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French and German export specialization: similarity or divergence?

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

- Various studies of the trade performance of France and Germany find similarity in the two countries' sectoral export specializations. An examination of highly disaggregated data using the CEPII revealed comparative advantage indicator yields a more nuanced view. When examining aggregated data, France and Germany are found to have similar areas of revealed comparative advantage but those areas are concentrated in fewer sectors in Germany than in France. The similarity in revealed comparative advantage is far less clear-cut when the data are examined at a more detailed level.

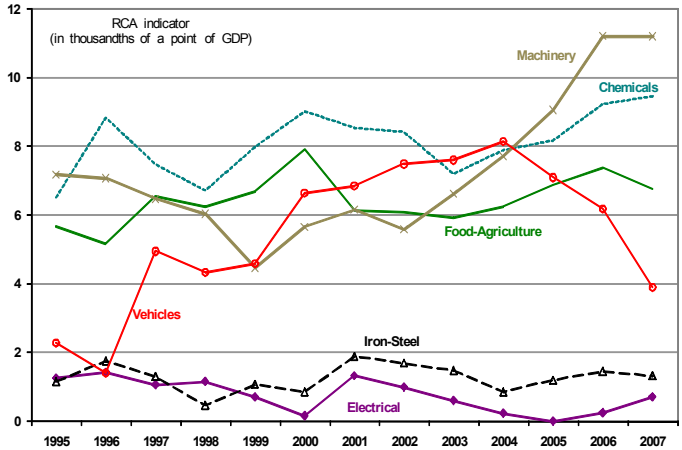
- According to the aggregated sector data, both countries have revealed comparative advantage in Vehicles, Chemicals, Machinery (including aeronautics), and to a lesser degree in the Electrical sector. France also has comparative advantage in Food-Agriculture and to a lesser degree in Iron-Steel. But Germany's revealed comparative advantage in the Machinery and Vehicles sectors is far higher than France's.

- Over the 1995-2007 period, Germany's structure of comparative advantage was more stable than France's, as the Vehicles and Machinery sectors remained distinctly in the lead in Germany. On the other hand, France's comparative advantage was gradually concentrated in the Machinery sector, on the strength of aeronautics, while the Vehicles sector lost considerable ground at the end of the period. The concentration of comparative advantage in aeronautics leaves French exports particularly exposed to changes in the euro.

- Germany's concentration of areas of revealed comparative advantage by product appears even more clearly at a more detailed disaggregated level: France's highest comparative advantage is in products in the Machinery, Electrical, Food-Agriculture, and Chemicals sectors, and luxury products, while Germany's comparative advantage is concentrated in products in the Vehicles and Machinery sectors. France appears to have more diversified areas of comparative advantage, whereas Germany's are concentrated in top-of-the-range vehicles and capital goods.

- Since 2000, both countries have achieved their largest gains in comparative advantage in high-technology products (the Electrical, Machinery and Chemicals sectors for France, and the Machinery, Electrical and Vehicles sectors for Germany). There are greater divergences in the two countries' losses in comparative advantage. For France, these areas are concentrated in numerous high-technology products (for the essential part, in the Electrical and Vehicles sectors), while Germany's losses are in low-value-added, low-technology products.

France's revealed comparative advantage, by sector



Source: Chelem database

DGTPE
DIRECTION GÉNÉRALE DU TRÉSOR
ET DE LA POLITIQUE ÉCONOMIQUE

Various economic studies of French and German trade performance find that the two countries' export sector specializations are similar.[1] **The implication is that differences in export performance are not explained by poor industrial specialization decisions by France.** An analysis of German and French revealed comparative advantage provides additional insight into the sectoral breakdown of each country's exports, by measuring which sectors make positive or negative contributions to their trade balance.

The revealed comparative advantage indicator, a concept introduced by B. Balassa (1965) and developed in France by CEPII, measures, for a given year (or period), the difference between the observed trade balance for a given product and the theoretical balance that would arise if it were exactly proportional to that product's share in a country's international trade (see Appendix). A comparative advantage is indicated by a positive difference (a higher surplus or smaller deficit than the theoretical balance) and a comparative disadvantage by a negative difference (a greater deficit or smaller surplus). By identifying the strong points and weak points in a country's export performance, the revealed comparative advantage indicator allows the characterization of that country's structure of export specialization. According to international trade theory, the concept of comparative advantage as established by Torrens and Ricardo in the 19th century and subsequently developed sets out that if countries have comparative differences in costs under autarky, then each will gain by specializing and exporting those goods in which it has the greatest comparative advantage or least comparative disadvantage, while importing the other goods from its trading partners.

Box 1: **The CEPII Chelem database classification system**

This paper uses data from the CEPII Chelem database (data available through 2007); the Chelem classification is not identical with the French Customs classification. Revealed comparative advantage (RCA) is calculated at the most detailed level of the CEPII Chelem sector classification, i.e., for 71 product categories; these 71 categories are not identical with, but for the most part are relatively close to, aggregation level A129 (75 product categories) in the NAF-CPF revision 2 (2008) classification used by French Customs.[a] On the other hand, the 11 sector aggregates in the CEPII classification are quite different from the 10 categories in aggregation level A17 of the French Customs classification.

The CEPII classification identifies the following 11 sector aggregates: Machinery, Chemicals, Vehicles, Food-Agriculture, Iron-Steel, Electrical, Non Ferrous, Wood-Paper, Electronic, Textiles, and Energy.

In particular, some of the major sectors mentioned in the remainder of this note are defined as follows:

- **Machinery sector:** *metallic structures, miscellaneous hardware, engines, agricultural equipment, machine tools, construction equipment, specialized machines, arms, ships, and aeronautics*. Most of these items are included under "Machinery, electrical, electronic and computer equipment" in the Customs classification breakdown, except for metallic structures and miscellaneous hardware included under "Other manufactured products," and ships and aeronautics which are included under "Transportation equipment" in the Customs classification (also including the Vehicles sector, which is distinct from "other transportation equipment" in the Chelem classification).
- **Chemicals, Iron-Steel, Non Ferrous, Textiles, and Wood-Paper sectors:** most of the items in these Chelem sectors are included in a single Customs aggregate, under "Other manufactured products," except for iron ores, non ferrous ores and scrap, and unprocessed minerals n.e.s., which are included under "Natural hydrocarbons, other mining products, electricity, scrap."

a. See the details of this classification on the French Customs website: http://lekiosque.finances.gouv.fr/Appchiffre/guide/images/Table_AGREG.pdf.

1. Germany's revealed comparative advantage levels are higher than France's

In the context of the intensification of international trade, a trend analysis of revealed comparative advantage by major sector for France and Germany since 1995 permits the observation of trends in the intersectoral allocation of productive resources across export sectors, thereby identifying the countries' export specialization sectors.

The comparative variations in France's and Germany's areas of revealed comparative advantage over the 1995-2007 period are characterized as follows (see charts 1 and 2):

– The indicators reflect **similar choices in export specialization: both countries have revealed comparative advantage in the Vehicles, Chemicals, Machinery and Electrical sectors**. France also has revealed comparative advantage in the Food-Agriculture and Iron-Steel sectors. The sectors making the largest positive contribution to the trade balance are therefore somewhat more concentrated in Germany than in France.

– France's revealed comparative advantage indicators are far higher in the Chemicals, Machinery, Vehicles and Food-Agriculture sectors than in the Iron-Steel and Electrical sectors, but the trends differed substantially in the latter part of the period. Overall, a change has been observed in France's areas of revealed comparative advantages since the start of the 2000s:

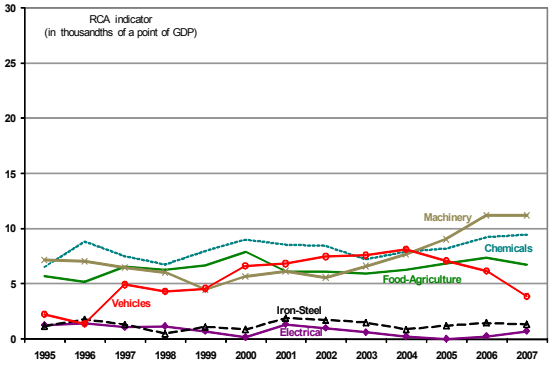
- The Chemicals sector, which was France's leading sector of specialization in terms of revealed comparative advantage since 1981, fell to second place starting in 2002, with a continuous deterioration in the indicator from 2000 to 2003. Since 2004, the value of the indicator has

(1) See CAE Report no. 64, "Évolution récente du commerce extérieur français" by P. Artus and L. Fontagné, 2006 (English-language summary, "Recent Trends in French Foreign Trade," Analyses E?conomiques, The Newsletter of the French Council of Economic Analysis, vol. V-06, Nov. 2006, and the report by G. Le Blanc, 2007, for Cercle de l'Industrie, "La France souffre-t-elle d'une mauvaise specialisation industrielle?" [Is France suffering from poor industrial specialization?]).

continuously improved, primarily owing to toiletries (perfumes and cosmetics) and pharmaceuticals. Exports by these key French areas of comparative advantage have proved reasonably resilient since the crisis began; they are the only product categories in which the trend has continued to improve in the recent period, even at the peak of the crisis.

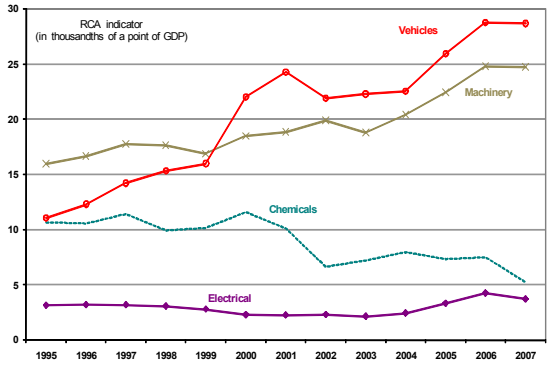
- At the same time, after continuously increasing its share in France's foreign trade since 1995, the Vehicles sector has pulled back significantly since 2005. That year marked the start of a difficult phase for the sector, which has continued despite the recent rebound in exports to major export destinations on the strength of (temporary) scrappage schemes. The Vehicles sector, which once ranked as France's top export specialization sector, ranked only fourth in 2007.
- The **Machinery sector** took off in 2002, and has been France's number one export specialization sector since 2005. **The rebound is attributable essentially to France's strong export specialization in the aeronautics area**.[2]
- Finally, since 2003 the **Food-Agriculture sector** overall has improved in France, after the slight pullback observed in 2000-2003. The sector benefits from a strong global reputation, particularly for wines and spirits.

Chart 1: France's revealed comparative advantage



Source: Chelem database

Chart 2: Germany's revealed comparative advantage



Source: Chelem database

– **The composition of Germany's revealed comparative advantage is more pronounced and more stable over time than France's:** the Vehicles and Machinery sectors have ranked distinctly highest in Germany's export specialization since 2005, followed by the Chemicals sector, which has lost ground in the period, and then the Electrical sector, which is well behind the other sectors.

- The **Vehicles sector has by far the highest revealed comparative advantage level**, which has risen sharply. Germany is a net exporter of automobiles, and has strengthened its position as the world's leading exporter in the sector.
- The **Machinery sector**, which is Germany's number two export specialization sector, has gained over the period as a whole, and most markedly starting in 2002. Germany's revealed comparative advantage in this sector is based on varied product categories: specialized machines and machine tools, engines, precision instruments, miscellaneous hardware, and construction equipment.
- The **Chemicals sector**, which in 2005 was one of Germany's top export specialization sectors, on a par with the Machinery sector, has continuously slipped over the period, starting in 2000 and despite some slight stabilization since 2003, due to sharp losses in revealed comparative advantage, primarily in basic organic and inorganic chemicals, and plastic articles.

Over the entire period of the analysis, for three of the four sectors in which both countries have a comparative advantage, **the value of the indicator is higher for Germany than for France; the exception is the Chemicals sector, in which France has outperformed since 2002**. The Vehicles, Machinery, and Electrical sectors thus make a larger positive contribution to Germany's trade balance than to France's, while the Chemicals sector makes a greater contribution to France's trade balance.

Examining the areas in which both Germany and France have comparative advantage, the positive variations in the Machinery sector are quite similar. On the other hand, the revealed comparative advantages in the Vehicles and Chemicals sectors have varied in opposite directions: While Germany has recorded gains in comparative advantage in Vehicles, and a loss in Chemicals, France appears to have focused more on Chemicals, especially since 2003, primarily due to its position in pharmaceuticals and toiletries.

(2) This must be interpreted with caution. It is attributable to the fact that, while the "French content" of Airbus aircraft is roughly 40% (and comparable to the "German content"), 70% of the finished aircraft leave from France (and only 30% from Germany); the figures therefore overstate France's comparative advantage, and understate Germany's comparative advantage, in aeronautics, relative to the economic reality in the industry.

2. Areas of revealed comparative advantage, by product category, have varied more in France than in Germany in recent years

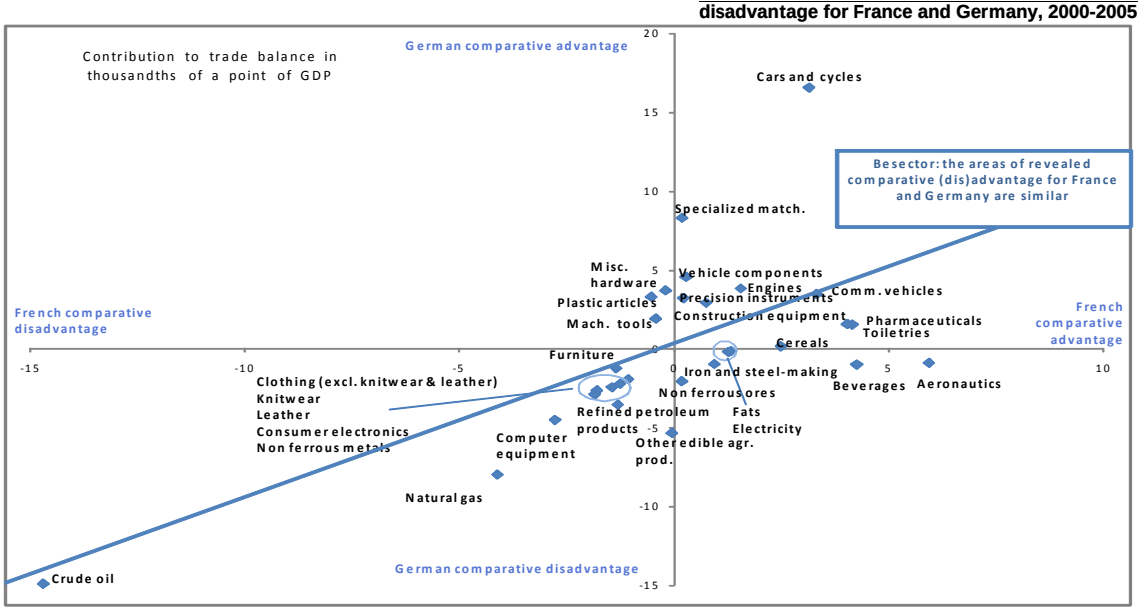
2.1 Revealed comparative advantage at a disaggregated level

On average, examining the 2000-2005 period at a more detailed disaggregated level,[3] France and Germany have their greatest revealed comparative advantage in different categories of high-value-added products, essentially in the medium- and high-technology sectors (see chart 3), with **aeronautics, pharmaceuticals, cars and cycles, vehicle components, engines and electricity for France; and cars and cycles, vehicle components, specialized machines and machine tools, engines, precision instruments, plastic articles and construction equipment for Germany. Further, in low-technology sectors, France has high revealed comparative advantage in luxury or up-market products (toiletries, and wines and spirits) as well as in certain agri-food products (cereals, and fats).**[4]

This breakdown into product categories permits a more nuanced assessment of the aggregate sectoral level findings regarding the similarity in the areas of greatest revealed comparative advantage between France and Germany: **the similarity is found only at the aggregated level of analysis**. For instance, in the Machinery sector, France derives its higher revealed comparative advantage only from the aeronautics product category, whereas Germany's areas of comparative advantage in the sector are far more diversified, corresponding for the most part to medium- and high technology products, i.e., specialized machines, engines, construction equipment, machine tools, and miscellaneous hardware. **The similarity between French and German areas of revealed comparative advantage in 2007 is actually restricted to two product categories, vehicle components and engines**. For the other product categories with a high degree of common specialization, Germany has a far greater comparative advantage than France in the cars-and-cycles and specialized machines categories, while France has a greater comparative advantage, but to a lesser degree, in aeronautics and beverages (essentially wines and spirits).

By contrast, the revealed comparative disadvantages for France and Germany are very similar for most product categories, e.g., crude oil, natural gas, knitwear,[5] clothing (excl. knitwear and leather), and computer equipment.

Chart 3: The ten product categories with the highest revealed comparative advantage and disadvantage for France and Germany, 2000-2005



Source: Chelem database, DGTPE calculations

2.2 Variation in revealed comparative advantages between 2000 and 2007

In 2000, France's main areas of revealed comparative advantage were relatively well-balanced across several product categories (see chart 3), with strong points in aeronautics, beverages, cars and cycles, vehicle components, pharmaceuticals, and toiletries. In seven years' time, the structure of France's comparative advantages has been concentrated in the aeronautics category, which accounted for 7% of France's total exports in 2007,[6] and which covers 18% of the total comparative advantage in 2007, compared with only 11% for beverages, France's second highest area of revealed comparative advantage. Pharmaceuticals (6%) and toiletries (3%) have also gained some ground, while beverages (3%) remain at the same level of specialization.

(3) Based on an analysis of the 71 product categories. Only the 10 product categories with the highest revealed comparative advantage and disadvantage values are presented here.

(4) Fats include oils and fats of plant or animal origin.

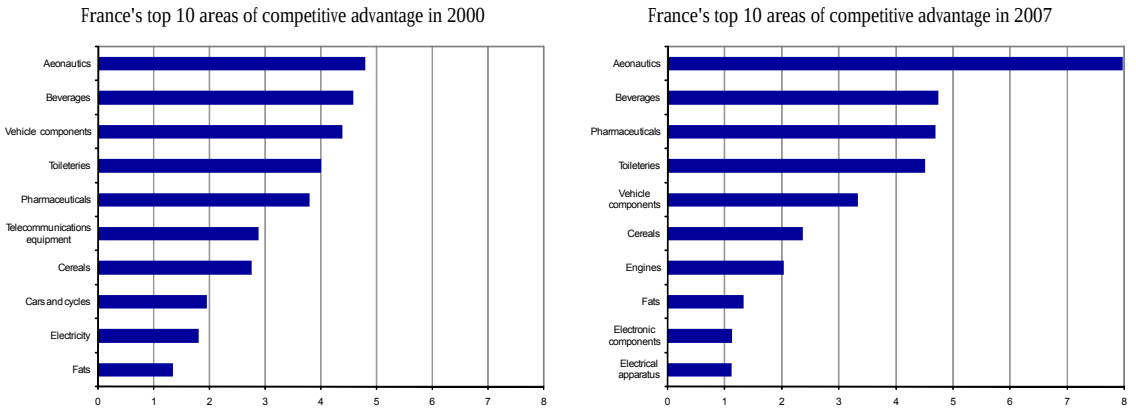
(5) Long description: Knitwear (made directly from yarns).

(6) Data on France's exports are drawn from French Customs.

The automobile industry, on the other hand, has retreated markedly in France's structure of comparative advantage: the vehicle components product category has slipped slightly, while the cars-and-cycles category, after being one of France's top ten areas of comparative advantage in 2000, is now among the areas with the lowest comparative advantage. Further variations in 2008 and 2009 have probably also been adverse. On the other hand, some high-technology product categories in the Machinery and Electrical sectors have moved into the top ten areas of comparative advantages since 2000, i.e., engines, electronic components, and electrical apparatus.

France's structure of comparative advantage, with its concentration in aeronautics, can be problematic insofar as the industry is particularly exposed to the impact of euro appreciation in terms of both production costs and price competitiveness outside the EU. In 2007, close to 70% of the industry's exports went to countries outside the UE27 (compared with 37% for total French exports),[7] and the main competitor, Boeing, could be aided by depreciation of the dollar. As Germany is also significantly involved in EADS production, it would also be affected were Airbus sales to weaken. Pharmaceuticals and beverages, which rank after aeronautics in France's areas of revealed comparative advantage, are also highly exposed, as close to 50% of French exports in these product categories are exported outside the EU.

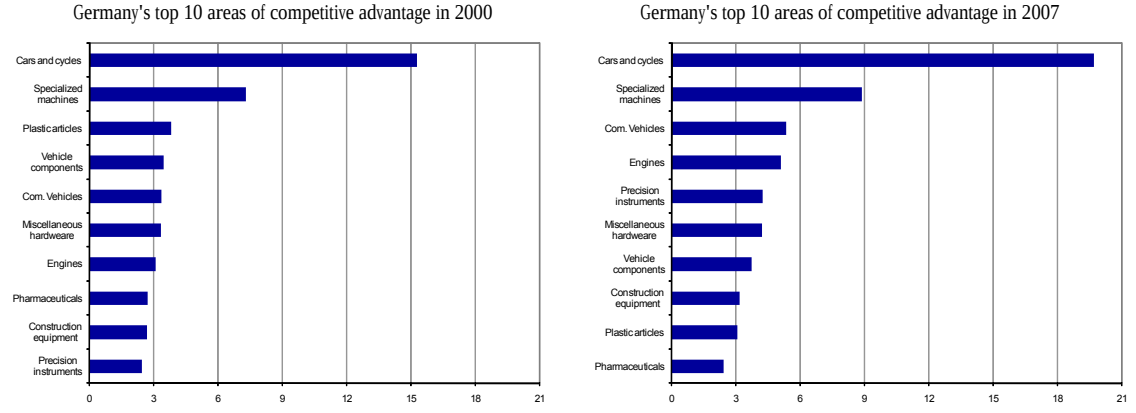
Chart 4: Change in France's areas of comparative advantage, 2000 - 2007



Source: CEPII Chelem database, DGTPE calculations

Germany's structure of comparative advantage is even more highly concentrated (see chart 4). Revealed comparative advantage in the cars-and-cycles product category is particularly high over the period as a whole, and accounted for 22% of total comparative advantage in 2007. Germany is thus the world's leading exporter of automobiles over the period as a whole, well ahead of Japan, which ranked second in 2007, and especially France, which ranked fourth. The cars-and-cycles product category is followed, at a considerable distance, by specialized machines. Revealed comparative advantage values in other categories are better balanced; these involve essentially categories in the Machinery sector (engines, miscellaneous hardware, and construction equipment).

Chart 5: Change in Germany's areas of comparative advantage, 2000 - 2007



Sources: CEPII, Chelem database, DGTPE calculations

(7) Despite considerable use of currency hedging instruments by the European aerospace industry.

2.3 The largest gains and losses in revealed comparative advantage between 2000 and 2007

Table 1 presents the 20 product categories with the greatest gains or losses in France's revealed comparative advantage between 2000 and 2007. **Large gains occurred in several high-technology product categories,**[8] **particularly in the Machinery sector** (aeronautics, and specialized machines), the **Electrical sector** (electronic components, precision instruments and electrical apparatus) and the **Chemicals sector** (pharmaceuticals); there were also large losses in comparative advantage in telecommunications equipment, computer equipment, and consumer electronics. Medium-high technology product categories also saw gains in RCA, in the Machinery sector (engines, and agricultural equipment) as well as **very sharp losses in RCA in the Vehicles sector**, in which France's RCA had been growing until 2004, and **in the Electrical sector**.

Table 1: France's principal gains and losses in comparative advantage, 2000-2007 (contribution to trade balance, in thousandths of a point of GDP)

Losses		Gains	
Telecommunications equipment	**–3.8**	**Aeronautics**	**3.2**
Cars and cycles	**–1.9**	Natural gas	1.9
Crude oil	–1.1	**Precision instruments**	**1.4**
Vehicle components	**–1.1**	**Electronic components**	**1.2**
Computer equipment	**–0.9**	**Engines**	**0.9**
Consumer electronics	**–0.9**	**Pharmaceuticals**	**0.9**
Ships	–0.8	**Electrical apparatus**	**0.7**
Electricity	**–0.8**	**Specialized machines**	**0.6**
Furniture	–0.6	Iron ore	0.6
Refined petroleum products	–0.5	**Agricultural equipment**	**0.6**

Interpretation: the product categories in bold are in the high- and medium-high technology sectors.

Sources : CEPII, Chelem database, DGTPE calculations

In line with the report by Fontagné and Gaulier (2008)[9] which identifies a rise in Germany's global market shares in high-technology products since 2000, **the sectoral breakdown of Germany's largest gains and losses in comparative advantage between 2000 and 2007** (see table 2) **indicates a distinct consolidation of its specialization in high-technology sectors.**[10] The largest gains in Germany's revealed comparative advantage involve high-technology products (precision instruments, specialized machines, machine tools, and electrical apparatus) and medium-high technology products (cars and cycles, commercial vehicles, and engines). On the other hand, most of the largest losses in comparative advantage occur in low-value-added and low-technology products (crude oil, natural gas, iron and steel-making, non ferrous metals, other edible agricultural products, and fats). Unlike France, Germany incurs only limited losses in comparative advantage in high-technology products, particularly in the Electrical sector. **In the areas in which both countries are specialized, France outperforms Germany only in aeronautics, electronic components, and pharmaceuticals.**[11]

(8) According to the 1997 OECD classification. High-technology sectors: aerospace, computers, office machinery, electronics, communications, pharmaceuticals. Medium-high technology sectors: scientific instruments, motor vehicles, electrical machinery, chemicals, other transportation equipment, non-electrical machinery. Medium-low-technology sectors: rubber and plastic products, shipbuilding, other manufacturing, non-ferrous metals, non-metallic mineral products, fabricated metal products, petroleum refining, ferrous metals. Low-technology sectors: paper and printing, textiles and clothing, food, wood and furniture.

(9) Fontagné L. and Gaulier G. (2008) "Performances à l'exportation de la France et de l'Allemagne", Rapport du CAE. (English-language summary in "Export Performances by France and Germany," Report by Lionel Fontagné and Guillaume Gaulier, Analyses Économiques, The Newsletter of the French Council of Economic Analysis, vol. VIII-9, Dec. 2008.).

(10) Work published by the COE (Centre d'Observation Économique) confirms the importance of technological content in how European importers assess French products. Anas J. (2009) "Résultats de l'enquête 2008 sur l'appréciation du rapport qualité-prix des produits français par les importateurs européens" (Results of the 2008 survey of the assessment of the price-quality relationship of French products by European importers), COE working document no. 6/2009.

(11) Germany's gains in comparative advantage in agricultural equipment are nearly identical to France's (+0.43), but do not appear on the list of the top 10 gains.

Table 2: Germany's principal gains and losses in comparative advantage, 2000-2007 (contribution to trade balance, in thousandths of GDP)

Losses		Gains	
Crude oil	−4.4	**Cars and cycles**	**4.4**
Basic organic chemicals	**−3.6**	Refined petroleum products	3.9
Natural gas	−3.0	**Engines**	**2.0**
Iron and steel-making	−2.9	**Commercial vehicles**	**2.0**
Non ferrous metals	−2.4	**Precision instruments**	**1.8**
Telecommunications equipment	**−1.8**	**Specialized machines**	**1.6**
Other agricultural products	−1.1	**Electrical apparatus**	**1.1**
Computer equipment	**−1.0**	Furniture	0.9
Fats	−0.9	Miscellaneous hardware	0.9
Electronic components	**−0.8**	**Machine tools**	**0.9**

Interpretation: the product categories in bold are in the high- and medium-high technology sectors.

Sources: CEPII, Chelem database, DGTPE calculations

3. Conclusion

The changes observed in French and German revealed comparative advantage provide insight into the recent contrasting trends in the countries' trade balances. Germany appears to have benefited from concentration and intensification of its comparative advantage in two areas. By marshalling its know-how in the automobile industry (cars and cycles) and the manufacture of high-technology machinery (specialized machines), Germany has consolidated its international positions, despite the rise of major emerging countries like China in world trade. More specifically, the improvement in Germany's trade balance is based, inter alia, on specialization in high-technology sectors, while tending to disengage from low-technology sectors. By contrast, except in aeronautics and pharmaceuticals, France has lost comparative advantage in high-technology areas (e.g., telecommunications equipment, cars and cycles, and vehicle components).

Nicole MADARIAGA

Appendix: **: Revealed comparative advantage calculated by CEPII**

Revealed comparative advantage (RCA) answers the question: "What are an economy's strong points and weak points?"
The CEPII revealed comparative advantage indicator is based on Balassa's RCA indicator (Balassa, 1965):

$$B_k = \frac{X_k + M_k}{X + M}$$

where X_k, denotes exports of product *k*, M_k denotes imports of product *k*, and *X* and *M* denote total exports and imports, respectively.
Instead of relative export structures, as in the classic Balassa method, the analytical indicator used here starts with the balance, and takes account of the size of the national market.
For a product *k*, the first step is to calculate the trade balance relative to the gross domestic product, *Y*, in thousandths of a point of GDP:

$$y_k = 1000 \times \frac{X_k - M_k}{Y}$$

The contribution of product *k* to the trade balance relative to GDP is defined by:

$$c_k = y_k - g_k \times y$$

where g_k is the share of product *k* in the country's international trade:

$$g_k = \frac{X_k + M_k}{X + M} \text{ et } y = 1000 \times \frac{X - M}{Y}$$

The contribution of *k*, or c_k, can therefore be written:

$$c_k = \frac{1000}{Y}\left[(X_k - M_k) - \frac{(X_k + M_k)(X - M)}{X + M}\right]$$

It is then necessary to eliminate the influence of changes that are not specific to the country examined, but that arise from variations in the share of products in global trade. Relative to a base year *t*, each *X* and *M* flow is adjusted for other years, *n*, by multiplying all flows by:

$$e^n = \frac{w_k^t}{w^t} / \frac{w_k^n}{w^n}$$

The revealed comparative advantage indicator c'_k is thus calculated taking into account the shares of global trade in base year t. For year *t*, it is identical to the relative contribution *c*; for other years, *n*, the distance increases the more world trade in product *k* deviates from the average trend for all goods.

Comparative advantage is calculated at the most-detailed level of the Chelem database classification (i.e., for the 71 product categories). The comparative advantage values for each of the eleven major sectors are calculated by summing the values of the product categories included in those sectors.

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