The Impact of Globalization, through Vertical Specialization, on the Labor Market: the French Case.

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Abstract

Globalization is often seen as responsible for the observed widening income distribution in industrialized countries. In this empirical paper, I show that a decrease in trade costs (globalization) modifies the international structure of production towards vertical specialization. Industries vertically specialize when different stages along the production spectrum locate in different countries. By shifting relative-labor-demand across countries, vertical specialization increases skilled-unskilled inequality in a way that is observationally equivalent to skilled-biased technological progress. I hence evaluate the contribution of vertical specialization in explaining the observed within-industry shift away from unskilled workers in France. Using input-output tables and labor data, I find that vertical specialization, defined as the share of imported inputs in production, rose from 9% in 1977 to 15% in 1996. Further estimations show that vertical specialization contributed from 11% to 15% of the decline in the share of unskilled workers in French manufacturing employment in the 1977-1985 period and for one-quarter in the 1985-1993 period.

1. Introduction

Are the benefits of globalization challenged by its adverse effect on income distribution? Whereas this issue is an old one among academics, it has regained interest in the past few years as it became a strong argument for anti-globalization groups. There is in fact a respectable basis in economic theory for the proposition that free trade will

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undermine real wages of those toward the bottom of the distribution.[1] In this paper, I explore the potential impact of economic integration or globalization on income distribution by looking at trade from a different angle than traditional Hecksher-Ohlin theory. I focus on plants reallocation and outsourcing and explore how much of the increase in inequality between skilled and unskilled workers in industrial countries could be imputed to such a trade.

Most of the available empirical literature suggests that trade accounts for a small fraction of the dramatic rise in skilled-unskilled inequality that took place in industrialized countries since the mid-to-late 1970's (see Table (6.1) in the appendix). While most trade explanations predict an increase in the within-industry share of unskilled to skilled workers, various authors show that the rise in inequality is primarily caused by a within-industry shift in relative demand away from the unskilled.[2] They hence conclude on the limited role of trade in explaining the increase in inequality and argue that skilled-biased technological change, caused by the rapid diffusion of information technologies and computers as well as the adoption of new forms of work organization, is the most likely culprit.[3]

However, as documented by Feensta (1998), Campa and Goldberg (1997) and Hummels et al. (1998 and 1999), trade has not only increased, but its nature has also changed. The decrease in the costs of trade (*i.e.*, lower tariffs, transportation costs, information or/and communication costs) has encouraged the delinking of productive operations, leading to the development of trade in intermediate goods, components, part, or work in progress, between production units in different countries. Production is increasingly fragmented and international trade increasingly vertically specialized. When globalization (lower trade costs) results in vertical specialization, with the unskilled-intensive stages within manufacturing industries shifting to low-wage countries, the within-industry ratio of unskilled to skilled workers falls in industrialized countries. In fact, when there is vertical specialization, the effects of trade and skilled-biased technological change on inequality are observationally equivalent and need to be disentangled.[4]

Whereas Strauss-Kahn (2002) theoritically confirms the potential role of trade, through vertical specialization, in explaining the increased inequality, this paper aims

[1] In the 1940s, economists W. Stolper and P. Samuelson, building on the Hecksher-Ohlin factor-abundance theory of trade, predicts that trade with low-wage countries raises the relative price of the skilled-intensive good. It implies an increase in the relative price of skilled labor and a reduction in the real wage of unskilled labor. Note that consequently, we should observe an increase in the ratio of unskilled to skilled workers within industries.

[2] E.g, Berman et al. (1994) and Lawrence and Slaughter (1993) have shown it for the U.S. and Machin et al. (1996) for the U.K., Sweden and Denmark.

[3] Acemoglu (2000) provides a clear and extensive survey on the literature to date.

[4] These points were first made in Feenstra and Hanson (1997 and 1998).

at assessing the magnitude of this vertical specialization effect. I first show that vertical specialization occured in France over the past two decades and then estimate its contribution to the observed within-industry shift away from unskilled workers. To determine the extend of vertical specialization, I build an index that measures the value of imported inputs embodied in goods produced using primarily data from input-output tables. The labor data used in the regression analysis distinguish workers per occupation within industry. All data come from the French National Institute of Statistics and Economic Studies (INSEE).[5] I find that vertical specialization rose significantly over the period from 9% in 1977 to 15% in 1996. It has contributed from 11% to 15% of the decline in the share of unskilled workers in manufaturing employment over the 1977-1985 period and for at least a quarter over the 1985-1993 period.

France features several relevant caracteristics that makes it a particularly good case study. Its market increased dramatically over the past three decades, while the European Union (EU), to which it belongs since its creation in 1957, enlarged from 6 to 15 member states and progressively established free movement of goods, persons, services and capitals among its members. France also has a large and diverse trading aera because of, among other factors, preferential trade agreements with Eastern European countries and former colonies. In addition, the French high unemployment affects unskilled workers more than their skilled counterparts. The skilled-unskilled unemployment rate differential widened in the 1980s, rising from 2.4 percentage points in 1981 to 7.6 percentage points in 1994[6]. This increase in unskilled unemployment is matched up by a decrease in the share of unskilled in total employment, as labor demand shifts away from unskilled workers. Therefore, French citizens by and large see vertical specialization as one of the main causes of unskilled unemployment. To my knowledge, there is, however, no empirical work that test for the accuracy of this belief.

This paper relates with two strands of literature: one on vertical specialization, the other on the impact of trade on income distribution. Campa and Goldberg (1997) study vertical specialization in Japan, U.K., Canada and the U.S, while Hummels et al. (1999) consider the French case among other OECD countries. Both papers focus on the magnitude and evolution of vertical specialization, but they neglect its effect

[5]Sebastien Jean has kindly provided all the labor data. The industry occupational decomposition is derived from an annual industry survey managed by the INSEE. The distinction between skilled and unskilled workers depends on occupation rather than education. Occupations have been divided into two groups which are relatively equivalent to the U.S white collars/blue collars decomposition. For further information on these data see Cortes O. and S. Jean (1997).

[6]The unemployment rate for male with low education (*i.e.*: levels 0, 1, 2 up to lower secondary education) rose from 5.4% in 1981 to 13.5% in 1994. The unemployment rate for male with high education (*i.e.*: levels up to tertiary education) increased from 3.0% in 1981 to 5.9% in 1994. The gap for women unemployment rate per education level is even larger. Data are from the OECD.

on the labor market. Note that I use a different index of vertical specialization and a higher level of industrial disaggregation than Hummels et al. Feenstra and Hanson (1996-1997-1998) estimate the impact of outsourcing on inequalities for the U.S. and find a significant contribution of outsourcing in explaining the observed increase in the relative wage of skilled workers during the 1980's.

The remainder of the paper is in five parts. Section 2 sets out my measure of vertical specialization and the data. It also presents results on vertical specialization levels and trends. In section 3, I examine the accuracy of the index by performing two different kinds of variance decomposition. Section 4 evidences the shift away from unskilled labor, a within-industries shift. In section 5, through a regression analysis, I estimate the impact of vertical specialization on employment inequality. Section 6 concludes.

2. The index of vertical specialization

To assess the degree of vertical specialization in level across industries and its evolution over time, I built and study an index to which we will refer as V. The index is computed at the industry level and it measures the share of imported input embodied in production. I primarily use Input-Output tables which include sector level data on inputs. Output, value added, import, and consumption data are derived from national account tables. All data come from the INSEE, and concern 100 sectors among which 60 are of interest[7]. The database covers the 1977-1996 period. Input-output tables provide the values of input used in production distinguishing between the different sources of supplies, *i.e.* the industry in which the input has been produced. However, in these tables, the input's values do not disentangle domestic or imported inputs. To get a measure of imported input, I weight, for each industry, the value of the input used in production, q_{jit}, by the import penetration ratio of the industry, m_{jt}. The import penetration ratio is, for each sector, the ratio of the value of imported goods from sector j to the value of domestic use of goods from sector j, where domestic use includes use as final good, use as intermediate good and use as capital good. The vertical specialization index is therefore:

$$V_{it} = \sum_{j=1}^{n} \frac{m_{jt} q_{jit}}{p_{it}}$$

[7] Over the 100 sectors, the Agriculture, Mining and Manufacture sectors are considered. They account for 90% of traded goods. They are therefore the ones concerned by vertical specialization. V has been computed for the services, transportation and business sectors and shows low levels (under 5% in 1996), which does confirm the sectors' choice. The selected sectors are listed in table (**??**) in the appendix.

where m_{jt} is the import penetration ratio, q_{jit} is the value of inputs (agriculture, mining, raw material and manufactures) from industry j used in the production of industry i, p_{it} is the value of total production of industry i and n is the number of industry considered.

V seems to adequately capture potential changes in the structure of production and the nature of trade toward more or less vertical specialization (i.e., if V increases an industry becomes more vertically specialized). However, to measure the impact of vertical specialization on inequality another, narrower, index is needed. In this second index, I only consider inputs that are purchased from the same aggregated sector than the good being produced. I decide to change the index because, as we will see in section 4, most of the increase in inequality between skilled and unskilled workers occurred within-industry in the 1977-1996 period. I therefore need a limited index of vertical specialization that capture within industry changes. The rationale behind this is the following. If, for example, the French automobile industry imports more steel, it will not affect French workers of the automobile industry but those of the steel industry. In the contrary, if it imports more automobile parts, automobile workers are affected, especially if the parts where formerly made by the same company, or at least purchased in France. The limited index of vertical specialization, Vl, is constructed the same way than V, with the inputs subscripts i and j belonging to the same aggregated sectors (*i.e.*, 3-digit industry j belong to 2-digit industry i).

To empirically implement the Vl index, I would ideally need firms specific data on the production process including the amount of imported inputs (parts and components, contracts done by others...) in total production. These data exist for the US in the Annual Survey of Manufactures, unfortunately, they are impossible to obtain for France.[8] Such data would be more precise and would provide information on stages of production that are located abroad. In fact, many French contracted goods are produced abroad whereas the design, marketing and headquarters activities are made domestically. These good are often exported directly to their final destination and do not come out in French Input-Output tables. This kind of outsourcing, which tend to separate production and non-production activities internationally, has increased dramatically over the past few decades. Think of the multitude of European and United States branded goods made abroad. A typical example is Nike,[9] which employs 2,500 persons in the US for marketing and headquarters activities and about 75,000 persons in Asia, where the shoes are actually produced before being sold to Nike. Not having access to "contracts done by others" data tends to lessen the level of vertical specialization, and therefore to underes-

[8] The US Annual Survey of Manufactures provides information, at a high level of disaggregation, on outsourcing such as (1) parts and components, (2) resals and (3) contract done by others.

[9] Mentioned in Feenstra and Hanson (1996).

timate its impact on inequality. I believe nevertheless that Vl, using the available data, captures a great deal of the vertical specialization's trend. Yet, one should keep in mind that Vl represents the lower bound of the potential magnitude of vertical specialization.

Table (**??**) in the appendix presents the V calculations per sectors, as well as the sectorial growth rate of vertical specialization between 1977 and 1996. Overall, V increases from 9% to 15%, which represents a 66% growth over the period. Campa and Goldberg (1997) have computed a similar measure of vertical specialization for the 1974-1993 period. They found that V rises from 4% to 8% in the U.S., from 16% to 20% in Canada, and from 13% to 22% in the U.K. Japan, in contrary, experienced a decreasing vertical specialization, which felt from 8% to 4%. The results I obtain for France are close to, whereas slightly lower, Campa and Goldberg's results for the U.K. This seems reasonable since the countries share a lot of similar features (European countries, part of the EU, size...). Moreover, Campa and Goldberg use more aggregated data (about 20 sectors), and they do not include the agricultural sector in their calculation, which tends to increase the index's value.[10] Hummels, Ishii and Yi (1997-1999) consider the value of imported inputs embodied in goods that are exported. Their measure, although more restrictive than mine, gives a good evaluation of vertical specialization by imposing that goods produced be sold abroad. It is however not adapted to my work since a shift in labor demand occurs whether the final good is exported or consumed domestically. Their index increases in France from 18% in 1972 to 24% in 1990. These results are much higher than mine, which can be easily explained by the nature of the index itself. Actually, sectors featuring the highest share of imported inputs are also relatively more exports oriented (the correlation between the levels of vertical specialization and the level of export orientation is of 0.45).[11] This observation sustains the idea of vertical specialization for cost advantage, export oriented sectors needing to be competitive on international markets.

Looking at V per sector, two broad facts emerge. First, the level of vertical specialization varies widely across sectors. While certain industries experienced a rapid increase (more than 80% growth), V declined in a number of cases (Iron Mining, Non-Ferrous Metals, and Wood Products). Second, it seems to be a consensus on the sectors mostly affected by vertical specialization (in level as well as in trend). In France, the industries that experience the most important rise in vertical specialization (for a significant level of V) are: Chemicals and Allied Products, Textile, Apparel and Leather, Rubber and

[10]When discarding the agricultural sector, the French vertical specialization rises from 10% in 1977 to 17% in 1996 with a growth of 67%.

[11]Author's calculation

Plastics Products, Transportation Equipment and Non-Electrical Industrial Machinery. This findings are consistent with Hummels et al's and Campa and Goldberg's results.

Results obtain with the restricted measure of vertical specialization are reported in table (**??**) in the appendix. Overall, Vl increases from 5% in 1977 to 8% in 1996, a 63% growth over the period. Vl is, as expected, lower than V across all sectors. However, in the textile, apparel, chemicals, transportation equipment and some machineries industries, the limited vertical specialization index reaches 15% to 30%. In these sectors, the growth in limited vertical specialization is extremely high over the period (from 80% to 270 %). Note that these sectors can relatively easily divide their production process in many stages. Figure (6.5) to (6.7) in the appendix present the sectorial trend in V and Vl over the period.

3. Is the index a good measure of international vertical specialization?

The index of vertical specialization is posited to capture the change in structures of production that occur when different stages along the production chain locate in different countries. Vertical specialization is hence expected to occur at the industry level and to increase trade. To confirm the accuracy of my measure of vertical specialization, I therefore need to verify that the index capture the change in sectors vertical specialization intensity (and not the variation of sectors composition of total production) and that it reflects a variation in the share of imported input in production, for a given level of inputs (and not a variation in the use of input independently of the supply's source).

A rise in V, (Vl), could actually correspond to an increase in production of highly vertically specializing sectors relative to production of other sectors. I check for this eventuality by performing a variance decomposition of V, (Vl). The change in V, (Vl), between 1977 and 1996 is decomposed into: the variation in sectors vertical specialization intensity, *(i.e.:* the within component) and the variation of each sector share of total production, *(i.e.:* the between component).

$$\triangle V = \triangle \sum_{i=1}^{n} \theta_i V_i = \sum_{i=1}^{n} \bar{\theta}_i \triangle V_i + \sum_{i=1}^{n} \bar{V}_i \triangle \theta_i$$

where θ_i is industry i share of total industrial production at time t. For now on, a bar over a variable denotes a mean value over the considered period.

Overall results of this variance decomposition are summarized in table (3.1), details results across sectors are available on request. The between and within sectors decomposition of the rise in vertical specialization are reported for the entire period (1977-1996) as well as for subperiods.[12] The column labeled total contains the annual rate of increase in vertical specialization. A comparison of the rates between periods shows an acceleration over time. The rise in vertical specialization occurred at a rate of 0.23 (0.12) percentage points per year in 1977-1985 and increased to 0.38 (0.20) percentage points per year in 1985-1996.

Figure 3.1: Industry/Sector Decomposition of the Rise in Vertical Specialization

V	Between	Within	Total	Within/Total
1977-1985	0.02	0.21	0.23	90%
1985-1996	0.00	0.38	0.38	100%
1977-1996	0.01	0.31	0.31	98%

Vl	Between	Within	Total	Within/Total
1977-1985	0.01	0.10	0.12	88%
1985-1996	0.00	0.20	0.20	102%
1977-1996	0.00	0.16	0.16	99%

Source: INSEE; Author's Calculations.

The within component largely dominates in both periods. It actually accounts for 0.21 (0.10) of the 0.23 (0.12) percentage point per annum increase in vertical specialization in the 1977-1985 period and for all the acceleration between the two periods. Overall sectors, the within component of the variance decomposition account for almost 98% (99%) of the total variation in vertical specialization in the 1977-1996 period. The increase in V, (Vl), is hence mainly caused by an increase in sectors vertical specialization intensity, which confirm the accuracy of V, (Vl), as measure of vertical specialization.

I also want to verify whether the occurring vertical specialization is internationally oriented. The observed growth in V, (Vl), could actually be caused either by an increase

[12]Choice of the subperiods has been made such that studies' comparison be facilitated. Berman, Bound and Griliches (1994) as well as Feenstra and Hanson (1996) adopt a similar timing.

in the use of inputs from all sources or by a shift away from domestically produced inputs. Obviously, vertical specialization affects the domestic labor market if it occurs internationally, substituting foreign to French labor. To approach this issue, I decompose the variance of the index of vertical specialization per industry into: the variation in the use of inputs in production, independently of the supply's sources, (*i.e.:* the within component) and the variation in the share of imported input in production, for a given level of inputs, (*i.e.:* the between component).

$$\triangle V_i = \sum_{i=1}^{n} \bar{m}_j \triangle (\frac{q_{ji}}{p_i}) + \sum_{i=1}^{n} (\overline{\frac{q_{ji}}{p_i}}) \triangle m_j$$

where V_i is the level of vertical specialization in sector i, m_j is the import penetration ratio of industry j, q_{ji} is the value of inputs from industry j used in the production of industry i, p_i is the value of total production in industry i and n is the number of industries considered.

Figure 3.2: Source Decomposition of the Rise in Vertical Specialization: Domestic/Foreign.

V	Between	Within	Total	Between/Total
1977-1985	0.24	-0.03	0.21	116%
1985-1996	0.4	-0.03	0.38	103%
1977-1996	0.32	-0.01	0.31	103%

VI	Between	Within	Total	Between/Total
1977-1985	0.09	-0.01	0.09	107%
1985-1996	0.18	-0.03	0.15	119%
1977-1996	0.17	-0.01	0.16	103%

Source: INSEE; Author's Calculations.

Overall results of this decomposition are presented in table (3.2). Sectors results are available on request. The between component, which correspond to a rise in foreign outsourcing, account for all the increase in vertical specialization, in each period, and therefore for all the acceleration. It increases from 0.24 (0.09) percentage points per year in 1977-1985 to 0.4 (0.18) percentage points per year in 1985-1996. The within component, which captures the annual rate of change in outsourcing from all sources, is negative and stable over the period. The decrease in all source outsourcing occurred at a rate of 0.03 (0.01) percentage points per year.

The variance decomposition confirms the accuracy of the index. The rise in vertical specialization has been induced by an increasing use of imported inputs. Interestingly, in some sectors the use of inputs decreases between 1977 and 1996. These industries tend to be increasingly self-sufficient over time. Technological progress could explain part of this phenomenon. New machines and techniques are made available, which allows some industries to produce goods that they would have outsourced otherwise.

4. A within industry shift away from unkilled workers

If firms vertically specialize to take advantage of labor cost differential across countries, the skilled-unskilled relative demand for labor should change within industries. In relatively high unskilled wage countries, (France is such), the share of unskilled workers within industries should decrease as firms outsource their unskilled intensive stages of production. In fact, vertical specialization, as skilled-biased technological change, shifts the skill composition of labor demand within industries. On the other hand, trade in final goods shifts the skill composition of labor demand between industries, from unskilled intensive industries to skilled intensive one. To assess which of this effects have been dominant, in France, during the past two decades, I perform a variance decomposition analysis of the aggregate shift away from unskilled labor. Following Bound, Berman and Griliches (1994), the change in the aggregate share of unskilled workers in total employment is decomposed into: the change in the allocation of employment across industries, (i.e.: the between component) and the change in the allocation of employment within industries, (i.e.: the within component).

$$\triangle E_u = \sum_{i=1}^{n} \bar{E}_{iu} \triangle s_i + \sum_{i=1}^{n} \bar{s}_i \triangle E_{iu}$$

where s_i is the employment share of industry i in national level. E_u is the aggregate share of unskilled workers, i.e. $E_u = \sum_{i=1}^{n} E_{iu} s_i$, and E_{iu} is the share of unskilled workers in industry i.

The following tables report the within and between components of the change in the aggregate share of unskilled workers, for the entire economy and for the manufacturing sector. Over all sectors, the shift away from unskilled labor occurred at a rate of 0.58 percentage points per year in 1977-1985 and accelerates to 0.62 percentage points per year in 1985-1993.[13] The annual rate of decrease is lower when considering the manufacturing sectors only (0.5 percentage point per year over the entire period) and shows a deceleration between the two periods.

Figure 4.1: Industry/Sector Decomposition of the Decline in the Share of Unskilled Workers: All Sectors.

	Between	Within	Total	Within/Total
1977-1985	-0.21	-0.36	-0.58	63%
1985-1993	-0.18	-0.43	-0.62	70%
1977-1993	-0.22	-0.41	-0.63	65%

Source: INSEE; Author's Calculations.

	Between	Within	Total	Within/Total
1977-1985	-0.07	-0.43	-0.50	86%
1985-1993	-0.05	-0.39	-0.44	88%
1977-1993	-0.07	-0.43	-0.50	86%

Source: INSEE; Author's Calculations.

Figure 4.2:

The within component dominates strongly in each periods. In the manufacturing sectors, it accounts for 0.43 percentage points of the 0.5 percentage points per annum decrease. The within-industry shift away from unskilled workers explains 86% of the fall in demand for this type of workers in total manufacturing employment.

To explain the rise in employment inequality, one must hence focus on factors which

[13] Labor data are limited to the 1977-1993 period. In the next section, regression analysis will hence be restricted to this period.

affect the within-industry employment's structure. As mentioned earlier, vertical specialization and skilled-biased technological progress are the most likely culprits.[14] In the next section, I estimate their respective impact in explaining the observed within-industries shift away from unskilled workers.

5. Estimation of the impact of vertical specialization on the labor market.

To further explore the contribution of vertical specialization in explaining the observed decrease in the within-industry share of unskilled workers, it is natural to turn to a regression analysis. An appropriate way to do so is to estimate a cost function. Following Berman, Bound and Griliches (1994) as well as Feenstra and Hanson (1996, 1997 and 1998), I estimate a cost-share equation of a translog function. I chose this specification for the following reasons. First, a cost function is more appropriate than a production function since firms face exogenous factor prices and choose quantity, rather than vice and versa. Firms choose inputs in order to minimize costs. Moreover, this specification allows me to have the within-industry share of unskilled workers as dependent variable of a regression which estimate the parameters of the cost function.[15] Finally, Brown and Christensen (1981) show that with such a specification level data can be used for quasi-fixed factors. It hence allow me to use quantity data for the quasi-fixed factor (*i.e.*, Capital) instead of price data, which are rarely available. Thus, the specification is:

$$\Delta E_{it} = \beta_0 + \beta_1 \Delta \ln(\frac{W_{uit}}{W_{sit}}) + \beta_2 \Delta \ln(\frac{K_{it}}{Yit}) + \beta_3 \Delta \ln Y_{it} + \beta_4 \Delta V_{it} + \beta_5 PD_t + \epsilon_{it} \quad (5.1)$$

where for each period t, E_i is the share of unskilled workers in industry i, $\frac{W_{ui}}{W_{si}}$ represents the industry i relative wage, K_i is the industry i level of capital utilization, Y_i is the industry i level of gross output, V_i is the industry i level of vertical specialization and PD is a period dummy.

The sign of β_1 is ambiguous and depends on the elasticity of substitution between skilled and unskilled labor. β_2 should be negative because of the substitutability between

[14] From now on, the limited measure of vertical specialization is used although it will be referred to as vertical specialization.

[15] A translog functional form also impose fewer restrictions on factor substitutability than either CES, Cobb-Douglas, or Leontief production technologies.

capital and unskilled labor. β_3 is expected to be negative as well. The output regressor controls for industry scale. As production increases, firms tend to substitute unskilled labor by skilled labor. β_4 should have a negative sign since French and foreign unskilled labor are supposedly substitute, and vertical specialization should take place to exploit lower unskilled labor cost abroad. Finally, β_0 measures the cross-industry technological change, it is therefore expected to be negative, while $\beta_0 + \epsilon_i$ represents the industry-specific technological change.

Following Berman, Bound and Griliches (1994), I assume that although there might be some industry-specific mixes of skill types, the relative price of labor does not vary across industries. Then, to avoid endogeneity problems, I omit relative wages from regression (5.1). This omission should only affects the constant term. Thus, the estimated regression is:

$$\Delta E_{it} = \beta_0 + \beta_1 \Delta \ln(\frac{K_{it}}{Y_{it}}) + \beta_2 \Delta \ln Y_{it} + \beta_3 \Delta V_{it} + \beta_4 PD_t + \epsilon_{it} \quad (5.2)$$

Endogeneity problems may arise when estimating (5.2) as the dependent variable and change in capital utilization may be correlated. There are, indeed, factors, as say, new computer innovations, that could affect at the same time the share of unskilled workers in total employment and the level of capital used. Consequently, the independent variable K_{it} and the unexplained change in the share of unskilled labor, captured in ϵ_i, would be correlated. This is a serious issue since it might bias the slope estimates significantly. To encounter this problem, two different approaches are considered.

Since there are no specific data for capital utilization, I use both net capital stock and electricity consumption as proxy. Net capital stock data, provided by the INSEE, are constructed according to the rule of perpetual inventories. Working with these data entails three main issues. First, capital utilization is usually much more volatile than capital stock since part of stocks can be stored and unused over a period. Secondly, the method of perpetual inventories provides estimated data on net capital stocks, which are hence measured with error. Finally, French data on net capital stock are not available at high level of industrial disaggregation, which restrict the estimation possibilities.[16] Using electricity consumption as a proxy for capital utilization is not new. This strategy has been first employed by Griliches and Jorgenson (1967), followed, among others, by Costello (1993) and Burnside, Eichenbaum and Rebelo (1995). They argue that electricity consumption is a good measure of capital utilization, Anxo and Sterner (1994) tend to prove it, in a paper dedicated to this issue.

[16] Data on net capital stock exist at the two-digit SIC level, whereas data on all other variables are available at the three-digit SIC level. The French nomenclature differs slightly from the American one. The SIC terminology is yet employ for simplicity reasons.

When assessing endogeneity, I therefore have to consider these two measures of capital utilization. Following Berman, Bound and Griliches (1994), I argue that when net capital stock is used, the endogeneity bias should not be too important since investments in capital and change in the share of unskilled workers should not have the same timing, new investment lasting over years. In order to verify that electricity consumption is not an endogenous variable, I instrument it by its lagged values. Past electricity consumption is, a priori, a good instrument since it is not affected by an innovation today, and it is correlated, at more that 30% with today electricity consumption. From column (b) in table (6.8) in the appendix, it is clear that the effect of a change in electricity consumption, on the change in the share of unskilled in employment, is robust to the instrumentation. Electricity consumption is therefore non-endogenous. An Hausman test confirmed this principle.

Determining which are the appropriate data to use for Y is also a concern. Two potential candidates are value-added and gross output. Berman, Bound and Griliches (1994) use value-added. It is justified as labor and capital are the only independent variables in their specification. On the other hand, Feenstra and Hanson (1996 and 1997) include a measure of outsourcing as regressor but also equate Y to value-added.[17] Specification (5.2) introduces data on material inputs other than capital and labor (recall: vertical specialization is the share of imported input in production). Gross output seems hence a more appropriate measure for Y. However, results are robust to the use of value-added, as shown in appendices (6.10) and (6.11).

It is necessary to control for the output level in regression (5.2). Omitting Y would misspecify the model. Wald tests perform on regression (5.2) strongly confirm this assumption, the null hypothesis of an insignificant Y being systematically rejected at the 1% significance level. The output level controls for industries scale. It is especially important to do so because of French labor market inflexibility. Firms that want to alter the share of unskilled to skilled workers used in production encounter difficulties in firing workers because of strong unions and labor laws. Hence, changes in the share of unskilled labor in employment often occurs as firms increase production.

Finally, I considered the potentionality of multicollinearity. However, checking for correlation between output and vertical specialization data as well as output and capital utilization data, I did not find any evidence of multicollinearity (the correlations always lye under 0.7 with some really low level depending on the data considered).

[17] Berman, Bound and Griliches (1994) as well as Feenstra and Hanson (1996, 1997 and 1998) equate Y to value-added. Due to the unavailability of certain price deflators, they however use shipment in their empirical work. Then, using value-added or gross output interchangeably when turning to the regression analysis does not seem to be a major problem.

Data are weighted by the industry's average share in total manufacturing employment, over each period. The choice of the weight has been done such that, over each period, summing up the dependent variables give the total within industry change. A weighted least square estimation is therefore performed, which reduces considerably the industry-specific heteroskedasticity. I estimate the slope parameters by running regression (5.2) over the 1977-1985 and 1985-1993 periods combined. Variables are in annual change averaged over the corresponding period.[18] Estimations are made using both measures of capital utilization at the two-digit SIC level and using electricity consumption at the three-digit SIC level. In either case, gross output and value-added are considered for Y. Robustness is checked by extending the time period to three periods of five years, 1977-1982, 1982-1987 and 1987-1992. Exploiting the time-series properties of the data further could give misleading results, since it might not isolate the long run change relationship from the business-cycle ones.[19]

Figure 5.1: Mean Rates of Change of Variables.

	1977-1985	1985-1993
DE_u	-0.501	-0.436
dln(*K/Y*)	0.353	0.588
dln(*Kelc/Y*)	1.786	1.741
Dln*Y*	1.012	1.202
DV	0.085	0.134

Source: Vertical specialization, output and capital data come from the INSEE.
The labor data are from Cortes and Jean (1997) database;
Author's Calculations.
Note: Data are weighted by the industry share of unskilled employment in total manufacturing employment. The sample consists on 22 two-digit industries. Variables are defined as:
dEu = 100 * annual change in unskilled workers'share of total employment,
*d*ln(*K/Y*) = 100 * annual change in ln(capital stock/real output),
*d*ln(*Kelc/Y*) = 100 * annual change in ln(electricity consumption/real output),
*d*ln(*Y*) = 100 * annual change in ln(real output),
dV = 100 * annual change in vertical specialization.

Table 5.1 gives the annual rates of change in the (logarithmic) variables for the

[18] Averaged over the 1977-1985 period for the 1977-1985 change...

[19] Estimation combining four periods of four years and five periods of three years were nevertheless performed. In either case, the results are consistent with the estimates presented below. Results are available on request.

selected periods.[20] As seen in section 4, we observe an annual decrease in the share of unskilled workers in total employment with a deceleration in the second period. It decreases at a rate of 0.50 annual percentage points in the first period and of 0.44 annual percentage points in the second period. The annual growth rate of production rises over time from 1.01 percent in the first period to 1.20 percent in the second period. Production became more capital intensive in both periods, independently of the measure chosen to proxy capital utilization. The growth of net capital stock in production rises from 0.35 percent per year during the 1977-1985 period to 0.59 percent per year during the 1985-1993 period, whereas the electricity used in production increases at about the same annual growth rate over both periods. Notably, vertical specialization increases over both periods with an acceleration over time. The growth rate of vertical specialization is of 0.085 percent per year over the 1977-1985 period and of 0.13 percent per year over the 1985-1993 period.[21] Table 5.2 reports annual change in variables for the three five-years periods considered.[22]

Figure 5.2: Mean Rate of Change of Variables.

	1977-1982	1982-1987	1987-1992
DE_u	-0.439	-0.532	-0.413
$d\ln(K/Y)$	0.134	0.334	0.213
$d\ln(Kelc/Y)$	0.537	3.845	1.771
$D\ln Y$	1.595	0.647	2.311
DV	0.079	0.132	0.155

Source: Vertical specialization, output and capital data come from the INSEE.
The labor data are from Cortes and Jean (1997) database;
Author's Calculations.

Note: Data are weighted by the industry share of unskilled employment in total manufacturing employment. The sample consists on 22 two-digit industries. Variables are defined as:
dEu = 100 * annual change in unskilled workers'share of total employment,
$d\ln(K/Y)$ = 100 * annual change in ln(capital stock/real output),
$d\ln(Kelc/Y)$ = 100 * annual change in ln(electricity consumption/real output),
$d\ln(Y)$ = 100 * annual change in ln(real output),
dV = 100 * annual change in vertical specialization.

[20] A similar table computed with a 50 three-digit industries sample is reported in figure (6.9) in the appendix.

[21] Note that these results differ from the one given in tables 3.1 and 3.2 for Vl. This is because the period considered is now limited to 1977-1993.

[22] The same table computed with a 50 three-digit level industries sample is reported in table (6.9) in the appendix.

Results from regressing equation (??) are presented in table 5.3.[23] In specification (1) to (3) the two eight-years periods (*i.e.*, 1977-1985 and 1985-1993) are combined, while in regression (4) to (6) the three-five years periods, (*i.e.,* 1977-1982, 1982-1987 and 1987-1992), are combined. In all specifications Y represents gross output. Results obtained when using value-added are presented in table (6.10) in the appendix. In the first and second specification the two-digit industries sample is used, whereas in the third specification the three-digit industries sample is employed. In specification (1), results are obtained by using net capital stock as proxy for capital utilization, in the second and third specification electricity consumption is used instead. Specifications (4) to (6) follow the same scheme.

Figure 5.3: Regression Results; Dependent Variable: Annual Change in the Share of Unskilled Employment in total Employment.

Specification	(1)	(2)	(3)	(4)	(5)	(6)
$d\ln(K/Y)$	-0.028	0.050*	0.002	-0.044**	0.013	-0.004
	(0.030)	(0.030)	(0.015)	(0.024)	(0.025)	(0.013)
$d\ln Y$	-0.126***	-0.106***	-0.082***	-0.104***	-0.088***	-0.062***
	(0.029)	(0.031)	(0.020)	(0.024)	(0.027)	(0.017)
dV	-0.857***	-0.849**	-0.584***	-0.499***	-0.483**	-0.319***
	(0.331)	(0.355)	(0.180)	(0.178)	(0.214)	(0.108)
Constant	-0.291***	-0.411***	-0.357***	-0.229***	-0.272***	-0.299***
	(0.064)	(0.091)	(0.065)	(0.057)	(0.070)	(0.049)
1985-1993	0.138*	0.130	0.114			
	(0.090)	(0.102)	0.091			
1982-1987				-0.156**	-0.177**	-0.115**
				(0.085)	(0.096)	(0.066)
1987-1992				0.142*	0.121	0.090
				(0.091)	(0.122)	(0.105)
Adj R-squared	0.453	0.474	0.438	0.422	0.380	0.387
# of observations	44	44	100	66	66	150

Source: Vertical specialization, output and capital data come from the INSEE
The labor data are from Cortes and Jean (1997) database
Author's Calculations

Note: Regressions weighted by the average share of industry employment in total manufacturing employment.
Number in parentheses are the estimated white standard errors which are robust to cross-sectional heteroskedasticity and correlation. Coefficient with a *** , **, * are significant at the 1% level, 5% level and 10% level respectively.

In all specifications, the coefficient on vertical specialization, ranging between -0.319 and -0.857, is statistically and economically significant. Notably, vertical specializa-

[23] A Likelihood ratio test and a Wald test were use to test the hypothesis of groupwise heteroscedasticity. A Breush-Pagan Lagrange multiplier test was use to test the hypothesis of cross-sectional correlation.

tion's slope coefficients do not change drastically with the data choice made for Y, although they are slightly higher when value added is used. Results on capital utilization are ambiguous. When net capital stock i s used as proxy, coefficients have the expected negative sign, which reflects the subtituability between unskilled labor and capital. However, when electricity consumption is used the coefficient's sign is sometimes negative, sometimes positive, depending on the specification. Due to the statistic insignificance of the capital coefficients and to the low contribution of this variable in explaining the decline in the share of unskilled workers in employment, I do not worry too much about this sign issue. More importantly, vertical specialization coefficients do not depend on the choice made to proxy capital utilization. These coefficients are actually almost similar under specification (1) and (2) or under specification (4) and (5). I therefore consider that results obtained at the three-digit level using electricity consumption are consistent. The observed deceleration in the annual rate of change in the share of unskilled workers in employment is mirrored by the positive coefficient on the 1985-1993 dummy. Similarly, the acceleration in the decrease in the share of unskilled in employment in the 1982-1987 followed by a deceleration in the 1987-1992 can be observed through the corresponding dummies' coefficients.

Table 5.4 reveals how changes in capital utilization, in output, in vertical specialization as well as the constant have contributed to the decline in the share of unskilled workers in manufacturing employment. I obtain these contributions by multiplying the slope coefficients by the annual rate of change in the corresponding variable and dividing by the annual rate of change in the share unskilled workers. For example, specification (1)'s coefficient is -0.857 in the first period, the annual growth rate in vertical specialization for this period at two-digit industry level is 0.085. Thus, vertical specialization contributes by 15% to the annual decrease in the share of unskilled workers in manufacturing employment in the 1977-1985 period. Notably, the impact of vertical specialization on the within-industry shift away from unskilled workers is undoubtedly positive and significant, and this result is robust across specifications. Interpretations rely on specification (3) and (6), which have the highest level of disaggregation and hence the most observations. Vertical specialization contributes by 11% to the annual decline in the share of unskilled workers in manufacuting employment during the 1977-1985 period and by 25% during the 1985-1993 period. The observed acceleration in vertical specialization corresponds to an increase in contribution. Results using the three five years periods are lower but show the same trend, vertical specialization contributes by 6% to the annual decline in unskilled workers share of employment during the 1977-1982 period, by 10% during the 1982-1987 period and 16% during the 1987-1992 period.[24]

[24]Contribution's results when Y = value added are given in table (6.11) in the appendix. For each specification, the vertical specialization contributions are slightly higher.

Figure 5.4: Contribution Results; Dependent Variable: Annual Change in the Share of Unskilled Employment in Total Employment.

	1977-1985	1985-1993	1977-1982	1982-1987	1987-1992
*d*ln(*K/Y*)	02 % (1)	04 % (1)	01 % (4)	03 % (4)	02 % (4)
*D*ln*Y*	25 % (1)	35 % (1)	38 % (4)	13 % (4)	58 % (4)
DV	15 % (1)	26 % (1)	09 % (4)	12 % (4)	19 % (4)
Constant	58 % (1)	67 % (1)	52 % (4)	43 % (4)	55 % (4)
*d*ln(*K/Y*)	-17 % (2)	-20 % (2)	-02 % (5)	-07 % (5)	-04 % (5)
*D*ln*Y*	21 % (2)	30 % (2)	32 % (5)	11 % (5)	49 % (5)
DV	14 % (2)	26 % (2)	09 % (5)	12 % (5)	18 % (5)
Constant	82 % (2)	94 % (2)	62 % (5)	52 % (5)	66 % (5)
*d*ln(*K/Y*)	-01 % (3)	-01 % (3)	01 % (6)	03 % (6)	01 % (6)
*D*ln*Y*	16 % (3)	20 % (3)	22 % (6)	07 % (6)	32 % (6)
DV	11 % (3)	25 % (3)	06 % (6)	10 % (6)	16 % (6)
Constant	74 % (3)	82 % (3)	70 % (6)	58 % (6)	72 % (6)

Note: Author's Calculations.
Variable contribution = (variable estimated coefficient * variable annual rate of change)/ share of unskilled workers in employment's rate of change.
Contributions add up to 100%.

Vertical specialization account for 11% to 15% of the within industry shift away from unskilled workers toward skilled workers in the 1977-1985 period and for one-quarter in the 1985-1993 period. The decrease in the share of unskilled workers in manufacturing employment non-explained by measured factor's change is assumed to be caused by skilled-biased technological change. These results are consistent with the one obtain by Feenstra and Hanson (1997 and 1998)'s. Over the 1979-1990 period, they found that vertical specialization contributed for 11% to 15.2% of the decline in the share of production workers in the wage bill. They obtained these results using a limited measure of outsourcing (within the same two-digit industries) close to mine. When using a more general measure of vertical specialization, they obtained a contribution of 31%. My results are in this range. Data discrepancy and country's specificity explain the difference.

6. Conclusion

This paper shows that vertical specialization rose dramatically in France over the 1977-1996 period. To the extend that this increase is due to a decline in trade costs, one could assess that globalization by shifting relative-labor-demand across countries has a large impact on skilled-unskilled income distribution. It certainly corroborates the potential role of trade liberalization in explaining increased inequality since vertical specialization shift relative-labor-demand within-industries and consequently the within-industry ratio of skilled to unskilled workers should increase in industrialized countries. In fact, globalization, through vertical specialization, increases inequality in relatively high-unskilled-wage countries, in a way that is observationally equivalent to skilled-biased technological progress.

Regression analysis shows that vertical specialization has contributed significantly to the observed decline in the within-industry share of unskilled workers in French manufacturing employment. Indeed, vertical specialization account for 11% to 15% of the within-industry shift away from unskilled workers toward skilled workers in the 1977-1985 period and for one-quarter in the 1985-1993 period. Whereas these numbers are not negligible, most part of the increase in inequality has been caused by skilled-biased technological progress. Surprisingly, while globalization raise passionate debates, it is unusual to hear that technological progress should be stopped because of its effect on income distribution. If policies that would accompany workers suffering from inequalities, trough retraining or reallocation subsidizing, could be implemented, fighting against globalization seems to be an inappropriate answer. One should keep in mind that globalization as technological progress undoubtedly increase average welfare.

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Figure 6.1: Trend in the employment and wage of skilled versus unskilled workers.

Authors	Variable Studied	Country	Period	Result *
OECD (1998)	Skilled-unskilled employment-population ratio differential, based on education levels.	The Netherlands	1990-1994	**4.2**
		Spain	1981-1994	**6.2**
		Denmark		**8.1**
		France		**11.7**
Strauss-Kahn (2000)	Skilled-unskilled employment differential, based on occupation.	France (all sectors)	1977-1993	**10.7**
		France (manufacturing sectors)		**8.5**
Bound and Jonhson (1992)	Ratio of average annual wage of college to high school graduate	U.S.	1979-1988	**15** %
Lawrence and Slaughter (1993)	Ratio of average annual wage of non-production to production workers	U.S.	1979-1989	**10** %

* percentage points except when otherwise indicated.

Figure 6.2: Vertical Specialization; Sectorial Results.

	1977	1996	% Growth 77/96
OVERALL	**0.09**	**0.15**	**66.0**
CHEMICALS			
Synthetic Fibers	0.16	0.36	120.1
Industrial Chemicals	0.12	0.22	87.2
Soaps and Cosmetics	0.11	0.22	95.5
Drugs and Medicines	0.13	0.21	62.7
MACHINERY			
Farm Machinery and Equipment	0.08	0.16	92.8
Non-Electrical Industrial Machinery	0.09	0.19	108.6
Industrial Equipment (including Engines and Turbines	0.08	0.14	75.6
Metalworking Machinery	0.07	0.11	62.7
Office and Computing Machinery	0.16	0.18	12.6
Electrical Machinery Products	0.11	0.16	47.6
Electronic Computing Equipment	0.08	0.14	71.6
Household Appliances	0.06	0.10	73.7
Motor Vehicles	0.08	0.17	107.1
Ship and Boat Building	0.12	0.21	77.8
Aircraft	0.13	0.24	87.6
Professional Goods	0.07	0.14	82.4
TEXTILE, APPAREL AND LEATHER			
Textile Industries	0.10	0.21	117.5
Leather and Leather Products	0.07	0.19	178.3
Footwear Industries	0.06	0.16	157.1
Apparel and Other Fabricated Textile Products	0.08	0.19	142.5
MINING AND METAL PRODUCTS			
Non-Metallic Mining and Quarrying, except Fuel	0.14	0.15	5.0
Iron Mining	0.09	0.05	-42.4
Primary Iron Industries	0.17	0.25	47.9
Primary Steel Industries	0.14	0.24	69.2
Non-Ferrous Mining	0.09	0.14	64.0
Non-Ferrous Metals Mining	0.30	0.26	-10.8
Miscellaneous Mineral Mining	0.06	0.11	94.8
Casting	0.15	0.19	30.6
Fabricated Metal Products	0.08	0.14	68.7
OTHER			
Agricultural Production	0.07	0.10	47.7
Forestry	0.00	0.02	300.0
Fisheries	0.04	0.06	47.6
Glass and Glass Products	0.05	0.09	95.7
Wood Products	0.09	0.08	-11.8
Stone and Clay Products	0.03	0.06	78.8
Meat Products	0.08	0.10	26.6
Dairy Products	0.08	0.11	33.8
Bakery Products	0.04	0.07	89.2
Canning and Preserving Food	0.09	0.16	72.8
Grain-Mill Products	0.07	0.11	45.2
Miscellaneous Food Preparation	0.08	0.10	29.5
Beverages Industries	0.05	0.09	87.0
Tobacco Manufactures	0.02	0.03	13.6
Furniture and Fixture	0.06	0.12	90.6
Paper and Allied Products	0.08	0.15	72.6
Printing, Publishing and Allied Industries	0.05	0.09	106.7
Rubber Products	0.10	0.19	90.0
Miscellaneous Plastic Products	0.16	0.34	120.0
Other Manufacturing	0.10	0.15	50.0

Source: INSEE database: Author’s calculation.

Figure 6.3: Limited Vertical Specialization; Sectorial Results.

	1977	1996	% Growth 77/96
OVERALL	**0.05**	**0.08**	**63.3**
CHEMICALS	0.09	0.19	121.2
Synthetic Fibers	0.14	0.31	128.7
Industrial Chemicals	0.09	0.18	105.9
Soaps and Cosmetics	0.08	0.14	84.6
Drugs and Medicines			
MACHINERY			
Farm Machinery and Equipment	0.03	0.06	96.4
Non-Electrical Industrial Machinery	0.05	0.10	95.9
Industrial Equipment (including Engines and Turbines	0.02	0.05	95.8
Metalworking Machinery	0.02	0.03	80.0
Office and Computing Machinery	0.14	0.16	14.0
Electrical Machinery Products	0.01	0.03	188.9
Electronic Computing Equipment	0.04	0.09	119.0
Household Appliances	0.02	0.05	200.0
Motor Vehicles	0.04	0.09	128.2
Ship and Boat Building	0.05	0.10	90.6
Aircraft	0.11	0.21	97.2
Professional Goods	0.03	0.05	112.0
TEXTILE, APPAREL AND LEATHER			
Textile Industries	0.06	0.15	145.8
Leather and Leather Products	0.02	0.09	273.9
Footwear Industries	0.04	0.09	165.7
Apparel and Other Fabricated Textile Products	0.07	0.18	143.1
MINING AND METAL PRODUCTS			
Non-Metallic Mining and Quarrying, except Fuel	0.12	0.11	-4.2
Iron Mining	0.02	0.01	-50.0
Primary Iron Industries	0.13	0.19	48.8
Primary Steel Industries	0.14	0.23	67.6
Non-Ferrous Mining	0.00	0.00	0.0
Non-Ferrous Metals Mining	0.21	0.18	-14.8
Miscellaneous Mineral Mining	0.00	0.00	0.0
Casting	0.12	0.14	18.5
Fabricated Metal Products	0.01	0.03	100.0
OTHER			
Agricultural Production	0.03	0.04	16.1
Forestry	0.00	0.01	1000.0
Fisheries	0.00	0.00	0.0
Glass and Glass Products	0.01	0.01	0.0
Wood Products	0.08	0.07	-22.6
Stone and Clay Products	0.02	0.03	61.1
Meat Products	0.08	0.09	19.7
Dairy Products	0.07	0.07	0.0
Bakery Products	0.00	0.00	0.0
Canning and Preserving Food	0.05	0.07	38.0
Grain-Mill Products	0.05	0.06	33.3
Miscellaneous Food Preparation	0.03	0.02	-12.0
Beverages Industries	0.00	0.00	100.0
Tobacco Manufactures	0.00	0.00	0.0
Furniture and Fixture	0.03	0.05	75.9
Paper and Allied Products	0.01	0.00	-40.0
Printing, Publishing and Allied Industries	0.01	0.01	71.4
Rubber Products	0.00	0.01	133.3
Miscellaneous Plastic Products	0.01	0.04	266.7
Other Manufacturing	0.01	0.04	216.7

Source: INSEE database; Author's calculation.

Figure 6.4: Manufacturing Sectors.

three-digit SIC level industries	Two-digit SIC level industries
Agricultural production	Agriculture, Forestry and Fishery
Forestry	Meat and Dairy Products
Fishery	Other Food Industries
Non Metallic Mining and Quarrying (except fuel)	Non Metallic Mining and Quarrying (except fuel)
Iron Mining	Ferrous Metals and Mineral
Primary Iron Industries	Non-Ferrous Metals and Mineral
Primary Steel Industries	Stone and Clay Products
Non-Ferrous Mining	Glass and Glass Products
Non-Ferrous Metals	Industrial Chemicals and Synthetic Fibers
Miscellaneous Mineral Mining	Soaps, Cosmetics, Drugs and Medicines
Stone and Clay Products	Casting
Glass and Glass Products	Non-Electrical Machinery and Equipment
Industrial Chemicals	Electrical Machinery Products
Soaps and Cosmetics	Household Appliances
Drugs and Medicines	Motor Vehicles
Casting	Other Transportation industries
Fabricated Metal Products	Textile and Apparel
Farm Machinery and Equipment	Leather and Footwear
Non-Electrical Industrial Machinery	Wood and Furniture
Industrial Equipment (including Engines and Turbines)	Paper and Allied Products
Metalworking Machinery	Printing and Publishing
Office and Computing Machinery	Rubber
Electrical Machinery Products	
Electronic Computing Equipment	
Household Appliances	
Motor Vehicles	
Ship and Boat Building	
Aircraft	
Professional Goods	
Meat Products	
Dairy Products	
Canning and Preserving Food	
Bakery Products	
Grain-Mill Products	
Miscellaneous Food Preparation	
Beverage Industries	
Tobacco Manufactures	
Synthetic Fibers	
Textile Industries	
Leather and Leather Products	
Footwear industries	
Apparel and Other Fabricated Textile Products	
Wood Products	
Furniture and Fixture	
Paper and Allied Products	
Printing, Publishing and Allied Industries	
Rubber Products	
Miscellaneous Plastic Products	
Other Manufacturing	

Figure 6.5: Sectorial Trend in Vertical Specialization

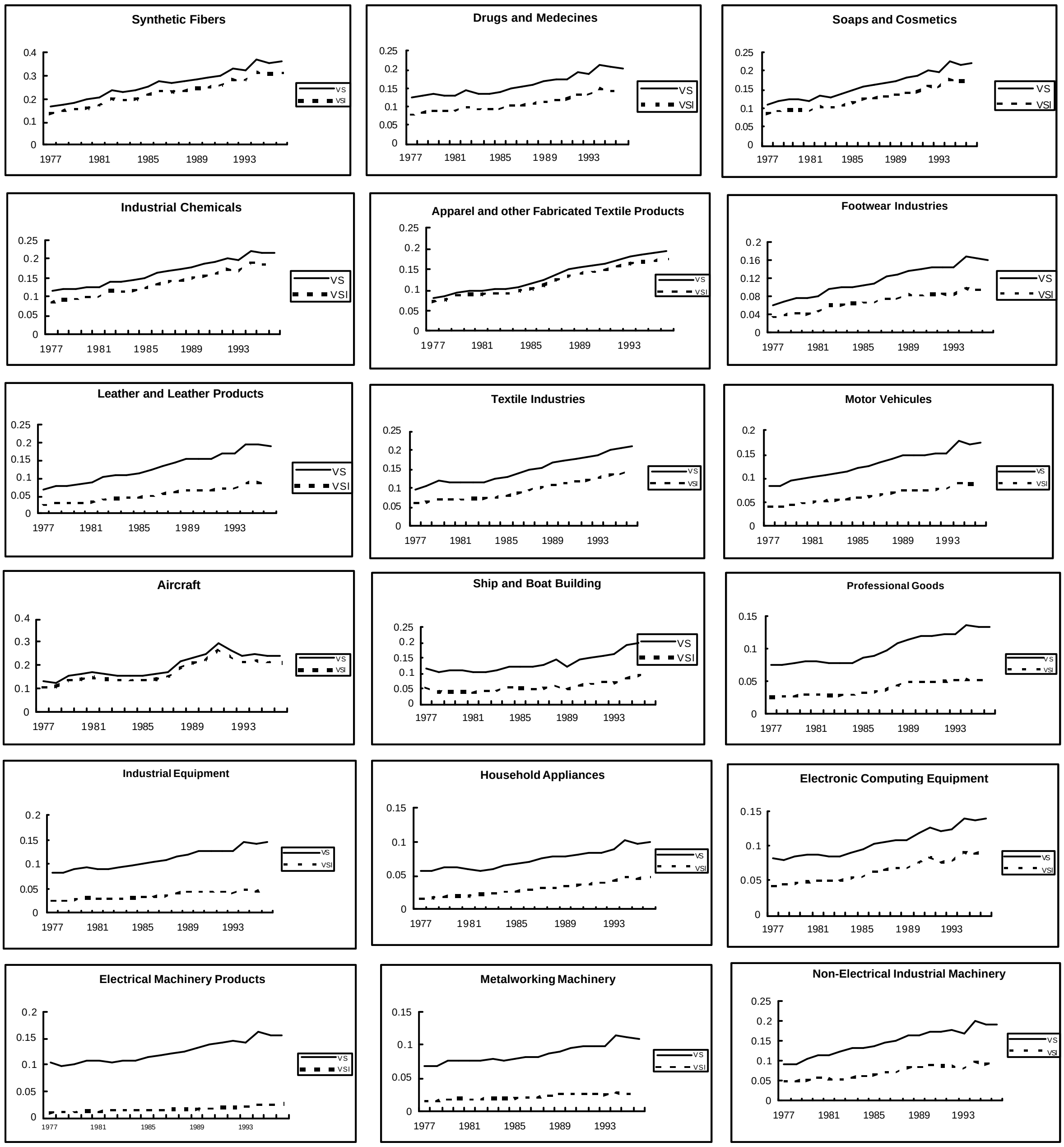

Figure 6.6: Sectorial Trend in Vertical Specialization (continue)

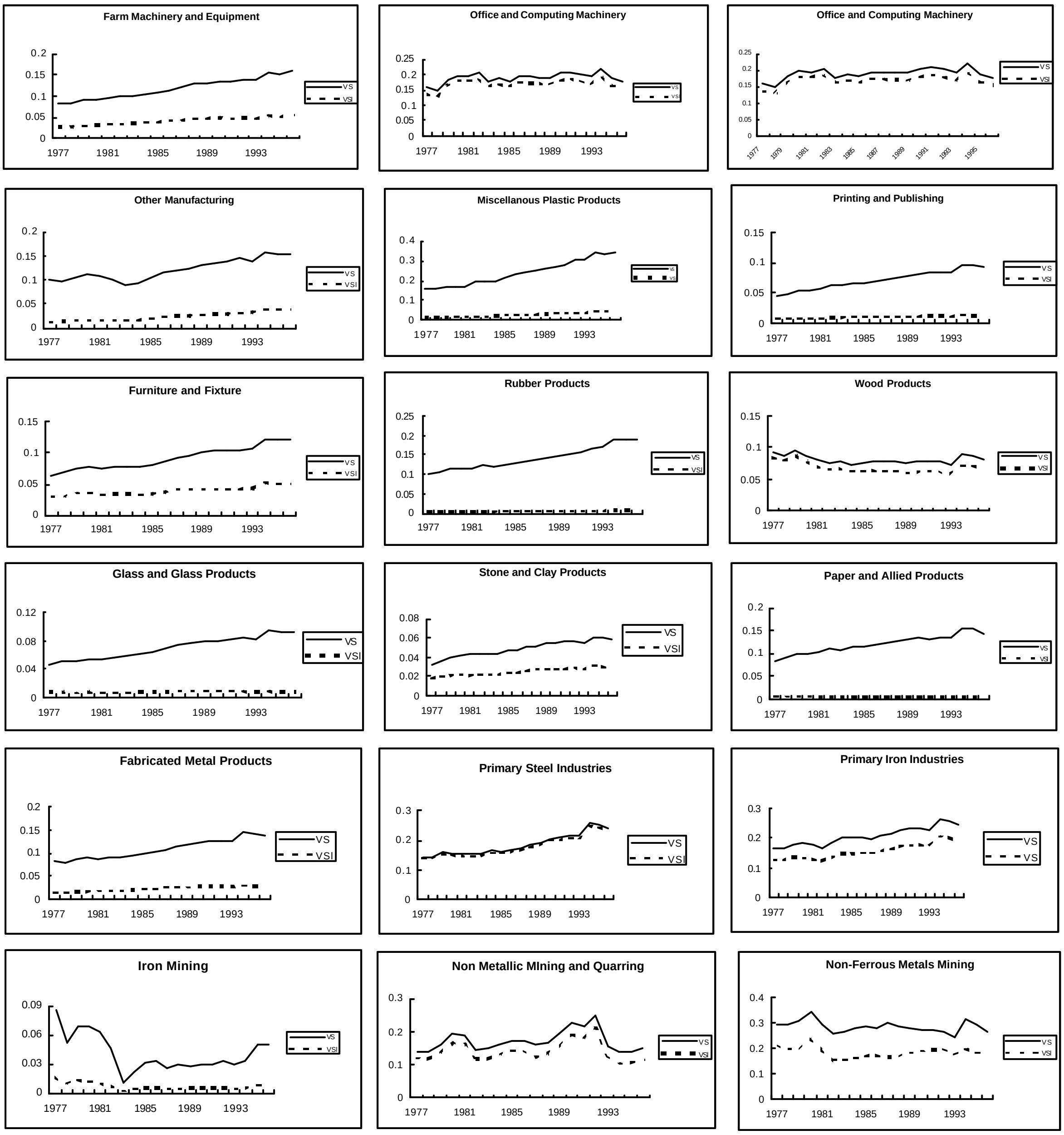

Figure 6.7: Sectorial Trend in Vertical Specialization (continue)

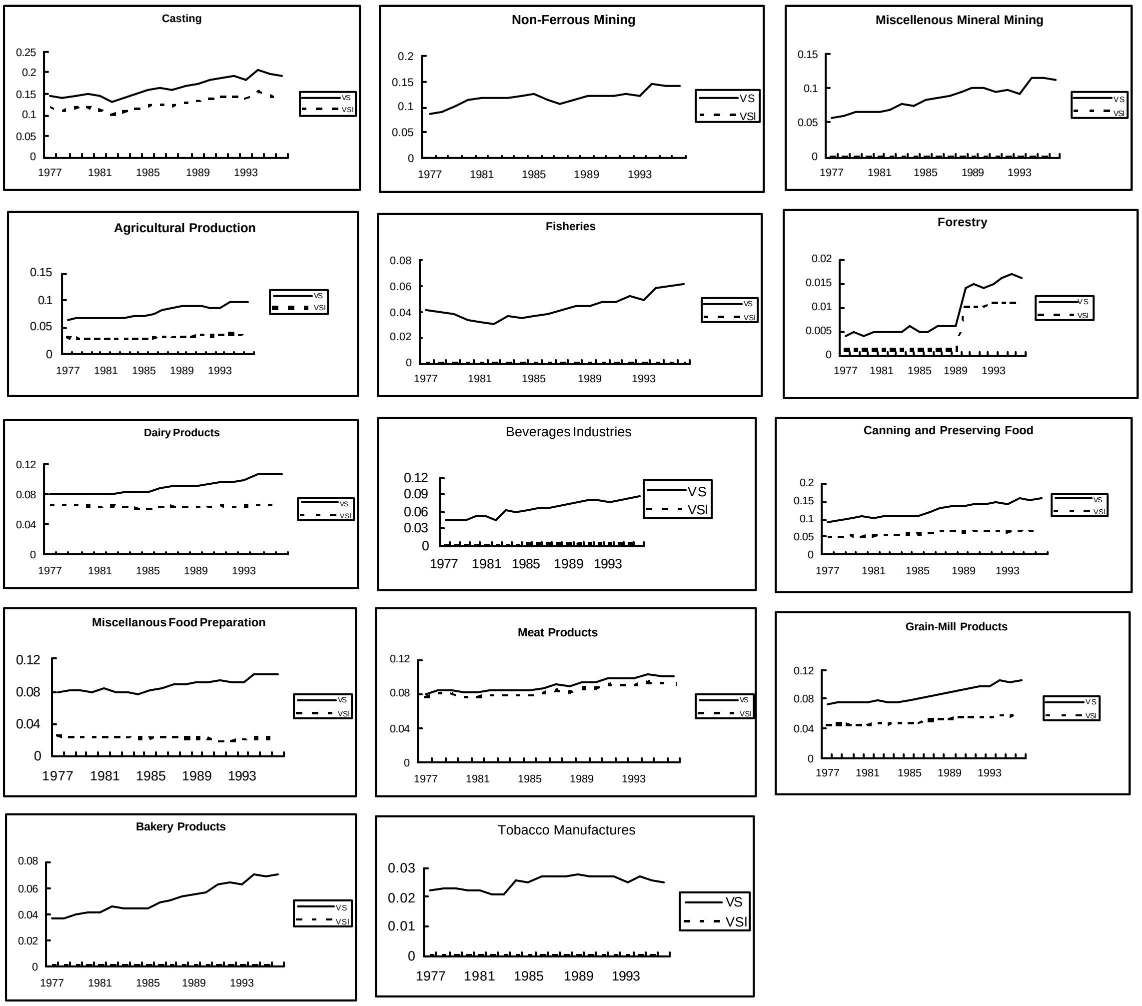

Figure 6.8: Regression Results; Dependent Variable: Annual Change in the Share of Unskilled in total Employment; Y=Value Added.

Specification	(a)	(b)
*d*ln*(K/Y)*	-0.009 (0.019)	0.001 (0.020)
*d*ln*Y*	-0.069*** (0.023)	-0.065*** (0.024)
dV	-0.408*** (0.147)	-0.401*** (0.150)
constant	-0.378*** (0.093)	-0.415*** (0.093)
1987-1992	0.209** (0.106)	0.222*** (0.108)
Adj R-squared	0.313	0.310
# of observations	100	100

Source: Vertical specialization, output and capital data come from the INSEE
The labor data are from Cortes and Jean (1997) database
Author's Calculations
Note: Regressions weighted by the average share of industry employment in total manufacturing employment.
Numbers in parentheses are the estimated white standard errors, which are robust to cross-section heteroskedasticity and correlation.
Coefficient with a ***,**,* are significant at a 1% level, 5% level and 10% level respectively.

Both regressions combine the 1982-1987 period and the 1987-1992 period, and include 50 three-digit industries. In regression (a) current value of electricity consumption have been used whereas in regression (b) lagged value of electricity consumption have been used.

Figure 6.9: Mean Rates of Change of Variables.

	1977-1985	**1985-1993**
dE_u	-0.485	-0.434
$d\ln(Kelc/Y)$	2.345	1.905
$d\ln Y$	0.954	1.060
dV	0.094	0.185

	1977-1982	**1982-1987**	**1987-1992**
DE_u	-0.429	-0.515	-0.415
$d\ln(Kelc/Y)$	1.467	3.146	1.383
$D\ln Y$	1.549	0.570	2.165
DV	0.087	0.164	0.205

Source: Vertical specialization, output and capital data come from the INSEE.
The labor data are from Cortes and Jean (1997) database;
Author's Calculations.

Note: Data are weighted by the industry share of unskilled employment in total manufacturing employment. The sample consists on 50 three-digit industries. Variables are defined as:

dEu = 100 * annual change in unskilled workers'share of total employment,
$d\ln(K/Y)$ = 100 * annual change in ln(capital stock/real output),
$d\ln(Kelc/Y)$ = 100 * annual change in ln(electricity consumption/real output),
$d\ln(Y)$ = 100 * annual change in ln(real output),
dV = 100 * annual change in vertical specialization.

Figure 6.10: Regression Results; Dependent Variable: Annual Change in the Share of Unskilled in total Employment; Y = Value Added.

Specification	(1)	(2)	(3)	(4)	(5)	(6)
$d\ln(K/Y)$	-0.055**	0.003	-0.010	-0.063***	-0.022	-0.017
	(0.026)	(0.030)	(0.016)	(0.021)	(0.025)	(0.014)
$d\ln Y$	-0.132***	-0.093***	-0.063***	-0.101***	-0.068***	-0.044***
	(0.026)	(0.031)	(0.018)	(0.023)	(0.027)	(0.016)
dV	-0.999***	-1.045***	-0.652***	-0.539***	-0.569**	-0.361***
	(0.345)	(0.444)	(0.193)	(0.182)	(0.246)	(0.112)
Constant	-0.263***	-0.323***	-0.337***	-0.216***	-0.253***	-0.292***
	(0.056)	(1.035)	(0.065)	(0.060)	(0.075)	(0.050)
1985-1993	0.091	0.058	0.070			
	(0.087)	(0.120)	0.102			
1982-1987				-0.193**	-0.137**	-0.108*
				(0.083)	(0.105)	(0.072)
1987-1992				0.111	0.085	0.057
				(0.096)	(0.145)	(0.119)
Adj R-squared	0.504	0.420	0.416	0.424	0.300	0.345
# of observations	44	44	100	66	66	150

Source: Vertical specialization, output and capital data come from the INSEE
The labor data are from Cortes and Jean (1997) database
Author's Calculations

Note: Regressions weighted by the average share of industry employment in total manufacturing employment.

Numbers in parentheses are the estimated white standard errors, which are robust to cross-section heteroskedasticity and correlation. Coefficient with a ***,**,* are significant at a 1% level, 5% level and 10% level respectively.

Figure 6.11: Contribution Results; Dependent Variable: Annual Change in the Share of Unskilled in total Employment; Y = Value Added.

	1977-1985	1985-1993	1977-1982	1982-1987	1987-1992
$d\ln(K/Y)$	04 % (1)	17 % (1)	-03 % (4)	15 % (4)	12 % (4)
$d\ln Y$	27 % (1)	12 % (1)	44 % (4)	-05 % (4)	42 % (4)
dV	17 % (1)	31 % (1)	10 % (4)	13 % (4)	20 % (4)
Constant	53 % (1)	60 % (1)	49 % (4)	41 % (4)	52 % (4)
$d\ln(K/Y)$	-01 % (2)	-02 % (2)	03 % (5)	16 % (5)	10 % (5)
$d\ln Y$	19 % (2)	09 % (2)	29 % (5)	-03 % (5)	29 % (5)
dV	18 % (2)	32 % (2)	10 % (5)	14 % (5)	21 % (5)
Constant	64 % (2)	74 % (2)	58 % (5)	48 % (5)	61 % (5)
$d\ln(K/Y)$	05 % (3)	06 % (3)	04 % (6)	13 % (6)	08 % (6)
$d\ln Y$	13 % (3)	04 % (3)	20 % (6)	-02 % (6)	18 % (6)
dV	13 % (3)	28 % (3)	07 % (6)	11 % (6)	18 % (6)
Constant	69 % (3)	78 % (3)	68 % (6)	57 % (6)	70 % (6)

Note: Author's Calculations.

Variable contribution = (variable estimated coefficient * variable annual rate of change) / share of unskilled workers in employment's rate of change. Contributions add up to 100%.