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Summary

Numerous acts of Parliament changed the financing of transport infrastructure in eighteenth century England. This paper examines the economic effects of turnpike acts, which greatly improved road infrastructure by introducing tolls. It shows that turnpike trusts increased property income in local areas by at least 20 percent. The findings shed light on why local property owners promoted and managed turnpikes. They also show that turnpike trusts accounted for at least 20 percent of the total growth in real land rents between 1690 and 1815 and added at least 1.65 percent to national income in 1815.
Scholars have long debated which factors contributed to economic growth in eighteenth century England. The most commonly cited factors are an abundance of coal, a skilled workforce, an entrepreneurial landowning class, high urbanization, greater access to colonial markets, and favorable political institutions. Recently there has been renewed interest in how local legislation affected investment and productivity. Between 1690 and 1830, numerous acts of Parliament changed the financing of infrastructure or altered property rights in land. Enclosure acts are perhaps the most well-known type of legislation because they eliminated common pastures and collective decision-making in agricultural villages. Canals acts are also well known because they fostered the most celebrated transport improvement before the railways.

Turnpike acts were another type of legislation that dealt with transportation infrastructure. Turnpike acts created a body of trustees and gave them authority to finance road improvements by levying tolls and issuing secured bonds. The trustees were typically local landowners and merchants who had a direct interest in the improvement of roads. The literature has shown that turnpike trusts generally increased road investment and helped to reduce transport costs. However, their effects on land rents or property income are not well established. Contemporaries of the time suggested that some turnpikes increased land rents, but there is no econometric evidence which establishes this point.

In this paper, I measure the effect of turnpike trusts on local property income using several data sets. I combine information on the location of turnpike trusts with the 1815 Real Property Assessment and the eighteenth century Land Tax in over 3000 parishes. Turnpike locations are also linked with more than 1600 observations on plot-level land rents in the Charity Commission Records. I analyze the effects of turnpikes trusts using simple mean differences as well as two-stage least squares. The instruments in the two-stage analysis are location on a major London
route or cross route in the seventeenth century. Both of these location variables are highly correlated with turnpike adoption, and are arguably unrelated to property income growth after controlling for other factors. The two-stage least squares estimates imply that turnpike trusts increased local property income per acre by at least 20 percent. They also suggest that parishes had higher property income per acre when more of their neighboring parishes had turnpikes. Overall, the results show that turnpikes contributed to higher property income in the parishes where they were adopted, as well as the parishes in nearby locations.

The findings have several implications for the literature on turnpike trusts and the English economy during the eighteenth century. First, there is a puzzle as to why local landowners and merchants promoted and managed turnpike trusts when the acts forbade trustees from earning direct profits through the tolls. My results show that the potential to earn indirect benefits through higher property income provided one motivation.

The findings also show that turnpike trusts contributed to economic growth. The estimates imply that turnpikes were responsible for at least 20 percent of the total growth in land rents between 1690 and 1815. They also show that turnpikes generated a social savings of at least 1.65 percent of national income in 1815. More generally, the findings suggest that acts changing property rights and the financing of infrastructure were a contributing factor to English economic growth during the eighteenth century.

The paper is organized as follows. Section I provides an overview of turnpike trusts and the related literature. Section II introduces the data. Section III examines the mean differences in property income or land rents per acre for parishes with turnpikes. Section IV describes the estimation model. Section V reports the estimated effect of turnpike trusts on property income.
Section VI checks the consistency of the results using other information. Section VII concludes and discusses some implications.

I.

There was a great need for transport improvements at the beginning of the eighteenth century. The road network, in particular, was in poor condition because of increasing traffic, limited expertise in road maintenance and construction, and most importantly, an ineffective system for road financing. According to the Statute for Mending Highways, passed in 1555, all parishes or townships were responsible for road maintenance in their jurisdiction. Parish and county officials could force local inhabitants to work on the roads for up to six days per year. Later acts gave officials the right to levy taxes on property income. Despite these legislative expedients, parishes spent little, and roads were often described as ‘ruinous’ or ‘impassible.’ The main problem was that parishes could not tax road-users, and therefore they could not appropriate any of the benefits from through-travelers. Parishes also had difficulties borrowing to pay for the high costs of widening and resurfacing.

The turnpike act emerged as a solution to the problems of the parish system. Turnpike acts named a body of trustees and gave them authority over a road that was previously maintained by several parishes. Trustees were granted a number of new rights. They were allowed to levy tolls, issue secured bonds, and purchase land. Turnpike acts also placed restrictions on trustees. For instance, they could not levy tolls above a maximum schedule, and they could not earn profits from the tolls. Instead, trustees had to devote all the revenues to road maintenance, salaries, interest, and debt payments.
Turnpike acts became very common during the eighteenth century. Figure 1 plots the annual number of acts creating new turnpike trusts between 1663 and 1836. The first turnpike act was in 1663, but they were not passed regularly until the 1690s and early 1700s. The first burst of turnpike acts occurred during the 1720s and included the establishment of 46 trusts. The second and largest burst occurred during the 1750s and 1760s. It included the passage of over 300 turnpike acts and applied to over 10,000 miles of road. By the 1830s there were over 900 trusts managing approximately 20,000 miles or 17 percent of the entire network.5

By 1770 turnpike trusts proliferated throughout England and Wales. Eric Pawson’s map shows there was a dense network of turnpike roads near cities in the West and North (see Figure 2). Some of these cities were undergoing the early stages of the Industrial Revolution, like Birmingham, Manchester, and Sheffield, but others were growing more slowly, like Frome, Gloucester, and Hereford. In the Southeast, the turnpike network was less dense and largely consisted of the major roads leading to London.

Figure 3 provides a more detailed perspective by illustrating the turnpike network in Bedfordshire.6 The dashed lines represent parish boundaries and the dark lines represent turnpike roads. Individual turnpike trusts usually passed through 5 to 10 parishes, or between 10 and 15 miles. It was also common for several turnpike roads to link the largest city, in this case Bedford, with its hinterland and other cities in neighboring counties. Lastly, it was common for major turnpike roads to pass through counties on their way to London. In Bedfordshire, two major turnpike roads passed through the southwestern and eastern part of the county.

A large body of research focuses on whether turnpike trusts affected road investment and transport costs. Most studies find that turnpike trusts raised road expenditure and reduced transport costs. For instance, there is evidence that turnpike trusts contributed to around half of
the 40 percent reduction in freight charges and passenger travel times between 1750 and 1820. There has been less research on whether turnpike trusts increased local property income. Some contemporaries argued that turnpike trusts increased land rents. For example, Arthur Young claimed that land rents increased from 7 to 11 shillings per acre once the Horsham to Epsom turnpike trust was established in 1755. However, beyond statements like this, there is little evidence that turnpikes raised property income in the locations where they were established.

There are several reasons why turnpikes trusts may have raised land rents. First, turnpikes gave farmers greater access to markets by reducing transport costs. Greater access to markets allowed farmers to earn higher prices for their products, or to shift to higher value produce, such as meat or dairy products. Second, lower transport costs contributed to greater productivity in agriculture. For example, farmers generally did not pay tolls when carting manure or lime along turnpike roads. Thus, it was more advantageous to use these fertilizers and raise output per acre. Turnpikes also reduced communications costs, which gave farmers better information about market conditions and new techniques. In short, if a parish had a turnpike road, then small holders may have realized higher income, or large landowners were able to charge higher rents.

Turnpikes may have contributed to higher property income through the growth of manufacturing as well. Turnpikes were often established in areas that already had manufacturing, but they could have encouraged more firms to locate in a particular city because they offered greater access to markets, or because they lowered the cost of obtaining information. The addition of more manufacturing led to investment in buildings and housing which added to property income. It also raised population which increased land rents.

Turnpikes could have also reduced manufacturing elsewhere by drawing firms away from one location to another. Agglomeration economies encourage firms to locate near one another.
If turnpike trusts decreased the attractiveness of one location in favor of another, then they would have contributed to depopulation and lower property income. The implication is that turnpikes may have increased property income in the parishes where they were located, but reduced property income in neighboring locations.

There is an opposite argument that parishes benefited from having more turnpikes in their general vicinity or region. Greater numbers of turnpikes allowed farmers and firms to access many markets, whereas a single turnpike provided access to less. Therefore, property income may have increased in parishes that had a greater density of turnpikes in their area.

The effect of turnpike trusts on property income is relevant for a number of issues in the literature. Turnpikes were generally promoted and managed by local elites. For instance, in 1718, the Sheriff, Deputy Lieutenant, Justices of Peace, gentlemen, freeholders, and inhabitants near Stokenchurch promoted a turnpike bill along their segment of the London-Oxford road. A Parliamentary survey in 1821 confirms that many trustees were locals who derived income from land. It also shows that some trustees earned income from ‘general’ or ‘personal’ sources, which meant they were involved in trade or possibly manufacturing.

Several scholars have suggested that landowners and merchants served as trustees because they hoped to benefit through higher property income or profits. For example, Richard Wilson discusses how the merchant community in Leeds served as trustees because the woolen textile industry depended on a well-maintained road network. Anne Thomas argues that pottery manufacturers, such as Josiah Wedgewood, served as trustees in Staffordshire because they needed good roads to bring their products to local markets or nearby rivers for shipment abroad. William Albert shows that turnpike investors were generally local landowners. He discusses a particular case where an agent advised a landowner to invest in a proposed turnpike
road because ‘when it is executed twill be of Utility & Benefit to your estate’. In this paper, I address what motivated local landowners by examining whether turnpikes increased property income in the locations where they were adopted.

Scholars have also examined the possibility that turnpike trusts had negative effects for some groups or locations. William Albert argues that riots against turnpike trusts were driven by concerns over the payment of tolls and the potential loss of income. Eric Pawson suggests that turnpike trusts contributed to the decline of some towns by reducing transport costs and increasing inter-city competition. My analysis addresses the negative effects of turnpikes by studying whether they reduced property income in parishes within 5 or 7.5 miles.

Lastly, my analysis addresses whether the growing volume of acts of Parliament dealing with property rights and public goods contributed to economic growth. One study uses changes in transport costs to calculate the social savings from turnpike acts. The estimates imply that turnpikes generated a social savings between 0.5 and 1 percent of national income in 1800 and 1820. The gains in property income provide another way of calculating the social savings from turnpike acts and similar types of legislation.

II.

There are several data sources on land rents or property income across England. First, there is the 1815 Real Property Tax Assessment and the Eighteenth-Century Land Tax. The Real Property Assessment was based on the annual income derived from land, houses, quarries, and mines in 1815. The assessments for each parish and township are published in the Parliamentary Papers. The Land Tax was levied in every year between 1692 and 1798. The relative contribution of each county remained fixed throughout the eighteenth century and was based on
an assessment of the annual income from land, buildings, and moveable goods in 1692. Moreover, the relative quota paid by each parish or township within a county was fixed by the assessment of 1692. This implies that the Land Tax quota for each parish or township in a given year is proportional to the distribution of land rents across parishes and townships in 1692. I use the 1798 Land Tax Quota because there is published information on the contribution of each parish or township in the Parliamentary Papers.

I collected data on the 1815 Real Property Assessment and the 1798 Land Tax Quota for over 3000 parishes or townships in eleven counties. The eleven counties include Bedfordshire, Buckinghamshire, Cambridgeshire, Hertfordshire, Leicestershire, Lincolnshire, Somersetshire, Worcestershire, Shropshire, the North Riding of Yorkshire, and the West Riding of Yorkshire. The eleven counties capture a variety of characteristics. Bedfordshire, Buckinghamshire, Cambridgeshire, and Hertfordshire are referred to as the ‘Home Counties’ because of their proximity to London. Leicestershire and Lincolnshire are located in the East Midlands, and were engaged in more pastoral agriculture than the Home Counties. Worcestershire and Shropshire are in the West Midlands and combined pastoral agriculture with coal mining and metalworking. Somersetshire is located in the Southwest and combined agriculture with woolen textile production. The West Riding of Yorkshire was a densely populated industrial county in the North, also specializing in woolen textile production. Lastly, the North Riding was a thinly populated pastoral region just north of the West Riding.

The Charity Commission Records provide another data source on land rents throughout England. Charities managed assets that supported the poor, local schools, and other causes. In a parliamentary report, each charity provided a retrospective history of their portfolio. The report
contains over 30,000 observations on the purchase price of land or the rental value of plots
between 1500 and 1910. It also identifies the parish and county where the plot was located.21

My analysis largely focuses on the Real Property Assessment and the Land Tax because they
were comprehensive in terms of geographic coverage. Moreover, the tax data documents the
distribution of property income at two dates, 1815 and 1692, which allows for a simple
application of econometric techniques, like two-stage least squares. There might be concerns,
however, about how accurately the tax data measures property income. Below I use the charity
records to determine whether a different data source yields similar results.22 I analyze the
observations for plots in Bedfordshire, Buckinghamshire, Cambridgeshire, Hertfordshire,
Leicestershire, Lincolnshire, Somersetshire, Worcestershire, Shropshire, the North Riding of
Yorkshire, and the West Riding of Yorkshire to ensure comparability with the tax data.

The tax data and the Charity records are matched with another data set that identifies which
parishes had turnpike trusts in their jurisdiction. There was a parliamentary survey in 1840 that
identifies the name of each turnpike trust and the parishes where the road passed.23 I identified
the year when each trust was established using the same survey, as well as the list of turnpike
acts in Albert and Pawson. My data set also includes the latitude and longitude for parishes.24 I
use latitude and longitude to calculate the fraction of parishes within a 5 or 7.5 mile radius that
had turnpike trusts. Specifically, I divide the number of parishes within 5 or 7.5 miles that had
turnpikes by the total number of parishes within 5 or 7.5 miles. The size of the radius is small
because I am interested in the local effects of turnpikes trusts. Moreover, as the radius increases
there is a greater likelihood of measurement error, because I don’t have information on turnpike
adoption in all bordering counties.
The tax data are also matched with other parish characteristics, including land area, population in 1700, 1750, 1801, 1811, and 1841, the number of acres enclosed through acts of Parliament, distance to London or the nearest town, and whether the parish had a canal in its jurisdiction. Distance to London or the nearest town is calculated using the latitude and longitude coordinates. The nearest town is defined as the closest parish, township, or borough with a population density above 0.5 persons per acre in 1801. The location of canals and their year of construction are identified using data from Mike Stevens, Jim Shead, and the Phillimore Atlas. The population figures after 1801 are available in the Parliamentary Papers. Before 1801, they come from Penelope Corfield, and are restricted to cities with a population above 2500. Given the limited information on population in the eighteenth century, I proxy for urbanization using a dummy variable for population above 2500 in each year.

Information on common property rights is derived from W. Tate. Previous studies have analyzed the fraction of plot acreage subject to common rights. To calculate a similar figure for the parish as a whole, I use information from enclosure acts. I assume that the fraction of acres enclosed between 1815 and 1875 represents the fraction of acreage subject to common rights in 1815. Similarly, I assume the fraction of acres enclosed between 1692 and 1815 represents the fraction of acreage subject to common rights in 1692.

I also identify whether a parish was located on a major London route or major cross route in the seventeenth century using the travel guide Britannia. Britannia was published in a series of editions starting with John Ogilby’s original version in 1675. Each edition provides a detailed description of the travel routes between London and most major cites. For example, Britannia lists two major London routes which pass through Bedfordshire: the London-Holyhead Road and the Great North Road. The London-Holyhead passes through Dunstable, Houghton Regis,
Chalgrave, Hockliffe, Battlesden, and Potsgrove (see Figure 3). I identify each of these parishes as being on a major London route in the seventeenth century.

Table 1 provides summary statistics on all the variables. The mean for the 1815 property assessment per acre is £2.05 and the mean for the 1798 Land Tax Quota per acre is £0.081. The 1798 Land Tax was set at 4 shillings-in-the-pound. Multiplying the parish quota by 5 implies a mean property income of £0.405 per acre in 1692. In the charity records the average land rent per acre is £2.37 in 1815 and £0.8 in the 1690s. The lower property income implied by the tax data is likely due to the under-assessment of income in northern counties.31 Moreover, charity plots rented for more because they were generally small in terms of acreage.32

The turnpike dummy for 1815 has a mean of 0.542, which implies that 54 percent of parishes had a turnpike trust by 1815. The mean for the fraction of parishes within 5 or 7.5 miles that have turnpikes in 1815 is 0.541 and 0.547 respectively. The similarity is to be expected because the fraction of neighbors with turnpikes within 7.5 miles averages the turnpike dummy over a larger area than the fraction with turnpikes within 5 miles.

III.

This section establishes the basic relationships between the turnpike variables and property income per acre or land rents per acre. Panel A of table 2 uses the tax data on assessed property income per acre in 1815 to make comparisons between parishes with and without turnpike trusts. Row 1 shows that the mean of the natural log of property income per acre in 1815 was significantly higher for parishes with turnpike trusts than for parishes without turnpike trusts. Since we can interpret the log difference as an approximation of the percentage difference, the estimates imply that property income per acre was around 20 percent higher for parishes with
turnpikes. Row 2 shows that the mean log property income per acre in 1815 was higher in parishes where the fraction of parishes within 5 miles with turnpikes was above the median. Row 3 shows a similar result where the fraction of parishes within 7.5 miles with turnpikes was above the median.

Panel B in table 2 uses the observations in the Charity data between 1800 and 1839 to make comparisons between plots in parishes with and without turnpikes. Row 4 shows that the mean log rent per acre was significantly higher for parishes with turnpike trusts than without turnpikes. In fact, the estimated percentage difference between charity plots in parishes with turnpikes is almost identical to the estimated difference for parishes with turnpikes using the tax data (see row 1 and 4). Rows 5 and 6 show that the mean log rent per acre was also significantly higher for plots where the fraction of parishes within 5 or 7.5 miles with turnpikes was above the median. In this case, the estimated percentage differences are smaller in the charity data than the tax data, but are generally similar. Overall, the data imply that property income per acre or land rents per acre were higher in locations that had turnpike trusts in their immediate vicinity or in neighboring locations.

The preceding tables make comparisons between all locations in the sample counties, but the relationship between turnpikes and property income might differ within counties because of the differences in regional wealth during the early nineteenth century. Table 3 addresses this possibility by examining the mean differences in the natural log of property income per acre or land rents per acre within counties. Column 1 shows that in 8 of the 11 counties, the mean log property income per acre was higher for parishes with turnpike trusts than without turnpike trusts. In five of the counties (Hertfordshire, Leicestershire, the West Riding of Yorkshire, the North Riding of Yorkshire, and Lincolnshire) the mean differences are significant at the 10
percent level or above. Column 2 shows that in 10 of the 11 counties the mean land rent per acre is higher for plots in parishes with turnpikes trusts. In five of the counties (Bedfordshire, the West Riding of Yorkshire, Buckinghamshire, the North Riding of Yorkshire, and Lincolnshire), the differences are significant.

Overall, the tax data and the Charity data show there is a positive relationship between turnpikes and higher property income or land rents per acre both within and across counties. Simple mean differences can be misleading, however, for two reasons. First, there are no controls for a variety of other factors which influence property income. Second, they don’t account for the selection process by which turnpike trusts came to be established in particular parishes. Specifically, if turnpike trusts were established in locations that were more (or less) likely to grow, then the mean differences might yield a biased estimate of the effects of turnpikes on property income. One solution is to use a two-stage least squares model, which accounts for unobservable factors as well as the selection of turnpikes into particular parishes. The following section develops this methodology in greater detail.

IV.

The estimation model is designed to analyze changes in property income per acre. Property income per acre is determined by a variety of factors, including soil quality, distance to markets, population density, transport infrastructure, and property rights over land. The following equation describes a log-linear relationship between parish property income per acre and a set of variables in year \( t \).

\[
y_{it} = \alpha + \beta_1 \text{pike}_{it} + \beta_2 \text{canal}_{it} + \beta_3 \text{common}_{it} + \beta_4 \text{urban}_{it} + d_t + u_i + \varepsilon_{it} \quad (1)
\]
\( y_{it} \) is the natural log of property income per acre for parish \( i \) in year \( t \). \( pike_{it} \) is a dummy variable that takes the value 1 if a parish has a turnpike in year \( t \). \( canal_{it} \) is a dummy variable for whether the parish has a canal. \( common_{it} \) is the fraction of acreage in the parish subject to common property rights. \( urban_{it} \) is a dummy variable for whether the parish has a population above 2500. \( d_t \) is a dummy variable for the year \( t \). Finally, \( u_i \) is a parish fixed effect and \( \varepsilon_{it} \) is an error term. The parish fixed effect captures a variety of factors which are constant over time, including soil quality, distance to markets, and location near the coast or navigable rivers. The dummy variable for time captures the general level of property income in each year.

To estimate equation (1), it is necessary to have observations in at least two years. I focus on 1815 and 1692 because the Real Property tax was assessed in 1815 and the 1798 Land Tax Quota was based on an assessment in 1692. Using these two years, one can rewrite equation (1) as the log difference in property income between 1815 and 1692:

\[
\Delta y_i = \alpha + \beta_1 \Delta pike_i + \beta_2 \Delta canal_i + \beta_3 \Delta common_i + \beta_4 \Delta urban_i + \Delta \varepsilon_i \quad (2)
\]

where \( \Delta \) signifies the difference between a variable in 1815 and 1692. \( \Delta pike_{it}, \Delta canal_{it}, \) and \( \Delta urban_{it} \) are now dummy variables that equal 1 if parish \( i \) got a turnpike, got a canal, or became urban between 1692 and 1815; \( \Delta common_{it} \) is the change in the fraction of acres subject to common rights. Notice also that the fixed effect \( u_i \) has been eliminated because of the differencing between the two years, and the dummy for the year is now the constant term.
Equation (2) can be interpreted as a standard ‘before-and-after’ analysis. The coefficient $\beta_i$ identifies whether parishes that had turnpikes established between 1692 and 1815 had a higher growth in property income per acre over this period. We can also interpret $\beta_i$ as an approximation of the percentage increase in property income per acre after a parish adopts a turnpike trust, which is the standard interpretation in a log-linear model with fixed effects.\textsuperscript{34}

The property differences equation controls for time-invariant unobservable factors, but the estimates for the turnpike dummy could still be biased upwards if turnpikes were adopted in parishes that were more likely to grow. This would be true, for example, if turnpikes tended to be established in parishes that experienced industrialization. On the other hand, estimates for the turnpike dummy could be biased downwards if turnpikes were adopted in parishes that were experiencing de-industrialization. I address endogeneity and other estimation problems in two ways.\textsuperscript{35} First, I include dummy variables for each hundred (a subunit of the county usually including 10 to 20 parishes or townships), distance to London, distance to the nearest town, and a dummy if the parish had a population above 2500 in 1700 as additional explanatory variables in equation (2). The hundred dummies provide a good control for unobservable factors associated with location. The distance to London variable helps to minimize the bias from the under-assessment of the Land Tax in parishes far away from London. It also captures any systematic growth differential between the Southeast and the rest of the country. Distance to the nearest town with a population density above 0.5 persons per acre in 1801 is also likely to matter for property growth because urbanization generates agglomeration economies which have spillover effects on nearby parishes. Agglomeration economies also imply that urban centers in 1700 might grow at a different rate.
Second, I estimate a two-stage least squares model where dummy variables for location on major London routes or major cross routes in the seventeenth century are used as instruments for the adoption of turnpike trusts. The key assumption is that location on major London or cross routes influenced the adoption of turnpikes in parishes, but did not affect property income growth between 1692 and 1815 after conditioning on the other control variables. Being located on a major route in the seventeenth century should increase the likelihood of a turnpike being adopted in a parish because it was already on a favorable travel route. A travel route would have been favorable if road repair materials, like gravel, were cheap, or if it provided the shortest path between major cities. These characteristics suggest that the London route and cross route dummies are valid instruments because cheap repair materials and proximity between major cities are unlikely to directly influence the growth of property income, after controlling for distance to nearby cities, distance to London, and the hundred dummies.

A parish might also be on a major London route or major cross route in the seventeenth century because its producers shipped a lot of goods to other cities. This would likely imply a higher property income for the parish in 1692, but it would not necessarily imply a higher growth in property income between 1692 and 1815. Therefore, dummies for location on major London routes or cross routes in the seventeenth century are still unlikely to directly influence the growth of property income.

Below I also estimate a two-stage model where the fraction of parishes with turnpikes within 7.5 miles is treated as an additional endogenous variable. The goal is to see whether having more turnpikes in neighboring areas affected parish property income after conditioning on whether the parish had a turnpike in its own jurisdiction. In this case, the instruments are the fraction of parishes within 7.5 miles that are located on a major London route, the fraction within
7.5 miles located on a major cross route, and the fraction within 7.5 miles that were urban in 1700. The first two variables should be correlated with a higher fraction of parishes with turnpikes within 7.5 miles for the same reasons that location on a major London route and major cross route are correlated with the turnpike dummy. Urbanization in neighboring areas is also likely to contribute to turnpikes in neighboring areas because of greater traffic in the area.

V.

This section discusses the results for various specifications of the two-stage least squares model using the tax data. Table 4 reports estimates for a ‘base-line’ model. Column 1 shows the first stage estimates of a linear regression of the turnpike dummy on distance to London, distance to the nearest town, hundred dummies, and dummies for whether the parish was located on a major London route or cross route in the seventeenth century. The second column shows the second-stage estimates of the log difference in property income on distance to London, distance to the nearest town, hundred dummies, and the turnpike dummy by 1815.

The main finding is that turnpikes increased property income by approximately 27 percent. This is larger than the average mean difference in the log property income per acre for parishes with turnpike trusts versus parishes without turnpikes. It is also larger than the estimated effect in an equivalent ordinary least squares model, which assumes that the adoption of turnpikes by 1815 is exogenous. The estimates from that model are not reported, but they show that turnpikes raised property income by 11 percent. Thus the two-stage estimates imply a much larger increase in property income from turnpike trusts. In a moment, we will see that this finding generally holds in other specifications as well.
The results in table 5 also show that parishes on major London routes or cross routes in the seventeenth century were more likely to get turnpikes. These findings confirm that the instruments are strongly correlated with the turnpike dummy. As discussed earlier, the main assumption is that location on a major London or cross route in the seventeenth century is independent of property income growth after including the other control variables. It is not possible to test this assumption directly, but I can use an over-identification test to see whether there is evidence that one of the instruments is correlated with the growth of property income, even after including the other control variables. The over-identification statistic is reported at the bottom of table 4. It suggests that we cannot reject the hypothesis that the instruments are independent of property growth after controlling for other factors.

There are other results of interest in table 4. Distance to London increased the growth of property income, but it had little effect on the adoption of turnpikes. Distance to the nearest town is negatively related to property income, and negatively associated with the adoption of turnpike trusts. This finding suggests there were effects from proximity to population centers.

Other specifications also show that the adoption of turnpikes caused property income to increase in parishes. Column 1 in table 5 reports results for the two-stage least squares model after adding variables for the adoption of canals, changes in the fraction of common acreage, and urbanization. The results show that the adoption of turnpikes caused property income to increase in parishes by approximately 23 percent. Thus, including observed changes in parish characteristics does not substantially change the estimated effects of turnpikes. The estimates in column 1 also yield some interesting results regarding enclosures, urbanization, and canals. As expected, they show that a reduction in the acreage under common property rights increased property income. The coefficient implies that property income would increase by 19 percent if
half of the acres in a parish were shifted from common to private property rights. This is similar to the estimates found by Greg Clark who used the charity records to analyze enclosures. The results also show that urbanization and the adoption of canals increased property income. The effects of canals are surprisingly small, but this may be due to the sample counties, which do not include Lancashire and Warwickshire where canals presumably had large effects.

Column 2 of table 5 uses a treatment effects estimator to analyze the effects of turnpike trusts on parish property income. It is similar to the two-stage least squares model except it uses a probit model to predict the probability that a parish adopts a turnpike in the first step, and then incorporates the probability of turnpike adoption in the equation for property growth. The estimated effect of turnpikes is slightly smaller in the treatment effects model, but the general conclusion is the same: turnpike increased property income in the parishes where they were adopted by at least 21 percent.

The last issue concerns the effects of having more turnpikes in neighboring areas. Table 6 reports estimates from a two-stage least squares model where the instruments for the fraction of parishes with turnpikes within 7.5 miles are the fraction of parishes on major London routes or cross routes within 7.5 miles and the fraction of parishes within 7.5 miles that were urban in 1700. Column 1 reports the estimates where the turnpike dummy is dropped. The main finding is that property income increased when a higher fraction of parishes within 7.5 miles had turnpikes. Multiplying the coefficient by 0.25 suggests that property income would have increased by approximately 10 percent if 25 percent of the parishes within a 7.5 mile radius adopted turnpikes. The first-stage results for the model in column 1 are not reported, but they show that the fraction of parishes on major London routes or cross routes within 7.5 miles continues to be strongly correlated with turnpike adoption, and like before, over-identification
tests suggest they are independent of the growth in property income, after including other controls.

We would also like to know the effect of turnpike adoption in neighboring areas after conditioning on whether the parish itself adopted a turnpike and *vice versa*. Column 2 of table 6 reports results from a two-stage least squares estimation that simultaneously accounts for the endogeneity of the turnpike dummy and the fraction of parishes within 7.5 miles with turnpikes. The estimates imply that property income increased by 20 percent if a parish had a turnpike and by 7 percent if 25 percent of the parishes within 7.5 miles had turnpikes.

Overall the econometric results suggest several conclusions about the relationship between turnpikes and property income. First, they confirm that turnpike trusts caused property income to increase. In other words, the positive relationship between turnpikes and high property income does not simply reflect the fact that turnpikes were adopted in more productive locations. Second, turnpike trusts did not increase the income of their local parishes at the expense of lowering income for neighboring parishes. Instead, greater numbers of turnpikes in an area added to parish property income.

**VI.**

The estimates imply that turnpike trusts increased property income in the parishes where they were located by at least 20 percent. How plausible is this estimate? In this section, I check whether the results are consistent with the estimates from another study which shows that turnpike trusts reduced real freight charges by approximately 20 percent between 1750 and 1820. First, I calculate the increase in prices received by farmers within 40 miles of a market when freight charges declined by 20 percent and production remained constant. Then I estimate
how land rents should change as a result of the increase in prices received by farmers. The results imply that a 20 percent decline in freight charges should increase rents by approximately 15 percent. This suggests that three quarters of the increase in property income attributed to turnpikes was due to lower transport costs increasing the income from existing agricultural production.

I carry out this exercise for wheat prices in the 1730s and 1740s, which is just before turnpikes became common and freight charges declined (see Table 7). I approximate the price received by farmers with the difference between wheat prices per bushel and the total freight charge per bushel, 0 to 40 miles from the market. The average market price of wheat was 3.5 shillings per bushel between 1730 and 1749. In the same period, freight charges averaged 0.033 shillings per-bushel, per-mile. These figures imply that the average price received by farmers was 2.83 shillings per bushel. If freight charges fell by 20 percent and market prices remained constant, then the average percentage change in prices received by farmers is 5.2 percent.

In a setting where farmers earn zero profits and labor is abundant, the local gains from higher prices will largely accrue to landowners because land is the scarce or immobile factor of production. The percentage change in land rents, therefore, can be approximated by the percentage change in prices received by farmers divided by the share of rents in total agricultural production costs. To see why, assume that the zero-profit condition holds; that is farming revenues equal farming costs. Revenues equal the prices received by farmers multiplied by total agricultural output, \( pQ \), and costs equals the wage times labor, \( wL \), plus rents per acre times acres in production, \( rT \). The total differential of the zero profit condition is given by the expression: \( \Delta pQ + p\Delta Q = \Delta wL + w\Delta L + \Delta rT + r\Delta T \). Now if farmers are already producing at
capacity and do not change their production mix, then the terms $\Delta Q$, $\Delta L$, and $\Delta T$ are zero, and the total differential simplifies to $\Delta pQ = \Delta wL + \Delta rT$. If wages are also assumed to be unaffected by changes in farm-gate prices, then the total differential simplifies further to $\Delta pQ = \Delta rT$.

Dividing the left-side by $pQ$ and the right-side by its equivalent, $wL + rT$, yields the following expression:

$$\frac{\Delta p}{p} = \frac{\Delta r}{r} \frac{rT}{rT + wL}.$$  

It says that the percentage change in prices received by farmers equals the percentage change in land rents per acre multiplied by the share of rents in total agricultural production costs. Therefore, to estimate how a 5.2 percent increase in average farm prices will affect land rents per acre, we can divide it by the percent of land rents in total costs.

Greg Clark estimates that in the 1860s, rent, tithes, and taxes were 41.5 percent of total agricultural production costs. It is likely that rent, tithes, and taxes represented a similar percent of costs in the mid-eighteenth century, which is what Clark assumes in his agricultural productivity calculations. The share of agricultural production costs due to land taxes should be deducted because land tax payments were not included in assessed property income. The average land tax was 3.7 shillings in the pound, or 18.5 percent, in the second half of the eighteenth century. This would imply that the share of agricultural production costs that accrued to rents after deducting taxes was approximately 34 percent. The last step is to divide the percentage change in prices received by farmers by the percent of rents in agricultural production costs. The calculation implies that land rents should increase by an average of 15 percent if turnpike trusts reduced transport costs by 20 percent.

The preceding calculations suggest that changes in transport costs can explain around three quarters of the estimated increase in property income associated with turnpikes. The remainder
may be due to their effects on land use, agricultural productivity, urbanization, or the attraction of inns serving the road transport sector. Such effects have been highlighted by a number of scholars who study transport improvements. E. H. Hunt and S. J. Pam, for example, show that farmers shifted from cereals to meat and dairy following the introduction of the railway in the nineteenth century. Rick Szostak argues that canals and turnpike trusts raised productivity by encouraging innovation. Lastly, Eric Pawson argues that turnpikes contributed to higher urbanization.50 There are no estimates of how much turnpikes specifically contributed to changes in land use, productivity, and urbanization; but it is likely that their impact was non-trivial.

VII.

The results have several implications for the literature on turnpike trusts and the English economy during the eighteenth century. The finding that turnpike trusts increased property income shows that local landowners had an economic incentive to promote and manage turnpikes. Many statutory authorities in eighteenth century England were ‘non-profit’ organizations and relied on the voluntary participation of local elites.51 There is a commonly-held view that elites served because they earned economic benefits through higher property income or profits from trade. The results here suggest that landowners recognized that turnpikes increased their property income, and that it encouraged them to serve.

Of course, there may have been other motivations as well. It is possible that landowners served as trustees because they wanted to extract a portion of the toll revenues through interest payments or procurement contracts. It is also possible that a sense of civic duty drove them to participate. While these alternative motivations cannot be ruled out, they are less compelling
than the inducement of higher property income. Interest rates on turnpike bonds were capped at 5 percent, which is less than the gains in property income. The effective interest may have exceeded 5 percent if turnpike bonds were traded below their par value, but even so, the likelihood of an 8 to 10 percent return was low. There was almost certainly some extraction of toll revenues through the procurement of land and materials, but these emoluments went to a few, and were not large enough to motivate most landowners. A sense of civic duty likely motivated some members of the landed elite, but such values would have to be extremely common to explain the widespread adoption of turnpikes.

The lure of higher property income may have provided the main motivation, but it was not sufficient for landowners to serve as trustees. Landowners faced a free-rider problem because no individual could be excluded from earning higher land rents. Daniel Klein suggests that for U.S. turnpike trusts the free-rider problem was solved by social pressure, such as community gatherings where individuals publicly stated their stock pledges. Social pressure may have played a similar role in England, where landed families were often linked through marriage and political organizations. The high concentration of landownership also helped to alleviate the free-rider problem. It is generally believed that landownership became more concentrated during the eighteenth and early nineteenth century. It is likely, therefore, that the local benefits from English turnpikes went to a smaller number of landowners, who had a relatively easy time cooperating with one another.

The econometric results also show that turnpikes did not reduce property income in nearby parishes. This could explain why there was relatively little opposition to turnpike petitions in Parliament. Pawson found that before 1750 only 15 percent of all new turnpike bills faced formal opposition. Based on these figures, he argued that turnpike trusts were uncontroversial.
My results are consistent with this assessment, because they show that turnpikes did not have negative effects at distances less than 7.5 miles. It is worth noting that negative effects could still be present at distances greater than 7.5 miles. For instance, the woolen textile industry in the West Country and East Anglia may have suffered once turnpikes opened their markets to greater competition from northern producers.

My results also imply that turnpike trusts made a significant contribution to economic growth in England. In the sample counties, 54.2 percent of parishes had turnpike trusts by 1815. Multiplying 54.2 percent by the estimate that turnpikes increased property income by 20 percent implies that they increased total property income by 11 percent (see table 8). Is this a large effect?

The impact of turnpike trusts can be gauged by their contribution to the total growth in land rents. Greg Clark estimates that real land rents grew by approximately 50 percent between 1690 and 1815. Robert Allen finds a relatively similar change in real rents in the South Midlands. Clark’s figures combined with my estimates imply that turnpike trusts contributed to 22 percent of the total growth in real land rents (see table 8). In other words, turnpike trusts made a significant contribution to the overall growth in land rents.

The effects of turnpikes can also be compared with enclosures. In my sample, the fraction of common acres between 1693 and 1815 fell by an average of 18.7 percent. If the elimination of common rights increased land rents by 38 percent as the estimates suggest, then enclosures increased total property income by 7 percent and account for 14 percent of the total growth in land rents between 1690 and 1815. Thus, turnpike trusts had a larger aggregate impact than enclosures.
A final way of gauging the contribution of turnpike trusts is to calculate their social savings, or the percentage of national income that would be lost if turnpike trusts were never established. Economic historians usually measure the social savings from transport innovations by multiplying the change in transport costs with the volume of traffic. Here I measure social savings using the income side of national accounts, specifically property income. If property income represented 15 percent of national income, then turnpike trusts would have generated a social savings of at least 1.65 percent of national income in 1815 (see table 8). The social savings are large considering that few technological changes were involved. In addition they are large relative to total factor productivity growth, which is estimated to be around 0.3 percent per year between 1770 and 1800.

It is worth emphasizing that 1.65 percent of national income may be a lower bound estimate of the savings from turnpike trusts. If I use the two-stage least squares estimates in column 1 of table 5, which imply that turnpikes increased property income by 23 percent, then the social savings would be 1.9 percent. If I also include the estimated gains for parishes within 7.5 miles, then the social savings would be even larger.

In conclusion, this paper adds to the broader literature on the economic effects of legislation in eighteenth century England. Throughout this period, landowners and merchants promoted acts that changed property rights to land or created new organizations with the right to provide infrastructure and public services. Legislation like this was fairly unique among European countries before the nineteenth century. The only exception is the Dutch Republic, which passed similar legislation at the provincial level during the seventeenth century. Understanding why England began using legislation to improve its economy will help to resolve the larger puzzle of why England became the first country to industrialize.
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*Report of the Commissioners for inquiring into the State of Roads in England and Wales* (P.P. 1840 XXVII).


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1 I would like to thank Jean-Laurent Rosenthal, Jan Bruekner, Gary Richardson, Marigee Bacolod, Ken Small, and seminar participants at Northwestern University for providing helpful comments. I would also
like to thank Robert Allen and Gregory Clark for kindly sharing their data as well as William Troost and Woong Lee for providing valuable research assistance. Lastly, I would like to thank the Bedfordshire and Luton Archives and Records Service for providing assistance.

2 See Langford, *Public Life*, and Hoppit, ‘Patterns of Parliamentary Legislation.’


4 See 2&3 Philip & Mary, c. 8.

5 For an overview of diffusion process see Albert, *Turnpike Road System*, and Pawson, *Transport and Economy*.

6 The map was made by F.G. Emmison in 1936. I would like to thank the Bedfordshire and Luton Archives and Records Service and the Bedfordshire Historical Records Society for publishing the map and for providing assistance.

7 For evidence on transport costs see, Gerhold, ‘Productivity Change,’ and Bogart, ‘Turnpike Trusts and the Transport Revolution.’


9 Rick Szostak in his book, *the Role of Transport*, provides a more general argument that better roads and canals led to greater productivity growth in Britain.

10 Details on this petition are available in the *Journals of the House of Commons*, Jan. 18, 1719.

11 See Report from the Select Committee Appointed to Consider the Acts now in force regarding *Turnpike Roads and Highways in England and Wales* (P.P. 1821, IV).

12 Wilson, *Gentlemen Merchants*, pp. 148-149.


16 Pawson, *Transport and Economy*, p. 323-329. Anne Thomas studied opposition to the Lawton and Stoke-upon-Trent turnpike by the inhabitants of Newcastle-under-Lyme. One of the main issues was that the proposed turnpike bypassed Newcastle, and thus reduced trade and services in the city. See Thomas, ‘Geographic Aspects,’ p. 68.


19 According to Donald Ginter, “the county land tax quotas were subdivided by local authority into quotas for each individual parish or township….these local quotas also became traditional and ossified.” This quote is taken from Turner and Mills, *Land and Property*, p. 180. Also see Ginter, *A Measure of Wealth*, for a detailed discussion of the eighteenth century land tax.


21 See Clark, ‘Land Rental Values,’ and Clark, ‘Common Sense’ for more information on the Charity Records.

22 I thank Greg Clark for kindly sharing his Charity data with me.

23 See *Report of the Commissioners for inquiring into the State of Roads in England and Wales* (P.P. 1840 XXVII).

24 I thank Greg Clark for providing the longitude and latitude data.


26 See *Accounts and Papers* (P.P. 1831, XVIII), Comparative Account of the Population of Great Britain in 1801, 1811, 1821, 1831, with the Annual Value of Real Property, 1815.


28 Tate, *A Domesday of Enclosure*. 

31
See Clark, ‘Common Sense.’

Bowen, *Britannia*.

See Mills and Turner, *Land and Property*.

See Clark, ‘Land Rental Values’ for more discussion of the size of Charity plots and its effects on rents.

There is a similar result if we restrict the observations to the years between 1800 and 1815.

This follows from the equivalence of the fixed effect model and the first differences model when there are only 2 years of data. See Wooldrige, *Econometric Analysis*, p. 284, for details.

The coefficient could also be downwardly biased because of measurement error. Some turnpike trusts undertook greater road improvements, and reduced transport costs by a higher amount. The variable $\Delta pike_i$ does not capture this variation and thus the estimated coefficient could be attenuated. Also, the log-linear functional form might be incorrect, resulting in misleading conclusions. Fortunately, Box-Cox tests show that the log-linear model is preferred against the linear-linear model.

Here I am implicitly assuming a linear probability model for the adoption of turnpikes. This is potentially problematic because the predicted probability of turnpike adoption could be below 0 or greater than 1. Below I show that the results are very similar when a probit model is used to predict whether parishes got turnpikes.

The over-identification test regresses the residuals from the second stage property growth regression on the instruments and the other exogenous variables. Test statistic is equal to the number of observations times the R-square, and is distributed as a chi-square with degrees of freedom 1.

As expected, the R-square in the over-identification analysis is very small and the dummy variables for whether the parish was located on a major London route or cross route are insignificant. I also experimented with other instruments like urbanization in 1700 and the log of the land tax per acre. A similar over-identification tests show that both of these variables are not valid instruments, and therefore they were not used.
39 Patricia Rice and Anthony Venables, in ‘Spatial Determinants of Productivity,’ find a similar relationship between wages and population density in the late twentieth century. This finding suggests that agglomeration forces were operating already in the eighteenth century.

40 Clark, ‘Common Sense’.

41 The estimates were obtained using the treatreg command in Stata with the two-step option which specifies that two-step consistent estimates of the parameters, standard errors, and covariance matrix of the model be produced. For a discussion of similar models, see Wooldridge, *Econometric Analysis*, p. 560-62.

42 I also estimated the two-stage least squares model after dropping parishes or boroughs that were urban in 1700. The results show that turnpikes increased property income by 28 percent.

43 The instruments for the turnpike dummy are location on a major London route or major cross route, and the instruments for the fraction of parishes with turnpike within 7.5 miles are the fraction of parishes on major London routes or cross routes within 7.5 miles and the fraction of parishes within 7.5 miles that were urban in 1700.

44 See Bogart, ‘Turnpike Trusts and the Transport Revolution’.

45 The price of wheat comes from Greg Clark’s data on agricultural prices.

46 See Bogart, ‘Turnpike Trusts and Transport Costs,’ for estimates of land carriage rates per ton-mile.


48 Ibid, p. 10.

49 I estimate 34 percent by multiplying 1 minus the tax rate times 41.5 percent or \((1-0.185)*41.5\). Of course, the true figure could be as low as 25 percent and as much as 40 percent, so I view 34 percent as an approximation of the share of rents in total agricultural production costs.

For instance, several Acts created Courts of Small Requests, which adjudicated disputes on credit contracts worth less than 40 shillings. The judges were local merchants who benefited indirectly through the expansion of credit and trade.

See Klein, ‘Voluntary Provision of Public Goods.’


See Clark, ‘Land Rental Values.’

Allen, *Enclosure and the Yeoman*.

It is worth noting that Clark’s estimates of the growth in land rents are lower than Turner, Beckett, and Afton, and thus the proportional contribution of turnpike trusts would be lower using the latter series.

Greg Clark finds a similar figure for the national level. See Clark, “Common Land”.

These estimates are similar to the social savings estimates from turnpike trusts’ contribution to lower freight charges and faster travel times. See Bogart, ‘Turnpike Trusts and the Transport Revolution.’

See Crafts and Harley, ‘Output Growth,’ and Antras and Voth, ‘Factor Prices.’
<table>
<thead>
<tr>
<th>Tax Data</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>1815 Property Assessment per Acre</td>
<td>2.05</td>
<td>10.60</td>
<td>0.06</td>
<td>333.73</td>
</tr>
<tr>
<td>1798 Land Tax Quota per Acre</td>
<td>0.081</td>
<td>0.602</td>
<td>0.001</td>
<td>22.368</td>
</tr>
<tr>
<td>Turnpike Dummy for 1815</td>
<td>0.542</td>
<td>0.498</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of Parishes within 5 mi. with turnpikes in 1815</td>
<td>0.541</td>
<td>0.320</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of Parishes within 7.5 mi. with turnpikes in 1815</td>
<td>0.547</td>
<td>0.257</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Urban 1700</td>
<td>0.008</td>
<td>0.091</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Urban 1801</td>
<td>0.041</td>
<td>0.199</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of Acres Enclosed, 1693-1815</td>
<td>0.188</td>
<td>0.308</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Canal Dummy</td>
<td>0.071</td>
<td>0.258</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Distance to London</td>
<td>196.04</td>
<td>85.56</td>
<td>15.26</td>
<td>561.94</td>
</tr>
<tr>
<td>Distance to the nearest town</td>
<td>6.96</td>
<td>5.30</td>
<td>0</td>
<td>148.28</td>
</tr>
<tr>
<td>Major London Route Dummy</td>
<td>0.129</td>
<td>0.335</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Major Cross Route Dummy</td>
<td>0.067</td>
<td>0.240</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>3108</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charity Records</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Rent Per Acre</td>
<td>1.620</td>
<td>1.752</td>
<td>0.057</td>
<td>32.83</td>
</tr>
<tr>
<td>Turnpike Dummy</td>
<td>0.520</td>
<td>0.499</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of Parishes within 5 miles with turnpikes</td>
<td>0.489</td>
<td>0.368</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction of Parishes within 7.5 miles with turnpikes</td>
<td>0.479</td>
<td>0.309</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>N</td>
<td>1695</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Mean Difference in the Natural Log of Property Income or Land Rents per acre between Parishes or Plots with Turnpikes vs. without Turnpikes

Panel A: Tax Data in 1815

(1) Mean Difference in the log property income per acre in 1815 between parishes with turnpike trusts vs. parishes without turnpike trusts  \(0.20^*\)

(2) Mean Difference in the log property income per acre in 1815 between parishes where the fraction with turnpikes within 5 miles is above the median vs. parishes where the fraction with turnpikes within 5 miles is below the median \(0.20^*\)

(3) Mean Difference in the log property income per acre in 1815 between parishes where the fraction with turnpikes within 7.5 miles is above the median vs. parishes where the fraction with turnpikes within 7.5 miles is below the median \(0.20^*\)

Panel B: Charity Records, 1801-1839

(4) Mean Difference in the log rent per acre for plots in parishes with turnpike trusts vs. charity plots in parishes without turnpike trusts \(0.19^*\)

(5) Mean Difference in the log rent per acre for plots where the fraction of parishes with turnpikes within 5 miles is above the median vs. plots where the fraction of parishes with turnpikes within 5 miles is below the median \(0.12^*\)

(6) Mean Difference in the log rent per acre for plots where the fraction of parishes with turnpikes within 7.5 miles is above the median vs. plots where the fraction of parishes with turnpikes within 7.5 miles is below the median \(0.13^*\)

* indicates that the mean difference is statistically significant at the 90% level or above.
Table 3: Mean Difference in the Natural Log of Property Income or Land Rents per acre between Parishes or Plots with Turnpikes vs. without turnpikes: Within-County Estimates

<table>
<thead>
<tr>
<th>County</th>
<th>(1) Tax Data</th>
<th></th>
<th>(2) Charity Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean Difference in the log property income per acre</td>
<td></td>
<td>Mean Difference in the log rent per acre</td>
<td></td>
</tr>
<tr>
<td>Bedfordshire</td>
<td>0.07</td>
<td></td>
<td>0.21*</td>
<td></td>
</tr>
<tr>
<td>Cambridgeshire</td>
<td>-0.01</td>
<td></td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Hertfordshire</td>
<td>0.28*</td>
<td></td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>Leicestershire</td>
<td>0.28*</td>
<td></td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>West Riding, Yorkshire</td>
<td>0.40*</td>
<td></td>
<td>0.20*</td>
<td></td>
</tr>
<tr>
<td>Buckinghamshire</td>
<td>-0.03</td>
<td></td>
<td>0.38*</td>
<td></td>
</tr>
<tr>
<td>Worcestershire</td>
<td>-0.26</td>
<td></td>
<td>-0.19</td>
<td></td>
</tr>
<tr>
<td>North Riding, Yorkshire</td>
<td>0.25*</td>
<td></td>
<td>0.26*</td>
<td></td>
</tr>
<tr>
<td>Lincolnshire</td>
<td>0.11*</td>
<td></td>
<td>0.15*</td>
<td></td>
</tr>
<tr>
<td>Sommersetshire</td>
<td>0.10</td>
<td></td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Shropshire</td>
<td>0.07</td>
<td></td>
<td>0.37</td>
<td></td>
</tr>
<tr>
<td>Average across Counties</td>
<td>0.11</td>
<td></td>
<td>0.15</td>
<td></td>
</tr>
</tbody>
</table>

* indicates that the mean difference is statistically significant at the 90% level or above.
Table 4: Turnpikes and the Growth of Parish Property Income per Acre between 1693 and 1815: Two-Stage Least Squares Estimates

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Turnpike Dummy</td>
<td>Log Difference in Property Per Acre</td>
</tr>
<tr>
<td>Turnpike Dummy</td>
<td>___</td>
<td>0.272</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0512)*</td>
</tr>
<tr>
<td>Distance to London</td>
<td>0.0001</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(.0009)</td>
<td>(0.0009)*</td>
</tr>
<tr>
<td>Distance to Nearest Town</td>
<td>-0.008</td>
<td>-0.009</td>
</tr>
<tr>
<td></td>
<td>(0.0022)*</td>
<td>(0.0023)*</td>
</tr>
<tr>
<td>Urban in 1700</td>
<td>-0.024</td>
<td>0.506</td>
</tr>
<tr>
<td></td>
<td>(0.0991)</td>
<td>(0.1006)*</td>
</tr>
<tr>
<td>Major London Highway Dummy</td>
<td>0.456</td>
<td>___</td>
</tr>
<tr>
<td></td>
<td>(0.0257)*</td>
<td></td>
</tr>
<tr>
<td>Major Cross Highway Dummy</td>
<td>0.363</td>
<td>___</td>
</tr>
<tr>
<td></td>
<td>(0.0351)*</td>
<td></td>
</tr>
<tr>
<td>Overidentification test statistic</td>
<td>0.93</td>
<td>(p-value)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.33)</td>
</tr>
<tr>
<td>Hundred Dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>3108</td>
<td>3108</td>
</tr>
<tr>
<td>R squared</td>
<td>0.31</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Notes:* indicates statistical significance at the 90% level and above.
Table 5: Turnpikes and the Growth of Parish Property Income per Acre between 1693 and 1815: Alternative Specifications

<table>
<thead>
<tr>
<th>Variable</th>
<th>Two-Stage Least Squares</th>
<th>Treatment Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnpike Dummy</td>
<td>.234 (.050)*</td>
<td>.219 (.044)*</td>
</tr>
<tr>
<td>Distance to London</td>
<td>.002 (.0009)*</td>
<td>.002 (.0008)*</td>
</tr>
<tr>
<td>Distance to Nearest Town</td>
<td>-.007 (.002)*</td>
<td>-.008 (.002)*</td>
</tr>
<tr>
<td>Urban in 1700</td>
<td>.551 (.096)*</td>
<td>.550 (.092)*</td>
</tr>
<tr>
<td>Urban Change</td>
<td>.259 (.048)*</td>
<td>.292 (.044)*</td>
</tr>
<tr>
<td>Fraction of Acres with Common Rights</td>
<td>-.382 (.028)*</td>
<td>-.398 (.026)*</td>
</tr>
<tr>
<td>Canal Dummy</td>
<td>.058 (.032)*</td>
<td>.069 (.030)*</td>
</tr>
<tr>
<td>Overidentification test statistic</td>
<td>2.17 (0.14)</td>
<td></td>
</tr>
<tr>
<td>Hundred Dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>3108</td>
<td>3108</td>
</tr>
</tbody>
</table>

Notes: the dependent variable in both columns is the difference between the log of parish property income per acre in 1815 and the log of the land tax per acre in 1693. * indicates statistical significance at the 90% level and above.
<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turnpike Dummy</td>
<td>.203</td>
<td>.203</td>
</tr>
<tr>
<td>Fraction of Parishes with turnpikes within 7.5 miles endogenous</td>
<td>.393 (.119)*</td>
<td>.269 (.124)*</td>
</tr>
<tr>
<td>Distance to London</td>
<td>.0005 (.001)</td>
<td>.0007 (.001)</td>
</tr>
<tr>
<td>Distance to Nearest Town</td>
<td>-.009 (.002)*</td>
<td>-.008 (.002)*</td>
</tr>
<tr>
<td>Urban in 1700</td>
<td>.484 (.101)*</td>
<td>.478 (.101)*</td>
</tr>
<tr>
<td>Urban Change</td>
<td>.292 (.049)*</td>
<td>.246 (.051)*</td>
</tr>
<tr>
<td>Fraction of Acres with Common Rights</td>
<td>-.410 (.027)*</td>
<td>-.386 (.028)*</td>
</tr>
<tr>
<td>Canal Dummy</td>
<td>.055 (.032)*</td>
<td>.043 (.032)</td>
</tr>
<tr>
<td>Over-identification statistic (p-value)</td>
<td>1.21 (0.54)</td>
<td></td>
</tr>
<tr>
<td>Hundred Dummies</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>N</td>
<td>3028</td>
<td>3108</td>
</tr>
</tbody>
</table>

Notes: In both columns the dependent variable is the difference between the log of parish property income per acre in 1815 and the log of the land tax per acre in 1693. * indicates statistical significance at the 90% level and above.
### Table 7: Changes in the Price Paid to Farmers for a Bushel of Wheat in 1730s and 1740s:

<table>
<thead>
<tr>
<th>Distance to Market in Miles</th>
<th>Market Price of Wheat (s./bu.)</th>
<th>Total Freight Charge (s./bu.)</th>
<th>Price Paid to Farmers (s./bu)</th>
<th>Price Paid if Freight Charges Fall by 20 percent (s./bu)</th>
<th>Percentage Change in Price Paid to Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3.5</td>
<td>0.27</td>
<td>3.17</td>
<td>3.23</td>
<td>2.1</td>
</tr>
<tr>
<td>20</td>
<td>3.5</td>
<td>0.54</td>
<td>2.83</td>
<td>2.96</td>
<td>4.7</td>
</tr>
<tr>
<td>30</td>
<td>3.5</td>
<td>0.80</td>
<td>2.50</td>
<td>2.69</td>
<td>8.0</td>
</tr>
<tr>
<td>40</td>
<td>3.5</td>
<td>1.07</td>
<td>2.16</td>
<td>2.42</td>
<td>12.3</td>
</tr>
<tr>
<td>Average, 0-40</td>
<td>3.5</td>
<td>0.54</td>
<td>2.83</td>
<td>2.96</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Notes: column (3) equals column (1) minus (2). Column 5 is ((4)-(3))/(3)*100. There are small differences due to rounding errors.
Table 8: Turnpike Trusts and the Growth of Property Income and National Income in England

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Percentage of Parishes with Turnpike Trusts by 1815</td>
<td>54.2</td>
</tr>
<tr>
<td>(2) Estimated Percentage Increase in Property Income from Turnpikes (Lowest 2SLS estimate for turnpike dummy)</td>
<td>20</td>
</tr>
<tr>
<td>(3) Percentage Increase in Total Property Income Due to Turnpike Trusts, 1690-1815</td>
<td>11</td>
</tr>
<tr>
<td>(4) Percentage Change in Real Land Rents between 1690s and 1810s</td>
<td>50</td>
</tr>
<tr>
<td>(5) Percentage Contribution of Turnpikes to the Growth in Real Land Rents between 1690s and 1810s</td>
<td>22</td>
</tr>
<tr>
<td>(6) Percentage of Property Income in National Income c1815</td>
<td>15</td>
</tr>
<tr>
<td>(7) Percentage Increase in National Income in 1815 Due to Turnpike Trusts</td>
<td>1.65</td>
</tr>
</tbody>
</table>

Notes: All figures are rounded and expressed in percentages.
Figures

Figure 1: The Annual Number of Acts Creating Turnpike Trusts, 1660-1836.

Source: The data on turnpike acts are found in Albert, *Turnpike Road System*. 
Figure 2: Eric Pawson’s Map of the Turnpike Network in 1770.

Figure 3: Turnpike Network in Bedfordshire

Source: Emmison, F.G., *Turnpike Roads of Bedfordshire*. 