The farmer as service provider: the demand for agricultural commodities and equine services

A. Bailey, N. Williams *, M. Palmer, R. Geering

Imperial College at Wye, Wye, Ashford, Kent TN25 5AH, UK

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Abstract

In recent years there has been much interest in alternative sources of income for farmers. This is because economic theory suggests that demand for agricultural commodities is inelastic so that, as incomes in society as a whole increase, those of farmers do not necessarily keep pace — hence the current problems with falling real farm incomes. In contrast the demand for services is relatively elastic. Thus it is logical to divert agricultural resources into service provision. One such service is provided by equine enterprises. We have estimated the own price and income elasticities of demand for selected agricultural commodities and for ‘equine services’. Our results confirm that demand for equine services is more elastic than for agricultural commodities. Thus diversification into horse enterprises is likely to have long term benefits for farmers vis-à-vis traditional agricultural production. © 2001 Elsevier Science Ltd. All rights reserved.

Keywords: Income and price elasticity of demand; Farm diversification; Horses

1. Introduction

British agriculture is experiencing a period where profitability has fallen to levels associated with the depression of the 1930s. In contrast, the UK economy as a whole has exhibited almost uninterrupted growth for many years. UK government statistics (MAFF, 1999) show that Total Income From Farming (TIF), which represents the income to farmers, partners, directors, their spouses and family workers was predicted to fall by 32% in 1998 from its level in 1997. This was the second year
of major decline so that TIFF had fallen by 58% in real terms over a 2 year period, albeit from a relatively high level in 1996. This should not distract from the fact that TIFF exhibits a long term downward trend. These data for 1973–1988 are illustrated in Fig. 1 along with data on the changes in the UK GDP over the same period.

There are a number of reasons for this income problem in agriculture, some unique to Britain but many more are universal. The agricultural industry in Britain is still suffering from the BSE crisis and, more generally, from the strong pound. The price support policies — such as the European Union’s Common Agricultural Policy — that have been pursued by developed country economies have encouraged investment in modern, productive agriculture. On a global scale, agricultural productivity has outstripped demand leading to surplus production of many commodities, at least in the developed world. The success of farmers in providing abundant food supplies for consumers has been at the root of agriculture’s income problem as surpluses have driven down farm gate prices, expressed in real terms, to levels not seen for several decades. Faced with these factors, those engaged in agriculture have little choice but to reallocate their physical and human capital to other uses. While this reallocation will often involve the complete withdrawal of resources from agriculture, it can also include using land for the production of non-food crops, the provision of environmental goods in return for transfer payments and the supply of services to the rest of the economy.

The purpose of this paper is to compare the demand for ‘traditional’ farm commodities such as cereals and meat with the demand for services to the rest of the economy, more specifically the demand for equine services. This is a novel area of study. While much research has focused on the demand for food products at the consumer level, almost none has examined demand at the farm gate. Even less research has been carried out into the economics of equine services.

![Fig. 1. UK gross domestic product (GDP) and total income from farming (1975 = 100). TIFF, total income from farming.](image-url)
2. The production of goods and services on farms

Before reporting on the findings of this research, it is appropriate to review briefly what insights economic theory can give regarding the reasons for agriculture’s decline relative to other sectors of the economy. The theory will also help explain how we might expect the demand for services derived from agricultural resources to differ from that for agricultural commodities.

Anderson (1987) provides a clear and concise discussion of the problem faced by agriculture as economies grow in real terms. In a closed economy (or the global economy) economic growth causes the share of agriculture’s contribution to GDP to decline, even if output growth is unbiased, simply because the demand for food products is relatively inelastic in response to income changes. The fact that the demand for farm products is less income elastic (as suggested by Engel’s Law) than the demand for manufactured outputs ensures that the relative price of agricultural products declines. This must be so to enable the increased volume of farm products to be cleared from this closed market since quantity supplied must equate to quantity demanded. Only if output growth is sufficiently biased toward the production of manufactures would this price reduction be prevented. However, since this would itself reduce agriculture’s share of total output the bias must be very strong indeed to ensure a large enough increase in the relative price of agricultural products to counter this effect.

For a small open economy, which engages in free trade with the rest of the world, the effect of global economic growth on the internal agricultural sector’s share of GDP is likely to be similarly depressing. However, this downward pressure on GDP share will be caused, or prevented, by different factors. First, since both farm products and manufactures are tradeable, their prices will be determined by global supply and demand. Consider the situation where productivity growth in the rest of the world occurs. Global, and therefore internal, prices of agricultural products must decline for the reason described above. If the internal economy fails to grow then agriculture’s share of GDP must suffer since the prices farmers receive must fall. However, contrary to the situation in the closed (or global) economy, productivity growth biased in favour of agriculture could, if large enough, counter this decline since domestic supply does not alter global output prices. This last point provides some theoretical justification for public sector R&D expenditure in agriculture to counter the farm income problem and avoid additional treasury expenditure on transfer payments in the form of farm subsidies.

Anderson then continues to discuss the fortunes of agriculture in a growing economy that also includes the production and consumption of non-tradeable goods and services. First, we must define the term non-tradeable. For non-tradeable goods we mean goods and services for which there are local markets but for which producers face very high barriers to entry into international markets. Either there exist no

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1 Here, a real economic growth refers not to growth caused by population increase alone, since this would not alter consumers’ real income and would not change individual consumption patterns and, therefore, relative prices.
international markets, or international markets are inaccessible because of institutional barriers in both directions or the costs of transportation are so great that international trade is not viable. For these goods and services, local (internal) demand must equate to local supply and their price is thus determined locally. To this end, consider the three sectors\(^2\) of agriculture, manufacturing and services\(^3\). Engel's Law indicates how demand will affect the three sectors. In general agriculture, manufacturing and service sectors face inelastic, elastic and highly elastic demand, respectively, in response to changes in consumers' real income. When the external global economy is growing the price received for the output of both tradeable sectors declines although, for the reasons given above, agricultural output prices must decline at a faster rate than for manufacturing. However prices in the third sector are determined by internal supply and demand and, since that level of demand increases as general incomes rise, both output and price could conceivably rise. In such a growing economy, the share of GDP captured by the service sector must rise at the expense of both agriculture and manufacturing, although the former will, as we have seen, suffer more.

So to summarise, the agricultural sector of an economy open to the pressures of a growing world economy, whether that internal economy is growing or not, will suffer from a decline in the share of GDP it captures relative to the manufacturing sector. If this internal economy also produces and consumes a significant quantity of non-tradeable or service goods then this situation is worsened. A falling share of GDP, in itself, might not be of concern. However, since all sectors must compete for factors of production, and at least some of these factors will possess mobility between sectors, then their price is likely to be driven by the derived demand in the service sector. As a result agriculture will suffer further from increasing factor prices and incomes will decline in real terms. Only if farmers are mobile and can leave the industry at a faster rate than agricultural output prices decline and/or input prices rise would individual farm incomes be maintained. Faced with these factors, those engaged in agriculture have little choice but to reallocate their physical and human capital to other more profitable uses. At one extreme this means a withdrawal of labour and capital from the industry, at the other it means expanding the farm business to take advantage of economies of size that exist in production (Dawson and Lingard, 1982; Dawson and Hubbard, 1987; Mukhtar and Dawson, 1987). The result of these two opposite but complementary trends will be fewer but larger farms. There are, of course, other options that involve re-allocation of resources away from food production but that retain the land and labour within the rural sector. These options include using the land for the production of non-food crops, the provision of environmental goods in return for transfer payments and the supply of services to the rest of the economy.

\(^2\) Anderson considers these first two sectors as one "tradeables" sector such that this economy can be depicted in two dimensions.

\(^3\) Here, Anderson uses the service sector to characterise the "non-tradeables" sector and justifies this assumption by stating that tradeable services will likely cancel out any non-tradeable manufactured goods in most economies.
The situation described above has spawned, not only government intervention in agricultural markets, but also a search to identify appropriate strategies that farmers should adopt to reduce this pressure on their incomes. One such strategy that has received support from government has been farm diversification. There are many different forms of farm diversification with differing resource requirements and different levels of profitability. The results of a survey of such diversified enterprises are reported by McInerney and Turner (1991). There are many examples of non-food agricultural products which these farmers could produce, examples include Christmas trees, bio-fuel, timber, industrial oil crops and hemp. However, as discussed above, a strategy of producing non-food manufactures in countries which have large service sectors, might not be sufficient to maintain profit levels.

3. The provision of equine services on farms

If farmers can use their productive assets to supply non-tradable services, then the rate of decline in relative farm incomes might be countered. Examples of successful farm produced service products do exist, and include accommodation, agro-tourism, sporting and recreational activities (McInerney & Turner, 1991). Amongst recreational activities can be numbered those involving horse riding or equine services. Anderson’s analysis suggests that these non-tradeable products are likely to be of value to counter the farm income problem. However, not all farmers will possess the assets necessary to produce all of these services. Land is heterogeneous in both soil quality and its aesthetic quality. Clearly not all farms are endowed with land of suitable aesthetic quality or location for either agro-tourism or recreational activities to be viable. However, as long as sufficient population density exists within easy travelling distance then the production of equine services might provide a viable ‘land using’ service alternative to traditional commodity production for many farmers. The opportunities for such equine services are summarised by Suggett and Houghton-Brown (1994).

Horses have a long association with UK agriculture, being for many centuries one of the prime sources of traction power, gradually superseding oxen and man. Although horses provided draught power on farms, many of the horses on farms were dual purpose, being also kept to breed horses for use by industry, commerce and transport (Chivers, 1983). The numbers of horses required for non-agricultural work declined by 75% between 1911 and 1939, largely as a result of the substitution of motor for horse draught for road transport and this had a knock-on effect on the number of breeding horses on farms. It was the advent of the agricultural tractor in the 1930s and 1940s that signalled the demise of the farm draught horse (Collins, 1983).

While the working horse population dwindled to almost zero during the twentieth century, recreational horse numbers were more resilient. Although they declined from c. 600,000 in 1901 to 330,000 in 1934, the population of recreational horses has recovered and in 1996 was estimated to be in the region of 500,000 (Produce Studies Group, 1996). Many recreational horse owners do not have sufficient land to keep
their horses and so pay to keep them at livery yards. The horse owner pays for the use of a stable — which may be a converted farm building or purpose built — and grazing. Other facilities, such as all-weather schooling arenas may be offered at extra cost. Such livery yards are frequently diversification enterprises on farms. From the farmer’s point of view, horse livery has many advantages: it utilises labour that may be under employed either generally or seasonally (Errington, 1988; Gasson, 1988); it uses buildings that are frequently redundant and unsuitable for modern large-scale farming; and it requires land and its associated agricultural crops such as grass and hay for feed and straw for bedding.

Within the UK, the outputs from equine services are largely recreational and must by definition fall into the category of services. As set out earlier we would expect that demand for services will be more elastic than for agricultural commodities. The central purpose of this paper is to test whether this holds true for equine services.

4. Methodology and data sources

The estimation of the characteristics of the demand for both equine services and for the products of agriculture takes a relatively simple approach. We estimate commodity by commodity demand functions having assumed separability between all commodities. Firstly we assume that the demand for each product or service is a function of its real price, the income of consumers and available leisure time where appropriate. More specifically we assume that each individual demand is Cobb-Douglas and can be written in logs as:

\[ X_{it} = \alpha + \beta_{iw} \ln w_{it} + \beta_{iy} \ln y_{it} + u_{it} \] (1)

where \( X_{it} \) is the demand for good \( i \) in time \( t \), \( w_{it} \) is the real price of good \( i \) in time \( t \), \( y_{it} \) is the general level of income in time \( t \) and \( u_{it} \) is the usual regression disturbance term required for estimation. In the specific case of the equine services demand function, an additional coefficient and available leisure hours variable is appended to Eq. (1). The \( \alpha \)'s and \( \beta \)'s are the parameters to be estimated. In this formulation the estimated \( \beta \)'s are numerically equivalent to own price and income elasticities of demand in quantity terms and represent the percentage change in the quantity of \( X_i \) demanded as either \( w_i \) or \( y \) changes by one percentage point. The \( \beta_{iw} \)'s and \( \beta_{iy} \)'s then represent a unit free measure of consumer response to changes in the commodities own price and consumer income, respectively.

The representation in Eq. (1) may not provide a general enough approach to the estimation of demand for leisure products such as equine services. For the individual, the decision to pursue leisure activity is likely to be a function of both available time and money income. At first glance the first of these variables appears to be easily found as time minus time employed. As Johnson (1966), Cesario and Knetsch (1970) and Bowker et al. (1996) find, the opportunity cost of leisure time provides useful information within estimated leisure demand studies. However, the question remains that the estimation of this opportunity cost of leisure is difficult where not
all players enter the labour market and where labour hours may be constrained by employment contracts (see Feather and Shaw, 1999, for further details of estimating the opportunity cost of leisure time).

In this work, we are less interested in discovering an individual’s determinants of participation in leisure activities themselves than measuring the characteristics of a demand function for a leisure product. Therefore, we might safely ignore the above considerations and postulate that the wage rate does provide a close approximation to the opportunity cost of leisure time. However, we might legitimately expect that a time series of average wage rates will be highly colinear with that of income. As an alternative we could use the quantity of free time to provide useful information upon the demand for equine services and re-parameterise Eq. (1) to include a further term in hours of leisure or free time.

In the case of Eq. (1), each estimated elasticity possesses its own well defined standard error which can be used to test the significance of difference between elasticities across commodities and importantly, in our case, between farm commodities and equine services. Here we construct the pair-wise ‘t’ test for significant difference between the elasticities for commodities \( i \) and \( j \) as:

\[
t_{ij} = \frac{\hat{\beta}_i - \hat{\beta}_j}{Se(\hat{\beta}_i) + Se(\hat{\beta}_j)^{\frac{1}{2}}}
\]

‘t’ is then distributed as a random variable within a ‘t’ distribution. Once confidence limits are assumed ‘t’ provides us with our test for significant difference between the behaviour of our two main commodity groups from which conclusions may be drawn.

For this study, the following data were required for estimation: annual data on the number of horses; the price of keeping a horse (the charge by the farmer to the horse owner); the level of consumption of a selection of farm products; the prices received by farmers for these products; and the level of general income.

No sufficiently long data series on the total number of horses used for recreation in the UK exists at present. The FAO do report statistics for the number of horses in the UK. However, since national sources of these statistics ceased in 1976, only estimates are reported thereafter. Various equine sporting associations keep records of membership over some period. However, changes in association structure ensure that the data are not amenable to this type of study. On a more positive note, MAFF have begun to collect census data on horse numbers once more which bodes well for future studies. Some attempts have been made to calculate the numbers of horses in the UK (e.g. Mellor et al. 1999) but they founder on the dispersed nature of the sector, with a significant proportion of horses being kept in small private paddocks or in yards that are not within the scope of the June Agricultural Census.

In the absence of hard data on changes in horse numbers a proxy had to be found. Fortunately, it was possible to gather data on the number of registered British Thoroughbred brood mares from Weatherbys. The General Stud Book, which was
first published in 1791, provides a definitive record of thoroughbred breeding over the last two centuries and contains the registrations of thoroughbred mares, stallions and foals. The Book thus provides an accurate figure for the number of brood mares and, more importantly for this study, the change in the number of mares over time. Data on the number of brood mares over the period 1961–1995 were extracted, giving a sufficiently long time series for analysis. The justification for using the change in thoroughbred numbers as a proxy for the change in all horse numbers follows from the central role of the thoroughbred in the British horse industry. The thoroughbred is the main breed of horse used for racing, but only a small proportion of those bred are considered good enough to actually race. The majority of those thoroughbreds that do not ‘make the grade’ are sold and used for recreational riding and/or cross breeding. Thus there is always a ready supply of this breed available to current and prospective horse owners. The price index of horse upkeep was calculated as the cost of full livery, stabling, purchased feed and land rent for grazing and forage aggregated using weights calculated from Cross and Houghton-Brown (1992) utilising price indices from HMSO (various issues) over the period 1961–1995.

For agricultural commodities, the quantities demanded of all meat, dairy products, potatoes, and wheat for human consumption were derived from disposal data from HMSO (various issues), for 1961–1995. Data on the demand for UK-produced wheat for human consumption were derived from utilisation data — flour production net of stocks. Quantity demanded of potatoes was similarly derived. For meat the quantity demanded used here includes the aggregate utilisation of both fresh and cured meats. The quantity demanded of dairy products is composed of the utilisation of milk for butter, cheese, condensed milk, milk powder, full cream and the domestic consumption of liquid milk. All data were derived from the Annual Abstract of Statistics (various dates). These data where then converted to index numbers. The focus of this study is at the farm level, therefore, our estimated elasticities should be calculated at farm-gate prices. Prices for each of the above farm products were found in HMSO (various issues), for 1961–1995. Where aggregation of individual price indices was necessary, the relative weights published with the data for the years in question were used.

Data on income were provided by estimates of UK GDP over the same sample period obtained from HMSO (various issues). All price and income series were then deflated using the RPI derived series “Purchasing Power of the Pound”, HMSO (various issues).

5. Estimation

The estimation of the five independent equations for equine services and the four agricultural commodities represented in Eq. (1) utilises ordinary least squares (OLS) regression techniques. However, as is well known, the results of a regression between two or more variables is only meaningful if those series can be demonstrated to be co-integrated (see Granger and Newbold, 1974, Granger, 1981, and Hallam et al.
1992, for an easy-to-follow review and demonstration of this concept). The utilisation of co-integration techniques thus avoids the specification of spurious relationships. In addition, the fact that an error correction representation of the estimated equation can provide a means of recapturing long run relationships between co-integrated variables provides yet more attractions to practitioners.

There are several approaches open to us to test for the condition of cointegration. Firstly we could test the order of integration of each individual series using Dickey and Fuller’s (1979) pre-test (DF), difference the series as appropriate, and then proceed if series can be demonstrated to be co-integrated. Alternatively the order of integration of the residuals of the fitted estimating equation (Eq. (1)) could be tested post estimation. These residuals, \( u \), are themselves integrated of order one (possess a unit root) if and only if the combination of all series in the equation (not just each individual series) are co-integrated. It is this last approach we adopted here. Estimation was facilitated using the Autoregressive Distributed Lag facility within Microfit 4.0 where a suitable lag structure for Eq. (1) was selected on the basis of the Schwartz Bayesian information criteria.

6. Results

The results of each of our five estimated demand equations are presented in Table 1. The estimated demand for equine services does not include terms in leisure hours since the number of available leisure hours provided no additional information toward the estimation of the demand for equine services. This result is not that

<table>
<thead>
<tr>
<th>Demand for (X):</th>
<th>Intercept</th>
<th>Dependant variable</th>
<th>Own price</th>
<th>Own Price</th>
<th>Income</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy products</td>
<td>3.8551</td>
<td>na</td>
<td>0.0092299*</td>
<td>na</td>
<td>0.62005</td>
<td>−0.44543</td>
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<tr>
<td>Potatoes</td>
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<td>−0.056628</td>
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<td>0.15388</td>
<td>na</td>
</tr>
<tr>
<td>All meat</td>
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<td>−0.06252</td>
<td>na</td>
<td>0.09382</td>
<td>na</td>
</tr>
<tr>
<td>Wheat for human consumption</td>
<td>2.2928</td>
<td>0.56313</td>
<td>−0.04137</td>
<td>na</td>
<td>−0.01481*</td>
<td>na</td>
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<tr>
<td>Equine services</td>
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<td>0.73948</td>
<td>−0.13014</td>
<td>na</td>
<td>0.21851</td>
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<td></td>
<td>0.13054</td>
<td>0.072204</td>
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\( ^a \) Standard errors are presented below their respective parameter in italics. Those estimated parameters not significantly different from zero at a 95% confidence level are marked with a *.

\( ^b \) Dependent variable (time, \( t^{-1} \)).

\( ^c \) Own price (time, \( t \)).

\( ^d \) Own price (time, \( t^{-1} \)).

\( ^e \) Income (time, \( t \)).

\( ^f \) Income (time, \( t^{-1} \)).
surprising in itself since we are concerned with the demand for equine ‘up-keep’ which must be paid regardless of leisure hours available for riding. This is a clear example of a ‘stock/flow problem’ described by Cowling, Metcalfe and Rayner (1970). In effect, this result suggests that horses are kept regardless of current usage levels in the anticipation of possible future use and utility. This ‘leisure hours’ term was then dropped from subsequent analysis.

The ability of all five independent demand equations in Eq. (1) to provide a good fit to the dependent variable, \( X_i \), does appear to be quite respectable. We report a measure of goodness of fit, the adjusted \( R^2 (R^2 \text{ Bar}) \), for each equation in Table 2. For all farm commodities, with the exception of dairy products, the estimated demand equations were able to account for over 80% of the variation in the dependent variable. The estimated demand equation for equine services provides a very good fit since the equation accounts for over 98% of the variation in the number of horses in our data. However, we should note that the maximisation \( R^2 \) is not our objective, in fact under serial correlation of the residuals, OLS \( R^2 \) is often artificially inflated.

We also report Durbin Watson’s \( d \) statistics, or Durbin’s \( h \) statistic under auto-regressive estimation, to test for the presence of serial correlation. In all cases it was possible to reject the hypothesis of either positive or negative serial correlation of the OLS residuals. We conclude that first order serial correlation of equation disturbances does not appear to cause inefficiency in the estimation of these five demand equations.

As mentioned in the previous section, for any regression equation to provide meaningful, non-spurious, results the series used in that regression should be integrated of the same order or some linear combination of the series employed should be co-integrated. To test this proposition we employ the DF test for unit roots upon the computed regression residuals, \( u \), from Eq. (1). These statistics, along with their critical values, are also reported in Table 2. In all cases, the equation DF statistics

<table>
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<tr>
<th>Equation test statistics</th>
<th>Durbin Watson</th>
<th>Durbin’s ( h ) statistic</th>
<th>1st order serial correlation(^a)</th>
<th>( R^2 \text{ Bar} )</th>
<th>Dickey Fuller(^b)</th>
</tr>
</thead>
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<td>Dairy products</td>
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<td>0.65472</td>
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<td></td>
<td></td>
<td></td>
<td>−4.8654</td>
</tr>
<tr>
<td>Potatoes</td>
<td>2.0619</td>
<td>na</td>
<td>None</td>
<td>0.83613</td>
<td>−5.7959</td>
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<td></td>
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<td></td>
<td></td>
<td>−4.4568</td>
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<tr>
<td>All meat</td>
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<td>0.88695</td>
<td>No positive</td>
<td>0.95307</td>
<td>−5.3264</td>
</tr>
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<td></td>
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<td>−4.8654</td>
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<tr>
<td>Wheat for human consumption</td>
<td>na</td>
<td>0.80492</td>
<td>No positive</td>
<td>0.80697</td>
<td>−4.9518</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>−4.8654</td>
</tr>
<tr>
<td>Equine services</td>
<td>na</td>
<td>0.43895</td>
<td>No positive</td>
<td>0.98465</td>
<td>−5.0013</td>
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<td>−4.8967</td>
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</tbody>
</table>

\(^a\) Acceptance, indecision or rejection of the hypotheses of either positive or negative first order serial correlation of the ordinary least squares disturbances, \( u \).

\(^b\) Figures in italics represent Dickey Fuller critical values.
exceed, in absolute terms, the magnitude of their respective critical value and suggest that none of the estimated equations are spurious relationships. In addition, the assumptions of OLS estimation are not violated by residuals, \( u \), which move away from their own mean of zero over time.

The long-run demand elasticities, computed from the error correction specification of each equation, along with their asymptotic standard errors are presented in Table 3. In all cases, our estimated own price elasticities of demand are negative, so that demand curves are downward sloping in accordance with theory. Only one of the five own price elasticities, that for dairy products, is not significantly different from zero at a 95% level of confidence. In the case of each of our chosen farm products, these estimated own price elasticities of demand are smaller, in absolute terms, than \(-0.21\) and are thus highly price inelastic. These results appear to be consistent with the estimates presented by Tiffin and Tiffin (1999) based on household consumption data. While their results are larger in magnitude, this is not surprising given that they estimate elasticity in expenditure form at the retail level. On a first inspection, the estimated own price elasticity of demand for equine services appears to be greater than those reported for farm products. However, this demand also appears to be relatively price inelastic.

In the case of our estimated income elasticities of demand, only that reported for wheat for human consumption fails to display a significant difference from zero at a 95% level of confidence. Within our group of farm products, these estimated income elasticities do appear to conform to a priori expectation. Those income elasticities of demand reported for ‘staples’, for example, wheat for human consumption at \(-0.027\), suggest that the demand for these products are highly inelastic to changes in general income. Worse still, consumption falls as general incomes rise so that the product appears to be an inferior good. The income elasticity of demand for meat, 0.301, suggests that this commodity is a normal good, consumption rises as incomes increase, but this response remains relatively small (inelastic). In all cases though,

<table>
<thead>
<tr>
<th>Elasticity (quantity) with respect to:</th>
<th>Price</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy products</td>
<td>(-0.0092299^*)</td>
<td>0.17461</td>
</tr>
<tr>
<td></td>
<td>0.06492</td>
<td>0.023637</td>
</tr>
<tr>
<td>Potatoes</td>
<td>(-0.056628)</td>
<td>0.15388</td>
</tr>
<tr>
<td></td>
<td>0.017945</td>
<td>0.032922</td>
</tr>
<tr>
<td>All meat</td>
<td>(-0.20052)</td>
<td>0.30093</td>
</tr>
<tr>
<td></td>
<td>0.089055</td>
<td>0.049144</td>
</tr>
<tr>
<td>Wheat for human consumption</td>
<td>(-0.094697)</td>
<td>(-0.0339^*)</td>
</tr>
<tr>
<td></td>
<td>0.044064</td>
<td>0.045268</td>
</tr>
<tr>
<td>Equine services</td>
<td>(-0.49956)</td>
<td>0.83877</td>
</tr>
<tr>
<td></td>
<td>0.17144</td>
<td>0.083304</td>
</tr>
</tbody>
</table>

* Standard Errors are presented below their respective parameter in italics. Those estimated parameters not significantly different from zero at a 95% confidence level are marked with a *. 
the demand for equine services does appear to be more elastic to changing income than that of the traditional products of land. Our estimated income elasticity for equine services does then appear to be close to unity as would be required for Anderson’s assertions\(^4\) to hold.

The pair-wise ‘\(t\)’ test of significant difference (from Eq. (2)) between each own price and income elasticity of demand for farm products and the own price and income elasticity of demand for equine services are presented in Table 4. In all cases the income elasticity of demand for equine services is significantly different from and of greater magnitude than its farm product counterpart at a 95% level of confidence. In the case of our estimated own price elasticities of demand all but one — that of all meat — display a pair-wise significant difference from the estimated own price elasticity of demand for equine services. This test suggests that the greater magnitude of our own price elasticity of demand for equine services relative to all other farm products is itself significant at a 95% level of confidence.

7. Discussion and conclusion

The results of the analysis suggest that the income elasticity of demand for equine services is significantly more elastic to changes in income than is the demand for each farm product at a very high degree of confidence. Further, we can suggest that the demand faced by equine service providers is significantly more responsive to changes in the price of this service than are any of the farm products considered here. This itself suggests that equine service providers might be disadvantaged relative to traditional farmers since an increase in the price charged for that service will reduce the level of demand they face at a greater rate than would be the case for food products. However, this apparent advantage for food producers is not realised because these producers must face exogenously determined global prices.

<table>
<thead>
<tr>
<th></th>
<th>Own price elasticity</th>
<th>Income elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy products</td>
<td>2.675</td>
<td>−7.670</td>
</tr>
<tr>
<td>Potatoes</td>
<td>2.570</td>
<td>−7.646</td>
</tr>
<tr>
<td>All meat</td>
<td>1.548</td>
<td>−5.561</td>
</tr>
<tr>
<td>Wheat for human consumption</td>
<td>2.288</td>
<td>−9.205</td>
</tr>
</tbody>
</table>

\( ^a \) Accept if the critical value is >1.697 in absolute terms.

\( ^4 \) Anderson reports that, for the more developed economies, income elasticities (in expenditure terms) for service goods tend to unity (Kravis et al., 1983; Summers, 1985). However, the elasticities reported here are in quantity terms and as such are likely to be of a lower value than their expenditure counterparts since the varying component, price, appears within both numerator and denominator.
for their products. Here then this apparent advantage for food producers turns out to
be a disadvantage because in the face of falling global commodity prices the quantity
demanded rises relatively little. Such a situation ensures that the revenue gained from
the sale of food products must also decline. Couple this with the situation of inelastic-
ity of supply, particularly in the short run (see Tyers and Anderson, 1992, for evi-
dence here) and the situation for food producers worsens still further since these
producers cannot react to price signals easily, particularly in the short-term.

Importantly, equine services are not tradeable internationally (as required by
Anderson's analysis) and to a limited extent between local areas. Therefore, the
prices for such services must be determined by both supply and demand within an
internal market or even at a relatively local level since consumers of such a service
are unlikely to travel any great distance to gain the service. Therefore, this result
suggests that new entrants to this market might be able to use price to encourage
potential consumers to purchase this service from them.

In addition, while a responsive long-run price elasticity of demand might appear
to disadvantage service providers, we might reasonably expect that the short-run
price elasticity of demand for these services is much less responsive. Table 1 tends to
support this assertion where our estimated short-run price elasticity of demand for
equine services is reported to be $-0.13$. To illustrate the point, consider a local
market for such a service. Local supply is likely to be finite and small, while
local demand could be large and variable in the short-run. As such if service provi-
ders increase the price they charge over some small range, the level of demand they
face is likely to be little affected. This would suggest that there is the scope for indi-
vidual suppliers to increase their prices to increase their profit. This situation could
be further enhanced if this short-run price elasticity of demand is not symmetric. In
such a case we might expect that while a real reduction in the price of equine services
does increase the level of those services demanded (that is horse numbers increase), a
similar price increase for these services would not elicit a similar magnitude reduc-
tion in horse numbers and demand. That is people readily embark on equestrian
activity but are reluctant to quit that activity as the costs increase.

The results of the analysis reported in this paper support the theoretical case that
demand for services is more income elastic than the demand for food products. As
incomes in the economy as a whole rise, so demand for farm-based services should
also rise. The implications of this are that a rational strategy for farmers who wish
to divert land and labour from food production to some other use should be the
provision of services. Equine services have the advantages of being familiar techn-
ology, certainly to a livestock farmer, and making use of both land and labour. A
further advantage of equine services is that they are supplied into a relatively closed
economy so that potential competition is limited. This paper makes no attempt to
quantify the relative profitability of equine services and agricultural commodities,
but instead concentrates on the effect of economic growth on this relationship.
However, the results do suggest that even if the current profitability of equine ser-
VICES is lower than agricultural production, one day this relationship will reverse. In
addition there may be some scope for increasing supply prices of these services
without seriously affecting demand.
References


