

ENCLOSURES IN SCOTLAND:  
EVIDENCE FROM THE OLD STATISTICAL ACCOUNT  
by

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## **ABSTRACT**

The purpose of this study is to assess the impact of enclosures on total factor productivity in the northeast of Scotland at the end of the eighteenth century. Rent, wage and price data for 49 parishes has been gathered from John Sinclair's twenty volume Statistical Account(1791-1798). Each of the parishes is characterised by the state of enclosure, land classification, market access, and whether or not lime, marl and turnip husbandry were in use. Economic analysis and statistical methods are used to assess the relationship between these variables, rent differentials and total factor productivity. The main findings of this study indicate that there were efficiency gains from enclosure and that those gains accrued to both landlords and to farm workers. These results have important distributional implications, and point to the different experience of rural workers in England and Scotland at this time.

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TO MY FAMILY,  
WITH LOVE AND THANKS

## 1. INTRODUCTION

The highland clearances of the early nineteenth century have become a defining moment in Scottish cultural history. Poems, stories, and ballads lamenting the loss of a way of life continue to be part of the Scottish ethos, especially among the descendants of those who were forced to emigrate to Britain's colonies. The removal of peasants from the land, and their replacement with sheep is considered by some to be one more example of the betrayal of the poor by the rich (Prebble, 1963). Scholarly historians are more reticent in their assessment of the significance of the clearances. For them, the story is more complex. Not only did resource constraints and high birth rates ensure that periods of scarcity were frequent in the region, but the Highland economy was also hindered by "low agricultural productivity, poor climate and primitive transportation systems..." (Devine, 1988). Some historians assert that the significance accorded the Clearances is misplaced, that it was only one part of a series of changes that marked the transformation of a backward, subsistence-based agrarian economy to a more productive, market-oriented system. This transition to capitalist farming is thought to have been one of the preconditions necessary for Scotland's "take-off" in the 19th century (Smout, 1998).

Misplaced or not, the drama surrounding the Highland Clearances hides a similar process that was of no less importance in the lowland regions of Scotland. That is, the enclosure of the previously open arable and common fields during the last half of the eighteenth century. Enclosure can be defined as "the extinction of common rights which



people held over the farm lands and commons of the parish, the abolition of the scattered holdings in compact blocks, [and] a reallocation of holdings in compact blocks”(Mingay, 1997). In contrast to England, those rights may not have been legal in Scotland, but they were traditionally acknowledged. In both countries, enclosure represented a distinct change in the institutions and the technology of farming.

Proponents of enclosure were driven by the widespread belief that enclosure led to higher yields, and to more efficient farm management. The old, more communally oriented system was seen to be barbaric and entirely inefficient (Sinclair, 1824). Contemporary observers such as Arthur Young believed that increased farm size, farm consolidation, and enclosures led to increased employment, but with an even greater increase in output per acre. This increased productivity is thought to have resulted in land rents that were double or triple their level prior to enclosure.

Writing in the 19th century, Marx countered that enclosure led to increased labour productivity as the result of increasing returns to scale on the large enclosed farms. That is, these more efficient farms required less employment per acre (Allen, 1992). Marx writes that “the systematic robbery of the Communal lands helped...to swell those large farms, that were called in the 18th century capital farms or merchant farms, and to ‘set free’ the agricultural populations as proletarians for manufacturing industry”(Marx, 1867). Marx specifically refers to Scotland, citing the case of the Duchess of Sutherland who evicted about 15,000 of her tenants between 1814 and 1820. Her highland estate lands of

close to 800,000 acres were transformed into 29 sheep farms, while the tenants were forcibly relocated to marginal land along the west coast (ibid. 802).

While there does not appear to be a major debate about the efficacy of enclosure among Scottish scholars, economic historians continue to debate the importance of enclosure to English economic development. That debate centres on the degree to which enclosure actually increased agricultural productivity, who benefited, and the appropriateness and limitations of different approaches used to measure those benefits<sup>1</sup>. Deirdre McCloskey can be credited with inspiring much of the quantitative analysis of enclosure since the 1970s (McCloskey, 1972). The focus of her groundbreaking article was enclosure, and why open field farming had persisted for so long given general agreement that it was highly inefficient. She presents a framework that is simple, yet firmly grounded in economic theory.

Under the assumptions of labour and capital mobility, McCloskey argues that land rents can be used as an indicator of productivity differentials among land holdings. McCloskey's article created a splash in the scholarly community because it brought the issue of enclosures into a more formal framework of analysis. Rather than taking the benefits of enclosures for granted, McCloskey set the process of enclosure into a neo-classical context and subjected it to cost/benefit analysis. Since her analysis is based on the 200 percent increase in rents cited in the early literature, McCloskey concludes that

the net benefits of enclosure were relatively high, yielding an estimated rate of return of 17 percent per year (McCloskey, 1975)

McCloskey cautions that one needs to control for the effects of other improvements which may have been occurring at the same time as enclosure but which were inconsequential to enclosure itself. That is, it may have been these new methods that led to higher productivity, and thus the higher rents that were paid after enclosure (*ibid.*). Rents would also be greater in parishes where population density was high, such as those with substantial manufacturing activity or those close to urban centres. Another factor to be taken into account is that the land may have been undervalued prior to enclosure if it was held under a long lease. This would come about if rents were fixed when the prices of agricultural output were low so that at the time of enclosure, the marginal product of land may be higher than the rent paid per acre.

While McCloskey did not attempt to assess her argument empirically, the article spurred economic historians to delve into numerous archives in search of data that could be used to create the more formalized measures of productivity suggested by McCloskey's approach. Allen's work on the farms surveyed by Arthur Young in the 1760s did just that. Cross sectional data from 231 farms was used "to estimate parameters like farm efficiency conditional on a farm's being open or enclosed" (Allen, 1982). In his study, he constructs geometric indices of factor costs and output prices,

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<sup>1</sup> An introduction to some of the various positions in the debate, see the archives of the EH.Res Forum at

which are then used to deflate the ratio of Ricardian surplus in enclosed and open farms. This methodology “provides a basis for decomposing relative surplus per acre into relative efficiency and relative output-input price variations”(ibid.). In his larger work, *Enclosure and the Yeoman* (1992), Allen points out that the contention that enclosure led to increased efficiency is based on two types of evidence. First, that changes in land use led to the adoption of improved methods more frequently among enclosed farms. To account for this possibility, it is necessary to identify which methods came along with enclosures and which were instituted prior to enclosure. Furthermore, one can assess which of these factors contributed to higher yields and greater labour productivity. The second type of evidence is based on whether rents did in fact rise after enclosure, and if so, whether the increased rents were the result of increased efficiency, or alternatively, a redistribution of income from farmers to landlords (ibid.).

Firstly, Allen compares the rents paid on these farms to the actual value of the land which he determined using the concept of the Ricardian surplus - that is, the revenue of each farm less the opportunity cost of the non-land inputs. The purpose of this experiment was to determine whether increased rents after enclosure were due to the renegotiation of previously open field leases which had been set in some past time and were rented at below market rates. Allen's findings show that this was the case for open or partially open farms. Allen notes that since rents accounted for about one third of this surplus, if they were raised by a factor of two and a half times, the surplus would

disappear. Thus "the conventional wisdom of the eighteenth century that enclosure doubled or trebled rents" is consistent with these results (ibid.).

Allen also shows that Ricardian surplus can also be used as a measure of farm efficiency, but in terms of total factor productivity (TFP). Rather than providing a measure of the productivity of individual factors of production, TFP is a broader measure of "output relative to the utilisation of all factors of production rather than just one as in output per acre or per worker"(ibid.). Using this approach, Allen countered the generally accepted belief that rent increases following enclosure reflected higher productivity. Rather, he argues that they represented a re-distribution of income from farmers to landlords. When rent differentials are adjusted to account for differences in land quality, enclosed farms appear to have been no more efficient than open farms.

In his study of farms in the Paris basin, Philip Hoffman uses the methodology suggested by McCloskey and Allen for calculating total factor productivity (Hoffman, 1991). That is, he combines information on rental rates, output prices, wages and other input prices to track productivity growth over time. Hoffman suggests that this approach is more reliable in assessing productivity growth than those using actual output per acre or output per worker. Not only are reliable statistics on yields difficult to obtain, but yields fluctuated considerable from year to year, and from one area of a farm to another making comparisons between time periods difficult. For studies using cross-sectional

data, this problem would seem to be of less significance, but the difficulty of finding good yield data remains a major constraint.

To assess the effect of enclosures on the productivity of northeast Scottish farms, one needs to find data on prices, quantities and/or rents. Fortunately, such a source exists. The Old Statistical Account (OSA) is a twenty-one volume compilation of parish surveys undertaken between 1790 - 1798 by Sir John Sinclair who at the time was the President of the Board of Agriculture<sup>2</sup>. A long list of questions was sent to parish ministers, covering most of the important economic, demographic, and social conditions in the respective parishes. While most of the surveys were returned within the first two years, some ministers took several years to return their report and required a considerable amount of encouragement. There is also great variety in the depth of information in the accounts. While most ministers did provide a wealth of information, only a few parish accounts have complete records of output quantities, wages, input and output prices, acreage under cultivation, and land rents. Nonetheless, many have at least some combination of at least two or more of the variables necessary to compare rental rates, wages and prices in open, enclosed, and partly enclosed parishes.

In this study, I make use of this resource to assess rent differentials and relative total factor productivity (TFP) in open, enclosed and partly enclosed parishes in five counties in the northeast region of Scotland. These counties are Angus, Kincardine,

Aberdeen, Banffshire, and Moray<sup>3</sup>. Statistics on average rent per acre, grain prices, and wages for 49 of the 202 parishes in this region was gathered, as well as qualitative indicators for whether the parish was enclosed, partly enclosed or mostly open. The writers of the accounts also provided information about the use of turnips, lime or marl, and whether there was a good road by which farmers could transport goods to market. Distance to market was provided in many of the parish accounts, and where this information was lacking, an estimate was made based on nineteenth century Ordnance Survey Maps of Scotland. Each parish was also assigned an agricultural land capability classification based on maps obtained from the Macauley Institute for Soil Research in Aberdeen, Scotland.

This paper will be divided into three sections. In the first, I present a brief overview of some of the distinctive features of the Scottish rural economy, including some of the historical and geographic factors that are relevant to agricultural productivity. Next, I examine the variation in land rents among 49 of the parishes and find that there are regional differences in rents that can, in part, be explained by differences in land quality and distance to market. Enclosure status is then included in the analysis to determine if rents were in fact higher in enclosed parishes than in open parishes. The results suggest that this was the case, and in the next section, I extend the analysis to

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<sup>2</sup> See Turner, M.(1997) for an interesting account of Sinclair's unsuccessful attempt to extend the parish by parish account to England.

<sup>3</sup> Represents the two counties of Nairn and Elgin. Only 1 of the 4 parishes in Nairn had enough data to be included in the study. Since these two counties have traditionally been joined together as Moray, I have done so here.

assess whether this rent differential is the result of higher productivity, or is more likely to be due to other factors that have thus far been omitted from the equation.

To accomplish this, I introduce the economic framework for analysis by which land rent differentials can be used to assess relative total factor productivity differentials among the parishes. I will provide an overview of the theoretical basis of this method, the assumptions necessary for it to be valid, and the potential drawbacks of such an approach. Since the use of rental rates alone requires strong assumptions about land characteristics, technology, and the prices of inputs and outputs, this section extends the analysis by incorporating these factors in the analysis. The results suggest that of all the factors considered in this study, enclosure status and distance to market contributed the most to total factor productivity differentials among parishes in the northeast of Scotland.

## **2. GEOGRAPHIC AND HISTORICAL BACKGROUND**

Any study of agricultural productivity needs to take into account the different soils and climatic conditions of the areas under study. This is particularly true for British agriculture since its landscape varies considerably across regions. As Langton points out, the physical geography of Britain is probably more varied "than that of any other area of similar size on Earth (Langton and Morris, 1986). However, the island can be broadly differentiated into two distinct classifications: highland and lowland. These two divisions are of considerable importance in assessing the agricultural productivity of particular areas in Scotland. Central and northwestern Scotland are mountainous regions with high



annual average rainfall, often receiving more than 40 inches per year (ibid.). The heavy rainfall, low temperature, and near constant cloud cover in these regions "make the ripening of cereal crops less certain than in the south and east"(ibid.). Thus, the geography and climate make the highland regions more suitable for grass growing and pasture as opposed to arable farming.

The south and eastern regions of Scotland have variable topographies and climates, but are more in line with those in England. The east coast strip, stretching from the Moray Firth in the North to Berwick on the border with England has an annual rainfall similar to that in central and eastern England, though has a lower average summer temperature than more southerly regions of England. Apart from a few pockets in Banff and Aberdeen, the soil along the northeast coast tends to be loamy, well drained and highly fertile. As one moves inland, the soil becomes heavier and is differentiated into stony loam and rocky peat which is poorly drained. As a result, farmers along the coast were primarily engaged in arable or mixed arable and pastoral husbandry, while those in the upland areas concentrated on raising livestock. However, even in the most remote and inhospitable highland regions, some oats and barley were cultivated. Of the five major regions in Scotland, the Northeast region, including the counties of Nairn, Elgin, Banff, Aberdeen, and Kincardine and Angus(or Forfar)<sup>4</sup> represents the largest distinct area with common market centres as well as similar topographies, climate, and soil conditions. That is not to say that it is a homogeneous region, but each of the counties in

this area has some endowment of the geographical factors conducive to productive agriculture.

Given its relatively inhospitable climate and limited endowment of good quality soil, hardy grains such as oats and barley were the principle crops throughout Scotland. These crops were grown in a system quite distinct from the traditional three-field rotation of England. In Scotland, fallowing was not usual. Instead, the farm was divided into infield and outfield. The infield, the best land closest to the farmhouses, was in constant cultivation and received all the manure from the byre, or stableyard (Whittington, 1973). Usually the infield was divided into three fields with one third sown with barley (or its variant, bere) and two-thirds with oats. The outfield often lay in patches some distance from the farmhouses and was usually of poorer quality soil. Here, a form of shifting cultivation was practiced in which an area would be broken up, the livestock folded (grazed) on it over the summer before it was ploughed and then sown with oats. Whittington writes that "this crop was grown continuously without further fertilisation until the land was incapable of returning the amount of seed necessary to sow the land the following year"(ibid. 533). At this point, the land was returned to its natural state for a period of three to five years and a new area was brought into cultivation.

While there were some regional differences, this type of field system was common throughout Scotland until the 18<sup>th</sup> century. A pattern of farm settlements

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<sup>4</sup> In some studies, the northeast region excludes Angus, in others it is included, sometimes with Perthshire.

resulted that was also a product of the feudal relations upon which traditional agriculture was based. While in some ways similar to the compact village of English countryside, in Scotland the farm communities were much smaller, usually only a few families sharing in the cultivation of the surrounding fields. Small groupings of farmhouses were clustered together into a *fermtoun* or *clachan*, the number of dwellings reflecting the number of families sharing in the cultivation of the surrounding fields. Adams explains that the difference between settlement size in England and Scotland up to the 18th century was due to the tenure relations. In Scotland, "the proprietor could call on his tenants for labour, and there was thus no need for a free labour force housed in a village"(Adams, 58).

Despite the decline of feudal relations, land ownership remained highly concentrated in Scotland. In the northeast, "the Atholl estates consisted of over 20,000 acres of both hill and fertile lowland..."(Adams, 1978, 58), and there were a handful of other families such as the Gordons, Forbes, Cumines, and the Earls of Fife, who controlled the great majority of the lands in the region. In fact, it is estimated that there were 7798 landowners in Scotland at the end of the 18th century, representing less than one percent of the population (Sinclair, 244). The only class of small landowners were those known as *feuers*, or *portioners*, whose holdings were mostly in the vicinity of larger villages or burghs, but these were so few in number that they cannot be "compared as a class to the English small farmer or yeoman"(Adams, 58).

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(Devine, 1984; Carter, 1979).

Traditionally, the Lairds (Lords) were the patriarchs of a highly stratified and paternalistic social system. The vast majority of the remaining population either paid rent, usually in the form of services or in grain, for the right to farm the land or worked as farm or house servants to the tenant farmers and proprietors. In the last half of eighteenth century, most of the tenants had written leases, some with longer terms than in the past, up to 19 years in length. Even so, short leases persisted and many of the writers of the OSA cited this factor as one of the greatest bars to improvement. Those with longer leases were the minority, and short leases would be a major disincentive for farmers to make improvements on their farms. Another potential tenant could offer the landlord a higher rent at the end of the lease leaving the improving tenant worse off for their efforts. In fact, some farmers developed strategies to prevent this occurrence. For example, "the farmer tried to improve his ground for 9 or 10 years, and the remainder of his lease, he scourged and over-cropped it" so that he did not have to "leave the fruits of his laborious and painful industry to another; a stranger, perhaps, or even an enemy, who has long envied him"(OSA vol. 11, 158; vol. 12, 310).

Besides the shortness of leases, another disincentive against the improvement of farms by the tenants reflected the power differential in the countryside. These rules, referred to as *thirlage*, required that tenants bring their grain to the landowner's mill. John Sinclair justifies this practice by suggesting that there was an important reason for this form of bondage when the new water mills were first erected (Sinclair, 1825). Only

by imposing this restriction could the proprietor be ensured of an adequate clientele to offset the costs of erecting the mill. Still, the practice was seen to be tyrannical, as tenants were forced to carry their corn to the landlord's mill, paying a certain share to the miller (usually about a fifteenth). By the end of the 18th century much protest was made against this monopolistic system and in the early 19th century acts of Parliament were passed which led to their abolition (ibid.).

Apart from the bondage to the mills, tenants in the old system tenants were required to perform services for the landowner as part of their rent payments, whether in the form of work at harvest time, gathering fuel, carrying produce to the markets, building roads, repairing fences and other structures. However, by the end of the 18th century, these service requirements had been reduced significantly from times past and the majority of the rents were paid in money and in grain. Despite its remnants in some form or another in the more remote parishes, the gradual elimination of services reflected the growing trend towards a money economy and facilitated the transition from subsistence farming to a more profit oriented system.

Before the changes of the later eighteenth century, rural society was highly stratified. At the top were tacksmen, often kinsmen of the Laird, who in turn rented out land to tenants (Whittington, 547). The tenants could rent portions of their land to sub-tenants (at a higher rent per acre than they are paying), requiring them to perform their services to the Laird, assist in the harvest, and other obligations. Below the tenants and

sub-tenants were crofters and cottagers who held small portions of land either from a tenant or from the Laird directly. These people usually worked as farm or house servants and might receive a yearly salary as well as their house and acreage as wages (Smout, 1998). Other servants and labourers were landless, sleeping in the master's barn or in a corner of the kitchen and receiving their meals as part of their wages.

For those who did have access to land, there were three types of tenancy agreements: multiple, joint, and single tenancies. As Whyte points out, it is important to differentiate between "holdings" and "farms"(Whyte, 1979, 137). In multiple tenant holdings, a farmer may rent his portion directly from the Laird, yet farm those holdings as part of a larger farm along with the other farmers with holdings in the same fields. In joint tenancies, groups of tenants would farm jointly, all being responsible for the rent, and each receiving his share of the harvest. Through the 17th century, this "pattern of agriculture in which two or more tenants worked together in the joint cultivation of a farm was common or dominant"(Whyte, 1979). In the Highland areas, 10-12 families farming together was more common. It is these two types of tenancies that were characterized by the system of scattered strips that prevailed over much of Western Europe. In Scotland, the scattered holdings were referred to as "run-rig". Sinclair writes that this system developed as a way for farmers to "divide the good and bad soil equally among the husbandmen" that united them "in the common cause when their property was in danger of depredation"(Sinclair, 229). These constraints are thought to have provided

the impetus for the development of a variety of communally oriented groupings in which tenants pooled their resources to minimise risk and allocate labour efficiently.

Single tenancy arrangements were the norm by the end of the eighteenth century in lowland areas. Farmers rented whole farms, as opposed to scattered holdings, directly from the landlord. While joint tenancies were thought to have prevailed through the 18th century, more recent surveys of estate rentals reveal that single tenancy agreements had overtaken multiple tenancies in the lowland areas, even by the end of the 17th century. On the Panmuir estate in the northeast county of Angus, only 29.7 percent of tenancies in the parishes of Lethnot and Nevar were jointly held in 1728, and by 1785 that share had fallen to 6.5 percent (Devine, 1994). Similar trends are found in the examination of eleven other estates in several regions of Scotland (*ibid.*). By the middle of the eighteenth century then, single tenancies had become the dominant form of tenure.

These trends contrast with the situation in the highlands, where in the traditional clan system of the Highlands, efficiency of the land was measured by its ability to support the maximum number of people, presumably to maintain the power of the Laird. Power, for the Laird, was measured by his ability to call up a large standing army to defend his territory (Whyte, 138). In fact, there are a number of references in the Old Statistical Account to the division of holdings, as opposed to consolidation, in many upland parishes. This reference to division should be differentiated from that in which the interspersed ridges are divided up among the tenants, and consolidated into compact

holdings.<sup>5</sup> For example, in the Sutherland parish of Tongue, the increased population since 1755 was attributed to the subdivision of farms. The creation of several smaller farms from one large one was thought to stimulate "employment and provision for a greater number of people, encourage industry and early marriage, and increase the natural attachment to their native soil"(OSA vol.3, 523). Here is evidence of a redistribution of land that favours those at the bottom of the social hierarchy. It is ironic that in just over two decades, this same county would become famous for its radical policy to reduce the population of humans in favour of sheep.

Apart from these few instances of division, it was consolidation of farms that was far more prevalent throughout the eighteenth century. Run-rig was seen to be inefficient, and "as long as this injurious system prevailed, all attempts at improvement were in vain"(Sinclair, 229). These inefficiencies were thought to come from a number of sources: intermingling of strips discouraged individual effort since any changes required the agreement of the other tenants (the assumption being that they would have been averse to change); the furrows between the ridges represented a waste of land; the system was a source of disputes since the close proximity of strips may have led to the inadvertent tossing of rocks and weeds from one tenant's strip to his neighbour's. Thus, run-rig was believed to foster old methods and to hinder tenants' willingness to adopt new methods and techniques. Consolidation of the intermingled strips, enlargement of

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<sup>5</sup>See Turner(1984). He notes that division in Scotland often refers to change in tenure whereas enclosure would refer only to the physical process of erecting fences. Even so, both appear to have been part of the same process, even in Scotland.



farms, and physical enclosure of the fields were believed to provide antidotes to these problems, and to result in higher yields.

There were practical reasons for physically enclosing the open fields, particularly in areas of mixed pastoral and arable farming. In these regions, fences prevented the livestock from trampling on the arable fields or from consuming the growing crops, and meant that the cattle could be night pastured rather than being brought into the byre every evening. In the past, the herdsman (or hind) had performed these duties, but enclosure made this position on the farm redundant. Enclosure was seen as "the fastest means of increasing productivity and rental"(Devine, 1994). Moreover, enclosure represented the physical demarcation of private holdings and was the final step in a process of institutional change from traditional, communally based farming practices, to individual operations oriented toward the market and profit maximization.

The transformation of agriculture during the last half of the 18th century is thought to have been a crucial factor in Scottish economic development. In 1700, it is estimated that five percent of the population lived in urban areas of 10,000 or more, compared with England and Wales where 14 percent resided in such large towns. Yet, by 1800 Scotland had become "one of the five most urbanized societies in Western Europe alongside England and Wales, the Netherlands, Belgium and Northern Italy"(DeVries cited in Devine, 1994). The rapid pace of Scotland's urbanization after 1750 stands in contrast with the more gradual process of urbanization in England and Wales. For

example, from 1700 to 1750 the percentage increase in urban population was 42 percent in England and Wales, while in Scotland the increase was 124 percent<sup>6</sup>. Between 1750 and 1800, there was more rapid urbanization throughout Britain with a rise of 83 percent in England and Wales and 132 percent in Scotland (Devine, 36).

This rapidly increasing urban population, driven largely by the growth of textile manufacturing, is thought to have had important implications for the agrarian sector (ibid.). Not only was there a fast - growing market for its produce, but the industrial demand for labour created a pull on the rural populace. Scottish farmers could achieve the increased output for the growing population by expanding the area under cultivation or by increasing the productivity of the existing fields. Enclosure is one of the factors thought to have facilitated that rise in productivity. Testing the voracity of this claim forms the remainder of this paper.

### **3. LAND RENTAL RATES IN THE NORTHEAST OF SCOTLAND**

A broad definition of rent is “the share of the produce taken by the landlord for the use of the soil and for the equipment of the farm”(Thompson in Turner, 1997)<sup>7</sup>. In a competitive market, rents are determined by the relative scarcity of land and the degree to

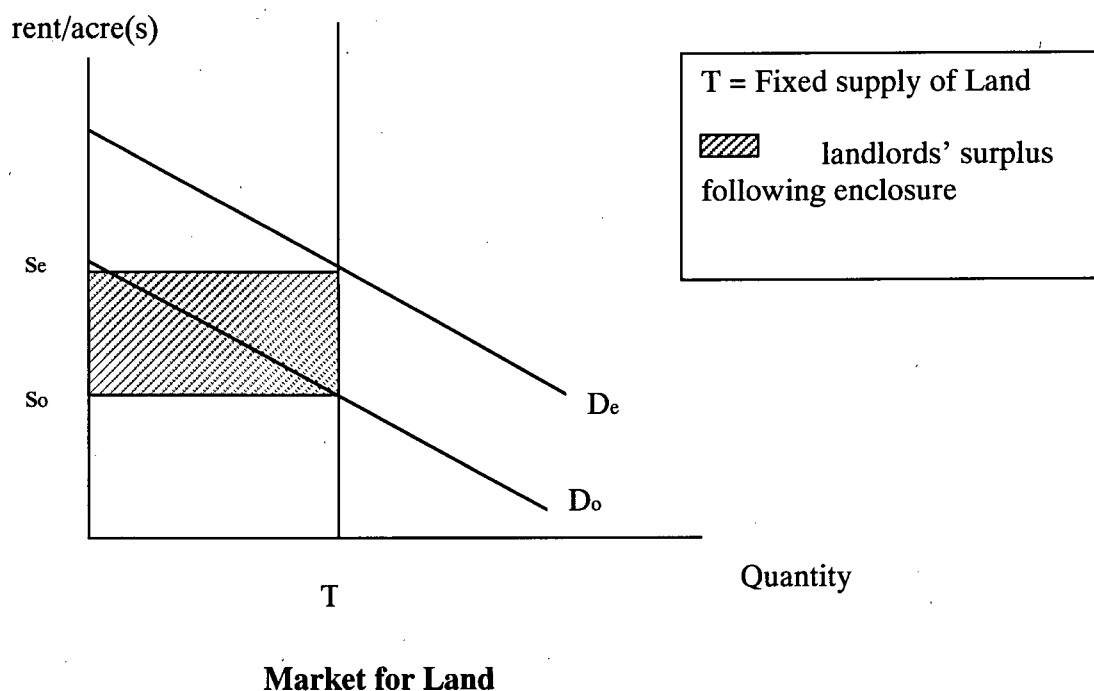
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<sup>6</sup> Still, even in 1801, only 17 percent of the population lived in towns of 10,000 or more(McDonald, 1937).

<sup>7</sup> Rental rates should be differentiated from Ricardian rent. The latter refers to the excess of revenues over the costs of labour and capital inputs, but as Allen(1992) notes, “the classical economists believed that farm rents tended to equal Ricardian surplus plus rates.”

which its use is demanded for economic activity. In Scotland, the quantity of arable land was essentially fixed so any increase in productivity would result in an increase in the demand for land, and a corresponding increase in rents. This relationship can be represented by the graph in Diagram 1.

**Figure 1**



An important consideration is whether rents were based on market prices, or by traditional practices such as in-kind payments, or services. If services were less prevalent in enclosed parishes than in open parishes, this would exaggerate the rent differential between the two. That is, service requirements increased the costs to farmers so one would expect rents to be lower where services were required. Additionally, where rents were paid as a fixed percentage of output, then one cannot assume competitive markets

for land. Reference is made to both of these practices in the *OSA*. As the pace of change quickened in the last half of the eighteenth century, rental payments were increasingly made in money terms, though grain rentals and services remained in some areas, especially in highland regions. In most lowland parishes, services had been all but abolished by the 1790s. Even where rents were made in terms of grain, it appears from the accounts in the *OSA*, that the rents were frequently calculated on the basis of the market price of grain, rather than on a particular share of output. Reference would be made to the market price of land, and a grain equivalent was then calculated based on the going price of oatmeal or barley<sup>8</sup>.

If rental rates do reflect market prices for land, then we can use them in a cost function, and hence an index for assessing total factor productivity differentials among open and enclosed parishes. I will be using the methodology developed by Allen (1982), but with rental rates rather than Ricardian surplus representing the cost of land in each parish<sup>9</sup>.

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<sup>8</sup> In some highland parishes in-kind rent payments persisted, but this did not appear to be the case for the parishes studied here.

This can be represented as follows:

**Figure 2**

$$\frac{A_e}{A_o} = \left[ \frac{\frac{s_e/s_o}{\left(\frac{p_e/p_o}{1/\gamma}\right)}}{\left(\frac{w_e/w_o}{\alpha}\right)^{1/\gamma} \left(\frac{r_e/r_o}{\beta}\right)^{1/\gamma}} \right]^\gamma$$

where  $A$  represents total factor productivity in either open(o) or enclosed(e) parishes,  $s$  is the average rent per acre(in shillings),  $p$  represents output prices,  $w$  input prices,  $r$  the rental rate of capital inputs,  $\gamma$  is the assumed share of total costs farmers pay in rent,  $\beta$  and  $\alpha$  are capital and labour shares respectively<sup>10</sup>.

If we assume labour and capital to have been perfectly mobile, and that markets for agricultural products were perfectly competitive, this formulation simplifies to:

$$\frac{A_e}{A_o} = \left\{ \frac{s_e}{s_o} \right\}^\gamma$$

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<sup>9</sup> A calculation of Ricardian surplus requires output quantities in order to determine revenues. The number of parishes with this information in the northeast sample was too small to do so.

<sup>10</sup> A full derivation of this model is in Appendix 1.

Thus, the total factor productivity differential between open and enclosed parishes simply becomes the ratio of rental payments in enclosed parishes over those in open parishes raised to  $\gamma$ , the share of rents in total costs<sup>11</sup>.

Several measures of rent are provided in the *OSA*. The rental statistic that is provided most frequently is that of the "valued rent" of the entire parish, a valuation in Scottish currency undertaken by the Court of Teinds in the late seventeenth century (*OSA*). Since these figures do not reflect the market price of land in the 1790s, they have not been made use of in this study<sup>12</sup>. The writers of the parish accounts also provided figures for average rents per acre. It is these rental rates that are the focus of this study since they are the stated average for arable land in the parish. Of the 202 parishes in the northeast region, a sample of 88 parishes was isolated where some measure of rents per acre was indicated and where the status of enclosures was provided. While some accounts gave one figure for the average rent per acre in the parish, in a number of cases some range was given for inferior land and another for the best land. For example, in the mostly enclosed parish of Fordoun, rents for "inferior land" were 3-10 shillings, and 15-20 shilling for "best land"(*OSA* vol. 4, 496). In some of these accounts, a breakdown of acreage into infield (best) or outfield (inferior), pasture, woodland, and waste was provided so that a weighted average of the rental rate for the parish could be calculated. Unfortunately, it was not all that common for this breakdown to be provided. Where no

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<sup>11</sup> In a perfectly competitive market, total costs would equal total revenues.

<sup>12</sup> It may be that valued rent could prove useful if used to assess the change in the value of land between the two periods, but more research would be needed to clarify the basis of this valuation.

distribution of acreage for the different rental rates was provided, an average of the two ranges was assumed. This will have overstated the rents in parishes where more than half the land was "inferior" or "open" and understated rents in those parishes where more than half the land was of high quality or enclosed<sup>13</sup>.

A "Total Rent" statistic in pounds Sterling is also provided in the accounts, representing the total rent both in money and in produce, paid to the landowners<sup>14</sup>. One could calculate the average rent per acre of the parish by dividing this figure by the total acreage, but this would not provide an accurate indicator of the market price of land. If the sample includes parishes in which other productive activities play a role, such as fishing, quarrying, or manufacturing, then this measure of rent for agricultural land would over estimate its market value. When such a calculation is made, the resulting average rents are considerable lower, about 1/6, the average rent figures provided in the accounts. This arises because arable land usually comprised a relatively small share of the total land in a parish. Other types of land use include wastes and tree plantations.

In contrast, the average rents provided in each of the parish accounts appear to be careful estimates of the price of agricultural land. These rents have been used for all of the analysis in this study. They are first grouped by county to determine if there is a

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<sup>13</sup> While this may result in some sample bias, it is hoped that there would not be a systematic bias upward or downward for open or enclosed parishes alone. In future work, one might analyse these two types separately.

<sup>14</sup> It would appear that this information often came directly from farmers and landowners themselves. In some cases, the writer comments that there was some hesitancy on the part of the landlords to divulge this information and in such cases either an estimate was made or no rental information was provided.

regional basis for the variation among them. The results are presented in Table 1, and show that average rents are, on average, higher in the two southerly counties of Kincardineshire and Angus.

**Table 1**  
**Comparison of Average Rent by County**

<b>County</b>	<b>Average Rent/Acre n=88</b>
Aberdeen	12.71
Banff	11.93
Moray	14.15
Kincardine	15.52
Angus	16.13

We would expect this regional variation in rents to be primarily based on differences in soil quality, climate and distance to markets. The more productive the soil, the more favourable the climate, and the closer that land is to markets, the more it will be desired by farmers. Given that the supply of land is fixed, rents will be bid up above the rents of poorer quality land further from markets. Ideally then, we would want to classify each of the parishes by some geographical characteristics such as soil quality, altitude, and climate. Many of the accounts do make mention of the physical attributes of the parish, including whether the soil in certain areas is loam or clay. However, these



designations are rather sketchy, and it was not often possible to determine the proportion of each parish having a particular soil type.

Unfortunately the land classification system most often used for studies of England and Wales does not include Scotland<sup>15</sup>. To resolve this problem, a series of maps of an agricultural land capability classification system for Scotland was found and has been generously provided on loan from Jim Gould at the Macaulay Institute. There are other land classification systems that do include Scotland, but these tend to be based on land use rather than on the inherent quality of the land for agriculture. Obviously, land use has changed in the last two hundred years, so these other systems are not useful for this study. On the other hand, the Macaulay classification system not only includes a soil classification, but also incorporates climatic features such as temperature and wind exposure in their classifications.

There are six classes, with the first four indicating land that is suitable for arable cropping. Of these four, the first two classes represent land that is capable of producing a wide variety of crops with high yields. Class 2 is limited in minor ways by "wetness problems, slightly unfavourable soil structure or texture, moderate slopes or slightly unfavourable climate"(Bibby, 1985). There are a few pockets of the latter, but no Class 1 land in the study region. Class 3 land is the most prevalent type in the northeast of Scotland. It is characterised by land that is "capable of producing good yields of a

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<sup>15</sup> British Ministry of Agriculture, Fisheries and food, Land Classification(1955)

narrow range of crops, principally cereals and grass, and/or moderate yields of a wider range including potatoes, some vegetable crops..."(ibid.). Class 4 is limited by moderately severe wetness, occasional floods, shallow or very stony soils, moderately steep gradients, ... [and a] moderately severe climate..."(ibid.). Classes 5 and 6 are more suited to grasslands and rough grazing and have been combined into one, Class5. Each of the parishes has been matched to the maps and a designation made that is based on the predominant land capability class for that parish.

Apart from the quality of land, one would expect rents to be higher in parishes closer to key market towns. Of the 35 parish accounts in the sample where some mention of the direction of trade was mentioned, 30 reported that grain was exported to other regions in Scotland or to foreign markets. Proximity to market reduced transportation costs and increased access to goods unavailable in the more remote regions. Inland regional markets were an important part of the rural economy, and many of these provided a central point at which farmers in a region could both sell produce from the farm, and buy those goods which he did not produce himself. While there was exchange of grain at these markets, the principal destination for the surplus grains produced in the northeast of Scotland was ultimately Edinburgh, Glasgow, and even farther afield to London or the Baltic region. It also seems that, in some cases, the more profitable crops were exported from a parish while the cheaper barley, bear, potatoes, and turnips were either produced within the parish or imported from other areas.

Given the role of export markets then, the distance to a major market with shipping facilities would affect rental rates more than the distance to a regional market that tended to only function several times a year, monthly, or at most once a week. In fact the parish account will often make a comment on the distance that farmers must travel to take their grain to market. This will be followed by the name of the market, most often Aberdeen, Montrose, and Dundee, in the eastern and southern coasts of the region, or Portsoy, Banff, and Lossiemouth in the north. It may be the case that these regional markets were important though, especially for those parishes that produced a surplus of dairy and meat products, so it would probably be a good idea to account for them in future work.

**Table 2**  
**Rents and Geographic Characteristics of Parish**

<b>Dependent Variable = Rent</b>		
<b>Independent Variables: n=49</b>	<b>Estimated Co-efficients:</b>	<b>t-statistic</b>
Land Capability:	0.994	(0.5266)
Class 2		
Class 4	0.0543	(0.0117)
Class 5	0.3945	(0.1604)
Distance to Market	-0.1772 ‡	(-1.953)
Constant	15.043	(18.63)
Omitted Variable - Class 3 land	R-squared adjusted: = 0.04	

‡: significant at the 10 percent level

The results of an OLS regression of rental rates on both distance and a series of dummy variables representing the land capability classes indicate that rental rates were not significantly higher in parishes with Class 2 land than in those with Class 3. These results are shown in Table 2. Nor were they significantly lower than those in parishes with Class 4 or 5. This may arise because there is not a great degree of variation in land qualities between parishes. Most parishes are comprised predominantly of Class 3 land. Table 3 shows the percentage of parishes in each county with the different land types.

**Table 3**

**Distribution of Land Capability by County(% of Parishes)**

<b>County (with number of parishes in sample)</b>	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>	<b>Class 5</b>
Aberdeen (39)	0	77	18	3
Banff (10)	0	90	0	10
Moray (13)	16	46	23	15
Kincardine (9)	33	67	0	0
Angus (22)	27	68	0	5

The importance of distance is confirmed though, with each mile a parish is from a major market reducing rents by 0.18 shillings per acre. That is, rent in a parish that is 15 miles from a major market, will be 1.80 shillings higher on average than a parish that is 5 miles away, all other factors being equal. The small R-square indicates that there are important variables excluded from the model. That is, that land capability and distance to

market explain only a small share of the variation in rental rates in the sample of parishes presented here.

The next issue to explore is the role of institutions and technology that might result in rental rate differentials. In particular, we will look at whether enclosures play a role in explaining the variation in rents across parishes. A first step in the evaluation of the effect of enclosures would be to determine whether rents per acre were in fact higher in parishes where all or the great majority of farms were enclosed compared to those where farms were largely open. An intermediate category of enclosure, partly enclosed, was also created to account for those parishes where enclosure was underway, but only represented a minority of the farms or acreage in the parish. If enclosure status is included in a regression equation of rents distance, there is an increase in the adjusted R-squared (to 0.20). Table 4 shows the outcome of this regression. The equation was estimated for both a linear and a non-linear relationship. A Box-Cox regression provided an incrementally better fit than the OLS, but for ease of interpretation, only the OLS results have been reported here<sup>16</sup>

One might be concerned that the best land was enclosed first, or that markets tended to be concentrated high quality land, so that there is an association between the land, distance, and enclosure variables. If this were the case, then any regression results might be affected by multicollinearity. That is, we might erroneously find a relevant

variable insignificant<sup>17</sup>. The PCOR option in Shazam was employed to test whether there is correlation between any of the independent variables.

**Table 4**  
**Rent Differentials, Enclosure, Land, and Distance**

<b>Dependent Variable: Rent</b>		
<b>Independent Variables:</b> <b>n=49</b>	<b>Estimated Coefficients:</b>	<b>t-statistic</b>
Enclosed	4.8809†	(3.304)
Partly Enclosed	0.8904	(0.6750)
Class 2	-0.3356	(-0.1897)
Class 4	1.6713	(0.3931)
Class 5	1.6682	(0.7347)
Distance	-0.1939‡	(-2.34)
Constant	13.783	(13.80)
<b>Omitted Variables:</b> Open parishes and Class 3 land	<b>R-squared</b> <b>adjusted =</b>	

†significant at the 1 percent level  
‡ significant at the 5 percent level

The resulting correlation matrix of coefficients suggests that there is no clear correlation between enclosure and the land variables, but that there may be a correlation between distance to market and land classes 4 and 5. One might expect to find this result since these land types were usually in the regions farthest from the coast and thus most distant

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<sup>16</sup> A Box-Cox regression is used to test for the non-linearity of a regression equation(Kennedy, 1998)

<sup>17</sup> Type II error.

from the major markets. Finally, there was no relationship apparent between enclosure and distance to market.

Since low correlation coefficients does not always rule out the possibility of multicollinearity, further testing seems called for. A common test is to run a series of auxiliary regressions to assess whether each of the explanatory variables is correlated with the others. These regressions suggest that there is a greater likelihood of parishes in Class 2 land being enclosed, and less likelihood of parishes being enclosed in Class 4 and Class 5 land. We can see how land types are distributed among enclosed, partly enclosed, and open parishes in Table 5. Distance to market was negatively associated with Class 2 land and positively associated with Class 4 and 5 land. This reflects the results from pcor test above for the same reasons. Distance to market was not associated with enclosure status.

**Table 5**

**Distribution of Parishes by Enclosure and Land Capability(Percent)†**

	<b>Class 2</b>	<b>Class 3</b>	<b>Class 4</b>	<b>Class 5</b>
<b>Enclosed(11)</b>	27	73	0	0
<b>Partly(14)</b>	7	86	0	7
<b>Open(24)</b>	18	75	4	13

† Number of parishes with each type of enclosure status is indicated in brackets.

While the above tests do confirm that there is collinearity between some of the explanatory variables, what may be relevant for this study is the degree of that multicollinearity. Condition indices can be made us of and are thought to provide a more

reliable test for multicollinearity (Kennedy, 1998; Gujarati, 1988). Moderate multicollinearity is suspected if the condition index is between 10 and 30, while if the value of a condition index is greater than 30 then severe multicollinearity is indicated. The PC command in Shazam will perform such a test. The highest value in the resulting condition indices was 3.6327, suggesting that multicollinearity, if it exists, is probably a minor problem.

Thus far in this study, I have shown that rental rate differentials in the northeast of Scotland can be partially explained by differences in the distance to market, and whether or not the farms in the parish were enclosed. The impact of these factors is not inconsequential, but they do not approach the cited premiums on enclosed land cited in much of the literature. The OLS results for this sample suggest that rental rates in parishes that were enclosed appear to have been approximately 34 percent higher than rents in open parishes. This figure is in line with Greg Clark's findings in his work on Charity Commission rents. In those studies, he found that rents on enclosed land were 29 percent more than open, significantly less than the doubling or tripling often claimed.

If we were to accept the McCloskey story that labour and capital were mobile, then this rent differential would reflect a productivity differential of 10.25 percent<sup>18</sup>. Certainly, this represents a small return relative to the costs of enclosure. The question

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<sup>18</sup> That is,  $\frac{A_e}{A_o} = \left\{ \frac{s_e}{s_o} \right\}^{\gamma} = \{1.34\}^{1/3} = 1.1025$  if land's share is 1/3 of total costs.



remains, however, whether these rental rate differentials do indicate productivity differentials. What if McCloskey's assumptions are unrealistic for Scotland at this time? In the next section, I bring input and output prices into the analysis to test these assumptions and to incorporate them into a total factor productivity measure for each parish.

#### **4. WAGES AND PRICES**

By the eighteenth century, agricultural markets were well developed in Scotland. Trade had long been an important part of the Scottish economy, with grain, cattle, linen, and spirits the primary export commodities. Until 1795, prices were rising relatively slowly in Scotland, but following the commencement of the Napoleonic War, there was a rapid price inflation. Since the parish accounts were completed between 1791 and 1798, inclusion of any parish accounts referring to prices after 1795 would probably result in biased estimates. To prevent this problem, only those accounts that were based on parish circumstances up to and including 1794 were included in the study. Fortunately, the great majority of accounts refer to this earlier period so the overall usefulness of the 20 volumes is not significantly diminished by this problem.

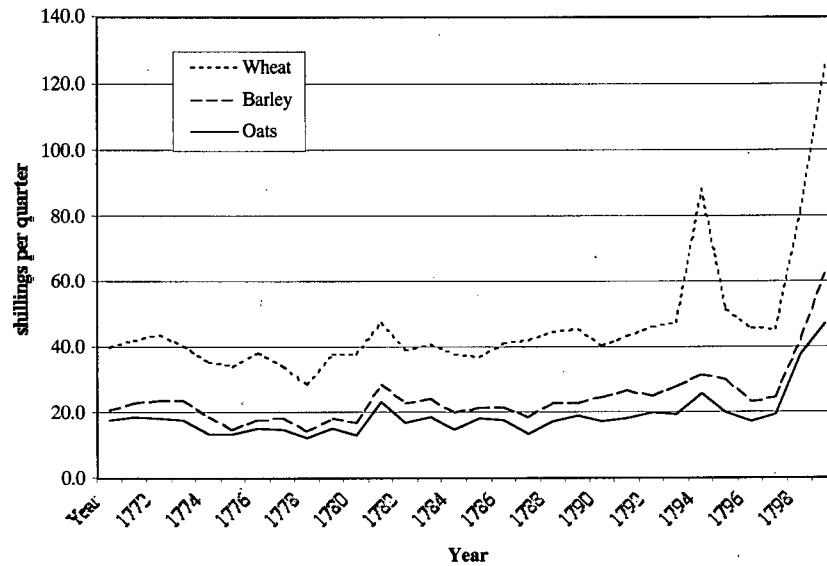
#### 4.1 Output Prices

With external markets having an important role, one would expect output prices of agricultural products to be determined outside of regional markets, especially outside any given parish. The creation of a weighted output price index for each parish was beyond the scope of this study. Such a task would have required a much more detailed study of each parish to determine the distribution of acreage under various crops, the relative role of livestock, fisheries, and other activities, and their corresponding prices. Certainly, it would be a worthy addition to future work, but the parish accounts indicate that the main source of revenue for most farms in the northeast was the sale of oatmeal and barley. Since these were by far the most prevalent crops grown in the region, and oats usually accounted for 2/3 of the grain output, making use of oatmeal prices as a proxy for the output price index seems reasonable, at least for this preliminary study. Furthermore, it appears from Charts 1 and 2 that oatmeal and barley prices moved together, so any parish by parish differential in oats prices probably reflects barley price differentials as well<sup>19</sup>.

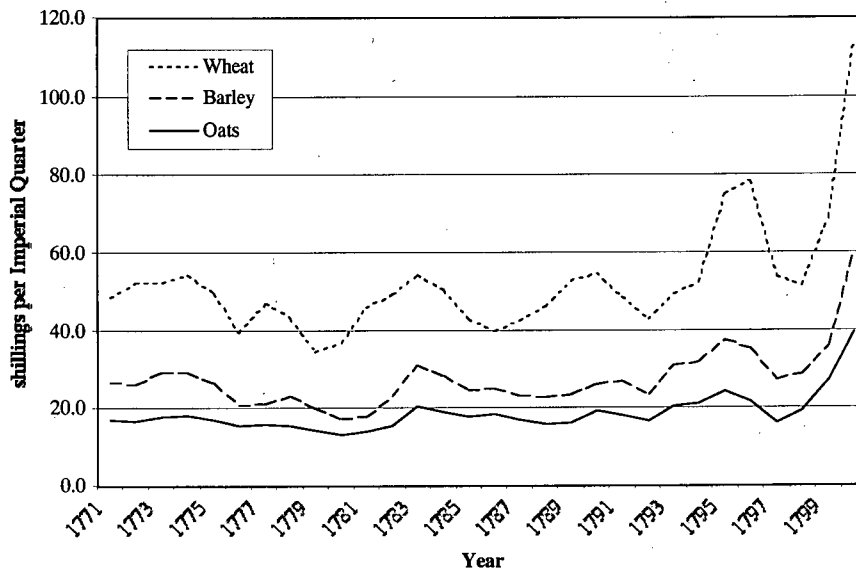
What is at issue here though, is whether the price of output was different in open and enclosed parishes. If it is true that enclosure led to more efficient farms, and prices were determined in local or regional markets, then we would expect that output prices in

### Diagram 3

Average Price of Grain at Haddington Fairs(1771-1800)  
Source: Hamilton, H. (1963)



Average Grain Prices, England and Wales(1771-1800)  
Source: Mitchell, B.R. (1990) British Historical Statistics



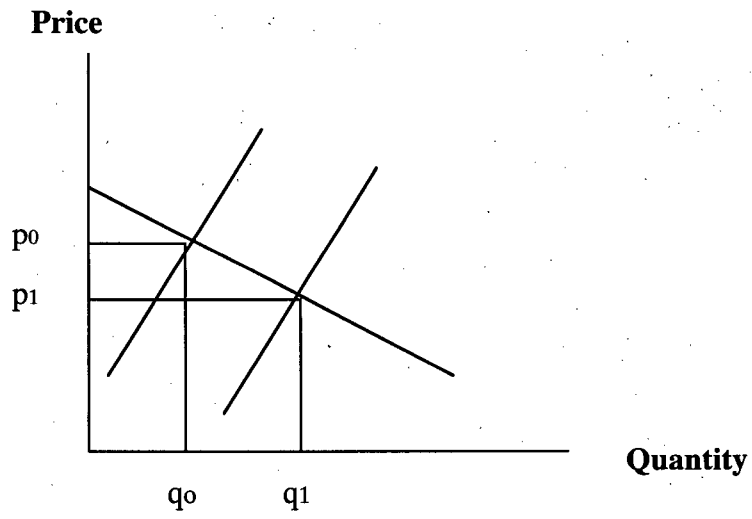
enclosed parishes would be lower than those in open parishes. In effect, the institutional and technological change embodied in enclosure may have led to higher productivity by improving yields, or by reducing the amount of labour required per acre. In either case, the result would be a reduction in unit costs in enclosed parishes, a corresponding increase in supply, and a fall in the price of oatmeal<sup>19</sup>.

In contrast, if parishes in the northeast were price takers, one would expect to find no difference in the price of oatmeal among the parishes, whether open or enclosed. Any decreased costs due to efficiency gains from enclosure would translate to higher profits in those parishes relative to open ones. . Diagram 2 shows these interactions. Oatmeal prices were gathered from the parish accounts that also had information related to rental rates and enclosure status. Several tests, using a variety of functional forms, were performed to determine whether prices were higher in enclosed parishes than open parishes or if distance to market was a factor. The results in Table 4 suggest that there is no significant relationship between output prices, distance to market and enclosure status. That is, it would appear that local grain markets in the northeast of were integrated with the larger national and international markets.

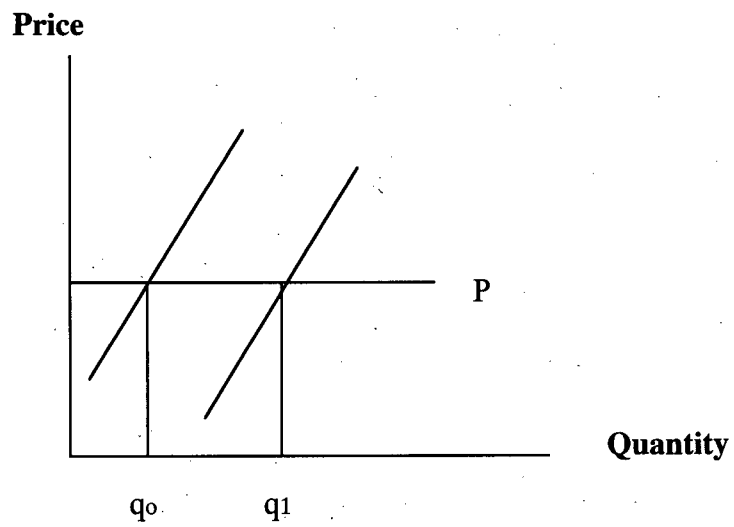
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<sup>19</sup> The units of measurement for grain prices for Haddington(Scotland) were converted from bolls to English quarters so that prices in the two charts could be compared.

**Figure 4**  
**Oatmeal Markets**



**Local Market**



**Broad Market**

**Table 6**  
**Oatmeal Prices, Enclosure and Distance to Market**

<b>Dependent Variable: Price of Oatmeal</b>		
<b>Independent Variables: n=30</b>	<b>Estimated Coefficients</b>	<b>t-statistics</b>
Enclosed	0.2679	(0.4338)
Partly	-0.0356	(-0.06152)
Distance	0.0218	(0.6303)
Constant	13.143	(34.15)
Omitted Variable: Open	R-squared adjusted = -0.09	

#### **4.2 Wages and Labour**

The results in the previous section suggest that output prices did not vary on the basis of state of enclosures in a parish. That does not necessarily follow for wages. McCloskey argues that English labour in the eighteenth century was mobile. That is, labour markets were regional rather than local. If, as Arthur Young believed, enclosure resulted in higher productivity and an increase in the demand for labour, then any temporary increase in wages would be bid down as other workers moved into the enclosed parish in response to higher wages<sup>20</sup>. As a result, farm labour does not benefit from the increased productivity of enclosures. If, on the other hand, enclosure led to increased efficiency through a reduction in the number of workers demanded per acre, then labour would have been released from the rural areas. It is this surplus agricultural

labour that is thought to have provided the manpower for industry. It is in this sense that landlords and those with access to land would have benefited from enclosure, while labour did not.

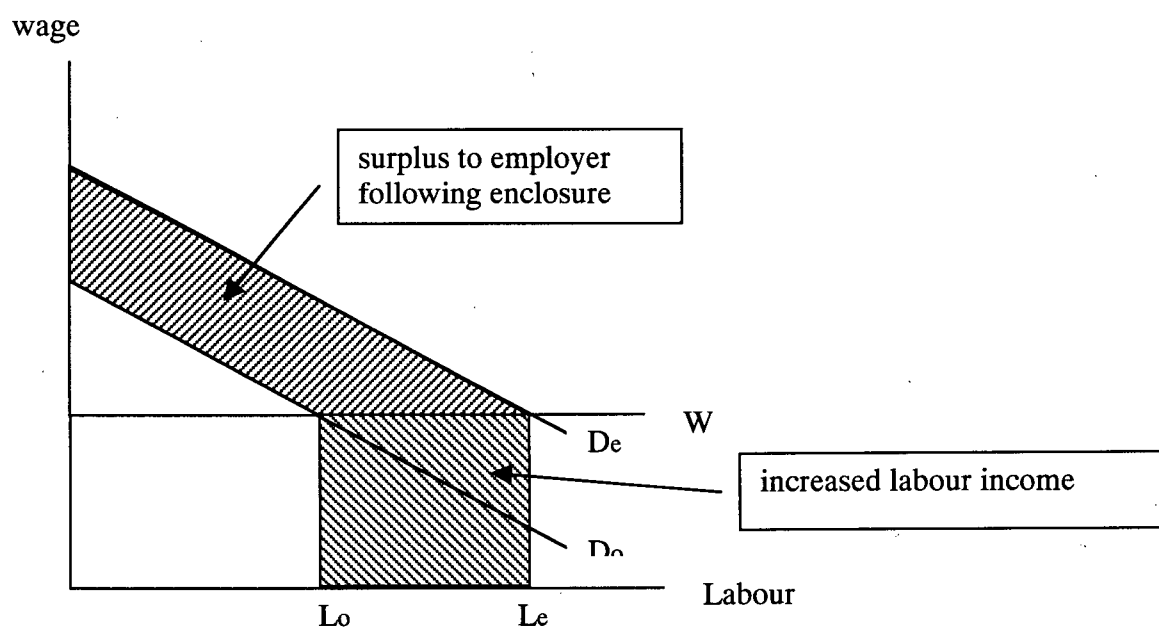
What if labour is not mobile though, so that wages are determined locally rather than regionally? Here, the story would be quite different. We can see the difference in the two types of labour markets in Diagram 2. With a regional labour market, we would expect labour supply to be quite elastic, so that any increased demand for labour does not result in an increase in the wage rate. In contrast, where labour supply is either perfectly inelastic or upward sloping, then an increase in demand would result in an increase in the wage rate. In this case, the increased efficiency gains from enclosure may go to labour as well as to land. While it is true that there was increased movement of the population from rural to urban areas during this period, it is not clear that labour was so mobile that wages were equalized across the country or even across a region such as the northeast. For example, suppose the majority of the population of Scotland at this time was engaged in agriculture, and that labour supply was relatively inelastic. If enclosure resulted in an increase in the demand for labour in those parishes, the wage would rise in those parishes since workers in other parishes prefer to remain where they are. Alternatively, if there were a reduction in the quantity of labour demanded in enclosed parishes, and rural labour supply was inelastic, we would expect to see lower wages than in open parishes.

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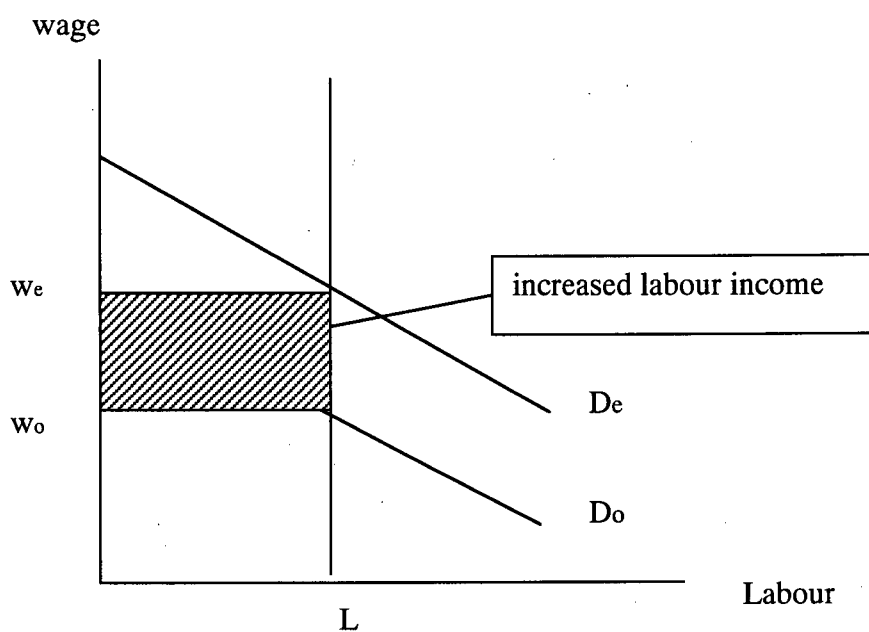
<sup>20</sup> The equalisation of wages would only be the case if enclosure was an isolated phenomenon. If enclosures were prevalent, wages would still rise in general equilibrium.

Figure 5

(a) Regional Labour Markets



(b) Local Labour Markets





Wage data was gathered from the parish accounts to test whether McCloskey's assumptions about labour mobility are relevant to Scotland. A cursory survey of all 202 parishes reveals an apparent difference in the wages paid for day-labourers in the more southerly counties of Kincardine and Angus compared to those in Aberdeenshire and the northern counties. The writers report the wages of various occupations, such as wrights, bricklayers, masons farm servants, and day-labourers. The latter two types of workers are of relevance to the farm employment. Day-labourer was chosen as the source of wage differentials, since they would probably be the most mobile of workers, and thus have the most competitive wage in all regions. Furthermore, farm servants often received a significant share of their wages in the form of in-kind payments. This would make any comparison of wages between parishes highly suspect. Since it is likely that the wages of day-labourers and farm servants moved together, using only those of the day-labourers should be adequate.

Once the focus was placed on the wages of day-labourers, it was necessary to clarify what the wage rate included. Most writers stated whether or not the wage rate included victuals(meals or grain), and in several accounts, the value of those victuals was provided. The majority of accounts provided the wage including victuals so it was this wage rate that was used. Where the account stated wages without victuals, the information on the value of victuals(2 pence per day) was used to adjust those observations. This method should minimise the problem of measurement bias as long as the price of victuals is constant throughout the sample. As we saw in the section on

output prices, there was not a significant variation in oatmeal prices in the region, so the assumption of the money equivalent for victuals seems appropriate.

A sample of 70 parishes was used to test whether there was a regional variation in wage rates. An OLS regression of wages on county dummies revealed that wages in Kincardine and Angus were significantly higher than the 7.03 shilling per day<sup>21</sup> average in Aberdeenshire. In Kincardine, the average wage was 1.7 shillings higher, while in Angus the difference was 2.70 shillings. Wages were also regressed on distance to market to see if this might explain some of the regional differences. The results indicate that this is not the case. At least some of this wage differential could be explained by the fact that the major manufacturing centres were located in or near these counties. While the major urban center of Aberdeen is located in the county of that name, it lies just over the River Dee that forms the county boundary with Kincardine. Therefore, many of the northern parishes of Kincardine would have closer access to Aberdeen than a good many of the parishes in the more distant areas of Aberdeenshire itself. Furthermore, more parishes in the two southerly counties would be proximal to Montrose and Dundee where a considerable concentration of manufacturing existed.

It may also be the case that wages were higher where there was a significant level of rural industry. For example, in some parishes there were such activities as bleach mills, weaving, and distilleries. Depending on the interaction of the relative supply and demand

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<sup>21</sup> all day-labourer wage rates include victuals

for urban, rural industrial workers, and farm workers, workers in these rural enterprises may have been paid a higher wage. If labour was not very mobile, then the wages of farm workers may have been bid up in these parishes. An assessment of the significance of rural industry is beyond the scope of this study, but should form part of any future work. Such an assessment should be possible since most writers identified the existence of manufacturing in their parish, and many provided a breakdown of the population by occupation. Thus, it may be possible to determine the role of rural industry on wages, and more importantly, on the overall productivity of the parishes.

These issues aside, the primary focus of the present study is to assess the role of enclosures on rental rates and total factor productivity. The above sample of 70 parishes was matched with the sample of parishes in which rental rates and enclosure status was provided. The resulting sample of 50 parishes was tested to determine whether there is a relationship between wage rates and enclosure status. The results are presented in Table 7 and show that wages appear to have been significantly higher in enclosed parishes than open parishes. Even in partly enclosed parishes, wages appear to have been higher, though by a slightly smaller degree. This wage premium supports an argument that at least some of the benefits of enclosure accrued to labour in Scotland. Furthermore, the existence of a differential also indicates that wages should be included in an assessment of total factor productivity differentials among open and enclosed parishes.

**Table 7**  
**Wages and Enclosure**

<b>Dependent Variable: Wages of day-labourers</b>		
<b>Independent Variables:</b>	<b>Estimated Coefficients:</b>	<b>t-statistic</b>
Enclosed	1.8155†	(3.144)
Partly	1.6019†	(2.873)
Constant	7.0345	(24.06)
Omitted Variable: Open Parishes	R squared adjusted = .2013	

† significant at the 1 percent level

### 4.3 Capital

The next stage in creating a factor cost index for the assessment of total factor productivity is to assess the variation in the cost of capital. The rental rate of capital is defined in the following way:

$$r = (i + d)P_K$$

where  $i$  is the opportunity cost of capital,  $d$  is the depreciation rate, and  $P_K$  is the price of capital inputs.

There are several types of capital inputs that are utilised in agriculture. These include financial capital, seeds, livestock, and equipment such as ploughs and carts. A comprehensive index of capital input prices would include the prices of all of these, each being deflated by their share in total costs. A number of parish accounts do refer to the return on capital since the parish's church funds were usually held in an interest bearing account. A survey of the accounts suggests that the usual rate of return was 4.5 - 5 percent. For the present study, it has been assumed that this rate was uniform throughout the northeast region. This seems reasonable, since at this point in Scottish economic history, capital markets were linked to the London financial markets. However, farmers also made use of physical capital in the form of farm equipment, cattle, and horses. Obtaining a parish by parish account of the prices of these forms of capital has proven to be an extremely difficult task. While many of the parish writers included statistics for the number of ploughs, carts, horse, cattle and sheep in their accounts, only a few of those accounts that included the relevant rental, enclosure and wage data also provided details about the prices of these capital assets.

Since farming implements were of simple construction during this period, it seems reasonable to assume them to be the same across parishes. The evidence on grain prices would support the contention that seed prices are also uniform across parishes, but taking such an assumption about the expected return of livestock seems more problematic. Unfortunately, the prices of cattle, horses, and sheep, when they were given, were not always clear on the size or unit upon which the price was based. Even

so, with the cattle trade with England playing a significant role in the Scottish economy, it is more probable that cattle prices were determined outside of any given parish in the northeast. The question of whether livestock in enclosed parishes were healthier is worth considering though since it would affect the depreciation rate of capital. That is, if it is true that the quality of cattle in enclosed parishes was higher, even if all farmers paid the same price for their livestock, depreciation would be lower, and thus the return to capital would be higher in enclosed parishes.

Despite these reservations, the rental rate of capital will be assumed equal across the sample. I have also assumed that seed prices are uniform across parishes since the evidence on grain prices would support such a contention. Further research would need to be undertaken to determine the appropriateness of these assumptions and whether they play a significant role in productivity differentials among open and enclosed parishes.

## 5. TOTAL FACTOR PRODUCTIVITY

The analysis so far suggests that the assumption of competitive markets for output and capital is reasonable. Therefore, the average rental rate figure for each parish has been adjusted to account for labour costs only. It should be pointed out that the resulting calculation of TFP for each parish does not provide a measure of the level of TFP since it omits a number of factor and output prices that have been assumed equal across parishes. What it does provide us with is a proxy by which we can assess relative TFP in open and enclosed parishes. The same sample of average rent data that was used to assess rent differentials was adjusted by the following formula<sup>22</sup>:

$$tfp = s^{\gamma} w^{\alpha}$$

where  $s$  is the average rent per acre,  $\gamma$  land's share in total costs,  $w$  the wage of day-labourers, and  $\alpha$  labour's share in costs.

These TFP indicators for each parish were subjected to the same sequence of regression analyses as the sample consisting of rental rates alone. Assumptions have been made about the exponents in the above equation, with land usually accounting for 1/3 of costs, and labour also 1/3. Sensitivity tests were performed to determine whether the results are significantly affected by different assumptions made about these factor

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<sup>22</sup> See appendix II

shares. The results of the preliminary regressions for regional and land quality variables were similar to those for rents alone. Only the results of the regression of TFP on the land, distance and enclosure variables are reported here in Table 8.

The results of these regressions are highly suggestive that the factors contributing the most to productivity differentials among parishes in the northeast, are enclosure and distance to market. The sensitivity tests reveal that the estimated coefficients on the significant variables are not terribly responsive to different assumptions about the relative shares of land and capital. For example, under the base assumption that land and labour each account for 1/3 of costs, the TFP differential between enclosed and open parishes is about 20 percent. Whereas, if we use the factor share of 25 percent that Hoffman found for land in French farms, TFP is only 2 percent lower. Even if land were to comprise 50 percent of total costs, the productivity differential between open and enclosed parishes would only be 25 percent. Similar results were found when labour shares were altered. Essentially, the results in Table 8 appear to indicate that enclosure did result in an increase in efficiency in the northeast of Scotland, but that those efficiency gains were modest.

### **5.1 New Methods**

Besides enclosure, there are other factors that are thought to have contributed to increased efficiency in farming during the seventeenth and eighteenth centuries. These



include the use of turnips and calcium-based fertilisers such as lime and marl. Many of the *OSA* accounts indicate whether these technologies are in use on the farms in the parish. Dummy variables were created to indicate whether or not these technologies were made use of in each of the parishes. The results indicate that turnips and lime technology in this sample of parishes do not significantly affect productivity differentials. This does not mean that they were not important. Rather, the use of turnips was almost ubiquitous in the region with 45 of the 49 parishes in the sample indicating the use of turnips. Lime and marl were also in general use, with 78 percent of these parishes making use of these fertilisers in their fields. What benefits arose from lime and turnips had already been achieved, even on farms that were open.

## **5.2 Landlords**

Another factor that is continually referred to in the accounts is the number of residing landlords. In fact, many writers lament the poor state of agriculture in the parish and point to the fact that there are few or no residing landlords present as the primary bar to improvement. Some of the parish observers see residing landlords as the sole instigators of positive change in the parish, with farmers being seen as backward and resistant to new methods. Even Sinclair regarded this as an extreme view, and most accounts point to the considerable constraints faced by the tenants.

**Table 8**  
**TFP with Enclosure, Land, and Distance to Market**

<b>Dependent Variable: TFP</b>		
<b>Independent Variables: n=49</b>	<b>Estimated Coefficients:</b>	<b>t-statistics</b>
Enclosed	0.8933†	(4.980)
Partly Enclosed	0.3988†	(2.486)
Class 2	0.2355	(1.105)
Class 4	0.2642	(0.5115)
Class 5	0.1293	(0.4687)
Distance	-0.0324†	(-3.203)
Constant	4.5118	(32.93)
Omitted Variables: Open parishes and Class 3 land	<b>R-squared adjusted = 0.46</b>	

: Significant at the 1 percent level

Furthermore, tenant farmers may have been justified in their aversion to potentially risky new crops or rotations when the sole source of income for most families at this time was the harvest of these crops. Several ministers referred to this aspect of justified risk aversion in their accounts. In his *Analysis of the Statistical Account of Scotland* John Sinclair counters the opinions of those proprietors who attribute the slow progress of change on the farms in their estates to the backwardness of their tenants.

"On the subject of caution and prudence in the farmer, it is remarked, that such proprietors as are bent on improvement, are too apt to complain of the slow progress of new methods among their tenantry, which they erroneously impute to stupidity or obstinacy.; but, considering how many richer people have suffered deeply by experiments and speculations in husbandry, it is lucky for landlords, that tenants are, in these particulars, not so venturous as proprietors. Indeed with a heavy rent hanging over them, and their credit and livelihood at stake, it behoves them, not only to see before they believe, but to be somewhat easy in their circumstances, before they hazard new schemes, or hastily lose sight of those cautious habits, which originally enabled them to carry on their business to advantage"(Sinclair, 1825).

With tenant farmers so constrained, residing landlords were seen to have the local knowledge, financial resources, and economic power necessary to effect change. Non-residing landlords were the majority though. They were criticised for their lack of contribution to the national wealth, since they "wantonly expend, in foreign countries, the income derived from the labour of their tenantry(ibid.)" In contrast, residing landlords who had an established residence in the parish were considered to be more likely to take an interest in the long-term development of their estates (ibid.). Sinclair adds that the "residence of proprietors is justly considered of the highest importance to the

improvement of a district. By introducing into the farms in their own possession, the most improved modes of managing the different kinds of soil, they exhibit an example to their tenants, by which a change of culture is produced..."(ibid.).

It is not clear that landlords should be credited with all the improvements in agriculture. Yet, capital did tend to be concentrated in the hands of the owners of land, and in the eighteenth century, this class was increasingly comprised of successful merchants and businessmen, as opposed to the landed aristocracy. As Smout writes, landowners provided the fixed capital for enclosure and reconstruction of farms, instigated the building of roads and harbours, and were the prime investors in rural enterprise, especially textile industries(Smout, 1964). If there is a close relationship between landlords and these infrastructure and capital projects, there could be an increase in productivity where there was a greater presence of landowners.

Surveys of the parish accounts suggest that the changes most frequently instigated by "improving landlords" include the introduction of sown grasses, turnips, and clover, a regular rotations of crops, drainage, new implements, enclosure, and the re-organisation of the fields so that they have clearly defined structure and boundaries. If it is true that residing landlords played such a role, one would expect to find a close association

between a them and a high cost venture such as enclosure. The results of a regression of enclosure on a residing landlord variable are shown in Table 9<sup>23</sup>.

**Table 9**  
**Enclosure and Residing Landlords**

<b>Dependent Variable:</b> Enclosed		
<b>Independent Variable:</b>	<b>Estimated Coefficient</b>	<b>t-statistic</b>
Residing Landlords per 1000 acres	0.8071	2.806
Constant R-squared Adjusted = 0.11	-0.0107	-0.1136

The fact that there is an association between enclosure and the density of residing landlords adds weight to the argument that landowners had an important role to play. Ideally, one would wish to assess the importance of the specific methods credited to these landlords to determine to what degree they affect productivity differentials among the parishes. Unfortunately, the variety of new rotations, and the paucity of detailed references to many of the new methods in this particular sample suggest that the task of assessing the relative role of these improvements in Scotland must be left to future work. Nonetheless, it may be that some measure of the presence of landlords in a parish may act as a proxy for these improvements. If it were true that landlords were the leaders in introducing new technology, then one would expect to find a positive relationship between such a variable and the indicator for productivity. While it is the actual number

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<sup>23</sup> Three variables were tested – number of residing landlords, residing landlords per 1000 population and

of residing landlords in a parish that is cited as the important factor, a more suitable statistic may be to determine the number of resident landlords for a given level of population or per square mile. The estimates for all three variations were found to be significant when included in the regression equation, but only the estimate for the equation with the number of residing heritors per 1000 population is shown in Table 9<sup>24</sup>.

**Table 10**

**TFP and Landlords**

<b>Dependent Variable = TFP n=49</b>	<b>Estimated Coefficients:</b>	<b>t-statistics</b>
Enclosed	0.9137†	(5.290)
Partly	0.3923†	(2.608)
Distance	-0.0359†	(-4.192)
Lime	-0.1329	(-0.7732)
Turnips	0.2223	(0.8635)
Residing Landlords per capita	0.0917‡	(1.976)
Constant	4.6617	(14.91)
Omitted Variables: Open, Class 3	<b>R-squared adjusted = 0.52</b>	

†: Significant at the 1 percent level

‡: significant at the 5 percent level

This result appears to confirm the claim that landlords may have had a positive impact on improving efficiency in farming in Scotland. Still, the precise nature of the relationship

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residing landlords per 1000 acres. Only the latter showed a significant relationship.

between landlords and productivity is not clear, so caution is called for in interpreting the results<sup>25</sup>.

## 6. CONCLUSION

The findings in this paper support the argument that efficiency gains were to be had from enclosure. The premium of 20 percent is smaller than those claimed by eighteenth century proponents of enclosure, but they are significant. Even if landlords received only half of the returns through increased rent, they would have been enough to spur the expense and effort of enclosure. The other major finding of this paper is that labourers in enclosed parishes were better off than their open field counterparts. The existence of a wage premium in enclosed parishes suggests that labour requirements were higher in these parishes relative to open ones. This fact points to the complexity of the enclosure issue and the importance of acknowledging the different conditions in Scotland and England.

As Jack Goldstone points out, "...there are many kinds of enclosures at different times and in different places"(Goldstone, 1998). In the case of Scotland, it might be helpful to think of enclosure as comprising two distinct processes. In the first, the consolidation of the intermingled holdings, the creation of one farm out of several small holdings, and the loss of access to common wastes and pastures resulted in a reduction in

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<sup>24</sup> Once again, a Box-Cox regression was performed, but the results were not significantly different than those from an OLS so only the latter are reported for ease of interpretation.

the number of people with direct access to the land. Essentially, this phase of enclosure is institutional in nature. One or two farmers now cultivated the land on which ten or more families had farmed prior to consolidation (McDonald, 1937). Many of these dispossessed people emigrated from Scotland to foreign lands, or found work in urban centres. Thus, we find that 110 of the 202 parishes in the northeast of Scotland report depopulation between 1755 and the 1790s. In this sense, the enclosure experience of England and Scotland may be similar

The other aspect to the enclosure process is more complex. It comprises the physical re-arrangement of the arable fields into more regularly shaped holdings, the building of fences and walls to enclose the fields, and, at the same time, involves the introduction of new crop rotations and other farming practices. One could think of these changes as the technological aspects of enclosure. How they proceeded, and who benefited from them depended crucially on the nature and size of the labour force remaining in the parish. Tom Devine points to the different labour market conditions in England and Scotland:

“The fundamental distinction between southern England and lowland Scotland lay in labour supply. If the period 1780 to 1830 is considered as a whole, then it is clear that there was a glut of agricultural labour in the south produced by population growth, and the contraction of industrial employment and its concentration in northern England, together with

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<sup>25</sup> For example, in the TFP regression in Table 9, residing landlords per 1000 population was significant,



limited migration from the region. Farmers therefore did not need to tie labour to long contracts to ensure a regular supply: it was hardly ever scarce and, after 1815, usually available at low cost"(Devine, 1994).

In Lowland Scotland, increasing numbers of former tenants, sub-tenants, and cottars had lost direct access to land, emigrating or finding work in the cities of Glasgow, Edinburgh, or even further south, in England. While many left the parishes in the early stages of enclosure, some did stay behind. It was this group whose labour was required on the consolidated farms. In the past, these small holders had exercised some independence, only working seasonally on the tenants' or landowners' farms. Following the changes in the organisation of the fields, they became a full-time labour force under the direct control of the farmers(Devine, 1994). While these labourers had lost access to land, they seem to have ended up better off than their counterparts in the open parishes. As labour demand increased with the implementation of the new methods that came along with enclosure, the wages of farm workers rose. Where labourers had been employed seasonally in the past, now they were increasingly employed year-round(Devine, 1994). In a relatively tight labour market, that would mean increased wages. It may also be the case that the higher wages in enclosed parishes reflect returns to ability. That is, labourers in the improved parishes were selected for particular skills or qualities and farmers were willing to pay higher wages for those abilities. Further

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while the others weren't. For enclosures, only the residing landlord per 1000 acres variable was significant.

analysis of the specific nature of the rural labour market at the time of enclosure will have to be left to future work.

These results have important implications for distribution. Where in England, any benefits of enclosures are thought, by conservatives and Marxists alike, to have accrued only to land, and to those with legal rights to it. In Scotland, rural workers also appear to have benefited. The *OSA* writers repeatedly point to the improved standard of living among the rural population over the previous several decades. For example, in the parish of Forfar in Angus, the writer compares the conditions 50 or 60 years in the past with circumstances in the 1790s. He observes that before "there were not above seven tea-kettles, as many hand-bellows, and as many watches in Forfar; now tea-kettles and hand-bellows are the necessary furniture of the poorest house in the parish, and almost the meanest menial servant must have his watch"(OSA). Many accounts also point to the improved diet and health of the parishioners, with many of the elderly living well into their nineties, and quite a number beyond 100 years of age.

Finally, the analysis and evidence in this paper points two other methodological issues. The first is that rental rates alone do appear to be a reasonably good indicator of qualitative productivity differentials between enclosed and open parishes. On their own though, they may miss important parts of the picture. That is, they might exclude the impact of local labour markets. Another aspect that emerges from this study is the value of the *OSA* itself as a cross-sectional source of statistical information. Certainly, the

Statistical Account has been made use of by historians and geographers of Scottish development, but few have attempted to base statistical analyses on the wealth of information provided in the accounts. It is not clear why this should be so. Perhaps, it is the result of a mismatch of information. That is, scholars who are familiar with the Old Statistical Account are not oriented toward econometric analysis, while those who are so inclined are unfamiliar with the source. In any case, further work of the sort undertaken in this paper would appear to offer a wealth of potential insights into Scotland at a time of significant change.

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# Appendix 1

## Derivation of Relative Total Factor Productivity

Let  $Q = AL^\alpha K^\beta M^\gamma$  be the production function of the farms in a parish.  
where L, K, and M represent factor inputs, and technology exhibits constant  
returns to scale so that  $\alpha + \beta + \gamma = 1$ . A = Total Factor Productivity(TFP).

If we divide the production function by K, then

$$\frac{Q}{K} = AK^{\beta-1} \left(\frac{L}{K}\right)^\alpha \left(\frac{M}{K}\right)^\gamma$$

Since the farms in the parish are cost minimizing, then

$$\frac{r}{w} = \frac{L}{K} \quad \text{and} \quad \frac{r}{s} = \frac{M}{K}$$

so

$$\frac{Q}{K} = AK^{\beta-1} \left(\frac{r}{w}\right)^\alpha \left(\frac{r}{s}\right)^\gamma$$

$$K = \frac{Q}{A} \left(\frac{r}{w}\right)^{-\alpha} \left(\frac{r}{s}\right)^{-\gamma}$$

$$rK = \frac{Q}{A} w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}$$

Similarly,

$$wL = \frac{Q}{A} w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}, \text{ and}$$

$$sM = \frac{Q}{A} w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}$$

Now, total cost is defined as  $C = wL + rK + sM$

$$\text{So, } C = 3 \frac{Q}{A} w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}$$

Dividing through by Q, we have

$$AC = \frac{3w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}}{A}$$

If the market for Q is competitive, then  $AC = P$  and

$$A = \frac{3w^\alpha s^\gamma r^{-(\alpha+\gamma)+1}}{P}, \text{ where P is the price of output.}$$

$$= \frac{3s^\gamma}{P/w^\alpha r^{-(\alpha+\gamma)+1}}$$

(cont'd)

$$= 3 \left[ \frac{s^\gamma / \frac{1}{P^\gamma}}{\frac{\alpha}{w^\gamma r} \frac{-(\alpha+\gamma)+1}{\gamma}} \right]^\gamma$$

Now, we can compare relative TFP of open( $A_o$ ) and enclosed( $A_e$ ) parishes:

$$\frac{A_e}{A_o} = \left[ \frac{\frac{s_e/s_o}{(p_e/p_o)^{1/\gamma}}}{(w_e/w_o)^{\alpha/\gamma} (r_e/r_o)^{\beta/\gamma}} \right]^\gamma$$

If the prices of output and non-land inputs are the same in open and enclosed parishes, the denominator will go to 1 and we have,

$$\frac{A_e}{A_o} = \left\{ \frac{s_e}{s_o} \right\}^\gamma$$



## APPENDIX II

### Total Factor Productivity Indicator:

According to Hoffman(1991), TFP can be expressed as:

$$A = \frac{w_1^{v_1} \dots w_n^{v_n}}{p_1^{u_1} \dots p_m^{u_m}}$$

where  $w$  represents the various inputs and  $v$  their respective factor shares;  $P$  represents an output price index.

Since the rental rate of capital is assumed to be the same in open and enclosed parishes, and testing indicates that prices of output also do not vary by enclosure status, both  $r$  and  $P$  will disappear in a ratio of TFP in enclosed parishes over TFP in open parishes.

Therefore, we need only adjust the rental rates in the sample by the wage variable.

Thus,

$$A = s^\gamma w^\alpha$$

It should be noted that this TFP calculation is not a measure of the level of TFP in each parish, but does provide a figure with which we can calculate relative TFP among open and enclosed parishes.