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**The recent evolution of corporate networks in France and the United Kingdom:**

**Resilient structures facing the financial crisis**

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**Abstract**

The evolution of intercorporate networks in France and the United Kingdom from the start of the century has been somewhat paradoxical. In France, the share of foreign investors in the capital of large companies has increased at a much faster rate than the rest of Europe; this has weakened historical state and familial patronal bonds and led to some convergence with the Anglo-American model. Yet the main French companies still remain much more tightly interlocked through shared directorships than firms in the United Kingdom.

In the context of endogenous shocks presented by the 2007-08 financial crisis can continued convergence between these different corporate governance systems be expected or is a retreat to more familiar structures of interaction more likely? To assess the recent dynamics of these two intercorporate networks, we study interlocking directorates among the 100 main companies on the Paris and London Stock Exchanges, thanks to a dataset covering the 2006-2010 period. In both economies, the corporate network becomes less centralized and the business elite core more fragmented. However these structural changes do not seem to have affected the latter's capacity for mobilization in case of uncertainty.

**Keywords: interlocking directorates, corporate networks, business elite, dynamics of networks, financial crisis**

France and the United Kingdom stand as opposing ideal types of corporate governance; expressions of the respective *dirigiste* and *laissez-faire* heritages of each economy. Interlocking directorates among main companies are more cohesive in France than in most Western countries. Paradoxically, the share of foreign investors is also higher in France. The cohesion of interlocks has coincided with a strong state interventionism, based on both ownership control and managerial control. Capital networks have been very hierarchical and pyramidal with a robust financial core and the state bureaucracy at their top; at the managerial level, former state bureaucrats are frequently found among executive and non-executive directors. By contrast, the United Kingdom is characterized by relatively sparse director interlocks among boards, coinciding with limited state intervention and a wider range of capital funding sources. Given the decreasing state interventionism in the governance of big companies in France, interlocks are likely to become less and less cohesive and the overall structure increasingly like that in the United Kingdom. However, against this trend, the 2007-08 financial crisis is likely to have affected the intercorporate networks in both economies. The objective is to measure the effects of these changes on the network.

The dataset comprises the 100 main French companies according to their capitalization at the Paris Stock Exchange. We analyze firstly the global evolution of interlocks among them from 2006 to 2010, secondly the evolution of intercorporate networks, and thirdly the evolution of the linkages among the main interlockers. Globally, we observe a decreasing centralization of the intercorporate network and a process of relative balkanization among the business elite. In the last part, we raise the question of the renewal of the corporate elite. Indeed, the observed decentralization phenomenon may be, at least partly, due to the removal of a few very central directors. The changes in the structure of interlocks do not eventually seem to reflect a renewal of the directors' profiles.

## **1. The importance of interlocks in France and the United Kingdom**

Corporate networks in France and the United Kingdom serve as antithetical cases among the main Western countries. In Windolf's (2002) cross-national comparison of interlocking directorates France had the least number of interconnected firms but the greatest interconnection among these, whereas the United Kingdom had the reverse. Among the 374 main firms in France, fewer were interconnected; isolates represented a bigger share (43%) than in Germany (32%), the United States (14%) or the United Kingdom (8%). However, interconnected firms were more integrated in France than in the other countries. The density among firms with ties was higher (4.92) than in Germany (4.21), in the United States (1.89) or in the United Kingdom (1.53). Interconnected French firms did not only exhibit more interlocks, but also more multiple interlocks among each other. The proportion of multiple relationships (20%) was rather high. Moreover interlocks in France were more centralized, as the firm with the greatest number of interlocks in these countries was French. In brief, the French corporate network had the most cohesive core and the United Kingdom, the most dispersed.

Two models emerge (Windolf, 1999): the Anglo-American model and the Franco-German model. In the United States and the United Kingdom, ownership is far more dispersed and the weight of institutional investors is more important than in Germany and in France. Further, interlocks form a very dense core in France and in Germany as opposed to the corporate networks in the United States and the United Kingdom. In Germany, this network intersects the ownership network to a great extent, whereas in France the overlap is weaker, but varies as a function of the share of owned capital. French capitalism presents very specific patterns even compared to Germany, to the extent that control relies on different mechanisms. In Germany, control stems from a joint-regulation based on ownership interlinkages among non-financial firms. In France, interlocks are structured in particular by state regulation and family capitalism.

The state bureaucracy exerts its influence thanks to shareholdings and *pantouflage*<sup>1</sup>. Besides, familism is stronger in France than in other main Western countries. As a consequence, the French ownership network is hierarchical and pyramidal, whereas it is star-like in Germany and inverted star-like in the United States and in the United Kingdom (Windolf, 2002).

Morin (2000) scrutinized the structure of French capital networks in the 1990s, highlighting the importance of financial cores and poles. The ownership network was clustered around the major banks, which owned large shares of main industrial groups. Three kinds of ties coexisted: intermediation ties among banks inside the financial core, alliance ties among industrial groups inside financial poles, and control ties inside business groups. Brokering main cliques of financial and industrial companies, the state played the role of an overwhelming ruler. This dominant position has weakened with financialization and globalization. As financial markets have liberalized, the share of foreign investment has increased.

The relatively sparseness of director interlocks among firms in the United Kingdom and the United States, has been attributed to the greater use of capital markets by these firms for funding (Scott 1991). With little reliance on particular state or institutional investors for funding, it is suggested that there is little need for close ties with these institutions. Further, financial institutions themselves, tend to have a notably wider range of director interlocks than other firms, pointing to a relationship between interlock structure and capital borrowing and lending patterns. However, there is little empirical evidence of such a relationship in the absence of financial distress; director interlocks tend to develop between financial and non-financial firms when the latter encounter financial difficulties (Mizruchi and Stearns 1988). The distinctiveness of the Anglo-American “model” may be more the outcome of a particular distribution of large,

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<sup>1</sup> “*Pantouflage*” refers to bureaucrats (from ministries, prefectures, embassies, high administrative bodies, etc.) leaving the administration to work in the private sector.

minority-owned, domestic and financial firms, each of which have characteristic patterns of interlocking (Carroll and Alexander 1999, Dooley 1969, Ornstein 1984)<sup>2</sup>. At the same time, some British peculiarities can be expected, given the persistence of landowning and Empire-originating transnational interests among the largest firms (Cain and Hopkins 2001, Cronin 2012).

Scholars deduce conflicting arguments from these evolutions. To Windolf (2002), the French model may demonstrate stability thanks to the strength of multi-level networks, with the state bureaucracy at the highest level, and of familism. To Morin (2000), the French model is, on the contrary, converging towards the shareholder value model, since privatizations, financialization and globalization lead to a disintegration of financial cores: Foreign investment now represents a higher share than cross-shareholdings in the capital of main French business groups. In a broad outline, we may sketch these perspectives as the sociological and the economic points of view. The first argument complies with the social reproduction theory, whereas the second point of view supports the convergence theory, as it principally concentrates on equity linkages. Focusing each on different dimensions of intercorporate networks, they draw opposite conclusions from the same evolutions.

## **2. How did interlocks evolve between 2006 and 2010?**

The objective of this study is to assess the impact of the changing institutional context on the structure of interlocks among the main French companies and among the main British companies between 2006 and 2010. The main institutional changes relate to the rise of foreign investors with the liberalization of financial markets and a declining state interventionism,

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<sup>2</sup> For a recent broad survey of the director interlocks literature see Cronin (2011).

particularly so in France. Since the late 1990s, an increasing share of the capital of major companies has been held by foreign investors. Interlocks should decrease, given the importance of foreign investors in their capital.

The French model could indeed evolve, even if it does not mean a mechanistic convergence toward the shareholder value model. We expect in particular that the intercorporate network also becomes less and less hierarchical, with the disintegration of the “hard cores”. The latter are groups of companies - “financial poles” - clustered around major French banks. This policy was implemented in the mid-1990s by the former Minister of Finance, Edouard Balladur, to keep control over main French companies despite their privatization.

Another consequence might be a lesser homogeneity and cohesion among the business elite network. The profiles of interlockers might evolve and, in France, former bureaucrats might lose their central positions. Bourdieu (1989) argues that social reproduction is based on two kinds of capital: cultural capital and economic capital. Two main profiles could be found in the French business elite. Those rich in cultural capital, succeeded in getting to the highest positions in the business elite, after having been graduated in an elite school (mostly in Polytechnique and in ENA) and having started their career as civil servants (generally in a ministry, the Treasury, or a cabinet). The second category referred to heirs, who inherited and developed a family business group. However, the situation has changed since the 1980s. Comet and Finez (2010) show that education and career are less determinant than economic capital in membership of the business elite core. The cohesion of the business elite in France has been partly due to a few former bureaucrats who have occupied very central positions in the network of interlocking directorships (Dudouet and Grémont, 2007). As the State has played a lesser role in the governance of big companies in France, particularly since the late 1990s, these directors may become less and less central, which may induce the decay of many bridges within the network.

In the United Kingdom, a relatively stable pattern of director interlocks had been eroded by the liberalization of the financial sector in 1986 (Scott 1991). This had generated explosive growth and internationalization in the sector, disrupting the traditional “clubish” social relationships that had long-dominated the City of London (Cain and Hopkins 2001). The continued growth of an internationalized financial sector as a major part of the UK economy through the early 21<sup>st</sup> century, both introduced a stream of new players to the directorate and turned the attention of incumbent firms offshore. The increasing numbers of directors with offshore rather than domestic linkages, are likely to have undermined the centrality of the traditional core and the cohesiveness of the business elite as a whole.

A crucial event occurred during this period, however: the financial crisis of 2007-08, which triggered a series of banking collapses, commencing with Northern Rock in September 2007 and climaxing with the bankruptcy of Lehman Brothers a year later.<sup>3</sup> The crisis endangered financial institutions but also other firms’ access to funding, with interbank lending collapsing from August 2007. Problems regarding bank solvency, a decline in the availability of credit and damaged investor confidence had an impact on stock markets, where securities suffered large losses from late 2007 to early 2009. The financial crisis, which led to a severe economic recession, should have affected the governance networks from late 2007 onwards. Did the crisis in particular weaken the position of banks among interlocking directorates? How did firms adapt their governance structure to this difficult context?

### **3. Methods and data**

The dataset includes the 100 largest domestic firms listed on the Paris and London Stock Exchanges in 2006. Firms are selected according to their capitalization and their nationality (French or British respectively). The capitalization criterion may be discussed, as the

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<sup>3</sup> For a chronology, see Bank of England (2008).

capitalization of a company may depend on financial markets as well as on its size and performance. However this criterion appears more relevant than turnover or employees, which are very specific to economic sectors. In the case of France, the data set provides information on board members, who sit in *conseils d'administration*, *directoires* or *conseils de surveillance*, and on CEOs, when they do not sit on boards, at 31 December 2006, 2007, 2008, 2009 and 2010. In the case of the United Kingdom, all members of boards of directors on these dates are included.

The data thus exclude ArcelorMittal, Dexia and STMicroelectronics, International Power, whose owners are offshore, state-owned companies, as SNCF and La Poste in France or Royal Mail in the UK, family-owned companies, as Auchan, nor mutual companies or savings banks. The Royal Bank of Scotland and Lloyds Bank, partly nationalized in 2008 but remain listed on the London Stock Exchange, are included. Consequently, we are not able to extend our conclusions to “the largest companies”. Nonetheless these criteria are a guarantee of homogeneity, regarding the way boards are composed. For the recruitment of board members in state-owned or family-owned companies obey different rules. Further, we selected firms whose capitalization was over €1 billion. In a larger data set it would have been more difficult to compare firms because of their too dissimilar sizes.

We mainly focus on interlocking directorates, utilizing social network analysis in Pajek (see de Nooy et al., 2005). This two-mode network can be transformed into one-mode networks of firms or of directors, which are undirected. Two main features of networks are analyzed: their cohesion and their connectivity. Cohesion depends on the number of ties. Density translates the number of ties divided by the maximum number of potential ties. The larger a network, the less dense it is in general. In addition, we analyze the nodes in the networks that stand at the most advantageous positions. In intercorporate networks, degree centrality means the total number of interlocking directorates of a company. In an undirected network, a high degree centrality

may translate strong activity as well as strong attractiveness. In the case of individuals, degree centrality means the total number of board members with whom they may sit according to their appointments. A high degree centrality may then mean numerous appointments and a high status within the business elite. It also indicates a wide personal network. Connectivity considers the breadth of a network. Component analysis enables to assess the extent to which a network is interconnected. A component is a subset of nodes, which are interconnected thanks at least to one path. If there were numerous small components among firms, it would signify a weak capacity of communication and coordination. The average distance among nodes can be calculated only inside a component: it refers to the mean of the shortest paths between each pairs of nodes. A short average distance among firms by means of director interlocks may suggest an efficient communication network.

#### **4. The dynamics of interlocks between 2006 and 2010**

##### The general evolution of interlocks

As predicted by the convergence argument, the density of the French interlocks decreased between 2006 and 2008, but then increased between 2008 and 2010 in the wake of the financial crisis, whereas the density of the United Kingdom network, generally declined throughout (see Tables 1 and 2). In the case of France, the density in the bipartite network decreased from 1.26% in 2006 to 1.21% in 2008, and increased to reach back its initial level at 1.26% in 2010. The same evolution can be measured in the network of firms, with a density decrease from 6.47% in 2006 to 5.67% in 2008, and an increase to 6.95% in 2010, and in the network of directors, with a decrease from 1.66% to 1.53% and a consecutive increase to 1.57%. Density increased considerably between 2008 and 2009, following the financial crisis, in particular among firms (7.48% in 2009) and among directors (1.64%). By contrast in the United Kingdom, the density of the bipartite network was little changed throughout the period at 1.12%, half the density of the French network. But this stability was not echoed in the firm and director networks; a

decline is evident in the UK firm network from 2.67% to 2.53% and in the director network from 1.25% to 1.21%. A single exception to these trends occurs in 2007, where firm density increased as a consequence of a dip in total number of directors that year.

In France, the average path distance in the main component of each network followed a similar trend to density but in the United Kingdom a steady increase in distance was evident. In the French bipartite network, average path distance increased from 6.86 in 2006 to 7.19 in 2008, then decreased to 6.83 in 2010. In the French firm network, it fluctuated from 2.69 to 2.82 2006-08, then 2.63 in 2010 and, among board members, from 3.51 to 3.67, then 3.49. It similarly reached its minimum in 2009, just after the financial crisis (6.73 in the bipartite network, 2.60 among firms, and 3.43 among directors). In the UK bipartite network, the average path distance, initially a third greater than the French average, increased steadily from 9.11 in 2006 to 11.46 in 2010, two thirds greater than the French average. In the UK firm network, it increased from 3.82 to 4.98 and, among directors, from 4.63 to 5.81, again doubling in distance from the French average.

[Insert Tables 1 and 2 about here]

#### Diespersion of the intercorporate network

The French intercorporate network experienced a declining centralization, particularly between 2006 and 2007, while centralization within the UK firm network remained constant throughout the period (see Tables 1 and 2). In France, degree centralization halved from 0.21 in 2006 to 0.11 in 2010. The hierarchy of firms in terms of degree distribution completely changed. In 2006, the most central firms were BNP, Lagardère and Veolia. By 2010, BNP had lost one third of its ties, and Lagardère and Veolia half (see Table 3). More generally, the top firms in the 2010 hierarchy exhibit fewer ties than the top firms in 2006, though seven of the sixteen most central firms in 2006 remained so in 2010. In the United Kingdom, degree centralization

remained constant. Eight of the sixteen most central firms in 2006 remained most central in 2010, generally losing one quarter of their ties to other firms (see Table 4).

Among the most central firms in France in 2006, we mainly find financial institutions (BNP, Eurazeo) and firms linked to public markets, specialized in sectors like defense (Lagardère, Thales), water services (Veolia) or building industry (Bouygues). Financial institutions appear less central in 2010. Most central firms are then mainly industrial firms (Areva, Saint Gobain, Lafarge) and energy providers (GDF Suez, Total, EDF). BNP is only ranked fifth according to degree distribution. If its closeness centrality is slightly the same as in 2006, its betweenness noticeably diminished. In the UK, the most central firms in 2006 are predominantly resources (BP, Rio Tinto, Anglo American), financial (Lloyds, Prudential) or energy distributors (BG Group, Centrica, National Grid). In 2010 financial firms (Lloyds, Prudential, Standard Chartered) and manufacturers are more predominant (Tate & Lyle, Unilever, Astrazeneca).

[Insert Tables 3 and 4 about here]

While interlocks decreased in general in France between 2006 and 2008, then recovered after this, multiple relations dropped acutely 2006-10 (see Table 1). The network lost more than half of its multiple interlocking directorships during the period, despite a brief reversal in 2009. In the United Kingdom, the number of multiple ties fluctuated around eight during the period, a quarter of the French level.

#### A relative disintegration of the business elite core

The hierarchy among French directors is less stable than the hierarchy among firms. While Henri Proglia (Veolia), Michel Pébereau (BNP) and Georges Chodron de Courcel (BNP) remained among the most central directors during the period, their degree centrality dropped. Only four of the eighteen most central directors in 2006 remained in 2010 (see Table 4). In the

United Kingdom, again only four of the eighteen most central directors in 2006 remained in 2010 and the degree centrality dropped 6.

[Insert Tables 3 and 4 about here]

In order to apprehend the evolution of the core of the corporate elite core, we examine the main interlockers, who sit in at least three boards, and on the multiple relations among them, which represent at least two common board memberships. This implies a restriction to the strong ties inside the business elite core. A unique common board membership may be contingent, whereas multiple common board memberships represent an opportunity to coordinate and thus better translate the social structure of the corporate elite.

Figures 1 to 4 present the evolution of the French core during the period. Looking first at the years 2006, 2008 and 2010 a general trend of fragmentation and reduced transitivity can be seen. In 2006, the network included 10 components (of at least two nodes), 11 in 2008, and 8 in 2010. The most visible change is the fragmentation of the main component. In 2006, the main component gathered one third of the 65 main interlockers. Between 2006 and 2008, this split into four components. The remaining main component lost most of its members and only comprised 11% of the 57 interlockers in 2008. In fact, only Michel Pébereau, Jean-Louis Beffa, Alain Joly and Hélène Ploix remained; they were joined by the earlier separate component of Anne Lauvergeon and Thierry de Rudder. The process of fragmentation is thus not linear, and it mainly relates to the biggest component. The other components remained relatively stable between 2006 and 2008. The disintegration of the main component led to a greater homogeneity of components regarding the directors' profiles – former bureaucrats, heirs or managers. Between 2008 and 2010, half of the components - the smallest - disappeared and were replaced by three new pairs of nodes. Moreover, there remain no more cliques in 2010 among interlockers, which may translate a decreasing transitivity among interlockers. Against this

general trend of dissipation of the core of the French network, a temporary reconsolidation is evident in 2009 (see Fig. 3). The main component agglomerates with the addition of new multiple directors and new cliques appear. This recombination could result from a process of mobilization, which could also explain the increasing cohesion of interlocks after the financial crisis.

[Insert Figures 1, 2, 3 and 4 about here]

The core of the UK director network displays a similar trend of reducing size and transitivity through the period but this comprised more the dissolution of a single component than fragmentation (see Figures 5 to 8). In fact, while the UK core is much smaller than the French, it is more concentrated; 44% of the UK main interlockers belonged to the main component in 2006 and more than a third remained in it by 2010. In fact, density increased from 2007 to 2009 and there was a peak in degree centrality in 2007. Further, the trend of a gradual weakening of the main component belies a more radical dynamic: between 2006 and 2008 the main component was almost completely replaced by new multiple directors.

## **5. Discussion and conclusion**

The convergence argument claims that French capitalism would be more and more similar to the Anglo-American capitalism, itself becoming increasingly transnational. From this argument, a decrease of interlocks could be expected in the United Kingdom and France since the last waves of privatizations and the consecutive rising share of institutional investors in the capital of French companies. A competing argument, linked to the social reproduction theory, rather predicts the stability of national models and so of corporate networks. Considering the recent evolution of corporate networks, both arguments may appear pertinent.

From 2006 to 2010, a general trend of reduced density and the diminished centrality of banks is evident in both the United Kingdom and France, but this trend was punctuated. From 2006

to 2008, the density of interlocking directorates in France decreased, as it had since the early 2000s (Dudouet & Grémont, 2010). The corporate network became less centralized and the network of main interlockers more fragmented. However in 2008, just after the financial crisis, this tendency somewhat reversed. Between 2008 and 2009, the density of French interlocks rose, whereas the number of isolates as well as the average distance among firms decreased. Among main interlockers, multiple ties rocketed, as did their degree centralization. Between 2009 and 2010, the evolution of interlocks respected anew the previous tendency measured before the crisis: a decreasing cohesion of the intercorporate network and a relative fragmentation among main interlockers. As a consequence, apart from the evolution between 2008 and 2009, the network experienced a decreasing cohesion and centralization.

In the United Kingdom, density of the corporate network in general steadily diminished and path distance steadily increased 2006-10. But the cohesiveness of the main interlockers increased in terms of density 2007-09, together with a peak in degree centralization in 2007. Moreover, the apparent steady diminution of the size and transitivity of the main component among multiple interlockers, masks a complete turnover in its composition in 2006-08. Again, this could be explained through a process of social mobilization in response to the financial crisis, which impacted heavily in the United Kingdom in 2007.

One could have expected other effects from the financial crisis. It could have on the contrary induced sparser intercorporate networks, due in particular to a lesser intermediation role of financial institutions, firstly affected by the crisis. However, it triggered exactly the opposite phenomenon. The density of interlocks soared, reflecting a strong capacity of mobilization among business leaders. This may suggest that even if interlocks decrease on the long term, those leaders keep an unaltered capacity to coordinate in case of danger or uncertainty. Indeed there is evidence of both the British and, particularly, the French business elites comprising small worlds interconnected through multiple linkages based on similar social background and

education, friendship ties or other social ties cultivated in various organizations such as clubs and think tanks (see Bond 2004, Comet and Finez, 2010, Cronin 2012, Finez and Comet, 2011).

Moreover, one must be cautious when interpreting the dynamics of interlocking directorships. Their evolution may not be linear and rather follow a process of increasing and then decreasing centralization over time similar to the “spinning top model” (Lazega et al., 2006). The relative fragmentation of main interlockers may, for instance, be partly due to a few very central directors, renouncing appointments, like Louis Schweitzer John Buchanan and, to a lesser extent, Claude Bébéar. As status and seniority are crucial to be selected in the boards of the biggest companies, centralization may tend to increase for a while. Reversely, the departures of the most central senior directors from the informal elite may be harmful to the cohesion of the network and engender a decreasing centralization. This might have contributed to the observed relative balkanization of the corporate elite core. Further analyses should be performed to test these hypotheses.

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Table 1: Characteristics of interlocking directorates in France 2006-10

	2006	2007	2008	2009	2010
<b>Bipartite network</b>					
N	1126	1157	1184	1263	1204
Density (%)	1.26	1.22	1.21	1.27	1.26
Average distance in the main component	6.86	6.99	7.19	6.73	6.83
<b>Network of firms</b>					
N	100	101	101	99	99
Density (%)	6.47	6.04	5.67	7.48	6.95
N in the main component	90	90	90	93	91
Average distance in the main component	2.69	2.75	2.82	2.60	2.63
Degree centralization	0.21	0.15	0.14	0.14	0.11
<b>Network of directors</b>					
N	1026	1056	1083	1164	1105
Density (%)	1.66	1.60	1.53	1.64	1.57
Average distance in the main component	3.51	3.56	3.67	3.43	3.49
<b>Network of main interlockers*</b>					
N	65	60	57	66	55
Density (%)	15.8	14.4	14.5	14.0	15.9
Degree centralization	0.18	0.15	0.14	0.22	0.16
Multiple ties	47	32	24	39	21
Average distance in the main component	2.14	2.23	2.22	2.19	2.19

\*Directors appointed to more than two boards.

Table 2: Characteristics of interlocking directorates in the UK 2006-10

	2006	2007	2008	2009	2010
<b>Bipartite network</b>					
N	1084	1074	1092	1098	1044
Density (%)	1.12	1.13	1.11	1.11	1.12
Average distance in the main component	9.11	9.7	10.08	11.05	11.46
<b>Network of firms</b>					
N	100	100	100	100	100
Density (%)	2.67	2.87	2.61	2.51	2.53
N in the main component	73	82	81	83	82
Average distance in the main component	3.82	4.11	4.33	4.74	4.98
Degree centralization	0.04	0.04	0.04	0.03	0.05
<b>Network of directors</b>					
N	984	974	992	998	944
Density (%)	1.25	1.24	1.22	1.20	1.21
Average distance in the main component	4.63	4.93	5.12	5.61	5.81
<b>Network of main interlockers*</b>					
N	56	53	46	44	50
Density (%)	7.7	8.1	9.6	9.7	8.5
Degree centralization	0.11	0.12	0.07	0.06	0.15
Multiple ties	13	8	13	9	7
Average distance in the main component	3.78	5	5.2	4.6	3.78

\*Directors appointed to more than two boards.

Table 3: The largest French firms by degree centrality in 2006 and 2010

	2006				2010		
	degree	closeness	betweenness		degree	closeness	betweenness
<b>BNP</b>	21	0.45	0.07	AREVA	17	0.44	0.06
<b>LAGARDERE SCA</b>	21	0.44	0.07	<b>SAINT-GOBAIN</b>	17	0.44	0.04
VEOLIA ENVIRONNEMENT	18	0.44	0.05	<b>GDF SUEZ</b>	16	0.44	0.04
ACCOR	17	0.43	0.05	<b>TOTAL SA</b>	16	0.44	0.04
THALES SA	17	0.42	0.05	<b>BNP</b>	15	0.44	0.05
IMERYS	16	0.41	0.06	LAFARGE	14	0.44	0.05
<b>SUEZ</b>	15	0.44	0.04	EDF	14	0.42	0.05
<b>TOTAL SA</b>	15	0.42	0.06	NEXANS	14	0.41	0.05
BOUYGUES SA	15	0.42	0.04	ALSTOM	14	0.41	0.03
SCOR SA	15	0.42	0.04	LVMH	14	0.41	0.03
<b>RENAULT</b>	14	0.42	0.04	CARREFOUR	14	0.41	0.03
EURAZEO	14	0.39	0.07	<b>AIR FRANCE - KLM</b>	13	0.42	0.02
<b>AIR FRANCE – KLM</b>	13	0.40	0.03	<b>RENAULT</b>	13	0.41	0.04
SANOFI-AVENTIS	13	0.39	0.02	BOLLORE	13	0.40	0.04
<b>SAINT-GOBAIN</b>	12	0.41	0.02	<b>LAGARDERE SCA</b>	12	0.40	0.03
AIR LIQUIDE SA	12	0.39	0.02	SUEZ ENVIRONNEMENT	12	0.40	0.02

Table 4: The largest UK firms by degree centrality in 2006 and 2010

	2006				2010		
	Degree	Close-ness	Between-ness		Degree	Close-ness	Between-ness
<b>VODAFONE GROUP</b>	20	0.23	0.06	TESCO	20	0.22	0.12
BP	18	0.27	0.12	STANDARD CHARTERED	18	0.23	0.12
<b>LLOYDS BANKING GROUP</b>	18	0.26	0.10	UNILEVER	16	0.23	0.12
<b>RIO TINTO</b>	18	0.26	0.07	<b>AVIVA</b>	14	0.23	0.08
<b>AVIVA</b>	16	0.25	0.06	<b>BG GROUP</b>	14	0.21	0.14
ANGLO AMERICAN	14	0.23	0.04	<b>LLOYDS BANKING GROUP</b>	14	0.23	0.15
<b>BG GROUP</b>	14	0.25	0.09	<b>RIO TINTO</b>	14	0.21	0.05
CENTRICA	14	0.24	0.07	TATE & LYLE	14	0.18	0.18
JOHNSON MATTHEY	14	0.22	0.08	<b>VODAFONE GROUP</b>	14	0.18	0.05
<b>PRUDENTIAL</b>	14	0.23	0.04	<b>ASTRAZENECA</b>	12	0.21	0.02
REXAM	14	0.22	0.02	<b>BUNZL</b>	12	0.19	0.04
<b>ASTRAZENECA</b>	12	0.22	0.01	COMPASS GROUP	12	0.20	0.07
BAE SYSTEMS	12	0.22	0.03	LOGICA	12	0.22	0.09
<b>BUNZL</b>	12	0.19	0.06	MONDI	12	0.20	0.12
KINGFISHER	12	0.23	0.03	<b>PRUDENTIAL</b>	12	0.22	0.11
NATIONAL GRID	12	0.21	0.01	TAYLOR WIMPEY	12	0.20	0.11

Table 4: Degree distribution among the most central French directors in 2006 and 2010

	<b>2006</b>		<b>2010</b>
<b>Henri Proglio</b>	112	Jean-Dominique Comolli	74
<b>Georges Chodron de Courcel</b>	103	<b>Henri Proglio</b>	70
Louis Schweitzer	75	<b>Michel Pebereau</b>	70
Charles de Croisset	69	Antoine Bernheim	69
<b>Michel Pebereau</b>	68	Patricia Barbizet	66
Daniel Lebegue	63	Robert Peugeot	66
Bruno Bezar	61	<b>Georges Chodron de Courcel</b>	65
Jean-Rene Fourtou	59	Jean-Martin Folz	64
Francois de Combret	59	Francois David	63
Franck Riboud	55	<b>Ernest-Antoine Seilliere</b>	62
Lindsay Owen-Jones	54	Aldo Cardoso	60
<b>Ernest-Antoine Seilliere</b>	54	Jean Laurent	60
Baudouin Prot	53	Helene Ploix	58
Philippe Camus	50	Thierry Desmarest	56
Serge Tchuruk	49	Jean-Cyril Spinetta	55
Anne Lauvergeon	49	Amaury de Seze	55
Augustin de Romanet de Beaune	48	Colette Lewiner	55
Claude Bebear	48	Denis Kessler	54

Table 5: Degree distribution among the most central UK directors in 2006 and 2010

	<b>2006</b>		<b>2010</b>
<b>Sir John Reginald Hartnell Bond</b>	51	Rudolph Harold Peter Markham	46
Dr John Gordon St Clair Buchanan	46	<b>Sir John Reginald Hartnell Bond</b>	39
Sir John Thomas Parker	44	Carolyn Julia McCall	38
John Silvester Varley	42	<b>Jan Harm Christiaan Du Plessis</b>	36
Sir Julian Michael Horn-Smith	41	Baroness Sarah Elizabeth Mary Hogg	34
<b>Douglas Jardine Flint</b>	39	Colin Richard Day	34
Henry Michael Pearson Miles	39	Gareth Richard Bullock	34
Penelope Lesley Hughes	39	Lord Evan Mervyn Davies	34
Ann Frances Godbehere	38	<b>Douglas Jardine Flint</b>	33
<b>Jan Harm Christiaan Du Plessis</b>	36	James Frederick Trevor Dundas	33
<b>Philippe Leslie Van De Walle</b>	36	Valerie Frances Gooding	33
Nicholas Charles Edward Land	35	Andrew Thomas Higginson	32
Stuart John Chambers	35	Sir Richard John Broadbent	32
Cynthia Blum Carroll	33	<b>Philippe Leslie Van De Walle</b>	29
Andrew George Inglis	32	Prof Wim Dik	29
Brendan Robert Nelson	32	Kenneth John Hydon	28

Fig. 1: Double common board memberships among French main interlockers in 2006

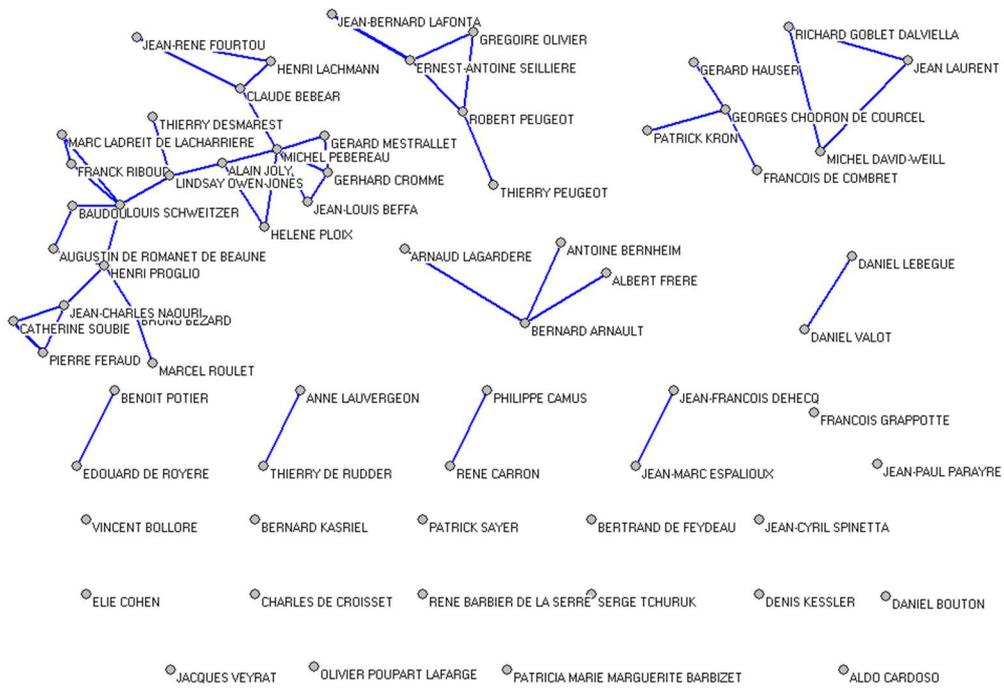


Fig. 2: Double common board memberships among French main interlockers in 2008

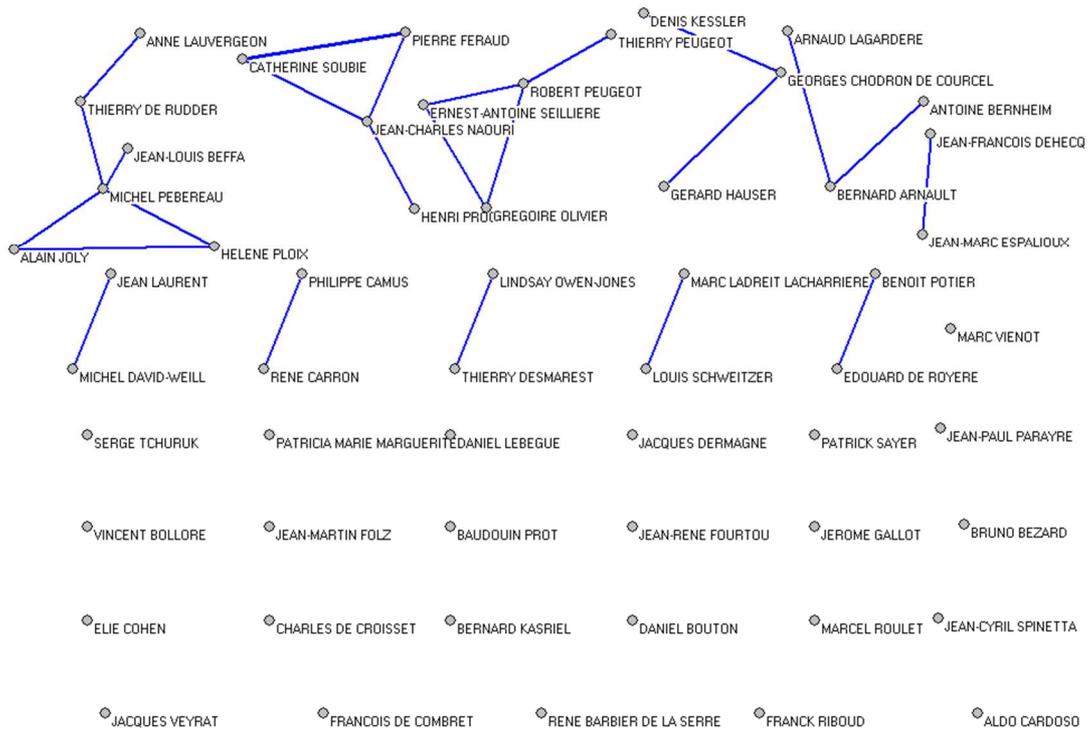


Fig. 3: Double common board memberships among French main interlockers in 2009

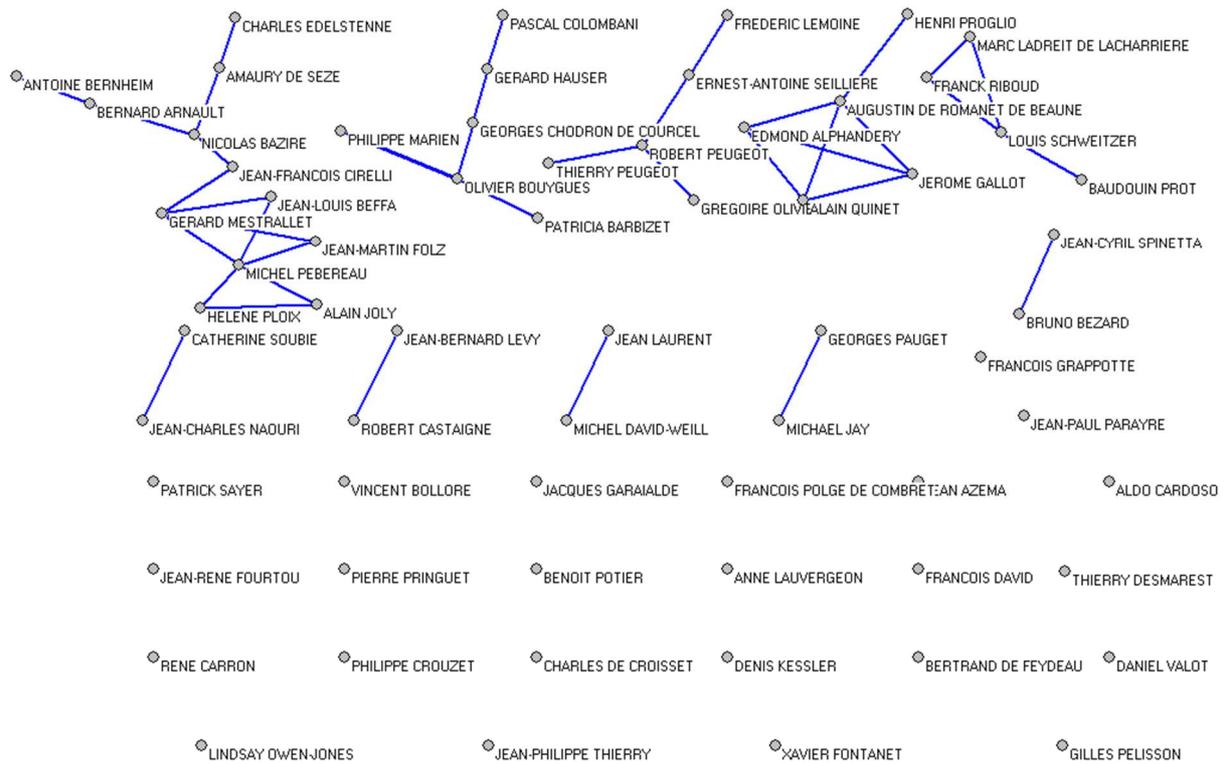
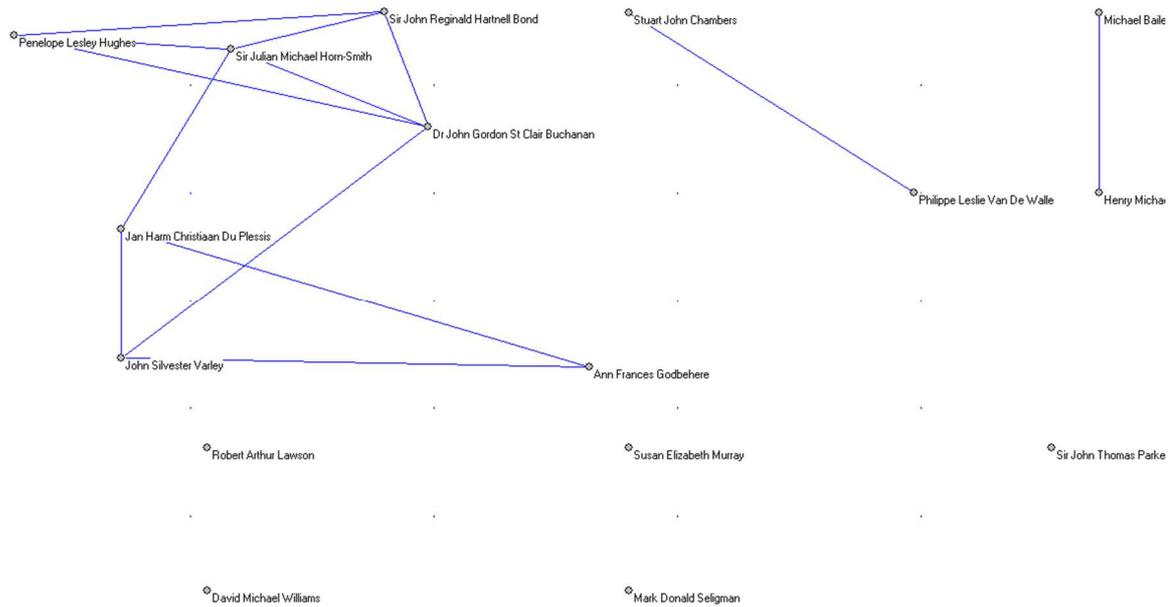


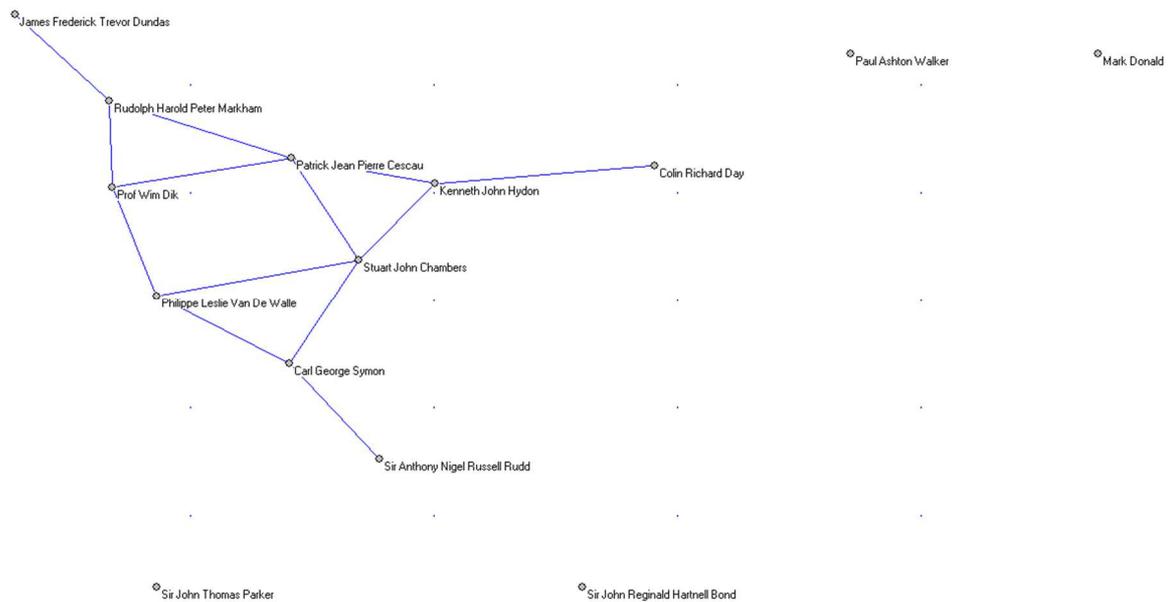
Fig. 4: Double common board memberships among French main interlockers in 2010



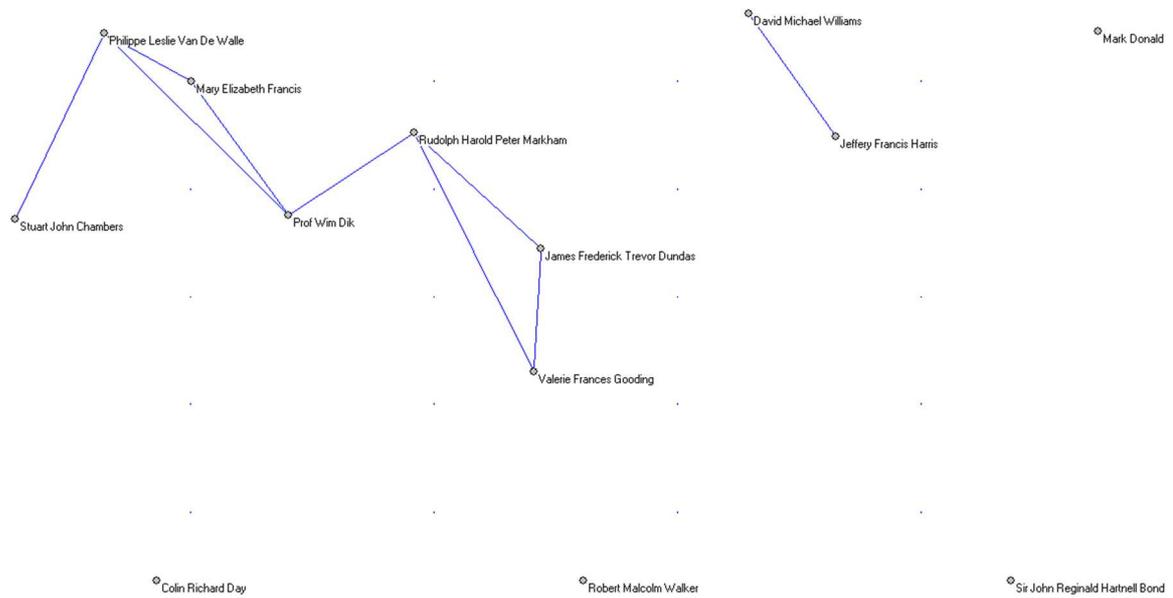
*Fig. 5: Double common board memberships among UK main interlockers in 2006*



*Fig. 6: Double common board memberships among UK main interlockers in 2008*



*Fig. 7: Double common board memberships among UK main interlockers in 2009*



*Fig. 8: Double common board memberships among UK main interlockers in 2010*

