THE ECONOMIC EFFECTS OF THE ENGLISH PARLIAMENTARY ENCLOSURES*

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Abstract

We use a dataset of the entire population of English Parliamentary enclosure acts between 1750 and 1830 to provide the first evidence of their impact. Parliamentary enclosure led to the systematic rationalization of traditional property rights. Exploiting a feature of the Parliamentary process that produced such legislation as a source of exogenous variation, we show that such enclosures were associated with significantly higher crop yields, but also higher land inequality. Our results are in line with a literature going back to Arthur Young and Karl Marx on the effects of Parliamentary enclosure on productivity and inequality. They do not support the argument that informal systems of governance, even in small, cohesive, and stable communities, were able to efficiently allocate commonly used and governed resources.

Keywords: Enclosure, Economic Development, Inequality, England. **JEL classification**: D02, N5, O43.

1 Introduction

In 1808 the English agriculturalist and arch "improver"[1] Arthur Young stumbled on a natural experiment. He noticed that the adjacent Cambridgeshire parishes[2] of Childersley and Hardwicke, even though "divided only by a hedgerow" (Young, 1808, p. 217), had startlingly different economic outcomes. In Hardwicke wheat yields were 16 bushels per acre while in Childersley, on the other side of the hedgerow, they were 24, 50% higher. What could explain the difference? Not the economic fundamentals since Childersley consisted of "perfectly similar soil" (Young, 1808, p. 217). Rather, Young attributed the difference to the fact that Hardwicke "remains in common field" while the land in Childersley had been enclosed.

The presence of "common field" was indicative of the persistence of the pre-modern organization of the English countryside. Parliamentary enclosure swept all of this away and was a profound transformation which influenced English agriculture. It divided common land and open fields into distinct individually owned private farms and allowed more broadly for a massive re-organization and rationalization of property rights. In the process it not only potentially impacted farming techniques and technological adoption, but also created large numbers of externalities, for example facilitating the expansion and modernization of road networks. All these changes potentially helped to induce the agricultural and industrial revolutions. Enclosure had been taking place in piecemeal and partial ways since the later Middle Ages, but was complicated by requiring the unanimous approval of all landowners for it to take place in a whole parish. New momentum emerged after 1750 by the introduction of an innovative mechanism; enclosure via an act of Parliament which allowed an entire parish to be enclosed if the owners of 3/4 of the land (by value) agreed.

In this paper we provide the first estimates of the impact of Parliamentary enclosure on efficiency and distribution in agriculture. In a new dataset covering 15,000 parishes in England, we compare parishes that were enclosed in the Parliamentary period (1750-1830), to parishes that were not enclosed by this method. We study the consequences of Parliamentary enclosure for efficiency and distribution around 1830 by measuring agricultural yields and land inequality.

To investigate this empirically, however, it is important to note that where enclosure had already taken place by agreement or in a piecemeal fashion, parishes likely expected to gain less from parliamentary enclosure. To some extent they would already have realized the productivity improvements of enclosure. This would be true even though the historical evidence suggests that piecemeal enclosure was often inefficiently done and aspects of the parliamentary mechanism, such as a definitive map of the new land settlement, were valuable even in parishes that were already to some extent, and even completely, enclosed. There is

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[1]On "improvement" see Slack (2015).

[2]A parish is a local administrative unit typically coincidental with a village.

therefore a great deal of unobserved heterogeneity in the characteristics of different parishes influencing whether or not they decided to apply for a Parliamentary enclosure, a bottom-up process that began with a petition. Since this was costly, many of the costs had to be born upfront, and the process might not succeed, this was a significant decision.

To account for this type of selection and to establish a causal interpretation of the effects of *Parliamentary* enclosure we use a feature of the Parliamentary process for approving a proposed enclosure as a source of variation in the likelihood that a parish would opt to enclose via parliament. In particular, we construct an instrumental variable as follows: We use the fraction of enclosure petitions that pass in Parliament for a group of nearby parishes that would have had similar political representation had they petitioned to enclose, as a source of quasi-experimental variation in the probability of a left-out parish enclosing through Parliament.

Our approach is motivated by the fact that getting enclosed involved three steps. First, a parish petitioned Parliament in the form of a draft enclosure Bill. Then, a committee of Members of Parliament (MPs) was tasked with judging the quality of the Bill against a large number of legal requirements, called standing orders. Finally, a potentially amended Bill passed or failed in a vote. Because the recommendation of the committee was usually followed, Tate (1945) notes that a leading reason that "an enclosure bill failed" was "failure to comply in detail with the standing orders of the House" (Tate, 1945, p. 138-139). Since committees for parishes were typically composed of local MPs we posit that, if petitions were checked against the standing orders similarly in parishes that likely would have had similar committee composition, we can use the leave-one-out probability of passing in those parishes, conditional on petitioning, as an instrument for passing a Parliamentary enclosure Bill in the left-out parish. The main advantage of this source of variation is that it is defined for both parishes that petition and parishes that never petition.

Because we condition on petitioning and compute the fraction of petitions that pass, rather than using the leave-one-out mean of realized Parliamentary enclosures across parishes, geographical 'common shocks' are unlikely to invalidate our strategy (Angrist, 2014).

There may still be unobservables at the level of the committee in Parliament in London that correlate with local economic outcomes. But to validate our strategy, we note that parishes were small relative to the constituencies their MPs represented, and electoral incentives for individual MPs were largely absent.[3] In addition, any involvement an MP may have had with a petitioning parish would be captured by removing the petitioning parishes. To empirically substantiate these assertions, we show that a number of variables that would plausibly correlate with the expected return to Parliamentary enclosure for the left-out parish

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[3]About 85% of elections were uncontested, and less than 10% of the population was enfranchised. Considering that the average member of Parliament represented 387 parishes, electoral incentives were largely absent.

are uncorrelated with our instrument.

Since parishes voluntarily petition Parliament for enclosure, and because our instrument induces variation in the likelihood of passing a Bill successfully through Parliament, our instrumental variable strategy estimates the Local Average Treatment Effect (LATE) for those 'complier' parishes that self-select into considering or taking the Parliamentary route to enclosure. Parishes that were already enclosed piecemeal and stood to gain so little that they would never consider the Parliamentary route for enclosure are 'never-takers' for this instrument, and are downweighted by our Two Stage Least Squares estimator (Imbens and Angrist, 1994).

Using our instrument, we find that Parliamentary enclosure leads to an increase in agricultural yield of 45% and we show this is not driven simply by substitution from one agricultural activity into another. This estimated effect is in line with Young's study of Childersley and Hardwicke and the 'before-after' comparisons of single parishes made in contemporary agricultural reports (Stone, 1808; Rudge, 1807). This estimated effect is, as we discuss later, also realistic considering the high costs of implementing Parliamentary enclosure. We find a 22 percentage point increase in the Gini coefficient of the value of plots of land in an enclosing parish (relative to a mean of 0.74).

We interpret our IV estimates through the lens of a recent literature on Marginal Treatment Effects (Heckman and Vytlacil, 2005; Brinch et al., 2017). This approach naturally allows us to conceptualize the treatment effect as a function of the "resistance to treatment". In our context this can thought of in terms of the factors, like high land inequality and a small number of landowners, which led to unanimous or more extensive piecemeal enclosure. Parishes with high land inequality should show high levels of "resistance to treatment" and correspondingly low marginal treatment effects since they are the ones that had less to gain, in expectation, from the parliamentary process. Since the IV, by estimating the LATE, downweight such parishes, a natural conjecture would be that if one estimated the Average Treatment Effect (ATE) one would find far small estimates of the productivity benefits of parliamentary enclosure. This is for the intuitive reason that the never takers, which had considered parliamentary enclosure but chose not to petition, would have had relatively little to gain and higher levels of productivity. Indeed, we find that the ATE is 75 to 78 percent lower than the corresponding IV estimate.

Our results suggest that, as Young argued, leaving land "in common field" did indeed lead to large efficiency losses. Through what mechanisms did parliamentary enclosure increase yields? We then study this. For productivity, we focus on three: Innovation, investment and coordination. Contemporary advocates of Parliamentary enclosure suggested that it promoted "improvement", by which they meant investment, innovation, and experimentation in new techniques. We capture innovation with data on the count of agricultural patents filed in a parish. We measure investment by focusing on infrastructure and the quality

of local roads. Parliamentary enclosure acts did not just re-distribute land rights they also took advantage of this re-organization to create new roads and revoke traditional rights of passage. These were likely important externalities from the process. To capture coordination, we measure the acreage in a parish that was either sown with turnips or subject to appropriate fallowing practices. Both tasks, sowing turnips and optimal fallowing, were known to replenish depleted soils and improve output, but may not have been adopted because their implementation required coordination among villagers with disparate interests within commonly governed fields. Parliamentary enclosure gave everyone the freedom to implement best practices without the need for coordination. We find evidence that Parliamentary enclosure is associated with both innovation and improved infrastructure and agricultural practices.

Our paper contributes to an at least 250 year long debate (documented in the next section) on the economic effects of the English Parliamentary enclosures. This debated both the efficiency benefits, but also the distributional aspects.

With respect to efficiency, we show that Parliamentary enclosure had a substantial positive effect on agricultural yields. Though economic historians have examined aspects of this debate and studied some partial datasets, we are the first to study the universe of parliamentary enclosures, bringing together novel data on yields and mechanisms. These findings also contribute to the broader debates on the role of property rights in development. To some extend they speak to the literature of the 'tragedy of the commons' (Hardin, 1968). But it is important to emphasize that our results cannot be interpreted as the narrow efficiency effects of moving from common to private ownership, since as we mentioned enclosure was a fundamental re-organization in property rights with many externalities, moreover some land in parishes that enclosed by parliamentary act had already previously been enclosed by a different method. They do say something about whether or not local institutions could govern resources, even the commons, efficiently (Ostrom, 1990), in a case where property rights were well-defined (Coase, 1960) and institutions could potentially change endogenously in an efficient way (Demsetz, 1967).[4] Our findings do not support the notion that communities can innovate systems of governance to efficiently allocate collectively managed resources, the same conclusion reached by Bogart and Richardson (2009, 2011) for our context and period. In this sense, our work coincides with research on the efficiency benefits of individualized private property rights (Besley and Ghatak, 2009; Field, 2007; Galiani and Schargrodsky, 2010; Fergusson, 2013; Besley, 1995).

The debate on the distributional impact has been even more charged. Parliamentary enclosure involved an institutional process that allowed for small landowners who might have opposed it to be over-ruled. It was exactly this feature that led Marx (1990, p. 885) to claim it was a "form of robbery" (see also Hammond

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[4]Indeed, both the commons and the open fields were governed by informal institutions and norms regulating usage and cooperation, which could be enforced both through social sanctions and in the manorial courts (Ault (1965) and Neeson (1993), chapter 5).

and Hammond (1911) and Thompson (1963)). The division of common lands may have been inequitable because some rights were far easier to establish than others and not all rights were compensated. Enclosure was also expensive and since capital markets were imperfect, liquidity constrained individuals might have had to sell out. Indeed, Neeson, using a similar natural experiment methodology to that wielded by Young, showed that the number of small landowners fell by 21% in Northamptonshire parishes after they were enclosed, while there was no change in unenclosed ones (Neeson, 1993, p. 249). Consistent with this, and a potential mechanism for large increases in land inequality, we find that Parliamentary enclosure is associated with significant falls in the share of individuals with small landholdings, known as "cottagers".

This paper proceeds as follows. The next section discusses the relevant historical and institutional background to this paper, focusing on the process of enclosure, the political procedures in Parliament that led to a Parliamentary enclosure act being passed and the literature which has assessed enclosure's impact. Section 3 introduces our dataset. Section 4 introduces our identification strategy and our estimation framework. Section 5 presents the Two Stage Least Squares estimates of the effect of Parliamentary enclosure. Section 6 discusses heterogeneous treatment effects. Section 7 discusses mechanisms. Section 8 concludes.

2 Setting and context

In this section we provide the necessary background to extra-Parliamentary as well as Parliamentary enclosures.[5] We first give a picture of what parishes "in common field" typically looked like. We then discuss how the process of enclosure was bottom-up and instigated by the parish landowners and subject to transactions costs which meant that, prior to the parliamentary mechanism, an entire parish could only be enclosed by the unanimous agreement of all the landowners. This as more likely in places with few landowners. Nevertheless, failing unanimity, various types of partial agreements and enclosures could and did take place. We next discuss the details of the Parliamentary process and show what this meant in practice in a parish. We finally provide an overview of the historical literature on the consequences of enclosure.

2.1 What did a parish "in common field" look like?

In some parts of England at the start of the period of Parliamentary enclosures, canonical versions of medieval strip farming systems persisted. The most famous version of this featured (usually) three "open" fields, like in Barton-upon-Humber which we show as Figure 1. The left panel shows the situation in Barton

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[5]Standard works are Tate (1967), Yelling (1977), Turner (1980) and Mingay (1997)

prior to Parliamentary enclosure. The defining feature of open fields is that farmers owned land which they had well defined property rights to, but this land lay scattered in strips in the three large fields. Barton also had various types of "common land" such as the Ings at the top left which were meadows leading down to the river Humber. It also had a marsh (known as 'waste') and cow and horse pastures and the 'common wolds' at the bottom of the map. These lands were not normally farmed. Instead, local inhabitants had all sorts of common rights, what Thompson (1963) calls "a dense cluster of claims and usages" (p. 239), to the use of these lands: the right to graze livestock on the three main fields after crops had been harvested, the use of meadow, common land, and woodlands. They also had the right of estover or the cutting of bracken and furze, and for the digging of building materials such as stone, clay, and sand. In addition, there was the right of turbary to cut turf for burning as fuel.

The bottom of Figure 1 also depicts "old enclosures" which in Barton were mostly part of the village area. Though the map of Barton is good for developing intuition, it is also somewhat misleading in that there were very few early or piecemeal enclosures in the parish. Enclosure didn't normally just divide up pristine open fields and commons, it was also "a frequent practice at enclosure for landowners to exchange small patches of old enclosed land for the new allotments in order to eliminate awkward detached pieces of their estates, and provision for this was normally included in the acts" (Chapman, 1987, 27). In Figure 2 we reproduce an 1838 map of Elmstone Hardwicke in Glouchestershire (from Yelling (1977, 75)) which is perhaps the more typical case of what parishes looked like before they enclosed via parliament. Here one sees three large enclosed farms, A, B, C whose lands are depicted in the three different types of shaded areas. Though the owners had gradually managed to enclose land over time their properties were highly fragmented. At the same time the open fields persisted and these enclosed farms also had holdings there. Manor farm (A), for example, was 72 % enclosed implying that 28 % of its land was still in the open fields or in claims on the commons (Yelling, 1977, 74). Importantly, parishes like Elmstone Hardwicke, which had not chosen to enclose via Parliament by 1838, are in our control group.

2.2 The Process of Enclosure

Enclosing a parish was a bottom-up process. Both before, during and after the period of Parliamentary enclosures, it started with negotiations between the landowners of a parish, who had to gain sufficient consensus for the process to move forward. The key distinguishing feature of enclosures prior to the institutionalization of the Parliamentary process is that for the whole parish to enclose there had to be unanimity amongst the landowners. Short of this many types of partial and piecemeal enclosure, as in Elmstone Hardwicke, were feasible. The case study literature suggests that an important determinant of

whether the entire parish could enclose by unanimity was how concentrated landownership was. Parishes with one or very few landowners could reach a unanimous agreement more easily. Indeed, early enclosures seem to have been dominated by lords enclosing their *demesne* land, which was manorial land that was farmed by what would have originally been villeins (serfs) (see Kerridge (1969, p. 96-97) and Slater (1907, p. 155)). In his study of Kesteven, Lincolnshire, Mills (1959) found that early enclosure was initiated by resident lords and monastic foundations and the greater the presence of freeholders, the more enclosure was delayed. Failing the ability to enclose completely, large landowners often led whatever enclosure could be achieved (Martin, 1979). Thirsk (1967a, p. 254) sums up the evidence from Lincolnshire as indicating that "Something like 70% of the reported enclosures in the period 1485-1550 were carried out by the nobility and squirearchy alone". Such enclosures were typically partial. Enclosing in such situations was a complex process as Chambers (1932, p. 142) pointed out

> though townships might be similarly situated in regard to the quality of soil they held ... a township that was divided amongst numerous owners ... would have many conflicting interests to overcome before enclosure could take place; while one that was in the hands of a single owner, and occupied mainly by tenants at will, or short leaseholders and so on, would be free from obstacles of this kind.

Turner summarizes the consensus view when he notes "the fracture of landownership among a large number of small proprietors was a reason for delayed enclosure" (Turner, 1984, p. 66).[6] [7]

Extra-parliamentary agreements to enclose were often only documented locally. Alternatively, the landowners could attempt to get a decree from the Court of Chancery to ratify an agreement. Yelling (1977, p. 18) notes however that "Chancery Decrees usually give only a general indication of the acreage and type of land enclosed, and some uncertainly may remain as to the precise date the enclosure took place". Moreover, as Beresford (1961, p. 58) observed, this was quite a contrived process since "it was a necessary fiction that a dispute existed, otherwise the jurisdiction of the court might not run".

Though enclosure was facilitated by "the opportunity provided by the Parliamentary procedures to overrule opposition from small landowners" (Yelling, 1977, p. 113) it is important to recognize that it did so in contexts where when parishes decided whether to use the Parliamentary mechanism "very few had been left completely untouched by earlier piecemeal enclosure" (Turner, 1980, p. 137). Even while

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[6]One of the themes of Gray (1915) and the subsequent literature, is that the variation in the timing of enclosure is related to idiosyncratic factors that created 'frictions' in the process of negotiating enclosure. For example, he contrasts the earlier timing of enclosure in Herefordshire compared to Oxfordshire noting that this could be explained by it being much easier to agree in the former because the size of townships were smaller Gray (1915, p. 153). See also Thirsk (1967b) and Thirsk (1964, p. 23) for other related examples.

[7]The eighteenth century commentator Henry Homer observed that "The necessity of universal agreement among proprietors especially where they are numerous is an almost insurmountable obstruction to any improvements being made in lands during their open field state" (Homer, 1766, p. 7-8).

Parliamentary enclosure proceeded in the eighteen and nineteenth centuries, partially enclosed parishes weighted the costs and benefits. They sometimes opted for an act of Parliament, but sometimes they kept on trying the piecemeal approach. O'Donnell (2014, p. 110) notes that "non-parliamentary methods continued to be important after 1750" and the study of detailed local records in four southern counties by Chapman and Seelinger (2000) found non-parliamentary enclosure agreements to be as common as Parliamentary acts in the eighteenth and early nineteenth centuries. The evidence of O'Donnell (2016) for Northumberland is similar and see the evidence he cites, for example from Westmorland.

2.3 The Parliamentary Process

The institutionalization of the Parliamentary route to enclosure in the eighteenth century brought greater clarity to the process, and critically, it made it easier to fully enclose a parish because it provided rules which over-ruled opposition. To start the process, the parishioners had to petition Parliament with a draft enclosure bill. When this was submitted to Parliament, the parishioners had to simultaneously present a "consent document" listing all the landowners in the parish, the value of their holdings, and their signatures as to whether they were in favor of the enclosure (Consent), against (Dissent), or indifferent (Neuter). No official figure was ever laid down for the proportion of these landowners who had to be in favor for Parliament to proceed. It was said to be 3/4 or 4/5 of landowners by value (though there are documented cases of parishes that were enclosed where less than 3/4 of the landowners were in favor (Mingay, 1997, p. 67). It was only in 1836, with the passage of the General Enclosure Act, that a 2/3 majority was specified.

Though negotiations began informally, parishioners would typically have a hired lawyer draw up a potential enclosure bill, then there would be an open public meeting to discuss it. After they had done this, the bill had to be fixed to the church door for three summer Sundays prior to the next Parliamentary session. If there was sufficient agreement, the bill would be presented to Parliament. The presented bill would then typically form the basis of a Parliamentary enclosure act. In Parliament, the bill was judged by a committee of Members of Parliament (MPs) against a large number of legal requirements, called the standing orders. If these were judged to have been satisfied, the committee would recommend that the bill be subject to a vote on the house floor and enacted into law. We describe this process in detail in the context of our identification strategy in Section 5 of the paper.

The bill specified the names of people who would become the commissioners, usually three, and the name of a surveyor. If the bill became an act of Parliament, the commissioners undertook the division and re-organization of the lands. First, the surveyor would map the lands to be divided. Then, the

commissioners would hold a series of meetings, where people would come forward to present their claims and try to establish their rights. As we noted, rights to the fruits of the commons were complex and often informal. The commissioners had to spend a long time soliciting evidence and interviewing multiple local residents to try to establish who used the commons and for what purpose. In the written bill itself, considerable attention was paid to processes emphasizing transparency and the points at which people could protest against decisions. When agreement was not possible, ultimately, appeals against commissioners' decisions could be taken to the local Quarter Sessions or the Chancery Court. Finally, the commissioners made the Award, which specified the division of the lands and an award map (see Kain and Oliver (2011) for a collection of the Award maps), placed it on the church door and had it read in public. Mingay (1997, p. 72-73) lays out all the events in the process from the first meeting of the commissioners on June 30, 1782 in Kingston Deverill to the final legal Award on August 23, 1785.

Finally, Parliamentary enclosure was a costly process. Leaving aside the value of all the time involved in making it happen, a lawyer had to be hired to make up the initial petition to Parliament. The landowners who wanted to enclose had to pay for the survey which would be the basis for the new land settlement, and they had to cover the costs of the commissioners who re-organized the land. In addition, Parliamentary enclosure forced parishioners to build new roads and fence their lands. These costs were divided between the landowners in proportion to the size of their holdings. Occasionally, the commissioners sold off portions of the newly enclosed lands to help pay some of these costs. See Stone (1808, p. 103) for a contemporary cost estimate for Barton. More generally, Turner (1984, p. 59-60) summarizing a great deal of evidence, argues that over the whole period of Parliamentary enclosures the total cost of enclosing was at least 12 pounds per acre on average (a "lower bound"). For a farmer owning 20 acres of land, the total cost of enclosure could be 240 pounds. This was almost five times the annual income of such a farm in the late 18th century (Mingay, 1997, p. 113). Since these costs had to be paid at the time enclosure took place this represented a serious problem for smallholders or liquidity constrained individuals (Turner, 1981).

2.4 The immediate consequences of Parliamentary enclosure

What happened when a parish was enclosed by parliament? Mingay (1997, p. 7) defines a Parliamentary enclosure as involving

> the extinction of common rights which people held over the farmlands and commons of the parish, the abolition of the scattered holdings in the open fields and a re-allocation of holdings in compact blocks, accompanied usually by the physical separation of the newly created fields ... [and] by the erection of fences, hedges and stone walls.

This is more or less exactly what happened in places like Barton. The right panel of Figure 1 shows the map of Barton and the new consolidated farms after Parliamentary enclosure. All common lands have been eliminated and the large landowners who pushed for enclosure are clearly visible on the new map. These were Marmaduke Nelson Graburn, William Graburn, as well as the owners of the tithes, George Uppleby, Esq., and his wife Sarah (Ball, 1856, p. 69). After enclosure these three families owned 63% of the parish (Russell, 1968, p. 36). This map also shows a few of the other things that were packaged with Barton's enclosure. A new system of roads was built, and in the top right one sees lands "for tithe". When enclosure started in 1797, tithe incomes, which accounted for 10% of agricultural output, were usually in the hands of private people. In the process of Parliamentary enclosure, the tithe holder was typically compensated for surrendering his right to the tithe in exchange for an enlarged landholding. Other similar types of compensation appear on the map. George and Sarah Uppleby also received land for "glebe" and Marmaduke Nelson Graburn and the Upplebys also each got a "corn rent allotment". These ancient rights were also compensated with extra land.

2.5   The Literature

Parliamentary enclosures and their consequences received a great deal of comment at the time from politicians and intellectuals. Many did not agree with Young on the productivity benefits.[8] No doubt the effects of enclosure were heterogeneous, as was the efficiency of the initial situation, so something more systematic than case studies is desirable. As we saw, Young himself and other contemporaries made many calculations suggesting that Parliamentary enclosure improved productivity. Some modern assessments follow Young, with Overton simply stating: "Enclosure facilitated innovation and changes in land use because the constraints imposed by common property rights, the scattering of land, and collective decision making could be overcome" (Overton, 1996, p. 167). Overton regards the correlation between improved agricultural productivity, technological change, and Parliamentary enclosures to be so strong that a causal connection seems highly likely. He concludes:

> the major upsurge in agricultural output and productivity came after the mid-eighteenth century: this coincides with the major burst of Parliamentary enclosure (Overton, 1996, p. 167).

Another authoritative source, Clay (1984) recognizes that "open field communities could and did make alternations to their field course, and even to the physical lay-out of their fields ... as was necessary for the incorporation of the new crops into their farming system" (p. 133-134), but he nevertheless concludes

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[8]For example, William Cobbett in his *Rural Rides* (Cobbett, 2001, p. 41).

"there is no doubt that where open field prevailed the need for communal agreements did retard the pace of change" (p. 134).

On the other hand, Mingay (1997, p. 94) ends up arguing that "There can be no general conclusion that enclosure, by releasing farmers from the limitations of communal farming, inevitably led to general improvements." And Thirsk (1963, p. 99-100) concludes that the open field system was innovative and flexible. Indeed, the most sophisticated empirical work on the productivity effects of enclosure, due to Allen (1982), finds very little effect. Allen's sample is of 231 farms, scattered mostly over the Midlands or different parts of northern England, extracted from a tour of England by Arthur Young between 1768 and 1770. He finds that the average treatment effect of Parliamentary enclosure on yield is rather low, with an increase of yield between 2.5% and 8.4%, depending on the dataset. It is unclear however how Young chose the sample with the only clue being that he met the farmers at York horse races. McCloskey (1989) bases her estimate on a selection of contemporary secondary sources which report differences in rental rates in "open" and "closed" villages.[9] The predominance of these studies suggest that rents doubled as a consequence of enclosure leading her to estimate modest productivity increases of 13%.[10] Some modern scholars, like Daunton (1995, p. 114-117), accept this evidence as establishing that there were indeed few productivity effects.

In Table 5 we collect available estimates of the increase in wheat yields along with our own findings. Clearly, our own results are closer to those of Young and contemporaries than more modern economic historians. We believe that this is likely because nobody has yet proposed a methodology for solving the inferential problem that Parliamentary enclosures were endogenous. Since potential gains from choosing Parliamentary enclosure for previously enclosed parishes are a counterfactual outcome, econometric techniques that allow us to estimate such counterfactual outcomes are necessary to estimate a more realistic treatment effect of Parliamentary enclosure. Our approach gets closer to the true causal effect. Here the before and after comparisons are the most compelling and though we do not have the data to implement such a strategy on a large scale, it is interesting that our IV results come close to these findings.

Just as contemporaries debated the productivity impacts of enclosure, they also discussed the likely impacts on distribution. The most famous nineteenth century hypothesis about the impact of Parliamentary enclosures was advanced by Karl Marx in Volume I of *Capital*. He argued that:

> the law itself now becomes the instrument by which the people's land is stolen ... The Parlia-
> mentary form of the robbery is that of 'Bills for Inclosure of Commons', in other words decrees

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[9]As our discussion of piecemeal enclosure makes clear, there was really no such thing as a purely open or purely closed village, unless the latter was enclosed by parliamentary act.

[10]An earlier attempt to use this methodology generated an estimate of a 7% increase in productivity (McCloskey, 1972, 35).

by which the landowners grant themselves the people's land as private property, decrees of expropriation of the people ... the systematic theft of communal property was of great assistance ... in 'setting free' the agricultural population as a proletariat for the needs of industry. (Marx, 1990, p. 885-886).

In Marx's argument, Parliamentary enclosures were the process by which large landowners expropriated small landowners, leading to a large rise in land inequality and the creation of a landless population, who then migrated to work in the factories of the industrial revolution. His views were largely re-affirmed by famous 20th century studies such as those by Hammond and Hammond (1911) and Thompson (1963). Thompson states that "Enclosure ... was a plain enough case of class robbery, played according to fair rules of property and law laid down ... by property owners" (p. 237-238). Thompson, like Marx, emphasized the dispossession of small landowners and landless who, unable to survive anymore without access to the commons, became available for factory work. The consensus amongst scholars currently is that in fact there was little corruption in this process, so the words "stoled" and "robbery" are not accurate.[11] Nevertheless, (Armstrong, 1989, p. 722) notes "enclosure could be entirely legal in regard to respecting property rights and yet be inequitable" and thus consistent with significant increases in inequality.

Ultimately then, the existing literature is inconclusive. One can make theoretical arguments about the efficiency of the open fields system (McCloskey, 1972; Townsend, 1993) and the usage of the commons (Ostrom, 1990), but one can also argue, on theoretical grounds, the opposite (Hardin, 1968; Samuelson, 1954). One can also argue that enclosure increased land inequality even though it was legalistic. But by how much? All the mechanisms emphasized make conceptual sense, but what is their quantitative significance? Our study is motivated by the salience of the question and the unsettled state of the evidence.

3   Data

In this section we introduce the unit of observation used in the empirical analyses in this paper. We also introduce the main variables and discuss measurement. Table 1 presents summary statistics.

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[11]Tate argued that the Parliamentary process tends to "show how very scrupulously and conscientiously the commissioners carried out their duties. They display almost an excessive regard for legality ... and a meticulous attention to the minutae of the business" (Tate, 1967, p. 173). The legality of the process is emphasized by virtually every study. For example, (Mingay, 1997, p. 57-58), (Armstrong, 1989, p. 721), Gonner (1966, p. 76-77)

3.1 Unit of observation

The unit of observation in this study is a parish. There were about 15,000 parishes and parish-like units in England around 1830. At the time of the 1831 census, the average parish had 387 inhabitants.[12] Each enclosure act explicitly enclosed either a single parish or a field common to several parishes. The parish is therefore the natural unit of observation for studying enclosure.[13] We use a cross section of parishes prepared for the 1851 census as our unit of observation (Kain and Oliver, 2001). Using parish names, we then merge other data sources to our cross-section of parishes. The effective number of observations in our regressions depends on the geographical coverage of our outcome variables.[14] We remove London and other cities and towns from our sample throughout.

3.2 Enclosure

We measure Parliamentary enclosure from the *Domesday of English enclosure acts and awards* (Tate and Turner, 1978). This source lists each enclosure act passed during the Parliamentary enclosure period. In total it records 5,383 acts and covers the universe of Parliamentary enclosure. For each act we record the parish(es) it enclosed. Figure 3 shows the number of parishes enclosed over time via Parliamentary act. Our Appendix provides a photograph of an enclosure act and a bar graph of the number of parishes enclosed by county. We measure Parliamentary enclosure by an indicator equal to one if a parish was enclosed by an act of Parliament.

Failed enclosure acts. As described in section 2 of this paper, enclosure had to be proposed to Parliament. Often, these bills failed and were not enacted into law. Failed acts are not in the database of realized enclosures of Tate and Turner (1978). We therefore expanded their database to include all failed enclosure acts as well. For acts proposed before 1800, we rely on Hoppit (1997), who records all failed acts in Parliament. For acts proposed after 1800, we read the *Journal of the House of Commons* which records Parliamentary proceedings. We recorded each instance of enclosure being proposed. By comparing the resulting list with the realized enclosures from Tate and Turner (1978), we identified enclosures that were proposed but did not pass.

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[12] In southern England, the parish was the main unit of local administration. In northern England, parishes were historically larger, and were often composed of several hamlets. We use the hamlets as the local unit of observation in this case. Some data vary only at the parish level. In this case, we aggregate hamlets to parishes. The average population figure of 387 is the average after aggregating in this way. The largest parish in 1831 is Leeds with 85,287 inhabitants. Older and larger cities had their city centers split up into multiple parishes.

[13] That is not to say that all land in a parish had to be in common field. In some parishes, larger parts of the parish may already have been enclosed piecemeal. To capture this, each act recorded the acreage of *land* affected by the act, in addition to other stipulations, like road construction. In a robustness check we use this intensive margin variation.

[14] As we discuss in our section on outcome variables below, our data on yield and inequality come from agricultural surveys. The reduction in sample size from the total number of parishes to the effective number of parishes in our regression reflects this. For example, parishes in our sample are on average further away from London and more rural. For our data wheat yield, our sample is further constrained by the fact that parishes would have to grow wheat for yields to be measurable.

In sum, for each parish we know whether it was enclosed by Parliament, the number of times enclosure was proposed, and whether a proposed enclosure passed. We use failed Parliamentary enclosures as part of our identification strategy, which we discuss below.

3.3   Outcome variables

We measure agricultural yield using data from Kain and Prince (2006), who study the records of the survey collected prior to the 1836 Tithe Commutation Act. In this process the commissioners measured agricultural yields for a large number of parishes, both enclosed and unenclosed. We record wheat yield in bushels per acre in 1836 from these returns. We focus on wheat, which has the most observations and was the most important staple crop around this time. From the Tithe commissioners' records (Kain and Prince, 2006), which were a part of the Tithe Commutation Acts, we record the value of each plot in a parish. In total we have data on 8,333,558 plots, which gives us a dataset of 681,650 individuals who either own or farm one or more plots, and for whom we know the value of their holdings. On average, a parish with plot level agricultural data has 41 landowners that are in the tithe records. From this dataset we compute the land value Gini coefficient for each parish for which we have data, assigning zero land value to individuals who don't own any land but do rent a plot from someone else owning the land. To study mechanisms, we record several new measures of innovation and change in agricultural practices as well as measures of the presence of cottagers, holders of small plots, which we will introduce below.

3.4   Other variables

We collect a large number of additional variables, which we introduce below as they become relevant in the empirical part of this paper.

3.5   Summary Statistics

In Table 1 we provide summary statistics of our main outcomes, split by an indicator equal to one if a parish experienced Parliamentary enclosure between 1750 and 1830. In a simple t-test we find that enclosed parishes have significantly higher yields and have a higher land value Gini. In the next sections we explore these patterns in detail.

4 Empirical strategy

As we outlined in our background section, all parishes potentially stood to gain from enclosure through Parliament. There was, however, substantial heterogeneity between parishes in the extent to which this was true. Parishes that had effectively enclosed over time in piecemeal steps may still have benefited from having a definitive map drawn. However, this benefit was likely less than for parishes that, in addition to having a definitive map, would also gain from the rationalization of property rights. This means that there is heterogeneity in the returns to petitioning, and therefore in the decision to petition, and ultimately, in the probability of Parliamentary enclosure. Relative to the high costs of Parliamentary enclosure, it may not have been worth it for some, but profitable for others.

This observation is the key empirical challenge of this paper. As parishes that had already (partially) enclosed likely already realized some of its effects, we expect to underestimate the true effect of Parliamentary enclosure if we rely on simple comparisons between parishes that enclosed through Parliament and those that did not. In this section we introduce our empirical strategy, which focuses on estimating the treatment effect for those parishes that would potentially take up Parliamentary enclosure. This is the 'policy relevant' group: It is these parishes that the opening up of the Parliamentary route for enclosure was intended to benefit.

The core of our empirical strategy is the fact that after petitioning, enclosure bills were judged by a committee in Parliament. This committee decided whether the bill complied with legal requirements. We posit that there are differences across the committees who represented different parts of the country over our study period in the fraction of proposed bills under their jurisdiction that passed. For parishes that did not petition, these differences would have been important had a committee been convened for a petition. If true, this observation implies that we could use the leave-one-out fraction of Parliamentary enclosures petitions that passed under the jurisdiction of the committees adjudicating new petitions for different parts of the country as an instrumental variable for Parliamentary enclosure. In the remainder of this section, we will discuss the historical background for this instrument, measurement, estimation, challenges to identification, and balance.

4.1 Parishes and Parliament

Each parish in England was part of a constituency, and each constituency sent two Members of Parliament (MPs) to Parliament. There were two types of constituencies, county, and borough. County constituencies were rural constituencies covering large parts of England. There were 40 such constituencies. In our dataset, an average county constituency covers 387 parishes. Borough constituencies covered

medieval cities and were often very small.[15] The franchise was heavily restricted to wealthy male citizens, less than ten percent to the population. Political competition was limited: 85% of elections in our sample period were uncontested. Because we remove cities and towns from our analyses, we in practice restrict to county constituencies. In these constituencies, there were hundreds of parishes that had virtually no control over the outcome of elections, unless they happened to be home to a large landlord or the MP himself.

4.2 The Parliamentary process for enclosure Bills

In section 2 we discussed the process that led to an enclosure act. Here we provide the relevant detail on the Parliamentary stage of the process.

Once a bill was agreed upon in a parish, it was submitted to Parliament by a lawyer hired by the petitioning parish. In Parliament, it was subject to what was called the 'Private Bill procedure'. Any Bill in Parliament can either be public or private. Public pertains to the entire country, such as Bill on tariffs or war. Private pertains to local or individual issues, such as naturalization and divorce, but also from about 1700 on included local issues to do with property, like enclosure. Both types of acts were subject to separate procedures. We provide a step-by-step breakdown of the Private Bill procedure in the Appendix. Each bill was judged by a committee of MPs. These committees were tasked with judging a bill by a large number of legal requirements, called standing orders. There were numerous standing orders for private Bills, and additional standing orders for enclosure Bills in particular. The most important distinction between Public and Private Bills is that Private Bills were required to adequately represent all stakeholders' interests. Such requirements are of course impractical for public Bills but make sense for divorce and other private matters. By submitting enclosure Bills as private Bills, petitioners ensured that the interests of all stakeholders were represented. For example, the enclosure specific standing orders specified that bills needed to be posted on the church door. These orders also stipulated that a committee formed to judge a Bill should review the enclosure consent document and ascertain that the requisite majority of landowners, as well as other stakeholders (such as the owners of the tithe) were adequately represented. To do this, committees were authorized to request documentary evidence, to call witnesses, and to require amendments to proposed Bills. After this, the committee was required to hear any 'counter-petitions' from stakeholders who felt disadvantaged by the proposed Bill. At the end, a committee made a recommendation and there was a vote by the Commons. Through the standing orders and the committees, Parliament offered a mechanism to resolve disputes that would potentially scuttle unanimous agreement. After having been passed by the

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[15]The electorate in some boroughs was so small that they were called 'rotten', as a handful of voters elected two MPs, as many as were elected by the about ten thousand voters in Yorkshire.

Commons, the Bill would move to the House of Lords where another vote occurred before a Bill was signed into law by the king.

Throughout these procedures, it was by no means guaranteed that a Bill would pass. For Oxfordshire, about a third of proposed Bills failed (Tate, 1949). For Nottinghamshire, the number is also about a third (Tate, 1942). In our database of all enclosure Bills, about 20 percent of Bills failed.

4.3   The committee in practice

We described so far the theoretical legal procedure. The formal procedure may of course differ from the de facto implementation of the law. As for the task of the committee, it is clear from contemporaries' descriptions of the process that its de facto mandate was the resolution of potential conflicts of interest in the Bill (May, 1844, p. 76):

> "a bill for the particular benefit of certain persons may be injurious to others; and to discriminate between the conflicting interests of different parties, involves the exercise of judicial inquiry and determination."

The members did so by applying the standing orders. In fact, Fisher (2009) notes:[16]

> "A private bill could not be introduced without confirmation that the standing orders had been complied with, and the committee's function was to establish whether this was so, and report its conclusions to the House."

In the Appendix, we provide a description of the full practical procedure from a contemporary lawyer's handbook. This handbook also lists in full text the standing orders an enclosure act was required to comply with (Ellis, 1802).

In principle, any MP could be assigned to be on a committee, but in practice the MPs representing the constituency from which a petition came, and MPs from surrounding constituencies constituted the committee formed to judge a Bill: "The members .. are usually the county members, or those from a neighboring constituency" (Tate, 1967, p. 95).

There was a committee for every Bill. For Private Bills, it is clear that MPs on the committee had a large degree of discretion over the rigor with which the standing orders were applied (Lambert, 1971). It stands to reason that there was variation across committees in what fraction of Bills within their jurisdiction passed.

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[16]We consulted the online version of this book, available here: http://historyofparliamentonline.org/volume/1820-1832/survey/vii-procedure-and-business-house. Current as of 12/01/2020. The quotation appears on this page.

When the committee reached a verdict, they "...report to the house that the Committee has gone through the Bill, and then they will order it to be engrossed" (Ellis, 1802, p. 89). The committee then went up to the speaker of the House to vote. Although formally every MP was allowed to vote, there is later, but probably representative, evidence from the 19th century "that routine business, whether public or private, was transacted round the speaker's chair, while the rest of the house chatted and moved about to speak to friends" (Lambert, 1971, p. 98).

In conclusion, a committee of MPs was required to formally judge a proposed enclosure against a large number of standing orders. At the end of the process, a law could be produced that enacted Parliamentary enclosure. At this stage, as we saw in section 2, Parliament appointed commissioners and a surveyor that went to the involved parishes to document and map everyone's holdings and implement the actual enclosure.

4.4   Using the Parliamentary procedure

We exploit the fact that enclosure Bills were enacted through Parliament in London, even though they usually pertained to an individual parish, and at most to a few parishes. Similar committees would receive petitions from the part of the country they represented, and whether a petitioning parish would enclose through Parliament was in part determined by the committee's decision. These facts allow us to use the leave-one-out mean of the number of petitions that passed over parishes that would plausibly have had a similar committee in our sample period.

The main advantage of this approach is that we can compute this leave-one-out mean both for parishes that petitioned and for parishes that did not. A second advantage is that, because we condition on petitioning rather than computing the leave-one-out mean of realized Parliamentary enclosure across nearby parishes, local common shocks, detrimental to typical leave-one-out instruments (Angrist, 2014), are unlikely to be a problem for us. Such shocks would affect the incentives to petition, but not the process of judging a petition in London. By conditioning on petitioning, we 'shift' the construction of our instrument to Parliament in London. Because the role of a committee can be interpreted as judging the quality of a proposed Bill, our strategy is similar in spirit to 'examiner' designs, common in labor and public economics (e.g. Card et al. (2020) and Dahl et al. (2014); fundamentally, these strategies go back to Angrist et al. (1999)). What is different from these designs is that in our study parishes are not randomly assigned to committees. In the previous paragraphs we provided narrative evidence that parishes had little control over the Parliamentary process. Below we provide a number of 'balance checks' that show that factors at the parish level that may correlate with economic outcomes are uncorrelated with our instrument. We find

balance throughout.

4.5 Measurement

There are two measurement challenges to this strategy. First, the precise composition of committees is not systematically recorded in the Parliamentary archives. Second, committees are not defined for those parishes that never petition. Our solution to both challenges is to identify a geographical area around a given parish which, we claim, captures the set of parishes for which committees would have been similar for. For parishes that did petition, this area captures parishes with similar committee representation to the petitioning parish. For parishes that did not, this area captures the representation they would have faced had they petitioned. We then compute the leave-one-out mean of the proposed enclosures that passed within this area, over our sample period. The reason to average over our entire sample period is practical. We do not know when a parish that did not petition would have, had they faced a committee that would have induced them to petition.[17] We hypothesize that this probability correlated with the probability of a Bill passing in the left-out parish. To operationalize the use of the leave-one-out mean petitions passing as an instrumental variable for Parliamentary enclosure, we proceed in several steps.

1. For each parish, we identify the k closest parishes. In our baseline estimates, we set $k = 350$, and we vary k in the Appendix. This area is intended to capture the area from which MPs would be selected to serve on the committee for a petitioning parish. For example, if a parish is near a constituency boundary, the committee would likely consist of MPs from both the constituency the parish is in, as well as the neighboring constituency. If a parish instead was in the heart of a large county constituency, the committee was typically staffed with the county constituency representatives as well as MPs from nearby boroughs within the constituency.[18] This way, the bandwidth k identifies the likely composition of a committee, whether it was actually formed or not. We discuss an example that builds intuition below.

2. For parishes within k, leaving out the petitioning parish itself, we compute the fraction of petitions that were successful. If a parish petitioned twice, first unsuccessfully and subsequently successfully, we include it in this computation twice. To compute the instrument in the same way for enclosing

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[17]This of course implies that we include committees in the construction of the instrumental variable for parishes that did petition from before their petition happened. Because we intend to capture an aspect of the political representation in London that may or may not induce parishes to petition, we do not want to condition on any timing information we may have about Parliamentary enclosure. We would only be able condition this way for parishes that did in fact enclose through Parliament.

[18]Note that we drop parishes that are in such boroughs from our dataset, and the construction of our instrument does not take passed or failed enclosures from boroughs into account. It is still the case that rural parishes likely had MPs from nearby boroughs on the committees judging their petition.

parishes and parishes that never enclose, we compute this measure using enclosures over our entire sample period.

Figure 4 contains three maps that provide intuition for the construction of the instrument for the parish of *Meldreth* in Cambridgeshire. The figure superimposed between subfigure (a) and (b) shows a bounding box to situate the case study within England. The extent of this box is the full extent of subfigures (a) and (b).

In subfigure (a) we show the extent of k. Note that k spills into several neighboring constituencies, such as Bedfordshire and Hertfordshire county constituencies, and Cambridge and Huntingdon borough constituencies. This reflects our assertion that MPs from these constituencies were likely to be on the committee for Meldreth should it petition. In subfigure (b) we shade parishes within k by enclosure status. Parishes in white never petitioned. Parishes in light gray successfully petitioned. Parishes in dark gray petitioned, but their petition failed at least once. We construct the value of our instrument for Meldreth by dividing the number of successful petitions by the total number of petitions within k.

Meldreth did in fact petition for enclosure on December 16, 1812. Although we cannot know the full composition of its committee, when a Bill was first assigned to a committee or when an MP returned with a Bill to the Commons, names of individuals were sometimes recorded in the Journal of the House of Commons. In the case of Meldreth for instance, after the petition was delivered, Lord Francis Osborne (MP for Cambridgeshire) and Lord Charles Manners (the second MP for Cambridgeshire) were charged to prepare the Bill for Parliamentary scrutiny and were made part of the enclosure committee. Later on, Thomas Brand (MP for Hertfordshire), who was a committee member, reported that the standing orders had been complied with. Hertfordshire is indicated in subfigure (b). Hertfordshire borders on Cambridgeshire, and Meldreth is close to their border. After a challenge to the petition due to some lands that were interspersed with neighboring parishes, the Bill was reported to have complied with all standing orders on June 3rd 1813.

4.6   Challenges to identification

As introduced above, an important challenge to identification originates with the leave-one-out nature of the instrument. A now large literature points out that group means as instruments for left-out individual outcomes can produce a sufficiently strong estimated first stage even in the absence of a true first stage due to common shocks at the group level (Angrist, 2014). This would be a problem for us if we took the mean of an indicator for enclosure across parishes within k. Common shocks may affect the decision to petition for Parliamentary enclosure irrespective of what happens in Parliament, for example. We, instead, condition

on petitioning, 'shifting' the construction of the instrument to Parliament in London. It may still be the case that the pass rate of petitions correlates with local (un)observables in a way that in turn correlates with economic outcomes, violating the exclusion restriction. The most direct way this could occur is if, for example, MPs live in parishes with certain characteristics.[19] The behavior of MPs in Parliament in connection with enclosure has been studied extensively by William Tate (Tate, 1942, 1945, 1949, 1967). Tate (1949, p. 220) concludes:

> Enough evidence has been adduced to suggest strongly, though hardly to prove, that on occasion members went out of their way to take part in enclosure proceedings for parishes where they or their friends, allies, or patrons had estates. But that this was done systematically, habitually, and upon a large scale is demonstrably untrue.

Our leave-one-out strategy addresses these concerns in principle by omitting the petitioning parish. In addition, we provide a number of balance checks below which support our assertion that parish characteristics are uncorrelated with our instrument.

A more subtle challenge to identification is that the leave-one-out pass rate of petitions for Parliamentary enclosure may correlate with the probability that other Bills pass. There are two types of such legislation. The first type is national legislation. For this type, such as the Corn Laws, our concern is muted because they were uniformly implemented throughout the country, involving all MPs. The second type is other legislation that passed through the Private Bills procedure.[20] Of this the most important sub types were drainage, canal and turnpike Bills. Drainage Bills enacted embankment and subsequent drainage of local bodies of water, such as the Lincolnshire Fens, or drainage of waste lands. Since these were lands not previously farmed, we do not think that the fact that these Bills passed through the Private Bill procedure is a threat to our identification strategy. They also rarely failed. Between 1660 and 1800, only 30 drainage acts failed (Hoppit, 1997). Canal and turnpike Bills enacted the construction of canals and turnpike roads. From the perspective of an individual parish, such acts had much larger committees, as all MPs representing the involved constituencies typically sat on the committee for a canal or turnpike. For example, the famous Bridgewater Canal, built in the 1760s to link the newly industrializing cities of Lancashire with the coast, had a committee composed of 76 members when the Bill that allowed it to move forward went through the House of Commons in 1761-1762 (Williams, 1948, p. 36). In addition, a canal or turnpike going through

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[19]For example, Sir Charles Mordaunt represented Warwickshire for 40 years, between 1734 and 1774. The first enclosure act that was proposed when he was in Parliament was for Wellesbourne Mountford, where he was the lord of the manor - the major local landowner. Note that in the construction of the instrument for Wellesbourne Mountford, this enclosure attempt would be omitted.

[20]This could be actual Private Bills of the types we described above, or from 1798 these could also be local acts. Local acts are subject to the same procedure as Private Bills but do not necessarily have to do with a private matter. For us what matters is that they were subject to the Private Bill procedure in Parliament.

a parish typically only involved the private sale of land for the canal or road, and not a complete overhaul of the parish, as was the case with Parliamentary enclosure. Taken together, drainage, canal and turnpike Bills are also not quantitatively important. Out of 11,029 Bills that passed through the Private Bills procedure 36 percent were enclosure Bills and only 4.5 percent were either drainage or turnpike Bills while 1.5 % were canal Bills. The largest remaining category is naturalization, divorce, and bequest Bills.[21] To empirically substantiate our assertion that drainage and turnpikes are unimportant for our results, we control for whether a turnpike passed through a parish and whether drainage was in operation in the Appendix, and find that this does not explain our results (we ignore canals here since there were sufficiently few of them).

4.7 Estimation Framework

In this section we outline a simple framework that introduces our instrumental variable analysis. We provide a full framework starting from a simple Roy (1951) model in the Appendix. In this section we present a simplified version. We model the economic effects of enclosure as follows:

$$Y = \beta_1 E + X_p \beta_2 + V \tag{1}$$

Where Y is an observed outcome, E is an indicator for Parliamentary enclosure, X is a vector of other variables potentially related to Y and V is a disturbance term. It will be useful to express our treatment effect of interest in two ways. We are interested in the treatment effect of Parliamentary enclosure. In Equation 1 this effect is captured by β_1. We now also express Equation 1 in terms of potential outcomes. Let Y_0 denote the potential value of Y in the absence of Parliamentary enclosure and Y_1 denote the potential value of Y in the presence of Parliamentary enclosure. Both Y_0 and Y_1 are random variables. We can then re-express Equation 1 as:

$$Y = Y_0 + (Y_1 - Y_0)E = \beta_1 E + X\beta_2 + V \tag{2}$$

With $\beta_1 \equiv Y_1 - Y_0$ and $V \equiv Y_0 - \beta_2 X$. This re-expression does not change the economic interpretation of any quantities from equation 1, β_1 still captures the treatment effect and V still represents the disturbance term. Under the assumption that $Y_0, Y_1 \perp\!\!\!\perp E|X$, an OLS estimate of β_1 identifies $E(Y_1 - Y_0|X)$, or the Average Treatment Effect (ATE) (Angrist and Pischke, 2008, Chapter 2.3).[22]

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[21]The Private Act calendar can be found here: https://www.legislation.gov.uk/changes/chron-tables/private/intro. The Local Act calendar can be found here: https://www.legislation.gov.uk/changes/chron-tables/local/intro (both accessed September 2021).

[22]The difference between $Y_0, Y_1 \perp\!\!\!\perp E|X$ and $Cov(enclosed, \epsilon|X, s) = 0$ is mainly notational.

The fundamental problem we face is selection into treatment based on unobservables: Partially enclosed parishes stood to gain less from Parliamentary enclosure than unenclosed parishes. A standard way of modelling such selection, following Heckman (1979), is to suppose the existence of a latent index U. We observe the decision of petition for enclosure if:

$$E = 1\{f(Z) - U \geq 0\} \tag{3}$$

Here Z captures observable factors that influence the decisions to enclose. Importantly, we assume that $Z = (\tilde{Z}, X)$, which includes both X and an excluded instrument $\tilde{Z}$. f is an unknown function. With such a conceptualization, for parishes that already enclosed partially, the unobserved index value U may take a high value. This index is often referred to as the "resistance" to treatment (Brinch et al., 2017). In this terminology, parishes that stood to gain little from Parliamentary enclosure resist treatment, and have high values of U.

4.7.1 Estimating the LATE of Parliamentary enclosure

A natural choice for $f(Z)$ is a linear function in Z. In such cases we obtain a standard linear (first stage) probability model (Vytlacil, 2002). We now introduce the model we estimate:

$$E_p = \gamma_0 + \gamma_1 Z_p + X_p \gamma_2' + s + \varepsilon_p \tag{4}$$

Where E_p equals one if parish p is enclosed by Parliament at any point between 1750 and 1830, and zero otherwise. Z_p is our instrument. X_p is a vector of covariates. To account for scale differences, we control for the area of the parish. To capture geographical differences, we control for terrain elevation and a vector (n=11) of soil type fixed effects s, which capture further differences in the agricultural potential of a parish (see Allen (1982) on the importance of soil type as a measure of productivity differences. Data come from the Food and Agricultural Organization (FAO)). We are concerned about spatial correlation in outcomes and regressors, as well as spatially correlated unobservables. We therefore include latitude and longitude, latitude interacted with longitude, and region fixed effects (n=4), as covariates.[23] Throughout our analyses, we report heteroskedasticity robust standard errors, as well as Conley (1999) standard errors correcting for arbitrary two-dimensional spatial correlation. We consider parishes within 70 kilometers of

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[23]Our regions are defined as follows. We define the 'North' as being composed of the Cheshire, Cumberland, Durham, Lancashire, Northumberland, Westmorland, and Yorkshire. We define the 'South-West' as Cornwall, Devon, Dorset, Gloucestershire, Somerset, and Wiltshire. We define the 'South-East' as Bedfordshire, Berkshire, Buckinghamshire, Cambridgeshire, Essex, Hertfordshire, Hampshire with the Isle of Wight, Huntingdonshire, Kent, Oxfordshire, Norfolk, Suffolk, Surrey, and Sussex. We define the 'Midlands' as Derbyshire, Herefordshire, Leicestershire, Lincolnshire, Northamptonshire, Nottinghamshire, Rutland, Shropshire, Staffordshire, Warwickshire, and Worcestershire.

one another to be potentially spatially correlated. We choose 70 kilometers because, when we vary this cutoff, 70 km yields the most conservative standard errors. Because enclosure was predominantly a rural phenomenon, we restrict our sample to rural England, defined as being outside a historical city or borough. In practice, this excludes about 600 cities and towns.

We use this first stage together with the following second stage:

$$Y_p = \beta_0 + \beta_1 E_p + X_p \beta_2' + s + v_p \tag{5}$$

This model relates an outcome Y in parish p to Parliamentary enclosure through an indicator E_p, which equals one if parish p is enclosed through Parliament at any point between 1750 and 1830. Since our outcome variables are measured close to 1830, we measure the effect of being enclosed during 1750-1830 at the end of this period. Our coefficient of interest is $\hat{\beta}_1$. In our Appendix, we present scatter plots of the basic correlations between enclosure and our outcomes of interest, and in the next section we present estimates in table format.

We estimate the system of equations 4 and 5 using Two Stage Least Squares. Studying such models, Imbens and Angrist (1994) showed that with a binary instrument and a binary endogenous variable, instrumental variable analysis identifies a Local Average Treatment Effect (LATE). Subsequent contributions showed that the LATE logic extends to models with covariates and continuous instruments (see e.g. Angrist and Imbens (1995) and Angrist et al. (2000)). In our study, the LATE is the treatment effect for the subset of parishes for whom the instrument influences the decision to petition. These parishes are referred to as the 'compliers'. In the introduction we used the term to 'consider' enclosure, which we can now make precise. Because the decision to petition for enclosure should take into account the likelihood of a petition passing in Parliament a parish is a complier and considers enclosure if either they petition or they would have petitioned had they faced a different value of the instrument. Parishes that stood to gain so little that they would have never petitioned regardless of the value of the instrument, or 'never takers', are downweighted by the 2SLS estimator.[24] The group of parishes that consider Parliamentary enclosure is the 'policy relevant' group because the Parliamentary route to enclosure was instituted exactly for these parishes.

Estimation. Due to self-selection out of Parliamentary enclosure for those parishes that do not stand to gain from it, the Two Stage Least Squares estimate of the effect of enclosure recovers the 'Local Average Treatment Effect' of enclosure, a weighted average across the treatment effects of parishes with different

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[24]In a model with covariates, Angrist and Imbens (1995) show that with covariates estimating the LATE involves saturating X_p. Angrist and Pischke (2008) note that saturation is undesirable in practice and instrumental variable estimation including both the instrument and covariates linearly is often a good approximation. However, this may not hold generally (Blandhol et al., 2022).

potential 'gain' from enclosure (Imbens and Angrist, 1994; Heckman and Vytlacil, 2005). We want to relate the LATE to the ATE, to quantify the degree to which selection into Parliamentary enclosure affects our results. We therefore rely on recent advances in the literature on 'marginal' treatment effects (Björklund and Moffitt (1987); Heckman (1997); Heckman and Vytlacil (1999); Heckman and Vytlacil (2005); Heckman and Vytlacil (2007)) and, after estimating the LATE, we estimate the different treatment effects of enclosure, by how much parishes stood to gain from enclosure. Before reporting results, we study balance.

4.8   Balance

In this section we study the exclusion restriction underpinning our identification strategy. We have argued that parishes are small relative to constituencies, and by leaving out individual parishes we purge the instrument of a direct connection with the parish whose (absence of) enclosure is being instrumented. For our identification strategy to be valid, we require the instrument to be excludable. Although this requirement is not formally testable, we study balance on observables to build a case for its plausibility.

Table 2 reports results from several estimates of a linear model of the following form:

$$Y_p = \beta_0 + \beta_1 E_p + X_p \beta_2^{'} + s + \varepsilon_p \tag{6}$$

In this equation, E_p and X_p are defined as above. We use several pre-determined variables as outcome variables Y_p. We first study whether differences in economic development before the start of our study period correlate with our instrument. If so, the exclusion restriction is likely violated. We consider tax revenues in 1525 from the Tudor Lay Subsidies (Sheail, 1968), both per capita and in levels. The Lay Subsidies are reported at the parish level and reflect income differences before the start of our study period. Column (3) studies potential productivity measured by the agricultural suitability for growing wheat, as computed by the Food and Agricultural Organization, and column (4) uses total population in 1525, measured from the Lay Subsidies. Next, we study differences in social structure, starting with MPs or members of the nobility living in a parish in 1700, before the start of our study period. We code this variable from Adams (1700). Finally, we follow Allen (1992) who argues that the presence of well-to-do farmers, or yeomen, was important for agricultural development. We measure the presence of yeomen from a dataset of probate records made available by the Cambridge Center for Population history. These are records of wills, which inlude social status identifiers. We measure the fraction of individuals leaving a will that were identified as yeomen.[25] We report standardized coefficients. On all measures, we find balance in

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[25]A probate record is a record of possessions at death. These data have been analyzed in Keibek (2017b). In Keibek (2017a), the author estimates that around 1700, 14-17% of adult males submitted a probate records. We use probate between 1688 and 1715. We have 93,852 probate records, evenly distributed over this period, and we compute the fraction of individuals that were identified as yeomen in this dataset. We have data for 7,336 parishes.

the sense that estimated coefficients are small and insignificant.

While it is never possible to check balance on all (un)observables, these results provide credence to our assertion that our instrument is excludable: Characteristics of an individual parish that may correlate with the potential return to enclosure are uncorrelated with our instrument.

5 Two Stage Least Squares Results

In this section we use our identification strategy to estimate the LATE of Parliamentary enclosure and we find that it is associated with increases in agricultural productivity and land inequality.

In Table 3 we report our 2SLS implementation of equations 5 and 4. We begin with the natural log of wheat yield in bushels per acre as our outcome variable, and we vary the inclusion of covariates.

Panel I reports estimates of Equation 5, panel II provides estimates of Equation 4, and panel III reports reduced form estimates. In panel II, we find a positive and significant first stage. Increasing the leave-one-out pass rate of nearby enclosure Bills from zero to one results in a 58% to 77% increase in the probability of being enclosed through Parliament. Using Conley standard errors with a spatial cutoff of 70km we find first stage F-statistics of 13 to 25. These F-statistics are our most conservative measure of the strength of the first stage. Using either heteroskedasticity robust standard errors or different distance cutoffs leads to larger F-statistics. We report results with different distance cutoffs in the Appendix. These estimates support the informativeness assumption of our instrument and provide evidence that our instrument is strong enough for our second stage estimates to be credible.

Panel I reports the second stage 2SLS estimates corresponding to these first stages. In columns (1) and (2) we study agricultural yield. Column (1) present results controlling for fixed effects only and column (2) presents our main result for agricultural yield, including our full set of covariates. We find a positive and significant effect of enclosure on the natural log of wheat yield. The combined results in panels I and II, column (2), are corroborated by our result in Panel III, column (2), which shows a positive and significant correlation between our instrument and ln(Wheat Yield). The estimated effect of Parliamentary enclosure on agricultural yield in column (2), 0.45 (Conley s.e. 0.19) is interpretable as a percentage change. Therefore, enclosing through Parliament is associated with 45% higher yields. We can benchmark our estimated effect against the long-run change in yield. Between 1300 and 1750, the start of our study, yields increased on average by 9 bushels to about 20 per acre (Allen, 2005). The gain in yield associated with enclosure is therefore approximately half that of the accumulated gain over the preceding 450 years.

The Conley standard errors are our most conservative way to assess significance. When we use either

heteroskedasticity robust standard errors (reported in Table 3) or vary the cutoff (reported in the Appendix) we estimate more precise effects.

In columns (3) and (4) we study land inequality. In column (3) we only control for fixed effects, and in column (4) we present our main result. We find that the effect of enclosure on land inequality is equal to 0.22, relative to a mean of 0.74. This result is significant at the 5% and 1% level using respectively stringent Conley standard errors or heteroskedasticity robust standard errors. As before, the reduced form results in Panel III are in line with this finding. Taken together, the estimates in this section show a significant effect of Parliamentary enclosure on agricultural yield and land inequality. Subject to the exclusion restriction, these results are interpretable as causal.[26]

Robustness. In the Appendix, we implement several exercises to assess robustness of the measurement of our main variables, our specification, and inference. We first vary the bandwidth k in the construction of our instrument, as well as the cutoff used in the computation of our spatial standard errors. We then use the share of the land area of parish as the measure of Parliamentary enclosure, rather than an indicator, to show robustness to measuring Parliamentary enclosure this way. We then vary measurement of our main outcome variables. We first show that we can use yields for barley or oats to obtain similar, albeit more noisy, results. When then vary the measurement of inequality. We use inequality of land size rather than value, and we control for the number of landowners, obtaining very similar results. We finally, following our discussion on challenges to identification, control for the presence of drainage and turnpikes. This does not affect our results.

Discussion of the estimated treatment effects. Our 2SLS findings speak to the long-standing debate on the effect of enclosures on English development. We are not the first authors to make an attempt at estimating such effects. The main difference between our study and previous attempts is, however, that we use the universe of Parliamentary enclosures and a significantly larger dataset of crop yields. We collect the most prominent estimated effects in Table 5. For example, Allen (1982, 1992) estimates an increase of yield between 2.5% and 8.4%, depending on the dataset. McCloskey (1989) estimates higher increases, between 10 and 13%. Turner (1980) finds higher estimates still at 26.4%. These studies make mostly cross-sectional comparisons and suffer from the same selection issue we face. Some contemporary estimates try to make more controlled comparisons. As we discussed in our introduction, Arthur Young made a side-by-side comparison of two parishes and found a yield differential of 50%. The General View of Agriculture reports, cited in section 2 as well, allow before-after comparisons, and suggest yield increases

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[26]An important second requirement has recently been pointed out by Blandhol et al. (2022). The LATE interpretation of a Two Stage Least Squares estimate was originally established for a model without covariates (Imbens and Angrist, 1994). For models with covariates, the LATE interpretation carries over if all covariates are saturated. Blandhol et al. (2022) show that a linear approximation to the saturated specification can lead to divergence between the 2SLS estimate and the LATE. When we estimate our models without covariates we obtain similar estimates.

of 66% (but note that this estimate is based on a small number of observations). Our IV estimates, at 45%, are more consistent with these latter estimates than with the more modern literature finding small effects. We conjecture that these contemporary estimates, as well as our estimates are in line with the true effect of Parliamentary enclosure because both try to account for selection. In the next section we study this conjecture, by comparing the LATE and ATE of Parliamentary enclosure estimated within a single framework, which allows us to quantify the effect of selection.

6   Heterogeneous Treatment Effects

We now return to our empirical framework introduced above where we introduced our IV strategy as estimating the LATE, and motivated by a potential outcomes framework. An extensive literature has taken a different approach than the literature focused on potential outcomes and LATEs. For example, Heckman (1979) first used an instrument to explicitly control for selection on observables of the form captured in Equation 3. Subsequent contributions have focused on estimating treatment effects by different *levels* of U. The object of interest in such exercises is a function relating a treatment effect of interest, $Y_1 - Y_0$, and U. The treatment effects recovered from such a function for a specific level of $U = u$ are referred to as 'marginal treatment effects' (Björklund and Moffitt, 1987; Heckman, 1997; Heckman and Vytlacil, 1999, 2005, 2007; Brinch et al., 2017). The main advantage of this alternative approach for our purposes is that we can re-estimate the ATE and the LATE, the estimand of our IV exercises, as weighted averages of the MTEs. By using our instrument to 'control' for selection and recovering both the ATE and LATE we study selection into petitioning for Parliamentary enclosure.

6.1   Marginal Treatment Effects

The object of interest when estimating MTEs is $MTE(u) = E[Y_1 - Y_0|U = u]$ where U is defined as the unobserved 'resistance to treatment' in Equation 3. In this section we discuss the estimation of the MTEs, largely following Brinch et al. (2017).

Normalization. The starting point in the literature is to study the *quantiles* of U rather than the (latent) values of U. Brinch et al. (2017) suggest the following normalization of equation 3:

$$f(Z) - U \geq 0 \iff p(E = 1|Z) - \tilde{U} \geq 0 \tag{7}$$

where $\tilde{U} \sim \text{Uniform}[0, 1]$. We re-label $\tilde{U}$ as U from here on. This expression implies that a 'propensity score' of getting treated for a level of the instrument has to be higher than U to decide to enclose through

Parliament. We denote the propensity score as $r = p(E = 1|Z)$. After this step, we redefine the marginal treatment effects as $MTE(u) = E[Y_1 - Y_0|U = u]$ with $U \sim \text{Uniform}[0, 1]$.

The separate approach The implementation approach we follow is called the 'separate approach' (Brinch et al., 2017). The separate approach starts by estimating the propensity scores r from a 'first stage' Probit model, regressing our indicator for enclosure on all covariates and our instrument. The predicted values from this regression are the propensity scores r. Following Brinch et al. (2017) we then assume a quadratic relationship between potential outcomes and u in two subsamples, composed of all enclosed parishes, and all unenclosed parishes. We also add covariates.

$$E[Y_e|X, U = u] = \gamma_0 + \gamma_1 X + \gamma_2 u + \gamma_3 u^2, \quad e = 0, 1 \tag{8}$$

Here both the γs and u are unobserved. Brinch et al. (2017) show that we can derive from Equation 8 the following parametric relationships:[27]

$$E[Y_e|X, r] = \beta_0 + \beta_1 X + \beta_2 r + \beta_3 r^2, \quad e = 0, 1 \tag{9}$$

Since we can estimate propensity scores r, we use the *estimated* coefficients $\hat{\beta}$ to recover the unknown coefficients γ. Because we now know each coefficient $\hat{\gamma}$ we can vary U between zero and one and plot the corresponding treatment effects in $Y(e)$-U space. The MTE curve is the vertical difference of the Y_1 and Y_0 curves. Note that the propensity score in Equation 9 acts as a 'control function' for the effect of selection into treatment (Heckman, 1979).

ATE and LATE as weighted averages of MTEs. For our purposes, the main advantage of estimating the MTEs is that Heckman and Vytlacil (2005) show that many parameters of interest can be written as a (known) weighted average of the MTEs. In particular, it is possible for us to derive both the LATE and the ATE in this framework. The ATE is simply the average of the MTE, while the LATE is a weighted average:

$$\text{ATE} = \int_0^1 MTE(u)du \tag{10}$$

$$\text{LATE} = \int_0^1 MTE(u) * weights_{LATE}(u)du \tag{11}$$

The $weights_{LATE}(u)$ rescale the MTEs to their contribution to the LATE. These weights are formally defined in Heckman and Vytlacil (2007).

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[27]To recover Equation 9 from Equation 8 note that we can rewrite Equation 8 for enclosed parishes as $E[Y_1|X, U = u] = E[Y_1|X, U = u, r < U]$ using Equation 7. Integrating out U gives Equation 9. An analogous operation recovers Equation 9 for unenclosed parishes. The Appendix provides more detail.

Identifying assumptions. Importantly, Vytlacil (2002) shows that the identifying assumptions necessary to estimate the LATE using Two Stage Least Squares and as a weighted average of MTEs are identical. We can therefore compare the estimated LATE in the previous section to the LATE estimated within the MTE framework. In the remainder of our analyis have three different objects of interest: the Average Treatment Effect (ATE) $E(Y_1 - Y_0|)$, the Local Average Treatment Effect (LATE) $E(Y_1 - Y_0|X, \text{complier})$, which our Two Stage Least Squares estimator estimates, and a function defining Marginal Treatment Effects (MTEs) $E(Y_1 - Y_0|X, U)$.

6.2 MTE Results

We now present our MTE results, starting with ln(Wheat Yield) in Figure 5. In Subfigure (a) we plot several quantities of interest as a function of the resistance to treatment U. The most important one is the MTE curve, which traces out treatment effects of Parliamentary enclosure as a function of U. Since this curve is downward sloping, treatment effects are higher for parishes that are less likely to 'resist' enclosure, as we would expect. At high levels of resistance to the treatment, we suspect parishes are partially or piecemeal enclosed, as these parishes stand to gain less from enclosing via Parliamentary act. We can see that these parishes would have had a low treatment effect had they enclosed through Parliament. We interpret this result as consistent with our hypothesis that this is because they have already captured much of the gains of enclosure. As U decreases the number of piecemeal enclosed parishes falls. Accordingly, the treatment effect rises because the counterfactual comparison becomes Parliamentary enclosure and informal governance, rather than Parliamentary enclosure and enclosure through other means.[28]

Subfigure (b) contains the main results of this exercise. It plots the ATE computed within the MTE framework (from equation 10), our 2SLS estimate from Table 3, and the corresponding LATE from the MTE framework (equation 11). In addition, we report results from an OLS regression. This regression is the corresponding linear regression for our IV regressions of yield on our Parliamentary Enclosure indicator in Table 3. We report the regression equation and table in the Appendix. The main conclusion from subfigure (b) is that, comparing lines vertically, the ATE is lower than the LATE. Within the MTE framework, it is easy to see why. The LATE downweights parishes with higher resistance and estimates the treatment effect for compliers only. We plot the LATE weights in Subfigure (a). Comparing lines vertically in Subfigure (b), we see that 75 percent of the difference between the OLS and the LATE estimates is explained by the distance between the ATE and LATE.[29]

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[28]We estimate the MTE curve when there is support of the propensity scores on the entire interval [0, 1] for both enclosed and unenclosed samples. If there is no intersecting support, then we have to extrapolate MTEs. We show in the Appendix that we have good support on the interval [0, 0.7] and that beyond 0.7 our results are partially extrapolated using the assumed quadratic functional form of Equation 8.

[29]In addition, note that the OLS is not equal to the ATE. This is due to selection into Parliamentary enclosure along other

In other words, the fact that the ATE and LATE estimate the treatment effect of Parliamentary for different groups of parishes explains most of the observed difference in estimated effects between them. Our substantive interpretation of this observation has been that this is fundamentally due to partially enclosed parishes standing to gain little from Parliamentary enclosure, but at the same time being in the control group for cross-sectional analyses that do not account for selection. We can further substantiate this point by studying potential outcomes separately. We do so in Subfigure (c) by plotting potential outcome Equation 8. We find that the potential outcome of enclosure, Y_1, is essentially constant across values of U. In contrast, the potential outcome for not enclosing, Y_0, is sharply upward sloping, indicating that the heterogeneity in the treatment effect, $Y_1 - Y_0$, is driven by heterogeneity in Y_0. We interpret this finding as follows: Had parishes not enclosed, productivity depends on the degree to which partial enclosure is successful. U captures this because partially or piecemeal enclosed parishes resist Parliamentary enclosure. For parishes with high U, we therefore see essentially the same treatment effect under counterfactual Parliamentary enclosure as see under unanimous enclosure. For parishes without piecemeal enclosure (low U) not enclosing leads to substantially lower productivity than a counterfactual Parliamentary enclosure would bring. This results in a large difference between Y_0 and Y_1 and a large MTE. This means that unenclosed parishes stood to gain most from Parliamentary enclosure whereas partially enclosed parishes stood to gain little.

In Figure 6 we repeat this exercise for land inequality. 78 percent of the difference between the 2SLS and the OLS estimates of the effect of Parliamentary enclosure on inequality is explained by the difference in the ATE and the LATE. Subfigure (c) shows that for land inequality too, the untreated potential outcome is driving the result, with parishes likely to resist Parliamentary enclosure already having realized increases in inequality. These are likely the parishes that managed to enclose unanimously precisely because they were highly unequal to begin with which concentrated decision making power.

In this section we provided evidence that the ATE is much lower than the LATE for Parliamentary enclosure. We argue, and substantiated, that this is due to selection into Parliamentary enclosure. Failing to account for this type of selection may explain the low estimates of the effect of Parliamentary enclosure in previous contributions. Note that because what parishes stand to gain is ultimately unobservable, modern techniques for estimating counterfactual outcomes are necessary to estimate a more realistic treatment effect of Parliamentary enclosure. In the next section we provide additional historical evidence on how selection into Parliamentary enclosure worked. Afterwards, we study mechanisms.

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dimensions than the potential gain from Parliamentary enclosure. Also note that the LATE is not exactly equal to our 2SLS estimate. This is essentially an approximation error and not substantively important. We discuss it in the Appendix.

6.3   Selection into Parliamentary enclosure

The large quantitative effects of enclosure we find are consistent with the case study and historical literatures. With respect to yields a great deal of evidence suggests that unenclosed, and more importantly, piecemeal enclosed, land was inefficiently organized and used. Above we emphasized that Parliamentary enclosure had advantages even for parishes that had undergone even sizeable piecemeal enclosures because it allowed for a global rationalization of holdings, it created a definitive map and legal rights in ways that more informal enclosures did not. We saw however that the modern economic history literature has not come to a conclusion, mostly because of the lack of a comprehensive empirical study.

Interestingly the preponderance of more systematic contemporary analysis did support Young's views. Around the same time as he wrote a whole series of "General Views" of the agriculture in various counties were commissioned by the Board of Agriculture and several of these make the type of yield comparisons he did. Even better, some present evidence on yields before and after enclosure. For example, Bedfordshire in the parishes of Eaton and Milton Bryan wheat yields increased by 66% and 29% respectively (Batchelor, 1813, pp. 227, 238). Young himself authored the report on Lincolnshire and reports data before and after for Barton which suggests that wheat yield increased by 150% after enclosure (Young, 1808, p. 104). On average across all the reports for which there are before and after numbers, wheat yields increased by 66%.

The general optimism about increased productivity is reflected in the language of enclosure acts. The Bill submitted to Parliament in 1782 for the enclosure of Kingston Deverill in Wiltshire began:

> The lands ... lie intermixed and dispersed, in small parcels and most of them are inconveniently situated in respect to the Houses and inclosed lands of the Owners and Proprietors thereof; and in their present Situation are incapable of any considerable Improvement; and it would be very advantageous to the several Persons interested therein ... if the same were divided, and specific Shares thereof allotted to them in Severalty, in proportion to their respective Rights and Interests therein; but the same cannot be effected without the Aid and Authority of Parliament (Mingay, 1997, p. 33).

This clearly suggests that those proposing "inclosure" thought it would promote "improvement". Several mechanisms, some of which we will investigate later, were often discussed which could explain this. One is the consolidation of the strips in the open fields and the rationalization of haphazard piecemeal enclosures. Contemporary commentators consistently viewed this as a huge benefit either because people could farm and invest without the costs of coordinating with others, or because there were scale economies. In 1794 Thomas Stone remarked

> The first great benefit resulting from an enclosure is contiguity, and the more square the allotments are made, and the more central the buildings are placed, the more advantages are derived to the proprietors in every respect (Stone, 1808, 143).

William Marshall, author of a series of studies of the rural economies of different counties emphasized the sheer rationalization of holdings, stating "In Rural Economy, straight lines and right angles are first principles which can seldom be deviated from with propriety" (Marshall, 1788, p. 125). Yet on his extensive travels he found that reality was different noting in the piecemeal enclosed Vale of Pickering that "each man's property is still perhaps scattered over the township" (Marshall (1788), p. 8) while in East Norfolk he noted the "abundance of petty enclosures" which he found "disgraceful" (Marshall, 1787, p. 125). Summing up a large literature Yelling opines "the effects of piecemeal enclosure ... were .. deplored by those concerned with the proper layout of farms. For the structure of piecemeal-enclosed holding rarely approached the ideal: normally the process of enclosure and consolidation had drifted apart ... so that enclosures preserved many of the defects of the old open-field arrangements" (Yelling, 1977, 125-126). Chapman and Seelinger (1995, 36) also notes how piecemeal enclosure "tended to perpetuate holding fragmentation". Parliamentary enclosure allowed for full consolidation and a global rationalization of landownership.

Second, the partially documented nature of such arrangements led to disputes. Yelling notes that a benefit of a Parliamentary enclosure was that it "had the advantage that it set aside all doubt about the validity of enclosure" (Yelling, 1977, 9). (Gray, 1915, 305) also notes that a consequence was "to establish authoritative titles to ownership" . Hence by confirming "the entire existing arrangement" (Yelling, 1977, 13) Parliamentary enclosures helped to definitively settle property rights and "provided a degree of security which was lacking in informal piecemeal enclosures" Chapman and Seelinger (1995, 36). In the view of (McCloskey, 1972, 24), a Parliamentary act "was necessary in order to prevent one man from imposing on his fellow villagers a revival of the open fields whenever it suited his immediate convenience, by reasserting his ancient rights of common after the enclosure". Important to definitively settling property rights was the Parliamentary enclosure produced an official map. Yelling notes that "Unlike general enclosures, piecemeal activity gave little incentive to the production of special maps or surveys" (Yelling, 1977, 71) .

Third, the efficient use of the open fields required mass cooperation within the village and stopped individuals experimenting with new techniques. Additionally, land was wasted in the many "balks", which were lands reserved for divisions or access ways between strips. The fact that herds mingled together on the open field also made it very difficult to engage in selective breeding of animals, an important investment. Young argued in his *General Report on Enclosures* submitted to the Board of Agriculture in 1808 that

> there can be no doubt of the superior profit to the farmer by cultivating enclosures, rather than

open-field arable. In one case he is in chains - he can make no variation according to soil, to circumstances, or times. He is bound down to the production of corn only ... a mere horse in a team, he must jog on with the rest. Quoted in Daunton (1995, p. 113).

Another piece of relevant evidence supporting the quantitative effects we find is that, as we documented above, enclosure was extremely costly. The expected increase in yields must have been sufficiently high to make paying these costs upfront worthwhile.

With respect to land inequality case study evidence supports the idea that enclosure was associated with large increases and provides several mechanisms via which it increased.[30] The proximate reason seems to be that large farms expanded at the expense of small farms. This was both because small landowners lost land at enclosure and because other smallholders sold out. Later we provide direct evidence that the number of smallholders or "cottagers" fell as a consequence of Parliamentary enclosure. Farms may have got smaller because individuals had less well defined rights to the commons rights, or because of the land they lost through compensation for the tithe holder. Smallholders may have sold out because their farm was too small to be viable, or they did not have the wealth to cover the costs of Parliamentary enclosure upfront. The case study evidence supports all these channels.

Detailed studies of the compensation of rights suggest that this was a source of increased inequality at enclosure. Often, as in Croston, Lancashire, studied by Rogers (1993), common land, in this case Croston Finney, was "owned" by large landowners; "whereas the proprietary claims of the Hesketh and de Trafford families as Lords of the Manor were acknowledged, their possession was also conditioned by an insistence on user-rights which attached to copyholders and other freeholders" (Rogers, 1993, p. 146). However, "Such rights did not belong to every villager but were attached to open-field holdings or certain cottages, and only their owners or occupiers were certainly entitled to make use of them" (Neeson, 1993, p. 56). When Parliamentary enclosure came, the legal rights of the Hesketh and de Traffords trumped the informal use rights of other residents. They received almost 600 of the 800 acres of the Finney (Rogers, 1993, p. 146). The main problem was that "Mere customary users of the common land had no legal right to compensation in the event of an enclosure, and did not generally receive it" (Armstrong, 1989, p. 722). Alternatively, "only narrowly defined legal right was acknowledged at enclosure; more widely enjoyed customary right was sometimes ignored ... while rights attached to land were relatively safe ... rights and customs enjoyed by inhabitants were more vulnerable" (Neeson, 1993, pp. 63, 78). In Barton-upon-Humber between 12% and 15% of claims that were made on the commons were rejected by the enclosure commissioners (Russell, 1968, p. 27-28). Thus the rights to collect furze and turbary were extinguished, typically without any compensation. Other rights, particularly those associated with cottages, which might involve the right to

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[30]Allen (1992) concluded this from his data on rental rates.

put a cow on the commons, were better defined legally and were compensated, but possibly insufficiently since their implications for land were not clear (e.g. how much land should one be compensated with now that there is no commons on which to tether your cow?).

Neeson showed how in Burton Latimer the commissioners "compensated the house-dwellers and cottage commoners for their eight hundred acres of wold with about seventy three acres situated in the same place" (Neeson, 1993, p. 217). Young himself observed that few enclosure allotments for non-legal rights were above one acre in size and he quoted an enclosure commissioner as saying "which being insufficient for the man's cow, both cow and land are sold to the opulent farmer" (Mingay, 1975, pp. 101, 137).

The commutation of the tithe seems to have complemented the impact of the inequitous recognition of rights. In Neeson's research on Northamptonshire, in the parish of West Haddon, the Lord of the Manor Thomas Whitfield owned 262 acres and the right to collect the tithe prior to enclosure and 600 acres (about a quarter of the parish) afterwards (Neeson, 1993, p. 205). In Hibaldstow, Lincolnshire, the lord of the manor, William Dalison received 1241 acres of land in the "general allotment" and in addition 110 acres in lieu of tithes and a further 58 acres for giving up "manorial rights". His total allotment left him owning a third of the parish (Russell, 1968, p. 16-17). The impact of tithe commutation was systematically quantitatively large. Martin (1979, p. 333) calculated that "17.4 per cent [of lands] re-allotted under Warwickshire awards were transferred to compensate for loss of tithe dues." In Buckinghamshire it was 20% (Turner, 1984, p. 65). Turner comments "Tithe commutation was calculated at about one fifth or one sixth of the open field land and one eighth or ninth of the commons ... This ... was almost certainly in excess of the value of the original tithe" (Turner, 1984, p. 65-66). In Barton the tithe owners, the Upplebys, were compensated with 1161 acres of land (Russell, 1968, p. 32) close to Turner's 20%. In addition the tithe owner did not have to cover the costs associated with this extra land, for example fencing, which fell on the other landowners, see Turner (1984, p. 54) in general and Russell (1968, p. 25) for the details of this in the Barton case.

This inequitous treatment of rights and the impact of tithe commutation often led the smallholders to oppose the Parliamentary enclosure to start with and after it happened they "sold out to settle their tithe payments, or to avoid the cost of fencing and draining, or because the land was useless without the commons" (Neeson, 1993, p. 217). The case study evidence is overwhelming that smallholders did sell out and this land was accumulated by the larger and wealthier landowners. In Croston, though others apart from the Heskeths and de Traffords did receive allocations, many sold out with the number of farmers owning less than 5 acres going from 68 before enclosure to 40 afterwards (Rogers, 1993, p. 146). In West Haddon, while the Whitfield family accumulated land, as we saw above, "After enclosure the number of landowners ... fell by 18 per cent" (Neeson, 1993, p. 204). Neeson's broader evidence

from Northamptonshire shows both a contraction of small farms, an expansion of large farms and a rapid turnover in ownership, and using the Land Tax returns she shows that movement out of these returns after enclosure "was most common amongst those with least land" (Neeson, 1993, p. 230). These findings are echoed in Martin's research on Warwickshire and he documents that as a consequence of enclosure "the overall share of the smaller proprietors was reduced as well as their numbers" (Martin, 1979, p. 337). In Buckinghamshire "It is quite clear from the evidence in the land tax that the total number of landowners decreased over the forty-year period from the 1780's to the 1820's" (Turner, 1975, p. 566).

Though the Land Tax records to not directly speak to this, other evidence suggests it is likely that small proprietors sold out to larger landowners. Martin's conclusion is that "enclosure held out a good opportunity, in a generally thin market, of enlarging upon an existing possession" (Martin, 1979, p. 339).[31] Turner, studying the parish of Little Brickhill in Buckinghamshire, noted a large decrease in the number of landowners in the year prior to the enclosure act. "In this case there was a massive accumulation by a George Henry Rose of Westminster, including the prestigious purchase of the manor ... These declines measure a sudden selling out by the owners in an effort to avoid enclosure costs" (Turner, 1975, p. 568). Martin noticed that Parliamentary enclosure awards sometimes actually record incidences of land sales during the process of enclosure, which could take years. "In fact, land purchases are recorded in at least 55 of 133 awards which deal with common-field land, while some 34 (25 per cent) record the engrossment of purchased land by the principal estate owner" (Martin, 1979, p. 338). By engrossment Martin means the expansion of their properties by large landowners.

Overall then, while the quantitative effects we find are large, they are consistent with the case study and historical literatures.

7 Mechanisms

In this section we study mechanisms that may connect Parliamentary enclosure to our outcomes. We discussed the most prominent potential mechanisms in section 2. For changes in agricultural productivity, they can be grouped under innovation and coordination. When landowners are residual claimants on their investment, their incentives to innovate are greater. Similarly, not having to coordinate with others may increase agricultural output. Strip farming, for example, limited the scope to shift from arable to pasture due to shared investment in ploughs, and the larger contiguous fields necessary for pasture. Other mechanisms may also be at play. A Parliamentary enclosure act usually forced the construction of new roads or the improvement and extension of existing roads. Such infrastructure investments may separately

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[31]For similar evidence from Leicestershire see Hunt (1959).

have been conducive to trade and development. For inequality, the most plausible mechanisms suggested in the literature discuss the prohibitive costs of the implementation of Parliamentary enclosure which forced people with smaller plots to 'sell out'. In this section we present OLS evidence on these potential channels.

We start by studying innovation, measured by agricultural patents, and the quality of roads, measured in an agricultural survey. If Parliamentary enclosures lead to enhanced incentives for innovation and improvement, we may see more agricultural patents being filed by residents of enclosed parishes. We use data from Dowey (2013), who collected a database of agricultural patents. These returns allowed us to geographically locate the patents, as they record the place of residence of the patent holders. 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 1750 and 1850. We next study roads, a novel mechanism which has been less emphasized in the literature (but has been studied in other contexts, see Bogart (2005)). We code an indicator equal to one if the quality of roads in a parish was assessed to be poor in the tithe surveys (Kain and Prince, 2006). Table 4 presents results. We find that Parliamentary enclosure is associated with more agricultural patents being filed as well as with a lower probability of a parish having poor roads.

A second strand of proposed mechanisms concern the adoption of more effective agricultural practices, which may have been more attractive after Parliamentary enclosure because there was no longer a need to coordinate (Young, 1771). To capture this potential mechanism, we consider the planting of turnips and the act of fallowing as two basic agricultural improvements. Planting turnips or 'nitrogen fixing' crops like clover in between other crops like wheat, or between harvests, replenishes the soil while still yielding a crop and allowing for continuous harvesting (Allen, 2008). Fallowing instead allows the land to 'recover' and was common in open field villages. Fallow land, however, can be pulled into continuous cultivation, provided farmers find the appropriate crop mix. We record the adoption of these practices from survey data compiled by Kain and Prince (2006). Their surveys record the acreage of parish planted with turnips (at the time of the survey) and an indicator for whether a parish leaves lands fallow. We expect that Parliamentary enclosure improves agricultural practices because these improvements can now be chosen individually rather than necessitating coordination. This is what we find in Table 4.

We now turn to the disappearance of people with smaller claims on the commons as a mechanism driving our observed increases in land inequality. We measure this by the number of cottagers as a fraction of the total number of landowners. We identify cottagers by the description of their landholdings in the tithe records. Although cottagers were typically thought to have no land at all, in the tithe records they are recorded as having at least the land the cottage is on. We therefore normalize by the number of landowners. In section 2, we discussed the case study evidence for Parliamentary enclosure which suggests

that smallholders might have had to sell out due to the high costs of buying out the tithe holder and the implementation of the enclosure act, as well as loss of common rights. In Table 4, column (5), we find that Parliamentary enclosure is associated with a lower share of small landowners in a parish. This result is consistent with disappearance of small landowners and engrossing as at least partially driving our finding that Parliamentary enclosure leads to higher land inequality.

While it is never possible to fully explore all mechanisms, we have sketched in this section a number of potential mechanisms linking Parliamentary enclosure to economic change. We find support for increased innovation and the adoption of better, but known, agricultural practices. This likely reflects the fact that individual farmers no longer needed to coordinate. We also provide tentative evidence in support of Parliamentary enclosure being associated with infrastructure improvement. Finally, we show that Parliamentary enclosure is associated with a falling number of cottagers.

8 Conclusion

The English Parliamentary enclosure movement is one of the most controversial economic policies in history. In this paper we have provided the first causal evidence of its economic effects.

Our first contribution is a dataset of all Parliamentary enclosures. This dataset reveals that about one third of all parishes in England used this route to enclosure. Across about 15,000 parishes covering all of England, we compare parishes that were enclosed by Parliament to those that were not. The fact that one third were enclosed through Parliament means that many parish communities chose to not follow this route. Instead, they enclosure piecemeal. This observation creates the main empirical challenge of this paper. We construct an instrumental variable for *Parliamentary* enclosure as the leave-one-out mean of the success of Parliamentary enclosure acts in an area around the parish.

Our second contribution is that we find that enclosure led to substantial increases in agricultural yield and a large increase in land inequality. These results confirm two famous sets of hypotheses about the impact of Parliamentary enclosures which have claimed that they had large positive effects on incentives and productivity, see Young (1808) or Hardin (1968), but at the same time led to severe increases in inequality, for example Marx (1990).

Our results reveal a fascinating political economy of the reform of property rights. Prior to 1750, even though traditional governance mechanisms were unable to allocate common resources efficiently, they could not be reformed politically because people likely anticipated the large redistributional effects. These existed because upon Parliamentary enclosure some sorts of rights were much easier to confirm than others, because compensating tithe holders involved large amounts of land and because imperfections in capital

markets meant that poor people were not able to benefit from any improvements in productivity. The innovation of the Parliamentary process allowed enclosure to move forward in one third of English parishes because it allowed large landowners to over-ride those who had previously blocked change. This came at a cost in the form of increased land inequality.

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Figure 1: ORGANIZATION OF LANDOWNERSHIP IN BARTON BEFORE AND AFTER ENCLOSURE
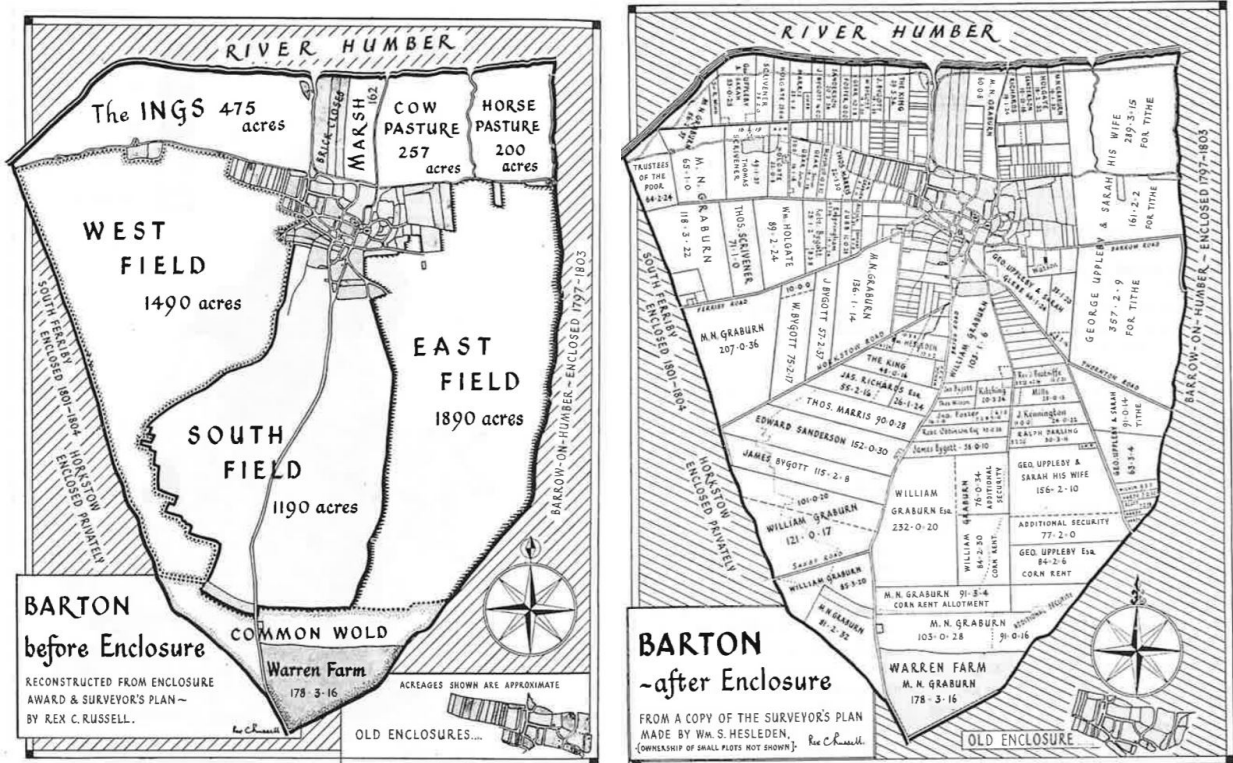

Notes: the map on the left shows the commonly held plots of land in Barton-upon-Humber, before enclosure. Barton was enclosed between 1797 and 1803. The right map reflects the results of Parliamentary enclosure. Source: Mingay (1997).

Figure 2: ORGANIZATION OF LANDOWNERSHIP IN ELMSTONE HARDWICK
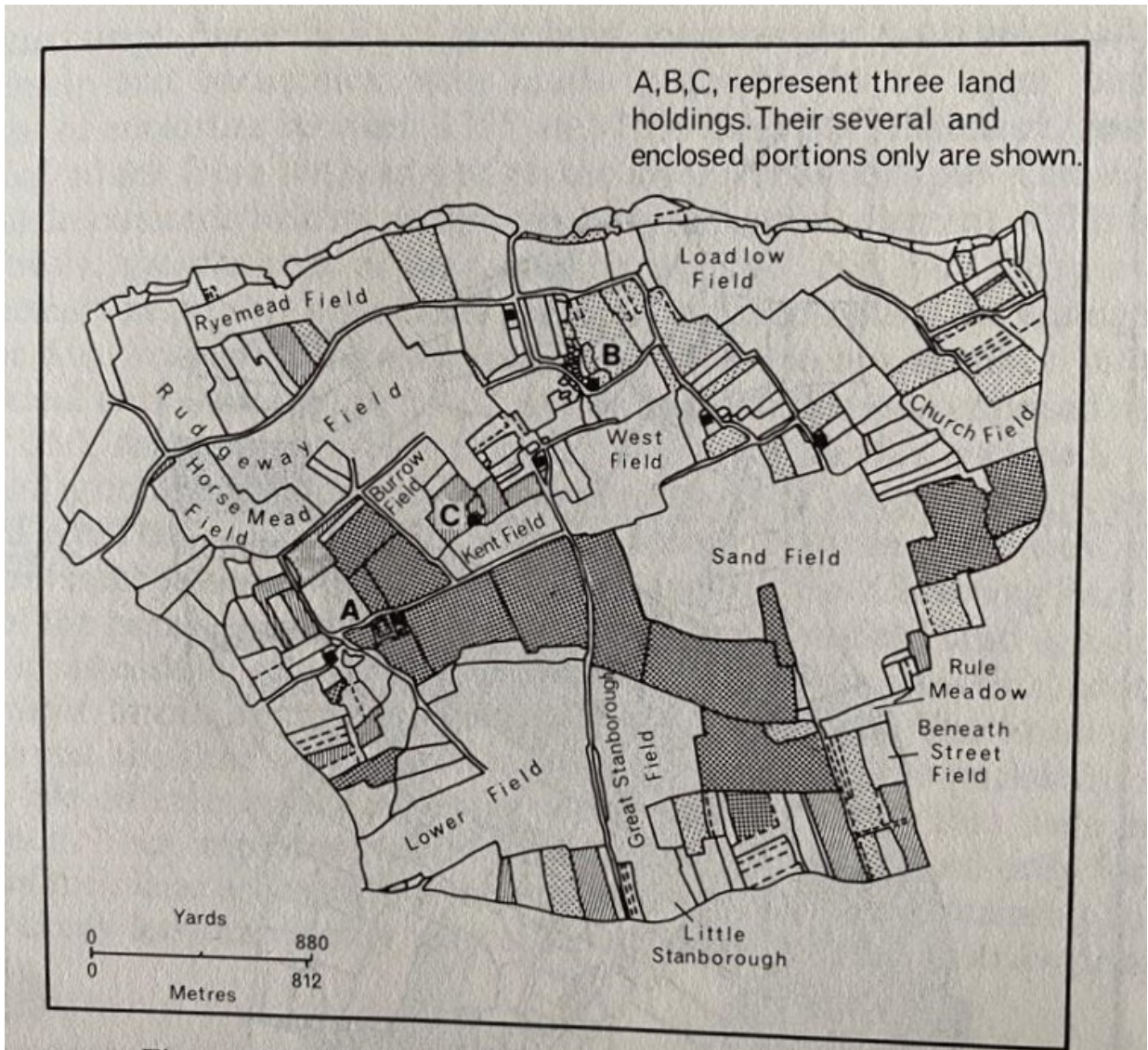
Notes: This map shows the distribution of landownership in Elmstone Hardwick in 1838 before it was enclosed through Parliament. Source: Yelling (1977).

Figure 3: THE NUMBER OF PARISHES ENCLOSED THROUGH PARLIAMENT, BY YEAR
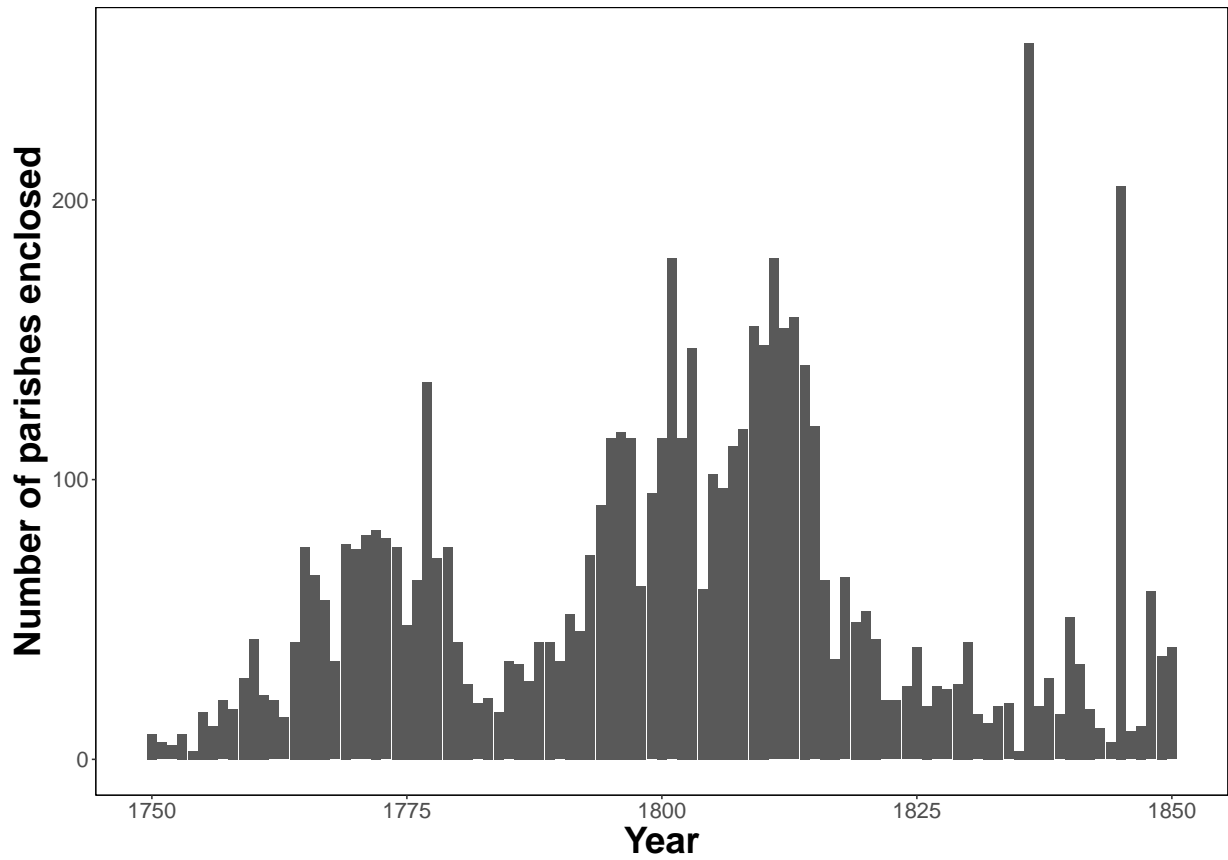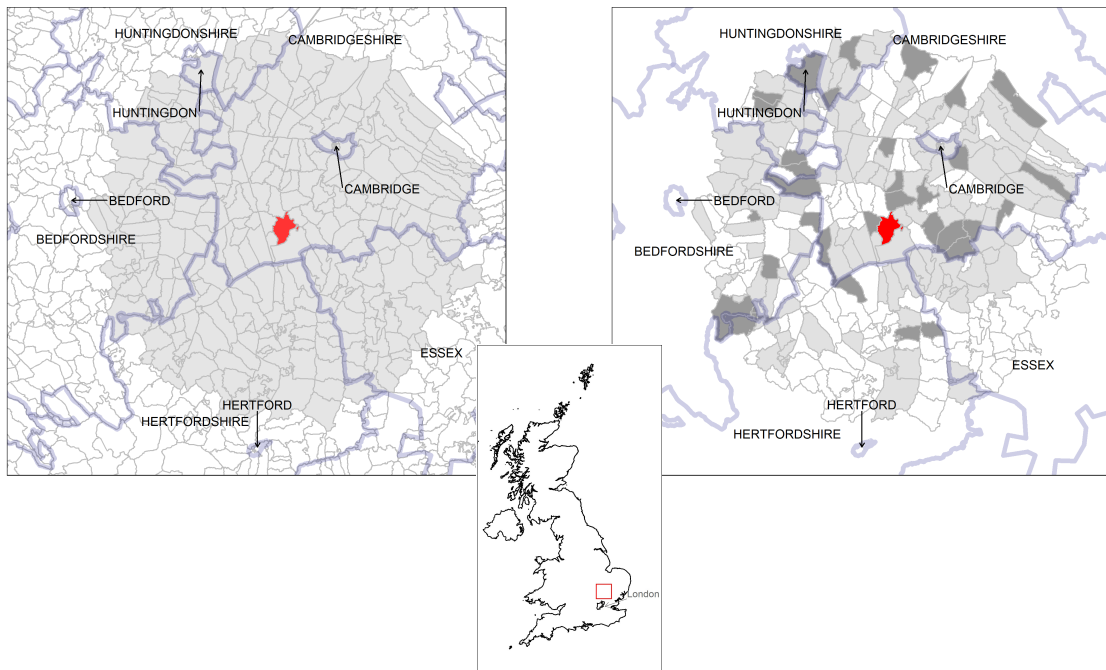

Notes: This graph shows the total number of enclosed parishes per year. Source: Tate and Turner (1978).

Figure 4: INSTRUMENT CONSTRUCTION
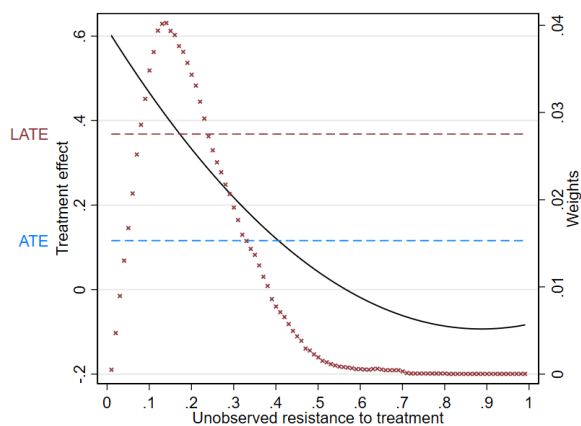
(a) Meldreth with k = 350 nearest neighbors
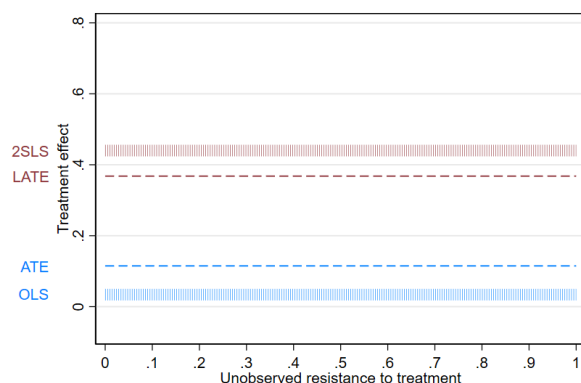
(b) Neighbors by Parliamentary enclosure attempt status

Notes: Subfigure (a) shows the parish used for this case study, Meldreth, is in red. Parishes in gray are those within k = 350 neighbors of Meldreth. Constituency boundaries are in purple, with associated text in black. Subfigure (b) shows the parish used for this case study, Meldreth, in red. Parishes outside of k = 350 neighbors are omitted. Parishes in white never attempted to enclose. Parishes in light grey successfully petitioned to enclosed. Parishes in dark grey failed their petition to enclose at least once. Constituency boundaries are in purple, with associated text in black. A figure depicting the location of our case study is superimposed between the two subfigures. The red bounding box is the extent of Subfigures (a) and (b).

Figure 5: MARGINAL TREATMENT EFFECTS FOR ln(WHEAT YIELD)

(a) MTE Curve

Notes: The Marginal Treatment Effect (MTE) curve traces out the treatment effect as a function of unobserved resistance to enclosure in solid black. We derive both the LATE and ATE, plotted in dashed red and dashed blue respectively, from the MTEs. The ATE is a arithmetic average of the MTE, while the LATE is a weighted average of the MTE for compliers, with the weights plotted as red crosses.

(b) 2SLS vs OLS

Notes: In the MTE framework, we derive both the LATE and the ATE. These are the horizontally dashed lines in red and blue respectively, same as above. The 2SLS estimate is plotted as the vertically dashed red line, while the OLS estimate is plotted as the vertically dashed blue line. Estimates for OLS taken from Table **??**, column (2). Estimate for 2SLS taken from Table 3, column (2), panel I.

(c) Potential Outcomes

Notes: We plot the MTE curve in this figure, together with the curves for Y_1 and Y_0. The MTE curve is the vertical difference between these two curves.

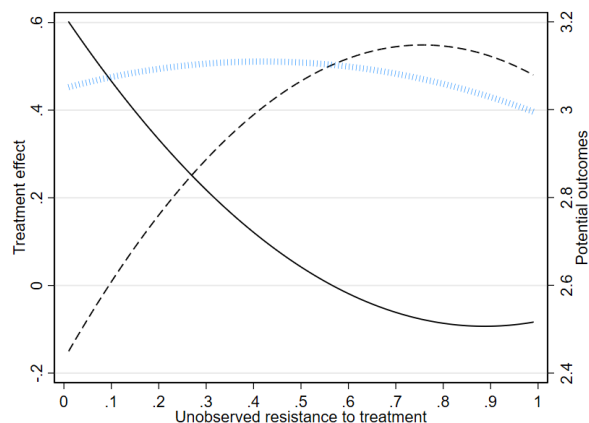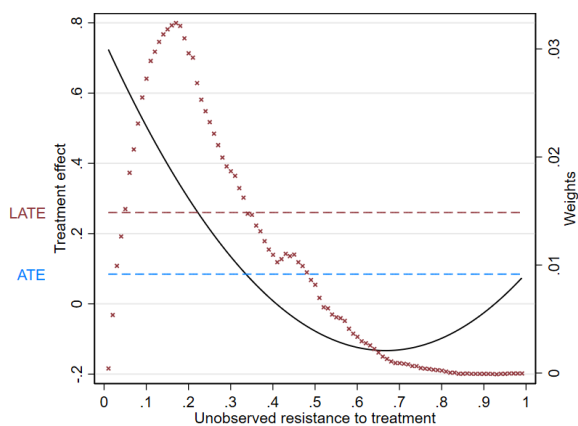Figure 6: MARGINAL TREATMENT EFFECTS FOR GINI (LAND VALUE)

(a) MTE Curve

(b) 2SLS vs OLS

Notes: The Marginal Treatment Effect (MTE) curve traces out the treatment effect as a function of unobserved resistance to enclosure in solid black. We derive both the LATE and ATE, plotted in dashed red and dashed blue respectively, from the MTEs. The ATE is a arithmetic average of the MTE, while the LATE is a weighted average of the MTE for compliers, with the weights plotted as red crosses.

Notes: In the MTE framework, we derive both the LATE and the ATE. These are the horizontally dashed lines in red and blue respectively, same as above. The 2SLS estimate is plotted as the vertically dashed red line, while the OLS estimate is plotted as the vertically dashed blue line. Estimates for OLS taken from Table ??, column (4). Estimate for 2SLS taken from Table 3, column (4), panel I.

(c) Potential Outcomes

Notes: We plot the MTE curve in this figure, together with the curves for Y_1 and Y_0. The MTE curve is the vertical difference between these two curves.
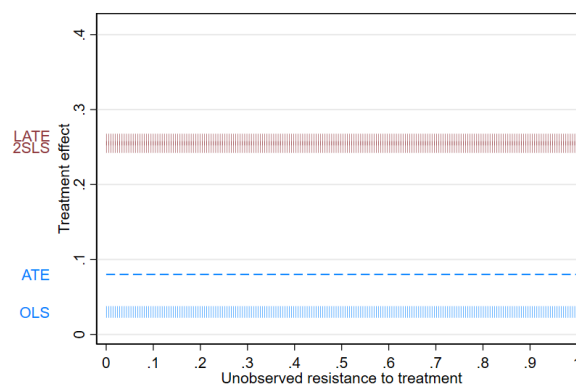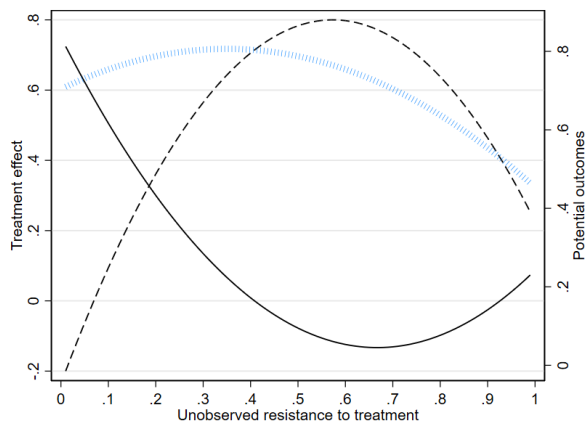
Table 1: SUMMARY STATISTICS FOR MAIN OUTCOME VARIABLES

Sample:		PARLIAMENTARY ENCLOSURE		NO PARLIAMENTARY ENCLOSURE			
	N	mean	sd	mean	sd	difference	t-stat
ln(Wheat Yield) in bushels per acre	4003	3.08	0.19	3.04	0.23	0.04	5.81***
Gini (land value)	5015	0.78	0.19	0.71	0.21	0.07	12.02***

Notes: ln(Wheat Yield) in bushels per acre is the natural log of the number of bushels of wheat per acre. Gini (land value) is a Gini coefficient of the value of land owned by parishioners in the 1836 tithe returns.

Table 2: BALANCE TESTS

Dependent variable:	TAX REVENUE PER CAPITA 1525 (1)	TAX REVENUE 1525 (2)	SUITABILITY FOR WHEAT (3)	POPULATION 1525 (4)	NUMBER OF MPs 1700 (5)	NUMBER OF NOBILITY 1700 (6)	FRACTION OF YEOMEN 1700 (7)
Leave-one-out successful enclosure	0.008	-0.006	-0.004	0.045	0.003	0.004	0.019
	(0.015)	(0.018)	(0.035)	(0.032)	(0.012)	(0.013)	(0.033)
	[0.010]	[0.010]	[0.007]	[0.015]	[0.015]	[0.011]	[0.012]
Observations	6791	7581	13919	7581	9339	9339	7414
R^2	0.02	0.08	0.50	0.32	0.01	0.00	0.12
Scale: Parish area	Y	Y	Y	Y	Y	Y	Y
Geography: Elevation	Y	Y	Y	Y	Y	Y	Y
Location: Latitude, longitude, latitude*longitude	Y	Y	Y	Y	Y	Y	Y
Regional differences: Region fixed effects (n=4)	Y	Y	Y	Y	Y	Y	Y
Soil characteristics: Soil type indicators (n=11)	Y	Y	Y	Y	Y	Y	Y

All regressions are estimated using OLS. The unit of observation is a parish. All regression restrict to rural parishes. All point estimates are standardized. Tax revenue per capita 1525 is total tax revenue divided by total population in the 1525 Lay Subsidy returns. Income 1525 is total tax revenue in the 1525 Lay Subsidy returns. Suitability is the suitability of the soil for growing wheat. Population 1680 is total population in the 1680 hearth tax returns. Population 1525 is total population in the 1525 Lay Subsidy returns. Number of MPs living in parish in 1700 is the number of members of parliament in 1700 that have their residence in a parish. Number of nobility living in parish in 1700 is the number of members the nobility in 1700 that have their residence in a parish. The instrument is the leave-one-out fraction of the proposed enclosures that pass through Parliament and are enacted into law. We take the nearest k parish neighbors and compute total $\frac{\text{successful enclosures}}{\text{attempts to enclose}}$ in this range. Conley standard errors correcting for spatial correlation are in parentheses. These use a triangular kernel with a boundary of 70km. Standard errors correcting for heteroskedasticity are in brackets.

Table 3: THE EFFECT OF PARLIAMENTARY ENCLOSURE ON AGRICULTURAL YIELD AND INEQUALITY

Dependent variable:	LN(WHEAT YIELD) IN BUSHELS PER ACRE		GINI (LAND VALUE)	
	(1)	(2)	(3)	(4)
	Panel I: IV estimates			
Parliamentary enclosure (yes/no)	0.48	0.45	0.16	0.22
	(0.31)	(0.19)	(0.08)	(0.10)
	[0.09]	[0.08]	[0.04]	[0.05]
Mean dep. var.	3.05	3.05	0.74	0.74
SD dep. var.	0.21	0.21	0.21	0.21
Observations	3641	3641	4446	4446
	Panel II: first stage			
	Dep. var.: Enclosed (yes/no)			
Leave-one-out successful enclosure	0.58	0.58	0.77	0.68
	(0.16)	(0.14)	(0.15)	(0.14)
	[0.06]	[0.06]	[0.07]	[0.07]
Conley F-stat on Excluded Instrument	13.41	16.68	25.16	24.51
	Panel III: Reduced Form			
Leave-one-out successful enclosure	0.28	0.26	0.12	0.15
	(0.14)	(0.09)	(0.07)	(0.06)
	[0.04]	[0.04]	[0.03]	[0.03]
Scale: Parish area	N	Y	N	Y
Geography: Elevation	N	Y	N	Y
Location: Latitude, longitude, latitude*longitude	N	Y	N	Y
Regional differences: Region fixed effects (n=4)	Y	Y	Y	Y
Soil characteristics: Soil type indicators (n=11)	Y	Y	Y	Y

Notes: All regressions in panel I are estimated using two-stage least squares. The unit of observation is a parish. All regression restrict to rural parishes. ln(Wheat Yield) in bushels per acre is the natural log of the number of bushels of wheat per acre. Gini (land value) is a Gini coefficient of the value of land owned by parishioners in the 1836 tithe returns. Parliamentary enclosure (yes/no) is the predicted enclosure probability from the corresponding first stage reported in Panel II. The instrument is the leave-one-out fraction of the proposed enclosures that pass through Parliament and are enacted into law. We take the nearest k parish neighbors and compute total $\frac{successful\ enclosures}{attempts\ to\ enclose}$ in this range. Conley standard errors correcting for spatial correlation are in parentheses. These use a triangular kernel with a boundary of 70km. Standard errors correcting for heteroskedasticity are in brackets.

Table 4: MECHANISMS: INNOVATION, COORDINATION, AND LANDOWNERSHIP

	Innovation		Coordination		Ownership
Dependent variable:	NR. AGR. PATENTS	ROAD QUALITY POOR (YES/NO)	TURNIPS GROWN (ACRES)	LANDS FALLOW (YES/NO)	COTTAGERS/ LANDLORD
	(1)	(2)	(3)	(4)	(5)
Parliamentary enclosure (yes/no)	0.02	-0.11	0.13	-0.09	-0.17
	(0.01)	(0.04)	(0.04)	(0.04)	(0.04)
	[0.01]	[0.03]	[0.04]	[0.03]	[0.03]
Observations	13920	5288	2290	5288	3180
Scale: Parish area	Y	Y	Y	Y	Y
Geography: Elevation	Y	Y	Y	Y	Y
Location: Latitude, longitude, latitude*longitude	Y	Y	Y	Y	Y
Regional differences: Region fixed effects (n=4)	Y	Y	Y	Y	Y
Soil characteristics: Soil type indicators (n=11)	Y	Y	Y	Y	Y

Notes: All regressions are estimated using OLS. The unit of observation is a parish. All regression restrict to rural parishes. Nr. Agr. Patents is the number of agricultural patents filed by residents of a parish between 1750 and 1830. Road quality poor (yes/no) is an indicator equal to one if the qualities of the road in a parish is assessed poor by the tithe surveyors. Turnips grown (acres) is the total number of acres of turnips grown in 1831. Lands fallow (yes/no) is an indicator equal to one if a parish was recorded as leaving lands fallow. Cottagers/Landlord is the number of cottagers divided by the number of landlords. Parliamentary enclosure (yes/no) is an indicator equal to one if a parish was enclosed through Parliament at any point between 1750 and 1830. Conley standard errors correcting for spatial correlation are in parentheses. These use a triangular kernel with a boundary of 70km. Standard errors correcting for heteroskedasticity are in brackets.

Table 5: COMPARISON OF OUR ESTIMATES OF THE IMPACT OF PARLIAMENTARY ENCLOSURE TO THE LITERATURE

Source:	LITERATURE					THIS PAPER	
	(1) ALLEN (1982)	(2) ALLEN (1992)	(3) MCCLOSKEY (1989)	(4) TURNER (1980)	(5) GENERAL VIEWS	(6) OLS	(7) 2SLS
Change in Wheat Yield	8.4 %	2.5%		26.4 %	66%	3.4%	45%
Implied Change in Productivity from Rents			10 to 13%				

Notes: This table reports estimates of the change in yield due to enclosure. The estimates in columns (1)-(4) are cross-sectional, comparing enclosed to unenclosed parishes. Column (5) is a before-after comparison in a sample of five parishes in the General Views of Agriculture from Bedfordshire, Cambridgeshire, Gloucestershire, Lincolnshire and one estimate for the county of Nottinghamshire, also from its General View of Agriculture. Column (1) is a sample taken from Arthur Young of several farms, as analyzed by Allen (1992). Column (2) is Allen (1992)'s own analysis which uses 1801 data and tries to control for soil type. Column (3) is from McCloskey (1989). Column (4) is from Turner (1980) reported in Allen (1992). Column (5) is computed as the average percentage change across six estimates from the General View of Agriculture, reported in Batchelor (1813, p. 227, 238), Gooch (1811, p. 126), Rudge (1807, p. 381), Stone (1808, p. 104), and Lowe (1798, p. 45). The estimates from Turner (1980); McCloskey (1989); Allen (1992) in percentage terms are reported in Boyer (1993).