Industrial Location and Economic Potential in Western Europe

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Agricultural Economics Research Institute, Oxford

Abstract

Economic potentials were calculated for Western Europe by taking regional incomes and costs of distance between regions in order to measure each region's attraction for manufacturing industry under various sets of conditions.

Separate centres of high potential were found before the Customs Union, but afterwards, a single European centre was formed comprising of regions in the Rhine valley of West Germany, south-east Netherlands, and eastern Belgium.

An enlarged Common Market and transport developments did not alter the general pattern, although potentials increased more in the centre than in the periphery. Britain, despite its assumed membership of the E.E.C., remained outside the most attractive region in all cases considered.

An analysis of employment data indicated that the greatest growth had occurred in regions where potential had risen most (Belgium and the Netherlands) following the Treaty of Rome.

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Throughout Western Europe it is apparent that population and manufacturing industries are concentrated in certain important industrial regions. Although some manufacturing industries can still be classified as materials-orientated (location determined by the cost or difficulty of transporting important material inputs; processing involves a weight loss) or market-orientated (producing goods which, in relation to their value, are exceptionally heavy, bulky or perishable), the majority of industries can now be best described as being footloose.

The term footloose indicates that such industry is not tied to any specific location by either of the above considerations and there is a wide range of sites where a firm might reasonably locate so far as the transport of materials or products is concerned. With technical developments in both processing (greater output per unit of input) and transportation (relatively cheaper distance costs), industries which were once tied to a particular location can now take other factors into consideration when making their location decision. Even though there is theoretically a wide range of reasonable locations for a footloose industry, it is found that the choice will tend to respond to certain definite factors.

A general description of what is happening in the modern industrial world is that the macro-location of both industry and population is tending towards an ever-increasing concentration in a limited number of areas; their micro-location, on the other hand, towards an ever-increasing diffusion, or “sprawl”.

The aim of this study is to examine which regions in Western Europe are the most attractive to industry, and the likely effect which an enlarged Customs Union and developments in transport might have on the distribution of the most favoured regions. This study attempts to discover whether, if Britain were a member of the Common Market, any part of Britain would be included within the region of greatest potential for economic growth in Europe, or whether Britain would be relegated to a position on the periphery, and likely to decline in importance relative to the other countries of Europe.

THE CONCEPT OF ECONOMIC POTENTIAL

The method chosen to measure the attraction for industry of all regions in Western Europe was the calculation of their economic potential. The economic potential of any given point is defined by summing the regional incomes around it, each regional income having been first divided by the distance costs of reaching it. The following arguments attempt to justify the choice of regional incomes and distance costs as the most important variables for determining the location of manufacturing industries.

Two fundamental questions will affect the location decision of industrial firms. In the first place, the main sources of inputs and the main markets for the product must be determined and secondly, an appraisal must be made of the costs of distance incurred in reaching these from any particular point.

To an increasing extent, it is the areas of dense population which will provide some of the most vital inputs as well as being the main markets. Such regions can generally provide a large and diversified labour force, specialized services, and repair services, as well as the less quantifiable inputs such as the timely supply of information and easy contact with competitors and Government departments. The capacity of a region to act as a market and also as a supplier of inputs can be measured by the regional income.

The area of greatest attraction to industry will be the region where the distance costs are least to all possible markets. This central location is likely to become of increasing importance as the

production size of individual firms expands due to economies of scale, and each firm is able to supply a larger market. Therefore, the further away a market is from a firm, the less attractive it will be. The relationship between the manufacturing area and markets is obviously reciprocal; the growth of the industry will increase the size of the market and more industry in turn will be attracted to the area, to the detriment of the surrounding peripheral regions.

The concept of potential has been borrowed from the physical sciences where it is used as an electrical measure. It was used in location analysis by Stewart (1947), in the form of a population potential; Stewart saw that the tendency of people to congregate in large cities represented an attraction of people for people that turned out to have a mathematical as well as a verbal resemblance to the physical law of electrical potential. The greater the density of population of an area, the more attractive it would be to other people. Stewart mapped population potential for several countries on the basis of 1930 population figures; and found in Europe, for example, that the most attractive areas demographically extended from South East England through the Low Countries to Germany.

The concept of potential has since been used as a measure of the attraction of people as a market for goods by Harris (1952); Warntz (1959); and Elkan (1968). The direct forerunner of this present study is an article by Clark (1966), in which the economic potentials of Britain are estimated.

PLAN

The stages of the investigation will be discussed under two headings: the estimation of economic potentials (the methods used and assumptions made), and an analysis of the pattern of economic potentials under the following five conditions:

I. *The situation existing prior to the Treaty of Rome.*
Countries analysed: France, West Germany, Italy, Belgium, the Netherlands, Luxembourg and Britain. Each country pursues an independent policy and is separated from all others by frontiers and tariff barriers.

II. *The present situation.*
Countries analysed: The E.E.C. countries and Britain. Complete freedom of movement of goods, labour and capital among all of the E.E.C. countries is assumed, but Britain remains cut off by a tariff barrier.

III. *The predicted situation of an enlarged Common Market.*
Countries analysed: The six existing E.E.C. countries with Britain, Norway, Denmark and Eire. There would be freedom of movement among all countries within this enlarged Community.

IV. *The predicted situation of cheaper shipping costs in Europe.*
Countries analysed: Same as in III. With the use of containers, the relative costs of short distance shipping would fall.

V. *The predicted situation with the Channel Tunnel in use.*
Countries analysed: Same as in III. The use of the Tunnel would further reduce the costs of transport between Britain and mainland Europe.

THE ESTIMATION OF ECONOMIC POTENTIALS

The economic potential for any one region can be expressed by the following formula:

$$P_i = \frac{I}{M} + \sum_{j=1}^{n} \frac{I_j}{M + T_{ij} + F}$$

Where P_i = economic potential of region i; I = regional income; M = minimum cost (handling and distribution within each region); Σ = sum of: income divided by costs for all regions other than i; T_{ij} = transport costs from region i to region j; F = frontier tariff; 1 to n = 103 regions of Western Europe plus 9 other world regions.

The calculation of the economic potential for each of 103 regions in Europe was performed by computer. The sources of data and the methods used to prepare the computer programme will be discussed below under separate headings.

(a) *Units of measurement*

All costs and values are for convenience expressed in terms of a single unit, namely of U.S. dollars at 1962 exchange rates. In the measurement of the distance costs, all calculations have been made on the basis of the average cost of moving a 10 ton load of a heavy commodity.

(b) *Regions and nodes*

The countries analysed have been sub-divided into regions, with each region represented by one particular town. In the case of France, Italy, the Netherlands and Belgium, the regional divisions used in the official national statistics could be taken without alteration for this investigation, as the regions were of suitable size. This gave the following subdivision: France, 21 regions; the Netherlands, 11 regions; Belgium, 9 regions; and Italy, 19 regions. Luxembourg was undivided. For Britain and West Germany, the British Standard Regions and the German Länder gave regions which were too large for the purpose of this study. Britain was re-divided on the basis of counties to give 17 regions, and Germany was re-divided using the *regierungsbezirke* and *landkreise* to give 22 regions. For conditions III–V, the enlarged Common Market was assumed to include Eire, Norway and Denmark (because if Britain became a member of the E.E.C. it is likely that these other three countries would also join), and these countries were each included as single separate regions.

For the calculation of distance, a town was chosen to represent each region. In many cases these were the obvious administrative centres, but in others a town was chosen on the basis of population size or centrality in the region so that the nodal town approximated the centre of gravity, or the central place serving the surrounding region. In cases where a country was not sub-divided into regions, the capital city was used. The regions and nodes chosen are listed in Appendix 1.

(c) *Regional income*

There were two major problems to overcome when calculating the regional income figures. First, there was the problem of finding

a breakdown of each country's national statistics into sufficiently small regions so that the divisions coincided with the regions used in the project, or where the divisions given could be amalgamated to form the required regions. Adequate information could not be acquired within Britain, and so these data were collected from the Statistical Office of each country. Secondly, comparable sets of data needed to be chosen for all countries and the values converted to U. S. dollars, 1962.

The estimation of comparable figures of the regional incomes was completed in two stages. Using data from the U.N. National Accounts Statistics, an average of the National Income for each country was made for the period 1960–1964 and this average was expressed in 1962 prices and converted into U.S. dollars. It might at first sight have been thought desirable to try to convert the national currencies into dollars by estimating the purchasing power parity rather than converting on current exchange rates, but in fact, exporters would be more interested in the money incomes of their markets and not in their purchasing power over local goods.

The official exchange rates as quoted by the I.M.F. for 1962 were used. The average per capita income in U.S. dollars resulting from using the I.M.F. exchange rates gave the following index:

When Britain equalled 100 units:

Italy	= 58 units
Netherlands	= 84 units
Belgium	= 98 units
France	= 104 units
Germany	= 105 units
Luxembourg	= 118 units

The second stage of the income calculation was to distribute the national totals between regions. From the information gathered on the Continent, regional figures were chosen to act as a guide to the distribution of income in each country. For Britain, the only data available were personal incomes which were less suitable for the purposes of this study than the regional incomes collected for the other countries, in that the importance of London and the South

was probably over-stated. Each regional figure was expressed as a percentage of the total for the country, and these proportions were used to break down the total national income into the regional portions. For Luxembourg, Eire, Denmark and Norway the total national income sufficed as the countries were not broken down into regions.

The resulting regional incomes in 1962 U.S. dollars were then attached to each node which represented a region when included in the computer programme. The sources used and the calculated regional incomes are given in Appendix 1.

(d) *Distance costs*

Minimum cost. A minimum cost of $28 per 10 ton load was included in the calculation as a factor of division, representing the handling and distribution costs incurred within a region. This cost was the same for every region. It was necessary to include a fairly large minimum cost to use in the first part of the potential formula, in order to divide the income of the region for which the potential was being calculated (transport and tariff costs being zero within the region itself), otherwise a mathematical absurdity would result with the potential reaching infinity.

Land transport costs. In order to calculate the cost of transport between nodes, a network of link costs representing the cheapest practicable route between the 103 nodes was constructed. For this, two measurements were needed: the road and rail transport costs per 10 ton-miles, and the distance in miles between every node.

For the first measurement, the transport rate per 10 ton-miles, it was decided that the load of goods would have the choice of travelling either by road or by rail, and that the decision on which means of transport was chosen would depend upon the distance between nodes. Therefore, for short journeys which were taken to be of less than 200 miles, goods travelled by road, and for longer journeys of more than 200 miles, goods travelled only by rail. The representative rates employed were taken from the analysis of economic potential in Britain by Clark (1966); by road, a 10 ton load would cost 28 cents per mile, and by rail, 11.6 cents per mile.

For the second measurement, the mileage between nodes, the network of links was built up by measuring the distances between neighbouring nodes. It was assumed that the distance between the nodes was the same whether travelled by road or by rail, therefore only the road network was measured. The distance by using the most important and/or direct road was measured, and in the case of West Berlin, two links were taken, representing the two autobahn routes between the city and West Germany.

It was then necessary to pick out which would be the cheapest practical route by summing the intervening segments of a journey between any two nodes while obeying the constraint that journeys of over 200 miles were made by rail, and journeys of under 200 miles were made by road.

The problem therefore arose of reconciling the two demands: ensuring that the journey was the cheapest, and ensuring that all journeys under 200 miles were undertaken by the more expensive road transport. The computer was used to solve this problem. Two networks were constructed, with a duplicate network linking a set of dummy nodes, each of which corresponded to one of the real nodes but to which no regional income was attached. The links of the duplicate network were exactly the same in length and in number as the links between the real nodes.

The difference between the two networks lay in the way in which the distances were costed. The original network represented the road costs, and the duplicate network the rail costs, with the dummy nodes denoting rail stations. In order to ensure that only journeys greater than 200 miles were costed at the lower rate, a surcharge was added to all the rail journeys at a fixed rate. At a distance of 200 miles from a node, the cost of transporting goods by road or by rail would be the same, and in order to make the costs equal at 200 miles, it was necessary to add a surcharge of $32.67 to the rail journey. The figure was included in the network as a transfer link joining the dummy node with the real node at both ends of the journey. This transfer link was costed at $16.33, half the total surcharge, thus allowing for the link at both ends of the journey. In this way the rail journey would be chosen if and

only if the link was 200 miles or more, because with the surcharge all distances shorter than 200 miles would be more expensive. The use of the surcharge also ensured that a journey between two nodes could not be mixed, in that it could not consist of a road journey to an intermediate node if less than 200 miles, and continue as a rail journey from then on. Figure 1 below illustrates the two networks and the transfer links used to calculate the transport costs.[1]

It was decided for simplicity that inland waterways should not be included in the analysis. Although the canal network is of great importance, especially in the Netherlands, Germany and Belgium (carrying about 64 per cent, 29 per cent and 27 per cent of the total freight transported in each country respectively) only a very small proportion of the freight can be classified as specific inputs for the manufacturing industries, or as manufactured products.

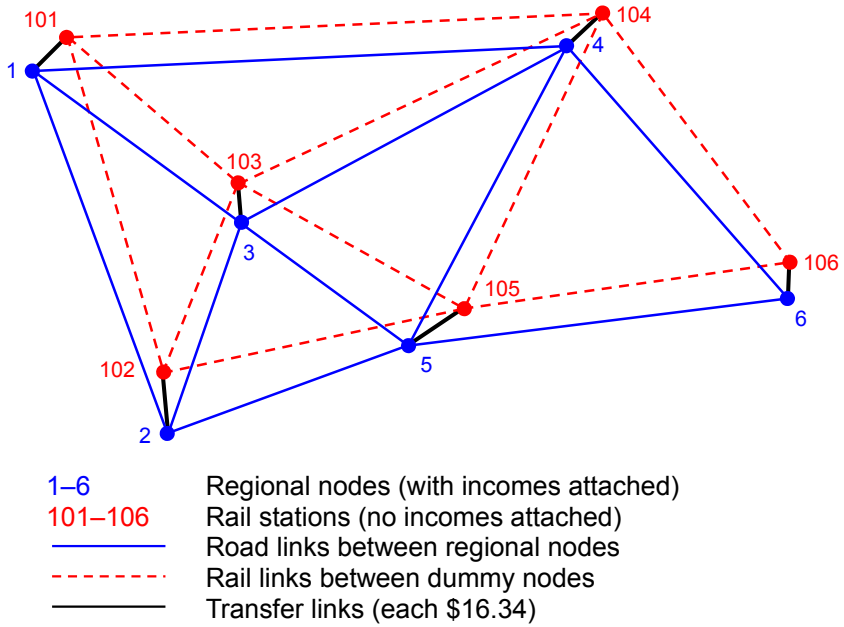


Figure 1: A diagrammatic representation of the duplicate networks

1 The writers are grateful to Mr. Antony Clark of the Operations Research Department of Tate and Lyle for designing this ingenious method.

Sea transport costs in Europe. An estimate of the average cost of shipping a 10 ton load was needed to calculate the costs of the fourteen sea links between Britain and mainland Europe, between Italy, Sicily and Sardinia, and between Italy and France. Since this study compared the distribution of regions attractive to industry in the present, and also in the predicted future, two different sets of shipping costs were collected: higher costs representing shipping rates before containers were in use, and a second set of lower costs for the predicted situation when all inter-European shipping freight would be transported by containers on "roll-on roll-off" ferries.

It proved extremely difficult to reach a satisfactory estimate of a representative cost for shipping an average 10 ton load at pre-container rates, because to a shipper than can be no such thing as an "average" load of goods. Instead, the costs of sending 10 tons of cheap glassware between various European ports were collected and from these data a representative cost was calculated in terms of a terminal cost, and a marginal cost, to illustrate the fact that there would be an initial high charge of using a ship, but once at sea, the cost per sea mile travelled would be low.

The least squares method was used to estimate the parameters a and b in the equation $y = bx + a$ where x represented the sea miles, y the charge per 10 ton load, and the a value represented the terminal cost and the b value, the marginal cost. This gave \$133.5 terminal cost and \$0.274 per sea mile marginal cost for a 10 ton load. This pre-container rate was used in conditions I–III.

The costs of using containers were collected from forwarding agents for existing container services operating between Britain and mainland Europe. The rates charged in 1968 were collected and used although substantial decreases in these rates might well occur in future. It was assumed that, after allowing for some wastage of space, a container of 1600 cubic feet would represent a load of 20 tons. The representative costs were then calculated, which gave \$52.9 terminal costs, and \$0.1064 per mile marginal cost, per 10 ton load. This rate for container shipping was used in conditions IV and V.

An additional cost of $28 per 10 tons was made at both ends of a sea journey to allow for harbour dues and similar charges at both ports. The ports used in the fourteen sea links were not, in most cases, regional nodes, and the simplest way to connect the ports to the transport network was to include the ports as dummy nodes linked to the road and rail systems but without a regional income attached. When a load of goods used a sea link, it was assumed that a mixed journey was possible; in other words, because the sea crossing entailed an inevitable unloading and re-loading of goods, road transport on one side and rail transport on the other side of the sea crossing would be permissible.

The Channel Tunnel. For condition V, a Channel Tunnel of 32 miles linked Dover and Calais. It was assumed that all goods would be carried by rail through the tunnel. For hauls between nodes less than 200 miles apart, goods would be carried by road to the coast, loaded onto a train to cross to France and continue by road to the destination; and for journeys of over 200 miles, the goods would travel by rail without a break of bulk. A toll of $70 per 10 tons was levied on all goods using the tunnel, but for journeys of under 200 miles an extra cost of $30 per 10 tons would be incurred to cover the loading and unloading of goods onto the tunnel train. To these fixed costs of $70 and $100 for rail and road journeys respectively, a marginal cost (calculated at railway rates) of travelling the 32 miles of tunnel length was added. The tunnel competed with container shipping that was using the same routes and costing the same amount as in condition IV.

As stated above, the calculations were performed by computer on the basis of cost of journey and not on mileage, and so, with different fixed costs now applying to road and rail, the previous relationship of equal costs at 200 miles would no longer hold true. To overcome this problem, the programme was run twice through the computer. In the first run, only rail costs were used for the Channel Tunnel, and all crossings which used the tunnel as opposed to sea links were marked. Once the cost of travelling 200 miles by rail using the tunnel was calculated, it followed that all journeys costing less than this amount would be less than 200

miles and therefore should be costed by the road rates. These links were calculated a second time, this time being costed at the higher road rates, and the economic potentials were amended according to the second set of results.

Tariffs in Europe. The third component of the distance costs is the tariff: the surcharge incurred when a 10 ton load of goods crosses a frontier. Within Western Europe the tariff was arbitrarily estimated at $210 per 10 ton load and represented not only the tariff levied, but also imputed costs of uncertainty arising out of trade with a foreign country.

It was this item in the calculation which was removed to show that a customs union had been formed. In condition I, therefore, each country was separated by a tariff of $210 which was levied on all goods crossing each frontier. In condition II, the tariff became zero for goods travelling between the existing E.E.C. countries, and for condition III, the tariff became zero for goods travelling within the enlarged Common Market. In order to ensure that goods crossing Europe paid only one tariff and not a charge every time a different frontier was crossed (in other words, goods in transit were assumed to travel "in bond"), the tariffs were put into the computer by means of a tariff matrix.

(e) *Adjustment to allow for trade with the rest of the world*

It would have been obviously highly misleading, and would cause considerable distortion, to think that the countries analysed were isolated from trade with the rest of the world. Some kind of adjustment was therefore necessary to take account of trade with other countries within the rest of Europe and in other continents.

The other European countries included in the analysis were: Sweden, Switzerland, Austria, Spain, Portugal, Greece, Finland (capital cities taken as node); Eastern Europe (Budapest taken as node), and the USSR (Kiev taken as node). The national income for each country, with the exception of the USSR and Eastern Europe, was taken from the U.N. National Accounts Statistics for the year 1962. In the case of the USSR, and of Eastern Europe, representative incomes were calculated assuming that the average per head income would be 7.5 per cent of that of the U.S.A. (to

allow for the considerable restrictions still imposed on trade with the West). The transport network was extended with road and rail links to join the other European nodes. The tariff levied on goods crossing frontiers remained at $210 per 10 tons.

The countries outside Europe were grouped into nine regions and an approximate distance between each region and Western Europe was then assumed: U.S.A. and Canada: 3,000 miles from Western Europe; Latin America and the Caribbean: 6,000 miles; South Africa: 6,000 miles; all other parts of Africa: 3,000 miles; Asia, west of India and Pakistan: 3,000 miles; India and Pakistan: 5,000 miles; Japan: 13,000 miles; all other parts of Asia: 8,000 miles; Australia and New Zealand: 11,000 miles. Trade with China was omitted.

Within each of these nine regions, a land journey connected an assumed centre of economic activity with the coast. For U.S.A. and Canada, and also for India and Pakistan, a land journey of 500 miles was taken and assumed to be a rail journey; and for all other non-European regions, the land distance taken was 100 miles, and therefore assumed to be a road journey.

An average regional income for each of these nine regions was estimated by using the U.N. National Accounts Statistics for 1962, and pre-container shipping rates were used to estimate the cost of the transport links which for convenience ended either at Liverpool or at Le Havre. The rates quoted by Liverpool shipping companies for transporting a 10 ton load of typical mechanical and electrical equipment were used to estimate representative costs. This gave a $347.8 terminal charge and $0.133 per mile marginal charge, per 10 ton load.

For the long distance journeys higher port charges and harbour dues seemed a reasonable assumption and these costs were raised to $42 per 10 tons at each end of the journey.

The cost of trading across frontiers was also taken as being higher, because of the greater risks involved for goods travelling the longer distances, and this cost was taken as being one-third higher than within Europe, at $280 per 10 tons.

ANALYSIS OF THE PATTERN OF ECONOMIC POTENTIALS

As a result of the calculation, five different values had been estimated for each region, denoting the changes in locational value for manufacturing industry under the five sets of conditions. In order to show the distribution of potentials, five maps were drawn, using the potential values and regional boundaries to locate the position of lines of equal potential at 200 potential unit intervals.

The higher the potential figure of a region, the more attractive that region would be to manufacturing industry.

I. *Pre-Treaty of Rome Situation: Potential Map I*

Range of potentials. The potential values are all low compared with the potentials resulting from the other sets of conditions. The values range from under 1400 for regions in Southern Italy, Northern Ireland and Northern Scotland to over 2900 in Cologne and Düsseldorf in West Germany.

Pattern of potentials. A most striking contrast is apparent between the potential pattern in the Benelux countries and in West Germany, France and Britain. Within the Benelux countries, three areas of depression are found where potentials fall below 2000: Flushing, in south-west Netherlands; Groningen, Friesland, Drenthe, Overijssel and Gelderland in north-west Netherlands; and the Belgian region of Luxembourg and the country of Luxembourg. In these countries the disadvantages of the tariff barrier to trade and the comparatively small home market have outweighed the advantages of location in the centre of Europe. On the other hand, West Germany, France and Britain all contain a well-defined core region of over 2800 with potentials decreasing with distance away from these central regions. The largest region of high potential lies in Germany where five regions measure over 2800 (Osnabrück, Münster, Düsseldorf, Köln and Hessen) and most of the other German regions fall within the second potential order of between 2600–2800. In Britain, London and South East England is the centre of the high potential area, and the other attractive regions include Midland, Southern, Eastern and North-

West England which measure between 2600–2800. From around this centre, potentials decline swiftly toward the north and west. France has the smallest region of high potential value: the Paris Basin is the obvious centre but only three other regions, Haute Normandie, Champagne and Picardie fall in the second highest potential rank. Italy belongs to neither group: potentials are all low (below 2400) and decline steadily from north to south.

II. *The Present Situation: Potential Map II*

Range. The potential values of the Common Market countries have all increased greatly: the highest potentials, in West Germany, measure over 3600 and all other regions of the Community with the exception of south-west France, West Berlin, and Italy south of the Po valley, measure over 3000. The British figures remain the same as in the previous situation, and no region in Britain has a potential value of 3000 or over.

Pattern. With the removal of the frontier costs between the E.E.C. countries following the Treaty of Rome, a dramatic change has taken place in the pattern of potentials: no longer are there separate highs and lows, but instead, the region of greatest potential is super-imposed over national frontiers, giving an international core region and an international periphery. The regions with a potential of over 3600 form a contiguous group and include the regions of Aachen, Düsseldorf and Köln in West Germany; Antwerp, Limburg, Liege and Brabant in Belgium; and Noord Brabant and Limburg in the Netherlands. The potentials decline with distance away from this European centre, but the tariff barrier between Britain and the E.E.C. countries causes the potentials to decline more swiftly in a north-west direction.

The greatest changes in potential values have taken place in the Benelux countries: regions within the east and south-east of these countries have risen from a position in the lowest potential group to a position in the highest rank, an increase in potential of over 50 per cent. In Germany, regions in the Rhine valley have retained their leading position but the potentials of regions in the east and south of Germany have declined relative to the central region (although rising in absolute terms), and now form part of

the international periphery. In France, regions in the north and east are well placed in relation to the group of highest potentials but no longer is any region included in the highest category. The decline in potential towards the south-west of France has become more apparent than in the pre-Treaty of Rome situation. In Italy, the potentials have increased in absolute terms, but relative to other regions of Europe, the position of the country has not improved. In Britain the potentials have remained unaltered from the pre-Treaty of Rome situation, and as a consequence the position of Britain in relation to the E.E.C. countries has suffered a very great decline, with London and South East England changed from an area of highest potential to rank on a par with central Italy.

III. *Predicted Situation of an Enlarged Common Market: Potential Map III*

Range. The enlargement of the Common Market to include Britain, Eire, Norway and Denmark has brought about a rise in the potential value of all regions. The European regions have not benefited equally from the removal of the tariff barriers. If the British potentials are excluded, the increase in potential of the ten most attractive central regions has been greater than the increase in the ten regions of lowest potential: a 3.6 per cent increase compared with a 2.7 per cent increase.

Pattern. The concentric pattern of the potentials within Europe has not been altered. Britain's membership of the E.E.C. has improved the country's relative position with the potentials of the British regions increasing by 8 per cent on average, but the rise has not been sufficient for any part of Britain to be included within the most attractive area of Europe. The highest potential is recorded for London and South East England, but this potential is 20 per cent below the average value of the regions comprising the potential centre.

IV. *Predicted Situation of Improved Transport: Potential Maps IV and V*

Range. The assumption of the use of containers for sea freight within Europe (Map IV) and the completion of the Channel Tunnel

(Map V) in each case has lowered transport costs and therefore has increased further the potential values for all regions. Certain regions have been directly affected: Britain and in the container case Sicily and Sardinia, but if these values are discounted, the average increase in potential again has been greater in the regions within the highest potential rank than in those within the lower potential rank.

Pattern. Although Britain's relative position has been improved with the potentials rising on average by 10 per cent in Map IV and by 6 per cent in Map V, the country remains outside the most attractive area of Europe. London and South East England has a potential which is 12 per cent below the average of the highest potential group in Europe with container shipping, and 9 per cent below with the assumption of a Channel Tunnel.

USE OF EMPLOYMENT DATA TO CHECK CHANGES OF POTENTIAL

Employment figures for manufacturing industry were used as a check on whether employment responded in the period after the Treaty of Rome to changes in potential which had been observed. Regional employment data were collected, and the manufacturing industries sub-divided into the following categories: expanding industries (metal manufacture, engineering, vehicle manufacture, chemicals and related industries); declining industries (textiles, clothing and footwear); and other manufacturing industries.

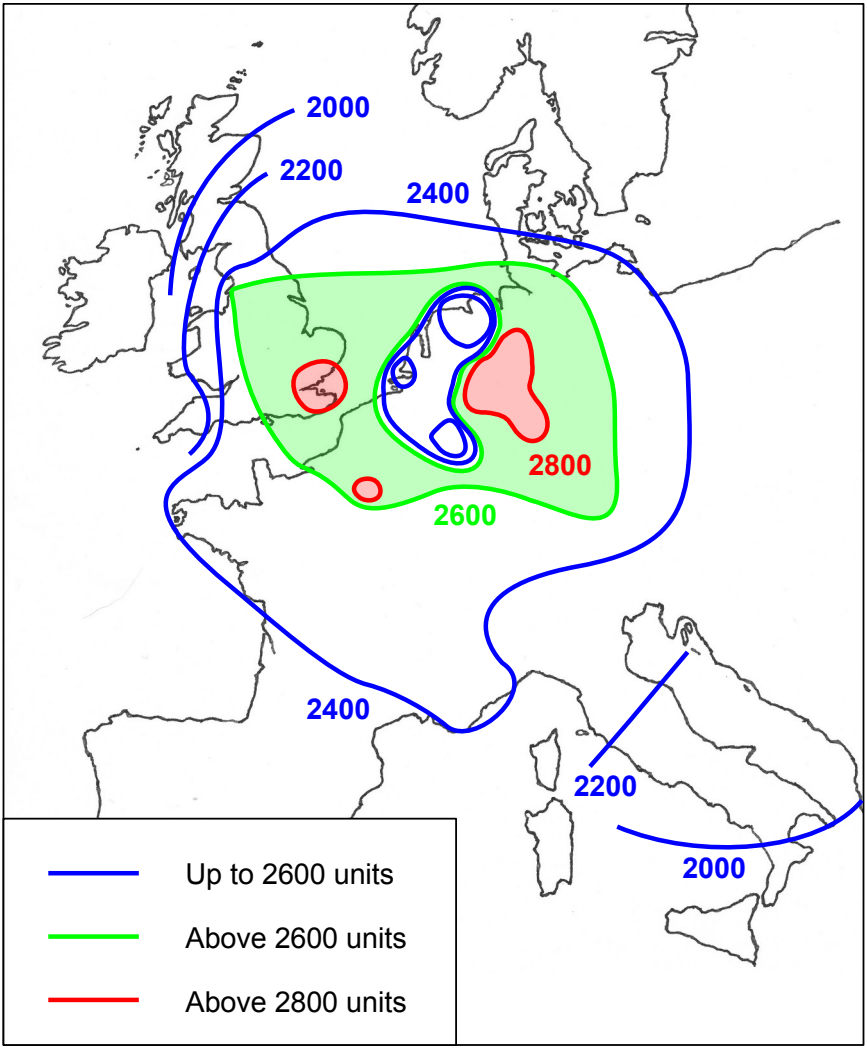
The increment or decrease in employment in the pre-Treaty of Rome period of 1950–1960 and in the present E.E.C. period of 1960–1965 were calculated and expressed as annual figures per 1,000 of total population, for each region, and for each branch of manufacturing industry. The sources used and the changes of employment calculated for each of the two time periods are given in Appendix II. Although this was a far from ideal measure owing to the inevitable distortion caused by each country's regional policy, whereby incentives have been given to industry to locate in peripheral or problem areas, from these data it can be seen that the regions in which the potential values have risen most have also

experienced the greatest increases in employment. Very high increases in employment were found in eastern and southern Netherlands and eastern Belgium, but in the more remote regions such as south-west France, southern Italy and northern Germany, the employment has tended to decline or to grow more slowly in the 1960–1965 time period than in the earlier period. There has been some indication of a response of employment to the changed locational value of certain regions following the Treaty of Rome.

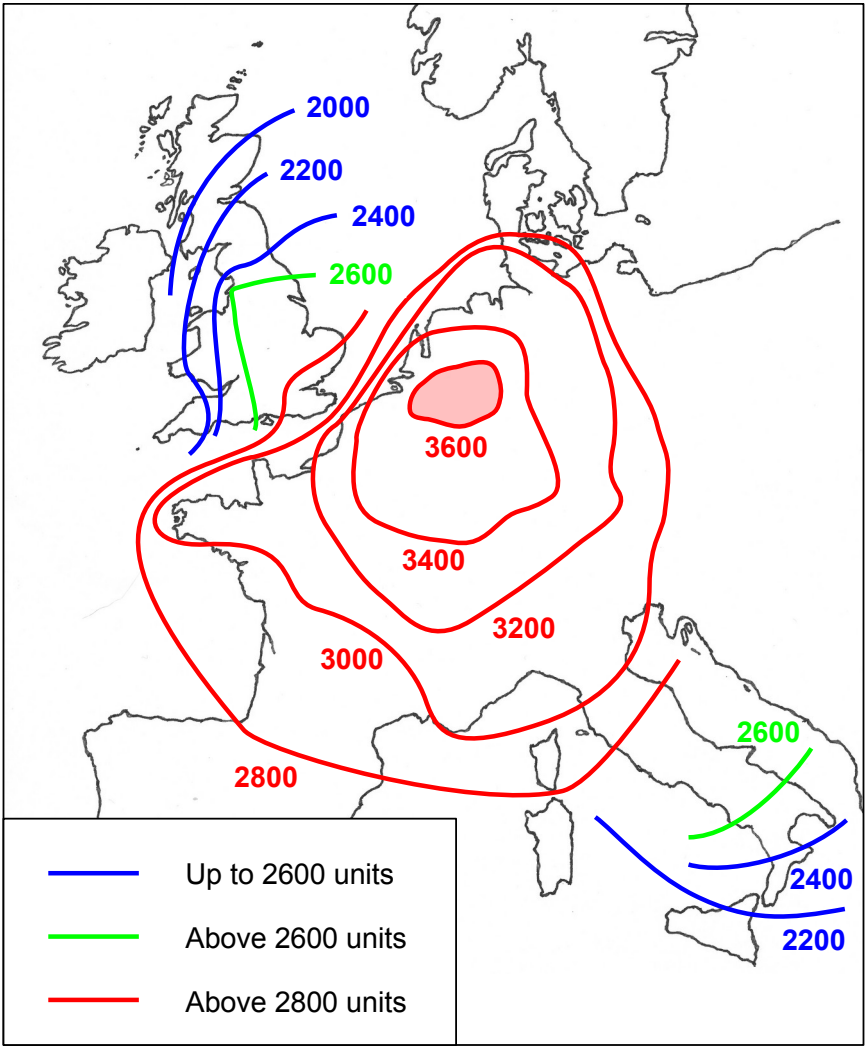
CONCLUSION

From this study of economic potential, a distinct change in the distribution of the regions of greatest attraction to manufacturing industry has been shown to have taken place: prior to the Treaty of Rome, three discrete areas of high potential were found, but the Customs Union brought about a single central region of high potential from which potentials diminished with distance. The economic potentials suggest that in future manufacturing industries will tend to locate and become concentrated within the Rhine valley of West Germany, eastern Belgium, and the south east Netherlands. Before the Treaty of Rome, one of the three areas of high potential was in Britain, but since that date and despite the assumptions made which directly improved Britain's position relative to the rest of Europe, the country has been shown to lie outside the central area of greatest potential in Europe.

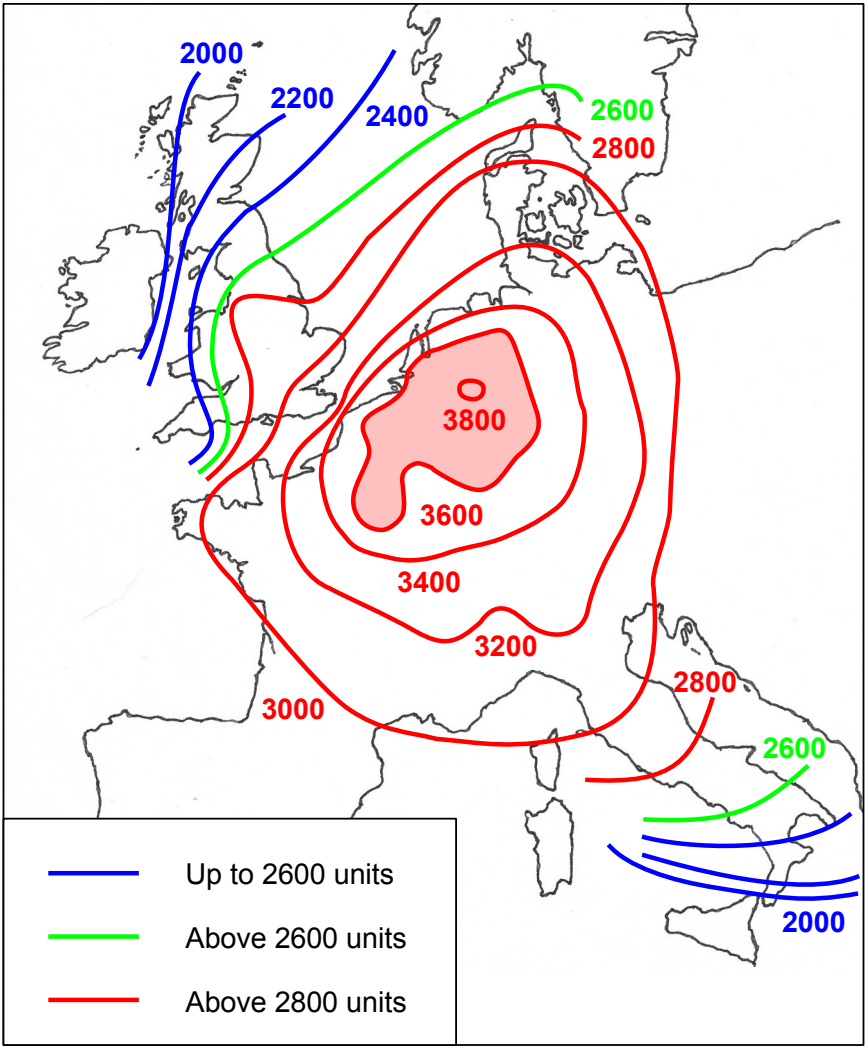
Since the Customs Union agreement entails not only the unhindered movement of goods across frontiers but also freedom of labour and capital, the possibility arises that the labour and capital of Common Market countries which are remote from the potential centre of Europe will in future migrate to the centre, to the detriment of the countries on the periphery.



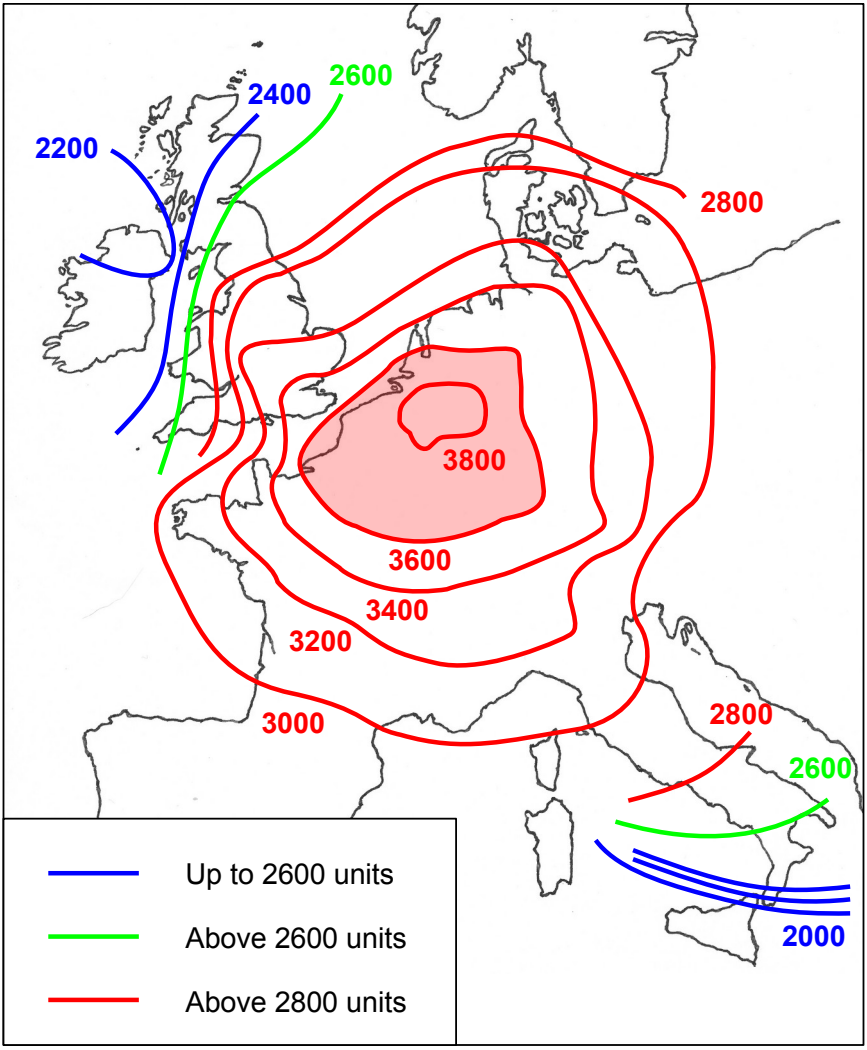
Map 1 – Before the Treaty of Rome



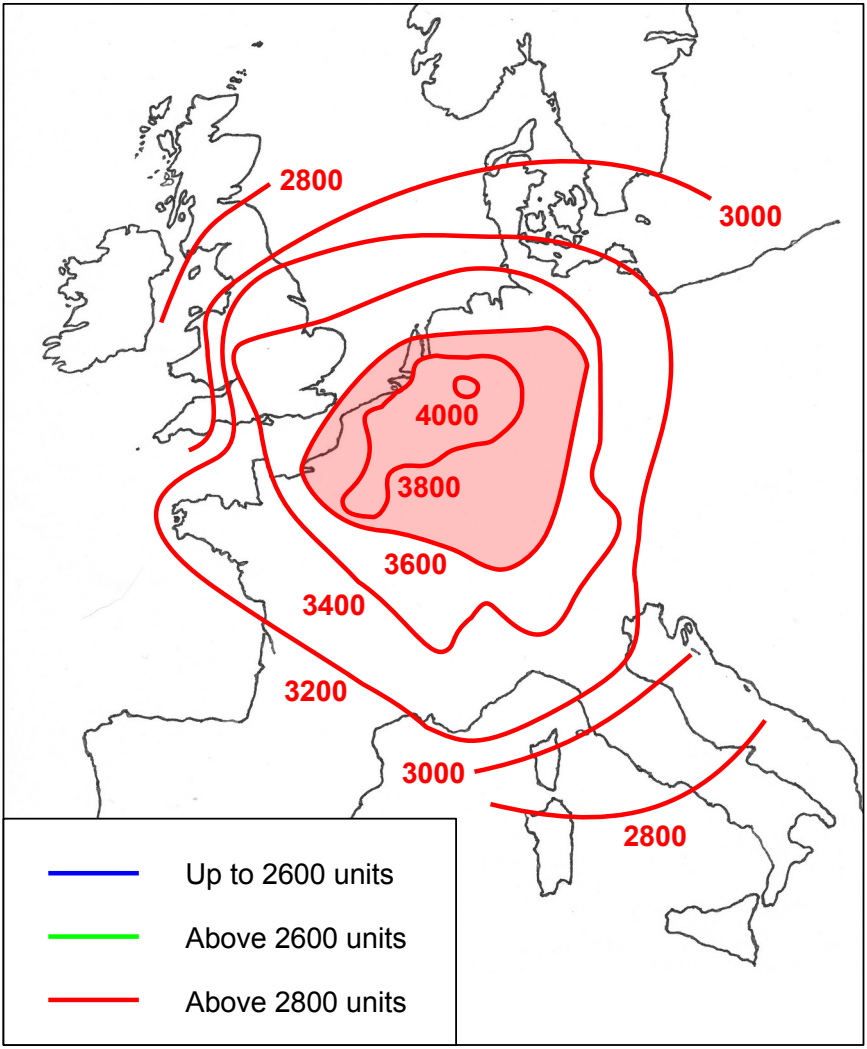
Map 2 – The E.E.C. Six and the U.K.



Map 3 – Enlarged Customs Union



Map 4 – Containerised Transport



Map 5 – Channel Tunnel

NOTE ON THE PATTERN OF EMPLOYMENT CHANGE

In order to estimate the representative employment associated with each rank of potential, the economic potentials resulting from the pre-Treaty of Rome conditions were used with the employment figures for the 1950–1960 period, and potentials from the present situation were used with employment figures for the 1960–1965 period. In both cases potentials were listed in ascending order and divided into quintiles, giving five groups of regions of increasing attraction to manufacturing industry. The employment figures for the three branches of industry were then allocated to each region. The median employment value was taken as the representative employment increase (or decrease) for each quintile and for each industrial category. The results are shown in Table 1 below.

Representative increase or decrease in manufacturing employment
(per annum and per 1,000 total population)

Quintile	Category	1950–1960	1960-1965
1st (lowest)	Expanding	+ 0.361	+ 0.522
	Declining	+ 0.065	– 0.113
	Others	+ 0.044	+ 0.034
2nd	Expanding	+ 0.646	+ 0.732
	Declining	– 0.173	– 0.153
	Others	+ 0.270	+ 0.010
3rd	Expanding	+ 1.113	+ 1.981
	Declining	– 0.153	– 0.295
	Others	+ 0.104	+ 0.164
4th	Expanding	+ 1.689 *	+ 1.654
	Declining	– 0.294 *	– 0.201
	Others	+ 0.134 *	+ 0.297
5th (highest)	Expanding	+ 1.689 *	+ 1.674
	Declining	– 0.294 *	– 0.017
	Others	+ 0.134 *	+ 0.572

* Due to unsuitability, German data were omitted for 1950–1960 and the 4th and 5th quintiles for this period were taken as a single group.

Within the expanding manufacturing industries, the expected pattern occurred during the 1950–1960 period with employment increasing as potential value rose; but in the 1960–1965 period the increase in employment was definitely highest in the 3rd quintile of potential and not in the region of greatest attraction to industry.

The dominance of the third quintile might suggest that large scale industrial plants requiring a large land area are tending to locate away from the most favoured regions, due to the increasing costs of congestion and the high price of suitable land, as well as Government control.

The decrease in employment in the declining industries tended to be greatest in the higher potential quintiles in the 1950–1960 period. In the 1960–1965 time period, the most marked decrease in employment occurred in the 3rd potential quintile, and by far the slowest decline took place in those regions most favourable to industry. The firms in the central regions would appear to have a locational advantage and the firms are forced out of the industry first in the less favoured regions.

The employment change in the other manufacturing industries forms no coherent pattern in the 1950–1960 period, but in the later period of 1960–1965, manufacturing employment has tended to increase most where potential value is highest. Since this category of industries includes the smaller and more mobile industries, it seems reasonable that they should tend to grow faster in the most attractive regions.

Acknowledgement
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Appendix I. Regions, Nodes, and Regional Incomes

Regional incomes expressed as an average
for 1960–1964 in millions of dollars (1962).

Country	Region	Node	Income
Netherlands	Drenthe	Emmen	245
	Zeeland	Flushing	256
	Friesland	Leeuwarden	390
	Groningen	Groningen	434
	Utrecht	Utrecht	690
	Overijssel *	Enschede	713
	Limburg	Maastricht	757
	Gelderland †	Arnhem	1,113
	Noord Brabant	Eindhoven	1,258
	Noord Holland	Amsterdam	2,316
	Zuid Holland	Rotterdam	2,962
Belgium	Luxembourg	Bastogne	197
	Namur	Namur	373
	Limburg	Hasselt	455
	West Flanders	Bruges	1,014
	East Flanders	Gent	1,210
	Hainaut	Mons	1,242
	Liège	Liège	1,252
	Anvers	Antwerp	1,666
	Brabant	Brussels	2,939
Luxembourg	–	Luxembourg	417
West Germany	Oberpfalz	Regensburg	748
	Bremen	Bremen	952
	Oldenburg	Oldenburg	1,020
	Aachen	Aachen	1,020
	Unterfranken	Würtzburg	1,020
	Koblenz	Koblenz	1,156
	Kassel	Kassel	1,292
	Saarland	Saarbrücken	1,496
	Südbaden	Freiburg	1,768
	Schleswig-Holstein	Kiel	1,904
	Münster	Münster	2,516

Country	Region	Node	Income
West Germany	Osnabrück	Osnabrück	2,584
	Ober und Mittel-Franken	Nurnburg	2,720
	West Berlin	West Berlin	2,788
	Köln	Köln	3,128
	Hannover	Hannover	3,740
	Rheinhessen	Mannheim	3,876
	Hessen	Frankfurt	4,692
	Bayern	München	5,712
	Hamburg	Hamburg	5,780
	Baden-Württemburg	Stuttgart	5,848
	Düsseldorf	Duisburg	12,240
France	Limousin	Limoges	662
	Franche Comté	Besançon	1,049
	Basse Normandie	Caen	1,159
	Champagne	Rheins	1,269
	Auvergne	Clermont Ferrand	1,269
	Poitou-Charentes	Poitiers	1,269
	Bourgogne	Dijon	1,380
	Alsace	Strasbourg	1,545
	Languedoc	Montpellier	1,545
	Picardie	Amiens	1,821
	Centre	Tours	1,821
	Midi-Pyrénées	Toulous	1,876
	Bretagne	Rennes	2,042
	Haute Normandie	Rouen	2,152
	Pays de la Loire	Nantes	2,428
	Aquitaine	Bordeaux	2,594
	Lorraine	Nancy	2,814
	Provence	Marseilles	3,587
	Nord	Lille	4,691
	Rhône Alps	Lyons	5,022
	Région Parisienne	Paris	13,189
Italy	Valle d'Aaosta	Aosta	93
	Basilicata	Potenza	217
	Umbria	Perugia	372
	Trentino-Alto Adige	Trento	465

Country	Region	Node	Income
Italy	Calabria	Catanzaro	558
	Marche	Ancona	621
	Abruzzi e Molise	Chiete	621
	Sardegna	Cagliari	621
	Friuli-Venezia	Udine	714
	Puglia	Bari	1,396
	Liguria	Genova	1,489
	Sicilia	Palermo	1,862
	Campania	Napoli	2,017
	Toscana	Firenze	2,110
	Veneto	Venezia	2,265
	Emilia-Romagna	Bologna	2,637
	Lazio	Roma	2,823
	Piedmonte	Torino	3,444
	Lombardia	Milano	6,701
Britain	South Scotland	Hawick	331
	Central Wales	Aberystwyth	398
	North Wales	Denbigh	464
	North Scotland	Inverness	1,126
	Northern Ireland	Belfast	1,126
	Devon and Cornwall	Plymouth	1,193
	South Wales	Cardiff	1,855
	South-West England	Bristol	2,849
	Southern England	Reading	3,246
	Northern England	Newcastle-on-Tyne	3,313
	Central Scotland	Glasgow	4,174
	North Midlands	Nottingham	4,439
	Eastern England	Cambridge	4,637
	East & West Ridings	Leeds	5,167
	Midlands	Birmingham	6,559
	North-West England	Manchester	7,817
	London and South East	London	17,556
Eire	–	Dublin	1,747
Norway	–	Oslo	4,039
Denmark	–	Copenhagen	5,981

* Includes North East Polder

† Includes South Ijsselmeer Polder

Sources for Appendix 1

The sources of regional income data for Appendix I were:

Netherlands: Income Distribution by Province, 1960. Publisher W. de Haan N. V. Hilversum, 1966; received from the Centraal Bureau voor de Statistiek, The Hague.

Belgium: Regional National Income, 1961. From a communication received from L'Institut National de Statistique, Brussels.

West Germany: Gross Domestic Product at Market Prices by Länd and Regierungsbezirk, 1961. From *Sozialprodukts-berechnungen der Länder, Heft 2,* 1966.

France: Regional Value Added, 1962, from *Etudes et Conjoncture*, Numero Spécial, 1966.

Italy: Net Product by Region in 1962, from the publication *Moneta e Credito*, Banca Nazionale del Lavoro, Rome, 1963.

Britain: Personal incomes before tax for 1964-65, from the *Inland Revenue Report* for year ending March 1966.

Appendix II. Employment Changes in Manufacturing Industry (1950s and 1960s)

Increase or decrease per annum, per 1,000 total population.

Regions are ranked according to employment growth in expanding industries in the time period after 1960.

Region	Expanding Industry		Declining Industry		Other Industry	
Netherlands	*1950-60*	*1960-63*	*1950-60*	*1960-63*	*1950-60*	*1960-63*
Noord Brabant	+ 1.210	+ 5.366	+ 0.647	+ 0.575	– 0.719	+ 3.957
Groningen	+ 0.361	+ 4.442	+ 0.808	+ 1.045	– 0.977	+ 1.959
Drenthe	+ 1.651	+ 4.432	– 0.021	+ 0.659	+ 0.049	+ 1.324
Overijssel	+ 0.018	+ 3.222	– 0.102	– 0.283	+ 0.040	+ 2.802
Friesland	+ 0.491	+ 2.715	– 0.248	+ 0.167	+ 0.067	+ 2.254
Limburg	+ 1.036	+ 2.381	– 0.214	+ 0.705	– 0.116	+ 2.706
Zuid Holland	+ 0.208	+ 1.960	– 0.748	– 0.374	– 0.223	+ 1.017
Utrecht	– 0.596	+ 1.919	– 0.539	+ 0.181	+ 0.476	+ 1.015
Gelderland	+ 1.288	+ 1.351	– 0.697	– 0.027	+ 0.398	+ 2.098
Zeeland	+ 0.271	+ 0.268	– 1.219	+ 1.411	– 0.823	+ 1.976
Noord Holland	+ 0.340	+ 0.188	– 1.052	– 0.164	– 0.113	+ 1.533
Belgium	*1955-60*	*1960-65*	*1955-60*	*1960-65*	*1955-60*	*1960-65*
Limburg	+ 0.800	+ 4.830	+ 0.133	+ 0.885	+ 0.335	+ 0.632
West Flanders	+ 1.290	+ 2.571	– 0.221	– 1.110	+ 0.540	+ 0.721
Luxembourg	– 2.273	+ 2.422	– 0.193	+ 0.032	– 0.047	+ 0.617
Anvers	+ 1.377	+ 2.108	– 0.024	+ 0.004	+ 0.202	+ 0.602
Brabant	+ 0.611	+ 1.574	– 0.678	– 0.008	+ 2.601	+ 0.521
Hainaut	– 0.141	+ 1.133	– 0.173	+ 1.901	– 0.175	+ 0.246
East Flanders	+ 0.234	+ 1.000	+ 1.086	– 0.589	+ 0.270	+ 0.543
Namur	+ 0.089	+ 0.702	– 0.064	– 0.150	+ 0.036	+ 0.283
Liège	+ 0.446	+ 0.529	– 0.610	– 0.513	– 0.016	+ 0.059
Luxembourg	*1950-60*	*1960-63*	*1950-60*	*1960-63*	*1955-60*	*1960-63*
Luxembourg	+ 2.054	+ 1.321	+ 0.073	+ 0.435	– 0.011	– 0.284
West Germany	–	*1960-63*	–	*1960-63*	–	*1960-63*
Saarland		+ 2.641		+ 0.658		+ 0.247
Bayern		+ 2.402		+ 0.420		+ 0.314
Baden-Württemburg		+ 2.328		– 0.318		+ 0.297

Region	Expanding Industry		Declining Industry		Other Industry	
West Germany	–	*1960-63*	–	*1960-63*	–	*1960-63*
Niedersachsen		+ 1.684		+ 0.054		– 0.647
Nordrhein-Westfalen		+ 1.385		– 0.421		+ 0.361
Rheinlandpfalz		+ 0.566		+ 0.049		+ 0.402
Hessen		+ 0.208		– 0.017		+ 0.642
Schleswig-Holstein		– 0.157		– 0.058		+ 0.073
Hamburg		– 0.351		– 0.466		– 0.114
West Berlin		– 0.952		– 0.489		– 2.906
Bremen		– 6.940		– 0.067		+ 0.099
France	*1954-62*	–	*1954-62*	–	*1954-62*	–
Franche Comté	+ 2.850		– 0.429		+ 0.178	
Picardie	+ 2.533		– 0.477		+ 0.388	
Haut Normandie	+ 2.354		– 0.797		+ 0.060	
Centre	+ 2.028		– 0.350		– 0.066	
Région Parisienne	+ 1.774		– 0.761		+ 0.163	
Alsace	+ 1.711		– 1.315		+ 0.113	
Lorraine	+ 1.625		– 0.715		– 0.063	
Bourgogne	+ 1.521		0.000		– 0.118	
Basse Normandie	+ 1.462		– 0.237		+ 0.085	
Champagne	+ 1.243		– 0.239		+ 0.105	
Nord	+ 1.193		– 0.993		– 0.039	
Pays de la Loire	+ 1.113		– 0.369		+ 0.096	
Rhône Alps	+ 0.804		– 0.783		+ 0.051	
Limousin	+ 0.742		– 0.150		– 0.395	
Provence	+ 0.723		– 0.214		– 0.037	
Auvergne	+ 0.645		– 0.551		– 0.022	
Languedoc	+ 0.579		– 0.165		– 1.374	
Midi-Pyrénées	+ 0.569		– 0.435		– 0.053	
Aquitaine	+ 0.553		– 0.379		– 0.516	
Bretagne	+ 0.419		– 0.290		– 0.149	
Poitou-Charentes	+ 0.406		– 0.157		+ 0.201	
Italy	*1951-60*	*1960-65*	*1951-60*	*1960-65*	*1951-60*	*1960-65*
Piedmonte	+ 3.415	+ 3.802	– 0.542	– 1.150	+ 0.397	+ 0.164
Emilia-Romagna	+ 1.970	+ 2.998	+ 0.721	– 0.295	+ 0.900	+ 0.005
Veneto	+ 1.594	+ 1.981	+ 0.222	+ 0.255	+ 0.621	+ 0.489
Umbria	+ 0.084	+ 1.811	+ 0.098	– 0.126	+ 0.349	+ 0.101
Lombardia	+ 3.053	+ 1.780	– 0.064	– 0.951	+ 0.938	+ 0.321

Region	Expanding Industry		Declining Industry		Other Industry	
Italy	*1951-60*	*1960-65*	*1951-60*	*1960-65*	*1951-60*	*1960-65*
Friuli-Venezia	+ 0.600	+ 1.744	– 0.517	+ 0.415	+ 0.609	+ 0.914
Toscana	+ 0.943	+ 1.163	+ 1.890	+ 0.079	+ 0.537	+ 0.146
Marche	+ 0.643	+ 0.846	+ 0.792	+ 0.445	+ 2.541	– 3.756
Trentino-Alto Adige	+ 0.692	+ 0.840	– 0.141	– 0.763	+ 0.452	+ 0.178
Abruzzi e Molise	+ 0.362	+ 0.780	+ 0.497	+ 1.074	– 0.121	+ 0.166
Puglia	+ 0.198	+ 0.602	+ 0.874	+ 0.064	– 0.013	– 0.164
Campania	+ 0.471	+ 0.567	+ 0.574	– 0.660	+ 0.532	+ 0.008
Lazio	+ 0.710	+ 0.384	+ 0.469	+ 0.778	+ 0.295	+ 0.020
Sardegna	+ 0.274	+ 0.226	+ 0.058	– 0.028	+ 0.172	+ 0.042
Basilicata	+ 0.034	+ 0.155	– 0.155	– 0.124	– 0.207	– 0.155
Sicilia	– 0.377	+ 0.097	+ 0.351	– 0.686	+ 0.096	– 0.225
Calabria	+ 0.158	+ 0.009	– 0.114	– 0.362	– 0.299	– 0.186
Valle d'Aosta	– 4.040	0.000	+ 4.040	– 9.091	0.000	0.000
Liguria	+ 0.351	– 0.904	+ 0.460	– 2.625	– 0.017	– 0.327
Britain	*1953-58*	*1959-64*	*1953-58*	*1959-64*	*1953-58*	*1959-64*
Southern England	+ 3.467	+ 3.690	+ 0.009	+ 0.030	+ 0.393	+ 1.249
Eastern England	+ 3.612	+ 2.891	+ 0.015	+ 0.033	+ 1.373	+ 1.470
Midlands	+ 2.538	+ 2.539	– 0.056	– 0.008	+ 0.022	+ 0.480
South Wales	+ 0.537	+ 2.378	– 0.206	+ 0.144	+ 0.948	+ 0.585
East and West Ridings	+ 0.988	+ 1.170	– 0.923	– 0.986	+ 0.797	+ 0.953
North Midlands	+ 1.047	+ 1.123	– 0.238	– 0.103	+ 0.193	– 0.683
North and South Scotland	+ 1.173	+ 1.229	– 0.080	– 0.094	+ 1.462	+ 0.348
North Wales	+ 2.619	+ 1.035	+ 0.150	+ 0.406	+ 0.228	+ 0.971
	1951-60	*1960-65*	*1951-60*	*1960-65*	*1951-60*	*1960-65*
North-West England	+ 1.469	+ 0.829	– 1.736	– 1.902	+ 0.843	+ 0.629
London and South East	+ 1.245	+ 0.774	– 0.208	– 0.146	+ 0.672	+ 0.075
South-West England	+ 1.753	+ 0.658	+ 0.080	+ 0.115	+ 0.843	– 0.205
Central Wales	+ 1.575	– 0.150	– 0.071	+ 0.199	– 1.881	+ 0.077
Central Scotland	+ 0.288	– 0.449	– 0.372	– 0.299	+ 1.697	+ 0.027
Northern England	+ 2.186	– 0.710	+ 0.001	+ 0.170	+ 0.078	+ 0.480
Northern Ireland	-	– 0.387	-	– 0.870	-	+ 0.542

Sources for Appendix 2

The sources of regional employment data for Appendix II were:

Netherlands: Industrial Employment Censuses, published by the Centraal Bureau voor de Statistiek, The Hague.

Belgium: Social Security Regional Statistics for workers by province and activity, L'Institut National de Statistique, Brussels.

Luxembourg: Enquête Annuelle sur la Production Industrielle Effectif Total, Luxembourg.

West Germany: Industrie und Handwerk, Reihe I, published by the Statistisches Bundesamt, Wiesbaden.

France: Evolution 1954-1962 de l'emploi par branches et par regions, published by the Institut National de la Statistique et des Etudes Economiques, Paris, 1964.

Italy: Occupazione in Italia: Industria, published by the Istituto Centrale di Statistica, Rome, 1966.

Britain: Ministry of Labour, Local Employment Returns: ER.II, (not published but access granted by the Ministry of Labour).

Notes

For Germany, employment figures were only available for Länder, giving 11 regions instead of the 22 regions used for the analysis of potentials. The 1950-60 figures were not used since they would not be representative, owing to the post-war period of reconstruction.

At the time of writing regional employment data for France after the year 1962 were unobtainable.

In Britain, a change in the definition of employment regions meant that only 14 regions could be used for the earlier period, although figures for further regions were available for the later time period.