Swedish Agriculture in Economic Development 1870-1939

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Introduction

The period 1870-1939 was decisive for industrialisation and for the creation of an industrial society in Sweden. It was also a period of comparatively rapid economic growth in Sweden in a European perspective. The annual average per capita growth was above 2 percent, placing Swedish growth clearly above any other European experience in this period. This was basically due to successful industrialisation. At the same time, agriculture met new pressures to transformation, both internally and externally. New competition arose on the labour market from emigration and from expanding industries and services as well as on the market for grain from foreign suppliers. There were also transformation pressures of a positive character. Rising income, urbanisation and infrastructural development created new markets while industrialisation and foreign trade supplied new inputs and new technology to agriculture.

In a broader European perspective this period has been labelled “the first green revolution”, indicating the substantial role agricultural transformation may have played to sustain the modernisation of industry and society. (Van Zanden 1991) However, in the historiography of Swedish growth, agriculture has not taken any prominent position and it has been in the shadows of the dominant industrial expansion. (Cf. Jörberg 1973) The question here is how Swedish agriculture met these new challenges and to what extent it contributed to the overall successful Swedish growth experience in the decades around the turn of the century 1900.

The pressure from foreign competition and from industrialisation also released political forces to protect and to support Swedish agriculture. Three major steps were taken in these respects. In 1888 tariffs on grain were introduced to reduce the competition from overseas imports. As in most European countries this was a first step towards a more protectionist foreign trade policy. In the early 20th century a new legislation was taken to subsidize the creation of small-scale family farms. This measure should support traditional rural life and to counteract emigration which was seen as a major threat by proponents of the leading classes in Sweden. In the early 1930s a new agricultural policy was adopted to regulate agricultural prices in order to make income of the agricultural population more comparable to the income of industrial wage labourers. This was the key formula in a new pact between the Social Democratic Party and the Peasants Party that enabled the Social Democratic Party to form a government in 1933 and to release a “Keynesian” economic programme with the first element of the Swedish Model that was to put its imprint on development after the Second World War.

Comparative sectoral development

At the beginning of the period, Sweden was obviously an agricultural society. More than 2/3 of the population were mainly employed in agriculture. (Table 1.) The industrial sector and services shared the remaining third equally. In contribution to GDP, the sectoral differences were not that large but agriculture was the dominant part also in this respect. However, over the period agriculture lost its primary position - in terms of contribution to GDP it was surpassed by industry in the 1890s and in terms of employment both industry and services overtook agriculture in the 1930s.

Table 1. Shares of GDP in current prices and shares of total employment in agriculture, industry and services in Sweden 1870-1939.

Year	Shares of GDP			Shares of employment		
	Agriculture	Industry	Services	Agriculture	Industry	Services
1870	46.8	21.3	31.9	69.4	14.9	15.7
1890	32.8	31.7	35.5	58.2	18.4	23.4
1910	27.3	37.0	35.7	47.8	22.8	29.4
1930	15.9	43.9	40.2	34.5	30.0	35.5
1939	13.4	46.3	40.3	29.5	31.9	38.6

Sources: Krantz/Schön (forthcoming); Schön (2000).
Note: Service shares are exclusive of real estate.

High Swedish growth rates 1870-1939 were mainly accomplished by strong industrial growth and in a comparative perspective the high rates were due to a very favourable Swedish development after 1910, i.e. during the war and the inter-war period when large parts of Europe went into stagnation. In this period, Swedish growth actually accelerated. This in turn was basically the outcome of a shift in the Swedish industrial structure in conjunction with the so called Second Industrial Revolution. Thus, up to the 1890s, Swedish industrialisation was largely relying upon natural resource based industries such as saw mills and iron works. From the 1890s, however, more sophisticated industries became increasingly important. Saw mills and iron works stagnated while engineering industries and chemical industries (including pulp and paper) came to the forefront and these new industries had a very decisive impact upon Swedish exports after the First World War.

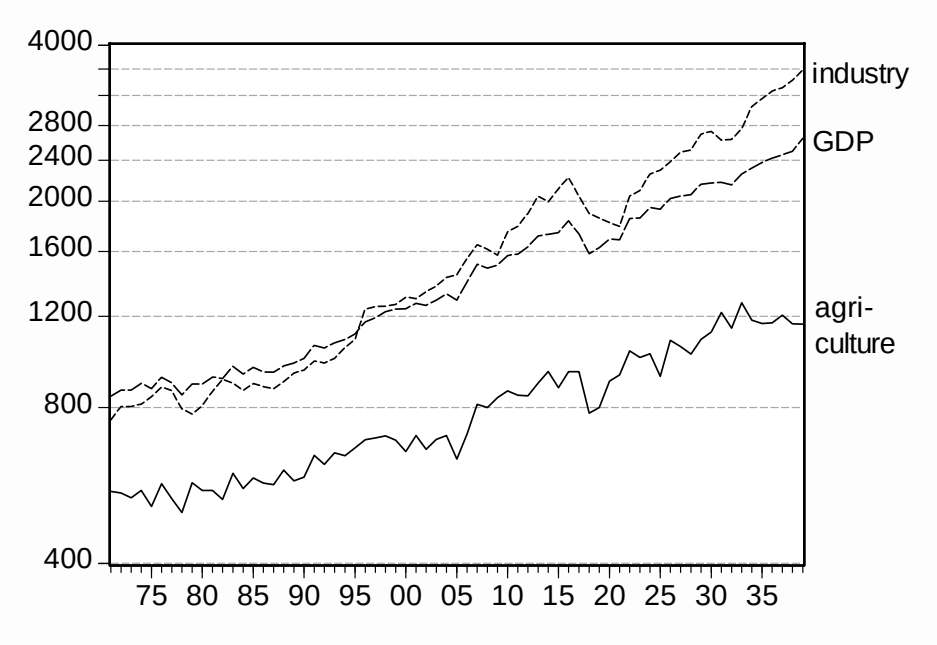
There was also a shift towards a modernisation of services. Traditional services such as domestic work, military and religious services lost ground while modern services in finance, trade, communication and education expanded from the turn of the century and in particular these services advanced in the 1920s. (Schön 2000)

The sectoral shifts had a decisive impact upon the Swedish society. Up to the 1890s a large part of both industrial work and services was performed in the countryside. Natural resource based industries and traditional services were to a great extent rural in character. With the second wind in industry and with the modernisation of services, these sectors and the Swedish society became much more urban in character. Thus, the boundaries between employment in agriculture and in other sectors, that at an early stage of industrialisation had been quite vague, became more clear-cut.

Productivity

Within this broad characterisation, Swedish agriculture does not play a very prominent role in the economic growth of the industrial breakthrough period. Agricultural labour productivity, for instance, was on a much lower level than in the economy as a whole and it increased more slowly. (Figure 1.) Thus, the distance widened over time despite the release of labour from agriculture. While agricultural labour productivity (measured at 1910/12 constant prices) was about 2/3 of the industrial and the over all labour productivity in the early 1870s, it had dropped to less than half of the over all and to 1/3 of the industrial productivity at the end of the 1930s. The over all growth was mainly due to the rapid growth of productivity in industry and to the enlargement of the industrial sector. That was particularly the case from the 1890s onwards when modern industrialisation really took off in Sweden. Thus, while agricultural labour productivity grew by 1.3 percent annually on average over the period, industrial labour productivity grew at a rate of 2.3 per cent.

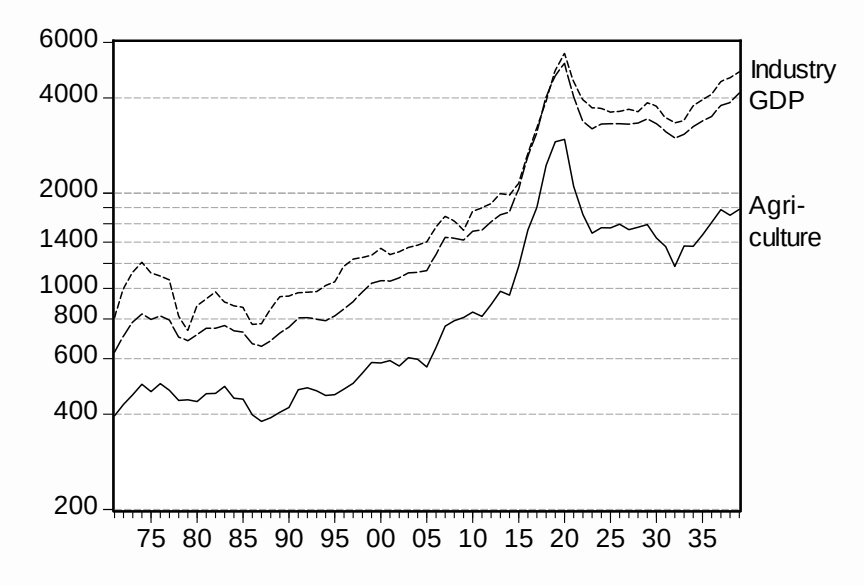
Figure 1. Labour productivity in agriculture, industry and at the GDP level in Sweden 1870-1939. SEK in constant prices, 1910/12 price level.



Sources: See table 1.

To some extent the effects on income of this sizeable difference in productivity growth was modified by relative price changes. In current prices the value added per labourer in agriculture kept a rather stable position of 2/3 of the over all level and ½ of the industrial level in the pre-war period. (Figure 2.) During the war agriculture even improved its position. However, in the interwar period an adverse development of agricultural prices aggravated the situation and value added per labourer fell to an historical trough in the early 1930s of less than 40 percent of the general Swedish level and less than 1/3 of the industrial level. This deplorable situation set of course the stage for the new agricultural policy implemented in 1933.

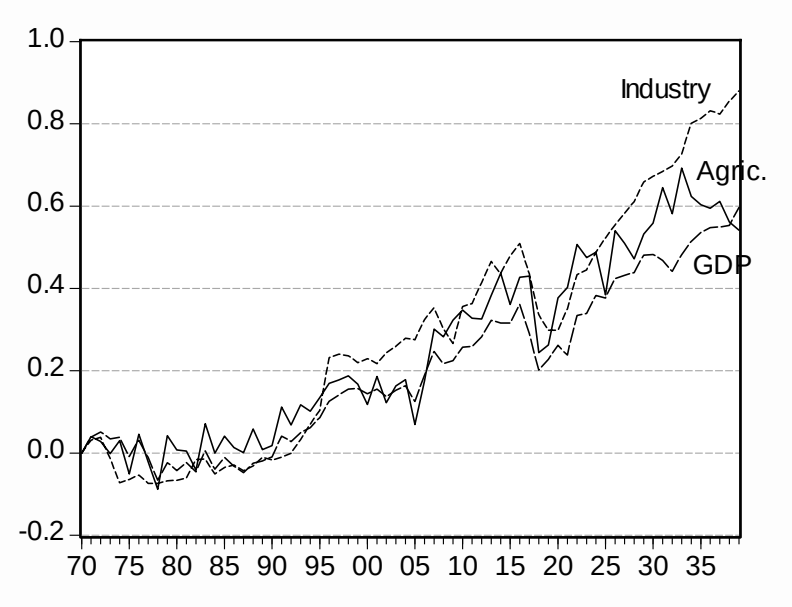
Figure 2. Value added per employed in agriculture, industry and at the GDP level in Sweden 1870-1939. SEK current prices.



Sources: See table 1.

Slower growth of labour productivity in agriculture did not mean, however, a considerably slower growth in total factor productivity. In this respect, agriculture actually kept pace with industry up to 1930. (Figure 3.) After the implementation of the new agricultural policy, total factor productivity fell back noticeably in the 1930s, but agriculture still kept itself abreast with the over all total factor productivity growth. Thus, over the whole period tfp growth in agriculture was 1.0 percent annually and in GDP 0.9 percent. Industrial tfp growth was at the higher level of 1.4 percent - a marginal to agriculture that very much arose in the 1930s. The reason for the much greater differences in labour productivity growth than in total factor productivity growth is obviously that capital intensity grew at a much lower rate in agriculture than in the economy as a whole, and it grew in particular much slower than in industry.

Figure 3. Accumulated TFP in agriculture, industry and at the GDP level in Sweden 1870-1939. Index 1870=0.



Sources: See table 1.

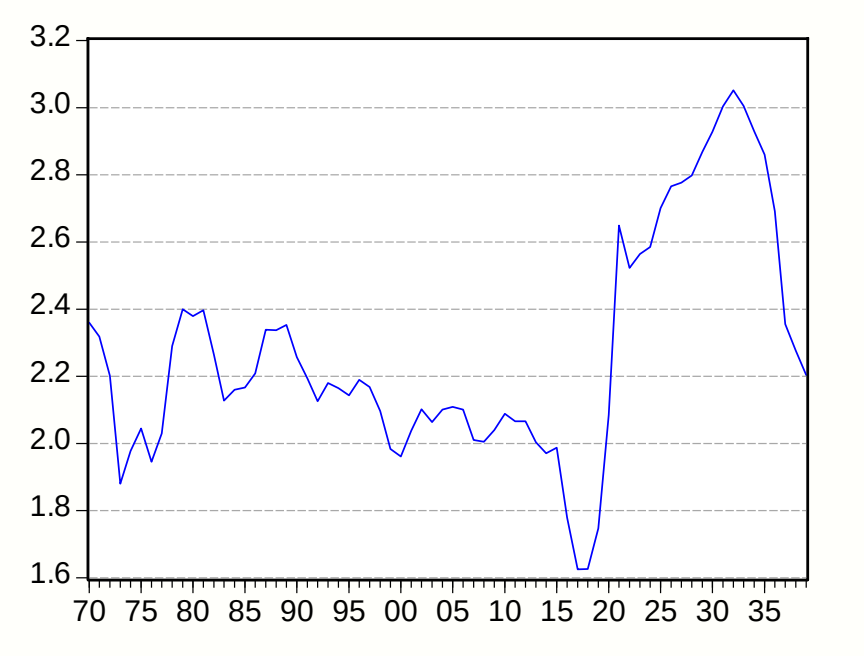
Thus, one can conclude that agriculture was not able to reap the benefits of the new capital intensive industrial technology, born with the electrical motor and the combustion engine, to any large extent before 1939 and it was not able to catch up from its low level in productivity. On the other hand, one may also conclude that agriculture was able to introduce innovations and innovative behaviour, not embodied in capital, at a rate good enough to keep pace with the overall total factor productivity growth.

Wages

The economic position of agriculture is largely reflected in the relation between the wages of agricultural workers and the wages of unskilled workers in manufacturing industry. The wage level was much higher in industry, 2-3 times. (Figure 4.) In comparison with the value added per employed in current prices, the comparatively larger wage differential between the two sectors indicates that the marginal productivity of the wage labourer was closer to the average productivity level in industry than in agriculture. It also indicates that quite a large differential was needed to attract labour to the industrial sector. The differential certainly also indicates a lower cost of living at the countryside, in particular at a time when living still was mostly made up of food, fuel and shelter.

There were strong variations over time, however, in the wage relation between agriculture and industry and one can discern three trend periods. From the 1870s to the late 1910s the wage differential tended to diminish somewhat. That was contrary to the movement in labour productivity with the slower agricultural growth but reflected relative price movements and productivity in current prices rather well. Furthermore, up to the First World War the real product day wage in agriculture increased quite substantially and somewhat stronger than labour productivity, indicating a shift towards labour in income distribution. This was the period with the fiercest external pressure on agriculture with competition both from the import of grain and from mass emigration, reducing prices and increasing wages for unskilled workers in agriculture, while returns from land were reduced. The latter situation changed during the war, when the blockade to foreign trade favoured domestic agriculture for a short time. From the early 1920s, however, a new trend appeared. Industrial and agricultural wages diverged strongly as did the value added per labourer in the two sectors. Furthermore, in the 1910s and the 1920s the real product day wage in agriculture stagnated, which had no counterpart in productivity development. This was a period of a more protected domestic market and of a dwindling emigration of labour. Thus, one may conclude that there was another shift in income distribution, from labour to capital and land owners. The very large wage differential in the 1920s indicates that a strong structural tension arose from the rapidly modernising urban industrial and service sectors in relation to the more slowly adapting agriculture. The labour market became segmented. The differential also indicates that the agricultural sector may have functioned as “an employer of last resort” in a situation of shifts in demand and supply that were detrimental for unskilled workers. The third period, then, is the 1930s. The slumping relative wages indicates the plight of agriculture in the crisis of the early 1930s. The reaction of wages to the new agricultural policy was, however, very direct and strong. In the short term, agricultural wage labourers were the most favoured part in the pact formed between the labour party and the peasants’ party.

Fig. 4. Hourly earnings of manufacturing workers in relation to hourly earnings of agricultural workers in Sweden 1870-1939.



Source: Bagge et.al. (1933); Sveriges Officiella Statistik.

Note: Workings hours in agriculture from estimation in Bagge et.al.

The factors of production in agriculture

Labour

Two things are clear. Firstly, agriculture was a large sector in terms of employment over the whole period. Secondly, the productivity comparisons make it quite clear that labour was released from agriculture at a rather slow pace.

In the early 1870s agriculture was by far the largest sector of the economy in terms of employment. More than two thirds of the Swedes were mainly occupied in agriculture with its subsidiaries fishing and forestry and they certainly lived in the countryside. There were, however, great seasonal variations and part-time occupations in other sectors flourished (see below). The boundaries between the sectors were certainly not very clear. These difficulties in measuring the input of labour in agriculture are well known. (See e.g. O'Brien/Prados 1992).

It is probable that there is an upward bias in the accounts of the number of labourers in the earlier decades. One can assume with some certainty that occupations in the agricultural and rural economy were more flexible and that seasonal variations in occupations were greater at an early date. Thus, the accounts of labour input are probably more accurate at a later date. With this bias the early productivity estimates may be to low and the rate of increase to high. On the other hand, working days were normally longer at the beginning of the period. The regulation of the working day had probably a stronger impact upon agriculture than upon other sectors and thus a shortening of the working day may counteract the effects of the number bias.

Furthermore, the difficulties in estimating the labour input are particularly pronounced with the female population. According to prior investigations and estimates, one third of the work of the adult females in the agricultural households is referred to the agricultural sector and the rest is referred to paid or unpaid domestic work (and the latter category is not included in GDP or in employment).

In absolute terms, agricultural occupation peaked around 1880 and from that time the exodus from the sector started. It accelerated somewhat after the turn of the century with the more rapid industrialisation and then the decrease accelerated even more in the 1920s and 1930s – although the very sharp drop in agricultural employment was to come after the Second World War.

There was a very pronounced gender bias in the exodus. It was to a large extent females that left agriculture. Between 1890 and 1940 the number of females in the agricultural sector was reduced by one half. In the same period the number of men decreased by only one tenth. (Morell 2001) It was primarily young women that left the countryside for a new urban life. The female labour market widened with the growing service sector and new consumer goods industries. The urban surge for the comparatively cheap female labour is also reflected in a considerable relative increase in urban female wages in the 1920s. (Svensson 1995) On the other hand men were more attached to the soil, often as the heirs of the family farm, and they were slower to react to or more resistant to the lure of higher income and a modern life.

Undoubtedly, though, the countryside became much duller with this female drain. It all prepared for the rapid decrease of rural (male) population in the post-war period.

The comparatively slow decrease of male labour from the agricultural sector, despite the wide and widening productivity gap to industry and services up to the 1930s, is furthermore explained by the structure of ownership and labour organisation in Swedish agriculture. Large holdings and wage labour were not the characteristic forms of ownership and labour. Swedish agriculture was rather characterized by peasant farming on fairly small sized plots with the family household as the main source of labour. For young people wage work in other households was a stage in life where you earned experience before becoming your own, running your own household and farm. (Dribe 2000) As long as this perspective on life was vivid – apparently it stayed longer among males – the productivity gap could widen considerably.

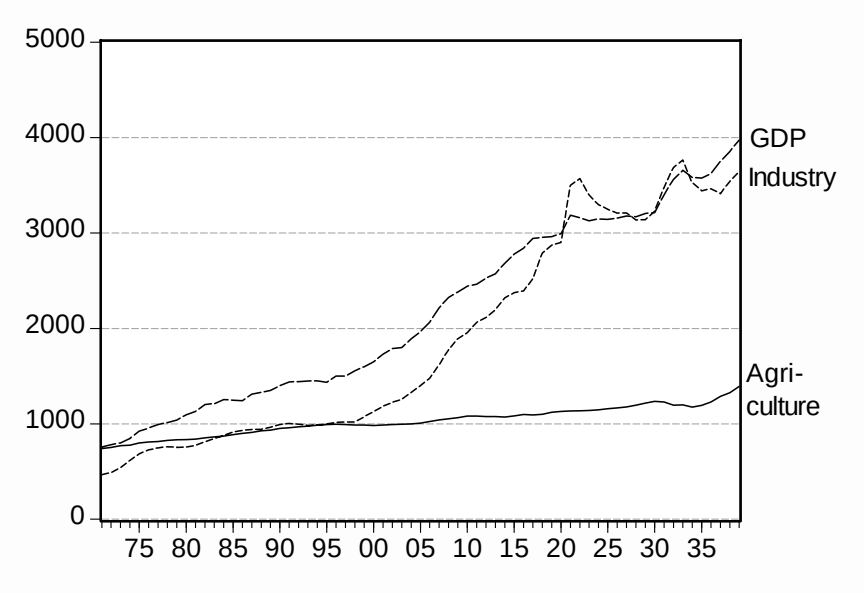
The agricultural compromise in the 1930s between the social democrats and the peasants' party also introduced a new element in relation to the land market. The social democrats had become very adverse to the proliferation of small-scale holdings, that was considered very much in the interest of large landowners providing them with abundant labour supply in peak periods – this "last resort of employment" created only hard toil and miserable conditions. From the late 1930s a new policy was adopted to support mergers of holdings in order to create family farms large enough to sustain rational mechanisation. This policy was to become effective in the rationalisation of agriculture after the Second World War.

Another question is, however, in what manners this mainly family-based agricultural sector were able to accommodate to new circumstances and increase its labour productivity and total factor productivity in the period up to the 1930s. We will return to that question.

Capital

At the beginning of the 1870s the capital endowment per employed in agriculture was very close to the average of the economy. (Figure 5.) This is not too surprisingly since agriculture made up some 70 percent of employment. It is more telling that the relative capital stock in agriculture was considerably above that in industry. Thus, the stock of cattle and buildings made agriculture a comparatively capital intensive sector. However, capital in industry and in infrastructure multiplied, particularly after the turn of the century, with increases of 5 to 7 times per employed. The increase in agriculture was in contrast very modest – in absolute terms the capital stock actually stagnated between 1890 and 1930. From the 1920s the difference in capital equipment between the sectors had become huge. This very weak capital stock performance of agriculture does of course explain the difference between the relative performances of labour productivity and of total factor productivity.

Figure 5. Capital per employed in agriculture, industry and at the GDP level in Sweden 1870-1939. SEK in constant prices, 1910/12 price level.



Source: Krantz/Schön (fortcoming); Schön (2000); Statistiska Centralbyrån (1960); Jörberg (1972): Kander (mimeo).

Note: The capital stocks at sector and GDP levels are aggregation of building capital and machinery capital, estimated from annual investments back to 1800 with the Perpetual Inventory Method. The agricultural stock also comprises the cattle stock, estimated from the number of cows, oxen and horses. Prices of cows and oxen in 1910/12 are from Jörberg and horse price is constructed from the price of oxen and the muscle power relation between oxen and horses in Kander.

Figure 6. Capital stocks of buildings, machinery and cattle in Swedish agriculture 1870-1939. Thousand SEK in constant prices, 1910/12 price level.

Source: See figure 5.

Within a slowly changing total capital stock in agriculture, the composition of capital changed very markedly over the seven decades. (Figure 6.) Buildings remained the quantitatively most important element in the capital stock but it was in both relative and absolute retrogression from the 1890s onwards. The most dynamic element was machinery. Its share rose strongly from a very insignificant position 1870. There was a strong investment drive in new machinery from 1905 over the First World War. This was the period of the commercial breakthrough of the new motor and machine technology that was launched in the so called Second Industrial Revolution. Although the impact from this new technology was much stronger in industry and infrastructure, as was seen from figure 5, it certainly affected also the composition of capital in agriculture. Probably the inflationary agricultural prices during the war prolonged this boom in machinery investments. There was another investment surge in the 1930s under the double impact of the new agricultural policy, which created more optimism in long term perspectives among farmers, and the electrification of the Swedish countryside that was very much extended during the 1920s and the 1930s as a complement to new equipment.

There is some correspondence between increasing relative agricultural wages and investments in machinery and equipment, at least in the sense that the 1920s of relatively decreasing agricultural wages also saw stagnation in investments. In the late 19th and early 20th century there were increasing investments in labour-saving harvesting equipment such as cutting, binding and threshing machinery. Draught animals or stationary steam-powered locomobiles were mainly used to run the equipment. The tractor was introduced as early as 1905 but it was not very effective at this point and was hardly diffused before the end of the 1930s. With the shift to animal produce, milking became one of the most laborious tasks and it was performed almost exclusively by women. Thus, the introduction of mechanised milking machinery was of great significance in particular when female labour tended to leave agriculture. The milking machinery appeared in 1920 and it was more widely diffused in the 1930s. (Morell 2001)

One can also note that although forestry became an important subsidiary to agriculture, it did not involve much equipment before 1940. The planting and felling was done manually with simple tools such as spades, axes and saws.

The total cattle stock was rather stable over the period as a whole. A long run increase up to 1910 was extinguished during the war, due to shortage of fodder, while a cattle recovery in the 1920s was short-lived. The composition changed however. The number of cows increased considerably up to the 1910s with the expansion of milk production. In the same period the number of oxen decreased very sharply and they were replaced by horses.

The changing composition of capital may explain part of the long term productivity increase in agriculture. The substitution of horses for oxen in combination with new machinery equipment certainly introduced a more efficient technological block into agriculture. The productivity of this block was further enhanced in the 1930s when electrification of the countryside became really effective and the diffusion of tractors commenced. The immediate impact upon productivity was meagre, however. Instead the increase in capital intensity in the 1930s resulted in a sharp drop in total factor productivity. This may be seen as an instant of the productivity paradox in a situation of transformation of the agricultural sector – the great increases in productivity were to come after the Second World War when the sector was reorganised in relation to new prerquisites.

Land

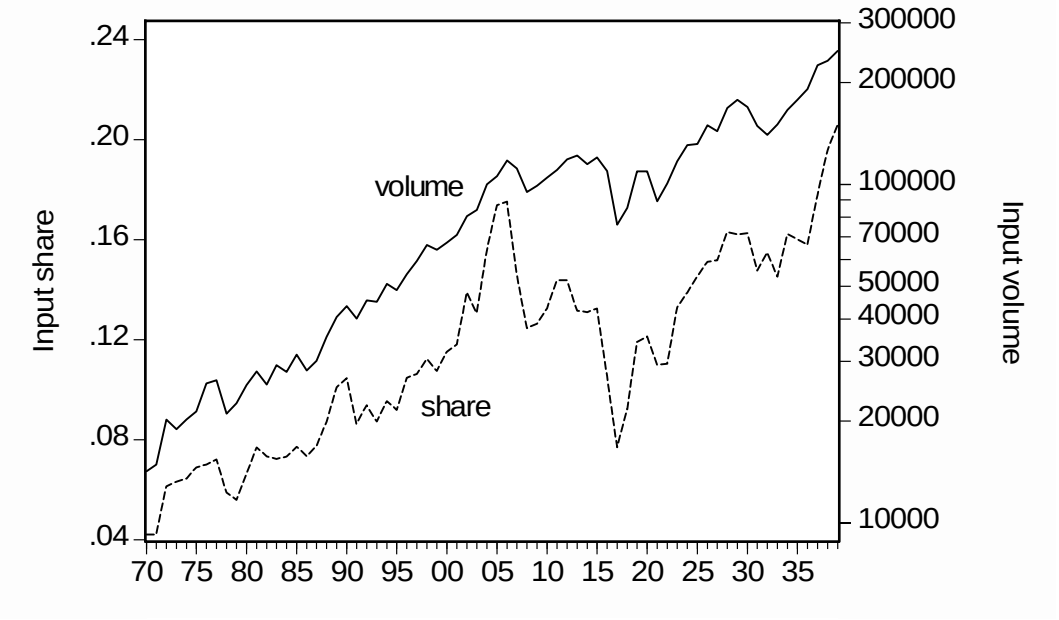
The total amount of land changed very little over the period 1870-1939. Up to 1870 there had been a considerable reclamation of land from impediments such as marshland or lakes. With the new competition on the grain market, these reclamations came to an end. Within a stable total amount of land there was, however, a shift from pasture to cultivated land. That shift did not in any way mean retrogression in cattle breeding but rather the reverse – cattle breeding and the production of animal produce became more intense with the cultivation of fodder substituting for the more extensive grazing of pasture lands and harvesting of meadows.

In the production accounting exercise this more intensive use of land is accounted for by the input of labour and equipment. Thus, the roughly fixed amount of land may be excluded in the calculation of contributions to growth with no consequences.

Industrial input

An increase in current input from the industrial sector into agriculture may have been one source of productivity growth. Industrial inputs such as chemical fertilizers, processed fodder, horse shoes, coal and petrol multiplied over the period. In volume terms these inputs grew 15 times 1870-1939. (See figure 7.) As a share of gross agricultural output they increased from 4 to 20 percent. One can also notice that the growth pattern is very similar to the pattern of the real product day wage and rather similar to the investment trends - growth was strong both absolutely and relatively up to 1905, followed by stagnation until 1930 and new growth in the 1930s.

Figure . Industrial input into the agricultural sector 1870-1939. Thousend SEK in constant prices, 1910/12 price level. Industrial input as share of gross output in current prices.



Sources: Schön (1988); Schön (1995); Krantz/Schön (forthcoming).

Composition of production

In terms of final produce, agriculture had three main areas: the cultivation of grain, the breeding of cattle for milk and slaughter, and forestry. When calculating the weight of these three lines of production, the intermediate production of input into the sector such as the breeding of draught animals or the cultivation of fodder crops is included in the value of the final output. For instance, the value of the extensive cultivation of hay for feeding cows during the long winter season is included in the milk or meat produce. Thus, the shares are based upon output values for final use.

The weight of these production areas shifted quite substantially over the period. Around 1870 grain production for human consumption still dominated agriculture. The whole of the 19th century had seen an expansion of grain land, mostly to feed the growing population but to some extent also to produce a new export good, oats for the English market to feed the horses. During the first half of the 19th century animals had been kept not only for their produce of meat and milk but also to a large extent as complements to the grain cultivation for their draught power and their manure. Already in the mid-19th century demand for animal produce such as milk, meat and pork was increasing with a rise in the relative price. This development gained further strength after 1870 with the influx of cheap grain from overseas and an increasing income elastic demand for animal produce.

Furthermore, up to the mid-19th century forestry had been of a minor importance to the economy of agriculture. Forestry mainly provided building material and fuel locally, but with the expansion of the sawmill industry from the 1850s it received new weight in the income of the agricultural sector. Roughly 50 percent of the final value of the new export income of sawn goods was derived from the logging and transporting work performed in forestry.

Figure 7. Shares of grain, animal produce and forestry in the final products of Swedish agriculture 1870-1939.

Source: Schön (1995).

From the late 1870s up to the early 20th century, animal produce increased its share very strongly from around one third to more than one half of the income of the sector. Since this was more or less at the expense of grain production, the weights within agriculture proper shifted even more. Thus in the late 1930s animal produce took a share of four times that of grain.

Forestry kept its relatively strong position until the end of the 19th century but it was somewhat weakened in the early 20th century due to stagnation of the sawmill industry. The pulp and paper industry, that was to increase its demand for raw material very decisively after the Second World War, was still too small to compensate for the saw mill stagnation.

These shifts in weights follow very markedly the changing relative prices in Sweden. From 1870 up to the outbreak of war, the price indices of both animal produce and forestry had increased by some 40-50 percent in relation to grain prices. The relative price increase of animal produce was even more pronounced after 1890 than before, despite the fact that tariffs on imported grain were introduced in 1888 to protect Swedish agriculture. One might say that the income elasticity had a stronger impact upon prices than the tariffs. On the other hand, though, the tariffs raised the prise also on fodder products so the effect on the price relation was somewhat reduced.

The war and its aftermath saw very heavy price fluctuations but after the war there was a noticeable relative decline in the price of animal produce to a marked bottom in the early 1930s, nearly back to the price relation to grain from the 1870s. These were the year of crisis when animal products, and in particular milk but also pigs, had become clearly dominating in bringing income to the peasants.

Overall, there are similarities between the structural transformation of agriculture in Sweden and in neighbouring Denmark, despite the more protectionist trade policy adopted in Sweden in the 1880s. Production of grain for human consumption stagnated while proper agriculture

was geared to animal produce such as milk and cattle as inputs for dairy and slaughter industries. There are however differences in the intensity of this transformation. While Danish agriculture became more specialised and exposed to international trade as an export branch, Swedish agriculture was mainly directed to the domestic market. Thus, protectionist policy was an option for peasants to slow down the transformation in Sweden. But transformation pressure arose from many corners, particularly from new urban sectors that were only weakly linked to agriculture, resulting in a huge structural tension between agriculture and industry and services in the inter-war period.

With the crisis of the 1930s, Swedish protectionist policy became even more effective involving harsh quantitative restrictions of grain imports and subsidies of butter exports to keep up internal prices. To some extent, though, the negative effects on the transformation of agriculture from these measures were to be counteracted by the new regulation of the land market and the support for rationalisation of agriculture in order to increase productivity.

There was also another difference between Sweden and Denmark, namely the importance of forestry to Swedish agriculture. With the rise of the sawmill industry as a new export branch in the second half of the 19th century, silviculture diffused in Sweden. The forest became part of the rational use of land and forestry created a new stream of income for peasants and land owners that was closely related to the export markets.

Thus, forestry and animal produce linked Swedish agriculture to the markets of the new industrial society.

Work organisation and productivity increase

There is one aspect of the new composition that arose in the last decades of the 19th century that may explain the long run viability of small-scale farming and the productivity increase. The new composition of production gave a new variety to agricultural work that was perhaps particularly important in a country such as Sweden. Sweden has a long winter season when productivity in agricultural work is at a very low level, particularly in any work related to grain cultivation. Rural life of course had to adapt to these conditions. Prior to 1870, when grain cultivation dominated with its high seasonal fluctuations in labour demand, “proto-industrial” domestic crafts flourished in winter time, especially in forested areas where there was a good supply of fuel for light and heating and also supply of raw materials such as wood, iron or leather. With the growth of animal farming and forestry the seasonal variations diminished dramatically and it also affected the labour organisation within the household. Attending the cattle and milking was a daily duty over the whole year and it was very much a female responsibility. Work in the forest was almost exclusively undertaken in winter time, engaging men and draught animals. With this transformation of agriculture, a smaller number of people could be employed more rationally over the whole year. It also involved the need of a greater flexibility in the distribution of work between different tasks and a wider shared competence in the work force. One can assume that such flexibility and competence was more readily provided within the market-oriented family-based farms than at larger estates. Up to the Second World War this transformation of agricultural production prevented a more drastic restructuring of ownership and landholdings.

But the transformation certainly involved new challenges that were difficult or even impossible to meet within the sole frame-work of family-based farming on small holdings.

Large technological devises such as threshing machinery, locomobiles or tractors put up such challenges as did the handling and the logistics of fresh milk production. These challenges invoked a new cooperative spirit among peasants, very much inspired by the somewhat earlier development in the same direction in Denmark. Thus, while large estates already in the 1870s had set up dairies for taking care of their milk (and that of adjacent farms) in the production of butter, farmers established cooperative dairies in the 1890s. The cooperative movement started in the south of Sweden (close to Denmark) and spread northwards. (Sommestad 1992) It became very much the prototype of a new peasants' movement of producers' cooperatives (important also for the later regulation of the market). In a similar fashion, local cooperation spread in the late 19th and early 20th century for the common use of threshing machinery and locomobiles. In the 1910s and 1920s these "threshing cooperatives" became agents for setting up sites for electricity generation or local networks for transmission, before the national grid was fully effective. (Olsson 1988)

Of equally great importance for a transformation of agriculture that involved a very large number of farmers, were the new organisations to diffuse knowledge of new methods and new crops that were set up in the course of the 19th century. Swedish peasants were increasingly organised within associations devoted to such enlightenment. The high degree of literacy made this information comparatively very effective and the newsletters or journals of the associations could at least theoretically reach almost every peasant. The market-driven transformation of the production composition was thus supported by a new structure of information in the countryside.

Some conclusions on agriculture in industrial development

Thus, one may conclude that productivity grew very much thanks to a better allocation of labour with less seasonal unemployment or less severe seasonal drops in marginal productivity. Furthermore, this reallocation involved the adoption of new methods, crops and products that was stimulated by market incitements, by the diffusion of knowledge and by cooperative behaviour among peasants that combined household economics and capitalist economic rationality. The contribution from capital accumulation to growth was limited, however, which shows up in the rather slight difference between labour productivity growth and total factor productivity growth. The strong increase in machinery investments during the 1930s indicates a new turn but that did not have any effect on productivity as yet.

Although, one may say that the structural tension grew between agriculture and industry, particularly in the inter-war period, there certainly also arose a new complementarity between a transformed agriculture and a modernizing industry and society. Thus, food industries with direct links to agriculture became a very important part of Swedish industry up to the Second World War. Furthermore, many engineering industries produced machinery and equipment to farmers. The strong increase in milk production created many links to industrial production and it renders example of the two kinds of links mentioned above. The cream separator was an important innovation in the 1880s that increased the productivity in handling the milk at the farms but production of the separator was also the backbone of a new engineering industry in Sweden and of a new company that was to become global (Alfa Laval). The milk production was also dependent upon a new infrastructure in taking care of the milk and a new network of dairies and modern transportation, bringing milk and butter to the urban population. On this basis another innovative industry was created in the 1930s that also should become global (TetraPak). At the same time, the intensified agricultural work with reduced

slack seasons meant a greater propensity of the agricultural population to buy factory goods and so the growth of industries of consumer goods and equipment was sustained.

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