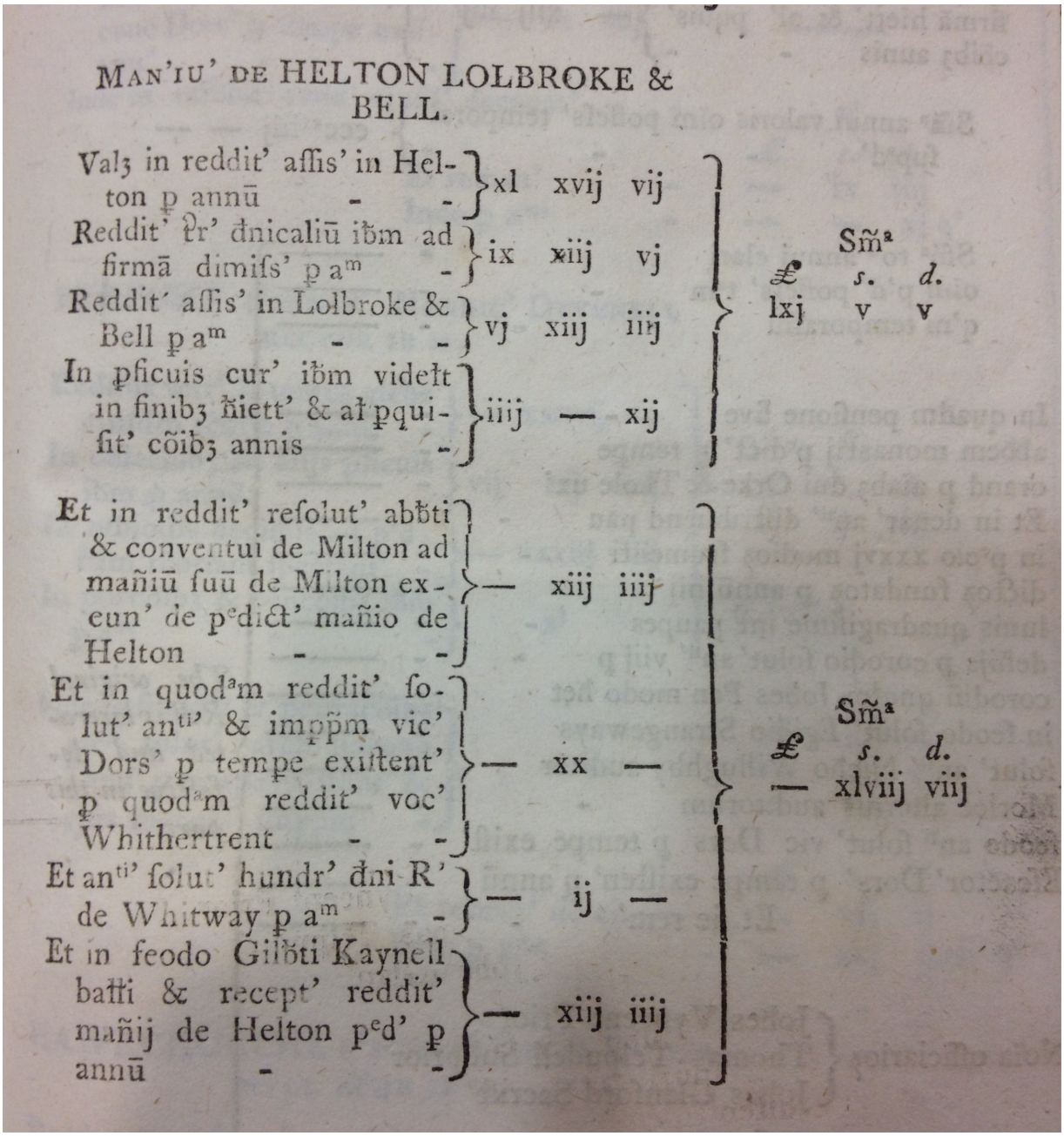
The first entry is an assize rent (*reddit assis'*, a fixed rent) in Helton, which gives an annual income of £: xl s: xvii d: vii. The next entry is a part of the demesne (*tr'daicaliu*) that is not farmed by the rector (*firma dimiss'*) for which he receives a rent. The next entry is another assize 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 (*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-11. We therefore coded three 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 this paper.

[45] In order to distinguish these sources of income in the text 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).

Figure A-11: 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' ꝺr' ðnicaliū ibm ad firmā dimiss' p am -	ix	xiij	vj			
Reddit' assis' in Lolbroke & Bell p am - -	vj	xiij	iiij	lxj	v	v
In pficuis cur' ibm videlt in finibz ñiett' & alt pqui-sit' cōibz annis -	iiij	—	xij			
Et in reddit' resolut' abbti & conventui de Milton ad mañiū suū de Milton exeun' de pdict' mañio de Helton - -	—	xiij	iiij			
Et in quodam reddit' solut' ant' & imppm vic' Dors' p tempe existent' p quodam reddit' voc' Whithertrent - -	—	xx	—	—	xlviij	viij
Et ant' solut' hundr' ðni R' de Whitway p am -	—	ij	—			
Et in feodo Gilbti Kaynell balli & recept' reddit' mañij de Helton pd' 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)	
	Channels and the Lay Subsidies	
Occupational structure variables – 1831 census	Gatley (2005)	
Agricultural yield	Kain (1986)	
The number of agricultural patent holders	Woodcroft (1854)	The data were transcribed and made available to use by James Dowey, see Dowey (2013)
Number of Gentry in 1700	Adams (1700)	
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 and barley	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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