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THE INDUSTRIAL REVOLUTION IN THE LOW COUNTRIES IN THE FIRST
HALF OF THE NINETEENTH CENTURY--A COMPARATIVE CASE STUDY

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THE INDUSTRIAL REVOLUTION IN THE LOW COUNTRIES IN THE FIRST
HALF OF THE NINETEENTH CENTURY--A COMPARATIVE CASE STUDY¹

by

Joel Mokyr

Northwestern Europe has always enjoyed a prominent and perhaps slightly disproportionate role in the discipline of Economic History. It is therefore surprising that the Low Countries in the 19th century have as yet not received from English-speaking Economic Historians the attention they deserve by their location, their size and the uniqueness of their case.²

This neglect is the more surprising because the two countries, Belgium and the Netherlands, offer a unique opportunity for comparative economic history: two countries of comparable size, located in the same corner of Europe, surrounded by giants, with considerable overlapping in linguistic and cultural backgrounds. One of them, Belgium, undergoes a process of rapid industrialization in the first half of the 19th century, emerging in the 1840's as the most industrialized country on the continent. On the other hand, very little industrialization can be observed in the Netherlands in the first half of the 19th century. It may be important to inquire into the underlying causes of this gap not only in order to understand the particular economies of the Low Countries, but also because this investigation could shed some light on the mechanisms of economic growth and industrialization in certain types of economies.

The first section of this paper will be devoted to a summary description of the industrial sectors of the two countries between

1798 and 1850. Then some of the traditional explanations that have been put forward to explain their divergent patterns will be presented. This will be followed by a simple model of economic growth which will help in focusing on one crucial element in the differential development of the two countries. In section IV, the basic relevance of this model will be demonstrated. Finally, some evidence will be presented and some suggestions for future research made.

I

For the purpose of this paper it is useful to define the discontinuous element of the industrial revolution as the adoption of a new technology that is used to produce the same (or very similar) commodities that were formerly produced, by a new and more capital-intensive technique. The new technology is exogenously given to the economy (in this case, imported from England). This makes it possible to point at the closing years of the 18th century as the beginning of the industrial revolution in Belgium. From the beginning, three main centers of this industry can be distinguished: (i) the cotton center in East Flanders, in and around Ghent; (ii) the wool center in the département de l'Ourthe (now the province of Liège); along the Vesdre with Verviers and Eupen as its main focal points; (iii) the heavy industry in the city of Liege and surroundings and in the département de Jemappes (now the province of Hainault).

These three industries underwent remarkable expansion in the closing years of the 18th century and the first twelve years of the 19th. This can be illustrated by a few figures that are, of course, a poor substitute for an exhaustive study on the Belgian industry in the

French period ~~that~~ still remains to be written. The mechanized cotton spinning industry in Ghent grew from zero in 1798 (the year in which Lievin Bauwens smuggled his first mule from England to the continent) to 115,000 spindles employing about 10,000 workers in 1810.³ There is reason to believe that Ghent accounted for about two thirds of the total cotton industry in Flanders.⁴ The order of magnitude attained by this industry in a short period can thus easily be seen.

In 1798, the same year that mechanized cotton spinning was introduced in the Continent, the wool-producing firm of Biolley and Simonis in Verviers hired William Cockerill to construct the first spinning mills and carding machines at their plant. As in the cotton industry, the discontinuous element in this development is not the emergence of a new industry ex nihilo, but rather the application of a new technique to the production of old goods and the associated quantitative expansion. The annual rate of growth of the output of drapes between 1800 and 1810 is estimated at 6%, as compared to 0.46% between 1752 and 1784.⁵

As to the heavy industry, the data are less easily interpreted; two of the major breakthroughs in the English iron industry namely the use of coke in the smelting process and Cort's rolling and puddling process were introduced only after the French period.⁶ Nevertheless, the number of blast furnaces, estimated at 63 in the period before 1795, rose to 83 in 1814. The output per furnace grew from less than 1000 kg. a day to as much as 3000 kg. a day.⁷ Total output of cast iron in the département Sambre et Meuse (today the province of Namur) grew according to one source from 10,671 ton in 1789 to 15,240 in 1811.⁸

The collapse of the Napoleonic Empire and the incorporation of Belgium in the Dutch monarchy caused considerable strain to the young Belgian industry. By the end of the decade, however, it seems that recovery was by and large complete. In the mid twenties many important technological changes were introduced, including i.a. widespread use of steam power and mechanized weaving in cotton and wool. The total number of spindles in the Flemish cotton industry doubled in the 15 years of Dutch rule.⁹ The total amount of fixed capital in the cotton-spinning industry in East Flanders was estimated by a contemporary writer to have grown from about 1.5 million guilders in 1817 to 2.7 million in 1826.¹⁰ Similarly the woollen industry recovered after suffering a severe setback in the last years of the Empire: the arrondissement of Verviers produced about 88,000 pièces in 1811, 65,000 in 1815 and between 100,000 and 120,000 in 1830.¹¹ Likewise, the metallurgical industry grew considerably: 1817 marks the founding of John Cockerill's famous machine factory at Seraing, soon to become the most prominent plant of its kind on the Continent. Total output of cast iron was estimated in 1816 to be 65 million pounds (29 thousand ton).¹² In the mid thirties estimates vary between 135 thousand and 150 thousand ton.¹³ Output of coal increased from 16 thousand ton in 1815 to 180 thousand in 1830.¹⁴

After the revolution of 1830, industrialization seemed to lose some momentum. There is some evidence that the rate of growth of the cotton industry, due to a fall in the price of the final goods as well as rising raw material prices, was slowing down considerably.¹⁵ Some growth, however, still went on, despite difficulties on the demand side. In 1846 the number of spindles in the cotton industry was about

the same as in 1836,¹⁶ but raw cotton imports increased¹⁷ so that it is possible that excess capacity was reduced and that old machines were replaced by new and better ones. The woollen industry fared much better and was able to quadruple its exports between 1832 and 1844 (though the starting point of this series is unnaturally low).¹⁸ The greatest expansion was experienced by heavy industry, doubtlessly due in part to the construction of a railway network. In 1850, thus, Belgium emerges as the most industrialized country on the Continent.

It should be emphasized that the new industry did not supplant the old industry for a long time, but rather coexisted with it for most of the period under discussion. The old industry in Belgium before the industrial revolution was a typical "proto-industry"--a rural-domestic industry of peasants who had to supplement their incomes which had become insufficient because of population pressure on the land.¹⁹ The three main centers of the proto-industrial sector coincided to a large extent with the three centers of modern industry: the linen industry in Flanders, the woollen industry around Verviers and the metallurgical putting-out industry (nail-making, cutlery etc.) in Liège, Hainault and Namur. That this is no fortuitous coincidence will soon become clear.

As to the Netherlands, the availability of data is even more restrictive than in Belgium. But it is beyond doubt that industrialization was considerably slower. It is important to keep in mind that at the beginning of the period the Netherlands were far from being a non-industrial country. Especially in the maritime province (Holland), much industry existed. Most of these industries were

"traffics", i.e. activities associated directly or indirectly with Dutch commerce and shipping (which were still substantial at the end of the 18th century). In addition to ship-yards, sail making and food packing industries, the most important industries were paper, glass and earthenware, sugar refineries, distilleries and breweries, tobacco, luxury textiles (calico printing) etc. Some of these industries had already declined considerably in the 18th century, others much less so.²⁰ It is clear, however, that these industries suffered very severely during the French period, especially during the years of the continental blockade, and declined to a fraction of their initial size.²¹ The impoverished Dutch cities lost considerable fractions of their population, and many of the remaining urban dwellers were reduced to charity.²²

The post-Napoleonic period was a period of slow recovery for the traffic industries. The lack of data does not allow the determination of the extent to which this recovery was completed by 1830. What is clear is that industrialization of the kind that Belgium had experienced did not take place. In 1830 the largest and best known machine factory in the Netherlands employed only 80-100 workers.²³ The textile industry in the Twente areas was stagnant²⁴ while the woollen industry in the South (around Tilburg) grew very slowly and only with considerable government help.²⁵ No other industries of importance seem to have developed.

The secession of Belgium in 1830 gave a first push to adoption of new and more efficient techniques in the Netherlands. A few signs of modernization can be observed. Some progress was made in the traffic industries in the maritime provinces, and even more important were the

developments in the few areas in which there was some proto-industry (mainly in the East and South). The total horsepower of the steam engines used by the cotton industry in the Twente area rose between 1830 and 1850 from a negligible 18 HP to a slightly less negligible 220 HP.²⁶ Exports of this industry increased from about 30,000 pieces in 1834 to 730,000 pieces in 1840.²⁷ The influx of a few Belgian Orangist entrepreneurs, as well as the demand of the Dutch Indies for cotton goods, no longer supplied by Flemish industry, explain this growth. In the Tilburg area in the South, where these beneficial effects were by and large absent, growth was much slower.

Thus one could expect a large gap between the two countries around 1850, although divergent rates of growth do not prove this a priori. Unfortunately the lack of comparable national income accounts make such a comparison impossible. Some very crude indicators can be used here, however, to hint at the orders of magnitude involved. The total number of steam engines in the Dutch economy in 1837 is estimated at 72 with a capacity of 1120 HP, climbing to 392 machines with 7193.25 HP in 1853. The corresponding figures for Belgium for 1846 are 1514 machines, with a capacity of 37,007 HP.²⁸ The total value of Belgian textile exports in 1844 was about 60 million francs in 1833 prices, or a few percent less in current prices.²⁹ Dutch textile exports in current prices (average 1846-1850) was 9.4 million guilders or some 20 million francs.³⁰ A very different but equally suggestive illustration pertains to the participation in the famed Crystal Palace exhibition in 1851. Belgium was represented by 512 entries which won 2 gold medals and 97 distinctions. The Netherlands sent 114 exhibits

of which one received a gold medal and 16 distinctions.³¹ The Belgian population at the time was approximately 50% larger than Dutch population.

II

Some explanations of this quite remarkable example of uneven development have been suggested in the literature, though the problem itself has not frequently been posed in explicit form.³² The most obvious difference between the two countries is in their respective physical endowments: Belgium has rich deposits of coal and iron, whereas the Netherlands have relatively more fertile agricultural land, but no iron and virtually no coal. This argument can hardly explain the whole phenomenon since two of the pivotal sectors in Belgian industry, wool and cotton, used imported raw materials. Steam power began to be used widely in Belgium only after 1825. On the other hand, the Dutch did have rich endowments of peat, which was widely used as a fuel in Dutch industry.³³ In addition, the importance of wind as an energy source should not be discounted. The paper, oil and sawmill industries in North Holland relied heavily on this cheap source of power.³⁴

The difference in historical background is of somewhat greater importance. Destructive wars and political settlements had destroyed all of the Belgian shipping and commerce and most of its industry in the last decades of the 16th century, whereas these activities prospered in the Netherlands. The result was that a politically dominant commercial class à la Amsterdam--probably a hindrance to modern industry--was absent

in Belgium. Of equal importance was the absence in Belgium of a heritage of technological traditionalism and entrepreneurial conservatism. The latter two were some of the factors that made it so difficult for the Dutch traffics to transform themselves into modern industry. Losses sustained by the traffic industries in the last third of the 18th century and the first decade and a half of the 19th may have discouraged the already very risk-averse Dutch investors from industrial projects.

Linked to this argument is the emphasis put on the demand side. The Belgian provinces were annexed to France in 1795 and enjoyed a large market of 50 to 60 million consumers (including military demand, an important component) until the collapse of the First Empire. This demand more than compensated for the loss of the overseas market. On the other hand, the Netherlands were incorporated into the Empire as late as 1810, and the tariff barrier between the Dutch provinces and the rest of the Empire was not lifted until 1812.³⁵ Obviously, advantages on the demand side provided the Belgians with a considerable edge over the Dutch. However, this cannot fully explain the continuous growing of the gap during the Dutch period and the post-revolutionary period, and it is certain that the industries that grew in Belgium during the Empire were not "hot-house industries".³⁶

Similar to this vein is the line that emphasizes the various roles of the respective governments that ruled the two countries. The help and encouragement enjoyed by the Belgian industry from the Austrian and later French governments in the form of tariff protection, prizes for inventions, technological contests, exhibitions, the opening of technical schools and subsidies were indeed of major importance.

More unexpected is the attitude of King William I of Orange, who tried to encourage Belgian industry as much as he could and committed part of his private wealth to this purpose. The founding of the famous Société Générale is only one example of this policy.³⁷ But this in a sense underlines rather than resolves the problem. Why would a Dutch (and protestant) King literally bet all his money on Belgian industry rather than try to emulate it by establishing similar enterprises in the Northern provinces?

An argument frequently encountered in the writings of Dutch economic historians as an explanation for their country's relative backwardness has been the lackadaisical mentality of Dutch entrepreneurs in the 18th and 19th centuries. It is interesting to note that a kind of "Landes-Gerschenkron debate" on the importance of social attitudes and entrepreneurship can be observed among Dutch specialists.³⁸

"...The industrialist in the early capitalist period (i.e. 1813-1870)... is content with a normal profit and does not even consider changing his methods as long as he is not compelled to by his consumers... he does not engage in organization or calculations, leaving this matter to his foreman... the industrialists of this period cannot complain about lack of leisure and could devote themselves to what was then considered as the noblest pastime: poetry..."

writes an authority.³⁹

Prototypes and caricatures of narrow-minded, cautious and conservative entrepreneurs can be found in 19th century Dutch literature, such as in the writings of Hildebrand and Potgieter. The economic implications of this are obvious: technological backwardness, high risk aversion and high leisure preference of entrepreneurs. If one extends "entrepreneurial attitudes" to include saving and investment behavior, a satisfactory explanation for Dutch

slow industrialization could be obtained. However, the differences in this respect between the two countries are a matter of degree rather of essence. Moreover, entrepreneurship was to some extent an internationally mobile factor--many of the pioneers of Belgian industry were English or of English descent so that its relative absence cannot fully account for long-run trends.

Finally, the existence of a large proto-industrial sector in Belgium and the relative density of rural population have recently been put forward as an explanation of industrialization in Belgium.⁴⁰ This view is correct, but merits some elaboration, since it is by no means clear which mechanism is operating here. Capital accumulation in the proto-industry, cited by Mendels, seemed relatively minor, since there were severe difficulties in transforming accumulated circulating capital into fixed capital in the absence of good capital markets. Nor is there much reason to believe that the proto-industry created a technological and entrepreneurial infrastructure that facilitated the growth of modern industry. Inventions were by and large all imported from England and it is far from clear how the proto-industry facilitated their adoption. Most entrepreneurs, except in the woollen industry, were homines novi or of commercial backgrounds and seldom directly connected to proto-industrial production.⁴¹ It will thus be useful to develop a more formal framework in which the various factors in this process can be analyzed with some rigor.

III

Assume an open economy in which only two commodities are produced, textiles and food. Before the industrial revolution both are produced in a traditional (rural) sector. Food (A) is produced by a usual production function with a fixed amount of land, whereas the output of the proto-industry, Z, is produced by a one-input, constant-returns-to-scale technique.⁴² Thus:

$$(1) \quad A = A(\bar{T}, L_A) \quad \frac{dA}{dL} > 0, \frac{d^2 A}{dL^2} < 0$$

$$(2) \quad Z = b \cdot L_Z$$

where $\bar{T}$ is the (fixed) amount of Land, L_A the amount of labor allocated to the production of A and b the productivity of labor in the production of Z. For simplicity it will be assumed that only A is being consumed, while Z is completely exported. Population pressure on the land is such that agricultural output is insufficient to feed the whole population. Hence the need to supplement the peasants' budget by the revenue of exported Z goods. If the economy is small enough, the terms of trade faced by it in selling its Z goods abroad in exchange for food, $\frac{P_A}{P_Z}$, are constant. By proper choice of units we can set this ratio equal to unity. It is clear then that the condition that peasants are in equilibrium requires $b = \frac{P_A}{P_Z} \frac{dA}{dL} = \frac{dA}{dL}$. Hence population growth can go on unchecked by the usual Malthusian mechanisms, since there are no diminishing returns in the Z-good production. This is the substance of Mendels' argument in regard to population in Flanders in the 18th century.⁴³

The more important result, for our purposes, is that b will dominate the agricultural wage irrespective of the allocation of labor between the production of Z and the production of A .

Assume now that the industrial revolution "takes place". A new, modern sector is created which produces a close substitute for the Z -good. For simplicity assume that this new good is identical to the Z -good, but to avoid confusion denote it separately, Q . Assume that Q is produced by a production function using both fixed capital and labor in fixed proportions⁴⁴

$$(3) \quad Q = c \cdot \min (L_Q, nK)$$

where n is the number of workers manning each machine and c is the output of each worker. In addition, the modern sector produces machines. Machines are made by labor only, under constant returns to scale and are assumed to be eternal.⁴⁵

$$(4) \quad \dot{K} = m \cdot L_K$$

where m is the productivity of labour in producing machines.

We have thus a two-sector, open economy with a traditional sector producing A and Z , a modern sector producing Q and K and a rest of the world sector, patiently buying all of Z and all of Q in exchange for A goods at a fixed ratio. Again we shall assume for simplicity that the workers in the modern sector consume only A goods, so that the whole industrial output of Z and Q goods is exported.

I shall introduce now two additional assumptions that are, however, not simplifications but stylized facts, describing the early stages of industrialization. The first is the assumption that there is no capital market: all (except the very first) investments are financed exclusively out of retained profits.⁴⁶ Secondly, all technological change is embodied in new capital goods so that technological progress and capital are simultaneously taking place.⁴⁷ Consequently capital accumulation is a necessary condition for industrialization and growth. The meaning of this assumption is that technological progress is not only defined as a change that enables, say, the machine making work-shops to build better machines. Technological progress also includes the transition of workers from the Z-sector to the Q-sector to work on machines that embody a technology superior to the one used in the Z-sector.

It will by now have become clear that the structure of this model is very similar to a surplus-labor economy, since labor can be hired at a fixed cost, b .⁴⁸ Note, however, that there is no "surplus" labor in this economy--all labor is employed and none is superabundant in any sense. The parameter b is not a "Constant institutional wage",⁴⁹ but a fixed opportunity cost of labor determined by a one input and linear technique described by eq. (2).

The working of the model can now be sketched. For any given capital stock K (everything except the parameters is a function of time but subscripts will be suppressed) the input of labor is given:

$$(5) \quad L_Q = n \cdot K$$

which produces an output or revenue (since prices are set to equal unity)

$$(6) \quad Q = cnK.$$

On the other hand the wage rate is fixed at b . Hence total profits are:

$$(7) \quad R = cnK - bnK = nK(c-b).$$

Out of this profit, a fixed proportion s_{π} is ploughed back into the firm.

In other words, $s_{\pi}R$ constitutes a wage fund that is used to hire workers in the machine producing sector. The number of workers that can be hired is:

$$(8) \quad L_K = \frac{s_{\pi}R}{b}$$

and their output in terms of machines is:

$$(9) \quad K = \frac{s_{\pi}R}{b} \cdot m$$

substituting (7) into (9) and rearranging yields:

$$(10) \quad \frac{\dot{K}}{K} = s_{\pi}nm\left(\frac{c}{b} - 1\right) = g$$

where g is the (warranted) rate of growth. On the other hand, define total past investment in fixed capital as outlays in the purchasing or construction of capital goods:

$$(11) \quad I = \frac{bK}{m}$$

then the rate of profit, π , is:

$$(12) \quad \pi = \frac{R}{I} = nm\left(\frac{c}{b} - 1\right) = \frac{g}{s_{\pi}} \text{ or}$$

$$g = s_{\pi} \cdot \pi. \quad 50$$

It is important to emphasize the meaning of π , since for a given s_{π} , π will determine the rate of growth of the economy. Profits in this model are classical rather than neo-classical: they are the residual of the total revenue after wages have been paid.⁵¹ In no way should π be regarded as the marginal product of capital. In fact, π , in general, can be shown to diverge from the latter. It is more fruitful to view π as a rate of return to entrepreneurship, the rate of return to capital (as Solow claims) or the Marxian rate of profit (since R is clearly identical to the surplus value). The most convincing view of π is that of a quasi-rent. As has been noted the economy produces its output of textiles by two techniques, an efficient one (Q) and an inefficient one (Z). The economy cannot shift instantaneously from one technique to the other because the superior technology is embodied in new capital goods and the supply of capital goods is limited by a bottleneck in saving. The importance of this bottleneck is determined by the distribution of income and by s_{π} . Hence, the two techniques coexist, and as long as this disequilibrium situation lasts, the more efficient technique earns a quasi-rent. The temporary nature of this rent implies that in the long run

either nominal wages will start to rise until they reach c or prices of industrial goods will start to fall. In either case the rate of profit and hence capital accumulation should eventually fall to zero unless embodied technological change continues after the initial discontinuity, so that there are a multitude of techniques rather than two.

The importance of eq. (12), even in the more simplistic two-techniques model is in establishing a direct link between initial income distribution conditions and the rate of capital accumulation. The parameter b is equal to the wage rate only by virtue of the "pseudo-labor surplus" situation. In any other case, in which modern industry faces an upwards sloping labor supply curve the rate of accumulation of capital is not constant as given in eq. (10) but falls over time, since in this case wages rise with the process of industrialization. Moreover, it will be seen that even in cases in which the supply of labor is infinitely elastic, the initial level of wages will be of crucial importance. Substitute W_N (wages in country N) and W_B (wages in country B) for b in equation (12) and assume $W_N > W_B$. Two cases can be distinguished: in one case $W_N > c > W_B$ in which case country B will industrialize and country N will not. In the other case $c > W_N > W_B$, so that both countries will adopt the new technique, but the rate of accumulation (and hence of adoption) will be faster in country B.

Needless to say, there is no contention that wage differentials were the most crucial factor in determining which countries would undergo the industrial revolution and which not. Obviously, differences in the parameter s_π will have similar effects. Moreover, there is no need for the three technological parameters n , c , and m to be the same among

countries with highly different infrastructures. It is also unrealistic for many countries to assume that demand was perfectly elastic. In the case of the Low Countries, however, it seems that these other factors, though anything but negligible, were of secondary order of importance in comparison to the wage differential.

IV

Why should one expect a considerable wage differential between Belgium and the Netherlands? As there was a large proto-industrial sector in Belgium but not in the Netherlands, the pseudo surplus labor model described in the previous section applies to the former but not to the latter. Although there is no strong a priori reason why the parameter b , derived from the Z-good producing sector, should be particularly low, there is little doubt that in fact it was. Agricultural productivity in Belgium was lower than in the Netherlands, since the labor/land ratio was much higher. In 1815 total population of the Northern provinces (not including Dutch Limburg) was 2,046,885 persons on an area of $30,386 \text{ km}^2$, which yields an overall density of 67.3 persons per km^2 . The corresponding figures for the Belgian provinces were 3,377,617 on an area of 34,217 (including Luxemburg), implying a density of 98.7 per km^2 .

The Northern provinces were, however, much more urbanized and if one subtracts off urban population the ratio of agricultural population per km^2 becomes 40.9 in the Northern provinces and 78.7 in the Southern provinces.⁵² The gap in agricultural productivity would be smaller than these figures imply, because the Belgians did have the Z-good, so that agricultural productivity would not fall below the productivity in Z-good

production. But the fact that, except for two areas, there is little Z-good production in the Netherlands indicates that agricultural activity was, in fact, more productive than in Belgium. The noted Dutch statesman, and political economist, Van Hogendorp, was once asked by a Flemish gentleman what the Dutch peasants did if they neither spun nor wove. The reply was that they made butter and cheese and that this provided them with sufficient work.⁵³ He should have said "sufficient income".

The extraordinarily low wages paid in the proto-industry has struck contemporaries as well as historians. In the Flemish linen industry, for example, a memorandum from 1765 estimates the daily income of a weaver to be 7 to 8 sous (0.63 to 0.72 centimes), which enabled the weaver to subsist on a diet of rye bread, potatoes, buttermilk, a little bacon on Sundays and water. Even lower figures are quoted in a letter dating from 1789.⁵⁴ In the 19th century, after a short boom during the empire, the wages of linen weavers and spinners fell to new lows, reaching catastrophic dimensions in the 1830's and 1840's.⁵⁵ It should be noted that during most of the period under discussion the Flemish proto-industry was for its greater part self-employed rather than a putting-out industry, so that the terms of trade between final output, raw materials and food wholly determined the income of the proto-industrial workers, given a productivity coefficient b.

The woollen and metallurgical rural industries in the Verviers-Liége area and in Hainault were, on the other hand, mostly putting-out industries. Putting-out in the Z-good complicates the picture somewhat, especially because the truck system (payments of wages in kind) and embezzlement of materials by the workers tend to distort the little information on wages that is available.⁵⁶ It is clear nevertheless that these wages were very low. A

source from 1741 estimated the wages in Leyden, Tilburg and Verviers to relate to each other as 3:1.5:1.⁵⁷ Wages in the woollen industry remained more or less stable throughout the 18th century, rising somewhat in the first decade of the 19th, but less than proportionally to the rise in output prices.⁵⁸ In the nail industry in the Charleroi area, the best workers earned an off-season wage of 6-7 sous, whereas others made no more than 3-4 sous. (The sou or patard de Liège was about 70% of the Flemish sou). During peak seasons, wages were much higher, but this lasted only for about six weeks annually.⁵⁹

The situation in the Netherlands was more complicated. It is possible, of course, to explain the wage differential between the Netherlands and Belgium entirely by the very absence of a proto-industry in the Netherlands and the higher agricultural productivity implied by that. But it seems that wages in the Netherlands were high compared not only to Belgium but to other countries as well.⁶⁰ "The wages of labour are said to be higher in Holland than in England, and the Dutch, it is well known, trade upon lower profits than any people in Europe" writes Adam Smith.⁶¹

Some additional conjectures in regard to the reasons of the high level of Dutch wages are thus in order. The fact that urbanization was so intense may by itself be a factor, since mortality in the cities was high and this tends to underline the need for bidding away workers from agriculture at relatively high wages. In addition, the existence of a large structure of welfare and charity organizations, especially in the cities, may have had considerable effect on the level of wages

in general and its downward stickiness in particular. In addition, it could be that the high wages were established during the peak of Dutch economic prosperity and had since outlived it, maintained by inertia and institutions preventing them from falling during less favourable periods. It is also possible that, since employment in the Dutch cities was either directly or indirectly connected to the commercial-maritime sector, employment was subject to rather severe fluctuations, so that wages included a risk premium.

An interesting note is struck by Charles Wilson. The large government debt in the Netherlands, Wilson argues, caused an exceptionally high level of taxation. Since most taxation was indirect and levied on necessary consumption goods, this tended to drive the wage-level up and profits and production down.⁶² This fits in well with the framework described above, especially since taxes remained high in the 19th century.

But on the other hand the emphasis on taxation raises two problems. First, an indirect tax will in general be borne only partially by the consumers in the form of higher prices. The supply curve of labor (as a function of nominal wages) shifts to the left, but equilibrium wages will rise less than proportionally to the rise in prices. In addition, the employers, facing higher costs, may be able to raise output prices unless foreign demand is perfectly elastic. In short, the actual importance of indirect taxes on the wage level and on profits depends on the elasticities of supply and demand of consumption goods, of labor and of the final product.

A second problem arises from the Dutch national debt being largely domestically held. It is necessary to assume that the rentiers who owned the debt were a different subset of the population than the industrialists whose profits are curbed by the high wages, and that they had no interest in investing in industry. Otherwise, the high-wage-low-profit result of the Wilson-effect will be insignificant, since industrialists are assumed to reinvest a part of their profit.

Finally, one could return to the entrepreneurship argument propounded above. Microeconomic theory postulates wages to be equal to the marginal product of labor if and only if the firm maximizes profits. But the essence of the entrepreneurship argument seems to be that these "bad" entrepreneurs were in fact not maximizing profits. It does not matter whether they were maximizing some utility function (in which profits appear as one argument among many) or whether they were not maximizing anything at all; in either case wages will be somewhere between average and marginal product, and thus higher than in a country in which entrepreneurs are more aggressive.

V

To summarize the foregoing, there is reason to believe that lower wages may have been important in determining rapid industrialization in Belgium and high wages in determining Dutch stagnation. It was demonstrated that there were structural differences between the two countries that could enhance such a gap. It is necessary to show, however, that wages were in fact significantly lower in Belgium. To look at nominal wages would be sufficient in this case since for our purpose the interesting problem is not the standard of living of the workers, but rather the slice

that is left over of the revenue pie for the producer after wages have been paid.

Aggregate income distribution data for this period are, however, virtually unavailable. For England, for example, the data before 1880 are too scattered and incomplete to make aggregate figures possible.⁶³ As to the Low Countries, for most of the first half of the 19th century the data are of such nature as to cast heavy doubt on the validity of any inter-spatial comparison. It is thus fortunate that there is one source that allows us to perform the comparison without the usual caveats pertaining to the comparison of data assembled by different statistical services. This is the Dutch industrial survey of 1819.⁶⁴ This survey, actually undertaken in 1820, contains valuable information about the number of industrial firms, the number of adults and children employed and the daily wages earned. In addition some qualitative information as to the "state of business" as compared with previous periods is supplied, some general remarks added. Since the returns are organized by province, it was possible to calculate aggregates which could be used for North vs. South comparisons.

Some of the main defects of this survey should be mentioned, in order to underline the fact that these data are crude approximations and unsuitable for more powerful and refined econometric tests. For one thing, the data shown in table (1) are provincial averages, weighted by the number of workers in each industry in that province. However, the original wage entries for each industry in each province as they appear in the returns, are already averages over all firms in that

industry. There is strong reason to believe that unweighted averages were employed by the officials in charge of aggregating the original returns. This procedure tends to bias the figures downwards since it seems that wages were positively correlated with the size of firms (though the correlation is weak). Other sources of possible bias and inaccuracy are payment of wages in kind, the seasonal nature of some forms of employment, the fact that many wages were piece--rather than daily wages and the particular timing of the survey (at the end of a prolonged depression). Some other shortcomings of the data, stemming from clerical or administrative error, have been corrected as far as possible.⁶⁵

Nonetheless, the 1819 survey constitutes a unique source of information for this period. It should be mentioned that by checking provincial returns (as far as they were available) against aggregate returns, it could be verified that most municipalities (which were in charge of the actual collecting of the data) conducted the survey in a responsible and efficient way, and the compilation and editing were carried out with scrutiny. In spite of its weaknesses, the 1819 survey thus provides a unique opportunity to test the hypotheses advanced in this paper. The main aggregates, computed from the returns, are presented in Table I.

It can readily be seen that adults' wages, taken as whole, are almost 60% higher in the Northern provinces. Moreover, the two Northern provinces in which wages are relatively low, Overijssel and N. Brabant, are the same provinces in which proto-industry existed and where the nuclei of modern industry started in the 1830's. In the Belgian pro-

vinces wages are exceptionally low in Flanders and Antwerpen, somewhat higher (but still considerably below the Northern average) in Liège. The only exceptions are Hainault and Namur, partially explained by the importance of coal mines in these two provinces, which traditionally paid higher wages.

Table I: Total Number of Firms, Adults and Children Employed and
Daily Wages in Cents

<u>(1)</u> <u>Province</u>	<u>(2)</u> <u>Firms</u>	<u>(3)</u> <u>Adults</u>	<u>(4)</u> <u>Children</u>	<u>(5)</u> <u>Adults' Wages</u>	<u>(6)</u> <u>Children's Wages</u>
N. Brabant	8,659	12,716	2,400	55.2	16.5
Gelderland	5,130	6,692	1,267	62.7	18.2
S. Holland	6,764	20,446	1,739	86.0	25.8
N. Holland	8,493	25,674	2,184	94.2	20.2
Zeeland	3,094	3,653	621	82.5	19.0
Utrecht	3,126	8,169	2,438	82.0	21.2
Friesland	4,991	8,785	1,384	76.5	13.5
Overijssel	4,636	12,209	3,261	58.2	32.6
Groningen	4,606	6,606	852	76.0	22.3
Drenthe	1,234	1,967	n.d.	73.4	n.d.
<u>Total North</u>	50,733	106,917	16,146	74.8	22.4
S. Brabant	6,732	13,608	538	59.8	9.5
Limburg	6,770	6,371	236	52.4	19.6
Liège	5,482	27,911	4,018	65.6	23.9
E. Flanders	37,288	101,601	10,780	40.3	17.5
W. Flanders	59,336	74,675	3,806	32.3	12.8
Hainault	8,415	32,893	2,591	77.1	29.0
Namur	2,712	6,915	163	70.6	30.6
Antwerpen	7,192	23,167	1,391	48.6	24.1
Luxembourg	8,395	12,295	273	54.5	23.6
<u>Total South</u>	142,184	299,436	23,796	47.8	19.5
<u>Total</u>	193,055	406,353	39,942	54.1	20.6

Source: See footnote.64.

Other hypotheses, testable in principle, can be derived from the simple model presented in section III. For example, one could test the hypothesis that as long as the proto-industry exists, wages in the modern sector do not rise significantly. In the Netherlands we should see a stable or declining wage so long as population growth is unaccompanied by industrialization. Another test could focus on the relative importance of the wage differential by estimating proxies to the ploughing-back and technological parameters of eq. (12). It should also be possible to correlate the relative importance of the proto-industry with the wage level, but the availability of data is a major obstacle here, compounding difficulties in defining the relevant variables.

Notes

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²Belgium is covered to some extent in D. Landes: The Unbound Prometheus, Cambridge, 1969, Ch. 3 and in W.O. Henderson: Britain and Industrial Europe, 1750-1870, 2nd. ed., Leicester, 1965 pp. 102-138. (The latter deals only with the interaction of Britain and Belgium). The Netherlands have been virtually untouched by English-speaking economic historians and non-specialists have to rely on translated work, sometimes in abridged form. A recent article of a very general nature is J.A. Van Houtte: "Economic Development of Belgium and the Netherlands from the Beginning of the Modern Era", The Journal of European Economic History, Vol. I, No. 1 (Spring 1972), pp. 100-120.

³L. Varlez: Les Salaires dans l'Industrie Gantoise, Vol. I (L'Industrie Cotonnière), Brussels, 1901, Annexe 3.

⁴N. Briavoinne: De l'Industrie en Belgique, Causes de Décadence et de Prosperité, sa Situation Actuelle, Brussels, 1839, Vol. II, p. 374.

⁵P. Lebrun: "Croissance et Industrialisation, l'Expérience de l'Industrie Drapière Verviétoise 1750-1850", First International Conference of Economic History (Stockholm, 1960), Contributions and Communications, Paris, 1960, p. 566.

⁶Briavoinne, op. cit., Vol. I, pp. 252-262. On the relative backwardness of the Belgian iron industry around 1820 see: G.M. Roentgen "Berigt van den Toestand van de IJzerwerken in de Waalsche Provinciën" (Report on the Situation of the Iron Works in the Walloon Provinces), 1823, Edited with an Introduction by M.G. De Boer, Economisch-Historisch Jaarboek (Year-book of Economic History), Vol. IX, The Hague, 1921, pp. 103-105.

⁷N.Briavoinne: "Sur les Inventions et Perfectionnements dans l'Industrie", Academie Royale de Belgique, Mémoires Couronnés Vol. XIII (1838), pp. 121, 124.

⁸J.P.B. de Montalivet: Exposé de la Situation de l'Empire, Paris, 1813, pp. 48-49. Montalivet's figures are, however, highly suspect and his data for the départements of Jemappes (Hainault) and Ourthe (Liège) are much too low. For some of Montalivet's data see: J. Craeybeckx: "Les Débuts de la Revolution Industrielle en Belgique et les Statistiques de la Fin de l'Empire", in: Mélanges offerts à G. Jacquemyns, Brussels, 1968, pp. 115-144.

⁹Briavoinne (1839), op. cit., Vol. I, p. 173 puts the number of spindles in 1829 at 285,000. In 1835 the total number of estimated at 383,320 of which more than 300,000 are "active". Cf. X. Heuschling: Essai sur la Statistique Générale de la Belgique, 2nd ed., Brussels, 1841, p. 95.

¹⁰H. Coppejans-Desmedt, (ed.): "De Statistieken van E.C. Van Der Meersch over de Katoenindustrie in Oost Vlaanderen" (The Statistics of E.C. Van Der Meersch on the Cotton Industry of East Flanders), Bulletin de la Commission Royale d ' Histoire, Vol. 128 No. 3 (1962), pp. 121-181.

¹¹R. Demoulin: Guillaume 1^{er} et la Transformation Économique des Provinces Belges, Liège, 1938, p. 322.

¹²"Mémoire sur les Houillères des Provinces de Hainaut, Namur, Liège et Limbourg", Mons, 1816 cited in A. Warzee: "Exposé Historique et Statistique de l'Industrie Métallurgique dans le Hainaut", Mémoires et Publications de la Société des Sciences, des Arts et des Lettres du Hainaut, 2nd. Series, Vol. 8 (1860-1862), p. 43.

¹³Briavoinne (1839), op. cit., Vol. II, p. 290. Heuschling, op. cit., p. 100.

¹⁴Demoulin, op. cit., p. 315.

¹⁵P. Schöller: "La Transformation Économique de la Belgique de 1832 à 1844", Bulletin de l'Institut de Recherches Économiques (Louvain), Vol. XIV, No. 4 (1948), p. 585.

¹⁶Statistique de la Belgique, Recensement Générale (1846), Industrie, Brussels, 1851, pp. x, xi. The figure cited is more than 380,000. Cf. footnote 9.

¹⁷Imports average about 5,000 ton in the first years of the thirties, rise to double that figure in 1850. See Briavoinne (1839), op. cit. Vol. II, pp. 374-375 and G. Jacquemyns: "Histoire de la Crise Économique des Flanders (1845-1850)", Académie Royale de Belgique, Mémoires, Vol. XXVI (1929), p. 159.

¹⁸Schöller, op. cit. p. 594.

¹⁹This is pointed out by F. Mendels: "Industrialization and Population Pressure in 18th Century Flanders", unpublished dissertation, University of Wisconsin, 1969.

²⁰J.G. Van Dillen: Van Rijkdom en Regenten (On Wealth and Regents, Handbook of the Economic and Social History of the Netherlands During the Republic), The Hague, 1970, pp. 540-557.

²¹F.J.B. D'Alphonse: Aperçu sur la Hollande (1811), published by the Dutch Central Bureau of Statistics, the Hague, 1900, pp. 223-309.

²²Délibération du Conseil du Département du Zuiderzee, 2 Sept. 1811. R.G.P. (National Historical Publications), Vol. 16, p. 1164.

²³I.J. Bruggmans: De Arbeidende Klasse in Nederland in de 19^e Eeuw (1813-1870) (The Working Class in the Netherlands in the 19th Century, 1813-1870), 3th ed., Utrecht-Antwerpen, 1971 (orig. pub. in 1925), p. 33.

²⁴J.A.P.G. Boot: De Twentsche Katoennijverheid, 1830-1873 (The Cotton Industry in Twente, 1830-1873), Amsterdam, 1935, pp. 23-25.

²⁵A.W.M. Keune: "De Industriële Ontwikkeling gedurende de 19^e Eeuw" (Industrial Development During the 19th Century) in: H.F.J.M. Van Den Eerenbeemt and H.J.A.M. Schurink, (eds.): De Opkomst van Tilburg als een Industriestad (The Rise of Tilburg as an Industrial City), Nijmegen, 1959, pp. 21-24.

²⁶Boot, op. cit., Appendix 2.

²⁷id., p. 71.

²⁸For the Netherlands: Staatkundig en Staathuishoudkundig Jaarboekje (Yearbook of Politics and Political Economy), Vol. 7 (1855) p. 69. For Belgium: Statistique de la Belgique, op. cit., pp. x, xi.

²⁹Schöller, op. cit., pp. 592-594.

³⁰Statistisch Jaarboekje (Statistical Yearbook of the Netherlands), Vol. 1 (1851), p. 218 (2).

³¹Figures cited by H. Baudet: "De Dadels van Hassan en de Start der Nederlandse Industrialiteit" (The Start of Dutch Industrialism), in: Bedrijf en Samenleving (Enterprise and Society), Festschrift presented to Prof. I.J. Brugmans, Alphen on the Rhine and Brussels, 1967, p. 3.

³²Some of the arguments presented here appear in Van Houtte, op. cit. and in id.: Economische en Sociale Geschiedenis van de Lage Landen (Economic and Social History in the Low Countries), Antwerpen, 1964. Others have been drawn from arguments in different contexts.

³³On the importance of peat see P. Van Schaik: "De Economische Betekenis van de Turfwinning in Nederland" (The Economic Significance of Peatmining in the Netherlands). Economisch-Historisch Jaarboek Vol. 33, (1971), pp. 201-219. I am indebted to Prof. Jan De Vries for bringing this point to my attention.

³⁴A.M. Van Der Woude: "Het Noorderkwartier" (The Noorderkwartier, A Study of the Demographic and Economic History of Western Parts of the Netherlands), A.A.G. Bijdragen (Contributions) No. 16, Vol. II, pp. 476, 488, 496.

³⁵I.J. Brugmans: Paardenkracht en Mensenmacht, Sociaal-Economische Geschiedenis van Nederland 1795-1940 (Horsepower and Human Might, Economic History of the Netherlands 1795-1940), The Hague, 1961, p. 39.

³⁶This is emphasized by Crouzet: "Wars, Blockade and Economic Change in Europe, 1792-1815", J.E.H. Vol. 24, No. 4 (Dec. 1964) pp. 579-580. Cf. Landes, op. cit., p. 144.

³⁷Demoulin, op. cit., pp. 157-181.

³⁸For a summary see J.H. Van Stuijvenberg: "Economische Groei in Nederland in de 19^e Eeuw: een Terreinverkenning" (Economic Growth in the Netherlands in the 19th century--a Reconnaissance) in: Bedrijf en Samenleving, op. cit., pp. 195-225 and works quoted there.

³⁹Brugmans (1971), op. cit., p. 67.

⁴⁰Van Houtte (1972) op. cit., p. 108. F. Mendels: "Proto-industrialization: The First Phase of the Industrialization Process", J.E.H. Vol. 32, No. 1 (March 1972), pp. 241-261.

⁴¹P. Lebrun: "La Rivoluzione Industriale in Belgio", Studi Storici, Vol. II Nos. 3-4 (Dec. 1961) p. 589. J. Dhondt: "The Cotton Industry of Ghent During the French Regime" in F. Crouzet et alii (eds.): Essays in European Economic History, London, 1969, pp. 16-18.

⁴²This model is similar to S. Hymer and S. Resnick: "A Model of an Agrarian Economy with Nonagricultural Activities", A.E.R. Vol. LIX, No. 4 part I, (Sept. 1969), pp. 493-506, but differs from it in the crucial assumption that Z is sold rather than consumed. It is generally agreed upon that fixed capital requirements in the proto-industry were negligible. Cf. e.g. Mendels (1972) op. cit., p. 243.

⁴³Mendels (1969), op. cit., pp. 226-256. For a similar hypothesis from a different point of view see R. Braun: "The Impact of Cottage Industry on an Agricultural Population", in: D. Landes, ed.: The Rise of Capitalism, N.Y., 1966, pp. 53-64.

⁴⁴The formal set-up has been borrowed from R.M. Solow: Capital Theory and the Rate of Return, Amsterdam, 1963, although the context is of course different. It should be emphasized that the assumption of a fixed proportions (Leontief) production function is by no means essential to the arguments; the same results can be shown to hold under a neoclassical production function.

⁴⁵The simplifying assumptions of no capital input in the production of capital, as well as the absence of depreciation can easily be relaxed without changing any basic result.

⁴⁶This is emphasized for Belgium in R. Cameron: Banking in the Early Stages of Industrialization, N.Y., 1967, pp. 130-131. Similar arguments have been made for France by Landes, op. cit. pp. 130, 131n. and for England by e.g. F. Crouzet: "Capital Formation in Great Britain During the Industrial Revolution", in: id. (ed.): Capital Formation in the Industrial Revolution, London, 1972, p. 188. R.M. Hartwell: "The Causes of the Industrial Revolution, An Essay in Methodology" in, id.: The Industrial Revolution and Economic Growth, London, 1971, p. 144. The contention is not that capital markets were wholly absent but rather that they contributed little in the financing of fixed capital in the early stages of the industrial revolution.

⁴⁷See e.g. Hartwell, op. cit., p. 146.

⁴⁸One could complicate this model by adding an "Arthur Lewis Hill", a constant to be added to the rural wage level necessary to induce rural workers to the town. This would by no means alter the conclusions. See W. Arthur Lewis' seminal articles: "Economic Development with Unlimited Supplies of Labor", The Manchester School Vol. 22 No. 2 (May 1954), pp. 139-191 and "Unlimited Labor: Further Notes", The Manchester School Vol. 26, No. 1 (Jan. 1958) pp. 1-32.

⁴⁹For a definition see John C. H. Fei and Gustav Ranis: Development of the Labor Surplus Economy, Homewood, Ill., 1964, pp. 21-22.

⁵⁰This equation has appeared in the literature in various forms and contexts. For some examples see: N. Kaldor: "Alternative Theories of Distribution", REStud Vol. XXIII, No. 2 (April 1956), p. 96. Joan Robinson: "A Neoclassical Theorem", REStud Vol. XXII, No. 3 (June 1962), p. 219. If s_{π} is maximal, i.e. unity, then $\pi=g$, the familiar Von Neumann result.

⁵¹The classical definition of the rate of profit has in the denominator total capital, including circulating capital. Computation will show that this profit rate will be equal to $\pi \cdot \frac{1}{1+nm}$, and all our conclusions are still valid.

⁵²All figures for the Northern Provinces from Staatkundig...Jaarboekje op. cit., Vol. II (1850), pp. 315 ff or calculated from them. For Belgium: Demoulin, op. cit., p. 400.

⁵³K.G. Van Hogendorp: Bijdragen tot de Huishouding Van Staat in Het Koninkrijk der Nederlanden (Contributions to the Political Economy of the Kingdom of the Netherlands), Amsterdam, 1825, Vol. V, p. 167.

⁵⁴Cited by Varlez, op. cit., Vol. II, p. xix.

⁵⁵E. Ducpétiaux: Mémoire sur le Pauperisme dans les Flanders, Brussels, 1850 pp. 66-67. P.C. Van Der Meersch: "De L'État de la Mendicité et de la Bienfaisance dans la Province de la Flandre Orientale", Bulletin de la Commission Centrale de Statistique (Brussels), Vol. V (1853), p. 237.

⁵⁶On the use of the truck system see C. Génart: L'Industrie Cloutière en Pays Wallon, Brussels, 1900, p. 28. Cf. P. Lebrun: L'Industrie de la Laine à Verviers, Liege, 1948, p. 264. The quantitative importance of embezzlement is, by its very nature, impossible to appraise, but it may have been important as a supplement to wages. Cf. sources quoted by Mendels (1972), op. cit., p. 244.

⁵⁷Cited in W.W. Posthumus: "De Industriele Concurrentie tussen Noord- en Zuid-Nederlandse Nijverheidscentra in de XVII^e en XVIII^e Eeuw" (The Competition between the Industrial Centers in the Northern and Southern Netherlands in the 17th and 18th centuries), in: Mélanges d'Histoire offerts à H. Pirenne, Brussels, 1926, p. 376. Note that Tilburg is one of the few areas in the Netherlands in which proto-industry is important.

⁵⁸Lebrun (1948), op. cit., p. 325.

⁵⁹Génart, op. cit., p. 26.

⁶⁰Van Dillen, op. cit., p. 553. Joh. De Vries: De Economische Achteruitgang der Republiek in de Achttiende Eeuw (The Economic Decline of the Dutch Republic in the Eighteenth Century), Amsterdam, 1959, p. 107.

⁶¹Adam Smith: The Wealth of Nations (Andrew Skinner, ed.), Harmondsworth, 1970, p. 194.

⁶²C. Wilson: "Taxation and the Decline of Empires, an Unfashionable Theme", in: id.: Economic History and the Historians, Collected Essays, London, 1969, pp. 114-127.

⁶³P. Deane and W.A. Cole: British Economic Growth, 1688-1959, 2nd ed., Cambridge, 1967, p. 148.

⁶⁴I.J. Brugmans (ed.): Statistieken van de Nederlandse Nijverheid uit de Eerste Helft der 19^e Eeuw (Statistics of Dutch Industry from the First Half of the 19th. Century). Published as R.G.P. (National Historical Publications), Vols. 98,99, The Hague, 1956.

⁶⁵J. Mokyr: "An Early 19th Century Industrial Survey", unpublished manuscript, Yale University, 1971, pp. 9-15.