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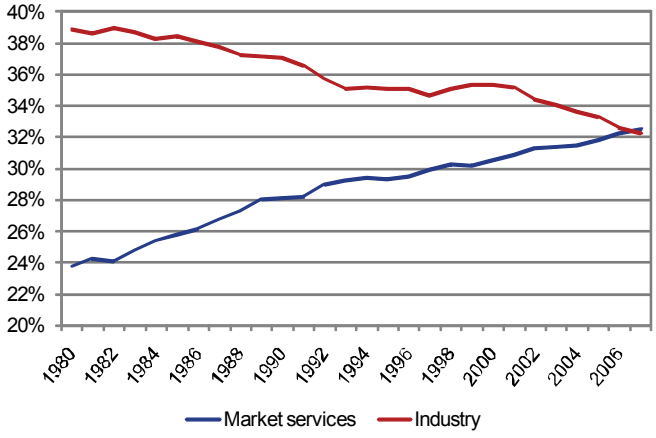
The decline in industrial employment in France (1980-2007): how to account for it?

This study was prepared under the authority of the Directorate General of the Treasury (DG Trésor) and does not necessarily reflect the position of the Ministry for the Economy, Industry and Employment.

- The decline in industrial employment has affected France like many of the developed economies. It can be pictured in the light of three concomitant trends over the period 1980-2007, namely the decline in industrial employment, a fall in this sector's contribution to GDP and, in parallel, strong growth in the market services sector.
- French industrial employment fell from 5.3 to 3.4 million jobs over the period 1980-2007, a decline of 36%. Industry's share of total employment fell by 11 percentage points, from 24% to 13%, while market services increased by 12 percentage points (from 32% to 44% of the working population) over the same period. This study assesses the main structural determinants of this phenomenon in France over the period 1980-2007, identifying three key factors.
- A not insignificant portion of the fall in industrial employment is explained by far-reaching changes in the production system. A feature of this has been growing use of the outsourcing of production activity from the industrial sector to the services sector. **The accompanying fall in industrial employment thus appears to be artificial, insofar as it merely reflects a transfer of previously industrial jobs to the services sector, with no real change in their content**. These job transfers are estimated at 25% of the industrial jobs lost over the period 1980-2007.
- Another portion of the jobs lost is explained by **distortions in the structure of demand over time, and by productivity gains in the economy**. This effect is transmitted via two main channels. First, productivity gains achieved throughout the economy boost agents' incomes; in developed economies, this leads to a shift in the structure of household spending in favour of services to the detriment of industrial goods. Its "structural" character does not mean that it is irreversible, and the capacity of manufacturers to offer new products will be a crucial factor. Second, the productivity gains achieved in industry reduce the need for manpower in this sector. For sure, these productivity gains lead in return to a fall in the price of industrial goods and, in consequence, to a rise in the demand for them, but this effect only partially offsets the initial impact in terms of reduction in manpower, given the limited substitutability between these products and other goods in the economy. These effects are thought to account for nearly 30% of the job losses observed.
- Foreign competition too seems to have contributed to the decline in industrial employment in France. At a minimum this would explain 13% of job losses over the period 1980-2007, and 28% over the period 2000-2007. These findings need to be treated with a degree of caution. Here too, once again, these job losses are not irreversible.

Share of industrial employment in the working population



Source: INSEE, DG Trésor calculations.

1. The growing use of outsourcing to market services is reckoned to explain 25% of the decline in industrial employment over the period 1980-2007, and therefore does not reflect a destruction of jobs

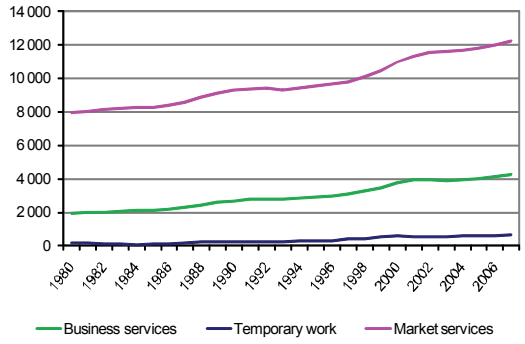
1.1 Employment in business services has grown sharply, especially in the temporary work sector, parallel to its decline in industry

In their search for greater efficiency, companies have rationalised their production processes, via a greater division of labour inside the country and growing recourse to outsourcing of a portion of industrial production processes to other sectors. This process implies that part of the observed reductions in employment in industry stems from a transformation of industry's frontiers. The resulting job losses are thus apparent only.

The trend in the relative importance of intermediate consumption in the production process is a first, very global, metric of the process of outsourcing, reflecting a strengthening of the division of labour in industry. Consequently, intermediate consumption in industrial production as a share of industrial production increased from 71% to 75% between 1980 and 2007.

The trend in employment in the market services also indirectly reflects the phenomenon of outsourcing, rising from slightly under 8 million people in 1980 to 12.2 million in 2007 (a rise of over 53%). This increase was especially pronounced in the business services, where employment rose 115% from 2 million to 4.2 million over the same period, and also for temporary work, which increased by 264% from 180,000 to 653,000 people[1].

Chart 1: Service sector employment (in 000s)



Source: INSEE and DARES.

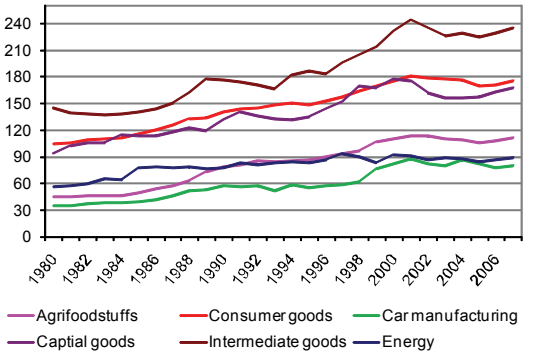
1.2 The number of jobs outsourced to business services rose from 480,000 in 1980 to 860,000 in 2007

To identify more precisely the share of business services sector employment directly attributable to demand from industry, we have drawn from the table of intermediate inputs, which supplies data on intermediate consumption of business services by each industrial sector. We deduce outsourced employment by multiplying this intermediate consumption by the ratio between business services sector employment and output[2].

The phenomenon of outsourcing turns out to have been growing in all sectors of industry throughout the period[3]. Recourse to outsourcing to business services thus represents 25% of industrial employment in 2007, versus 9% in 1980[4]. The number of jobs outsourced by industry to business services is thus estimated at 480,000 in 1980 and 860,000 in 2007.

This use of the outsourcing of production appears to be particularly high in the intermediate goods sector (240,000 jobs outsourced), consumer goods sector (180,000 jobs) and capital goods sector (170,000 jobs) sectors. The phenomenon appears to be more limited in car manufacturing and energy, where the number of outsourced jobs works out to around 80,000[5].

Chart 2: Jobs outsourced by industrial sectors to the business services sector (in 000s)



Source: INSEE, DG Trésor calculations.

(1) Data on temporary work are supplied by the Direction de l'Animation de la Recherche, des Etudes et des Statistiques (DARES), which has broken down temporary work by sector of utilisation since 1995. In 2006, for instance, recourse by industry to temporary work was estimated to be 275,000. Nevertheless, temporary work alone underestimates the extent of outsourcing, since this metric ignores the complete abandonment of certain activities by industrial firms.

(2) This methodology is drawn from Daudin and Levasseur (2005), "Délocalisations et concurrence des pays émergents : mesurer l'effet sur l'emploi en France" (Offshoring and emerging countries' competition: measuring the effect on employment in France), *Revue de l'OFCE*.

(3) Data on the breakdown of intermediate consumption by product for each sector are available only until 2006. Outsourced employment for 2007 is inferred, using the assumption that the share of intermediate consumption by each branch of industry in the output of the business services sector is constant relative to its 2006 level.

(4) Compared to the work force in each sector, the transfer of jobs to the business services sector is particularly high in the consumer goods, car manufacturing and energy sectors, for which outsourced jobs increased by more than 25% relative to their work force over the period. The share of outsourced jobs in the capital goods, intermediate goods and agrifood sectors, meanwhile, increased by between 12 and 15 percentage points over the period.

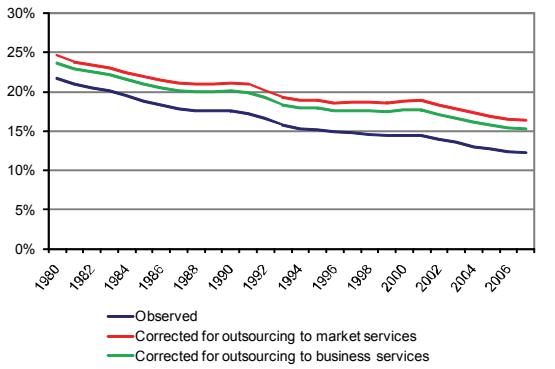
(5) The validity of these orders of magnitude was verified by referring to the results of a SESSI (Service des études et des statistiques industrielles) survey on the recourse by manufacturing firms to services in 2005. Spending on these services in 2005 is estimated to have amounted to €15 billion for the consumer goods sector, €9 billion for car manufacturing, €10 billion for capital goods, and €23 billion for intermediate goods. Applying the foregoing methodology, manufacturing industry outsourcing to business services in France is estimated to have represented 523,000 jobs in 2005, or 15% of industrial employment (versus 633,000 jobs, or 18% of industrial employment, calculated on the basis of the national accounts).

Finally, starting from the volume of jobs outsourced by industry in 2007 (860,000) and from the volume of jobs outsourced in 1980 (480,000), the far-reaching changes in the productive system during the period are reckoned to have resulted in the transfer of 380,000 jobs from industry to the business services sector. When compared to the 71,000 annual "job losses" recorded over the period, outsourcing to the business services sector could therefore account for 20% of this figure.

Applying this approach to all of the other market services sectors, we find that outsourcing is reckoned to have concerned 480,000 jobs over the period (18,000 jobs per year, on average), which represents 25% of industrial jobs lost.

Ultimately, the decline in industrial employment looks smaller when corrected for the outsourcing of industrial activities. According to the raw data, industrial employment fell from 22% of the working population to 12%, between 1980 and 2007. However, taking into account outsourcing within the business services sector, these figures are revised from 24% in 1980 to 15% in 2007 (and from 25% and 16% correcting for outsourcing by the market services sector as a whole).

Chart 3: Share of industrial employment in the working population



Source: INSEE, DG Trésor calculations.

Recourse by industrial firms to service providers has tended to stabilise in the recent period: it is thought that outsourcing now represents only 5% of industrial job losses observed between 2000 and 2007.

2. Nearly 30% of job losses in industry are traceable to the distortion of the structure of demand, and to productivity gains in industry and in the economy

2.1 Productivity gains could have affected industrial employment via rising overall incomes on the one hand, and the fall in the relative prices of industrial goods, on the other

Part of the decline in employment in industry over the period 1980-2007 can be explained by the relationship between productivity gains in this sector (and more generally in the economy), on the one hand, and the demand by agents, on the other. Two conditions are required for industrial employment to remain stable:

- overall productivity gains in the economy need to be accompanied by equivalent growth in the demand for goods and services in all sectors;
- a differential in productivity growth in favour of industry must also be accompanied by an equivalent increase in demand for goods and services in that sector.

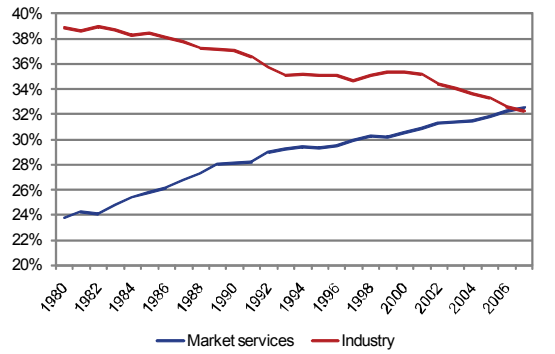
If the change in the demand for goods in the industrial sector does not square with these conditions, the improvement in productivity will lead to an imbalance in the market for goods, and entrepreneurs will react by adjusting employment in the sector (to the benefit of other sectors, if labour is perfectly mobile). Industry's share in total employment will decline as a result.

More precisely, technical progress affects the structure of demand (and hence employment) through two main channels, namely an income effect (associated with productivity gains throughout the economy), and a substitution effect (associated with the differential in productivity gains between industry and the rest of the economy) (see box 1)[6].

A simple analysis of accounting data concerning the sector breakdown of domestic demand is consistent with the idea that these two effects are involved in the process of falling industrial employment in France (see charts 2 and 3).

Domestic demand for industrial goods sector does indeed appear slack when expressed in money prices. This sector's share of domestic demand declined from 39% to 32% over the period 1980-2007, which is consistent with a low income elasticity of demand. The share of the service sector in domestic demand rose sharply, on the other hand, from 24% to 32% at current prices. Conversely, this is consistent with an income elastic demand for market services.

Chart 4: Share of industrial employment in the working population



Source: INSEE, DG Trésor calculations.

(6) We focus here on two main determinants of the transformations in the structure of demand, namely the low sensitivity of demand for industrial goods to changes in relative prices, and of income, accompanying productivity gains. Other effects, such as shocks in preferences, could shape this transformation, but they are less easily quantifiable.

Encadré 1 : **Mechanisms distorting the structure of demand and responsible for job losses in industry**[a]

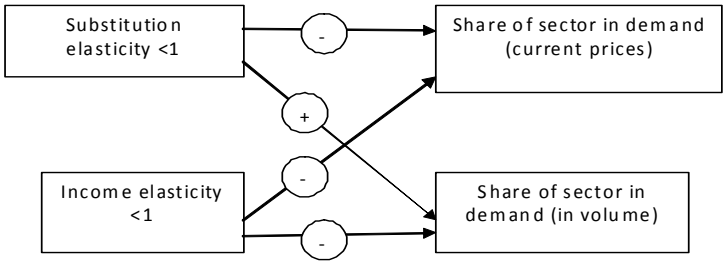
- The income effect, which is unfavourable to the industrial sector in the developed economies, tends to depress employment in this sector

Empirical work on consumption behaviour shows that agents modify the composition of their basket of goods consumed in a non-uniform manner in response to changes in their real income[b]. This non-uniform shift in demand is visible for industrial goods, but it also appears to affect the mix of industrial goods and services. According to empirical estimates, the income elasticities of demand for industrial goods thus appear to be greater than unity for small per capita incomes, and less than unity for higher per capita incomes[c].

- The substitution effect helps to stimulate demand for industrial goods. Nevertheless, the resulting growth in demand is lower than the growth in productivity.

Because productivity gains in the industrial sector are relatively greater than in the rest of the economy, this sector is able to lower the relative price of its goods, thereby stimulating demand for its products. According to the results of estimates at the macroeconomic level, the price elasticities of relative demand for industrial goods are less than unity[d]. That implies that the decline in the relative prices of industrial goods is not offset by an equivalent increase in demand in volume terms, leading to a net decline in this sector's demand for labour.

- The stimulus to demand for industrial goods resulting from the substitution effect (via the increase in industry's share of demand by volume) does not fully offset the fall in its labour needs resulting from the income effect and the sharp productivity gains in industry (resulting in a reduction in industry's share of demand at current prices).



a. See Demou (2010), *DG Trésor working paper no. 2010-01*, for a formal presentation of these mechanisms.
b. This behaviour is known in economics as "Engel's law", which formally refers to the non-homothetic nature of demand functions. This law is generally illustrated by the fact that the share of spending on food is very high at low income levels, then declines in favour of other goods as income rises. More recent extensions concern the non-uniform change in consumption choices among industrial products (as between products of different quality, technological content, and so forth). See on these questions the contributions of Bills and Klenow (2001), "Quantifying quality growth", *American Economic Review*; Falkinger and Zweimüller (1996), "The Cross-Country Engel Curve for Product Diversification", *Structural Change and Economics Dynamics*; Hunter and Markusen (1988) "Per capita income as a determinant of trade", *Journal of International Economics*.
c. Fontagné and Bouhlol (2006) estimate that the income level from which relative demand shifts against industrial goods ($8,690 at 1997 constant prices) was reached in the 1960s in France. "Deindustrialisation and the Fear of Relocations in the Industry", *CEPII working paper no. 2006-07*.
d. Rowthorn and Ramaswamy (1998), and Fontagné and Bouhlol (2006) estimate the impact of a change in the relative price of industrial goods on the share of industry in GDP and find elasticities of less than unity (ranging between –0.26 and –0.61 for the former, and between –0.49 and –0.62 for the latter).

2.2 Starting from a simulation that sets the share of industrial goods in domestic demand at current prices at its 1980 level, the share of job losses explained by the distortion of the structure of demand is estimated to some 29%

The role played by the transformation of the structure of demand in job losses can be assessed by simulating a counterfactual scenario in which the share of industry in domestic demand has been set at the level observed in 1980[7]. Compared to the situation observed in 2007, this amounts to assuming that the share of industry in domestic final demand rises, boosting domestic demand for industrial products while depressing demand for goods and services in the rest of the economy.

In the simulation proposed here, technology, i.e. the share of intermediate consumption in the different sectors, along with the share of imports in domestic demand, is fixed at the levels observed in 2007. Consequently, and assuming no change in competitiveness, an increase in domestic demand for industrial goods produces a corresponding increase in demand for imports of industrial goods. To neutralise the impact of international competition estimated below, it is assumed that the trade balance remains constant, i.e. that the change in exports is equivalent to that in imports. That amounts to assuming, in the counterfactual scenario, that the rest of the world also has a stronger preference for industrial goods: that the "preference shock" is global, in other words.

The simulation allows us to distinguish three main mechanisms via which changes in the structure of demand influence industrial employment, namely:

- first, application of the 1980 structure of domestic final demand to the 2007 spending level leads to a (fictitious) rise in domestic demand for industrial goods;
- this increase in final demand for industrial goods leads in return to an increase in intermediate demand for industrial goods;
- for a given global level of domestic final demand, the corollary of the rise in demand for industrial goods is a fall in domestic demand for goods and services in other sectors of the economy. This fall also results in a decline in intermediate demand for industrial goods in other sectors of the economy.

Simulation results are presented in the table below. Starting from the 2007 level of domestic spending (i.e. €1,930 billion) and the 1980 share of industry in domestic spending (34%)[8], domestic spending on industrial goods compatible with a constant sectoral distribution of spending is estimated to be €660 billion. By comparison with the situation observed in 2007, this equates to a demand shock of +€109 billion.

(7) In formal terms, this is equivalent to what the level of industrial employment would have been if the price and income elasticities had been at unity.

(8) We have eliminated energy from the industrial sector, since we consider that the final demand for goods in this sector is less subject to the substitution mechanism seen in the theoretical section.

Assuming no change in the trade balance, the demand shock with regard to industrial goods leads directly to a rise in domestic output with, in addition, the production of intermediate industrial goods that this entails. The (direct and indirect) industrial jobs content of the output calculated in 2007 can therefore be applied to the change in domestic final demand, which gives us the level of employment that would have existed had there been no change in the structure of domestic demand at current prices since 1980. The industrial jobs content of industrial production being estimated at 5,500 (direct and indirect) industrial jobs per additional € billion of extra output in 2007[9], the number of industrial jobs created in this scenario is estimated at 599,000. Moreover, starting from the indirect industrial jobs content of production in the rest of the economy, which is assessed at 400 jobs per € billion, the fall in final demand for goods and services in the rest of the economy results in a loss of 42,000 industrial jobs. Finally, since the level of employment observed in 2007 was 3,216,000 jobs, it flows from this that the loss of jobs resulting from productivity gains (and weak demand for industrial goods) is reckoned to be 556,000 jobs, or 29% of job losses.

Table 1: Simulation results

	Domestic final demand, whole economy (in €Bn)	Share of industry in domestic demand	Domestic final industrial demand (in €Bn)	Direct and indirect industrial jobs content of industrial production (in 000s per €Bn)	Industrial jobs content of production, rest of the economy (in 000s per €Bn)	Industrial jobs (in 000s)
1980 observed	454	34.20%	155	31	4.2	5063
2007 observed	1930	28.54%	551	5.5	0.4	3216
2007 simulated	1930	34.20%	660	5.5	0.4	3772

Source: INSEE, DG Trésor calculations, current prices. Industry does not include energy.

The analysis can be broken down by sector, revealing that job losses connected with the change in the structure of demand were particularly heavy in the agrifood, consumer goods and intermediate goods industries. Car manufacturing, on the other hand, enjoyed vigorous demand serving to create jobs over the period[10].

Table 2: Industrial jobs content of industrial trade and the effects of trade on industrial employment between 1980 and 2007

	Industrial jobs content of industrial production (in 000s per €Bn)		Domestic final industrial demand (in €Bn)		Job losses (in 000s)
	Direct	Direct + indirect	2007 observed	Simulated	
Agrifood industry	4.3	6.0	150	188	232
Consumer goods	4.2	5.6	173	214	229
Car manufacturing	2.1	3.9	88	84	–16
Capital goods	4.1	5.8	92	100	48
Intermediate goods	4.1	5.9	49	74	150

Sources: INSEE, DG Trésor calculations, current prices.

Consequently, nearly 30% of job losses in industry can be explained by a change in the sector breakdown of domestic demand, in connection with the sharp fall in the prices of industrial goods and the rise in agents' real incomes. These two effects combined are reckoned to have led to an average annual loss of 21,000 jobs between 1980 and 2007. The scale of these effects also appears to have been greater in the recent period: applying the same calculation to the 2000-2007 sub-period yields a figure of 43,000 jobs destroyed annually, or 65% of the destructions observed.

Much of the decline in industrial employment therefore stems from structural changes associated with the non-uniform nature of economic growth: the increase in real incomes resulting from productivity gains in a given sector does not necessarily lead to an increase in demand for that sector's products[11]. In conclusion, it is worth noting, first, that this phenomenon of falling industrial employment in fact conceals contrasting situations from one sector of industry to another; second, the fact that it is structural does not mean it is irreversible. **The ability of manufacturers to develop new products will doubtless play a crucial role in that respect, several studies having shown that the vigour of demand depends on the quality of products and their technological content**[12].

(9) The method used to calculate the jobs content is described in the DG Trésor working paper no. 2010-01.

(10) The fall in industrial employment associated with the decline in demand in the service sector is not taken into account in the simulations carried out at sector level. This explains the difference between job losses estimated at the aggregate level and those obtained when they are summed by sector (40,000).

(11) The non-specific nature of the phenomenon of deindustrialisation can also be illustrated by recalling the far-reaching changes that occurred during the period of industrialisation, with productivity gains in agriculture at that time serving to sustain demand for industrial goods.

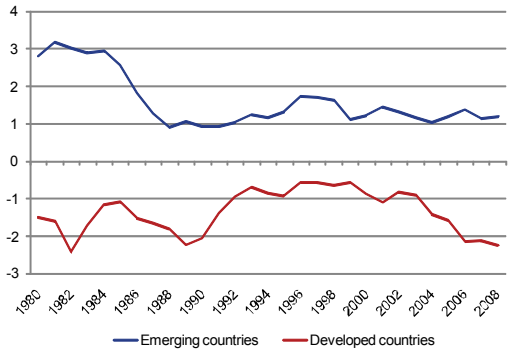
(12) See Francois and Kaplan (1996), "Aggregate Demand Shifts, Income Distribution, and the Linder Hypothesis", *The Review of Economics and Statistics*, 78(2); Melicianni (2002), "The Impact of technological specialisation on national performance in a balance-of-payment-constrained growth model", *Structural Change and Economic Dynamics*, 13(1).

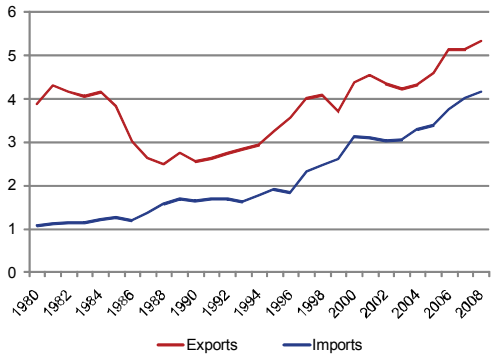
3. While its impact is hard to quantify, foreign competition too appears to have contributed to the decline in industrial employment in France

3.1 Industry's trade balance deteriorated over the period 1980-2007 (with the gap widening from –€15 billion to –€54 billion, at current prices)

The share of trade in industrial goods in GDP rose over the period, with the share of exports (respectively imports) of manufactured goods rising from 12% (respectively 11%) of GDP in 1980 to 17% (respectively 18%) in 2006. This reflects an increase in the openness of French industry, rising from 11.5% to 18%[13]. This sector's external balance deteriorated over the same period, with the deficit rising from €15 billion in 1980 to one of –€54 billion in 2007, at current prices.

Chart 5: solde et échanges avec les pays émergents





Sources: INSEE, DG Trésor calculations, at current prices.

Trade with the emerging countries registered particularly strong growth over the period 1980-2008, with exports rising from 3.9% to 5.3% of GDP and imports from 1.1% to 4.1%.

The increasing openness of the industrial sector and its deteriorating trade balance could explain part of the job losses observed in this sector. The mechanisms at work are complex, however, and we cannot establish a direct causal link between the above figures on the growth in trade (particularly with the emerging countries) and the destruction of jobs. Consequently, while the growth in industrial exports boosts industrial output (and hence industrial employment), the impact of imports is not entirely symmetrical. The impact of import growth on domestic production (and hence employment) depends in particular on the degree of substitution between imported goods and goods produced within the domestic economy. If the imports are perfectly substitutable for the goods produced domestically, then they reduce employment. If, on the other hand, the goods France produces are different from the ones it imports, then the effect on employment in France will be diminished[14]. In view of these difficulties, two methodologies have been used to assess the impact of foreign competition on industrial employment.

3.2 According to an approach based on the jobs content of trade, foreign competition is reckoned to be responsible for only 13% of job losses in industry

Assuming a substitution relationship between imports and domestic production, the impact of trade on employment can be captured approximately by calculating the jobs content of industrial imports and exports. In that case, the net impact on jobs of trade for each year indicates the level of employment necessary for the production of exports, from which are subtracted the number of jobs that would have been required if France itself had produced the goods instead of importing them. Over the long period, the change in the overall jobs content of trade depends on in the trade balance and productivity.

The jobs content of production in 1980 and 2007 is calculated by means of a methodology similar to the one used in the previous section: this one includes direct jobs in the corresponding sector, along with those resulting from the sector's intermediate consumption of industrial goods (see box 2). By multiplying the (direct / indirect) jobs content of production by the trade balance, we obtain the jobs content of trade. This analysis is carried out at the aggregate level (the industrial jobs content is estimated by dividing the economy into two sectors, as in the preceding section), and at a more disaggregated level (here we look at trends in the 5 main sectors of industry, excluding energy)[15].

(13) The degree of openness is defined as the sum of exports and imports relative to GDP*2.

(14) On this question, see the work of Fontagné, Gaulier and Zignago (2008), and of Schott (2004). Schott (2004), "Across-Product versus Within-Product Specialization in International Trade", *Quarterly Journal of Economics*, vol.119(2). Fontagné, Gaulier and Zignago (2008), "Specialization Across Varieties and North-South Competition", *Economic Policy*, vol.23(53).

(15) We have excluded the energy industry from our analysis owing to difficulties encountered in measuring the impact of oil imports on national employment. Because oil is imported for the most part, the assumption of a substitution of imports for national production does not apply.

On the basis of the trend in the jobs content of trade, the job losses traceable to trade represent between 3 and 83% of the total work force decline, depending on the sector. At the aggregate level, trade is reckoned to explain 13% of the industrial jobs losses (see table 3).

At the sector level, this evaluation also shows that:

- trade in agrifood products appears to have helped to slow the pace of job destruction;
- the manufacturing sectors, on the other hand, appear to have suffered from the negative effects of internationalisation (particularly in the car manufacturing and capital goods sectors).

Table 3: Industrial jobs content of trade in industrial goods and the impact of trade on industrial employment between 1980 and 2007 (see box 2 for the limits to the method used)

	1980		2007		Change in industrial employment associated with trade (in 000s)	Observed change in employment (in 000s)	Impact of trade on industrial employment
	Trade balance (€Bn)	Jobs content of trade (000rs)	Trade balance (€Bn)	Jobs content of trade (000rs)			
Industry	**6.2**	**191**	**−9.3**	**−51**	**−241**	**−1 913**	**13%**
Agrifood	0.9	16	7.2	42	26	−6	−427%
Consumer goods	−1.1	−39	−10.4	−58	−19	−563	3%
Car manufacturing	3.8	118	0.9	4	−115	−139	83%
Capital goods	3.9	125	5.7	33	−92	−345	27%
Intermediate goods	−1.2	−39	−12.7	−73	−33	−790	4%

Sources: INSEE, DG Trésor calculations.

Interpretation: In 1980, the capital goods industry registered a trade surplus of €3.9 billion and an estimated jobs content of trade of 125,000 jobs. The change in industrial employment associated with trade (calculated in col. 5) is the difference between the jobs content of trade calculated for 2007 and the corresponding figure for 1980. The last column shows the ratio between col. 5 and col. 6.

The impact of foreign trade appears to have strengthened in the recent period, since it is reckoned to account for 28% of job losses observed between 2000 and 2007.

The foregoing results need to be treated with caution. This is because, in spite of its simplicity and intuitive nature, weaknesses in this approach make its results hard to interpret (see box 2). What is more, the work presented in the literature based on the jobs content of trade approach produces very contrasting results. Consequently, the conclusions to be drawn from this work are to some extent unreliable[16].

Box 1: **The main limits to the jobs content of trade methodology used**

(i) We do not take account of the heterogeneousness of productivity levels within the domestic economic and vis-à-vis trading partners:

- Using the average level of productivity observed in the economy, the jobs content of exports is probably overestimated, insofar as exporting firms generally have higher than average levels of productivity.
- Symmetrically, the destruction of jobs arising from foreign competition affects the least productive firms in the sector, chiefly. As a result, the jobs content of imports is probably higher than the average level considered here.
- An additional source of bias comes from the fact that imports are not distinguished according to the level of development of the country of origin. Imports from less developed countries are generally more labour intensive than domestic production. The use of a substitute, at current prices, in this case leads us to underestimate the jobs content of imports[a].

(ii) The assumption of perfect substitution between imported goods and goods produced in the domestic economy is debatable:

- Trade between developed countries is primarily intra-industrial and is characterised by trade in varieties that appear to be complementary rather than substitutable in a basket of agents' consumption[b].
- Based on recent findings in the literature, developed countries and emerging (developing) countries increasingly tend to produce the same range of goods. Nevertheless, the emerging countries appear to be more specialised in less sophisticated ranges of goods that do not compete directly with developed countries' goods[c]

(iii) The approach based on jobs content ignores the general equilibrium mechanisms involved in the relationship between trade and employment.

- The assumption that the work force in sectors other than industry remain at their observed level is not germane, given potential substitution effects: imports of lower-cost goods has negative consequences for domestic production of these same goods, although they can have a positive impact on domestic production of other goods, which benefit from an income effect[d].
- The calculation of the net impact on jobs of trade does not explicitly explain the volumes of jobs destroyed or created by trade; rather, it explains a theoretical level of industrial jobs that would obtain in the absence of trade but at constant input and output prices.

a. To remove this limitation, certain studies use a substitution assumption in volume terms, under which a unit of imported goods is substituted for a unit of domestic goods (see Bonnaz, Courtot and Nivat (1994) "Le contenu en emplois des échanges industriels de la France avec les pays en développement" (the jobs content of France's industrial trade with developing countries), *Economie et Statistique*, no. 279-280). However, this assumption tends to overestimate job losses resulting from trade with the emerging countries, insofar as, at Northern hemisphere production costs, the volume produced by the Northern hemisphere (i.e. demand for these goods by Northern hemisphere agents) would probably be smaller.
b. See in particular Krugman (1989) "Differences in Income Elasticities and Trends in Real Exchange Rates", European Economic Review, 33, and Hummels and Klenow (2005, ibid.).
c. See Fontagné, Gaulier and Zignago (2008,ibid.) and Schott(2004, ibid.).
d. See G.Daudin and S.Levasseur (2005) for a review of the results of calculable general equilibrium models.

(16) Depending on the assumptions made concerning the degree of substitution between goods and differences in productivity between countries, studies find either a positive or a negative impact of trade on industrial employment. See Daudin and Levasseur (2005) for a presentation of the main findings in the literature (ibid.).

3.3 Between 9% and 70% of industrial jobs destroyed can be explained by trade, according to an alternative methodology based on an econometric estimation

This second evaluation is based on the work of Boulhol and Fontagné (2006), which estimates the impact of trade in manufactured goods on the share of manufacturing industry employment in total employment from a panel of 16 OECD countries for the period 1970-2002, by isolating trade with the emerging countries[17]. Their specification has been reestimated here by extending the estimation to 19 OECD countries over a longer period (1970-2007).

Based on the resulting parameters, we estimate that trends in external trade would explain 39% of jobs destroyed between 1980 and 2007. However, these estimations are unreliable, the interval of confidence at 95% ranging between 9% and 70%[18]. The impact of trade with the developed countries does not appear to be significantly different from zero, virtually all of the jobs destroyed being attributable to trade with the emerging countries. That is explained by the steep growth in imports from these countries, which have a higher jobs content than exports to these countries, and which have grown faster than the latter.

The impact of trends in external trade on the 2000-2007 sub-period alone should ultimately lead to the loss of 200,000 jobs, which is equivalent to 45% of the drop in industrial employment observed between 2000 and 2007. This share too is estimated with a high level of imprecision, the lower and upper bounds of the interval of confidence at 95% being respectively 9% and 80%, which means results need to be treated with a great deal of caution.

The main findings are summarised below:

Table 4: Summary of findings

	Average annual volume of industrial jobs destroyed	Effects of outsourcing to the service sector	Effects of productivity gains	Effects of international trade competition	
				Econometric approach	Econometric approach
1980-2007	**71 000**	25%	29%	13%	±39 %
2000-2007	**65 000**	5%	26%	28%	±45 %

Source: DG Trésor based on INSEE data.

NB: The sum of the three effects may be different from 100%, since the breakdown claims to be neither exhaustive nor independent of the effects considered.

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(17) Boulhol and Fontagné (2006), "Deindustrialisation and the Fear of Relocations in the Industry", CEPII working paper no. 2006-07. Their methodology is based on a dynamic model estimated according to the generalised method of moments, and includes per capita income (and the square of this variable), the level of fixed capital and year indicators as proxies.

(18) By directly utilising the parameters estimated by Boulhol and Fontagné (2006), the contribution of external trade is estimated at 26%. It is not possible to calculate the attendant interval of confidence from the results published in their article.

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