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The Few Leading the Many: Foreign Affiliates and Business Cycle Comovement

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Non-technical Summary

A few large firms have disproportionate influence on aggregate economic outcomes. Nokia in Finland, Dell in Ireland, Samsung and Hyundai in South Korea are often cited as examples of the dependence of nations on the economic activities of a few firms. Even in a country as large as the U.S., the sales of the top 50 firms represent about one fourth of the GDP.¹ Beyond these examples, Gabaix (2011) has theorized and shown that U.S. aggregate fluctuations are greatly influenced by shocks to large firms. di Giovanni & Levchenko (2011) and di Giovanni, Levchenko & Méjean (2011) also provide systematic evidence of the key role of large firms in aggregate fluctuations. Parallel contributions point to striking heterogeneity between large and small firms. They adjust labor differently along the cycle (Moscarini & Postel-Vinay 2009), they have different pricing strategies (Goldberg & Hellerstein 2009), and different innovation responses (Mansfield 1962).

This article first shows that large firms also differ from smaller firms in terms of their ownership structure. In France for instance, the share of foreign affiliates is much larger among large firms than among smaller ones. Using detailed firm-level data from the French statistical office that include the balance sheet and the nationality of all firms located in France, we show that majority-owned affiliates of foreign firms in France represent no more than 5% of the total number of French firms, but their contribution to the economic activity of France and its regions is substantial: they account for 23% of employment, 32% of value added, and half of total trade. Furthermore, we show that the spatial distribution of foreign affiliates is very uneven across regions. We then exploit this heterogeneity to examine the impact of the presence of foreign affiliates on the synchronization of international business cycles.

Foreign affiliates are likely to be closely linked to their country of ownership, but also to the activities of their parent company (Desai & Foley 2004). Because of both their size and their

¹For figures see Gabaix (2011) and di Giovanni & Levchenko (2011). The trade literature has also stressed that the lion's share of international trade is done by a few large firms (Bernard & Jensen 1997, Mayer & Ottaviano 2008).

linkages, foreign affiliates are likely to transmit shocks across borders and affect the correlation of business cycles between their home country and host locations. Using the micro-level data mentioned above and macroeconomic series of the GDPs of French regions and countries, we show that the few foreign affiliates located in France are a major determinant of the business cycle co-fluctuations of French regions and the country of ownership of the affiliates located in these regions. In our analysis, the co-fluctuation is measured by the correlation of GDP growth rates between region country pairs. We use different indicators to measure the presence of foreign affiliates. Our preferred one is the share of foreign affiliates in regional employment. Although value added may be manipulated by multinational firms for tax purposes, we also use the value-added share of foreign affiliates in a region's GDP as a robustness check. Our last alternative measure is the intensity of intra-firm trade, made up by the foreign affiliates. The analysis reveals that the activities of foreign affiliates increase the comovement between their host regions and their country of ownership. This effect is robust to the inclusion of other determinants pointed out in the literature, such as bilateral trade or the similarity of production structures (see Frankel and Rose 1998 and Imbs 2004). Region- or country-specific characteristics are also controlled for by introducing region and country fixed effects. Importantly, the inclusion of gravity variables does not affect the significance of the coefficient on the foreign affiliate presence, while bilateral trade is no longer robust in such a specification.

Information on intra-firm exports by foreign affiliates to their parents allows us to carefully identifying the nature of the linkages between the French affiliate and its foreign parent. The transmission of the shocks is dependent on whether the affiliate is or not vertically integrated into the production network of its parent. In the case of vertical integration, any shocks will transmit to the each stage of the international chain of production. We show that intra-firm trade in intermediate inputs appears to be a significant channel of influence of business cycle comovement.

Abstract

This paper uses micro-data on balance sheets, trade, and the nationality of ownership of firms in France to investigate the effect of foreign multinationals on business cycle comovement. We first show that foreign affiliates, which represent a tiny fraction of all firms, are responsible for a high share of employment, value added, and trade both at the national and at the regional levels. We also show that the distribution of foreign affiliates across regions differs with the nationality of the parent. We then show that foreign affiliates increase the comovement of activities between their region of location and their country of ownership. We find that intra-firm trade in intermediate inputs is a significant channel of influence of business cycle comovement. These findings suggest that a non-negligible part of business cycle comovement is driven by a few multinational companies, and that the international transmission of shocks is partly due to linkages between affiliates and their foreign parents.

JEL Classification: F23, F12, F4, F41.

Keywords: Granularity, Business Cycles, Multinational Firms, Intra-firm Trade.



Filiales Etrangères et Synchronisation des Cycles Economiques

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Résumé non technique

Une part importante des activités économiques est le fait d'une poignée de très grandes entreprises. Nokia en Finlande, Dell en Irlande, ou Samsung et Hyundai en Corée du Sud sont des exemples souvent cités pour souligner l'influence qu'ont quelques entreprises sur les agrégats macroéconomique des pays. Au sein même d'un pays tel que les Etats-Unis, les 50 plus grandes firmes comptent pour près du quart du PIB. Au-delà de ces exemples, de récents articles ont mis en exergue le rôle clé de quelques très grandes entreprises dans les fluctuations agrégées (Gabaix 2011, di Giovanni et Levchenko 2011, et di Giovanni, Méjean, et Levchenko 2012). Quelques travaux ont de surcroît montré la singularité des comportements économiques des grandes entreprises, dans leurs décisions d'emploi, leurs stratégies de prix ou leur choix de R&D (Moscarini et Postel-Vinay 2011, Goldberg et Hellerstein 2009).

Dans cette étude, nous montrons premièrement que ces grandes entreprises se singularisent également par leur nationalité. En effet, en France, une large fraction des grandes entreprises est composée de filiales de groupes étrangers. A partir de données françaises sur l'emploi, la valeur-ajoutée, le commerce et la nationalité de la quasi-totalité des entreprises en France (hors services), nous montrons que les filiales étrangères représentent seulement 5% des entreprises, mais que leur contribution aux activités économiques de la France et de ses régions est substantielle : elles comptent pour 23% de l'emploi, 32% de la valeur ajoutée, et près de la moitié du commerce. Les données révèlent également que la contribution aux activités économiques et l'origine des filiales étrangères et très différentes selon les régions. Deuxièmement, nous exploitons cette hétérogénéité pour examiner l'impact de la présence de filiales étrangères sur la synchronisation internationale des cycles d'affaires.

En plus de leur importance dans les activités économiques, les filiales de groupes étrangers ont la particularité d'avoir des liens forts avec leur pays d'origine (Desai et Foley 2004). Ce lien particulier combiné à leur taille suggère que les groupes multinationaux offrent un canal de choix pour la propagation internationale des chocs et donc pour les co-fluctuations de cycles économiques. A partir des données individuelles d'entreprise décrites plus haut et de données macroéconomiques pour les régions françaises et 162 de pays, nous montrons que la poignée de filiales de groupes étrangers en France est un déterminant majeur de la co-fluctuation des

cycles économiques entre les régions françaises et le pays d'origine des filiales implantés dans ces régions. Notre mesure de co-fluctuation est la corrélation bilatérale entre la croissance du PIB de chaque région française avec la croissance du PIB des pays. Divers indicateurs sont utilisés pour mesurer la présence de filiales dans les régions : la part de l'ensemble des filiales dont le groupe est originaire d'un pays donné dans la valeur ajoutée des régions, la part dans l'emploi, ou l'intensité en commerce intra-firme réalisé par ces filiales avec leur pays d'origine. Notre analyse révèle que le niveau de co-fluctuation entre une région française et un pays donné est positivement corrélé à la présence dans la région de filiales dont les parents sont implantés dans le pays. Cette corrélation est valide si l'on contrôle pour la présence d'autres déterminants mis en avant dans la littérature pour expliquer les co-fluctuations tels que le commerce entre ces deux entités ou la similarité de leur structure productive (voir Frankel et Rose 1998 et Imbs 2004). Les spécificités propres de la région ou du pays (capturés dans notre analyse par des effets fixes région et pays) n'altèrent pas non plus cette corrélation. Un second résultat notable de notre analyse économétrique est que l'inclusion de déterminants géographiques dans nos régressions n'affecte pas le lien positif qui existe entre co-fluctuation et présence de filiales étrangères. Il convient enfin de noter que la présence de firmes multinationales se révèle être un déterminant statistiquement plus robuste que le niveau de commerce bilatéral.

L'information dont nous disposons sur les exportations intra-firmes des filiales étrangères vers leurs pays d'origine nous permet d'identifier précisément les liens existant entre les filiales et leurs parents. La transmission des chocs dépend de la structure du réseau à laquelle appartient la filiale. Si le groupe fragmente ses chaînes de production, un choc aura des répercussions sur chacune des étapes du processus de production. Il apparaît que le commerce intra-firme de bien intermédiaires (révélateur de l'intégration verticale des filiales) est un canal privilégié de transmission des chocs.

Résumé court

Nous utilisons des données individuelles d'entreprises sur le bilan, le commerce, et la nationalité des entreprises localisées en France pour examiner l'effet des multinationales sur la co-fluctuation des cycles économiques. Nous montrons d'abord que les filiales de groupes étrangers, bien que ne représentant qu'une infime partie des entreprises localisées en France, contribuent très largement à l'emploi, la valeur ajoutée et le commerce, à la fois au niveau national et au niveau régional. Nous montrons ensuite que la répartition des filiales étrangères est très hétérogène entre régions. Enfin, nous montrons que la présence de filiales étrangères dans une région augmente le co-mouvement des cycles d'affaire entre la région et le pays d'origine de celles-ci. Ces résultats suggèrent qu'une part non négligeable des co-fluctuations internationales des cycles économiques est le fait d'une poignée de firmes multinationales; et que la propagation internationale des chocs est en partie due aux liens existant entre les filiales et leurs parents.

Classification JEL : F23, F12, F4, F41.

Mots clés : Granularité, Cycles d'Affaire, Commerce Intra-firme.

The Few Leading the Many: Foreign Affiliates and Business Cycle Comovement²

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1. Introduction

A few large firms have disproportionate influence on aggregate economic outcomes. Nokia in Finland, Dell in Ireland, Samsung and Hyundai in South Korea are often cited as examples of the influence of a few firms on the economic activities of nations. Even in a country as large as the U.S., the sales of the top 50 firms represent about one fourth of the GDP.³ Beyond these facts, Gabaix (2011) has theorized and shown that U.S. aggregate fluctuations are greatly influenced by shocks to large firms. di Giovanni & Levchenko (2011) and di Giovanni et al. (2011) also provide systematic evidence of the key role of large firms in aggregate fluctuations. Parallel contributions point to striking heterogeneity between large and small firms. They adjust labor differently along the cycle (Moscarini & Postel-Vinay 2009), they have different pricing strategies (Goldberg & Hellerstein 2009), and different innovation responses (Mansfield 1962).⁴ We document that large firms differ also in terms of their ownership structure from smaller firms. More specifically, the share of foreign affiliates is substantially larger among large firms than among smaller ones. We then provide evidence that these few but large foreign affiliates give rise to (aggregate) business cycle *co-fluctuations*.

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³For figures see Gabaix (2011) and di Giovanni & Levchenko (2011). The trade literature has also stressed that the lion's share of international trade is done by a few large firms (Bernard & Jensen 1997, Mayer & Ottaviano 2008).

⁴A few theoretical papers advocate large firms actually behave differently from small firms (Shimomura & Thisse 2009, Parenti 2012). Neary (2009) suggests these superstar firms are (domestic or foreign) multinationals.

Majority-owned affiliates of foreign firms in France represent about 5% of the total number of French firms, but their contributions to the economic activities of France and its regions are substantial: they account for 23% of employment, 32% of value added, and half of total trade.⁵ Moreover, it is likely that their activities are closely linked to the environment in their source country and to the activities of their foreign parent company (Desai & Foley 2004). They might therefore affect the correlation of business cycles between their home country and host locations.

In order to analyze the effects of foreign affiliates on business cycle comovements, we need a dataset that identifies the firms and their source country carefully, as well as their share in economic activities. We rely on detailed firm-level data from the French statistical office that include the balance sheet and the nationality of all firms located in France. In particular, it gives information on majority-owned affiliates that are controlled by foreign groups. The data have also detailed information on their location in each of the 21 Metropolitan French regions. We combine this information to precise data on bilateral trade and intra-firm trade. We then aggregate the data at the level of the regions and construct the share of employment generated by foreign affiliates in each region and their intensity in both arm-length trade and intra-firm trade based on their nationality. We match then the data to a large cross-section of bilateral pairs of correlations between the growth rate in a French region's and a country's GDP. We thus relate the bilateral correlations to the importance of the activities of foreign affiliates from a particular country in the region. We therefore exploit the differences in business cycles across French regions and the correlation of regions' business cycle with the business cycles in other countries to study the determinant of business cycle comovement.

Our paper offers new insights that go beyond the findings of the literature. We contribute to the aforementioned literature on large firms by documenting an important dimension that has been overlooked; namely, their nationality and ownership. More specifically, we show that the majority-owned affiliates of foreign firms are large in French regions. In Alsace for instance, they account for 10% of the regional number of firms, half of total sales and value added and about 3/4 of international trade. We also show that more than 70% of trade is conducted intra-firm. Moreover, since our data track their nationality of ownership, we document that the distribution of the activities of foreign affiliates based on their source country is uneven across regions.⁶ We use this heterogeneity to identify the effect of foreign affiliates on business cycle correlations.

We contribute to the literature on business cycle fluctuation in at least three respects. First, while other studies have focused on the role of foreign direct investment (Jansen &

⁵These figures and all the next figures are computed for all sectors of the French economy but the service sector.

⁶The share of value added by US foreign affiliates in Haute Normandie is 5 times bigger than in Bretagne. The share of value added by Japanese foreign affiliates in Nord Pas-de-Calais is 3,000 times bigger than in Midi-Pyrénées.

Stokman (2006); Hsu, Wu & Yau (2011)), we measure the real activity of foreign affiliates and show that they have affected the comovement of economic activities significantly.⁷ The share of foreign majority-owned affiliates in regional employment is used to capture the presence of foreign affiliates in French regions. We show that the share of foreign affiliates' employment increases significantly the correlation between the regional growth in GDP and that of the country of ownership.⁸ The magnitude of the effect is economically meaningful: a ten percent increase in the share of foreign affiliates' employment is associated with a 0.7% percent increase in the correlation of business cycle. Beside the impact of foreign affiliates activities, our empirical analysis includes several other potential important sources of business cycle comovement, such as bilateral trade (Frankel & Rose 1998), sector specialization and intra-industry trade (Imbs 2004), distance and border (Clark & van Wincoop 2001) and demand and supply shocks.⁹ We show that the positive and significant impact of the activities of foreign affiliates remains robust. Interestingly, bilateral trade, which has been proven to be an important determinant in numerous studies appears to have a limited impact once we control for the activities of foreign affiliates. It is moreover not significant once we control for other covariates. In other words, we find the multinational linkage to be more robust than the trade linkage.

Second, we carefully identify the nature of the linkages between the French affiliate and its foreign parent. The transmission of the shocks is dependent on whether the affiliate is or not vertically integrated into the production network of its parent.¹⁰ In the case of vertical integration, any shocks will transmit to the each stage of the international chain of production (Burstein et al. (2008); Tesar (2008)). Our results are consistent with the findings of Burstein et al. (2008) who show that cross-border trade in inputs among firms which are part of vertically integrated production networks, is an important determinant of synchronization. We go beyond their findings by using more precise information on exports of foreign affiliates to their home country. The data capture both intra-firm trade and arm-length trade of foreign affiliates. We can moreover identify the type of product that is traded. Intra-firm trade in intermediate inputs appears to be a significant channel of influence.

A third contribution lies in the analysis of business cycle comovements between regions and

⁷On evidence of the effect of bilateral FDI on the comovement of OECD countries, see Jansen & Stokman (2006).

⁸Bergin, Feenstra & Hanson (2009) and Zlate (2010) also point to the transmission of economic shocks through the foreign activities of (in their case) U.S. multinationals.

⁹Beside the influent contribution of Frankel & Rose (1998), many papers find evidence that more bilateral trade between countries leads to more business cycle synchronization. See among others: Baxter & Kouparitsas (2005), Kose & Yi (2006), Calderon, Chong & Stein (2007), Inklaar, Jong-A-Pin & de Haan (2008). In a refinement of the literature, few papers advocate the specificity of trade in intermediate inputs or production sharing between countries Burstein, Kurz & Tesar (2008), di Giovanni & Levchenko (2010) Johnson (2012) and Ng (2010).

¹⁰See section 2 for a discussion of the theoretical mechanisms.

countries. We show that the regional business cycles within France are fairly pronounced. Clark & van Wincoop (2001) and Fatas (1997) show that the process of *European* economic integration has increased cross-border correlations. Their results highlight the importance of European country borders in explaining regional business cycles. We show that positive and close correlations of GDP growth rates are however not only a feature of adjacent regions, but can be observed for several region-country pairs sharing a multinational linkage.

We finally provide evidence that, on top of country and sector determinants of co-fluctuations emphasized in the literature, the characteristics of firms such as size and (foreign) ownership matter to understand business cycle comovement.¹¹

The remainder of this paper is structured as follows. Section 2 provides a discussion of the source of the influence of foreign affiliates on business cycle correlations. Section 3 describes of the data and the construction of the bilateral database. In section 4, we provide four sets of stylized facts that show (i) the importance of foreign affiliates in regional economic activities, (ii) the strength of vertical linkages between foreign affiliates and their parent country (iii) the spatial distribution of investors in French regions based on their nationality, and (iv) the heterogeneity in the correlations between the GDP growth of French regions and countries. Section 5 describes the empirical methodology and discusses the construction and sources of the main empirical variables. In section 6, we present the econometric results. Section 7 concludes.

2. Sources of Influence

Most works looking at the determinants of business cycles were originally motivated by the possibility of an endogenous optimal currency area. Frankel & Rose (1998) argue that more integration leads to a greater business cycle synchronization. From a theoretical point of view, more trade does not necessarily lead to comovement. It depends on the nature of shocks and the patterns of trade. For instance, productivity shocks should lead to a greater specialization of countries in a world of inter-industry trade, and thus less comovement. By contrast, in a world of intra-industry trade, the same shocks should have the opposite effects. A deeper discussion can be found in di Giovanni & Levchenko (2010). Similarly to trade, the link between the presence of foreign affiliates and business cycle comovement depends on the pattern of linkages between the parent and its affiliates and the nature of the shocks. However, since we now look at firms, a third element of influence matters, namely the size of the foreign affiliates. In order to understand the role of foreign affiliates in the synchronization of business cycles, we need first to establish the conditions under which the shocks are transmitted from the parent to the affiliates. We

¹¹This is in line with Johnson (2012) conclusion that models should capture more accurately the microstructure of trade relationships, and in particular the concentration of multinational firms, to better replicate international business comovement.

will then explain the transmission to the economic aggregates and explain the comovement of business cycles.

Assume the two extreme cases of international production network that are either vertically or horizontally integrated. Trade in intermediate goods within the network of a multinational firm is characteristic of a vertically integrated network. This firm fragments its production process across geographic space. In such cases, any demand shocks will transmit to each stage of the chain, inducing strong linkages between the activities of the parents and the affiliates. A productivity shock or a technology shock may have similar consequences. If the network of firms is integrated horizontally, the foreign affiliates produce for the local market, and a local demand shock to the parent or to the affiliates should have no effect on one or the other. The reason is that in this extreme case, the production of the affiliates and the parent are independent. A positive correlation of activities would simply reflect that demand shocks for the parents and the affiliates are correlated. In the case of productivity or technology shocks, the impact on the correlation of activities is unclear. One possibility is that the parents which receive a technology shock transfer the technology to their affiliates. This would lead to a positive correlation of economic activities. Recent evidence provided by Ramondo, Rappoport & Ruhl (2011) shows vertical relationships between parents and affiliates without intra-firm flows. They suggest multinational firms transfer intangible inputs through the production chain. Such transfer could also be the source of linkages between parents and affiliates. In the same vein, Atalay, Hortacsu & Syverson (2012) provide evidence that, in the US economy, vertical linkages between firms are not primarily concerned with goods' trade. They show however that such structure allows firms to transfer intangible inputs.

Trade within the international production network or technology transfers explain the positive correlation of activities and the transmission of shocks between parents and affiliates. Assume now that this transmission takes place. We need to understand how the relation between the parent and the affiliates might influence aggregate business cycle comovement. We suppose first that the parent faces a macroeconomic shock. Examples of such macro-shocks include a new technology available in the country or a natural disaster. In such cases, if the foreign affiliates are sufficiently large, then their own activities have a non-negligible impact on the activities of their regions of location. The macroeconomic shock in the parent country is thus transmitted to foreign affiliates and to the foreign country, which induces a correlation of activities between the two economies.¹²

If the parent faces idiosyncratic shocks, then it must be large enough to drive output fluctuations in its domestic country. Gabaix (2011) shows that part of the US GDP slowdown in 1970 was driven by a 10-week-long strike at General Motors. If this type of

¹²For instance, the recent tsunami in Japan has strongly affected Japan's GDP and all Japanese firms and might also have affected the regions of location of their activities if their foreign affiliates were sufficiently large.

shock is transmitted to foreign affiliates, they might influence the fluctuation of GDP in their host country, given that they are also large enough.

In the remaining of the paper, we document that foreign affiliates are large enough in to impact their host region's GDP. We also provide reduced form evidence that the presence of foreign affiliates affects the correlation of the business cycles between their host regions and their country of ownership positively. Last, we show within firms vertical linkages are key to transmit shocks from one country to another.

3. The Data

Analyzing the correlation between business cycles comovement and foreign affiliates requires precise information on the location and activity of firms in France and on the link between the foreign parent and its affiliates. Our dataset is based on the aggregation of five confidential micro-level database that are provided by different French administrations. It describes value added, employment, and sales in French regions, as well as these regions' bilateral exports to and imports from 162 partner countries (with a distinction between intra-firm trade and arm-length trade of foreign affiliates) in the manufacturing, extractive, and agricultural industries. Within regions, this information is disaggregated based on the ownership status of the firm. Namely, we distinguish the economic activities of independent firms, French affiliates, and foreign affiliates. The data are matched to a cross-section of bilateral correlations of business cycles between 21 Metropolitan French regions and 162 countries. We briefly describe the main traits of our database in the next paragraphs. We give more details on the data and data processing in Appendix A.

To appreciate the size of the activity of foreign affiliates in France, we need data on sales, value added and employment. This data are taken from the *BRN* database (Bénéfice Réel Normal). The BRN is a compulsory report for all firms that have an annual turnover of more than 763,000 Euros. In order to identify the ownership status of the firms, we use the *LIFI* data which is an administrative dataset on the ownership and nationality of the parent company of firms located in France (Liaison Financière).¹³ According to the French statistical institute (INSEE), a firm is an affiliate of a group if the latter has the (direct or indirect) majority of voting rights. In our data, the share of voting rights owned by the parent firms varies from 50% to 100%. While the average share of voting rights is 86%, the median is 99%. We can therefore expect the parent company to exert a control on the decisions of the majority-owned affiliates. Moreover, having majority-owned affiliate ensures that the parent company is located in exactly one country. We classify firms based on their nationality. A French affiliate, which we denote by *MNE*, is located in France and owned by a French group. We denote the foreign affiliates by

¹³All firms with more than 500 employees or a turnover above one million Euros are asked about their ownership and financial structure. This includes their links with small businesses, which allows us to have information on small foreign affiliates.

FME, which are located in France and owned by a foreign group. We also keep track of their nationality whenever they are foreign-owned. The residual group of firms is denoted by *IND*. It is composed of firms that are located in France, but that are not owned at a majority by a group.

LIFI has also information on the main sector of activity of the parent and the affiliates at 4 digit. This allows us to identify whether the affiliates in France are in the same sector as their parent and gives us a crude method to distinguish between vertically and horizontally production networks (Buch, Kleinert, Liponner & Toubal (2005); Ramondo et al. (2011)). We moreover have precise information on trade of foreign affiliates. We use the EIIG firm-level survey (Échanges Internationaux Intra-Groupe) from the INSEE which provides a detailed geographical breakdown of the trade value of French firms at product level (HS4) and their sourcing modes – arm-length trade or intra-firm trade. The data are more precise than the data provided by the Bureau of Economic Analysis since we have information on arm-length trade of foreign affiliates in France. In addition, we can identify through the product dimension, whether the exports of a French affiliate to its origin country are in intermediate inputs.

Data on bilateral exports and imports of firms located in France are provided by French Customs. In 2004, 15% of the total number of registered firms are engaged in foreign trade (exports, imports or both). Yet the participation of firms to foreign trade differs to a great extent with their ownership structure and nationality. Among the three categories of firms defined above, the group of independent firms is far less internationalized than the group of affiliates of French firms. While we only find 9.6% of the total number of independent firms that are trading, there are respectively 36% of French affiliates and 78% of foreign affiliates that participate to foreign trade.

A firm located in France might have affiliates in different regions. When it comes to filling the BRN or the Customs' forms, the value added, sales or trade values are always allocated to the region of location of the headquarters. We follow the INSEE methodology and reallocate the value added, sales and trade of multi-plant firms across regions on the basis of employment measured at the establishment level.¹⁴ The statistics are then aggregated to the level of the Metropolitan regions for each year between 1999 and 2004.

Each cross-section is then combined with a vector of correlation of the business cycles between a French region r and a partner country c . We construct the correlation between each of the 21 regions and 162 partner countries over the 1990-2006 period.¹⁵ The data on regional GDP are taken from the INSEE while the data on countries' GDP are taken from the World Bank. The database is completed with the total exports and imports of

¹⁴In our sample, only 1.8% of firms are multi-plant and multi-region. Yet these firms account for 9.8% of total employment.

¹⁵The correlation of the cycles between region r and country c is computed either as the correlation in the annual growth rates or as the correlation of HP-filtered GDPs.

the partner countries, that we take from the Direction Of Trade Statistics (DOTS).¹⁶

4. The Key Role of Foreign Affiliates

As discussed in Section 3, there are two necessary conditions for business cycles to be transmitted across borders by multinational firms. First, the activities of the parent and foreign affiliates must be positively correlated. Second, foreign affiliates must be large enough to affect aggregate fluctuations in their host regions. The first condition was recently documented by Desai and Foley (2004) who show a positive correlation between the activity of parents and foreign affiliates. There is also a large literature on intra-firm trade which shows that parent companies organized their production at a global scale using their networks of foreign affiliates (Helpman 2011). At first sight, the second condition is less obvious. The first set of facts provide evidence on the importance of domestic and foreign affiliates for the output of their region of location. The second set of facts highlight the strength of vertical linkages between foreign affiliates and their parent country.

In the empirical analysis, we use French regional data to measure the correlation between the presence of multinationals and business cycle comovement. Thus, we need some heterogeneity across regions to identify our econometric model. The third set of facts show that there are disparities across regions in i) the intensity of the production of foreign multinational affiliates, ii) the origin of those foreign affiliates, and iii) in the pattern of aggregate co-fluctuations. Last, we show the heterogeneity in the correlations between the GDP growth of French regions and their partner countries.

Facts I: the few leading the many. It is well documented that multinational firms represent only a tiny fraction of the total number of firms. However, the aforementioned literature has emphasized that even a few firms may contribute substantially to GDP and employment. We aim to show that the affiliates of foreign firms explain a non-negligible part of aggregate co-fluctuations despite their low number and because they are the largest firms.¹⁷

In Table B.1, we provide a regional breakdown of the yearly contribution of independent firms, French affiliates, and foreign affiliates for six different outcomes: number of firms, employment, sales, value added and exports and imports. Perhaps the most informative feature of Table B.1 is the disproportionate role of affiliated firms - foreign affiliates in particular - in aggregate outcomes.

– Table B.1 about here –

¹⁶As detailed in Appendix A, values in dollars are converted into Euros using the euro-dollar exchange rate from Eurostat.

¹⁷Note that we do not focus the analysis on idiosyncratic shocks driving comovement.

There are at least three interesting facts that emerge from this table.

1. Foreign affiliates and French affiliates account for the vast majority of employment, sales and trade while they represent very few firms (5.2% of firms are FMEs and 17.2% are MNEs). French affiliates account for more than 41% of employment, sales and value added. Foreign affiliates account for about 1/3 of value added and sales and more than 22% of employment.
2. We find that trade is extremely concentrated among the group of foreign affiliates. On average, FMEs which represent 5.2% of the total number of firms account for about 47% of exports and more than 56% of imports. The contribution of French affiliates to international trade is also sizeable. They account for one third of French imports and 40% of French exports.
3. The concentration is very pronounced in some regions as Alsace or Bretagne. In Alsace, 10% of firms are foreign-owned while they represent about 50% of value added, 70% of exports and 80% of imports. In Bretagne, foreign affiliates represent about 3 percent of firms in the region, but make up 15% of the region's value added and about 2/3 of its trade (import and export).

Among the group of foreign affiliates, the concentration of economic activities rests on very few firms as shown in Table B.2. In Auvergne, the five largest foreign affiliates account for two-thirds of the total value added of all foreign affiliates. Taking the 10 largest foreign affiliates, this share reaches 73.8%. Given that foreign affiliates account for more than 30% of Auvergne's value added, the ten largest foreign affiliates account for more than 22% of the regional value added. Auvergne is not a particular case, the concentration of economic activities in the hands of a few foreign affiliates can be observed across regions.¹⁸ With respect to trade, the importance of the largest foreign affiliates is even more pronounced.

– Table B.2 about here –

Stylized facts from Tables B.1 and B.2 point to the importance of foreign affiliates in the regions. A change in their output or trade activities will affect regional GDPs directly. Adding indirect effects, through the link to local suppliers and customers, the impact of foreign affiliates would probably be even larger.

In Figure C.1, we investigate the ownership breakdown of the share of value added by the largest 1% firms. We also show figures on the composition of firms in the remaining sample, once we exclude the top 1% firms.

– Figures C.1 about here –

The results are striking. About 30 to 70 percent of the largest (top1%) firms have a

¹⁸For instance, the ten largest foreign affiliates account for 19.1% of total value added in Alsace, 18.3% in Lorraine, and 12.8% in Picardie.

foreign ownership. Less than 10 percent are independent. By contrast, the remaining group of firms is mostly made up of independent firms and the share of foreign affiliates is never greater than 10 percent.¹⁹ This fact suggests that firms are not only different with respect to their size and that few firms are sizably larger than other firms, but they are also different in terms of their ownership structure. In Appendix E, we show that affiliates of foreign parents tend to be the largest among the largest firms.

Facts II: intra-firm trade. Intra-firm trade has proved to be a particularly important determinant of business cycle comovement (Burststein et al. 2008). Table B.3 reports evidence on intra-firm exports and imports by French and foreign affiliates across French regions. The first set of results from Table B.3 stems from the comparison of exports (columns 1 and 3) and imports (columns 2 and 4) by French and foreign affiliates. While the share of intra-firm trade is already high for French affiliates, it appears that this share is even larger for foreign affiliates. This is particularly relevant for imports. The share of intra-firm imports by foreign affiliates is at least twice the share of intra-firm imports by French affiliates.²⁰ The table shows that there is an important degree of heterogeneity across regions. About 31% of the trade of affiliates in Aquitaine is intra-firm, while it is 75% for Centre.

– Table B.3 about here –

There are multiple linkages between foreign affiliates and their country of ownership. Our data reveal that 13.6% of total exports and 25.6% of total imports of foreign affiliates are with their country of ownership. This is substantial given the large cross-section of countries that we have in our sample. Furthermore, the last two columns of Table B.3 show that almost three quarters of the total trade between foreign affiliates and their parent country is intra-firm. In particular, 15% of foreign affiliates' exports are directed toward their parent country, and almost 80% of these exports are intrafirm. This suggests there exists very strong vertical linkages between foreign affiliates and their parent country.

¹⁹The information on the ownership of firms comes from LIFI. As discussed in Appendix A, this survey is exhaustive for firms with an annual turnover above 1 million euros and firms with more than 500 employees. If we focus on the sample of firms that are above one of these thresholds, we drop half of the firms, but the remaining ones account for 94% of total value added. Focusing on this reduced sample of firms, we find the same difference in the composition of the top 1% against the others. In particular, FMEs are over-represented in the largest 1% firms of this sample. Namely, FMEs account for 49% of the top 1% and MNEs account for 42%. By contrast, FMEs account for only 9.5% of the smallest firms, and MNEs 33%

²⁰Given the share of intra-firm trade for MNEs and FMEs, and the share of FMEs and MNEs in total trade, about 40% of French exports and 45% of French imports are intra-firm. As a comparison, Bernard, Jensen, Redding & Schott (2010) report that 46% of US imports are intra-firm.

Facts III: heterogenous location of firms with different nationality of ownership. We have shown that foreign affiliates constitute a large share of regional employment, value added and trade. Another important dimension concerns their country of ownership. In order to have an impact on business cycle comovement, affiliates from a particular foreign country must contribute to a significant share of regional outcomes. In France, 55% of the number of foreign affiliates are owned by parents from the United States, Spain, Germany, the United Kingdom, and the Netherlands. They account for more than two-thirds of the total value added made by foreign affiliates.

To be able to use the cross-region dimension of the data, we need some heterogeneity with respect to the nationality of foreign affiliates across regions. The share of value added is expected to be high for some investors in bordering regions, but the border alone cannot explain the location of activities and the comovement. Fortunately, the shares of value-added by country of ownership are not evenly distributed across all regions. It is interesting to look at the regional distribution of the shares of value added by important source countries; two sharing a border with France (Germany and Spain) and two outside Europe (the U.S. and Japan). This is represented in Figure C.2.

– Figure C.2 about here –

These maps show that the value added shares of German affiliates is large in Alsace-Lorraine, but also very large in Midi Pyrénées, which does not share a border with Germany.²¹ Spanish affiliates contribute largely to the value added created in Pays de la Loire and not in the neighboring regions of Midi-Pyrénées or Aquitaine.

Facts IV: the business cycles comovements. We now turn to the bilateral correlation between French regional GDPs and the countries studied. If there were only one French business cycle, the regional dimension would not add to the explanation of comovement. In Table B.4, we report the correlation of GDP growth between French regions. While the correlation is as high as 0.9 for a few regions, the correlation is very low and even negative for other pairs. Hence, French regions do not share perfectly correlated business cycles. We shall use this characteristic later on when we analyze the impact of foreign affiliates on business cycle correlations between French regions.

– Tables B.4 and B.5 about here –

In Table B.5, we report the maximum and minimum correlations of French regions with Germany, Spain, the U.S. and Japan. For Germany and Spain, the unconditional correlation of GDPs is among the highest with the regions where their foreign affiliates represent a substantive share of regional value added. Unexpectedly, we find a negative unconditional correlation for the U.S. and Japan in the regions where they account for a large share of value added.

²¹With the presence of large affiliates such as Airbus Deutschland and Siemens VDO Automotive.

These stylized facts show that there is an heterogeneity in the GDP growth correlations along two dimensions. First, a single country might have a high level of synchronization with some French regions and not others. This is the case of Germany with Alsace and Auvergne. Second, a single region might have a high level of correlation with one country but not with another. This is the case of the GDP growth of Alsace which is positively correlated to German GDP growth but not to Spanish GDP growth.

5. Empirical Strategy

Our analysis makes use of a cross-section of the business cycle correlations between 21 Metropolitan regions and 162 countries. Not all countries in the sample invest in France, so that the vector of correlations has many zero values. There are thirty four countries with majority-owned affiliates that report positive employment in the sample.²² However, most of the countries share a trade relationship with the French regions. We do not discard the zero values in a first test. Yet, we show in section 6 that our main findings remain when we do so. We estimate equation 1:

$$\rho_{cr} = \alpha FME_{cr} + \Omega_{cr}\beta + \nu_r + \nu_c + \epsilon_{cr} \quad (1)$$

with ϵ_{rc} is the disturbance term. We add a set of country and region fixed effects, ν_r and ν_c , that do not only control for the demand and supply shocks but also for omitted variable at regional and country-level. Country fixed effects capture all country characteristics that may explain the correlation between French regions and the country. In other words, the country fixed effects capture the business cycle correlation of France and the country. The region fixed effects capture the relative correlation of the region with respect to foreign countries and the other French regions.

ρ_{cr} is a vector of correlations of GDP growth rates between a country c and a region r computed over the 1990-2006 period. It is defined as $\rho_{cr} = corr\left(\frac{GDP_{c,t}-GDP_{c,t-1}}{GDP_{c,t-1}}, \frac{GDP_{r,t}-GDP_{r,t-1}}{GDP_{r,t-1}}\right)$.

To test the robustness of our results, we also transform the GDP series (in logs) using the filter proposed by Hodrick-Prescott (1997) and compute the correlation of the cyclical components of regional GDP and country GDP growth rate.²³

FME_{cr} is an indicator of the importance of foreign affiliates from country c in region r . As argued by Lipsey (2008), the measurement of the location of the production of a

²²Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Germany, Greece, India, Ireland, Island, Israel, Italy, Finland, Japan, Korea, Lebanon, Malaysia, Morocco, Netherland, Norway, Portugal, Saudi Arabia, Singapore, Spain, Switzerland, Sweden, Thailand, Tunisia, Turkey, United Kingdom, The United States, Venezuela. Nine of them have positive employment in all regions: Belgium, Germany, Italy, Finland, Netherland, Switzerland, Sweden, United Kingdom, The United States.

²³Since we use yearly data, we apply a smoothing parameter of 6.25 as recommended by Ravn & Uhlig (2002).

multinational might be influenced by the tax strategies followed by the parent firm. The measurement of the FME_{cr} indicator is therefore not straightforward. In order to control for the importance of foreign affiliates in French regions, we take employment rather than value added because we believe that employment is less subject to manipulation for tax reasons (Lipsev 2008). We define FME_{cr} as the share of employment by foreign affiliates of country c in region r .

$$FME_{cr} = \frac{\sum_f Emp_{fcr}}{Emp_r} \quad (2)$$

where Emp_{fcr} is the employment of firm f with ownership from c in region r . The denominator, Emp_r is the total employment in region r .²⁴ Since we know both the sectors of the foreign parent and the French affiliate, we also construct a measure of vertically integrated production networks. The construction is based on the 4-digit sector classification of the foreign parent and its French affiliate. We assume that a vertical relationship occurs whenever the parent is classified in another sector than the one of its affiliate. At 4-digit level of aggregation, the measurement of vertically integrated production network is underestimated.²⁵ We use moreover a second indicator which is the share of intra-firm export from region r to country c , IF_{cr} . This variable is constructed as follows:

$$IF_{cr} = \frac{\sum_{f \in C} (IFEX_{fcr})}{(x_{cr} + m_{cr})} \quad (3)$$

where $IFEX_{fcr}$ is the value of intra-firm export from the affiliates in region r to the parents in country c and x_{cr} and m_{cr} represents the value of bilateral export and import, respectively.²⁶ As in Burstein et al. (2008), we argue that the synchronization is more likely to be influenced by trade in inputs within the international production networks. We therefore need to identify these intermediates. We use the data provided by (Antràs, Chor, Fally & Hillberry 2012). They compute the distance from final consumption using U.S. input-output tables for 426 industries.²⁷ Products with a distance to final use greater than two are defined as intermediate inputs. This variable is computed as IF_{cr} using the sample of intra-firm exports of intermediates goods.

²⁴We also replicate the results using value added instead of employment.

²⁵While parents and affiliates classified in different sectors share a vertical relationship, we cannot distinguish between horizontally and vertically integrated network for affiliates and parents that are in the same sector at 4 digit level.

²⁶As the intra-firm trade variable is constructed from a survey, it is not directly comparable to the regional share of employment of foreign affiliates. In the following regression analysis, we will investigate their effects separately.

²⁷The Bureau of Labor Statistics provides a correspondence table to transform the 426 commodity codes into hs6 codes. We merge this information with our export data at the HS6 level.

The literature has emphasized other important determinants of business cycle comovement. We include them in the Ω_{rc} matrix. A first important factor relates to bilateral trade intensity (Frankel and Rose, 1998). We construct the index of bilateral trade intensity as the ratio of exports and imports between country c and region r over the sum of the region and country GDP.

$$BT_{cr} = \frac{x_{cr} + m_{cr}}{GDP_c + GDP_r} \quad (4)$$

It has also been shown that the productive structure as well as the structure of bilateral trade are key determinants of business cycle comovement (Imbs 2004). The similarity of production structure is usually computed from production data. In our case, such data are very difficult to use because of the lack of similar classification between the countries and the regions. We moreover do not have good sector-level production data for French regions. The existing data are aggregated at 1-digit sector level. Once merged with country data on production, this index would allow us to compare the relative specialization of countries in services, manufacturing and agriculture. Such an aggregate index hides important heterogeneity within sectors, and specifically within the manufacturing sector.²⁸ To circumvent this issue, we decided to compare the specialization of countries rather than their production. Both are tightly linked, and specialization presents the advantage to be easily observable from trade level data (which are available for regions and a large set of countries at highly disaggregated levels). We thus compare the specialization/production structure of countries by looking at the composition of their exports. We compute the dissimilarity index as follows:

$$DISIM_{cr} = 1 - \sum_k \left| \frac{X_c^k}{X_c} - \frac{X_r^k}{X_r} \right| \quad (5)$$

Where X_i^k/X_i is the share in total exports of country i of exports in sector k . Exports are computed at the 3-digit ISIC revision sector level. Since more similar partners are likely to face the same supply and demand shocks, a higher similarity should therefore lead to a greater synchronization of business cycles.

Having bilateral trade data at sector level, we can also evaluate the importance of intra-industry trade on business cycle comovements (Calderon et al. (2007); di Giovanni & Levchenko (2010); Fidrmuc (2004)). We use the French Customs data to allocate exporters and importers across regions and compute an index of Grubel and Lloyd for each

²⁸We report in the unpublished appendix specifications including this determinant. It does not affect our results.

pair of country and region.

$$IIT_{cr} = 1 - \frac{\sum_k |X_{cr}^k - M_{cr}^k|}{\sum_k X_{cr}^k + M_{cr}^k} \quad (6)$$

where X_{cr}^k and M_{cr}^k are the exports to and imports from country c , by region r , for sector k . In our analysis, we consider 4-digit level sectors of the HS nomenclature. An index close to one means that country c and region r trade similar types of products: they are engaged in intra-industry trade.

It is also likely that regions and countries that are geographically close to each other are affected by similar demand and supply shocks (Clark and van Wincoop, 2001). To capture geographical proximity, we use the distance and the presence of a common border between region and country. The border variable, $Border_{rc}$ equals one if country c and region r share a common border. To compute the distance between country c and region r , we first identify the latitude and longitude of each firm in our sample and of the capital city of each country. We then compute the distance between each firm and each country. The distance between region r and country c is the arithmetic average of the individual distance that separates the firms of region r and the capital of country c .

$$Dist_{rc} = \frac{\sum_{f \in \{r\}} dist_{fc}}{N_f^r} \quad (7)$$

where $dist_{fc}$ is the distance between firm f (from region r) and the capital of country c , and N_f^r is the number of firms in region r .

There are other factors that might influence the synchronization of business cycles. Kose & Yi (2006), Imbs (2004) and more recently Kalemli-Ozcan, Papaioannou & Peydró (2009) show that increased financial integration affect business cycle comovement across countries. We do not have information on this later determinant.

6. Econometric Results

Baseline Results. The results of the baseline estimation using the GDP growth rate correlation are reported in Table D.7.²⁹ The specifications include a full set of regions and countries specific effects.

– Table D.7 about here –

²⁹As an alternative proxy of business cycle, we also compute the GDP growth rate from the HP-filtered GDPs. The results are presented in Table E.14 of Appendix E. We show that our findings are robust to this alternative definition.

Columns (1) and (2) investigate the effect of the share of foreign affiliates' employment and bilateral trade on business cycle correlations, respectively. Both variables have a positive impact on the synchronization. Once we include both variables together, in column (3), the impact of the bilateral trade variable is less important and estimated with a much lesser degree of precision. It is an indication of the role of foreign affiliates in French international trade.

The impact of the share of employment by foreign affiliates is not only significant but also quantitatively important. Based on the preferred estimates from column (4), the standardized coefficient of the FME_{cr} variable is 0.06 while the standardized coefficients of the BT_{cr} and IIT_{cr} variables are 0.03 and 0.02 respectively. The effect of foreign affiliates is therefore large enough to be of substantive interest. Since we estimate a linear model, we can evaluate the elasticity of the FME_{cr} variable at mean values. Taking information from Table B.6, we find that a 10% percent increase in the employment intensity of foreign affiliates raises the business cycle correlation between their country of ownership and their region of location by about 0.6%.

The results suggest that the effects of bilateral trade and intra-industry trade are not significant, while the dissimilarity in the production structure does matter. In line with Imbs (1999) and Imbs (2004), synchronization appears to be smaller in regions that have dissimilar sectoral production patterns. The production structure dissimilarity variable is negative and significant. It is robust across specifications.³⁰

Further Analysis. The findings reported in Table D.7 point to an impact of the presence of foreign affiliates without distinguishing between the types of linkages that these affiliates share with their origin countries. An important aspect concerns the nature of the international production network, whether it is vertically or horizontally integrated. The data allows us to imperfectly identify the vertically integrated network. One crude methodology is to compare the 4-digit sector of the parent with the 4-digit sector of its affiliates. If these sectors do not match, we have a measure of vertically integrated network. As mentioned in Section 2, we should expect strong effect from this type of linkages. We reports the results in Table D.8:

– Table D.8 about here –

Column (1) of Table D.8 replicates the baseline analysis using the employment intensity of affiliates that are part of a vertically integrated network. We find a positive and significant impact of this intensity on business cycle comovement. A 10% increase in the employment intensity of vertically integrated affiliates raises the correlation of GDP growth rate by

³⁰We use an alternative definition of the dissimilarity index based on production data using a 1-digit classification. The results are shown in Table E.15 of Appendix E. The main findings remain robust to the alternative definition of the dissimilarity index.

0.4%. As mentioned earlier, we however underestimate the employment intensity as the sector classification of the parent and its affiliates are rather aggregated.

Another way to account for the vertical structure is to look at the exports of foreign affiliates toward their origin countries. Our data captures both intra-firm and arms-length exports of foreign affiliates. In Column (2), we replicates the previous results using the share of intra-firm export as explanatory variable. We find that a 10% increase of the share of intra-firm export increase the correlation of GDP growth rates by 0.2%. This impact is identical when we control for the share of export that affiliates outsource to their country of origin.³¹ This results confirm that the business cycle correlation is larger when trade takes place within the network of the multinational firm.

In columns (3) and (4), we replicate the analysis using the sample of intermediate inputs. The results barely change. They confirm that vertically integrated network are a channel of influence when analyzing the effects of foreign affiliates on business cycle correlation.

Before concluding, we discuss the results of some further sensitivity tests. We investigate whether the results are robust to the exclusion of countries that don't invest in France. We moreover replicate the baseline analysis using the value added intensity. We investigate the role of two exogenous components, distance and border, and show that the results are robust to their introduction. We finally consider a simple falsification exercise in which we allocate the employment intensity, FME_{cr} , randomly across regions.

Sensitivity Analysis. In the baseline estimations, we make use of the 1990-2006 period to compute the correlation of the GDP growth rates and of the year 2004 to construct the exogenous variables. The explanatory variables are however available for different cross-section from 1999 to 2004. Each cross-section is composed by the same bilateral pairs of regions and countries. We can therefore repeat the baseline analysis using different years of explanatory variables. In Table D.9, we repeat the cross-sectional estimates of columns 5 of Table D.7.

– Table D.9 about here –

As we can see, the results barely change and the robustness is high. In each cross-section, we evaluate the effect of the foreign affiliates' employment intensity to be roughly the same as in the baseline Table. We find that a 10% percent increase in the employment intensity of foreign affiliates raises the business cycle correlation between their country of ownership and their region of location by about 0.6%.

Recall that the baseline sample include countries that may or may not invest in a region, so that the share of foreign affiliates' employment may be zero. One crude way to investigate whether the results are driven by the zeros in employment intensity is to keep the countries

³¹We refer to outsourcing since the foreign affiliate export to an unaffiliated party.

for which we observe a positive value of employment in at least one region. We present the results in Table D.10. Notice that in this case, we drop about 80% of the observations of the initial baseline sample.

– Table D.10 about here –

Column (1) to (4) show that the foreign affiliates' employment share is still significant and positive. The estimated elasticity is slightly larger (because evaluated at different mean values). In column (4), we find that a 10% percent increase in the employment share of foreign affiliates raises the business cycle correlation between their country of ownership and their region of location by about 0.7%.³² In contrast, the trade variables is insignificant (as in the baseline sample). In line with the previous findings, we find a negative impact of the dissimilarity index on the business cycle correlation.

It is also likely that regions and countries that are geographically close to each other are affected by similar demand and supply shocks (Clark & van Wincoop 2001). The results are reported in Table D.11. Compare to the results of Table D.7, the inclusion of the bilateral distance and the border variables do not involve any notable change to the explanatory power of our regressions as measured by the R^2 .

– Table D.11 about here –

In the first two columns, we analyze the impact of distance and border on business cycles correlations.³³ The results point to a negative and significant effect of distance while the border variable is insignificant. In column (3) and (4), we introduce successively the foreign affiliates' employment intensity variable and the bilateral trade variable. Compare to the estimates of the baseline estimation, we find that bilateral distance and borders do not influence the coefficient of the foreign affiliates employment intensity significantly. The introduction of both variables lower however the impact and significance of the bilateral trade variable. In column (5), the impact of bilateral trade disappears while the foreign affiliates employment intensity is still highly significant.

As a further test, we consider the ratio of foreign affiliates' value added to regional GDP. This ratio is as an alternative measure of the foreign affiliates presence in the region. It is less relevant than the employment intensity since it is likely to be manipulated for tax reasons (Lipsey 2008). Table D.12 reports the results which are essentially identical to the baseline specification.

– Table D.12 about here –

The estimations consistently show a positive and significant impact of the foreign affiliates' value added intensity on the correlation of GDP growth rates. This impact is however

³²The mean value of the GDP growth rate correlations and of the employment shares in this sample are 0.12 and 0.001, respectively

³³We also control for the region and country fixed effects.

estimated with a lesser degree of precision than in the baseline estimations of Table D.7. As a main difference, we find a positive and slightly significant effects of the bilateral trade variable once we control for all the other covariates as in column (4).

As a final check, we propose a falsification exercise. We assign randomly the true foreign affiliates' employment intensity of each region to another.³⁴ This exercise might be informative since the business cycle comovement between a country and a region should not be influenced by the employment intensity of foreign affiliates coming from another country or located in another region. Table D.13 reports the results.

– Table D.13 about here –

The randomly assigned foreign affiliates employment intensity are always insignificant, as we expected.

7. Conclusion

This paper examines the ownership composition of firms within French regions to shed light on the role of foreign affiliates in explaining business cycle comovements. Foreign affiliates are linked to their foreign parents via intra-firm trade, technology transfers, direct investments or their decisions on production. They may thus transmit shocks across borders as long as they contribute largely enough to the economic outcomes of their host region.

Using rich data on the universe of French firms and their activities in France, we establish that the share of majority-owned foreign affiliates is larger among large firms than among smaller ones. Therefore, while there are very few majority-owned foreign affiliates, their contributions to the economic activities of France and its regions are substantial. The data also reveal that the distribution of the activities of foreign affiliates based on their nationality is heterogeneous across French regions. We exploit this to evaluate the role of foreign affiliates in synchronizing international business cycles.

We show that the presence of foreign affiliates - either measured through employment, value added, or intra-firm trade intensity - in a region increases the correlation between the fluctuations of the GDP of the region and that of the country of ownership significantly. We also demonstrate that French regions which host foreign affiliates which come from the same countries exhibit greater comovement of GDP growth.

The literature has shown that large firms contribute to aggregate volatility; we show that they also contribute to aggregate co-fluctuations when they are foreign-owned. Our findings thus point to previously unexplored dimensions of the impact of large firms on aggregate outcomes. Since they are important traders, the influence of bilateral trade on

³⁴For instance, we assign the German employment intensity in Alsace to a randomly chosen region and a randomly chosen employment intensity to Alsace.

business cycle comovements turns out to not be robust. This suggests that multinational linkages are more important than trade linkages.

The nationality and ownership structure of the firms are two dimensions that seem to have important implications for aggregate trade, employment and comovements. One extension of this study that we would consider especially worthwhile is to identify whether the idiosyncratic shocks of multinational firms are specific and important forces explaining these aggregate outcomes.

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Appendix

A. Data Appendix

We build a database that describes value added, employment, and sales in the manufacturing, extractive, agricultural sectors of French regions, as well as their bilateral exports to and imports from 162 partner countries and the value of intra-firm trade.³⁵ Within regions, we disentangle activities based on the ownership of firms. Namely, we distinguish activities generated by independent firms, French affiliates, and foreign affiliates (depending on their parent country). The data are matched to a vector of bilateral correlations of business cycles between 21 Metropolitan French regions and these 162 countries.³⁶ This dataset is built from the aggregation of several sets of micro-data that are provided by different French administrations.

Firms in France need to report their tax statements (through one of three alternative regimes) to the tax administration. The *Bénéfice Réel Normal* (BRN) needs to be filed by all firms that have an annual turnover of more than 763,000 euros in manufacturing and more than 230,000 euros in services. Firms with a lower turnover might still opt for the BRN regime, but they are automatically registered under the *Régime Simplifié d'Impositions* (RSI) instead of the BRN. Firms file for an RSI account for an annual turnover of less than 4% and a total employment of less than 11% (see di Giovanni, Levchenko, and Méjean 2011). Entrepreneurs (owner-manager-single-employee firms) with an annual turnover of less than 80,300 euros are subject to the MicroBIC regime, *Micro Bénéfice Industriel et Commerciaux*. These firms have a negligible weight in the distribution of annual turnover, value added and employment. Of all those regimes, the BRN is the most comprehensive regarding the information available, including balance sheet information on total employment and total value added.

The BRN is merged to "LIFI élargi", a dataset that has information on the ownership and nationality of the parent company of firms located in France. The dataset combines two sources of information. First, a survey on "large" firms that gives detailed information on the ownership of groups, the link between affiliates (at home and abroad), and information on shareholders. Only firms with more than 500 employees, or having a yearly turnover greater than 20 million euros, or having more than 1.2 million euros of shares of other firms are subject to this survey. The survey is completed with DIANE, a dataset that reports financial linkages between firms. Firms with an annual turnover above one million euros are surveyed. Notice that relatively large firms are surveyed, but they indicate their financial links with all their affiliates (if any) irrespective of their size. Furthermore, the sample of firms that are surveyed (the ones with more than 500 employees or more than 1 million euros of turnover) represents half of the firms, but these firms account for 94%

³⁵We do not have information on services.

³⁶We exclude the comovement between French regions and France as a whole.

of total value added.

We classify firms according to their nationality and ownership. We denote by IND (for independent), French domestic firms, which are located in France and not owned by a group. A French affiliate, MNE, is located in France and owned by a French group. We denote by FME foreign affiliates, which are located in France and owned by a foreign group. Later on, we will distinguish the foreign affiliates based on their nationality. At this stage, our data consists of an exhaustive panel of 184,929 firms, for the 1999-2004 period.

We merge the data with a dataset provided by French Customs that gives information on bilateral exports and imports of firms located in France. For each firm, this database reports the bilateral free-on-board value, the quantity of exports, the cost-insurance-freight value and the quantity of imports. Extra-European shipments of a value which is less than 1,000 euros are subject to a simplified declaration procedure and do not appear in our data. Within the Single European Market, the reporting threshold is based on the cumulated yearly export value of each firm (all destinations within the EU). This threshold has increased over time, up to 100,000 euros in 2002 and 150,00 euros in 2003.

Information on intra-firm trade is taken from the EIIG firm-level survey (Échanges Internationaux Intra-Groupe.) The data are provided by INSEE (Institut National de la Statistique et de Etudes Economiques) and are only available for 1999. The survey was addressed to all French firms whose value of trade was over 1 million euros, owned by groups that controlled at least 50% of the equity capital of a foreign affiliate. It provides a detailed geographical breakdown of the import and export value of French firms at product level (HS4) and their sourcing modes – outsourcing and/or intra-firm trade.

We aggregate the firm-level data at the regional level. A firm located in France might have several plants in different regions. When it comes to filing the BRN or the Customs' forms, the value added, sales or trade values are always allocated to the region of the headquarters of the multi-plant firm. In order to compute the regional GDP, the INSEE reallocates the value added of multi-plant firms based on the share of employment made by plants in each region. Each plant is recorded in a dataset called STOJAN that has limited plant-level information, mostly on its employment and its identifier. The identifier of the plant is such that it can be easily merged to the identifier of the firm. We use STOJAN to reallocate the value added, sales and trade of multi-plant firm. In our sample, only 1.8% of firms are multi-plant and multi-region. Yet these firms account for 9.8% of total employment.³⁷ We are now able to aggregate the statistics at the level of each of the 21 Metropolitan regions.

This database at the regional level is then combined with a dataset that contains the correlation of the business cycles between a French region i and a partner country c . We

³⁷We have access to this data for the 1999-2004 period.

consider 162 partner countries over the 1990-2006 period. The correlation of the cycles between region i and country c is computed as the correlation in the annual growth rates or the correlation of HP-filtered GDPs.

As a measure of regional GDP, we use the publicly available GDP computed by INSEE over the 1990-2006 period. We combine it with World Bank data for the GDP of countries, in current US dollars. While the GDP of the countries are in dollars, the French regional GDPs are in euros. We convert the GDP of the countries into euros using the EUR-USD exchange rate given by Eurostat. The database is completed with the total exports and imports of the partner countries that we take from the Direction Of Trade Statistics (DOTS).

B. Tables

Table B.1 – French regions: contribution of firms to economic activity by ownership structure

	# of firms		Employ.		Sales		Value added		Exports		Imports		
	IND	MNE	FMEs	MNE	FMEs	MNE	FMEs	MNE	FMEs	MNE	FMEs	MNE	FMEs
Alsace	75.5	14.4	10.1	29.9	38.5	29.9	51.1	27.2	49.5	21.4	69.8	14.2	76.7
Aquitaine	78.9	16.3	4.8	36.9	18.7	41.0	30.4	37.7	31.1	33.8	52.8	25.4	59.5
Auvergne	77.3	18.4	4.2	48.0	15.5	50.7	25.5	43.6	31.4	65.4	25.5	58.5	31.0
Basse-Normandie	74.1	21.5	4.5	42.6	18.2	46.7	25.8	42.9	23.1	36.0	50.4	31.6	54.7
Bourgogne	73.9	20.0	6.2	42.6	26.4	44.4	34.6	44.5	30.3	43.6	48.0	25.9	67.3
Bretagne	76.4	20.5	3.1	51.5	11.2	59.5	13.3	51.4	15.7	56.0	29.1	48.7	36.4
Centre	75.3	18.6	6.1	40.2	27.1	40.1	38.8	38.2	36.6	37.9	54.2	22.8	68.5
Champagne-Ardenne	74.1	19.6	6.3	41.9	26.0	44.9	31.9	45.0	29.4	49.0	38.9	27.8	61.0
Franche-Comte	75.6	19.8	4.6	49.0	16.2	52.4	22.8	47.1	22.6	43.6	44.2	48.8	36.8
Haute-Normandie	73.4	19.9	6.7	43.0	27.8	47.9	38.7	48.1	34.6	42.2	50.5	45.3	50.6
Ile-de-France	81.1	13.9	5.1	42.2	23.8	44.3	36.3	41.9	35.3	46.3	39.3	31.4	59.1
Languedoc-Roussillon	81.0	15.2	3.8	35.3	16.0	39.3	25.6	37.1	25.3	37.1	49.0	35.9	47.5
Limousin	77.0	18.4	4.6	36.7	16.9	42.8	22.0	39.7	20.5	40.0	41.8	42.9	39.5
Lorraine	75.5	17.0	7.5	36.4	30.4	37.7	42.6	33.5	41.4	28.9	62.7	26.6	62.7
Midi Pyrénées	79.5	16.6	3.9	37.3	19.8	32.2	39.0	36.2	31.8	19.4	54.9	19.5	58.5
Nord Pas-de-Calais	74.4	19.2	6.4	43.6	23.5	43.9	36.2	39.1	37.5	42.0	49.8	34.9	52.3
PACA	83.4	13.0	3.6	35.2	17.9	40.2	28.8	38.2	25.6	33.9	47.0	40.5	42.5
Pays de Loire	71.7	23.8	4.5	48.7	18.1	51.2	26.1	46.7	28.9	46.0	42.3	39.7	49.5
Picardie	74.6	18.1	7.3	37.2	31.4	37.7	43.8	35.6	40.3	33.3	56.5	23.6	64.9
Poitou Charentes	75.7	20.4	3.9	41.9	18.5	47.7	20.6	47.4	20.5	61.8	25.5	46.3	37.1
Rhône Alpes	77.6	17.6	4.8	41.7	22.2	44.9	30.6	43.2	26.5	44.7	41.5	35.7	50.7
Weighted average	77.6	17.2	5.2	41.6	22.7	43.9	33.5	41.3	32.1	40.5	46.7	32.1	56.4

This table displays the percentage contribution of independent French firms (IND), French multinational firms (MNEs), and foreign multinational firms (FMEs) to the economic activities of French regions in the manufacturing, extractive, and agriculture industries. *Employ.* stands for employment. Figures by region are averages over the 1999-2004 period. The averages are the weighted mean of regional values. Weights reflect the importance of each region for each outcome (their weight in France's total value added, France's total employment etc.). The figures are based on the authors' computations from 4 datasets: BRN, STOJAN, LIFL, and the French Customs data. Sales, exports, and imports are expressed in current euros. The row "Average" is the simple arithmetic average of regional contributions.

Table B.2 – Concentration among foreign affiliates: share of output done by the largest ones (%)

	Value-added		Sales		Exports		Imports	
	TOP5	TOP10	TOP5	TOP10	TOP5	TOP10	TOP5	TOP10
ALSACE	25.4	35.2	21.5	32.6	24.6	37.9	30.7	43.1
AQUITAINE	43.1	54.3	32.4	46	47.5	62.6	46.2	60.4
AUVERGNE	66.3	73.8	53.7	64.2	62.1	75.6	55.6	69.4
BASSE-NORMANDIE	33.3	47.8	43	55.8	59	74.3	58.6	75.9
BOURGOGNE	25.6	37.5	30.7	42.1	38.2	52.5	51.2	62.2
BRETAGNE	33.1	47	28.3	43.2	41.2	59.1	45.1	60.9
CENTRE	26.7	37.7	23.4	35	35.1	48.1	39.5	53.3
CHAMPAGNE-ARDEENNE	22.5	34.4	25.3	39.5	32.9	49.4	38.4	57.7
FRANCHE-COMTE	38.5	49.8	43.1	54.6	58.9	70.9	58.3	68.1
HAUTE-NORMANDIE	27.7	41.9	29.2	43.2	34.8	50.7	41.9	56.9
ILE-DE-FRANCE	34.7	40.4	28.3	35.7	18.2	29.4	38.3	49.5
LANGUEDOC-ROUSSILLON	43.6	57.2	40.4	54	52	73.2	49.7	67.2
LIMOUSIN	45.8	64	51.7	67.6	64.9	83.3	62.1	78.3
LORRAINE	31.7	40.1	21.4	31.9	24.8	38	20.1	33.3
MIDI-PYRENEES	54.4	66.6	63.5	71.7	75	83	73.9	81.2
NORD-PAS-DE-CALAIS	36.9	43.7	22.7	31.1	27.9	39.1	24.5	36.4
PACA	38	50.4	34	46.8	52.9	64.7	35.8	49.3
PAYS-DE-LOIRE	42.2	48.3	31.7	38.8	35.4	47.2	52.7	60.5
PICARDIE	19.9	31.4	18.1	30.4	24.5	37.8	30.1	43.6
POITOU-CHARENTES	33.9	48.8	30	45.5	52.4	67.4	38.7	54.4
RHONE-ALPES	18.8	26.1	24.1	30.8	25.7	35.2	37.6	45.3
Average	35.3	46.5	33.2	44.8	42.3	56.2	44.2	57.5

This table displays the percentage contribution of the 5 (TOP5) and 10 (TOP10) largest foreign multinational firms in economic activities made by all the foreign multinational firms in the French regions in the manufacturing, extractive, and agriculture industries. Figures by region are averages over the 1999-2004 period. The figures are based on the authors' computations from 4 datasets: BRN, STOJAN, LIFI, and the French Customs data. Sales, exports, and imports are expressed in current euros. The row "Average" is the simple arithmetic average of regional contributions. The table reads as follows (3rd row, 2nd column): in Alsace, 25.4% of the value added made by French firms is generated by the 5 largest ones.

Table B.3 – Share of intra-firm trade - MNEs and FMEs

Partner	MNE		FME		FME	
	Exports	Imports	Exports	Imports	Exports	Imports
ALSACE	0.45	0.31	0.58	0.61	0.84	0.73
AQUITAINE	0.48	0.22	0.59	0.31	0.92	0.37
AUVERGNE	0.65	0.07	0.35	0.37	0.84	0.63
BASSE NORMANDIE	0.49	0.36	0.57	0.55	0.86	0.47
BOURGOGNE	0.46	0.22	0.51	0.71	0.85	0.92
BRETAGNE	0.45	0.36	0.73	0.58	0.65	0.82
CENTRE	0.52	0.10	0.70	0.75	0.85	0.87
CHAMPAGNE ARDENNE	0.51	0.39	0.56	0.50	0.76	0.69
FRANCHE COMTE	0.46	0.42	0.67	0.52	0.82	0.71
HAUTE NORMANDIE	0.45	0.35	0.48	0.67	0.83	0.84
ILE DE FRANCE	0.53	0.18	0.65	0.65	0.89	0.85
LANGUEDOC ROUSSILLON	0.50	0.26	0.60	0.62	0.77	0.94
LIMOUSIN	0.57	0.29	0.33	0.57	0.71	0.80
LORRAINE	0.42	0.38	0.49	0.44	0.46	0.56
MIDI PYRENEES	0.35	0.24	0.79	0.39	0.95	0.57
NORD PAS DE CALAIS	0.29	0.36	0.59	0.52	0.76	0.75
PACA	0.40	0.35	0.51	0.63	0.85	0.88
PAYS DE LOIRE	0.42	0.13	0.56	0.63	0.73	0.80
PICARDIE	0.37	0.36	0.56	0.59	0.80	0.77
POITOU CHARENTES	0.52	0.30	0.54	0.43	0.63	0.75
RHONE ALPES	0.54	0.26	0.65	0.46	0.63	0.66
Average	0.47	0.28	0.47	0.55	0.78	0.73

This table displays the share of intra-firm exports and imports over the total exports and imports for French multinationals and foreign affiliates in the manufacturing, extractive, and agriculture industries. The first four columns consider trade between firms and all their trading partners. The last two columns consider only trade with the country of ownership. The figures are based on the authors' computations from 3 datasets: Mondialisation, STOJAN, and LIFI. The figures are for 2001. To illustrate: in Alsace, 58% of exports done by FMEs are intra-firm. And 84% of exports by FMEs to their country of ownership are intra-firm. Notice that in the data, the exports to their countries of ownership account respectively for 13.6% and 25.7% of the total exports and imports of foreign multinationals.

Table B.4 – Comovement between French regions: selected minima and maxima

5 Highest	Corr.
Lorraine / Poitou-Charentes	0.89
Pays de Loire / Centre	0.88
Pays de Loire / Franche-Comté	0.86
Pays de Loire / Haute-Normandie	0.88
Bourgogne / Poitou-Charentes	0.84
5 Lowest	Corr.
Midi-Pyrénées / Champagne-Ardenne	-0.07
Midi-Pyrénées / Alsace	0.01
Île-de-France / Champagne-Ardenne	0.07
Île-de-France / Lorraine	0.07
Île-de-France / Midi-Pyrénées	0.1

This table displays the 5 largest and 5 smallest levels of correlation of business cycles among French regions for the 1999-2006 period. The business cycle correlation is computed as the correlation of GDP growth between French regions. The regional GDP data are from the INSEE.

Table B.5 – Comovement between French regions and selected countries: extrema.

Germany			
3 Highest		3 Lowest	
Alsace	0.39	Languedoc-Roussillon	-0.138
Lorraine	0.36	île-de-France	-0.21
Picardie	0.35	Auvergne	-0.29
Spain			
3 Highest		3 Lowest	
Languedoc-Roussillon	0.62	Franche-Comté	0.20
Limousin	0.61	Champagne-Ardenne	0.19
Rhône-Alpes	0.60	Alsace	0.062
USA			
3 Highest		3 Lowest	
île-de-France	0.36	Centre	-0.30
Aquitaine	0.20	Picardie	-0.31
Bretagne	0.18	Nord-Pas-de-Calais	-0.32
Japan			
3 Highest		3 Lowest	
île-de-France	0.18	Picardie	-0.34
Basse-Normandie	0.11	Auvergne	-0.45
Haute-Normandie	0.066	Nord-Pas-de-Calais	-0.48

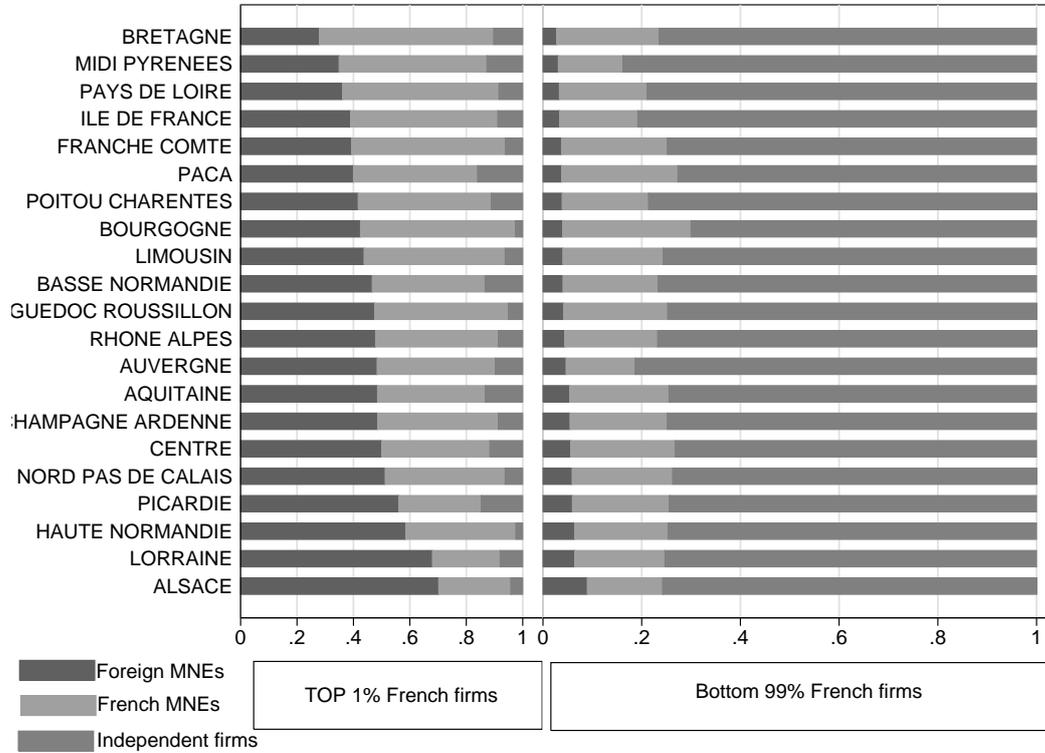
This table displays the 3 lowest and 3 highest levels of correlation of business cycles between French regions and 6 selected countries. The business cycle correlation is computed as the correlation of GDP growth of French regions and foreign countries. The regional GDP data are from the INSEE. The country GDPs are USD GDPs from IFS, converted into euros using Compustat data.

Table B.6 – Summary Statistics

Variable	Label	Obs	Mean	Std. Dev.
Whole sample				
Correlation of GDP growth rate	ρ_{rc}	3329	0.047	0.241
Correlation of HP-filtered GDP	ρ_{rc}	3329	0.082	0.251
Foreign Value Added Share	FME_{cr}	3329	3.10^{-4}	0.002
Foreign Employment Share	$FME_{cr}(Empl.)$	3329	2.10^{-4}	0.001
Foreign Employment Share (vertical)	$FMEV_{cr}$	3329	2.43^{-5}	0.0003
Bilateral Trade	BT_{cr}	3329	2.10^{-4}	0.001
Distance	$Distance_{cr}$	3329	7.935	0.823
Intra-Industry Trade	IIT_{cr}	3329	0.036	0.087
Border	$Border_{cr}$	3329	0.003	0.057
Disimilarity	$DISIM_{cr}$	3329	1.07	0.39
Intrafirm exports	IF_{cr}	3276	1.9210^{-3}	0.013
Sample of countries investing in at least one French region				
Correlation of GDP growth rate	ρ_{rc}	714	0.117	0.23
Foreign Value Added Share	FME_{cr}	714	1.56^{-3}	0.004
Foreign Employment Share	$FME_{cr}(Empl.)$	714	1.13^{-3}	0.003
Foreign Employment Share (vertical)	$FMEV_{cr}$	714	2.35^{-4}	0.0006
Bilateral Trade	BT_{cr}	714	5.84^{-4}	0.001
Distance	$Distance_{cr}$	714	7.31	1.066
Intra-Industry Trade	IIT_{cr}	714	0.126	0.123
Border	$Border_{cr}$	714	0.018	0.134
Disimilarity	$DISIM_{cr}$	714	0.779	0.29
Intrafirm exports	IF_{cr}	651	9.6610^{-3}	0.029

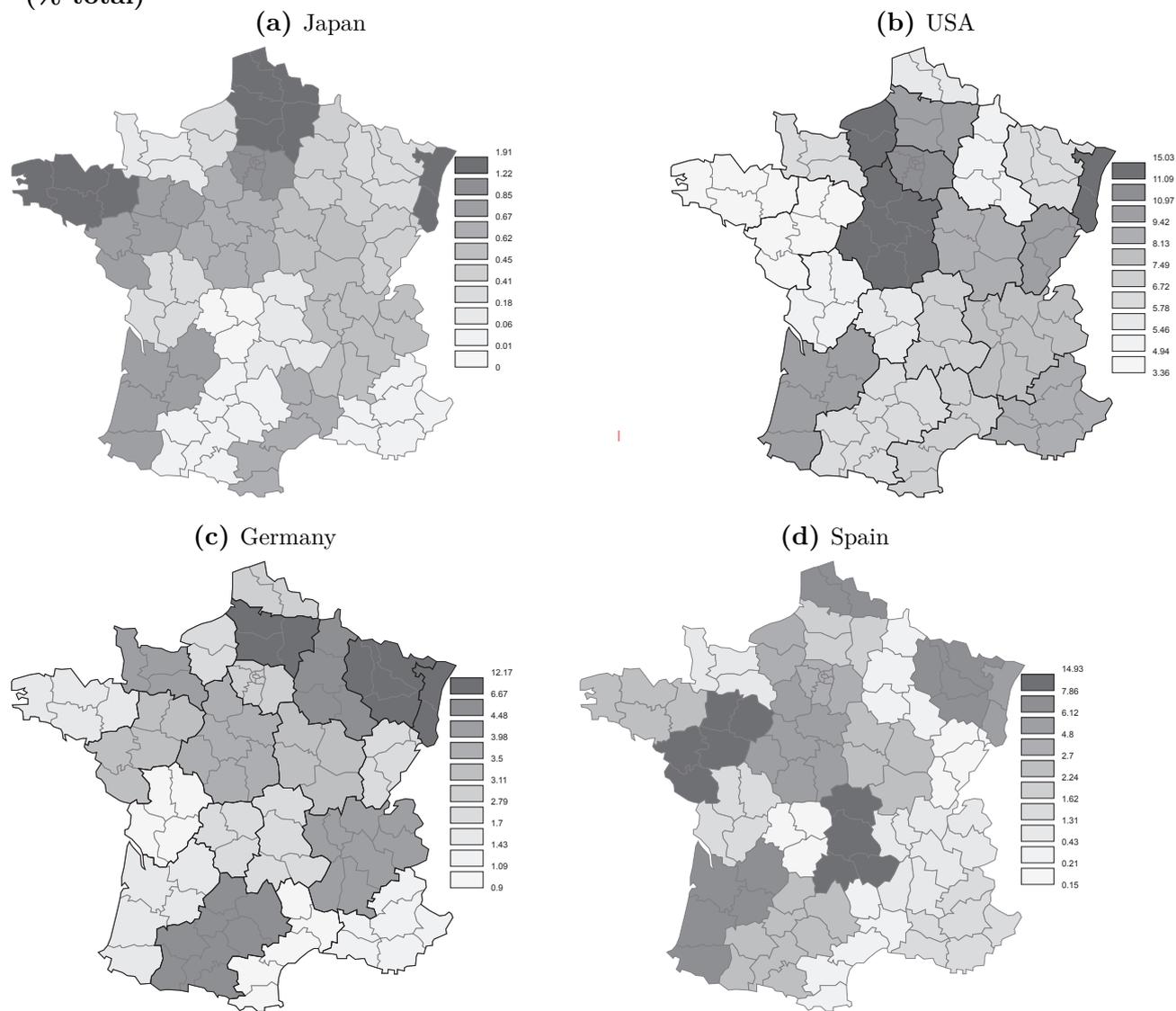
C. Figures

Figure C.1 – Ownership breakdown of firms in terms of v.a., by French region



This figure presents the (average over 1999-2004) ownership structure of the 1% largest firms and the 1% smallest firms, for each French region in terms of value added. Three ownership structures are distinguished: independent French firms, French multinational firms, and foreign multinational firms. The figure is based on the authors' computations relying on 3 datasets: BRN, STOJAN, and LIFI. The results stand for manufacturing, extractive, and agriculture industries.

Figure C.2 – Share of foreign affiliates in regional value added (manufacturing extractive, and agriculture industries), by country of origin of the parent, 2004 (% total)



D. Regressions Tables

Table D.7 – Foreign Affiliates and Business Cycle Correlations

	<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>			
	(1)	(2)	(3)	(4)
$FME_{cr}(Empl.)$	12.72*** (4.053)		11.01*** (3.431)	11.39*** (3.509)
BT_{cr}		20.42*** (2.680)	15.36* (1.951)	11.45 (1.508)
IIT_{cr}				0.06 (1.345)
$DISIM_{cr}$				-0.06*** (-4.460)
Region FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	3,402	3,402	3,402	3,329
R^2	0.691	0.690	0.691	0.695

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of employment (FME_{cr}) made by foreign affiliates from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , and the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table D.8 – Vertically Integrated Networks and Business Cycle Correlations,

<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>					
	(1)	(2)	(3)	(4)	(5)
$FME_{cr}vertical(Empl.)$	35.26*** (2.591)				
IF_{cr}		0.56** (2.389)	0.54** (2.329)	0.41* (1.783)	0.39* (1.69)
Out_{cr}			9.33 (0.647)		8.94 (0.559)
BT_{cr}	13.97* (1.943)	4.78 (0.552)	4.78 (0.555)	6.41 (0.730)	6.42 (0.740)
IIT_{cr}	0.06 (1.325)	0.07 (1.568)	0.07 (1.568)	0.07 (1.598)	0.069 (1.599)
$DISIM_{cr}$	-0.06*** (-4.325)	-0.06*** (-4.665)	-0.06*** (-4.672)	-0.06*** (-4.699)	-0.06*** (-4.700)
Sample	Full	Full	Full	Input	Input
Region FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	3,329	3,276	3,276	3,234	3,234
R^2	0.695	0.694	0.694	0.695	0.695

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of employment (FME_{cr}) made by foreign affiliates which belong to a different industry as their parent from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization, the share of foreign affiliates (from c) intra-firm exports to country c in total trade (IF_{cr}), and the share of foreign affiliates (from c) arm-length exports to country c in total trade (Out_{cr}). The last column focuses on exports of intermediate products. Intermediates products are defined from Antras et al. (2012) distance to the frontier. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table D.9 – Foreign Affiliates and Business Cycle Correlations (Yearly Estimates)

<i>Dependent variable: ρ_{cr} = Correlation of growth rate of GDPs</i>						
	(1)	(2)	(3)	(4)	(5)	(6)
Year	1999	2000	2001	2002	2003	2004
$FME_{cr}(Empl.)$	13.12*** (4.256)	13.08*** (4.529)	11.32*** (3.976)	10.77*** (3.886)	11.27*** (3.668)	11.39*** (3.509)
BT_{cr}	-0.89 (-0.103)	0.58 (0.095)	5.69 (0.890)	6.46 (1.016)	12.00 (1.549)	11.45 (1.508)
IIT_{cr}	0.07 (1.593)	0.07 (1.553)	0.06 (1.380)	0.06 (1.380)	0.05 (1.264)	0.06 (1.345)
$DISIM_{cr}$	-0.06*** (-4.615)	-0.06*** (-4.591)	-0.06*** (-4.502)	-0.06*** (-4.472)	-0.06*** (-4.434)	-0.06*** (-4.460)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	3,329	3,329	3,329	3,329	3,329	3,329
R^2	0.695	0.695	0.695	0.695	0.695	0.695

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables computed for years 1999 to 2004 are: the share of employment (FME_{crt}) made by foreign affiliates from country c in region r at period t , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , and the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table D.10 – Foreign Affiliates and Business Cycle Correlations - Restricted sample

<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>				
	(1)	(2)	(3)	(4)
$FME_{cr}(Empl.)$	8.75** (2.462)		7.16** (1.964)	7.62** (2.042)
BT_{cr}		20.40** (2.074)	15.72 (1.591)	13.03 (1.337)
IIT_{cr}				0.01 (0.073)
$DISIM_{cr}$				-0.10*** (-3.019)
Region FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	714	714	714	714
R^2	0.653	0.653	0.655	0.661

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. It focuses on the sample of countries that invest in at least one region in France. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of employment (FME_{cr}) made by foreign affiliates which belong to a different industry as their parent from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization, the share of foreign affiliates (from c) intra-firm exports to country c in total trade (IF_{cr}), and the share of foreign affiliates (from c) arm-length exports to country c in total trade (Out_{cr}). The last column focuses on exports of intermediate products. Intermediates products are defined from Antras et al. (2012) distance to the frontier. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table D.11 – Geography, Foreign Affiliates and Business Cycle Correlations

<i>Dependent variable: ρ_{cr} = Correlation of HP-filtered GDPs</i>					
	(1)	(2)	(3)	(4)	(5)
$FME_{cr}(Empl.)$			11.03*** (3.179)		10.75*** (3.091)
BT_{cr}				15.24* (1.841)	9.64 (1.183)
IIT_{cr}					0.06 (1.309)
$DISIM_{cr}$					-0.06*** (-4.425)
$Distance_{cr}$	-0.06** (-2.576)	-0.05* (-1.892)	-0.04 (-1.527)	-0.03 (-1.276)	-0.02 (-0.722)
$Border_{cr}$		0.06 (1.060)	0.01 (0.249)	0.04 (0.710)	0.01 (0.126)
Region FE	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes
Observations	3402	3402	3402	3329	3329
R^2	0.690	0.690	0.691	0.691	0.695

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of employment (FME_{cr}) made by foreign affiliates from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization, the bilateral distance, and a dummy equal to one for contiguous region-country pairs. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table D.12 – Foreign Affiliates and Business Cycle Correlations (Using Value-Added instead of Employment Intensity)

<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>				
	(1)	(2)	(3)	(4)
$FME_{cr}(VA)$	5.33** (2.118)		4.39* (1.864)	4.52* (1.895)
BT_{cr}		20.42*** (2.680)	17.98** (2.335)	14.19* (1.916)
IIT_{cr}				0.06 (1.341)
$DISIM_{cr}$				-0.06*** (-4.419)
Region FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	3,402	3,402	3,402	3,329
R^2	0.690	0.690	0.691	0.694

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of value-added (FME_{cr}) made by foreign affiliates from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , and the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

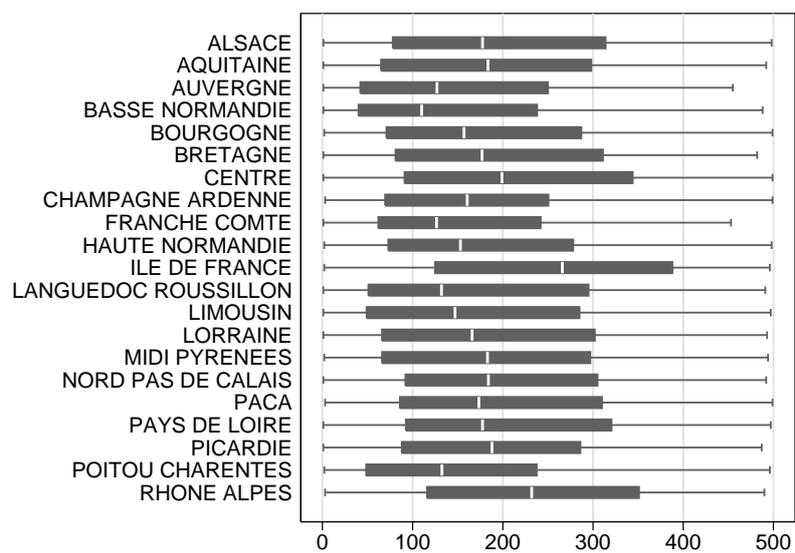
Table D.13 – Random assignment of affiliates composition across regions

<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>			
	(1)	(2)	(3)
$FME_{cr}(Empl.)$	-0.035 (-0.089)	-0.34 (-0.087)	-0.36 (-0.092)
BT_{cr}		20.43** (2.684)	16.57 (2.27)
IIT_{cr}			0.064 (1.49)
$DISIM_{cr}$			-0.056*** (-4.35)
Region FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Observations	3276	3276	3276

This table presents the results of a robustness check. Namely, we randomly assigned foreign affiliates composition across regions. We did the assignment 100 times. We then run 100 regression for each. The mean coefficients. The explanatory variables are the share of foreign affiliates from country c in their host region r employment (FME_{cr}), the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPs, the share of intra-industry trade (IIT_{cr}) between region r and country c , and the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization. Regression includes region and country fixed effects. Standard errors are computed as the average standard errors in our 100 trials. T-statistics are reported between parenthesis. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

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Figure E.3 – Ranking of the foreign affiliates among the 500 largest firms, by French region



This figure presents the ranking distribution of foreign affiliates among the largest 500 firms, for each French region. The results stand for manufacturing, extractive, and agriculture industries.

Table E.14 – Foreign Affiliates and Business Cycle Correlations (HP-filtered GDP)

<i>Dep. variable: ρ_{cr} = Correlation of HP-filtered GDPs</i>				
	(1)	(2)	(3)	(4)
$FME_{cr}(Empl.)$	6.97** (2.322)		5.61* (1.844)	5.80* (1.892)
BT_{cr}		14.83* (1.864)	12.25 (1.501)	7.52 (0.966)
IIT_{cr}				0.08 (1.629)
$DISIM_{cr}$				-0.06*** (-4.068)
Region FE	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes
Observations	3,402	3,402	3,402	3,329
R^2	0.663	0.663	0.663	0.667

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. It focuses on the sample of countries that invest in at least one region in France. The comovement is measured by the correlation of region r and country c HP-filtered yearly GDPs over the 1990-2006 period. The explanatory variables are the share of employment (FME_{cr}) made by foreign affiliates from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPS, the share of intra-industry trade (IIT_{cr}) between region r and country c , and the dissimilarity ($DISIM_{cr}$) of countries c and region r in terms of specialization. All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

Table E.15 – Foreign Affiliates and Business Cycle Correlations (Alternative measure of dissimilarity)

	<i>Dep. variable: ρ_{cr} = Correlation of growth rate of GDPs</i>	
	(1)	(2)
$FME_{cr}(Empl.)$	11.39*** (3.509)	10.70*** (3.288)
BT_{cr}	11.45 (1.508)	13.94* (1.785)
IIT_{cr}	0.06 (1.345)	0.07* (1.720)
$DISIM_{cr}(spéc.)$	-0.06*** (-4.460)	
$DIS_{cr}(prod.)$		0.10 (1.559)
Region FE	Yes	Yes
Country FE	Yes	Yes
Observations	3,329	3,329
R^2	0.695	0.693

This table investigates the determinants of the bilateral comovement of business cycles between French regions and foreign GDPs. The comovement is measured by the correlation of the yearly growth of region r and country c GDPs over the 1990-2006 period. The explanatory variables are the share of value-added (FME_{cr}) made by foreign affiliates from country c in region r , the bilateral trade (BT_{cr}) between region r and country c , normalized by the two GDPS, the share of intra-industry trade (IIT_{cr}) between region r and country c , the dissimilarity of countries c and region r in terms of specialization ($DISIM$, computed from 4-digit trade data), and the dissimilarity of production (DIS computed from 1-digit production data). All regressions include region and country fixed effects. Robust t-statistics are reported between parentheses. *, **, and *** indicate significance at 10, 5, and 1 percent levels respectively.

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