

Wagons at work, or a transport revolution from below: the case of southern Sweden, 1750–1850*

by Fredrik Bergenfeldt, Mats Olsson and Patrick Svensson

Abstract

The introduction of turnpike trusts has been considered to be an integral part of the rapid decline in transport costs in England. Institutional change in the transport system or the lack thereof has been used to explain if, and when, a transport revolution occurred. However, improved roads are just one component of declining inland transport costs. In this paper, we specifically analyse how the forms of transport employed on roads developed in the absence of major institutional changes to the road system. We use Scania, a province located in southernmost Sweden, during the period 1750–1850 as a case study of the development of transport means during the transformation from a rural economy to an emerging industrial one. Our main finding is the independent role of individuals in lowering their own transport costs, as demonstrated by the large increase in the value of wagons relative to other commodities, and the increasing share of wagons equipped with iron instead of wooden wheels and with iron axles instead of wooden axles. This finding indicates that it was possible to lower transport costs in pre-industrial Europe without institutional change.

An influential perspective in the literature maintains that the introduction of turnpike trusts in England during the eighteenth and nineteenth centuries marked a significant change in the financing of road improvements. It is argued that the establishment of these trusts created the necessary conditions for a transport revolution by leading to lower freight rates.¹ In contrast to England, other countries in pre-industrial Europe saw few major institutional changes that

* This research was conducted within the projects ‘Labour productivity during the agricultural revolution, 1700–1860’, financed by the Swedish Research Council (*Vetenskapsrådet*), and ‘Marknader, transporter och agrar omvandling’, financed by Svenska Handelsbankens forskningsstiftelser. Earlier drafts of the paper were presented at the Social Science History Association meeting in Chicago in 2010 and at the Economic History Society’s annual conference in Cambridge in 2011. We are particularly grateful for comments from Dan Bogart and Tim Leunig and from many colleagues in the Department of Economic History in Lund.

¹ D. Bogart, ‘Did turnpike trusts increase transportation investment in eighteenth-century England?’, *JECH* 65 (2005), pp. 439–68; id., ‘Turnpike trusts and the transportation revolution in eighteenth-century England’, *Explorations in Economic History* 42 (2005), pp. 479–508; id., ‘Did the Glorious Revolution contribute to the transport revolution? Evidence from investment in roads and rivers’, *EcHR* 64 (2011), pp. 1073–1112; D. Gerhold, ‘Productivity change in road transport before and after turnpiking, 1690–1840’, *EcHR* 49 (1996), pp. 491–515; see also M. Overton, *Agricultural revolution in England. The transformation of the agrarian economy, 1500–1850* (1996), p. 142; J. Mokyr, *The enlightened economy. An economic history of Britain, 1700–1850* (2009), p. 209.

affected either the organization of road maintenance or road investments. The general view of the road networks in pre-industrial Europe is that they were of low quality. Hypothetically, the means to spend on road maintenance and investments must have been limited throughout pre-industrial Europe. Indirect evidence indicates that this limitation was the case in such European countries as France, Spain, Portugal, Italy, Holland, Germany and the Scandinavian countries. The road networks in these countries suffered from a lack of government initiatives, political fragmentation and decentralized road maintenance.²

Improved roads are just one component of declining inland transport costs. One factor that has been frequently overlooked is the form that transport took. As Landers states, 'The efficiency of land transport depended on the draught animals, the vehicle and the surface'.³ In fact, investments in improved wagons or better draught animals may be the most viable options for individuals desiring to lower their transport costs when faced with growing commercialization. Coordination failures and free riding are limited compared to investments in roads. If roads were of a *sufficient* standard, not at least in terms of adequate width and surface, then improved wagons or better horses would lower transport costs because better wagons and/or improved draught animals could carry heavier cargo and travel faster.⁴ Of course, the definition of a *sufficient* road is somewhat ambiguous, but as long as the individual investment in better horses and wagons makes sense, the roads must be adequate to give a return on the investment.

In view of this discussion, we analyse how the means of transport, animal-drawn carts and wagons, developed in the absence of major institutional changes to the road system during periods of rapid economic development, such as the agricultural transformation and early industrialization. An examination of how transport evolved broadens existing knowledge of the nature of change in transport costs in pre-industrial Europe. Thus, our main hypothesis is that it was possible for individuals engaged in trade to lower transport costs in pre-industrial Europe without major institutional changes to road maintenance. We use Scania, which is located in southern Sweden, and the period 1750–1850, as a case for testing our hypothesis. This focus allows us to study the development of the means of transport in an economy undergoing an agricultural transformation with increasing long-distance trade. Scania is an area without navigable rivers or canals, so one in which wagons were the only form of transport for the inland conveyance of grain and in which the dominant producers, the peasant-farmers, transported their grain themselves: no commercial freight companies were established during this period.

The hypothesis is investigated at the micro-level in three different ways. First, we explore the stock and the quality of draught animals available for the peasant-farmers over time. Second, we analyse the development of wagons in the same way by looking at the relative prices of wagons to grain. Relative increases in the prices of horses and wagons in the absence of economies of scale in production is an indication that improvements in these transport means occurred. This quantitative measure makes it possible to trace the development of horses and wagons over time. Third, we provide a detailed account of the technical changes by using the descriptions of wagons in probate records.

² R. Szostak, *The role of transportation in the Industrial Revolution. A comparison of England and France* (1991), pp. 53–4.

³ J. Landers, *The field and the forge. Population,*

production, and power in the pre-industrial West (2003), p. 81.

⁴ For a discussion, see Bogart, 'Turnpike trusts', p. 488; Gerhold, 'Productivity change', p. 498–500.

I

As in many other countries, the English road maintenance system was a decentralized system based on parish responsibility. During the eighteenth and nineteenth centuries, this system was reformed by the introduction of turnpike trusts. The trusts gave a group of private investors the responsibility for a specific road line: they made it possible to invest in improvements by collecting tolls, issuing bonds, and where necessary purchasing land. This institutional innovation reduced uncertainty in new road investments, limited coordination failures and reduced free riding on other parishes' road investments.⁵ The turnpike trusts had a profound impact on the English road network, and it is suggested that they laid the foundation for a transport revolution in England in the eighteenth and nineteenth centuries. With the establishment of turnpike trusts, road investments increased, and road maintenance improved, thereby contributing to the improvement of the road's base, surface and width of the English roads, which led to lower freight rates and reduced travel times.⁶

In this way, the early transport revolution, with better roads being built alongside canals and improvement in coastal shipping, preceded the Industrial Revolution. On the eve of the Industrial Revolution, England had a more developed and integrated market than any other country in Europe due to improvements in the transport sector and easy access to both inland waterways and coastal ports.⁷ Declining transport costs made further regional specialization possible, while labour and capital were allocated more efficiently. It has even been argued that one of the most important effects of lower transport costs was an increased exchange of ideas and values, which contributed to improved efficiency in the initial stages of industrialization.⁸ Thus, the transport revolution was not an effect of the Industrial Revolution but rather an important prerequisite for it, as opposed to the expansion of the railways, which took place concomitantly with the Industrial Revolution.⁹

Road improvements and the turnpikes have been highlighted as vital parts of the transport revolution in England. These factors had a more significant impact on the economy than improved water transport,¹⁰ although the building of new canals is often described as the dominant economic feature. Clearly, water transport offered much lower transport costs for bulky goods than did road transport. Nonetheless, it has been argued that turnpike roads were more important than canals because the movement of goods was faster on roads than on canals.¹¹ It took less time to pack and unpack goods on a wagon or a packhorse than on a boat. In many cases, the ubiquity of the road system, along with shorter routes and faster speed, made road transport the most feasible option for the conveyance of goods, such as agricultural products and textiles.¹²

⁵ W. Albert, *The turnpike road system in England, 1663–1840* (1972); Bogart, 'Turnpike trusts'; id., 'Glorious Revolution'.

⁶ Bogart, 'Turnpike trusts'; Gerhold, 'Productivity change'.

⁷ J. Mokyr, *The lever of riches. Technological creativity and economic progress* (1990), p. 244; Szostak, *Role of transportation*, p. 53.

⁸ Mokyr, *Enlightened economy*.

⁹ Szostak, *Role of transportation*, p. 85; Mokyr, *Enlightened economy*, p. 203.

¹⁰ T. Barker and D. Gerhold, *The rise and rise of road transport, 1700–1990* (1995), p. 33.

¹¹ Mokyr, *Enlightened economy*, p. 209.

¹² J. A. Chartres and G. L. Turnbull, 'Road transport', in D. H. Aldcroft and M. J. Freeman (eds), *Transport in the Industrial Revolution* (1983), pp. 64–99.

Naturally, improved land transport had a larger overall impact on the transport of many low-cost goods than did the extension of water transport.¹³

In contrast to England, France saw only marginal improvements in its road network during the eighteenth century, despite the fact that the road network was in a critical state in the early part of the century.¹⁴ During this period, the French government was responsible for the construction of roads, and several attempts were made to improve the road system in the eighteenth century by investing in new roads. These efforts mostly involved expensive, high-status road projects, which crowded out the financial means for basic road investments and maintenance. The road maintenance in France was also poorly organized. Until 1787, it was based on *corvée* labour, in which men between the ages of 16 and 60 were required to work 30 days a year repairing roads. This system, with reluctant workers and limited time designated for road maintenance, meant that the maintenance of the French roads was often neglected, even when they were in a poor state.¹⁵

The view that turnpikes contributed directly to lower transport costs has not gone unchallenged. It has been argued that an improvement in roads could have taken place even without the turnpikes. Moreover, even if turnpikes were important in lowering transport costs in England, other improvements in land transport played an equally important part and took place independently of the turnpikes.¹⁶ For example, a gradual transition from oxen to horses is discernible in England as early as the Middle Ages. The main advantage of horses, compared to oxen, was the greater speed at which they could travel.¹⁷ Gerhold has suggested that the improved breeding and draught power of horses in the late eighteenth century was itself a gain in productivity.¹⁸ Furthermore, packhorses were replaced by two-wheeled wagons as early as the fourteenth century, and in the late seventeenth century, English carrying services began using four-wheeled wagons instead of two-wheeled ones. The adoption of four-wheeled wagons also took place among farmers, particularly wealthy ones engaged in grain production, during the same period, before the introduction of the turnpikes.¹⁹ Both of these changes were important for improving freight capacity.²⁰

Most of these improvements were introduced by the people transporting goods themselves independently of state-led institutional change. For example, increasing market involvement was an incentive for farmers to reduce their transport costs. For those who already were involved in the market, less time spent on conveyance meant that more time could be devoted to agricultural production, which increased agricultural productivity. Lower costs for transport also meant that remotely situated farms became more integrated in the market. In addition, when transport costs were lowered, urban-produced goods became cheaper for farmers, leading to further gains through an increased specialization in agricultural tasks.²¹

¹³ Szostak, *Role of transportation*, pp. 50–2; Barker and Gerhold, *Rise and rise*, p. 33; Chartres and Turnbull, 'Road transport', p. 94.

¹⁴ Szostak, *Role of transportation*.

¹⁵ *Ibid.*, pp. 60–7.

¹⁶ For a discussion, see Barker and Gerhold, *Rise and rise*, pp. 24–5; Gerhold, 'Productivity change', p. 506.

¹⁷ J. Langdon, 'Horse hauling: A revolution in vehicle transport in twelfth- and thirteenth-century England?',

Past & Present, 103 (1984), pp. 37–66.

¹⁸ Gerhold, 'Productivity change', pp. 501–2.

¹⁹ S. Porter, 'Farm transport in Huntingdonshire, 1610–1749', *J. Transport Hist.*, third ser., 3 (1982), pp. 35–45.

²⁰ Barker and Gerhold, *Rise and rise*, p. 25.

²¹ Szostak, *Role of transportation*, p. 29; Barker and Gerhold, *Rise and rise*, p. 34.

There are two possible scenarios based on the previous discussion. One is that better roads contributed to improving the transport means with increased freight capacity because of smoother surfaces and wider roads. These improved road qualities increased speed, facilitated heavier loads, eased the labour of horses and enabled the use of wagons instead of packhorses.²² Similarly, bridges were important for connecting road stretches in the transport system and allowing for the adoption of larger, heavier transport means.²³ However, if the roads and bridges were of a sufficient standard to allow for the introduction of better wagons, another scenario is that the individual farmers lowered their individual transport costs by breeding stronger horses and/or by improving their wagons. There are a number of indications in the literature that this was possible. This situation may have been as important for economic development as investments in new roads brought about by an institutional reform of the road maintenance system. Our intention is to deepen this discussion by focusing on the development of the means of transport in a context lacking institutional changes to the system of road maintenance.

II

The origin of the Swedish system of road maintenance and construction can be traced back to the Middle Ages. According to the national legislation introduced by King Magnus Ericsson in 1350, every landholding peasant had to participate in the maintenance and construction of Swedish roads: they had to provide building materials and labour for constructing and maintaining roads in proportion to their taxable land units (*mantal*²⁴). This obligation lasted until 1944, when the road administration was centralized.²⁵ In the eighteenth century, the state issued several decrees to ensure that road maintenance was, in fact, carried out. A new road law introduced in 1734, amongst other things, provided for regulated road maintenance twice a year for the peasant-farmers, gave instructions on how roads and ditches were to be made and provided for regular inspections by the district office (*Häradsrätt*) to identify the roads and bridges in need of maintenance. A royal decree was issued in 1790 that further stressed the peasants' role in clearing the roads and making them passable.²⁶

During the seventeenth century, an upgrading of the Swedish road network commenced with the construction of new roads and bridges, as well as a noticeable development of the main roads, which were financed by the state. The driving force behind this expansion was

²² Barker and Gerhold, *Rise and rise*, pp. 24–6; Bogart, 'Turnpike trusts', p. 488; Gerhold, 'Productivity change', pp. 498–500.

²³ D. F. Harrison, 'Bridges and economic development, 1300–1800', *ECHR* 45 (1992), pp. 240–61; J. Langdon and J. Claridge, 'Transport in Medieval England', *History Compass* 11 (2011).

²⁴ In principle, all land in Sweden had an assessment in *mantal*. During the eighteenth and nineteenth centuries, this was a strict measure of the farm's ability to pay taxes, i.e. its productive capacity. The fact that it was a capacity measure meant that the acreage varied.

On the fertile plains, a farm taxed at a third of a *mantal* consisted of around 20 hectares, whereas in the forests an equally taxed farm could have acreage of 100 hectares. When a farm was divided, its *mantal* was divided between the parties. The total sum of *mantal* in Scania was almost unchanged between 1688 and 1900.

²⁵ B. Gustafsson, 'Hur vägarna blev en kollektiv nytighet', in I. Norrlid, L. Olsson, B. Sandin, and J. Thelander (eds), *Över Gränser. Festskrift till Birgitta Odén* (1987), pp. 90–1.

²⁶ K. Enghoff, *De allmänna vägarna i Malmöhus Län* (1938), pp. 114–17, 128.

the strengthening of the centralized state in Sweden, which required better communications and transport.²⁷ The construction of new roads came to a halt during the eighteenth and early nineteenth centuries when the government invested in new canals instead. The building of canals did not address the transport needs of the majority of the peasant-farmers.²⁸ Even so, there were changes in agriculture in Sweden that might have indirectly affected road quality. As a result of land rearrangement and the end of the open-field system (i.e., enclosure) in the nineteenth century, roads were straightened and rebuilt.

It is important to note that despite continuous interest from the government in road maintenance, the overall organization of road maintenance was not changed in any way. Road maintenance continued to adhere to the medieval arrangement in which landholding peasants were responsible for road standards, and the government acted through decrees and fines in an attempt to make the system work.

Due to a lack of evidence, the efficiency of the road maintenance system in Sweden has not been analysed in detail. Nonetheless, there are some qualitative indications that the road organization functioned inadequately and that peasant-farmers lacked incentives to fulfil their duties. The constant interference through new royal decrees has been regarded as one indication that the system was poorly organized.²⁹ Furthermore, there was discontent among the peasant-farmers about their road maintenance duty, but the system was nevertheless preserved.³⁰ Even so, the maintenance of roads probably functioned in cases where farmers used the roads and thus had an interest in maintaining them.³¹ There is also some evidence from contemporary sources showing that there was an interest in maintaining high-quality and passable bridges.³² One limiting factor may have been the problem of coordinating a public good. If peasant-farmers in one parish improved their part of the road, they were not guaranteed that the peasant-farmers in the next parish would also do so. Rather, these latter individuals would have benefited from acting as free-riders, and the outcome may have been long conflicts between peasant-farmers in adjacent parishes and negligence of road maintenance.³³

The actual state of the roads in Sweden has been described in conflicting ways. One view is that Sweden had an underdeveloped road system in the eighteenth and nineteenth centuries.³⁴ The other view is that by the end of the eighteenth century, Sweden already had one of the best road networks in Europe with a reasonably well-functioning road maintenance system.³⁵ Naturally, with the paucity of data on roads, it is difficult to choose between these opposed positions, but a major increase in peasant-farmers' long-distance grain sales during the late eighteenth century onward is an indication of an at least adequate road system. One local study of western Sweden has dealt with changes in the form that transport took and its implications

²⁷ H. Westlund, 'State and market forces in Swedish infrastructure history', *Scandinavian J. Hist.* 23 (1998), pp. 65–88.

²⁸ G. Ahlström, *Infrastruktur och kommunikationer. Sverige under 1700- och 1800-talen* (1985); Westlund, 'State and market forces'.

²⁹ Gustafsson, 'Hur vägarna', pp. 90–1.

³⁰ J. O. Montelius, 'Svensk vägadministration: en historisk översikt', *Bebyggelsehistorisk tidskrift* 39

(2000), pp. 15–22.

³¹ Westlund, 'State and market forces'.

³² Enghoff, *De allmänna*, p. 117.

³³ *Ibid.*, pp. 118–19.

³⁴ *Ibid.*; G. Fridlitzius, 'Handel och Sjöfart', in O. Bjurling (ed.), *Malmö Stads Historia, del 3* (1981).

³⁵ See discussion in Ahlström, *Infrastruktur* and Westlund, 'State and Market'.

on the overall state of the roads. Gadd found that the use of pack saddles disappeared during the 1770s and was replaced by the use of wagons. Moreover, wagons with iron axles were introduced among the peasant-farmers around 1780 and became widespread throughout the grain-growing plains during the 1820s.³⁶ These changes and investments would have been impossible without improvement, or at least the achievement of a sufficient standard of the roads. Thus, the Swedish debate is similar to the English debate: were the roads of sufficient quality before the Industrial Revolution? Was it possible to lower transport costs without an institutional change to the road system?

III

Our case study is the region of Scania, which is located in southern Sweden. This region was dominated by agriculture until the industrial breakthrough of the late nineteenth century. Agriculture in Scania during the eighteenth and nineteenth centuries saw a rapid increase in output that more than quadrupled from 1700 to 1860.³⁷ The transformation of agriculture began with the earliest enclosures and the reclamation of new land in the 1750s, but it accelerated in the early nineteenth century with more radical enclosures and the introduction of new tools and new crop rotations. Agricultural change was also caused by the increase in grain prices and the removal of trade regulation in the late eighteenth and early nineteenth century, which encouraged producers to increase output.³⁸ Because the vast majority of the land (approximately 90 per cent c.1800³⁹) was managed by peasant-farmers, a central part of the agricultural transformation was the growing market involvement by these farmers. Scania was already a surplus producer of grain in the early seventeenth century. After the change of nationality from Danish to Swedish in 1658, trade was redirected to sales of grain to deficit areas in Sweden.⁴⁰ From the 1820s onward, exports of agricultural products, particularly grain, increased. When foreign demand for oats increased rapidly during the 1840s, the export volumes increased massively.⁴¹

Although the demand that came from the relatively small towns in Scania was rather limited, the towns were still important nodes in the grain trade. The agricultural surplus had to be conveyed by road transport to the major towns by the coast before being exported by sea to either foreign or domestic areas.⁴² It is quite clear that inland transport conditions for conveyance of grain differed regionally in pre-industrial Sweden. In central Sweden, the easy access to inland waterways, which consisted of lakes connected by canals, created favourable

³⁶ C. J. Gadd, *Järn och Potatis. Jordbruk, teknik och social omvandling i Skaraborgs län 1750–1860* (1983), pp. 183–95; C. J. Gadd, *Den agrara revolutionen, 1700–1870* (2000), pp. 262–65.

³⁷ M. Olsson and P. Svensson, 'Agricultural growth and institutions: Sweden, 1700–1860', *European Rev. Economic History* 14 (2010), pp. 275–304.

³⁸ See, e.g., M. Olsson and P. Svensson, 'Agricultural production in southern Sweden, 1702–1864', in Olsson and Svensson (eds), *Growth and stagnation in European*

historical agriculture (2011), pp. 117–39.

³⁹ M. Olsson, *Storgodsdrift. Godsekonomi och arbetsorganisation i Skåne från dansk tid till mitten av 1800-talet* (2002).

⁴⁰ Olsson, *Storgodsdrift*, pp. 42–8; K. Åmark, *Spannmålshandel och spannmålspolitik i Sverige, 1719–1830* (1915), p. 20.

⁴¹ G. Fridlitzius, *Swedish corn export in the Free Trade era* (1957).

⁴² Gadd, *Den agrara revolutionen*, pp. 180–1.

conditions for domestic transport of grain.⁴³ Most of the movement of grain took place in the winter in the northernmost parts of Sweden because of more favourable transport conditions when lakes were frozen and it was possible to use sleighs.⁴⁴ The southernmost parts of Sweden lacked both inland waterways and cold winters. Here, the roads were used for carriage of agricultural products, even during rainy winters and autumns when at times they could be quite muddy and difficult to use.⁴⁵

We employ probate records to measure the degree of investment in form of transport by these grain producers. In general, the records provide information on the household debts and assets of a deceased person. The marital status and occupation of the deceased, the place of residence, and the surviving children and their spouses are noted in the probate record. More importantly, there is also an assessment of the value of each item in the estate, including a short description of the item.

The problems of using probate records are now well known. The first problem is the representativeness of the inventory population; not all deaths resulted in an inventory. According to Lindgren, the deceased for whom inventories were not made generally lacked assets and/or debts. Lindgren found that it was mostly unmarried individuals and individuals belonging to the lowest social strata who were under-represented in the inventories.⁴⁶ For our purpose, this bias is of minor importance because we focus on the relatively wealthy group of farmers and their possession of draught animals and wagons. However, we must consider another problem: some of the deceased, although referred to as farmers, had retired and given up farming. This situation could lead to an underestimation of the stock and value of animals and wagons among farmers.⁴⁷ We attempt to overcome this problem by only using inventories in which there was a farm listed as an asset. However, for those who did not own their farms (i.e., for tenants), the landed property was not registered in the inventory. Using the name of the deceased and his place of residence and checking this information against the poll tax registers, we have corrected for this situation. A second problem concerns changes in the descriptions of the items. Often, the items in the probate inventory were defined in more detail when they were novel than after they had become common items. When items are more thoroughly described, we take this as an indication of a technical innovation. Conversely, we interpret the disappearance of references to an innovation as a sign of its general adoption.⁴⁸ Finally, there is a danger that the valuation of the items in the inventories did not reflect the real prices of the objects. This is not a problem for us as long as the bias is constant over time because we use only the relative value in relation to market scale prices on grain. Regarding this potential trend bias, earlier studies of Swedish probate inventories have shown that the inventory items were undervalued, but the size of the undervaluation was constant during

⁴³ T. Thorburn, *Economics of transport: The Swedish case, 1780–1980* (2000), pp. 26–7.

⁴⁴ Westlund, 'State and market forces', pp. 67–8.

⁴⁵ Gadd, *Den agrara revolutionen*, p. 263.

⁴⁶ H. Lindgren, 'The modernization of Swedish credit markets, 1840–1905: Evidence from probate records', *JECH* 62 (2002), pp. 810–32.

⁴⁷ A further discussion on this can be found in Porter,

'Farm transport', p. 36, who used probate inventories to investigate the adoption of four-wheeled wagons among English farmers.

⁴⁸ For a discussion, see J. Kuuse, 'The probate inventory as a source for social and economic history', *Scandinavian ECHR* 22 (1974), pp. 22–31; Gadd, *Järn och Potatis*; P. Hallén, *Järnets tid: den svenska landsbygdsbefolkningens järninnehav och järnkonsumtion* (2003).

TABLE 1. Probate records in the sample and percentages of observations

<i>Property rights status</i>	<i>%</i>
Freeholders	44.0
Crown tenants	26.0
Tenants under the nobility	30.0
	100.0
<i>Natural conditions</i>	<i>%</i>
Plains	36.0
Intermediate land	37.0
Woodland	27.0
	100.0
Mean Farm size (<i>mantal</i>)	0.34
<i>Year</i>	<i>Number of observations</i>
1750	35
1770	28
1790	33
1810	33
1830	50
1850	51
Total	230

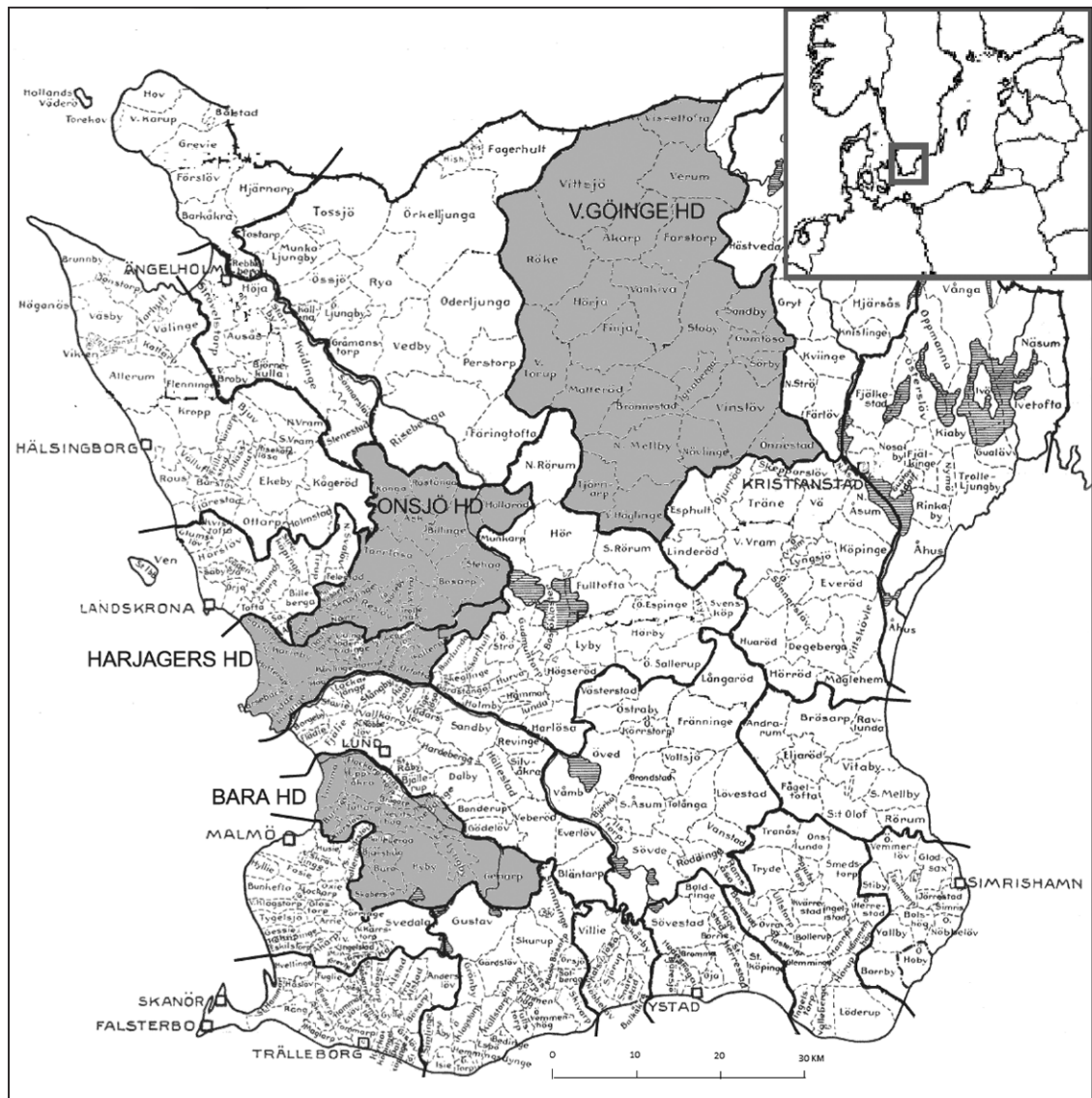
Sources: see Figure 1.

the period investigated in this paper.⁴⁹ Most importantly, these studies have shown that the valuation of wagons did not perfunctorily follow market price changes in grain, but reflected the condition and quality of the wagons.⁵⁰

We have collected information from the probate records for the period 1750 to 1850 with a range of 20 years between each data point, in all 230 records. No data point has less than 28 observations and the probate records collected comes from within three years from each data point (e.g. 1770 holds 1767–73), with the exception of 1750 which reaches back for two whole decades due to lack of observations. The data set was randomly collected from four districts (*härader*). It contains data on various geographical settings and different types of peasant-farmers with respect to property rights status, as seen in Table 1. In Scania, natural conditions tend to correlate with the distance to the nearest harbour. The best soils are

⁴⁹ M. Isacson, *Ekonomisk tillväxt och social differentiering 1680–1860. Bondeklassen i By socken* (1979), p. 223.

⁵⁰ Gadd, *Järn och Potatis*, p. 73.



MAP 1. Scania, showing the districts investigated

located on the plains near the coast, and most peasant-farmers in this category lived within 30 kilometres of a port. Although some of the peasant-farmers in the intermediate and wooded districts also lived within this range, some of them were as far as 80 kilometres from the nearest port (see Map 1).

The average size of the farms in our sample, 0.34 *mantal*, is close to the average size for all Scanian peasant-farmers during our period of investigation. Also over time, the average size of farms in the sample reflects the general development of farm sizes in the region. During periods of rapidly increasing agricultural production, farms became smaller, in terms of *mantal*, due to a process of farm division during the period under study. This pattern is

also reflected in the sample; in 1750, the average size was 0.47 *mantal*, a hundred years later it was 0.25, but during that period grain production per *mantal* increased massively.⁵¹ Thus, we have a sample of relatively wealthy landed farmers throughout the period. With respect to the farmers' property rights, the most striking contrast was between those tenants under the nobility and the two other categories of freeholders and crown tenants. Whilst the latter had secure property rights, manorial tenants held by insecure tenures. While the former paid predetermined taxes to the state or a state official, mostly in cash or in grain, the latter paid unregulated *corvée* dues to the manor. As for the composition of production, crops comprised the dominant share of total production for all farms in Scania during the eighteenth and nineteenth centuries. Rye, barley and oats were the major staple crops, while potatoes, buckwheat, peas and peas were also occasionally grown. Animal production consisted of foals, calves, lambs and geese.

IV

Improved transportation can be achieved by increasing speed, by increasing freight capacity while maintaining the same speed, or by a combination of both. A first way of accomplishing this could be to change from slower animals to faster and stronger ones. In line with this notion, we assume that if farmers had horses, these would be preferred over oxen for transport. Two characteristics speak in favour of the horses. First, oxen were slower and weaker, and, second, horses could be used for many different tasks and therefore bore no additional cost when used for transport.⁵² It is unlikely that horses were needed for other tasks at the same time as they were required for transport because peasant-farmers, relying on household labour, probably did not go to towns during the peak season of agricultural work. Moreover, the argument, proposed by some researchers, that horses pulling wagons were more expensive than horses used in agricultural tasks because they required more food⁵³ is, to a large extent, invalid here. Because the share of horse work used for transport on the peasant farms was rather small, potential extra costs were negligible.⁵⁴

From the probate records, we can determine that even before 1750, a Scanian farmer had, on average, seven horses and foals, and no farmer in the sample had fewer than two horses. This herd size remained the same until 1830, when an average farmer had approximately five horses and foals.⁵⁵ The presence of a relatively large number of horses indicates that a transition to horses had already taken place before the mid-eighteenth century, at least in southern Sweden. One method to estimate the quality of the horses over time is to relate their value to the general price movement. We use the price of the dominant grains, rye and barley, as indicators of the general development of prices calculated as an average of the grain prices for the five years preceding each point analysed, and we used the most expensive horse at each farm as the nominator for the value of the horse.

⁵¹ Olsson and Svensson, 'Agricultural growth', pp. 283, 285.

⁵² J. Langdon, 'The economics of horses and oxen in medieval England', *AgHR* 30 (1982), pp. 39–40.

⁵³ *Ibid.*, p. 33.

⁵⁴ Thorburn, *Economics of transport*, p. 101.

⁵⁵ This decrease in the number of horses has also been observed for other parts of Sweden and has been explained by improved ploughs requiring less draught power, Gadd, *Järn och Potatis*.



FIGURE 1. Relative value of the farm's best horse, 1750–1850 (1750=100)

Note: The value of the best horse per farm is divided by the average price of rye and barley for each period.

Sources: *Probate records*, Regional Archives of Lund: Bara häradsrätts arkiv; Harjagers häradsrätts arkiv; Onsjö häradsrätts arkiv; Västra Göinge häradsrätts arkiv; *Poll tax registers*, Regional Archives of Lund: Bara häradsrätts arkiv; Harjagers häradsrätts arkiv; Onsjö häradsrätts arkiv; Västra Göinge häradsrätts arkiv; *Historical Database of Scanian Agriculture*, Department of Economic History, Lund University.

From Figure 1, we can see that horses increased in value relative to grain between 1770 and 1810. This is an indication of improving horse quality, which coincides with the beginning of the so-called Crown Stallion Establishment (*Kronohingstinrättningen*) in Scania in 1778, intended for more and better breeding in the villages. After its establishment, it was ordered that a stud horse should measure at least 9 *kvarter* and 4 *tum* (143.81 centimetres). At the expense of the Swedish Crown, 136 stallions were bought from German and Swedish stud farms, each of which was assigned to a group of parishes and villages. The peasant-farmers were pressured by the government to use these stallions, and no others, for breeding. Peasants had to pay a fine of 60 *riksdaler* if they did not comply.⁵⁶

Although the Crown's stud lasted for only about ten years, the project resulted in the birth of more than 5000 foals of good breeding. More importantly, the stallions and their offspring remained in the villages and proliferated. Subsequently, no further major state projects were undertaken to improve the breeding of the peasants' horses, at least not until the 1860s. This development in horse breeding is consistent with the relative values of the best horses, as shown in Figure 1. The horses improved from 1770–90 onwards, most likely due to the improved breeding that began in the 1780s.

There are two ways to use horses for transport: as packhorses or to pull a wagon. Pack animals were less dependent on the width of the roads. This meant that roads had to be sufficiently wide before wagons could replace packhorses.⁵⁷ Pack animals were faster than horses pulling a wagon and could work for more hours per day. While horses pulling a wagon

⁵⁶ C. G. Weibull, *Skånska jordbrukets historia intill 1800-talet början* (1923), pp. 176–7.

⁵⁷ Bogart, 'Turnpike trusts', p. 488.

could only travel approximately 40–50 kilometres per day, packhorses could reach around 80 kilometres. However, packhorses could transport less weight.⁵⁸

To examine whether the horses in Scania between 1750 and 1850 were used as pack animals or as power to pull the wagons, we can again use our probate records. If horses were used as pack animals, we would expect to find special equipment related to this task among the items in the inventories. Indeed, in many of the inventories, saddles can be found among the items listed. However, most of these are designated as ‘riding saddles’ and not ‘pack saddles’.⁵⁹ Together with the wagons found in the inventories, this finding provides evidence that horses on Scanian farms were used predominantly for pulling wagons rather than as pack animals. It implies that by the middle of the eighteenth century the roads in Scania were of a sufficient quality to permit the use of wagons instead of pack animals.

V

We use two supplementary methods to examine the changes in the wagons. First, we study the development of prices of wagons in the probate records. Second, we perform a disaggregated analysis of the technical changes of wagons over time. It is important to note that we study wagons that were used exclusively for the conveyance of goods; we have excluded wagons that may be considered conspicuous consumption.

The long-term development of the relative value of the best wagon in each household is shown in Figure 2. We assume that the farm’s best wagon was the one that was used for long conveyance of agricultural goods. There was a rapid improvement in wagons that began sometime after 1770. From then on, the relative price of the farms’ transport wagons increased until 1810. The technical contents of this rapid increase in the value of wagons will be explored later, but we can already dismiss explanations linked to changes in raw material prices. The vital parts of improved wagons were made of iron, and the iron prices increased more slowly than the general price level (see Figure 6). The slower development of iron prices relative to the general price level was connected to a rapid increase in grain prices and a rising production of iron, which was produced by the ironworks in central Sweden.⁶⁰

It seems logical to connect this increase in the value of transport means with the concurrent expansion of internal trade and the commercialization of agriculture in Scania. Moreover, the period of the fastest growth in the relative price of wagons, 1790 to 1810, was not only characterized by a growing demand but also by soaring grain prices. Therefore, because we relate the value of the wagons to the price of grain, the figure shows a massive increase in the real wagon value, which points to this period as one of utmost importance for the improvement of

⁵⁸ Landers, *Field and the forge*, pp. 81–4. Packhorses could not only carry less weight, but to travel quickly they also had to be accompanied by a person riding on a horse; thus, the average weight per horse used was even lower than that calculated in previous studies.

⁵⁹ In a study of western Sweden, Gadd, *Järn och Potatis*, found evidence of pack saddles in probate inventories. They disappeared after 1775, indicating a

transition from packhorses to wagons.

⁶⁰ In a study of Sweden, Hallén, *Järnets tid*, p. 196, estimated that iron possession in Sweden increased rapidly during the eighteenth and nineteenth centuries. While an average sized farm in 1750 possessed 140 kilograms of iron, it possessed almost three times as much, 500 kilograms, in 1870.

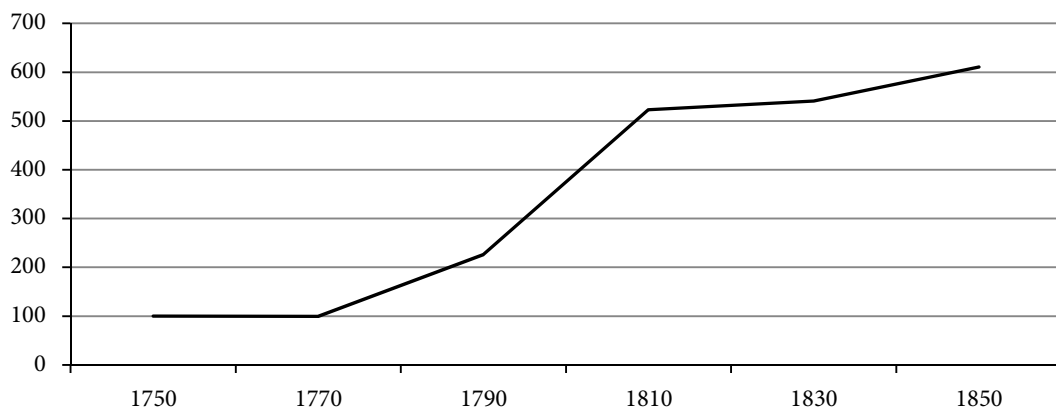


FIGURE 2. Relative value of the farm's best wagon, 1750–1850 (1750=100)

Sources: see Figure 1.



FIGURE 3. Relative value of the total wagons per farm, 1750–1850 (1750=100)

Sources: see Figure 1.

transport means. In the next period, from 1810 to 1850, the development of the relative value of the transport wagons seems to have been only modest, although marked by a somewhat more noticeable increase in the last period, a phase of strong commercialization after the repeal of the Corn Laws in Britain.

Another way of exploring the investments in wagons among peasant-farmers is to follow the total value of the wagon fleet over time. The long-term development of the total value of wagons per household in Scania is displayed in Figure 3. We use the previous procedure to compare changes over time. The total value of all wagons is deflated by the preceding five-year average of grain prices. As Figure 3 makes clear, the increase in the total value of wagons was rather slow in the period 1750–70, but it began to increase between 1770 and 1790 and was particularly robust in 1790–1810. From the 1810s onward, the development of grain prices and the summed value of the wagons among peasant-farmers remained constant, although a small



FIGURE 4. Average number of wagons per farm, 1750–1850

Sources: see Figure 1.

increase might have been evident during the initial phase of the mid-nineteenth century grain trade expansion.

A portion of the increase in the value of the total wagons per household was due to a larger number of wagons, as can be seen from Figure 4, and some of this increase was due to improvements in wagon quality. The growing number of wagons could be due to peasant-farmers investing in more wagons for transport or acquiring wagons that were more task-specific. Examining the inventories in detail, we find that at the same time that the best wagons were improved by seats, for example, they were also referred to as ‘transport wagons’ as opposed to ‘working wagons’, the phrase which seems to have been used previously for wagons used for both transport and production. Thus, at the same time that the best wagons were improved, they became exclusively transport wagons and were replaced in work by wagons designated for agricultural production.

Because these results build on different inventories for the respective time periods, we conduct a multivariate regression analysis (OLS regression) with the relative prices of the transport wagons as the dependent variable to control for the sample composition at each point in time (Table 2). Along with the time variable, measured as dummies for each specific time period, we also include natural conditions (plain land, intermediate land and wood land), type of land ownership and farm size as independent variables.⁶¹ The results demonstrate that the pattern found in the bivariate analysis holds when we control for farm size, land ownership and natural conditions. In line with the expectations, the major increase in the relative value of the best wagons took place during the sub-periods of 1770 to 1790 and 1790 to 1810 (as indicated by the change between the coefficients for the time variables in the regression).

To delve deeper into developments in the wagons during the period studied, we examine the detailed descriptions of the wagons in the probate inventories. An analysis of these indications

⁶¹ The farms without complete information on all these variables have been excluded from the regression, which leaves us with 185 observations.

TABLE 2. OLS regression with the relative value of transport wagon as the dependent variable, 1750–1850

<i>Category</i>	<i>Variable</i>	<i>Coefficient</i>	<i>t-value</i>	<i>P > t</i>
Farm size	Mantal	3.19	5.13	0.000
Land ownership	Freehold	r.c		
	Crown tenant	−0.66	−2.15	0.033
	Noble tenant	−0.32	−1.18	0.238
Natural conditions	Plains	r.c.		
	Intermediate	−0.82	−3.00	0.003
	Woods	−1.30	−4.44	0.000
Time periods	1750	r.c		
	1770	0.31	0.76	0.450
	1790	1.05	2.63	0.009
	1810	2.56	6.41	0.000
	1830	3.03	7.46	0.000
	1850	3.67	9.19	0.000
Number of observations	185			
F-value	22.95			
Prob > F	0.000			
R-square	0.56			
Adjusted R-square	0.54			

Note: r.c. is an abbreviation for reference category.

reveals changes in the transport technology. First, we outline changes in the types of axles and, subsequently, changes in the types of wheels.

The types of axles on the transport wagons are shown in Table 3. The pattern that emerges is that of a steady improvement of the transport wagons. The initial increase in the share of transport wagons with iron-sleeved axles in 1770 is noteworthy, although the percentage of transport wagons whose axles were iron-sleeved decreased from 1770 to 1790 and again from 1790 to 1810 and subsequently disappeared completely. This initial technological development, which wedged together the wheel with the axle, was a transitional construction to improve the strength of the wagons but was soon abandoned for real iron axles. Concurrently, as seen in Table 3, the proportion of transport wagons with iron axles increased rapidly until 1790, but decreased in the two subsequent periods. However, the declining share of wagons with iron axles was not a matter of technical regress. Rather, it was due to a more thorough description in the inventories when the iron axles began to emerge during 1770–1790 and less so in other periods, when iron axles were the standard. This interpretation is consistent with the larger share of unspecified wagons in 1750 and 1850, respectively, and the increasing value of wagons over time, as shown in Figure 2. By comparison, only 8 per cent of the wagons in

TABLE 3. Types of axles on the transport wagons (percentages), 1750–1850

	<i>Iron axles</i>	<i>Wood axles</i>	<i>Iron-sleeved</i>	<i>Unspecified</i>
1750	0	0	0	100.0
1770	23.0	0	8.0	69.2
1790	53.3	0	6.6	40.1
1810	34.4	0	3.1	62.5
1830	16.5	2.4	0	80.1
1850	4.2	0	0	95.8

Sources: see Figure 1.

TABLE 4. Types of wheels on the transport wagons (percentages), 1750–1850

	<i>Iron-rimmed wheels</i>	<i>Wooden wheels</i>	<i>Unspecified</i>
1750	0	0	100.0
1770	11.5	0	88.5
1790	16.7	0	83.3
1810	65.6	6.3	28.1
1830	61.9	0	38.1
1850	46.8	0	53.2

Sources: see Figure 1.

Västergötland, which is located approximately 250 kilometres north of Scania, had iron axles in 1783–90, but 80–95 per cent of them had iron axles in the 1850s.⁶²

Wheels constituted another crucial component of the wagons. They were important for both the durability of the wagon and its freight capacity. Low-quality wheels were easily worn out and in the worst case could be damaged beyond repair. This phenomenon was especially the case when the wagon carried heavy cargo.⁶³ Table 4 shows the description of the wheels on the transport wagons. In the periods leading up to 1810, the proportion of transport wagons with iron-rimmed wheels increased. The first two sub-periods, 1750–70 and 1770–90, saw a steady increase, but it was predominantly from the 1790s that most farmers invested in iron-rimmed wheels, leading to two-thirds of all transport wagons being equipped with iron-rimmed wheels by 1810. From then, we see the same pattern as for the axles, with a decreasing share of wheels being described as iron-rimmed. It seems unlikely, as before, that there would be a technological retrogression with respect to wheels on the wagons. It is likely that the iron-rimmed

⁶² Gadd, *Järn och Potatis*, p. 189.

⁶³ E. Esbjörnsson, 'Skånska Allmogevagnar', in *Skånes hembygdsförbunds årsbok*, pp. 55–6.

TABLE 5. Estimates of the materials in the moving parts of the transport wagons (percentages), 1750–1850

	<i>Iron</i>	<i>Wood</i>
1750	0	100
1770	27.3	73.7
1790	66.7	33.3
1810	93.7	6.3
1830	97.6	2.4
1850	100.0	0

Sources: see Figure 1.

wheels were carefully distinguished from wooden wheels when they first began to appear, but not later.

Merging these results and taking into consideration these failures to specify the types of axles and wheels, we can estimate the total quality improvements (Table 5). Our interpretation is that in 1850, all transport wagons were equipped with either iron axles or iron-rimmed wheels or, in most cases, both (Figure 6). This contrasts with the beginning of our period, when the probate records show that all wagons had wooden wheels and wooden axles. Again, when comparing the development in west central Sweden, peasant-farmers in Scania were somewhat slow in introducing iron wheels but early in introducing iron axles.⁶⁴ A possible explanation for this is the relative deficit of iron in south Sweden. Consequently, when iron was first introduced in this central grain district, it was used to directly increase loading capacity by replacing the wooden axles with iron axles.

Moving from wood to iron led to a set of improvements in transporting heavy goods. First, iron parts increased the loading capacity of the wagons. Iron was stronger and more durable than wood, which was particularly important when transporting heavy goods.⁶⁵ Second, the friction was lower with iron parts than with wooden parts. Wooden axles and wheels were greased with a homemade mixture of tar and swine lard. On longer journeys, the farmers had to grease these parts continuously, often using black slugs to smear the naves to lower friction and to prevent the parts from wearing out.⁶⁶ With the lower friction resulting from iron parts, the draught animals could pull more weight with the same effort. Thus, improved loading capacity and less friction meant that holding constant the quality and number of draught animals and the number of wagons and days used for transport, more goods could be transported, and transport productivity increased.

⁶⁴ Gadd, *Järn och Potatis*.

⁶⁵ Ibid, p. 193.

⁶⁶ I. Svanberg, 'Black Slugs (*Arion ater*) as grease: A case study of technical use of gastropods in pre-industrial Sweden', *J. Ethnobiology* 26 (2006), pp. 299–309.



FIGURE 5. *Father is going to town (Far ska köra te' stan)* by Frans Lindberg (1858–1944). The artist tries to display the typical buildings, clothing and other objects from the 1840s in Scania. The painting is kept by Österlen's Museum in Simrishamn and is reproduced with their permission.

VI

Previous research has concluded, or at least implied, that the introduction of turnpike trusts in England during the eighteenth and nineteenth centuries, contributed to lower transport costs. However, there were other ways to reduce costs for individuals in need of better inland transport, most notably by breeding stronger horses and/or improving wagons, if the roads were of a sufficient standard. Against this background, we asked whether transport costs could be lowered without institutional changes to the road system and major road investments. To answer this we looked at the development of draught animals and wagons in southern Sweden during the eighteenth and nineteenth centuries.

Our results demonstrate that transport costs declined without an institutional change to the road system. In the Scanian case, this outcome was due to two simultaneous changes. First, there were significant improvements as iron axles replaced wooden axles on the wagons and wooden wheels were substituted with iron-rimmed wheels on the wagons used for transport. These changes were important for improving the freight capacity and the reliability of the wagons. Moreover, the designation of wagons exclusively for agricultural production and conveyance indicates that farmers became increasingly aware of the importance of improved transport. Second, state-led actions to improve the quality of the horse stock through breeding were undertaken, which meant that the horses could travel faster and carry heavier cargo.

Indeed, the revelation of these improvements in land transport indicates that the roads and bridges were of at least a minimum and sufficient standard, enabling peasant-farmers to lower their own individual transport costs through investments in their means of transport. While we do not rule out the possibility that these farmers might have started to improve the roads as well, it is notable that all of these changes were undertaken despite the fact that the state did not initiate any institutional change to the road system or make any significant investments in roads. Furthermore, the evidence presented in this article shows that these improvements, which involved better wagons and breeding of horses, came during periods of rapid economic development. Although our results cannot be interpreted directly in a causal manner, they clearly indicate that the peasant-farmers took active measures to lower their transport costs in the face of growing commercialization and increasing agricultural surplus. In turn, these reduced transport costs might have contributed to the further commercialization of the peasant economy by providing incentives for increased specialization among farmers involved in trade and by involving more remotely situated peasant-farmers in the markets.

Our study contributes important insights into the decline of transport costs in pre-industrial Europe. When incentives for producers increased (due, for example, to increasing demand for agricultural products and a growing agricultural surplus), reaching the markets became sufficiently important that initiatives to lower transport costs were taken by the road users themselves. These initiatives consisted of investments in improved transport means or even in improvements of the roads within the old road maintenance system. This study highlights that it was possible to reduce transport costs in pre-industrial Europe despite the absence of an institutional change to the road maintenance system.