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"ESSAYS ON THE DRIVERS OF CHINA'S INTERNATIONAL TRADE"

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L’Université n’entend donner aucune approbation ni improbation aux opinions émises dans les thèses : ces opinions doivent être considérées comme propres à l’auteur.

A mes parents, Djeylane Fall et Aida Diallo, ma femme Oumou Ba

et à mon oncle Papa Ousmane Diallo!

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CONTENTS

Résumé

La Chine doit elle procéder à une réévaluation de sa monnaie le Renminbi ? Ses partenaires commerciaux souhaiteraient bien une décision allant dans ce sens là. Cependant la Chine est moins enthousiaste du fait de la croyance qu'une telle action nuirait à ses exportations. Ce débat a un sous-jacent bien particulier, en effet depuis son accession à l'OMC (Organisation Mondiale du Commerce), la Chine a accumulé des excédents commerciaux considérables, qui ont atteint 10% de son PIB (Produit Intérieur Brut) en 2008. La littérature s'est beaucoup penchée sur les conséquences d'une réévaluation réelle du Renminbi sur les excédents commerciaux de la Chine, sans pour autant tenir en compte l'évolution de certains aspects de l'économie chinoise suite à ses politiques de décentralisation et de son accession à l'OMC. Nous nous proposons d'ajouter à la littérature trois approches dans cette thèse que nous avons organisée en trois chapitres.

Dans la première approche (chapitre), nous avons étudié l'impact d'une réévaluation réelle de la monnaie chinoise sur sa balance commerciale. Ayant recours à des données de panel provinciales concernant les exportations et les importations des entreprises multinationales et domestiques dans la période 1996-2012 divisée en deux échantillons (1996-2006; 2002-2012), nous avons trouvé que les exportations et les importations réagissaient différemment à une réévaluation de la monnaie chinoise selon que les provinces concernées se situent à l'intérieur ou dans les cotes, mais aussi selon que l'entreprise est multinationale ou appartient à l'état chinois. Nous avons aussi constaté que l'effet d'une réévaluation du Yuan sur les exportations et les importations était plus accentué après l'accession de la Chine à l'OMC. Enfin, d'autres facteurs comme le taux de change nominal et les prix relatifs entrent en jeu dans l'explication de la dynamique des exportations et des importations de la Chine.

Dans le deuxième chapitre, nous avons étudié les effets spatiaux sur les exportations et les importations provinciales des entreprises multinationales et domestiques. Tenant en compte la dynamique dans les politiques de décentralisations adoptées par l'administration chinoise, nous avons utilisé trois différentes matrices de poids spatiales et maintenu la même division de période qu'au premier chapitre. La première matrice est composée de distance sphérique concernant 28 provinces de la Chine, la deuxième est composée de distance nautique concernant les provinces côtières, la troisième est composée de distance des rivières concernant les provinces situées autour de la vallée du Yangzi. La méthodologie d'estimation

spatiale utilisée a révélé des effets spatiaux importants sur les exportations et les importations des deux types d'entreprises, mais a aussi permis de faire un état des lieux sur l'intégration du marché domestique de la Chine.

Dans le troisième chapitre, nous avons étudié les flux de capitaux vers la Chine déguisés en valeur d'échanges commerciaux. En effet, la perception très répandue que la monnaie chinoise est sous-évaluée incite les investisseurs à faire entrer des capitaux en Chine sous forme de surfacturation des exportations et de sous-facturation des importations, car les entrées de capitaux sont strictement contrôlées. Nous avons proposé une nouvelle approche en utilisant les prix des produits échangés les plus susceptibles à la manipulation et étudié leur sensibilité à l'anticipation d'une réévaluation future de la monnaie chinoise représentée ici par « le taux de change future non livrable du Yuan à Hong-Kong». Nous avons trouvé que la balance commerciale de la Chine était relativement surestimée.

Mots-clés : Chine, balance commerciale, changement structurel, réévaluation réelle, données de panel, effets spatiaux, exportations, importations, modèle spatial, entreprise étrangère, entreprise domestique, capitaux entrant, prix des produits importés et exportés, taux de change futur, facturation inappropriée du commerce.

Abstract

Does China need to revaluate its currency the Renminbi? Its trading partners really hope so. However, China is less enthusiastic because of the belief that such decision would negatively affect their exports. This debate arose when China's trade surpluses ballooned after its WTO (World Trade Organization) accession, reaching 10% of its GDP (Gross Domestic Product) in 2008. There is a plethora of academic research on such debate, and a fundamental question was, if a more valued Renminbi would help alleviate global imbalances with China. Nonetheless the evolution of some aspects of China's economy has been rather ignored by the previous studies. We add to the literature three contributions organized as follows.

In the first contribution (chapter), we investigate the impact of a revaluation of the China's Yuan on its trade balance. We use panel data on export and import of multinational and domestic firms, disaggregated at a regional level in the period 1996-2012 separated into two samples (1996-2006; 2002-2012) in order to take into account the likely structural break after China's WTO membership. We find significant impact of a revaluation of the Yuan on export and import, the impact differs regionally, time period, and by firms. We also find that other factors like nominal exchange rate and relative prices play significant role in explaining China's trade balance.

In the second chapter, we investigate the spatial effects on China's trade performance. In fact, we use the same data and the same separated samples as in the first essay to account for the sharp differences between the findings for the provinces in the interior of China comparing with the provinces located in the coast. We use three different weight matrices to take into account the dynamism in the China's decentralization policies. The first one is a spherical distance weight matrix covering 28 Chinese provinces. The second one is a nautical mile weight matrix measuring the spatial effects for the provinces in the coast. The third weight matrix is the river distance weight matrix, measuring the spatial effects for the provinces in the Yangtze valley. We find significant spatial effects on export and import, varying between firms, regions and time period. This essay also reveals important facts on the China's domestic market integration.

In the last chapter, we put forth a new approach to measure capital inflows into China hidden in the regular trade flows. This phenomenon known as trade misinvoicing is suspected to actually overstate China's trade surpluses. In fact, the widely held perceived undervalued Yuan because of the trade surpluses fueled into expectations of a future revaluation of the

Chinese currency. We measure the sensitivity of the prices for some commodities which are the most susceptible to trade misinvoicing to the non-deliverable forward exchange rate for the Yuan in Hong-Kong. We find that, in fact China's trade balance is relatively overestimated.

Keywords : China, Trade balance, Structural break, Real appreciation, Panel data, cross border effects, export, import, spatial model, foreign owned firms, Chinese owned firms Capital inflows, Export and import prices, Forward exchange rate, Trade misinvoicing.

Introduction

China's strong presence in world trade at the beginning of the new millennium has been characterized by global trade imbalances, which have occupied most of the world economic policy debates during the last decade. China's growing role in international trade was regarded as a possible threat to world economy. Already in 2000, China had become the largest contributor to the US trade deficit, replacing the long-time leading contributor, Japan. In fact, China has experienced huge trade surpluses after its WTO (World Trade Organization) membership in 2001. China's trade surpluses ballooned in 2005 reaching 10% of its GDP in 2008, even though declining after. China has been the world's largest trading nation since 2013, and had already become the world's largest exporter of goods in 2009, overtaking the US. China's foreign trade increased 3.4% in 2014, significantly lower than the 7.6% rise in 2013. According to China's trading partners, especially the US, China's large trade surplus is due to its undervalued currency, the Renminbi (RMB). Global trade imbalances with China became a politicized issue in 2003, intensifying criticisms against China, indeed, Chinese trading partners point out the necessity to revaluate the RMB in order to alleviate existing trade imbalances, with associated resistance by the Chinese authorities.

In fact, the real value of the China's currency has been a hot topic following the phenomenal expansion of the country's exports over the last decade. China has been accused of manipulating its currency value to maintain competitive prices in exports. Although the nominal rate of the RMB against the US dollar has appreciated over 17% since the mid 2005, but merely 8% on a real trade-weighted basis by July 2008, the belief that the RMB is substantially undervalued still persists, as during the same time period, the US dollar

depreciated by 15% on a real trade-weighted basis. In sum, the RMB appreciation was minimal. However, a fundamental issue following these opposite views on currency adjustments should be: would an appreciation of the Chinese currency help correct the effects of global imbalances?

Answering this question may not be simple. As have already tried some economists, this issue is still a challenging one. First, this phenomenon is not something new in history, because the US-China case is similar to the US-Japan case in the 1980s. Japan's trade surpluses with the US represented 4.3% of its GDP in 1986, the highest level until 2006. Against this backdrop, some observers claimed that the Japanese Yen was manipulated and undervalued. Following the pressures from the US on the Japanese government,[1] the Yen appreciated by 50% by 1989, the Japanese trade surpluses started shrinking and were reduced to 1.5% of GDP in 1990. The level of the Yen was clearly not the main problem.

Can we expect the same outcome in the US-China case? To what extent may trade imbalances with China be responsive to exchange rate revaluation involving the RMB? Indeed, there is a plethora of academic research on China's trade phenomenon. By studying the extent to which a more revaluated Yuan would help alleviate global imbalances, economists have used different methodologies and have offered a range of estimates of the impact of a revaluation of the RMB on the Chinese trade surpluses.

However, some aspects of the China's economy such as the changing structure of trade after its WTO membership, regional characteristics related to its decentralization policies initiated in 1978, and the growing phenomenon of hidden capital inflows, overstating China's trade surpluses have been neglected. Indeed, in this thesis, we have taken into account these facts to unravel the

[1] Following the Plaza Accord in 1985, the party countries jointly intervene the foreign exchange markets to guide the US dollar to depreciate against the Japanese Yen and Deutsche Mark. See Ito (2009) for useful comments of these events.

factors behind the dynamism of China's international trade during the last two decades.

First and foremost, China's World Trade Organization (WTO) entry (2001) has boosted its economic growth and advanced its legal and governmental reforms. China's macroeconomic situation has improved remarkably. Its gross domestic product (GDP) grew by 7.9% in 2002, while exports increased by 19.4%. The rapid growth in China's trade volume is directly attributable to the improved trade environment following its WTO entry. The influx of foreign investment also increased rapidly. Multinationals have become more confident in investing in China after its WTO accession[2]. Constantinescu et al. (2015), using world trade data between 1970-2013, find a structural break in the trade-income relationship. When exploring country level data, they find that the responsiveness of trade to income in the 2000s is lower relative to the 1990s for both advanced economies and developing countries. This is true for the US, Latin America, and the Caribbean, but for the Euro area, they find an increase in the responsiveness of trade to income over the 2000s. More interesting, they find a decrease of the responsiveness of trade to income in the 2000s for China. Is it true for China when more disaggregated data at a provincial level are used? Do China's trade flows react differently to their determinants after WTO membership?

Second, in recent years, regional economic analysis has been widely developed. Mc Callum (1995) and Helliwell (1996, 1999) find provincial trade more important than international trade, with special reference to Canadian provinces. This literature put forth the idea that provincial and national linkages are more important than international linkages. We can expect strong provincial border effects on China's international trade flows when taking into account the domestic transportation of goods before sending them abroad. We may also

[2] China daily (November 2002).

account for the great disparities between regions in China (Aziz and Duenwald (2001)). There are quite pronounced economic inequalities across regions in China. In this regard, Naughton (2000) has stressed the marked differences in the capacity of regions to absorb economic shocks, while he underscored the associated advantages of a more unified overall domestic market.

« There have been concerns in recent months over the accuracy of the country's trade data, with speculation that some Chinese companies have overstated their exports to circumvent controls on cross-border transactions and bring more cash into the country », (China daily, January 2014). In this thesis, we have taken into account the hotly debated issue of capital flowing into China and hidden in the regular trade flows, overestimating China's current account surplus. The widely perceived undervaluation of the Yuan because of the trade surplus feeds into expectations of a future revaluation of the Chinese currency, and as there are capital controls in place, the only ways to enter speculative money in China is through regular trade and/or FDI.[3] This phenomenon for trade, under study here, and known as trade misinvoicing (Pak et al. 2003, for Brazil, US, Switzerland, Greece, Russia) can induce distortion in the measure of price and income elasticities to trade.

The benchmark findings of this thesis are a testimony on the necessity to take into account the massive changes in the China's internal economy during the last two decades when analyzing the determinants of China's international trade. Domestic infrastructure investments are a major factor having substantial implications for China's industrial competitiveness at the level of different regions. In fact, economic inequalities observed between regions in China challenge all attempts to explaining China's trade pattern without carefully disaggregating the determinants of China's international trade. Furthermore, the widely perceived phenomenon of disguised capital inflows in China,

[3] See Michael F. Martin and Wayne M. Morrison (2008) for more details on illicit inflows via FDI.

overestimating its trade surpluses, sparks in fact serious concerns about the accuracy of the previous estimates of the determinants of China's international trade. Our empirical analyses show that:

China's trade flows react differently to their determinants after its WTO membership, showing a structural break for the Chinese economy. The determinants of China's trade flows involving coastal and interior regions affect differently China's trade balance. Exchange rate revaluation is not the most important determinant of China's trade, mostly if distinguishing between the effects on China's trade flows of the nominal exchange and relative prices.

Chinese provincial cross border effects are important determinants of its international trade flows. When spatial effects are included in the specifications of China's international trade, the other determinants are less important in explaining China's trade flows. The cross border effects affect differently trade flows in the coastal provinces as compared with provinces in the Yangtze valley, and at the national level.

Finally, we find that China's export flows are overestimated, and import flows are underestimated. As a result, China's trade surpluses camouflage capital inflows hidden in the regular trade flows. So these findings mitigate the assertion that a unilateral appreciation of RMB could resolve global trade imbalance issue.

This thesis proceeds in three chapters. In chapter 1, we examine the impact of a revaluation of the RMB on China's external imbalance through the period 1996-2012 separated into two samples (1996-2006 and 2002-2012). To take into account the changing structure of China's international trade, we use trade data for the domestic and multinational firms implanted in China, disaggregated for 29 Chinese provinces. We use GMM (Generalized Method of Moments) methodology proposed for panels by Arellano and Bond (1991), which is more

efficient when time span is short relative to individuals. We also use in this chapter a common factor for robustness issue, which plays a significant explanatory role.

In the second chapter, we construct three spatial weight matrices to take into account the effects of cross provincial borders on China's international trade flows. The spherical distance weight matrix measures the impact of cross border effects on China's trade flows, the nautical miles and river distance weight matrices measure the impact of maritime and river connections on trade flows for the provinces along the sea coast and in the Yangtze valley respectively. The same trade data, time span, and separated samples as in the first chapter are used here in spatial lag and spatial error models. We find significant cross border effects on China's trade flows and the effects vary between areas, time periods, and firms.

In the last chapter, we investigate the phenomenon of capital inflows disguised in the regular trade flows, overestimating China's trade surpluses. In fact, the widely perceived undervaluation of the Yuan because of China's 'apparent' trade surpluses has fueled expectations of a future revaluation of the Chinese currency. In a panel gravity modeling framework, augmented with a mixed-effects model, we show that China's export and import prices for some commodities are sensitive to the non-deliverable forward exchange rate for the RMB in Hong-Kong, reflecting the impact of speculative factors on the pricing strategy of the traded goods. We have calculated the amounts of capital inflows into China through export and import nominal values between 1999-2009. The calculated amounts suggest clearly that China's trade surpluses have been overestimated, hiding disguised capital inflows.

Chapter 1

To What Extent a Revaluation of the RMB Can Affect China's Trade Balance?

1.1 Introduction

By end 2004 China's trade surpluses took an unprecedented turn upward reaching 10% of its GDP in 2008 even though they declined subsequently. With corresponding rapid accumulation of international currency reserves, particularly in US dollars, low rates of economic growth outside China, there has been considerable pressure put on China to appreciate the RMB, with associated resistance by the Chinese authorities. Indeed, a radical adjustment of existing RMB exchange rates appears to be viewed in a number of western countries as not just a compensatory measure, but almost a panacea for responding to certain economic woes elsewhere, where the latter have been exacerbated by the subprime and Euro zone financial crises. A fundamental question raised by such debates is the extent to which China's trade imbalances may actually be responsive to exchange rate revaluation involving the RMB.

Recent research has tried to attach some quantitative importance to the impact of an appreciation of the Chinese RMB on China's trade imbalances. Notably recent approaches have sought to control for the central role of China in not only Asian, but also overall international production networks, where a crucial distinction arises between Chinese exports and production entailing imported components, or transformed production - mostly from elsewhere in Asia - and exports based on value added which is generated within China's

internal economy. Multinational enterprises account for by far the lion's share of such transformed production and exports, amounting, as suggested by Ma et al. (2010) to fully approximately 80 percent of such activities. This issue has been central to a number of other recent contributions, considering the trade sensitivity of Chinese exports and imports to exchange rate changes. These include Cheung et al. (2012), Dees (2001), Aziz and Li (2007), Cheung, Chinn and Fujii (2009), Marquez and Shindler (2007), Thorbecke and Smith (2010), as well as Garcia-Herrero and Koivu (2009). Among earlier studies focusing on this question can be noted that by Cerra and Dayal-Gulati (1999) which estimated aggregate export and import price elasticities, over the period 1983 to 1997, to be highly inelastic with values, respectively, of -.3 and .7. Simulations by Benassy-Quéré and Lahreche-Révil (2003) of the trade effects of a depreciation of the RMB found that whereas exports between China and OECD countries increase, there was an associated reduction of imports coming from emerging economies in Asia, under the assumption that exchange rates within Asia remained constant. Further simulations by Kamada and Takagawa (2005), in this case for the effects of a 10% appreciation of the RMB, suggested only a limited impact on China's exports, while imports were weakly stimulated. Yue and Hua (2002), along with Eckauss (2004), based on periods prior to China's entry into the World Trade Organization, broadly confirmed the results of the foregoing studies; namely, that an appreciation of the RMB can produce a fall in Chinese exports, while Voon and al (2006), using sectoral data covering the period 1978 through 1998, also found similar negative effects. Nonetheless, while studies relying on recent data corroborate the foregoing findings regarding the likely impact of a RMB appreciation on Chinese exports, research, including that of Garcia-Herrero and Koivu (2009), as well as Marquez and Shindler (2007), identified a somewhat surprising result, that such an appreciation can actually produce a negative effect also on imports, where these studies examine China's trade performance from the perspective of global trade shares. More

recent studies seek to control for the rapid changing structure of the Chinese economy by using highly disaggregated data, and suggest the need for future studies to do so in order to obtain more precise estimates. Moreover, studies relying on more recent data corroborate the forgoing findings regarding the likely impact of an RMB appreciation on Chinese exports, with a sharp rise in elasticities associated with WTO entry. Cheung et al. (2012), which use disaggregated data, show more robust estimates, but the only way in which they allow for WTO effects is through a step dummy. More recently, Girardin and Owen (2014) identify a clear regime changes after the WTO entry in a regime switching analysis of the impact of a real RMB revaluation on the Chinese trade imbalances. The latest IMF working paper on the Chinese trade imbalances, Ahuja et al. (2012) investigates the dynamics behind the recent drop of the China's trade surpluses. They conclude that, growing domestic investment; worsening terms of trade, weakening external demand and the real effective exchange rate appreciation explain a large share of the post crisis decline in the Chinese current account surplus.

The novel perspective offered by the present research is an assessment of the extent to which a real revaluation of the RMB contributed in a meaningful way to the shrinking of China's trade surpluses. To do so, we conduct for two separate periods an analysis of new determinants of China's trade, among them, China's nominal effective exchange rate at a provincial level, as well as relative prices at a provincial level. The first sample spans the period 1996-2006, which allows us to take into account the features of the Chinese economy during the 1990s, and subsequently to compare with the second period of analysis (2002-2012), which exclusively contains the characteristics of the Chinese economy at the turn of the Millennium. This last sample leads us to analyze the impact of the real appreciation between 2002 and 2012, the beginning of the WTO membership, the pre-crisis, and the post crisis periods. We have taken into

account China's rapid changing structure of trade by using panel data of imports and exports for multinational firms implanted in China, and for the domestic firms, both disaggregated at a provincial level. The inclusion of a panel data set for 29 provinces not only facilitates more sophisticated econometric analysis, but also allows for distinctive regional effects. Notably, in this regard, it is likely that both trade price and income elasticities may differ substantially for coastal regions, relative to those in the interior, in light of the quite different historical evolution of their degrees of openness to international trade and foreign direct investment.

The dynamic panel analysis proposed here uses the methodology proposed by Arellano and Bond (1991) in order to analyze the panel covering 29 provinces and the period 1996-2012, separated in two samples of eleven years both, while breaking down the export and import trade flows to distinguish between multinational and non-multinational firms. The empirical analysis includes estimates of regional effective exchange rates, as well as statistics for regional GDP. Since foreign direct investment is highly asymmetrically distributed across Chinese provinces and, for historical and other reasons, quite concentrated in China's coastal provinces, the distinction between the determinants of trade flows involving coastal and interior regions is central to the empirical concerns examined here. Notably, much of the production activities of foreign subsidiaries in the coastal provinces and specialized export zones entail transformed exports (such as electronic products, including mobile phones, etc.), which are principally aimed at sales abroad, rather than for sale in the local domestic market.

For the first sample (1996-2006), an appreciation of the real exchange rate has a negative impact on exports for the two types of firms; the impact is negative for imports for both firms. For the second sample (2002-2012), the impacts show the same features, and are slightly greater in absolute value for

export. The perverse effect on imports disappears here for the non-multinational firms, while the impact of a real revaluation on the non-multinational import is positive. According to the overall effects on Chinese trade imbalances investigated in this chapter, we cannot conclude that the real revaluation of the Chinese currency has had a dominant role.

The rest of this chapter[4] is organized as follows. Section 2 offers an overview of salient features characterizing economic activity and trade at a regional level in China. The discussion in the following section then introduces the empirical methodology appropriate for such dynamic panel analysis, while in Sections 4 and 5 the actual econometric estimations are reported and interpreted. A concluding section summarizes the principal contributions of this research, while identifying avenues for further investigation.

1.2 An Overview of Distinctive Economic and Trade Characteristics of Chinese Regions

As of 1978 China opted for an economic policy of regional decentralization accompanied by a liberalization of international trade, which favor the development of special economic zones for the coastal regions, as well as a significant degree of export specialization in different areas[5]. Such reform policies undoubtedly entailed major implications for regional economic development, driven to a large extent by the literal explosion of foreign direct investment, which was, nonetheless, highly asymmetrically distributed across regions. Moreover, the concentration of state-owned firms often amplified such distributional effects, leading to quite pronounced economic inequalities across regions, as analyzed, by among others, Aziz and Duenwald (2001), Dayal-

[4] This chapter is realised with the collaboration of Mr Eric Girardin and Mr Robert Owen.

[5] *'Coastal' provinces here include: Anhui, Beijing, Fujian, Guangdong, Guangxi, Hainan, Hebei, Jiangsu, Jiangxi, Liaoning, Shandong, Shanghai, Tianjin, and Zhejiang. Interior provinces include all others except Chongching, Inner Mongolia and Tibet.*

Gulati and Hussain (2000) and Chen et al. (1996). Yet, the consequences of government policies in explaining the quite unequal nature of strategic export and import performance across Chinese regions have received considerably less attention. Both the export propensities and growth have varied substantially across regions, as illustrated, for example, by an annual growth rate of exports between 1990 and 1998 of 60.4% in the case of Xinjiang, whereas that of Heilongjiang amounted to only 2%. Associated with such divergent trade performance have been rising regional disparities in standard of living as documented by Chen and Fleisher (1996). Among other problematic consequences of such a fragmentation of the Chinese domestic market have been the challenges that these regional divergences in economic performance entail for macroeconomic stability. In this regard, Naughton (2000) has stressed the marked differences in the capacity of regions to absorb economic shocks, while he underscored the associated advantages of a more unified overall domestic market. The key role of foreign subsidiaries in accounting for such divergent regional economic performance is suggested by the dominant position in that regard of Guangdong, where, for example, multinational firms export not only more than domestic producers in Beijing, but also than foreign subsidiaries in all other Chinese provinces. Figures 1 and 2 illustrate certain salient examples of the remarkable build-up, over the 1996-2010 period, of international trade in certain regions, relative to the scenarios for other provinces.

Figure 1: Exports by Multinational and Non-Multinational Firms in Specific Regions (FIE= Foreign-Funded Firms' Exports, NFIE= Non-Foreign-Funded Firms Exports)

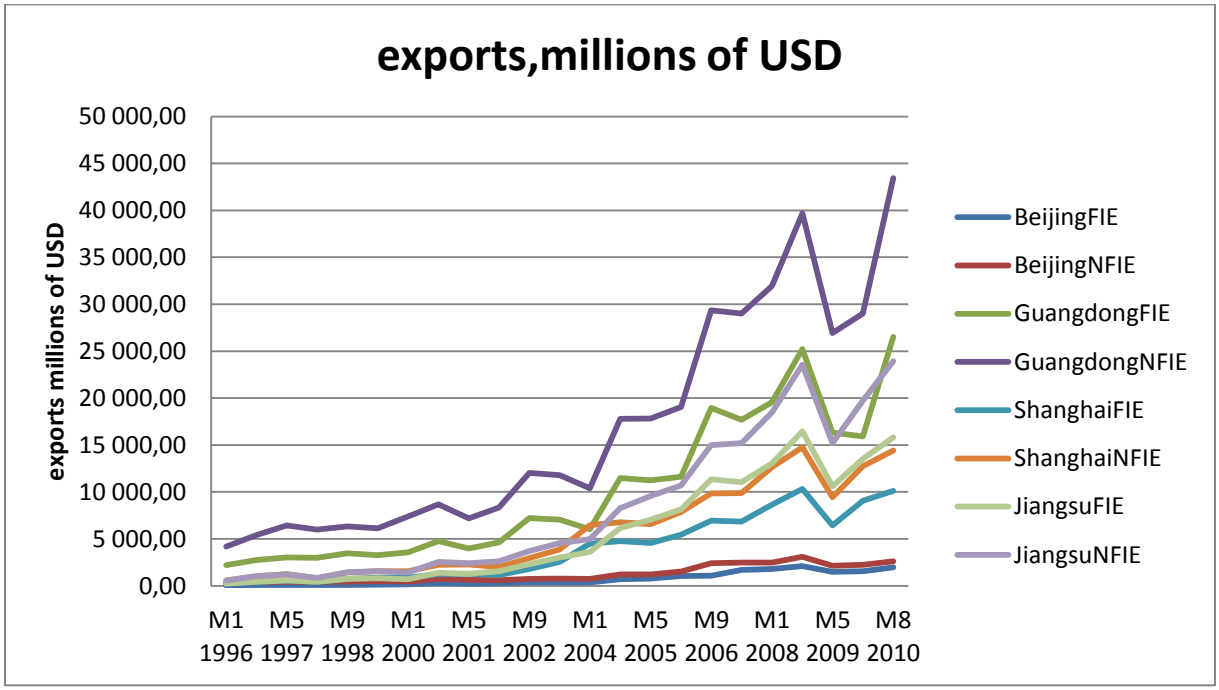
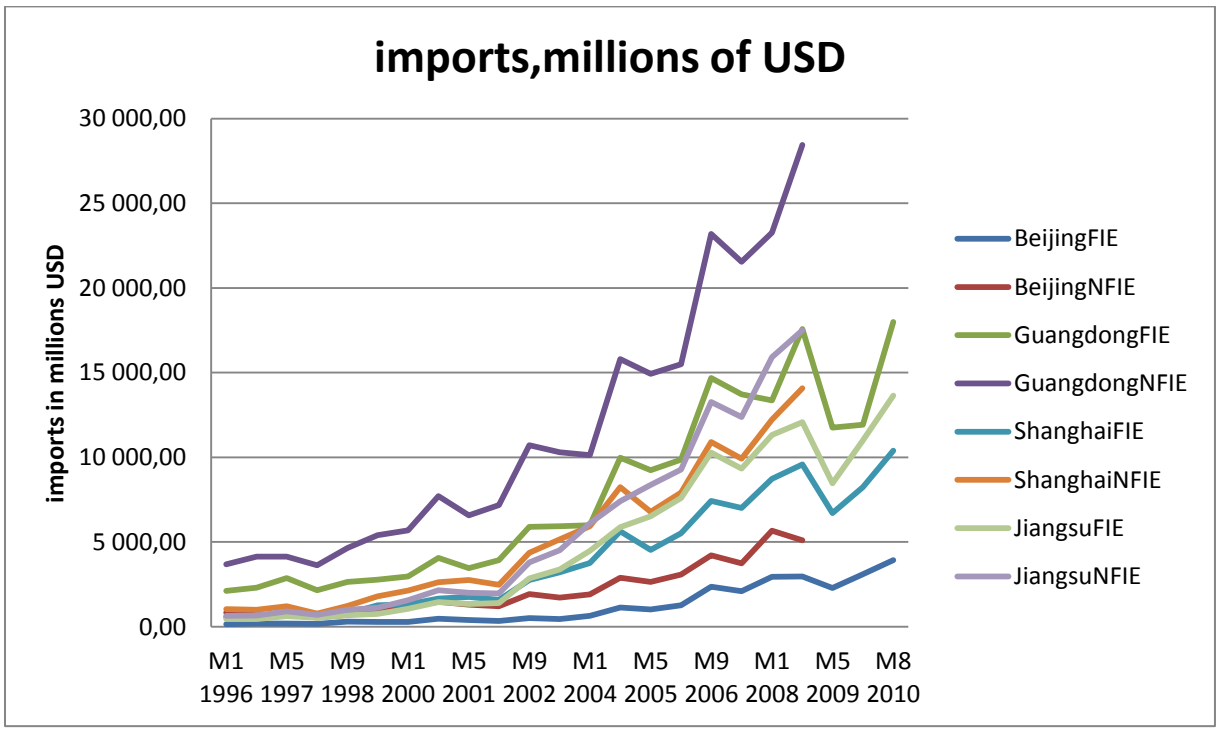


Figure 2: Imports of Multinational Enterprises and Non-MNE's for Specific Regions (FIE= Foreign-Funded Firm's Imports, NFIE= Non-Foreign-Funded Firms Imports)



Furthermore, a particular concern of the present research is that almost the quasi-totality of exports by multinational firms is concentrated in the coastal provinces, which account for 97% over the whole 1996-2010 period.

1.3 Presentation of Data and Econometric Methodology

First and foremost, we use a simple trade model with monetary structure as a brief recall on how an RMB appreciation can directly impact on the Chinese trade flows. We specify a monetary regime in a model with monetary non neutralities as the current Chinese exchange rate and monetary regime. Money demand and money stock determine prices of goods in terms of money.

We consider a simple 2 goods (good 1 and good 2) 2 countries (country 1 and country 2) pure exchange world. No time structure and a single period world is assumed, where X_1 and X_2 are the initial endowments of goods 1 and 2 in countries 1 and 2. X_1^1 X_2^2 and X_2^2 (X^j_i) denote the demands for good i (i= 1,2) in country j (j= 1,2).

China is assumed to be the surplus country, (country 1), and the deficit country (country 2) the rest of the world. The endogenously determined trade surplus is directly incorporated into the two country budget constraints.

Country 1 (China) fixes its exchange rate and has non accomodative monetary policy. Country 2 (the rest of the world) will be assumed to fix its money stock. This implies that jointly countries 1 and 2 exhibit relative money stocks inconsistent with the fixed exchange rate and monetary non neutralities result. This is assumed to be a reflection of policy choices by country 1. The fixed exchange rate choosen by country 1 (China) is represented by $\overline{e}$, and S the endogenously determined surplus denominated in the currency of country 2 (the rest of the world), the budget constraint for country 1 is

$P_1X_1^1 + \bar{e}P_2X_2^1 = P_1\bar{X}_1 - eS$ (1)

and, for country 2 :

$\frac{1}{\bar{e}}P_1X_1^2 + P_2X_2^2 = P_2\bar{X}_2 + S$ (2)

If, for simplicity, we assume a velocity of circulation of unity in both countries, and money stock in country 1 of $\overline{m}_1$ and in country 2 of $\overline{m}_2$, money demand and supply equations are :

$P_1X_1^1 + P_1X_2^1 = \overline{m_1}$ (3) and

$P_2X_2^2 + P_2X_2^1 + S = \overline{m_2}$ (4)

Adding demand supply equalities in goods gives equations (5) and (6)

$X_1^1 + X_1^2 = \bar{X}_1$ (5)

$X_2^2 + X_2^1 = \bar{X}_2$ (6)

The outcome of equations (1) - (6) gives 6 unknowns (X_1^1,X_2^2,X_1^2,P_1,P_2,S) for which $\bar{e}$ and $\bar{m}_1$ are policy parameters for country 1 given the setting of $\bar{m}_2$ in country 2. Thus, if country 1 is China and it changes the exchange rate for a given $\bar{m}_1$ there will be real side effects. In this model, the exchange rate setting acts as price intervention now supported by stock piling of foreign exchange. Changes in $\bar{e}$ in turn directly impact on S, as well as on real side of the economy. See Wang and Whalley (2010) for more details.

1.3.1 Presentation of Data

The panel data set used here covers annual statistics over the period 1996-2012 (detailed data description and descriptive statistics are available into appendix A). The principal data set is that of the CEIC, which has been

complemented with statistics from the International Financial Statistics (IFS) and World Economic Outlook (WEO) of the IMF. Central to this study are the statistics on regional exports and imports, which are broken down between multinational enterprises and Chinese domestic firms for 29 provinces, which have been deflated by the unitary values of exports and imports by Hong Kong[6] for these two control groups. Real effective exchange rates (REERs), calculated at a provincial level, the nominal effective exchange rate (NEERs), a computed relative price, along with regional GDP play a significant role in the subsequent empirical analysis. The source for China's REER is the BIS; while a province specific REER is generated by substituting the province-specific for the national consumer price index, both extracted from China's National Bureau of Statistics' database. World GDP is based on an aggregate figure for 22 industrialized economies, computed for WEO, which are the principal recipient countries of Chinese exports, and is expressed in real terms in billions of US dollars, having used the US consumer price index as a deflator. All of the data are used in logarithmic form.

1.3.2 Econometric Methodology

In order to assess the extent to which export and import from China are potentially influenced by a real revaluation of the RMB, the following relatively reduced form trade equations are estimated using the annual panel data set spanning the 1996-2012 period, separated into two samples where the series are broken down horizontally across the 29 provinces i, and for the two firm groups of MNEs and non-MNEs, j. Since the objective will be to test dynamic relations, the two equations for imports and exports are estimated for each sample using the Generalized Method of Moments (GMM) proposed for panels by Arellano and Bond (1991).

[6] Estimations using Chinese export and import unit values did not show any substantial qualitative difference and thus are not reported.

$$lnX_{jt}^{i} = \alpha_0 + \alpha_1 lnX_{jt-1}^{i} + \alpha_2 lnREER_{it}^{p} + \alpha_3 lnGDP_{it}^{w} + Controls_{it} + u_{it} \quad (7)$$

$$lnM_{jt}^{i} = \beta_0 + \beta_1 lnM_{jt-1}^{i} + \beta_2 lnREER_{it}^{p} + \beta_3 lnGDP_{it}^{p} + Controls_{it} + u_{it} \quad (8)$$

i = 1…, 29 provinces, j = firms, t = 1……17

lnX_{jt}^{i}, is the logarithm of the volume of exports associated with a given category of firms j in province i. The associated weights used are those of the overall trade for China, as a whole.

$lnREER_{it}^{p}$ is the logarithm of the real effective exchange rate calculated for each province, using its own consumer price index.

$lnGDP_{it}^{w}$ is the logarithm of world GDP

lnM_{jt}^{i} is the logarithm of the volume of imports associated with a given category of firms j in each of the provinces i.

$lnGDP_{it}^{p}$ is the logarithm of GDP at a provincial level.

Variables used as control here are FDI at a provincial level, the common factor and exports in the import function.

The term u_{it} contains two forms of errors, as represented by, $u_{it} = \mu_i + \lambda_t$

where μ_i corresponds to the individual error term for each province, while λt is a fixed effect related to each period of time, t.

The dynamic relation modeled here uses the methodology proposed by Arellano and Bond (1991). Such methodology is appropriate when N is large or moderately large while T is small. The presence of a lagged dependent variable in the Arellano and Bond methodology among the exogenous variables poses a potential problem of autocorrelation which will be resolved by the estimation procedure. A common factor has also been included in order to verify the robustness of the results for the two samples. In fact, it can be supposed that the

exports by firms from a given province are related to the overall exports from China in a specific sector. Finally the common factor help us correct for heterogeneity. Accordingly, all of the equations will be re estimated using a common factor in keeping with the method set forth by Gengenbach et al (2008). More specifically, the analysis of Gengenbach et al. considers two alternative assumptions: that the common factor F_t is either observed, or not observed. In the case where it is not, Bai and Ng (2004) propose using Principal Component Analysis (PCA) in order to estimate F_t. The potential problem with such an approach is that the estimation procedure suffers from the generated regressors' problem, since the errors from the first estimation stage risk being present in the subsequent estimation stages. In order to respond to this problem, Pesaran (2007) has proposed to use an arithmetic average for the observed variables in the horizontal cross-samples, as an approximation for the non-observable common factor. Such a hypothesis regarding the non-observability of the common factor appears to be much more realistic, and is accordingly the one relied on in the econometric estimation reported here.

It will be assumed that $Z_{it} = (Y'_{it}, X'_{it})'$ is a vector of idiosyncratic variables, where Y'_{it} is r * 1 and X'_{it} is m*1. F_t represents a vector of common factor sharing dimension k.

$Z_{it}^{+} = (Z'_{i,t}, F'_t)'$ is the global vector containing all of the variables. The ARMA representation (autoregressive moving average) of Z_{it}^{+} is given by the following expression:

$$A_i(L)\,(Z_{it}^{+} - (\pi^{*}_{i})'\, gt) = c_i(L)\,\in^{+}_{i,t},$$

$c_i(L) = |\Gamma_i^{+}(L)|$ is a scalar lagged polynomial. This ARMA representation implies that $Z_{it\ can}$ be written in the following form: $Z_{it} = \Lambda_i F_t + E_{i,t}$, where $E_{i,t}$, is independent across the panel horizontally;

Λ_i is the matrice (1 + m) * k of weights, and $E_{i,t}$ is a vector representing the idiosyncratic component of Z_{it}.

It can be noted that $\overline{Z}_t$, $\overline{\Lambda}$ and $\overline{E}_{it}$ represent the horizontal averages across the panel of Z_t, Λ and E_{it}, and as a result:

$$\overline{Z}_t = \overline{\Lambda} F_t + \overline{E}_t$$

(See Gengenbach et al. 2008).

1.3.3 Estimation Methodology

The estimation of equations 1 and 2 poses a number of potential econometric problems. Specifically, since the individual fixed effects can be impacted by the geographical situation of the different Chinese provinces, as well as their specific characteristics, they can be correlated with the explanatory variables. The fixed effects are contained in the error terms, which contain the specific unobservable provincial effects and the specific errors related to the provinces themselves. The presence of a lagged dependent variable raises a potential issue of autocorrelation. Finally, this panel is characterized, as previously noted, by a short temporal dimensionality, relative to the number of individual (provincial) observations across the sample horizontally. The approach adopted in this research is to undertake the estimations with the option of asymptotically more efficient two-stage estimation. In addition, the robust option is used to rectify possible problems of both heteroskedasticity and autocorrelation, while finally control for the potential bias that can arise when the number of instruments is comparable to the number of observations, which is often the case with relatively smaller panel samples. We apply also the correction of Windmeijer (2000) to compensate for the potential downward bias of the standard errors. In two step estimations the standard covariance matrix is already robust in theory but typically yields standard errors that are downward biased. In order to test

for autocorrelation in levels, the results of the autocorrelation tests in AR (2) need to be considered.

1.4 Principal Findings

For the sample 1996-2006, an appreciation of the real exchange rate has a negative effect on exports for the two types of firms; the effect is significant for both of them. The impact of world GDP is significant also for the two types of firms. The impact of a real appreciation is negative for imports for both types of firms, and significant for the multinational firms, but insignificant for the non multinationals. All of the impacts are higher in absolute value for the non multinational firms, considering export; they are more sensitive to a real revaluation, and to the world activity. However, for imports, multinational firms are much more impacted by a real revaluation, the impact is high and strongly significant, and we can explain that outcome by the processing activity which is dominant for the multinational firms. The imports of multinationals are affected by provincial GDP, which implies that such trade flows are also being used to serve the local Chinese market. The negative elasticity for imports in relation to the real effective exchange rate represents a counter-intuitive result, but, as previously discussed, is one that has also been frequently reported in the existing literature, but neither the impact of the real exchange rate, nor the impact of the provincial GDP is significant for the non-multinational firms which warrants further investigation.

The sample 2002-2012 is characterized by the following feature: the impact of a real appreciation on exports is negative for the two types of firms and significant at the 1% level. For imports, the impact is negative for the multinational firms at the 5% level, and positive for the non multinational ones at the 10% level. The introduction of the common factor confirms the results and the signs exhibited by the exchange rate for the two types of firms. For this sample, we can see that,

the impact of the real exchange rate is higher in absolute value, compared to the first sample, but very slightly. For import, the counter intuitive effects characterizing the impact of the real exchange rate is still observed for the multinational firms, but has disappeared for the non multinational firms. The introduction of a common factor shows that multinational imports are much more impacted by a real revaluation that can be explained by a high level of processing activity as shown by the counter-intuitive sign of the real exchange rate. For the case of MNEs, the explanation appears largely related to the vertical integration of these export-oriented firms, which constitute production chains across Asia. In such configurations, other Southeast Asian countries are principal suppliers of natural resource inputs, components and machines for foreign subsidiaries in China. Hence, the fall in export generated by an RMB appreciation is likely to have a direct pass through effect on such imports. In this regard, a study by the Monetary Authority of Hong-Kong (August 2003) has reported that international trade in transformed products represents fully 56% of overall intra-regional Asian trade outside of Japan. Lau et al. (2004) have reported that 48% of China's imports actually constitute products destined to be inputs for subsequent export abroad. Nonetheless, revisiting the stylized facts of China's processing trade reveals that in 2008, US$61 billion process import were originally produced in China, making China the second largest source of its own processing import. These processing imports were first manufactured by domestic firms, then exported to Hong-Kong, and eventually re-imported back as intermediate inputs by firms producing exports (Xing, 2011). Moreover, with the round-tripping of domestically made products between China and Hong-Kong, the exporting firms are able to receive 17. 5% value added tax rebates while importing firms benefit from the reduced prices. In 1993, the processing import originating from China amounted to US$1, 1 billion, about 2.9% of the total processing imports. By 2008, the amount was 16. 2%, which means that the tax incentive has been very effective in promoting

both export and import, so estimating an import function requires including controls, the most important of them appears to be exports. Accordingly, a real exchange rate appreciation can be expected to impact such export-oriented firms, which because of their international sales orientation are also impacted by changes in world income.

For the long term coefficients (for the second sample here), which are been inferred from the autoregressive lag, the real exchange rate elasticity estimates are -2.87 and 4.7, for multinationals and domestic firms respectively. In the export equation, the elasticity coefficients for world income are 7.57 and 5.05, respectively, in the case of multinationals and non-multinationals, while in the import equation the corresponding values are -15.2 and 8.5. In the import equation, however, the absorption effects of the provincial GDP are considerably lower, with the values of 1.17 for these same respective firm categories. Furthermore, in this period, imports of both firms are not sensitive anymore to the provincial GDP**.** This feature suggests investigating further determinants.

Table 1. The results for the first sample (1996-2006)

MNEs			***NMEs***	
Export	**without CF**	**with CF**	**without CF**	**with CF**
REER	-0.94***	-1.04***	-1.16***	-0.75**
GDPw	0.92**	0.16	1.04**	0.21
Import				
REER	-3.32***	1.05*	-0.17	0.09
GDPp	0.78***	0.94**	0.34	0.30

These indications ***, **,*, represent 1%, 5%, and 10% significance level respectively. Estimations' statistics are shown into appendix A with individual tables for each specification.

Table 1bis. The results for the second sample (2002-2012)

MNEs			***NMEs***	
Export	**without CF**	**with CF**	**without CF**	**with CF**
REER	-1.55***	-1.01***	-1.68***	-1.26***
GDPw	4.09*	0.37	1.82***	0.94***
Import				
REER	-0.91**	-1.36***	0.94*	0.28**
GDPp	0.07	0.09	0.10	0.05

These indications ***, **,*, represent 1%, 5%, and 10% significance level respectively. Estimations' statistics are shown into appendix A with individual tables for each specification.

The predominant share of the coastal provinces in the overall exports of multinational firms has already been remarked. Accordingly, it appears appropriate to confirm that the determinants of the MNE exports for these provinces are comparable to those found at a more aggregate level for all of China. In both periods, the real revaluation has a strongly significant impact on exports, but higher in absolute value for the first period; this can be explained by the processing export activities which are much more dominant in the coastal provinces, specifically exacerbated in the last decade. The impact of the world activity is strong and significant in the second sample, but insignificant in the first sample. A key first remark is that there is a greater impact of world income on the exports for the coastal MNEs, in contrast to the results already presented for all MNEs. The estimated elasticity in relation to the real effective exchange

rate is also much higher in absolute value for the coastal provinces in the second sample. For multinational exports in the center of China, for comparison purposes, the impact of a real revaluation is significant only in the second period of analysis, but the impact of the world activity is significant in both periods, but much stronger in the second period. The apparent impact of the real effective exchange rate is both much greater in absolute value and highly significant, in comparison to the results obtained for the coastal provinces. Most probably, this finding reflects the presence of spatial effects, but this issue warrants further consideration. Exports for MNEs in the interior provinces appear to be much more affected by world income and this effect is notably less than was the case for the coastal provinces. This conclusion is quite consistent with the view of Naughton (2000), who argued that different Chinese provinces appear to have quite different capacities to absorb external shocks. His analysis points to the need for China to develop a single unified market. All of the detailed estimations are shown in appendix B.

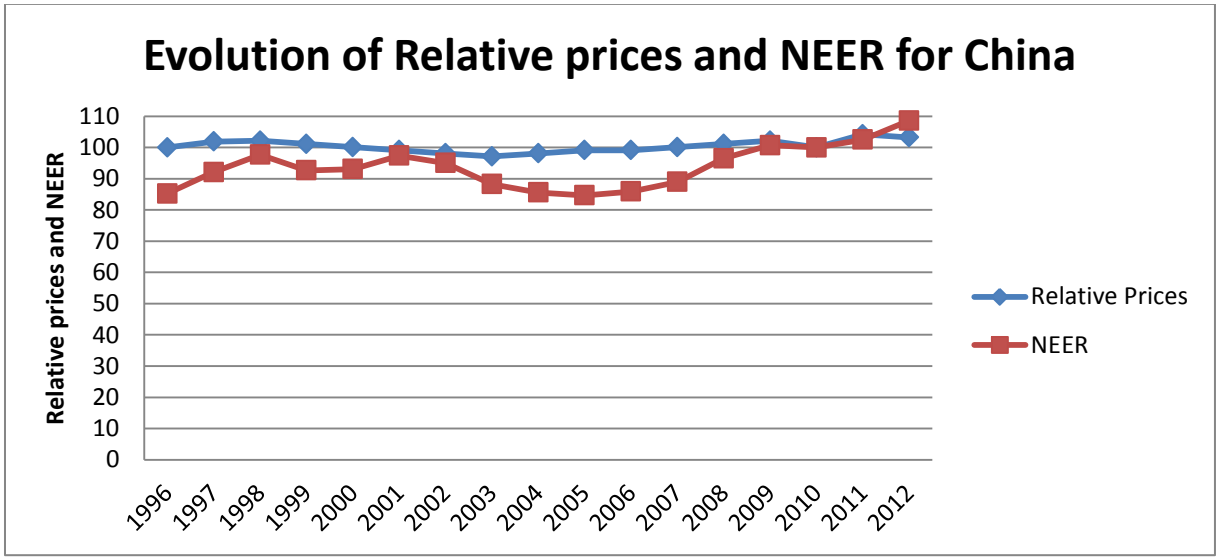
1.5 Exploring Further Determinants

Recent literature seeks to explore further determinants of Chinese trade flows in order to take into account the rapid changing of China's economic structure. As stated in Cheung et al. (2012), and Girardin and Owen (2014), China's exports are included in the import equation in order to account for the fact that processed exports generate imports, which are largely used as components, raw materials, or energy. As mentioned above, Multinational firms take the lion share in such activities (80% according to Ma et al. 2010). Following that literature, we include such determinants. For the Multinationals, exports are strong determinants of imports for both samples; the exhibited coefficients are highly significant. For the Chinese domestic firms, exports become a strong determinant of imports in the second sample that can be explained by the

catching up realized by domestic firms in the processing activities during the last decade. We can observe that the exhibited coefficient for the domestic firms is higher and more significant compared to the one of the first sample. The results are shown in appendix C.

In keeping with the analysis in Section 3, the empirical analysis now seeks to decompose the effects of different components of the real exchange rate on Chinese exports and imports, while using the regional panel to distinguish between estimates for the two categories of firms here for the recent period only. Specifically, relative prices of China in relation to its trading partners and the nominal effective exchange rate are now introduced separately, along with world GDP, as potential determinants in the Chinese export equation. The figure below shows the evolution of Chinese nominal effective exchange rate and relative prices between 1996-2012.

Figure 3. China's Nominal Effective Exchange Rate and Relative Prices



A rise in any of these series corresponds to an effective appreciation of the Chinese currency, as well as a rise in Chinese prices with respect to foreign prices.

As shown in Table 2 for trade involving multinational firms, relative prices are both highly significant and have the expected sign. This contrasts with the effects of a nominal revaluation, which appears to positively impact

multinational exports at a 5% level significance. Furthermore, the long-run coefficient for the relative prices is -7.5, higher in absolute value than the long-run elasticity for aggregate Chinese trade data after 2001 as compared to the findings on national trade data of Girardin and Owen (2014). Furthermore, in the case of multinationals the long run elasticity for the nominal exchange rate is 3. The coefficient of relative prices is higher in absolute value for the non-multinationals. We have for the non-multinational firms (Table 3) the expected sign for both determinants but only the relative-prices' impact is significant. For the long run coefficient, we have -5.6 which is closer to the value found at an aggregated level by Girardin and Owen (2014), which shows a nine-fold increase in absolute value compared to the pre-WTO period. For the nominal exchange rate, we have a positive elasticity but much below the value found with the aggregated data by Girardin and Owen (2014), where a one to one effect is at work. For disaggregated exports, in comparison to the findings of the latter study, relative prices explain significantly both trade series, with long-run coefficients closer to the results for the aggregate China's trade data in the case of non-multinationals. The nominal exchange rate effect is significant, but has the wrong sign in the case of multinational firms. Such an unusual effect warrants further investigations, as also noted for the determinants of import. However, in the first specification, the relative-price effects are three times larger than the effects of the nominal exchange rate movements.

Table 2. Multinational Exports with Relative Prices and NEER 2002-2012

Exports$_{-1}$	0.46*	(1.65)
GDPw	4.71*	(1.81)
Relative prices	-4.08***	(-2.72)
Neer	1.62**	(2.49)
Arellano-Bond test: AR (1) in first differences: z = -1.07 [0.29]; AR (2) in first differences: z = 0.79 [0.43]		

Sargan test of overid. Restrictions: $\chi^2(41) = 170.04$ [0.00]. Hansen test of overid. Restrictions: $\chi^2(41) = 27.11$ [0.95]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent. Respectively, 1%, 5% and 10% significance levels.

There is no sign of autocorrelation, while instruments are also valid. The corresponding results applying for export involving domestic firms are reported in Table 3.

Table 3. Non-Multinational Exports with Relative prices and NEER 2002-2012

Exports$_{-1}$	0.23**	(7.7)
GDPw	0.61***	(0.49)
Relative prices	-4.35**	(-2.12)
Neer	-0.05	(-2.3)
Arellano-Bond test: AR (1) in first differences: z = -1.74 [0.08]; AR (2) in first differences: z = 0.28 [0.78]		

Sargan test of overid. Restrictions: $\chi^2(6) = 6.31$ [0.39]. Hansen test of overid. Restrictions: $\chi^2(6) = 5.79$ [0.47]. Z values are in parenthesis and p-values between square brackets.These indications ***, **, represent significance at 1%, 5%.

The analysis, reported in the following Tables (4 and 5), considers import determinants for the two types of firms. The chosen specification includes a role for domestic absorption (real GDP-real Exports + real Imports), while again distinguishing between nominal exchange rate and relative prices effects, as well as using exports to proxy the effect of processing trade. For both categories of firms, there is a strong and significant impact of relative prices. For the imports of domestic firms, the elasticity is significant at 1%, with a one percent rise in the relative prices leading to a 15.3 percent fall in import. Such an impact is comparable to the results found using aggregate data, which shows that the influence of relative prices was present even before WTO but rose six-fold after entry. Nonetheless, the estimates for multinational firms, of -9.53, are lower in absolute value, while having the expected sign. The highly significant elasticity estimate for the nominal effective exchange rate is 4.07 with a long run

coefficient of 13.1, while for the non-multinationals, there appears to be a lower estimate of 1.7, which is significant at the 10% level only, while translating into a long-run coefficient of 4.2. Yet, the panel estimates reveal that imports react more to exports, than to absorption. More specifically, the effect of exports is also found to be significant at the 1% level in the case of non-multinationals with an estimated elasticity of 0.37 (corresponding to a 1.19 long-run value), with, as expected, a larger impact in the case of imports involving multinationals. In this latter instance, the elasticity is 0.72 (with 1.76 for the long-run effect) and significant at 5% level. The absorption elasticity estimates are non-significant for both categories of firms.

Table 4. Multinational Import with Relative prices, Export, Absorption and NEER 2002 2012

Imports$_{-1}$	0.59***	(2.82)
Absorption	11.07	(1.38)
Relative prices	-9.53**	(-1.94)
Neer	1.71*	(1.80)
Export	0.72**	(2.20)
Arellano-Bond test: AR (1) in first differences: z = -1.79 [0.07]; AR (2) in first differences: z = -1.25 [0.21]		

Sargan test of overid. Restrictions: $\chi^2(6) = 21.73$ [0.00]. Hansen test of overid. Restrictions: $\chi^2(6) = 12.04$ [0.06]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5% and 10% significance.

There is no sign of autocorrelation here; table 5 shows the results for the NMEs in the same period.

Table 5. Non-Multinational Import with Relative prices, Export, Absorption and NEER 2002 2012

Imports$_{-1}$	0.69***	(8.21)
Absorption	0.03	(0.64)
Relative prices	-15.3***	(-9.61)
Neer	4.07***	(11.19)
Export	0.37***	(3.95)
Arellano-Bond test: AR (1) in first differences: z = -2.40 [0.01]; AR (2) in first differences: z = -3.64 [0.00]		

Sargan test of overid. Restrictions: $\chi^2(50) = 277.54$ [0.00]. Hansen test of overid. Restrictions: $\chi^2(54) = 27.32$ [0.99]. Z values are in parenthesis and p-values between square brackets.These indications ***, represent 1% level significance

In sum, comparing with studies using aggregate trade data, the panel analysis presented in this section underscores the need to distinguish between trade involving MNEs and non-MNES, while also highlighting a key finding in Section III regarding different effects for relative price and nominal exchange rate components of real rate changes.

1.6 Concluding Remarks

The perceived undervaluation of the RMB in recent years has been critically linked in policy debates to trade imbalances involving China, notably with the United States. Both implicit and explicit arguments are that sufficient-enough appreciation of the Chinese currency would offset existing trade deficits of many industrialized countries with China.[7] Indeed, such acute policy concerns have gained in intensity, in light of the precarious state of much of the world's economies in recent years. Paralleling the precipitous build-up in China's trade surpluses with much of the rest of the industrialized world, have been profound structural changes in the international production networks redefining trade patterns across not just Southeast Asia and China, but also in the rest of the world. More generally such changes are redefining the international economic linkages between the Chinese economy and the rest of the world economy, thereby contributing to the complexity and the methodological challenges essential to assess the question of to what extent given degrees of RMB appreciation will significantly offset existing trade imbalances.

The present research has offered an empirical investigation based on a panel econometric approach relating to 29 Chinese provinces between 1996 and 2012 separated into two samples (1996-2006 and 2002-2012), while distinguishing between trade flows involving multinational and non-multinational firms. A key

[7] An apparent related issue regards the political economy of the process determining international negotiations with China regarding further appreciation of the RMB. Critically, such considerations include the political constraints within China in a context of growing disparities between regions in their economic performance, at the same time that political decision making processes may entail certain biases towards favoring the international competitiveness of interior provinces which have not yet substantially benefited from the economic returns to increased international openness.

finding is that an appreciation of the RMB can significantly impact China's trade surpluses by decreasing exports for both categories of firms. More specifically, this chapter has provided empirical evidence that a 10% appreciation of the RMB is associated with a decline for, respectively, MNEs and non-MNEs, of 9.4 % and 11.6% of their exports in the first sample, while in the second sample, we have respectively, 15.5% and 16.8% for the same level of appreciation. In the case of imports, the same level of appreciation actually results in 30.3% and 1.7% of reductions in the imports for these same two firm categories, for the first sample. However, when the common factor is included in this later estimation, the resulting coefficient for the multinational is an increase of 10.5% of their imports in the case of an appreciation of 10%. For the second sample, we have respectively, a decrease of 9.1% for the multinational, and an increase in imports of 9.4% for the non-MNEs, for the same level of appreciation. When the common factor is added, the signs of the coefficients do not change in any specification. While such a, non-standard, negative effect of an appreciation of the RMB on Chinese imports has been reported elsewhere, it is likely explained by vertical linkages and the role of Chinese imports in global production networks, where much of this import trade involves natural resources, components and other products complementary with China's exports, we can notice here that this counter-intuitive outcome has disappeared for the non-MNEs in the recent period.

The export performance of foreign subsidiaries located in the coastal regions has been shown to be strongly impacted by a real appreciation of the RMB, as well as by changes in world income, mostly in the second sample for the latter in comparison to the overall trade of multinationals in China. Nonetheless, multinational firms located in the interior of China also have shown an important negative sensitivity of their export in reaction to an RMB appreciation, where a key suggestion has been that spatial effects, reflecting, for

example, transportation and other transactions costs are potentially critical underlying determinants. In this regard, there appears to be clear associated evidence of a regional fragmentation of the Chinese international trade performance. A crucial related issue is that any assessment of the potential effects of further RMB appreciation needs to rely on an analysis of the explicit mechanisms of internal economic transformation, which potentially allow foreign subsidiaries to relocate to lower-wage regions further from the coast. Stated differently, any specific empirical finding, based on historical data, to assess the existing sensitivity of China's trade imbalances to past exchange rate changes, belies the apparent conceptual issue of possible interregional substitution of MNE production and associated international trade away from higher-cost coastal regions and towards the interior provinces, along with the associated time frameworks for such processes. Indeed, in this regard the limited overall time horizon during which China's economic transformation has occurred poses an apparent methodological challenge. A critical further issue identified in this research is both the major and rapid transformations of the Chinese economy, which have distinctive temporal and geographical dimensions. Yet, the complexity of such processes confronts not only the present, but also future, research with considerable challenges and difficulties. In this regard, there are apparent methodological constraints imposed by the availability and reliability of relevant statistical information.[8] Furthermore, the relatively limited time framework for characterizing industrial changes in China and their global economic implications confounds attempts to use econometric and other empirical analysis to validly identify associated dynamic adjustment

[8] Ideally, testing trade elasticities warrants the use of bilateral international trade statistics, at a disaggregate sectoral, and in the case of China regional level, which are unfortunately far from being available.

mechanisms. We also need to take into account the role of the Chinese administrations both local and national, on its trade performances.[9]

While exploring further determinants of China's trade flows, we find in this chapter that exports are important determinant of imports for both categories of firms during the two samples analyzed here. The NMEs have substantially catch up, showing a larger impact of exports on imports than the MNEs in the second sample. Furthermore, we disentangle nominal exchange rate from relative-price movements, and we find that, for both categories of firms, the relative-price movements have a negatively strong and significant impact on their exports and imports, with a more important impact on the imports for both categories of firms. The nominal exchange rate has a more important impact on the imports for the NMEs. Both impacts are significant and positive as predicted by the theory. However, for exports, the impact of the nominal exchange rate is not significant for the NMEs, while for the MNEs the impact is significant but exhibits the wrong sign as it is a positive rather than negative. This counter-intuitive result warrants further investigations.

Massive changes in patterns of international trade and foreign direct investment flows are redefining global production networks, and thereby the interconnectivity of China, in relation not just to much of Southeast Asia, but also industrialized and developing countries elsewhere. China, as the largest recipient of FDI, other than the United States, is experiencing associated technological transfers, which are redefining the country's innovative capacity and, consequently, the sectoral composition of its trade. Domestic infrastructure investments are also a major factor having substantial implications for China's industrial competitiveness at the level of different regions. Together, these truly

[9] China's regional development is highly related to regional trade performance which is further affected by regional governments' policy interferences that have explicitly and implicitly subsidized trade, often described preferential treatments used in so-called inter-regional campaigns of "bringing in merchants and attracting investors" (*zhao shang yin zi*). There is a real need to use a proxy to include in the estimated equations the role of the Chinese administrations on its international trade.

remarkable changes potentially impact central methodological concerns which are crucial for assessing the central problematic of this chapter – to what extent changes in RMB exchange rates can significantly offset the country's overall rapidly growing international trade imbalances. In addition to pointing to a number of theoretical issues, the present research also suggests the potential interest of using calibrated model simulations, and regime switching approach in order to explore further the complexity of the empirical issues addressed here. Central issues remain the role of changes in regional economic development in China, the WTO's entry which marked a clear regime change in the specification of China's export and import equations, international production networks, and the sectoral specificity of international adjustment processes. These and a host of other issues potentially can redefine the scope for trade elasticity optimism or pessimism, invoked by alternative scenarios for Renminbi appreciation, as well as the political economy of their relevance.

Appendix A.

Data definition and source

EXPORTS

China's exports in USD deflated by the unitary values of exports and imports by Hong-Kong. The data are in logarithm values. The types of export data considered are China's provincial exports for 29 provinces which are broken down between Multinational firms and China's domestic firms.

(Data Sources : CEIC)

IMPORTS

China's imports in USD deflated by the unitary values of exports and imports by Hong-Kong. The data are in logarithm values. The types of import data considered are China's provincial exports for 29 provinces which are broken down between Multinational firms and China's domestic firms.

(Data Sources : CEIC)

WORLD GDP

World GDP is based on an aggregate figure for 22 industrialized economies, computed for WEO, which are the principal recipient countries of Chinese exports, and is expressed in real terms in billions of US dollars, having used the US consumer price index as a deflator. Provincial real GDP in RMB in import equations is extracted from the China's National Bureau of Statistics data base. Both series are in logarithm.

REER

The real effective exchange rate of the Chinese currency, the Renminbi. The source for China's REER is the BIS; while a province specific REER is generated by substituting the province-specific for the national consumer price index, both extracted from China's National Bureau of Statistics' database.

NEER

The Renminbi nominal exchange rate, defined such that an increased value corresponds to an appreciation of the Renminbi. The series are extracted from the International Financial Statistics of the IMF.

DOMESTIC ABSORPTION

This variable is computed as follow (Real GDP – Real Exports + Real Imports) at a regional level.

RELATIVE PRICES

Computed as REER-NEER

Descriptive statistics for Multinational firms

Variable	Obs	Mean	Std. Dev.	Min	Max
rer	476	4.510493	.1169718	4.13783	4.785275
gdpworld	476	5.834729	.1370765	5.650764	6.018149
gdpprov	476	8.388867	1.147197	5.212596	12.4156
export	476	2.447712	2.494087	-4.742954	8.111551
import	476	2.433039	2.522324	-9.190138	7.748155
CF export	476	7.927505	.9731466	6.352571	9.194786
CF import	476	7.779493	.8053511	6.616708	9.066936

Descriptive statistics for Non Multinational firms

Variable	Obs	Mean Std. Dev.	Min	Max
export	476	3.671978 1.663072	-.161052	8.736535
import	476	3.115204 1.935609	-2.1454	8.323021
CF export	476	7.990801 1.013915	6.725985	9.887424
CF import	476	7.718378 1.040901	6.432083	9.80075
gdpworld	476	5.834729 .1370765	5.650764	6.018149
rer	476	4.510493 .1169718	4.13783	4.785275
gdpprov	476	8.388867 1.147197	5.212596	12.4156

Table 1 detailed with estimations' statistic

Table A1. Multinational Exports 1996-2006

Exports$_{-1}$	0.98***	(53.22)
REER	-0.91***	(-2.68)
GDPw	0.92**	(2.02)
Constant	2.01	(0.83)
Arellano-Bond test: AR (1) in first differences: z = -1.40 [0.16]; AR (2) in first differences: z = 0.83 [0.40]		

Sargan test of overid. Restrictions: $\chi^2(51) = 81.18$ [0.005]. Hansen test of overid. Restrictions: $\chi^2(51) = 25.62$ [0.99]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A2. Non-Multinational Exports 1996-2006

Exports$_{-1}$	0.81***	(7.64)
REER	-1.16***	(-3.49)
GDPw	1.04**	(2.09)
Arellano-Bond test: AR (1) in first differences: z = -2.84 [0.05]; AR (2) in first differences: z = -2.31 [0.021]		

Sargan test of overid. Restrictions: $\chi^2(43) =1$ 17.12 [0.00]. Hansen test of overid. Restrictions: $\chi^2(27.71) = 25.62$ [0.97]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A3. Non-Multinational Exports 2002-2012

Exports$_{-1}$	0.64***	(16.3)
REER	-1.68***	(-6.83)
GDPw	1.82***	(5.84)
Constant	-3.52**	(-2.45)
Arellano-Bond test: AR (1) in first differences: z = -3.08 [0.00]; AR (2) in first differences: z = -1.31 [0.19]		

Sargan test of overid. Restrictions: $\chi^2(50) =190.2$ [0.00]. Hansen test of overid. Restrictions: $\chi^2(50) = 25$ [0.99]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A4. Multinational Exports 2002-2012

Exports$_{-1}$	0.46***	(3.00)
REER	-1.55***	(-5.63)
GDPw	4.09**	(1.84)
Constant	2.01	(0.83)
Arellano-Bond test: AR (1) in first differences: z = -1.07 [0.29]; AR (2) in first differences: z = -0.95 [0.34]		

Sargan test of overid. Restrictions: $\chi^2(42)$ =159.78 [0.00]. Hansen test of overid. Restrictions: $\chi^2(42)$ = 27.74 [0.96]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A5. Multinational Imports 1996-2006

Imports$_{-1}$	0.26	(1.03)
REER	-3.32***	(-2.80)
GDPp	0.78***	(3.64)
Arellano-Bond test: AR (1) in first differences: z = -0.85 [0.397]; AR (2) in first differences: z = 0.71 [0.480]		

Sargan test of overid. Restrictions: $\chi^2(5)$ =8.69 [0.12]. Hansen test of overid. Restrictions: $\chi^2(5)$ = 9.93 [0.96]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A6. Non-Multinational Imports 1996-2006

Imports$_{-1}$	0.77**	(1.86)
REER	-0.17	(-0.26)
GDPp	0.34	(0.66)
Arellano-Bond test: AR (1) in first differences: z = -1.42 [0.157]; AR (2) in first differences: z = -1.39 [0.163]		

Sargan test of overid. Restrictions: $\chi^2(7)$ =27.31 [0.00]. Hansen test of overid. Restrictions: $\chi^2(5)$ = 17.95 [0.012]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A7. Multinational Imports 2002-2012

Imports$_{-1}$	1.06***	(13.06)
REER	-0.91**	(-2.09)
GDPp	0.07	(0.92)
Arellano-Bond test: AR (1) in first differences: z = -3.11 [0.002]; AR (2) in first differences: z = -0.51 [0.610]		

Sargan test of overid. Restrictions: $\chi^2(8)$ =52.86 [0.00]. Hansen test of overid. Restrictions: $\chi^2(8)$ = 20.89 [0.007]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Table A8. Non-Multinational Imports 2002-2012

Imports$_{-1}$	0.89***	(12.38)
REER	0.94*	(1.74)
GDPp	0.10	(0.40)
Arellano-Bond test: AR (1) in first differences: z = -2.32 [0.21]; AR (2) in first differences: z = -1.28 [0.200]		

Sargan test of overid. Restrictions: $\chi^2(6)$ =13.64 [0.034]. Hansen test of overid. Restrictions: $\chi^2(6)$ = 18.76 [0.005]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5%, and 10% significancy level respectively.

Appendix B. Results for the Multinationals in the coastal provinces and in the interior

Table B1. Multinational Coastal Export 1996 2006

$Exports_{-1}$	0.99***	(24.79)
GDPw	0.13	(0.40)
ReR	-1.17***	(-4.14)
Arellano-Bond test: AR (1) in first differences: z = -1.91 [0.06]; AR (2) in first differences: z = 1.96 [0.05]		

Sargan test of overid. Restrictions: $\chi^2(43) = 44.3$ [0.41]. Hansen test of overid. Restrictions: $\chi^2(43) = 13.23$ [1.00]. Z values are in parenthesis and p-values between square brackets.These indications ***, represent significance at 1%.

Table B2. Multinational Coastal Export 2002 2012

$Exports_{-1}$	0.61***	(8.52)
GDPw	2.37***	(4.55)
ReR	-0.69***	(-4.26)
Arellano-Bond test: AR (1) in first differences: z = -2.04 [0.04]; AR (2) in first differences: z = 1.48 [0.14]		

Sargan test of overid. Restrictions: $\chi^2(8) = 40.5$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(8) = 13.41$ [0.09]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent significance at1%.

Table B3. Multinational Interior Export 1996 2006

$Exports_{-1}$	0.24***	(2.76)
GDPw	2.72***	(3.75)
ReR	-0.53	(-1.03)
Arellano-Bond test: AR (1) in first differences: z = -0.87 [0.38]; AR (2) in first differences: z = 0.68 [0.50]		

Sargan test of overid. Restrictions: $\chi^2(8) = 34.76$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(8) = 9.31$ [0.31]. Z values are in parenthesis and p-values between square brackets.These indications ***, represent significant at 1%.

Table B4. Multinational Interior Export 2002 2012

Exports$_{-1}$	0.95***	(9.40)
GDPw	3.32***	(2.86)
ReR	-2.06***	(-5.22)
Arellano-Bond test: AR (1) in first differences: z = -1.12 [0.26]; AR (2) in first differences: z = 1.06 [0.29]		

Sargan test of overid. Restrictions: $\chi^2(9) = 45.90$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(9) = 7.73$ [0.56]. Z values are in parenthesis and p-values between square brackets.These indications ***, represent 1% significance. Number of obs = 280 Number of instruments = 13 Number of groups = 28 Wald χ^2 (2) = 300.14; [0.00].

Appendix C. Exports in the Import functions

Table C1. Multinational Import with exports as dependent variables 1996 2006

Imports$_{-1}$	0.13**	(2.58)
Exports	0.47***	(5.22)
ReR	-1.86*	(-1.76)
Arellano-Bond test: AR (1) in first differences: z = -1.15 [0.25]; AR (2) in first differences: z = 0.36 [0.72]		

Sargan test of overid. Restrictions: $\chi^2(43) = 123.97$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(8) = 25.54$ [0.98]. Z values are in parenthesis and p-values between square brackets.These indications ***, **,*, represent 1%, 5% and 10% significance.

Table C2. Non Multinational Import with exports as dependent variables 1996 2006

Imports$_{-1}$	0.75***	(5.11)
Exports	0.25*	(1.86)
ReR	-0.29	(-0.75)
Arellano-Bond test: AR (1) in first differences: z = -2.21 [0.03]; AR (2) in first differences: z = -1.36 [0.17]		

Sargan test of overid. Restrictions: $\chi^2(44) = 91.22$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(44) = 27.39$ [0.98]. Z values are in parenthesis and p-values between square brackets.These indications ***,*, represent 1%, 10% significance.

Table C3. . Multinational Import with exports as dependent variables 2002 2012

Imports$_{-1}$	0.65***	(4.78)
Exports	0.42***	(3.11)
ReR	-0.89***	(-3.49)
Arellano-Bond test: AR (1) in first differences: z = -2.19 [0.03]; AR (2) in first differences: z = -0.56 [0.57]		

Sargan test of overid. Restrictions: $\chi^2(8) = 52.84$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(8) = 19.18$ [0.01]. Z values are in parenthesis and p-values between square brackets.These indications ***, represent significance at 1%.

Table C4. Non Multinational Import with exports as dependent variables 2002 2012

Imports$_{-1}$	0.31**	(2.54)
Exports	0.99***	(8.63)
ReR	-0.66**	(-1.95)
Arellano-Bond test: AR (1) in first differences: z = -1.22 [0.22]; AR (2) in first differences: z = -1.04 [0.29]		

Sargan test of overid. Restrictions: $\chi^2(28) = 142.75$ [0.01]. Hansen test of overid. Restrictions: $\chi^2(28) = 22.97$ [0.00]. Z values are in parenthesis and p-values between square brackets.These indications ***, **, represent significance 1%, 5%.

Chapter 2

Do Provincial Cross Borders Matter for China's Trade Flows?

2.1 Introduction

The extent to which China's trade surplus was growing during the last decade, reaching 10% of its GDP in 2008, continues to raise concerns and a growing interest. Indeed, China's trade pattern has been studied with different methodologies. Recently the regional approach has been widely adopted because of its advantages, one of them: taking into account the disparities between provinces in China. From a historical point of view, in 1978 China opted for an economic policy of regional decentralization accompanied by a liberalization of its international trade, which favors the development of special economic zones for the coastal regions, creating strong imbalances between Chinese provinces. Nonetheless, the objectives of such a strategy were to generate spillover effects and to distribute the coastal provinces growth between the other regions. A fundamental issue related to these policies is whether interactions between regions affect China's international trade flows.

Recent research has thought to control for the gap between Chinese provinces' economic activities, for example, by making a crucial distinction between Chinese exports and production entailing imported components, from the Asian production chain mostly, and exports based on value added which is generated within China's internal economy. Commonly known in the name of

processing exports and imports, the bulk of the later activity is concentrated in the coastal regions in China. The foreign owned firms account for 80% of such activities, as stated in Ma et al. (2010). Using regional trade data implies taking into account the cross-province effects (externalities), which cannot be captured by standard panel regression with only a regional fixed-effects coefficient. There is a growing literature which considers the spatial localization as a key variable for understanding some aspects of China's economy. Nevertheless, this literature is confined to the growth spillover effects investigation among the Chinese provinces, for example, Amiti and Javorcki (2005); Holz (2009) studies trade barriers between provinces. Luo (2005), Aroca et al. (2005), Herrman et al. (2010) offer assessments on neighborhood effects. Furthermore, Ma and Assche (2013) study the attractiveness of an export processing zone, exploring the linkages between international suppliers and buyers of China's businesses. Using the distance between a location in a province and its closest major seaport, and distance between province and the location of buyers, they find significant evidence of spatial effects.

The novelty of the present research is to measure the impact of spatial interprovincial connections on Chinese trade flows, using the standard determinants of Chinese trade, such as the real exchange rate at a provincial level, world GDP, Chinese provincial GDP as control variables. In fact, the Chinese cross-provincial border effects can lead to new implications. Firstly, space matters in the analysis of China's international trade flows, disaggregated at a regional level because there are geographical determinants of development which have been neglected for long. This, however, is a story of absolute location in space for the spatial unit (province). Secondly, relative location also matters, that is the relative location of spatial units, such as simple neighborhood or distance. In this chapter, we construct three spatial weight matrices as fundamental determinants of China's provincial exports and imports. We are

interested specifically in the connections between provinces and their impacts on exports and imports, while breaking down exports and imports trade flows to distinguish between foreign owned and Chinese owned firms. The first spatial weight matrix (spherical distance) measures the impact of ground connections between the Chinese 28 provinces on its international trade flows. The second spatial weight matrix uses the nautical miles to measure the impact of maritime connections on trade flows for the provinces along the sea coast. The last spatial weight matrix measures the river connections and their effects on trade flows for the provinces in the Yangtze valley. We conduct the analysis through two separated samples to take into account the dynamics in China's decentralization policies. The first one span the period 1996-2006, the second one begins from 2002 which marks the China's WTO accession, and ending in 2012. We use both a spatial lag and a spatial error model according to the statistic tests conducted in this study.

The analysis reveals strong evidence of spatial effects on China's international trade. The spherical distance weight matrix shows strong provincial border impacts on exports and also on imports. For the foreign owned firms, the impacts on imports and exports are positive and significant during the first sample, while negative for exports and positive for imports in the second sample. For the Chinese owned firms, the impacts show the same features for both periods of analysis, we have positive impacts on imports through the two spatial models estimated, but for exports, in both periods the spatial error model indicates negative impacts. For the coastal provinces, the spatial effects are negative for foreign owned firms, but the results are significant only for exports. For Chinese owned firms, the impacts are positive and highly significant. Finally, in the Yangtze valley, the impacts on exports are positive for the two types of firms and significant, while for imports the impacts are not significant for the Chinese owned, negative and significant for the foreign owned firms. For

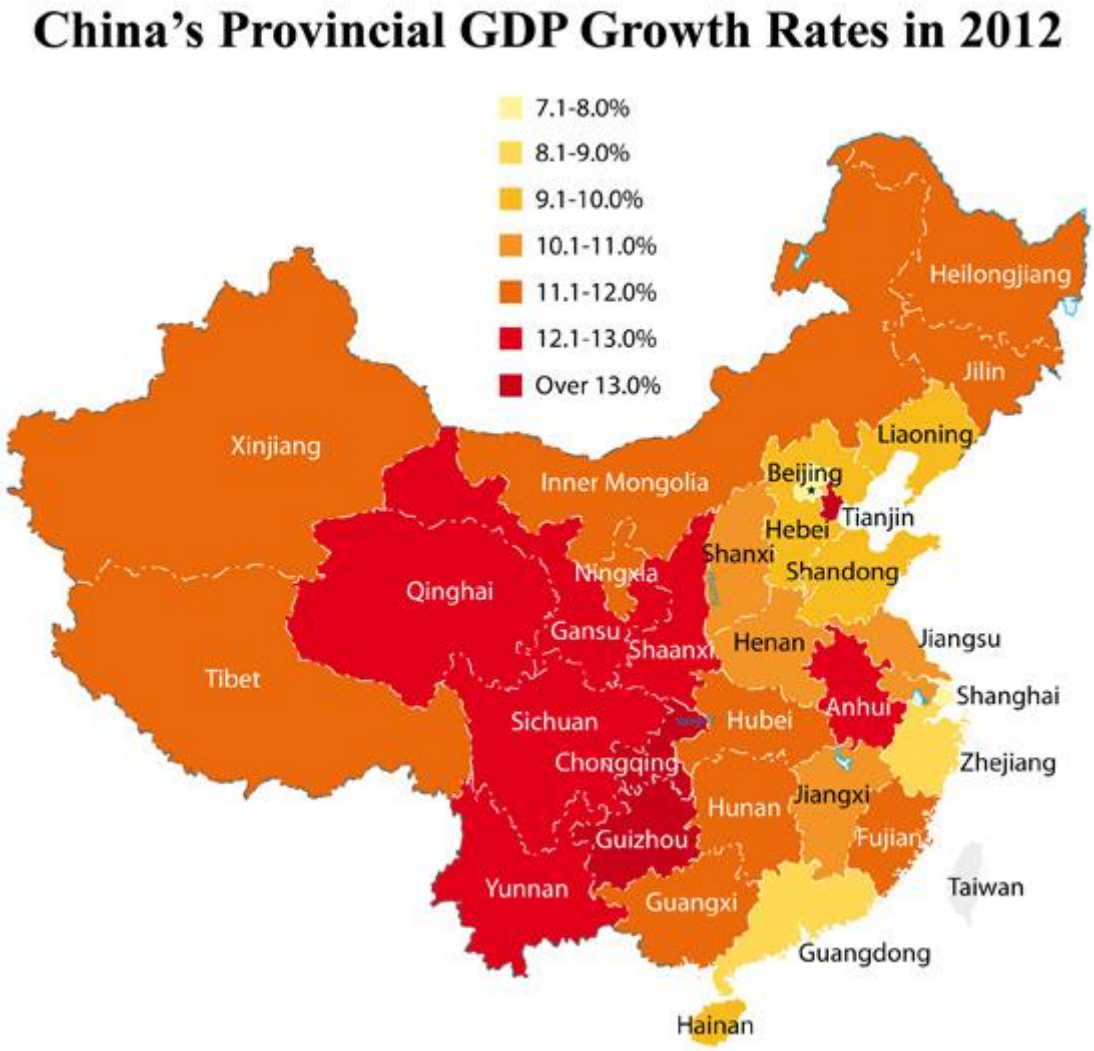
the second period, all of the impacts are positive and significant, highly significant for imports for the two types of firms. Negative spatial effects are interpreted here as complementarities between trade flows, and positive spatial effects are interpreted here as revealing competition between exporters and importers. The spatial lag model is here the more appropriate to make inference according to the statistics.

This chapter proceeds as follows. Section 2 offers an overview of China's provincial characteristics and trade behavior. Section 3 presents the data and the methodology; section 4 draws the principal findings, while section 5 gives the concluding remarks.

2.2 China's Territorial Characteristics and Regional Trade behavior

China, as the largest recipient of FDI, other than the United States, is experiencing associated technological transfers, which are redefining the country's innovative capacity and, consequently, the sectoral composition of its trade. China counts 23 provinces, five autonomous regions, four municipalities, and two special administrative regions. As of 1978 China opted for an economic policy of regional decentralization accompanied by a liberalization of international trade, which favors the development of special economic zones for the coastal regions, as well as a significant degree of export specialization in different areas. China's approach to trade reform has been a clear reflection of its overall approach to the transformation of the economy, gradual changes, with parallel pricing, a focus on decentralization of administration and retention of ultimate controls at the center. Each province was permitted to create its own trade agencies and corporations to engage in direct trading of its products. The figure below shows regional disparities in growth related to GDP in 2012.

Figure 1.

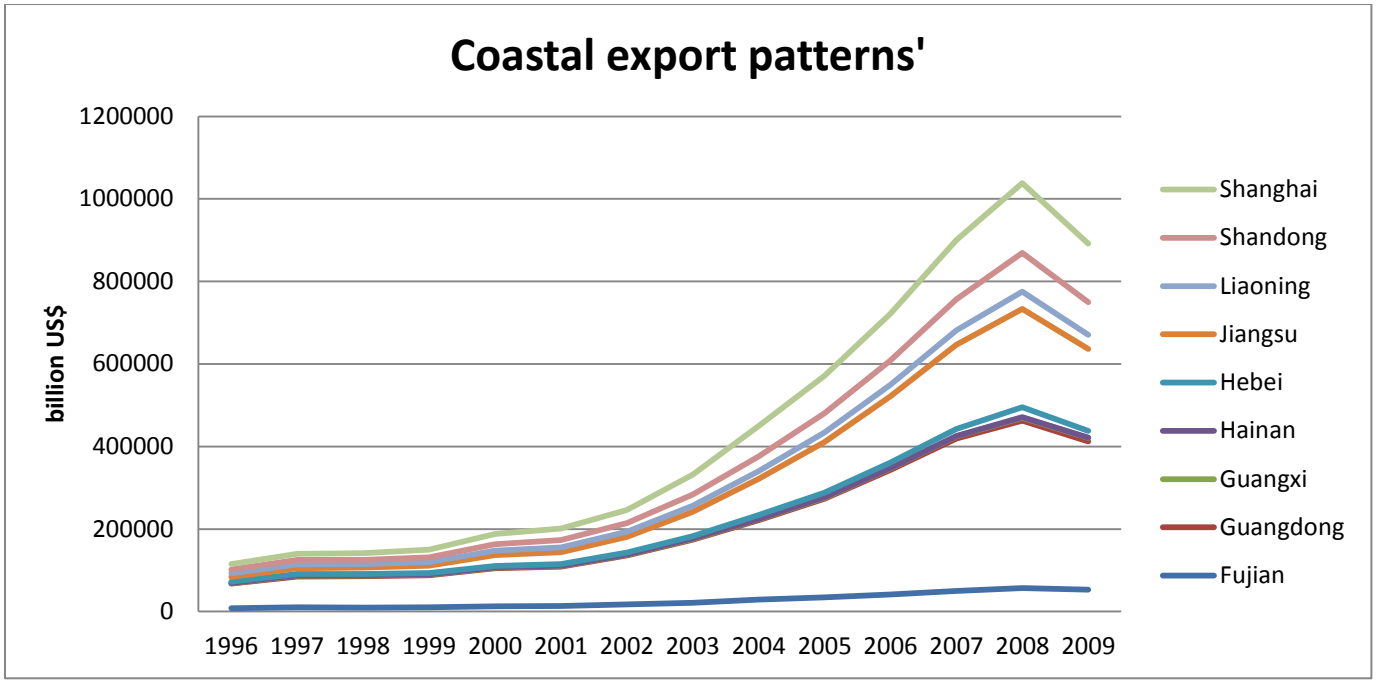


Source: China Briefing. Figure reported in China Briefing News (May 2013)

At the beginning of the creation of the special economic zones, the only places allowed to receive FDI enjoyed large inflows, sustaining a high growth rate, especially of exports. This strategy was very unequal from a spatial point of view and FDI location generated great disparities; the regional gap widened in 1992 according to Bao et al. (2002). However, the objective was to generate spillover effects and to enable the coastal provinces to share in the growth of the other regions.

FIGURE 2.

Exports in the coastal provinces

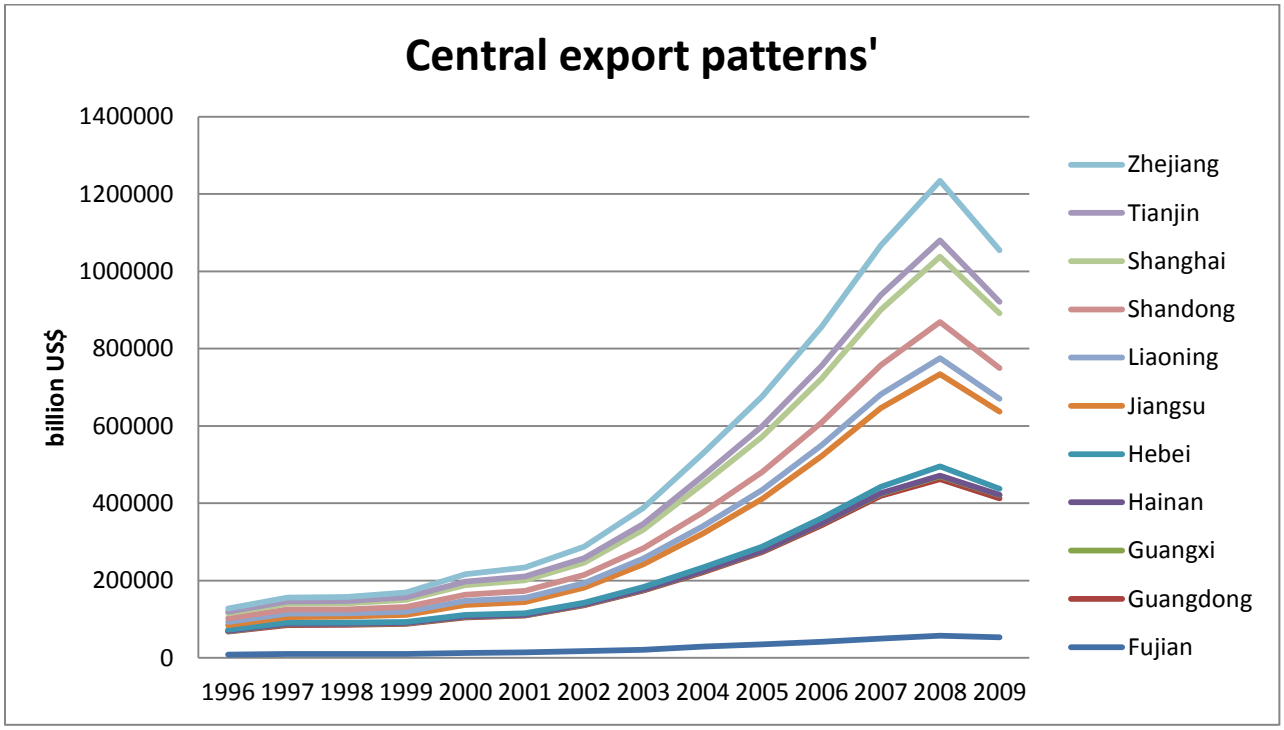


However in 2004, premier Wen Jiabao introduced the « rise of central China plan » which attracted both domestic and foreign capital in the heart of central China, for example, Hubei. With the implementation of this plan, the central China has returned to the spotlight as a major transportation and logistics hub. Besides Hubei, the other five provinces making up Central China (Shanxi, Anhui, Jiangxi, Hunan and Henan) are currently enjoying similarly optimistic economic outlooks; GDP levels in all six provinces have seen considerable increases since the implementation of the plan in 2004. Central China is poised to be the country's next source of high economic growth. Compared with the growing costs of raw materials, labor and land in the coastal areas, Central China, which boasts a strategic location, cheap labor force, and rising consumer market, is well on its way to become the economic growth engine of the country. Moreover, Hubei which has benefited from China's transport infrastructure

boom plays a vital role in linking the wealthy and more developed eastern region with the lesser developed but resource rich western region.

FIGURE 3.

Export in the central China



2.2.1 Evidence of Complementarities and Competition between Regional Trade Flows

During the period of 1978 to 1991, China adopted a number of measures to reform its traditional foreign trade system, including decentralization of trade planning. At the initial stage, one of the first steps was to decentralize the authority to engage in foreign trade. Such an approach to foreign trade system reform generated initial competition for export supply. The foreign funded firms were given authority to import raw materials and capital goods for their productions; they were also authorized to export their own products directly. The state also granted self management powers to those large and medium scale

export oriented firms, and firms were authorized to export their products and import the raw materials and intermediate inputs required for their productions, see Li (1997).

Trade and FDI have been important external sources of technologies for developing countries. Freer trades and investments lead to fiercer competition, which induces firms' innovative activities and collective efforts to upgrade. Economic integration is expected to reinforce the mechanism of technology transfer through trade and FDI, enabling firms to intensively interact with more diversified potential partners (Onodera 2008; Leshur and Miroudot 2008). FDI encourages firms to develop cross-sectional associations and collaborations with research institutes and universities, or learn technologies, strategies, and management ideas from competitors. Lall and Albaladejo (2004) find evidence of complementarities in the high-tech products.

Recently, more multinational corporations are developing design and R&D centers in China and in the ASEAN countries such as Singapore and Thailand. These strong production networks enable firms to develop cooperative relationships between their headquarters in home countries such as Japan and Taiwan and their affiliates in China. The « China plus One strategy » is another example that illustrates evidence of complementarities between trade flows. In fact, multinational firms, in order to mitigate the cost of overdependence on China alone, have adopted a strategy of production which may lead to large complementarities between trade flows. For example, a Japanese firm that produces domestic sewing machines in Guangdong (China), and in the outskirt of Hanoi (Vietnam). The headquarters in Japan is responsible for planning, designing higher end-models, and marketing. The factory in Guangdong is a main production base for developing lower-end models. To make the two factories in China and Vietnam complementary, the firm assigns the former to produce mechanically controlled domestic sewing machines that necessitate

skilled workers; and the latter, to assemble electronically-controlled ones that require workers to put modular units together. In addition, the base in China is expected to be a kind of mother factory, where new models are developed and production testing done. The factory in Vietnam relies on materials and parts made in China, see Ueki (2010).

We may also expect evidence of competition in the regional trade flows. According to the « China briefing » (May 2013), mentioning the competition between provinces in China, Jiangsu will overtake the province of Guangdong in 2015 if the latter does not step up its development. In fact, Guangdong has been facing fierce competition from other regions along the coast, especially from Jiangsu. The GDP gap between the two provinces has narrowed to just RMB310 billion in 2012, while it was RMB581 billion in 2008. Moreover, according to the China briefing also, among China's top 500 enterprises list for 2012, Guangdong takes 37 spots while Jiangsu occupies 51, and in terms of the top 500 private enterprises in China, Guangdong has 23, while Jiangsu has 118. For the provinces in the Yangtze valley, the situation has changed toward more competition in exports and in imports.

According to the econometric framework we use here, positive spatial autocorrelation exists when high values of trade correlate with high neighboring values or when low values correlate with low neighboring values, in the contrary, negative spatial autocorrelation exists when high values correlate with low neighboring values and vice versa. So in our specifications, we interpret positive cross border effects as evidence of competition between provinces, and negative cross border effects as complementarities between provinces.

2.3 Empirical Framework: Model and Data

In this chapter, we use a panel data set to analyze China's international trade. In recent years, there has been a growing interest in the specification and estimation of econometric relationships based on panel data. It can be explained by the fact that panel data offers an extended modeling possibility since it contains cross sectional and time series data at the same time. Since our data covers regional exports and imports of 28 Chinese provinces, spatial dependency may exist between our observations. In this section, we show that we need to account for spatial dependency in China's regional trade relying on some econometric tests.

2.3.1 The model

The spatial autoregressive (SAR) model put forth by Cliff and Ord (1973) is widely used by economists to model spatial dependency. Panel data with spatial interaction is also of great interest as it enables us to take into account the dynamics and control for the heterogeneity (e.g. Anselin, 1988, Baltagi et al. 2007, Yu et al., 2007). To investigate the spatial effects on China's international trade, we start from a general static panel model that includes a spatial lag of the dependent variable and spatial autoregressive disturbances:

$$y = \rho(I_T \times W_N)y + X\beta + u \quad (1)$$

Where y is an NT * 1 vector of observations for the dependent variable, X is a NT * k matrix of observations of exogenous regressors, I_T an identity matrix, W_N the N*N spatial weights matrix and ρ the corresponding spatial parameter. The vector of errors is expressed in the following way:

$$u = (\aleph_T \times I_N)\mu + \epsilon \qquad (2)$$

Where $\aleph_T$ is a T*1 vector of ones, I_N an N*N identity matrix, μ a vector of time invariant individual specific effects and ϵ a vector of spatially auto correlated innovations that follows a spatial autoregressive process of the form:

$$\epsilon = \gamma(I_T \times W_N)\epsilon + \vartheta \quad (3)$$

Both σ_{it} and ϵ_{it} are independent and identically distributed random variables with mean 0 and variance $\sigma_\vartheta^2 \, and \, \sigma_\epsilon^2$. Moreover, to respect the stationary conditions, ρ has to be less than one in absolute value. The vector of individual effects μ can be random or fixed. As we deal with data on regional exports and imports within the same area, here China, we may use fixed effects estimations, see Baltagi et al. (2003).

2.3.2 Data

The economic data covers annual statistics over the period 1996-2012. The principal data set is that of the CEIC, which has been complemented with statistics from the International Financial Statistics (IFS) and World Economic Outlook (WEO) of the IMF. Central to this study are the statistics on regional exports and imports, which are broken down between foreign owned firms and Chinese owned firms for 28 provinces[10], which have been deflated by the unitary values of export and import of Hong Kong for these two control groups ; Real effective exchange rate at a regional level, the source for China's REER is the BIS, while a province specific REER is generated by substituting the province-specific for the national consumer price index, both extracted from China's National Bureau of Statistics database.

2.3.3 Spatial dependency in China

[10] Note that for good asymptotic properties, we should have a large sample of individuals, while we have here 28 individual provinces.

Some problems may arise when panel data incorporates location components, spatial dependency may exist between the observations at each point in time. To the extent that distance affects economic behavior, observations associated with a specific location can be dependent on observations belonging to other locations. Moreover, heterogeneity of observations between spaces can be a crucial issue. Exports and imports of the foreign-owned and Chinese-owned firms are clearly not homogeneous at a provincial level (see figures 2 and 3). Spatial interactions between the different provinces in China imply that we have to consider the relative position of each province (Le Gallo 2000). We construct three different spatial weight matrices measuring the intensity and the sense of the variations of the spatial effects between provinces in China.

The first one is a contiguity matrix of order one. The element ω_{ij} of this matrix is defined as follows:

$$\omega_{ij} = \begin{cases} 1 \; if \; province \; i \; and \; j \; share \; a \; common \; border \\ 0 \; if \; province \; i \; and \; j \; do \; not \; share \; one \; border \end{cases} \quad (4)$$

Then following Lesage (1999), we standardize this matrix in order to have the sum of each row equal to one. The two other matrices represent the interactions of provinces in the coastal area and in the Yangtze valley, and are based on the distance between the different locations in these areas; we use the rivers distance and the nautical miles for the provinces in the Yangtze valley and the provinces in the coast respectively.

The weights between locations i and j are

$$\omega_{ij} = \begin{cases} \dfrac{1}{d_{ij}^{k}} \; if \; d_{ij} < c \\ 0 \; otherwise \end{cases} \quad (5)$$

where k is a constant and c a threshold from which we assume that spatial effects are negligible. One should be aware of the fact that China's provinces are of the geographical size of an average European nation. The use of these two matrices is another important contribution to the literature measuring spatial effects on China's economy. These two supplementary matrices are a mean to take into account the effects of goods transportation before sending abroad, and coming into these areas from abroad. Equation (5) means that we need to make specific assumptions to introduce spatial dependency. For example, if we calculate distance between regional centroids, that means, economic activity is assumed to be homogeneously distributed on the whole region whereas if we calculate distance between capitals, it means that economic activity is concentrated in these regional capitals. Each functional form allows us bringing out slight differences in the way spillovers affect pairs of regions. Our choice is based on the kind of economic interactions that we try to estimate. The cut-off i[11] is chosen following the quintile of the distribution of distance, and then we take the one which maximizes a LM joint test for spatial autocorrelation effects. Moreover, a stylized fact in China is that goods produced in the Eastern region are mainly used by the Western region to produce manufactured goods.

Spatial data are collected and constructed from many sources. The first matrix is traditional in spatial dependency investigations; we use the spherical distance between two locations represented by coordinated points. We take the most relevant cities in each region in terms of trade. Since China's provinces are very large, we use the longitude and latitude points available in china_spatdwm. As the bulk of China's international exports depart from the coastal provinces, we give priority to the coastal transportation of goods and in the Yangtze valley, which is near the coastal area. The nautical miles and rivers distance are collected from (www.searates.com), and are used as maritime and river

[11] Limit for spatial autocorrelation effects between two locations.

connections for the coastal provinces and provinces in the Yangtze valley respectively. We report in the appendix the LR and LM tests justifying the need to take into account spatial dependency in the analysis of exports and imports from China.

2.4 Principal Findings

We estimate a spatial panel Arellano-Bond linear dynamic regression lag model (SAR) and a maximum likelihood spatial error panel regression (SEM) following our statistic tests. We split the sample into two parts (1996-2006 and 2002-2012), so we have 11 years for each of them. In so doing, we take into account the evolution of the Chinese dynamics in political decentralization as mentioned above. As suggest by Barthélemy and Poncet (2008), studying the determinants of desynchronization of China's internal economy, the findings before the WTO membership (2001) cannot be extrapolated to the new millennium. Table 1 shows the estimations with the spherical distance weight matrix as a measure of Chinese provincial cross border effects on exports and imports for the Chinese owned firms and for the foreign owned firms in the first sample.

Table 1.Estimation with spherical distance weight matrix, sample (1996-2006)

Dependent variable: Exports and Imports by firm j in province i and year t (coefficients in columns specified without spatial effects are estimated with Arellano-Bond panel GMM)

Foreign-owned	***Exports***		***Chinese-owned***	
	Without spatial effects			without spatial effects
REER	-0.47	-0.94***	-1.13***	-1.16***
GDP world	0.73	0.92**	0.04	1.04**
Rho value	0.13***		0.07***	
Lambda value	0.12***		-0.002**	
Imports	Without spatial effects			Without spatial effects
REER	-0.16	-3.32***	-0.32**	-0.17
GDP province	1.24*	0.78***	0.11	0.34
Rho value	0.003		0.03**	
Lambda value	0.04***		0.04**	

Foreign-owned statistic tests. Export: SAR model: R2= 0.71; Log-likelihood= 15.9. SEM model: R2= 0.92; Log-likelihood= -501.5. IMPORT: SAR model: R2= 0.51; Log-likelihood= -210.2. SEM model: R2= 0.95; Log-likelihood= -405.6. These indications ***, **, represent. Respectively, 1% and 5% significance levels.

Chinese-owned statistic tests. SAR model: Export: R2= 0.83; Log-likelihood= 123.5. SEM model: R2= 0.96; Log-likelihood= -507.98. IMPORT: SAR model: R2= 0.81; Log-likelihood= 17.22. SEM model: R2= 0.97; Log-likelihood= -370.97. These indications ***, **, represent Respectively, 1% and 5% significance levels.

For the foreign owned firms, both spatial lag and spatial error models play important role. The results indicate that exports exhibit strong spatial dependence; the estimated Rho and Lambda values are almost of the same amplitude and are highly significant, while for the Chinese owned firms, the estimates are significant, but are less important in absolute value. The spatial

error model indicates a negative impact for the Chinese owned firms. For imports, the spatial linkages in trade have a similar impact on the two types of firms considering the spatial error model; for the lag spatial model, the estimatess are almost the same, but significant only for the Chinese owned firms. Considering the statistics, the (SAR) model is more relevant to make inference for exports, but for imports the (SEM) model can be seen as slightly more appropriate. We can observe through the results that spatial effects matter more for foreign owned exports considering the absolute values of the estimates. We can interpret this as more expensive transportation costs for the foreign owned firms. To go further, these transportation costs are more important in heavy industries (products that have a high weight), as stated in Ma and Assche (2013). However the coefficient estimates for imports indicate slight spatial interaction effects. This may arise from duty exemptions on imported raw materials and other inputs that foreign owned and domestic firms are granted, as long as they are used solely for exports purposes. The transportation costs are then less important for imports.

Table 2. Estimation with spherical distance weight matrix, sample (2002-2012)

Dependent variable: Export and Import by firm in province i and year t (coefficients in columns specified without spatial effects are estimated with Arellano-Bond panel GMM)

Foreign-owned	***Exports***		***Chinese-owned***	
	Without spatial effects			Without spatial effects
REER	-0.23	-1.55***	-0.41*	-1.68***
GDPworld	1.04***	4.09*	0.55	1.82***
Rho value	-0.07**		0.16***	
Lambda value	-0.002		-0.003*	
Imports	without spatial effects			Without spatial effects
REER	-0.64*	-0.91**	0.61***	0.94*
GDP province	0.07*	0.07	-0.06	0.10
Rho value	0.0001***		0.0001*	
Lambda value	0.15***		0.13***	

Foreign-owned statistic tests. Export: SAR model: R2= 0.24; Log-likelihood=-527.08. SEM model: R2= 0.89; Log-likelihood= -555.94. IMPORT: SAR model: R2= 0.38; Log-likelihood= -266.61. SEM model: R2= 0.90; Log-likelihood= -502.21. These indications ***, **,* represent. Respectively, 1%, 5% and 10% significance levels.
Chinese-owned statistic tests. Export: SAR model: R2= 0.53; Log-likelihood= -28.91. SEM model: R2= 0.93; Log-likelihood= -561.51. IMPORT: SAR model: R2= 0.88; Log-likelihood= -133.84. IMPORT: SEM model: R2= 0.77; Log-likelihood= -511.43. These indications ***, **,* represent. Respectively, 1%, 5% and 10% significance levels.

In this sample, the spatial effects are less important in determining exports for the two types of firms than for the first period. Nonetheless, the spatial lag effects indicate relevant cross border interactions for the Chinese owned firms, but here the (SEM) model seems to be more robust for both specifications. The

new outcome here is that the spatial effects are negative for the foreign owned firms for both specifications. For the other determinants of trade, only the result for world GDP is significant for the foreign owned firms, while exchange rate revaluation is significant only for the Chinese owned ones at the 10% level. For imports, all spatial effects are significant for both firms, and indicate positive spatial linkages. The spatial error model shows the higher impacts here, and is almost of the same amplitude for the two types of firms. The result for exchange rate revaluation is positive and highly significant for the Chinese owned firms, negative and significant at the 10% level for the foreign owned firms. In this sample, we can conclude that the spatial effects are less important in determining China's trade flows. The infrastructure boom following the decentralization plans of Chinese administration (central China on the rise 2004), has facilitated goods transportation, and created more linkages between provinces, as for example, the wealthy and more developed eastern region with the lesser developed but resource rich western region, facilitated by the phenomenal evolution of infrastructure in central China provinces, Wuhan for example. This fact can be interpreted as an evolution toward a more unified domestic market for China.

Table 3 shows the estimations with the nautical miles weight matrix as measure of maritime connections for the provinces along the sea coast. Real exchange rate revaluation and world GDP play an important role on spatial interactions involving foreign owned exports, but none of them are relevant for the Chinese owned firms. The cross border effects are negative and significant only with the spatial lag specification for the foreign owned firms, while for the Chinese owned ones the spatial error specification shows a positive, low but significant, border effects. For imports, both provincial GDP and real exchange rate revaluation shows positive and significant estimates for foreign owned firms. The cross border effects are not relevant for the foreign owned ones in both

specifications, but are largely significant for the Chinese owned firms, and the estimated spatial effects are almost perfectly similar in both specifications in absolute value and level of significance.

Table 3.Estimation with nautical miles weight matrix (coastal provinces), sample (2002-2012)

Dependent variable: Exports and Imports by firm j province i and year t (coefficients in columns specified without spatial effects are estimated with Arellano-Bond panel GMM)

Foreign-owned	***Exports***		***Chinese-owned***	
	Without spatial effects			Without spatial effects
REER	-1.9***	-0.69***	-2.10	-1.17***
GDP world	4.6***	2.37***	0.34	0.15
Rho value	-0.00009**		-0.000034	
Lambda value	-5.70^{e}-07		6.79^{e}-06***	
Imports	Without spatial effects			Without spatial effects
REER	2.05**	-0.96*	-0.28	0.74*
GDP province	0.32***	0.17	-0.07*	0.30
Rho value	-3.29^{e}-06		0.00001***	
Lambda value	-1.32^{e}-06		0.0001***	

Foreign-owned statistic tests. Export: SAR model: R2= 0.56; Log-likelihood= -148.3. SEM model: R2= 0.64; Log-likelihood= -305.57. IMPORT: SAR model: R2= 0.89; Log-likelihood= -174.13. SEM model: R2= 0.57; Log-likelihood= -237.5. These indications ***, **,* represent. Respectively, 1%, 5% and 10% significance levels.

Chinese-owned statistic tests. SAR model: Export: R2= 0.88; Log-likelihood= 53.14. SEM model: R2= 0.91; Log-likelihood= -205.86. IMPORT: SAR model: R2= 0.84; Log-likelihood= -160.21. SEM model: R2= 0.71; Log-likelihood= -199.54. These indications ***, **,* represent. Respectively, 1%, 5% and 10% significance levels.

Notes: for the coastal, only the sample beginning at the WTO membership is under investigation, corresponding to the period of high level of trade openness for these provinces.

Table 4 presents the river connections between the provinces in the Yangtze valley and their impacts on exports and imports for the foreign owned and the Chinese owned firms.

Table 4.Estimation with river distance weight matrix (Yangtze valley), sample (1996-2006)

Dependent variable: Exports and Imports by firm j in province i and year t (coefficients in columns specified without spatial effects are estimated with Arellano-Bond panel GMM)

Foreign-owned	***Exports***		***Chinese-owned***	
	Without spatial effects			Without spatial effects
REER	-1.26***	-0.53	-0.53***	-1.06***
GDP world	0.44	2.72***	0.39	0.74**
Rho value	0.00002**		0.0001***	
Lambda value	1.96^{e}-06		4.41^{e}-06	
Imports	Without spatial effects			Without spatial effects
REER	-1.3	-1.32***	-1.01***	-0.7**
GDP province	1.44***	1.08***	1.96***	0.65**
Rho value	-0.00003*		0.00004	
Lambda value	3.45^{e}-06		2.25^{e}-06	

Foreign-owned statistic tests. Export: SAR model: R2= 0.98; Log-likelihood= 35.54. SEM model: R2= 0.89; Log-likelihood= -179.77. IMPORT: SAR model: R2= 0.95; Log-likelihood=9.62. SEM model: R2= 0.88; Log-likelihood= -122.5. These indications ***, **, represent. Respectively, 1% and 5% significance levels.

Chinese-owned statistic tests. Export: SAR model: R2= 0.94; Log-likelihood= 52.10. SEM model: R2= 0.89; Log-likelihood= -69.42. IMPORT: SAR model: R2= 0.64; Log-likelihood= -105.9. SEM model: R2= 0.89; Log-likelihood=-93.66. These indications ***, **, represent Respectively, 1% and 5% significance levels.

In the Yangtze valley, exports exhibit positive and significant spatial dependence for the two types of firms, however, the effects estimated with the spatial error model are not significant. Here, the spatial lag effects are more relevant to make inference. For the two types of firms, the estimatefor real exchange rate revaluation is highly significant for the two types of firms, while the estimate for world GDP is not significant in for both types of firms. For imports, the spatial effects are significant for the foreign owned ones only. The result for Provincial GDP is highly significant for both types of firms. Meanwhile, the estimated coefficient of real exchange rate revaluation is significant (at the 1% level) only for the Chinese owned imports. Here also, the spatial lag model is more relevant to make inference. Table 5 shows the results for the second sample, beginning at the WTO membership.

Table 5.Estimation with rivers distance weight matrix (Yangtze valley), sample (2002-2012)

Dependent variable: Exports and Imports by firm j in province i and year (coefficients in columns specified without spatial effects are estimated with Arellano-Bond panel GMM)

Foreign-owned	***Exports***		***Chinese-owned***	
	Without spatial effects			Without spatial effects
REER	-1.36***	-2.06***	-0.52*	-0.65***
GDP world	0.23	1.32***	0.51**	0.89***
Rho value	0.00003**		0.0001**	
Lambda value	5.21^{e}-06*		3.76^{e}-06**	
Imports	Without spatial effects			Without spatial effects
REER	-0.50	0.74*	-0.16**	0.65*
GDP province	0.08	0.57	0.72	0.97
Rho value	0.0001***		0.0001***	
Lambda value	6.49^{e}-06*		2.40^{e}-06	

Foreign-owned statistic tests. Export: SAR model: R2= 0.98; Log-likelihood= 25.25. SEM model: R2= 0.60; Log-likelihood=-156.54. IMPORT: SAR model: R2= 0.66; Log-likelihood= -95.53. SEM model: R2= 0.57; Log-likelihood= -153.07. These indications ***, **, represent. Respectively, 1% and 5% significance levels.

Chinese-owned statistic tests. Export: SAR model: R2= 0.92; Log-likelihood=-4.15. SEM model: R2= 0.55; Log-likelihood= -121.98. IMPORT: SAR model: R2= 0.90; Log-likelihood= -26.44. SEM model: R2= 0.47; Log-likelihood= -136.69. These indications ***, **, represent respectively, 1% and 5% significance levels.

For this sample, all spatial specifications show significant spatial interaction effects involving exports, the estimated Rho and Lambda are positive for both types of firms. For imports the spatial effects are also highly significant at the

1% level for both types of firms, and the estimated spatial parameters are perfectly similar in significance level and in absolute value. River and coastal provinces have much more connections with the international market than the other Chinese provinces, especially the coastal ones, which are closely interconnected with other countries. This fact can be linked to their activity, processing trade mostly, where inputs are directly imported from abroad, as mentioned earlier in section 2 with the « China plus one strategy » plan.

A detailed analysis of the results can give partial answers to some issues under investigation in the literature such as China's domestic market integration. In the first sample (1996-2006) including the period before the WTO membership, China manifests a strong impact of provincial borders on international trade. The results show evidence of competition between provinces in exports and imports, and no evidence of complementarities, which is interpreted here as an evolution of China's domestic market toward more integration. However, in the second sample (2002-2012), we have strong evidence of complementarities in foreign owned exports, for the Chinese owned, only the spatial error specification shows evidence for market integration, as it was the case in the first sample. For imports, the situation has not changed; there is any evidence of complementarities between trade flows. Studying market integration in China with a spatial analysis framework, Pillath et al. (2010) conclude that China appears to be an economic federation of provincial economies and not a highly integrated economic system with a strong central government fostering and even enforcing economic integration. They point out the strong inward orientation of provincial economies, determined by certain incentives which are industry specific, leading to local protectionism. Bai et al. (2004), using data about structural convergence of industries, mention the fact that certain industries have higher tax plus profit margins, so that incentives for local protectionism are stronger.

The cross border effects in the coastal provinces reveal some step toward more complementarities in trade flows for foreign owned firms in exports and also in imports, but for the Chinese owned firms we have significant evidence of competition, which is more pronounced in imports.

For the provinces in the Yangtze valley, the situation has changed toward more competition in exports and in imports. There is more evidence of complementarities between foreign owned firms in the coastal area than in the Yangtze valley. For the Chinese owned firms, the feature is the same; there is more evidence of competition between them.

2.5 Concluding Remarks

In this chapter, we have adopted a spatial approach to the drivers of China's international trade. We use trade data on exports and imports disaggregated for 28 provinces in China, between 1996-2012, separated into two samples, distinguishing between foreign owned and Chinese owned firms' trade flows. Taking into account the dynamics in China's decentralization policies, we construct three spatial weight matrices. The first one is the spherical distance weight matrix, which shows the effects of cross provincial border for the 28 provinces on trade flows of the two types of firms. The second spatial weight matrix used the nautical miles, as measures of spatial effects on trade flows for the provinces along the sea coast. The last spatial weight matrix measured the impact of maritime connections for the provinces located in the Yangtze valley, as represented by the river distance weight matrix.

We find relevant provincial cross border effects on China's trade flows for the three spatial weight matrices used here. The spherical distance weight matrix shows different effects through the two samples and types of firms. In the first sample, the foreign owned exports are positively and significantly sensitive to

the cross border effects. For the Chinese owned firms, the impact is also positive on exports. For imports, the impacts are positive and significant only for the Chinese owned firms. According to the statistics here, the spatial lag model is more relevant to make inference. In the second sample, the cross border effects turn out to be negative and significant for the foreign owned firms, remain positive but larger for the Chinese owned firms. For imports, the cross border effects are more significant than in the first sample, and remain positive. The spatial effects matter less in the second sample, this fact may arise from the evolution of China's infrastructure which facilitates goods transportation, especially the rise of « central China plan », which facilitates the link between the wealthy and more developed eastern region with the lesser developed but resource rich western region.

For the coastal provinces, we decided to focus only on the period beginning in 2002, which was the China's WTO accession. For imports, the cross border effects matter only for the Chinese owned firms, while affecting only exports of foreign owned firms. In the Yangtze valley, exports for both types of firms are positively and significantly affected by provincial cross border effects in the first sample, while, for imports the cross border effects are only relevant for the foreign owned firms, which are negative here. In the second sample, all of the impacts are positive and significant for both types of firms. The cross border effects estimated for imports are of the same amplitude and level of significance for the two types of firms. These two areas have much more connections with international market than the other provinces of China, especially the coastal provinces which are closely interconnected with other countries. Furthermore, foreign owned and domestic firms are granted duty exemptions on imported raw materials and other inputs as long as they are solely for exports purposes. This advantage related to processing trade, which is concentrated mostly in the

coastal area, can decrease the transportation costs, leading to less important spatial effects.

A detailed analysis of the results shows that there are more complementarities in trade flows of foreign owned than in Chinese owned firms. This fact leads to the conclusion that China's economic policy toward domestic market integration is slowed down by its provincial trade characteristics.

Appendix

Appendix 1. Test for spatial autocorrelation

Table 1. Test for spatial autocorrelation, (cut-off Q1)

	Spherical distance	Nautical miles	River distance
	Test for SAR in a fixed effects panel data model		
LM test	29.40	20.18	28.70
	(0.00)	(0.00)	(0.00)
LR test	26.27	15.13	23.66
	(0.00)	(0.00)	(0.00)
	Test for SEM in a fixed effects panel data model		
LM test	27.80	17.45	27.73
	(0.00)	(0.00)	(0.00)
LR test	25.81	13.81	23.55
	(0.00)	(0.00)	(0.00)
	Joint tests for spatial autocorrelation		
LM test	29.58	20.21	29.32
	(0.00)	(0.00)	(0.00)
LR test	36.09	27.99	59.44
	(0.00)	(0.00)	(0.00)

Note: cut-off Q1

Table 2. Test for spatial autocorrelation, (cut-off Q2)

	Spherical distance	Nautical miles	River distance
	Test for SAR in a fixed effects panel data model		
LM test	40.26	33.37	53.42
	(0.00)	(0.00)	(0.00)
LR test	34.94	22.47	36.40
	(0.00)	(0.00)	(0.00)
	Test for SEM in a fixed effects panel data model		
LM test	39.44	33.37	57.39
	(0.00)	(0.00)	(0.00)
LR test	34.79	22.94	37.99
	(0.00)	(0.00)	(0.00)
	Joint tests for spatial autocorrelation		
LM test	41.33	37.80	59.44
	(0.00)	(0.00)	(0.00)
LR test	36.09	27.99	59.44
	(0.00)	(0.00)	(0.00)

Note: cut-off Q2

Table 3. Test for spatial autocorrelation, (cut-off Q3)

	Spherical distance	Nautical miles	River distance
	Test for SAR in a fixed effects panel data model		
LM test	39.93	39.24	67.94
	(0.00)	(0.00)	(0.00)
LR test	28.57	27.79	33.16
	(0.00)	(0.00)	(0.00)
	Test for SEM in a fixed effects panel data model		
LM test	42.51	39.24	73.41
	(0.00)	(0.00)	(0.00)
LR test	33.17	23.30	36.56
	(0.00)	(0.00)	(0.00)
	Joint tests for spatial autocorrelation		
LM test	44.13	49.40	74.58
	(0.00)	(0.00)	(0.00)
LR test	34.94	27.79	36.56
	(0.00)	(0.00)	(0.00)

Note: cut-off Q3

Appendix 2. Geographical classification for China's region :

Western regions: Gansu, Guizhou, Ningxia, Qinghai, Shaanxi, Sichuan, Xinjiang, Yunnan.

Central regions: Anhui, Heilongjiang, Henan, Hubei, Hunan, Inner Mongolia, Jiangxi, Jilin, Shanxi.

Coastal regions : Anhui, Beijing, Guangxi, Hainan, Hebei, Jiangsu, Liaonning, Guangdong, Shanghai, Shandong, Tianjin, Zhejiang.

Chapter 3

Trade Flows versus Capital Flows: Are China's Trade Surpluses Overestimated?

3.1 Introduction

During the last decade, China has accumulated a very substantial amount of foreign currency reserves, particularly in US dollars due to a large trade surplus which reached a staggering 10% of its GDP in 2008. However the current account surplus was cut in half during 2007-2009, amounting to a US$ 150 billion swing. Nevertheless, despite this rapid drop in the current account surplus, capital inflows remained strong for most of the post-crisis period leaving the total stock of reserves at US$4 trillion in June 2014. China's fixed exchange rate regime and strict capital controls dramatically exacerbated this

imbalance. Not surprisingly, investors and businesses find arbitrage opportunities and have strong incentives to circumvent capital controls in order to earn a sure profit from anticipated exchange rate shifts and/or interest rates differentials. Indeed, it is contended that the persistent Chinese trade imbalances may actually camouflage hidden « hot money » inflows, reflecting international financial speculation. A fundamental issue related to that economic environment is the extent to which China's trade surpluses are overestimated by such disguised capital inflows.

Recent research has investigated this phenomenon of capital movements in China with different methodologies and has offered a range of measures of the amount of capital flowing out of China and identified as capital flight.[12] Among them Gunter (1996), the pioneering study in this area, gives estimates of capital flight for the period 1984-1994, and also identifies high domestic financial transaction costs, inappropriate exchange rates, and political uncertainty as possible explanations. The computed amounts were US$-14.32 million outflows measured by the residual method (see the appendix for more details), and US$14.39 million inflows for the balance of payment method (see the appendix for more details) in 2001 according to Gunter (2004). Following Gunter (2004), academic studies measuring China's capital flight recognize other determinants including exchange rate policy, preferential treatment for foreign capital, as well as domestic/foreign return differentials, as in Ljungwall and Wang (2008), Sicular (1998), Wu and Tang (2000), Cheung and Qian (2010), and Lan et al. (2010). However as stated in Gunter (2004), adjustment for the misinvoicing of China's trade dominates all other possible sources of capital flight. This is confirmed in Lan et al. (2010), who find that trade openness is the main factor driving capital flight from China. Patnaik et al. (2008) analyze trade misinvoicing as a means to evade capital controls. Using a multicountry data set

[12] A common definition of capital flight is that it is composed of funds fleeing across national borders in search of sanctuary (Brown, 1992, P.294). In the current study, capital outflows will be referred as capital flight.

over a 26 years span, and calculating the insurance and shipping cost or CIF/FOB ratio for each country for each year, they find that misinvoicing is very large in China, 8% of GDP coming into the country accumulated from 1998 onwards. The share of trade misinvoicing in total illicit outflows was around 87% on average (Global Financial Integrity (GFI) report, 2012). Based on that same report excluding Hong-Kong and Macao from world and Chinese trade, trade misinvoicing-adjusted gross illicit outflows from China increased from US$ 172.6 billion in 2000 to US$ 602.9 billion in 2011, a 7.2% rate of growth per annum. The magnitude of trade misinvoicing is commonly estimated by juxtaposing trade data from the importing and the exporting country. For example, a firm interested in moving money out of a country would under-invoice its exports, thus bringing reduced foreign exchange into the country. Similarly, over-invoicing of imports would allow the domestic importer to gain access to greater foreign exchange than required. In an opposite way export over-invoicing and import under invoicing would be used to bring capital into the country.

The novel perspective offered by the present research measures capital inflows into China through trade misinvoicing based on a unique method to avoid some of the shortcomings found in the prior literature, the most important of them: data accuracy problem. Indeed, we use the final trade unit values in US$ per ton of more than two thousand individual commodities, trying to identify a link between Chinese export and import prices and the offshore non-deliverable forward exchange rate for the RMB in Honk-Kong including the usual determinants of export and import prices. Such a method is in keeping with the most widely accepted cause of capital inflows into China, which is expectations regarding prospective revaluations of the RMB. If portfolio holders of the Chinese currency expect a revaluation of the Yuan, they have a strong incentive to arrange for at least part of their holdings to be denominated in RMB

in order to profit from the expected RMB appreciation. A consideration of the impact of an appreciation of the (non-deliverable) forward exchange rate on Chinese export and import prices can offer a measurement of the potential value of disguised capital inflows which are being masked in terms of China's trade surplus. As stated by Xi (2011), "the RMB has consistently remained undervalued. In recent years when there were expectations that the Chinese RMB would appreciate, it appears that misinvoicing of trade was somewhat larger".

Our empirical study is based on panel gravity modeling frameworks. The empirical literature suggests, when dealing with bilateral trade data such as import and export unit values, to use a gravity model in explaining the trade pattern between countries. In line with the literature, for example Manova and Zhang (2012) we include in the analysis, in addition to the forward exchange rate, the following variables: the GDP of China's trade partner countries, China's GDP per capita, GDP per capita for the trading partners also, and a constructed remoteness variable. When we include the forward exchange rate for the Chinese RMB in the specifications of the export and import unit values, we use a mixed-effects model, which allows us to use a larger number of hypotheses of identifications for the different specifications.

Both specifications for export and import prices show significant evidence in support of the hypothesis formulated in the paper. An expected appreciation of the Chinese RMB has a negative impact on the prices of Chinese exports and a positive impact on the import prices as expected, because the Chinese currency is quoted per currency unit of foreign currency. The movements of funds through the trade prices for the selected commodities are sensitive to the forward exchange rate for the Chinese RMB, which reflects international financial speculation on the Chinese currency through trade misinvoicing. We have more robust results with the introduction of a common factor in the specifications.

The remainder of this chapter is organized as follows. Section 2 provides a discussion of the methodologies used in the prior literature measuring capital movements in China. Section 3 describes the data and presents the methodology; section 4 contains the principal findings. Section 5 gives the concluding remarks.

3.2 Related Literature

Facing stricter rules governing international currency and debt transactions intended to reduce illegal capital flows, portfolio holders responded by increasing their use of trade misinvoicing as a means of achieving the same end, as suggested by Gunter (2004). Capturing all the channels through which illicit capital may leave or enter a country is challenging. In the case of China, some attempts have been made to measure capital flowing out of the country through different methodologies. Among the methodologies, the balance of payments method and the residual measures have been used by Gunter (2004). The balance of payments method, credited to Cuddington (1986), consists in computing the sum of reported short term capital exports by the nonbank sector and, the balancing entry errors and omissions. The residual measure compares the source of funds and the use of funds. If actual foreign borrowing during a period exceeds the sum of the current account balance, the changes in international reserves and the amount of net foreign direct investment, it is assumed that the difference (or residual) represents capital flight (which can be positive or negative). The estimated figures were US$-14.32 million outflows measured by the residual method, and US$14.39 million inflows for the balance of payment method for China in 2001 according to Gunter (2004). Xu (2007) employs simple linear regressions to examine the effect of covered interest differentials and vector auto-regression (VAR) to examine the effect of expected currency real revaluation on the estimated amount of capital flows. Ljungwall

and Wang (2008), also using relatively-high frequency capital flight (outflows) data, consider six theoretically-plausible determinants in a VAR framework and find that the effect of external debt is significantly positive and that real GDP growth and foreign investor confidence are negatively related to capital outflows. Lan et al. (2010) estimates capital flight from 1982 to 2007 and seek to examine six potential determinants: real GDP growth, real interest rate differentials, real exchange rate, short term debt, trade openness, and political risk. They find that openness has a significantly positive effect on capital outflows from China, and indicates that trade misinvoicing is the main channel. Patnaik et al. (2008) analyze trade misinvoicing as a means to evade capital controls, using a multicountry data set over a 26 years span, and calculating the insurance and shipping cost or CIF/FOB ratio for each country for each year, from the same data base containing 53 industrialized and developing countries. They find that misinvoicing is very large in China, 8% of GDP accumulated from 1998 onwards.

The shortcomings in these two methodologies lie in the accuracy of the reported amount of capital flight (outflows) calculated. In the balance of payments method, the errors and omissions entry only captures the net effects of the unreported transactions. In the case of the residual measure, as it is based on the current account, a misreporting of exports might increase the size of the residual identified as capital flight (outflows).

Capital flight (outflows) through misinvoicing is calculated by matching up China's exports and imports figures to one of its trading partners, after adjusting for the additional cost of insurance and freight (CIF) on imports that are not included in the price of exports. One problem affecting this method is the schedule of recording of the figures: an export may be recorded in one year while the corresponding import is recorded the next year. Moreover, the exporters and the importers may both deliberately misinvoice the reported

amounts for different reasons like avoiding tariffs, circumventing quotas, etc. For example, Fisman and Wei (2004) quantified the impact of import tariffs on tax evasion, using data on trade between China and Hong-Kong. However, these shortcomings are far from being the most serious problems in estimating fair figures of capital flows disguised as true trade transactions between China and its trading partners. In fact, any attempt to measure capital movements in China is complicated by the role of Hong-Kong as a trade and a financial entrepot for China. The bulk of Hong-Kong's international trade takes the form of re-exports. Imports by Hong-Kong from the mainland are generally for processing and/or warehousing, before being re-exported to another country. According to Gunter (2004), considering the important role of Hong-Kong, measures of capital movements in China may actually be simply errors in province and destination, or capital that flows to Hong-Kong is simply reinvested in China and Hong-Kong. A more pessimistic interpretation is that Hong-Kong is a conduit for capital outflows. As there are no estimates of how much trade between China and Hong-Kong is destined for domestic consumption and how much is merely passing through as re-exports, economists have estimated illegal capital movements in China by both excluding and including Hong-Kong (and Macao) from the trade misinvoicing calculations. In the GFI (2012) report by Kar and Freitas, excluding Hong-Kong from world and Chinese trade, trade misinvoicing adjusted gross illicit outflows from China increase from US$ 172.6 billion in 2000 to US$602.9 billion in 2011, a 7.2% rate of growth per annum. As an illustration, Table 1 represents the top ten commodities misinvoiced between China and Hong-Kong, calculated with the "GER methodology", in billions of US$ or in percent, between 2007-2011, (see details of the GER methodology calculation in the appendix).

Table I. Top 10 Commodities Misinvoiced between China and Hong-Kong, Cumulative GER 2007-2011 (in billions of US$ or in percent)

HS07 Code	Description	Export invoicing US$billions	Import invoicing US$billions	GER US$billions	GER Growth %	Share in the Top 10 %
854231	Electronic integrated circuits, processors and controllers, whether/not combined with memories	77.6	6.5	84	13.1	19
854239	Other electronic integrated circuits, other than Amplifiers/Memories/Processors and Controllers	64.2	0	64.2	13.3	14.5
847330	Parts and Accessories of the machine of heading 84.71	55.6	0	55.6	8.4	12.6
851770	Parts of telephone sets, incl. Tel for cellular networks/for other wireless networks, other apparatus	49	5.4	54.8	10.3	12.4
851712	Telephones for cellular networks/for other wireless networks	4	32.2	36.3	164.5	8.2
852990	Other parts suitable for use solely/principally with the apparatus of headings 85.25 to 85.28, other	34.4	0	34.4	4.3	7.8
901380	Other devices, appliances and instruments	4.9	28.2	33.1	7.9	7.5
847130	Portable automatic data processing machines, weighting not more than 10 kg, central processing unit etc.	0.9	28.7	29.7	14.1	6.7
854232	Electronic integrated circuits, memories	26.4	0	0	6.6	6.1
847170	Storage units	22.8	0	0	13.3	5.4

Table from the GFI (global financial integrity report (2012))

The commodity grouping of (electronic circuits) has the largest cumulative illicit outflows due to export under-invoicing (US$77.6 billion) and import over-invoicing (US$6.5 billion), which account for nearly 20 percent of total misinvoicing involving the top ten commodity groupings. However, trade misinvoicing involving commodity grouping (mobile phones, etc.) has increased at the fastest pace over the period 2007 to 2011, commensurate with increasing trade in mobile phones. The deliberate misinvoicing of exports and imports comprises by far the major channel for the transfer of illicit capital from China, although the share has tended to fluctuate over the period 2000-2011. In the pre-crisis period 2000-2007, the share of trade misinvoicing in total outflows was around 87% on average while in the period since then, the share has come very slightly down to about 85%.

3.3 Data and Methodology

3.3.1 Data

Given the shortcomings mentioned above, the present paper uses a more intuitive approach that avoids assuming unwarranted data accuracy, this time to identify capital inflows into China through trade unit values. The selection strategy for the commodities is guided by the current pattern of China's bilateral trade. In fact, China's imports (excluding energy and commodities) are essentially intermediate products, inputs, parts and components, and exports are finished goods, and parts and components. We have selected over thousands of commodities exported and also thousands of commodities imported, and have computed average prices for 27 commodities grouped by category for exports, and also the same computations for imports. The final trade unit values data we use contain unit value information in US$ per ton, over the period 1999-2009, from the CEPII data base. Unit values are ultimately provided in the harmonized system 1996 revision with 6 digits both Free On Board (FOB) and Cost of Insurance and Freight (CIF). The CIF unit values rely on importers' declarations, and include all trade costs (except tariffs and domestic taxes after the border). The FOB unit value is a proxy for the trade prices at the factory gate, relying on exporters' declarations, and does not include trade costs. The unit values are finally average export and import prices for 27 groupings by category (see the appendix D for more details). The forward exchange rate for the RMB, corresponding to the (non-deliverable) quoted dollar rates in Hong-Kong is used to measure a hypothesized impact of an anticipated appreciation of the RMB on trade prices. We also have the GDP per capita, and GDP. Data for control variables are downloaded from the World Bank's World Development Indicators data base except data for distance, which are downloaded from the CEPII data base. We have constructed a measure of remoteness as a weighted average of a country's bilateral distance to all other countries in the world, using countries' GDP as weights, (see the appendix for the computation). We have also constructed a common factor variable for export and import prices, the computation method will be presented in the econometric methodology section.

Among the selected groupings, some are identified by the GFI report (2012) by Kar and Freitas to be the most susceptible to trade misinvoicing. These groupings include UN commodity trade statistics database (COMTRADE) group 84 (nuclear reactors, boilers, machinery, etc.) and group 85, (electrical and electronic equipment), with the sub-group for electronic circuits (HS code 854231) showing the largest cumulative illicit outflows (US $ 84.1 billion). Trade misinvoicing related to the sub-group for mobile phones (HS Code 851712) increased at the fastest pace from 2007-2011, according to the same report. They indicate that the more specialized a product the easier it is to misinvoice because an inspector would need specialized knowledge to judge whether the product is under or over-valued. Also, most of these commodities are often declared as parts and accessories of machines or such non-specific description. This allows traders to hide the actual market price of the product given the difficulty for customs unit value checks to flag price outliers.

3.3.2 The Offshore non-Deliverable Exchange Rate for the RMB in Hong-Kong

By definition, the non-deliverable forward is a cash settled forward contract, which for the Chinese currency means settlement in dollars. China is classified by the IMF as under an « other fixed peg arrangement », the IMF notes the switch to a more flexible rate in July 2005 (up to July 2008, and revived after June 2010) but adds that the limited flexibility, less than 2% for a given 3 month period, keeps China in a defacto fixed peg arrangement. In fact, China has adopted a managed adjustment regime of exchange rate system out of the dollar-peg periods.

China implemented a new interbank system called China Foreign Exchange Trading System (CFETS) in Shanghai in April 1994; see Fung et al. (2004). The

foreign exchange trading system is linked to major cities across China through satellite and ground communications. Three currencies are traded on CFETS: the Hong-Kong dollar, Japanese Yen, and US dollar; the People's Bank of China sets the opening quotes of the foreign rate based on the previous day and allows a narrow range of daily fluctuations. If the rate exceeds the defined band of fluctuation, currency trading stops automatically.

As China becomes more market oriented and global, foreign participants increasingly engaging in China business would like to hedge the risk of Chinese currency rate changes through a forward market. As a result, international banks recognizing this need set up an offshore non-deliverable forward (NDF) market to satisfy the demand by end 1996.

In this chapter, we will focus on the behavior of RMB/Dollar NDF rates for this market as roughly 85-90% of Chinese trade is invoiced in US dollar, with the remainder split between Euro and Yen, Manova and Zhang (2012). RMB NDFs with the US dollar are liquid, with a typical daily volume of about US$23 billion in 2010 (RBA bulletin (June 2012). Running an empirical analysis, using daily data from January 19, 1999 to November 4, 2003 for the NDF rates for various maturities with the US dollar, and spot data, and also having computed the forward premium for each NDF with the corresponding number of days for maturity, Fung et al. (2004) find that the market expects a revaluation of the Chinese currency relative to the US dollar because interest rate in both China and the United-States remain constant, and thus, there is no pressure to violate the interest rate parity. The discount is likely due to the increasingly large US-China trade deficit and mounting foreign reserves, as they conclude.

However, while the People's Bank of China controls the level of the RMB and offshore access, the current account is in turn freely convertible in trade related transactions that is an opportunity for those interested in speculating on the RMB through trade misinvoicing.

3.3.3 Methodology

For most of the period under investigation (1999-2009), due to continuous expectations of Yuan appreciation, China experienced net hidden capital inflows, see Xi (2011). We thus assume that firms take into account the expected appreciation of the Chinese RMB in their pricing strategy to profit from a future revaluation of the Chinese currency. For consistency with the prior literature, we first briefly recall how export and import prices vary with characteristics of the destination country. The micro-foundations of pricing behavior by exporters as mentioned by Campa et al. (2005) are presented as a useful starting point for understanding the import prices. By definition, the import prices for any country, $P_t^{m,j}$ are a transformation of the export prices of that country's trading partners, $P_t^{x,j}$, using the exchange rate E_t defined in units of the home (importing country) currency relative to the foreign (exporting country) currency:

$$P_t^{m,j} = E_t P_t^{x,j} \qquad (1)$$

The export prices, in turn, are a markup ($mkup_t^x$) over exporter marginal costs (mc_t^x). We thus transform equation (1) in logarithms as:

$$P_t^m = e_t + mkup_t^x + mc_t^x \quad (2)$$

The markup can be broken down into two components: an industry-specific fixed effect exogenous to exchange rate changes, whose value depends on the specific structure of competition in each industry and a second component which is correlated with exchange rate movements:

$$mkup_t^x = \emptyset + \theta e_t \quad (3)$$

An additional influence on import price sensitivity could enter through marginal costs, in the context of imported inputs or commodity prices. As in Campa et al.

2005, we assume that exporters' marginal costs of production are a positive function of demand conditions in the destination country:

$$m_t^x = c_0 y_t + c_1 cp_t^x \qquad (4)$$

Following Manova and Zhang (2012), we focus on three country characteristics in particular: size (GDP), income (GDP per capita), and overall economic remoteness, to explore how these market features affect Chinese exporters' bilateral prices. However as they use data for one year denominated in U.S. dollars, and given that 85-90% of Chinese trade is invoiced in U.S. dollars (with the remainder split between euro and yen), they do not take into account the effects of currency movements on firms' optimal pricing behavior. However, they mention that they control for it in an unreported regression. In order to assess the extent to which export and import prices are sensitive to an anticipated appreciation of the Chinese RMB, we augment their model with the latter variable and estimate the two following equations in a gravity model specification:

$$lnP_{ijt}^X = \alpha_{ij} + \gamma_t + \alpha_1 lnNDF_t + \alpha_2 lnGDP/capita_{jt} + \alpha_3 lnGDP_{jt} + \alpha_4 lnRemote_{ijt} + ln\varepsilon_{ijt} \qquad (5)$$

$$lnP_{ijt}^M = \alpha_{ij} + \gamma_t + \alpha_1 lnNDF_t + \alpha_2 lnGDP_{jt} + \alpha_3 lnRemote_{ijt} + ln\varepsilon_{ijt} \qquad (6)$$

Where P_{ijt}^X denotes the average export prices of country i (China) to country j (trading partner), P_{ijt}^M denotes the average import prices of country i (China) from country j (trading partner); $lnGDP/capita_{jt}$ the GDP/capita of a Chinese trading partner, $lnGDP_{jt}$ the real GDP of a trading partner. The fixed effects α_{ij} capture all types of unobserved country-pair specific heterogeneity that is constant over time, while the time effects γ_t capture all forms of time-varying heterogeneity that is shared among country pairs. The single most popular approach to estimating the gravity model using panel data is first to make it linear by taking logarithms and then to estimate the resulting log-linear model

by fixed effects ordinary least squares (OLS), commonly known as the LSDV estimation. However, although simple to implement, this approach is problematic because the OLS estimates of the log-linearized model may be both biased and inefficient in the presence of heteroskedasticity. To avoid all these shortcomings found in the previous literature, we follow the recommendations of Westerlund and Wilhelmsson (2009), who propose to estimate the gravity model directly in its non linear form by using the fixed-effects Poisson Maximum Likelihood estimator with bootstrapped standard errors. This model is shown to perform well in small sample. Now applying the Poisson ML estimator, the two estimated gravity equations can be written as follow:

$$P_{ijt}^{X} = \exp(\alpha_{ij} + \gamma_t) NDF_t^{\alpha 1} GDP/capita_{jt}^{\alpha 2} GDP_{jt}^{\alpha 3} Remote_{ijt}^{\alpha 4} \varepsilon_{ijt} \quad (7)$$

$$P_{ijt}^{M} = \exp(\alpha_{ij} + \gamma_t) NDF_t^{\alpha 1} GDP_{jt}^{\alpha 2} Remote_{ij}^{\alpha 3} \varepsilon_{ijt} \quad (8)$$

3.4. Principal Findings

The following two tables show the effects of countries' destination characteristics on the Chinese average export and import prices, without taking into account the effects of currency appreciation expectations on the firms' pricing strategy.

TABLE II. CHINA'S AVERAGE EXPORT PRICES AND DESTINATION MARKET CHARACTERISTICS

EXPORT PRICES (specification without RMBndf)		
GDP partner	0.0001***	[2.93e-06]
GDP per capita	-1.346e-07	[2.53e-07]
Remoteness	3.26e-06***	[3.47e-07]
Constant	-3.62***	[0.2692]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(9)$= 3221.9 [0.000]; Log likelihood= -60133.75		

Robust standard errors between square brackets. These indications ***,*, represent 1% significance level.

We expected in this specification, GDP per capita (destination country's income), GDP (market size) to be positively related to the Chinese export prices. The average f.o.b. export price increases with remoteness. All impacts except the GDP per capita are significant, compared with the findings of Manova and Zhang (2012); for example, they find -0.006 for GDP per capita, and-0.003 for GDP in relation to the Chinese average export prices. Table III shows how the Chinese import prices vary with remoteness, China's GDP partner.

TABLE III. CHINA'S AVERAGE IMPORT PRICES AND TRADE COST

IMPORT PRICES (specification without RMBndf)		
GDP partner	0.0003***	[6.78e-07]
Remoteness	1.09e-06	[6.95e-07]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(4)$= 210824.29 [0.0000]; Log likelihood= -2330450.8		

Robust standard errors between square brackets. These indications ***, represent 1% significance level.

The Chinese average import prices increases with the countries' origin GDP and remoteness. For the main objective of this chapter, the next results show the

relation between the forward exchange rate for the Chinese Renminbi as expectations of exchange rates appreciation effects on the pricing strategy adopted by exporters and importers. To this goal, we adopt a more intuitive specification by using a mixed-effects model. This model allows us to implement a more accurate system of identification in order to capture speculative behavior. First we assume that all of the individuals' commodities are not used to move money, and if a specific commodity is used to move money in a given year it cannot be used the next year. To take into account these considerations, we employ the mixed effects estimation. The fixed-effects are analogous to standard regression coefficient and are estimated directly, thus the Poisson maximum likelihood is used as described above, while the random-effects are not directly estimated, and are summarized according to their estimated variances and co variances. This technique allows us to use the name of the category groupings as "exposure" variable, this means product to use if equal to 1 and not to use if equal to 0. Table IV shows the estimates of the sensitivity of Chinese average export prices to the forward exchange rate for the Chinese Renminbi and the destination countries' market characteristics.

TABLE IV. CHINA'S AVERAGE EXPORT PRICES AND EXPECTATIONS OF EXCHANGE RATES APPRECIATION

EXPORT PRICES (specification with currency movements expectation)		
RMBndf	-0.28***	[0.0331]
GDP partner	0.0001***	[2.93e-06]
GDP per capita	-1.63e-07	[2.53e-07]
Remoteness	3.48e-06***	[1.22e-07]
Constant	-1.40***	[0.2919]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(10)$= 6121.73 [0.000]; Log liklihood= -60122.59		

Bootstrapped standard errors are between square brackets. These indications ***, represent 1% significance level.

The inclusion of the forward exchange rate for the Chinese RMB does not change the significance and the amplitude of the absolute value of the other

coefficients. Compared with the estimation in table II without the forward exchange rate for the RMB, the results are more robust; the log likelihood is larger when the NDF is included. The elasticity of the Chinese average export prices to the forward exchange rate for the RMB is highly significant. We have here the expected sign for the RMBndf, because the Chinese currency is quoted per currency unit of foreign currency. The movement of funds through the selected commodities here is highly sensitive to expectations of exchange rates appreciation. The manipulation of transfer prices and other invoicing practices represent a straightforward way of disguising capital flows, in terms of reported trade. Table V shows the reactions of Chinese average import prices to the forward exchange rate for the RMB and to the bilateral variables.

TABLE V. CHINA'S AVERAGE IMPORT PRICES TRADE COST AND EXPECTATIONS OF EXCHANGE RATES APPRECIATION

IMPORT PRICES (specification with currency movements expectation)		
RMBndf	0.37	[0.7718]
GDP partner	0.00027***	[6.50e-07]
Remoteness	-4.10e-07	[3.26e-06]
Constant	-6.23	[4.5968]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(3)$= 210721.3 [0.000]; Log liklihood= -2330463.6		

Bootstrapped standard errors are between square brackets. The indication ***, represent 1% significance level.

In this estimation, only the GDP partner is significant except the forward. As China's average import prices do not respond significantly to the forward exchange rate, the movements of funds involving the selected commodities here is not sensitive to expectations of exchange rates appreciation. Considering the log likelihood these results are not more robust than the other obtained in table III without currency appreciation expectations.

In the following estimations, we include a common factor for robustness issue. The common factor for the average export prices (cross-sectionally computed) see Pesaran (2007) represents the pricing strategy between the different categories selected. It will contain the potential value per year from all the selected exports and also, the potential magnitude of capital flows involved in exports misinvoicing, while the common factor for the average import prices (in cross-section) represents the expenses related to the imported components, parts, per year, and also contains the potential magnitude of capital flows involved in imports misinvoicing. Also, one more benefit from including the common factor is, it corrects for heterogeneity between firms, category groupings, and countries. Accordingly, all equations will be re-estimated using a common factor in keeping with the method set forth by Gengenbach et al. (2008), see in chapter one for more details.

Table VI shows the Chinese average export prices in relation to the destination market characteristics, the effects of expectations of exchange rates appreciation, when a common factor is included.

TABLE VI. CHINA'S AVERAGE EXPORT PRICES, DESTINATION MARKET CHARACTERISTICS, AND EXPECTATIONS OF EXCHANGE RATES APPRECIATION WITH A COMMON FACTOR

EXPORT PRICES (specification with export prices' common factor)		
RMBndf	-0.15***	[0.0574]
GDP partner	0.0001***	[2.93e-06]
GDP per capita	-1.82e-07	[2.53e-07]
Remoteness	1.96e-06***	[5.97e-07]
Common Factor	0.0001***	[0.00003]
Constant	-1.76***	[0.2779]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(11)$= 8551.5 [0.000]; Log likelihood= -60119.98		

Bootstrapped standard errors are between square brackets. The indications ***, represent 1%, significance level.

When compared with the results obtained in table IV, the forward exchange rate coefficient remains the highest in absolute value and significant at the 1% level. All other reactions are significant except for the GDP per capita. The effect of expectations of exchange rates appreciation on the Chinese average export prices is highly significant, and shows that firms take into account the forward exchange rate for the Chinese RMB in their pricing strategy.[13] The results are more robust than the ones obtained without a common factor; more instruments are also used here. Table VII shows the results for the average import prices when the common factor is included.

[13] In this chapter, considering the selected products, which are identified as the more susceptible to trade misinvoicing by the GFI report [2012]. We assume that firms do not take into account the forward exchange rate for hedging issue, but rather for speculative facts.

TABLE VII. CHINA'S AVERAGE IMPORT PRICES, EXPECTATIONS OF EXCHANGE RATES APPRECIATION AND TRADE COST

IMPORT PRICES (specification with import prices' and export prices common factor)		
RMBndf	0.56**	[0.2648]
GDP partner	0.00003***	[6.78e-07]
Remoteness	-1.86e-06	[1.48e-06]
Common Factor	4.76e-06***	[4.16e-07]
Constant	-7.56***	[1.4542]
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(5)$= 210883.06 [0.000]; Log liklihood= -2330445.6		

Bootstrapped standard errors are between square brackets. Indication ***, and **, represent 1% and 5% significance level. Common factor (1) is import prices' common factor.

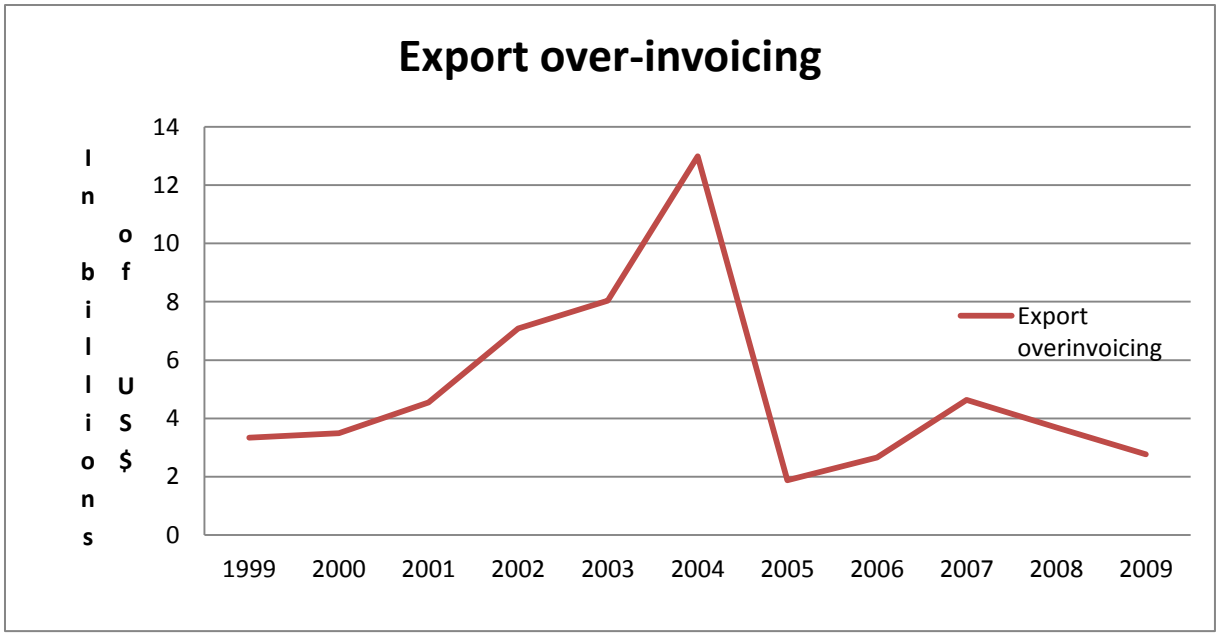
The inclusion of the common factor does not change the direction of the coefficients, we have all expected signs. The new result is that the effect of expectations of exchange rates appreciation on the pricing strategy of China's average import prices turns out to be significant, and is more important in absolute value compared with the estimation without a common factor. Moreover, the results here are robust, more instruments have been used, and the log likelihood shows that this specification is better than the one without a common factor.

One of the most widely accepted causes of capital inflows into China is expectations regarding prospective revaluations of RMB. If portfolio holders of the Chinese currency expect a revaluation of the Yuan, they have a strong

incentive to arrange for at least part of their holdings to be dominated in RMB, in order to profit from the expected RMB appreciation.

We have computed amounts of hidden inflows through the total value exported and the total value imported involving the selected commodities here. In fact, we use the elasticities (from the estimates including a common factor) of china's export and import prices to the forward exchange rate for the RMB to derive amounts related to international financial speculation overstating the amounts of China's trade imbalances between 1999 to 2009. As a brief recall, the Chinese currency is quoted per currency unit of foreign currency, so then the elasticity of export prices to the forward exchange rate for the RMB, which is negative here, represents an increase in the export prices of (0.15%) when an appreciation of 1% of the RMB is anticipated. For the import prices, an anticipated appreciation of 1% of the RMB is associated with a decrease of (-0.56%) in the pricing of imports. In the case of exports, the amounts calculated represent export over-invoicing, and in the case of imports, the computed amounts represent import under-invoicing. The following figure shows the evolution of hidden capital inflows in millions of US$ through export over-invoicing between 1999 and 2009.

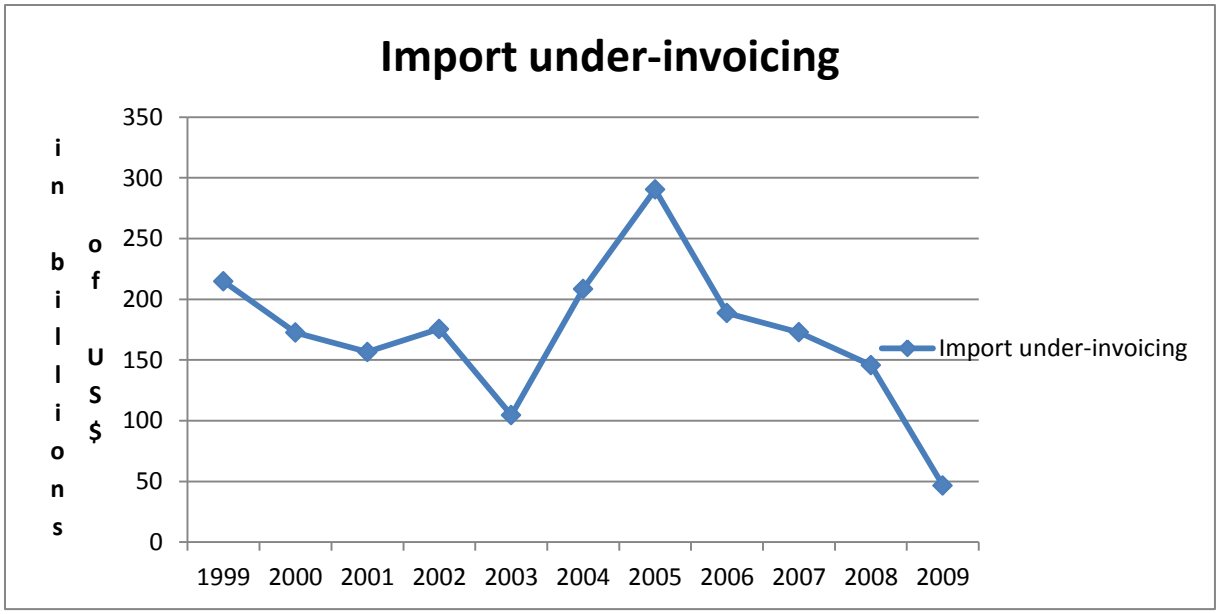
Figure I. Evolution of export over-invoicing in China during the last decade



Source: authors' calculations

Indeed, the Chinese trade surplus is suspected to actually camouflage a non-negligible amount of « hot money » inflows, with the aim of speculating on an anticipated appreciation of the RMB. The huge increase in 2005 corresponds to the year when the spot RMB appreciated and a year of large amount traded between China and its partners. The widely held perception that the Yuan was under-valued (because of the trade surpluses) may have fed into expectations of exchange rate revaluation in the future which could lead to speculative inflows. In fact, if portfolio holders of the Chinese currency expect a revaluation of the Yuan, they have a strong incentive to arrange for at least part of their holdings to be dominated in RMB in order to profit from the expected RMB appreciation. The drop then between 2007 up until 2009 is due to the global financial crisis that decreased world trade. Figure II shows the evolution of import under-invoicing through the selected commodities in billions of US$ between 1999-2009.

Figure II. Evolution of import under-invoicing in China during the last decade



Source: authors' calculations

We can observe for imports the same large increase in 2005 as for export over-invoicing, and the sharp drop between 2006 and 2009. Indeed the magnitude of trade misinvoicing depends on the amounts actually traded, as stated in the GFI (global financial integrity) report (2012). These amounts computed for exports and imports correspond to the hidden inflows into China involving the selected commodities used here.

In this chapter, we have identified a motivation behind trade misinvoicing which is speculation on the Chinese currency. In fact, the motivation for trade misinvoicing cannot be identified exactly as shown in the literature. The literature focuses on three broad motivations for misinvoicing. When firms pay high rates of customs duties or VAT (value added taxes) on imports, or are subject to quantitative restrictions, they have an incentive to understate the true value of imports. In the case of China, firms are suspected to overstate the true values of exports to profit from VAT rebates, Fung et al. (2011). Finally, trade misinvoicing is used for moving illicit capital into and/or out of a country, the aim is not exactly identified yet in the literature.

Our findings have several implications. First, trade misinvoicing curtails the collection of taxes; indeed tax revenue collection continues to be a persistent challenge in China. According to the GFI report (2012), the revenue performance of the general government (defined as central plus state and local governments) steadily improved from 13.8% of GDP in 2000 to 22.3% of GDP in 2011. However, China's revenue falls short of the G-7 group of major advanced economies, which averages 36.0% of GDP per annum, and lags behind emerging and developing countries average revenue collection of 26.6% of GDP. The Chinese government cannot collect sufficient tax revenues to meet its expenditures on the social safety net which account for just 5.7% of its GDP. Economies at comparable levels of development spend, on average, more than twice as much. In fact, illicit inflows are more likely to be channeled to underground economic activities than they are to boost the productive capacity of the official economy.

The most serious implication comes from the NDF market for the Chinese RMB. In fact, the offshore non-deliverable forward exchange rate (NDF) is taken into account by firms in their optimal pricing behavior, and indeed trade misinvoicing, involving the selected commodity groupings, may contribute significantly to putting pressure on the Chinese RMB toward appreciation. According to Gu and Mc Nelis (2012), the NDF market for the RMB plays a key role in transmitting pressures from Yen/Dollar volatility to the Chinese spot and financial markets. Indeed, the US takes the biggest share of China's exports (18% in 2010) and Japan takes the biggest share of China's imports (13% in 2010).

3.5 Concluding Remarks

The huge amount of foreign-currency-reserve build up generated by apparent China's trade surpluses during the last decade raises concerns about international financial speculation. In fact, the widely held perception that the Yuan is undervalued fed into expectations of exchange rate revaluation that led to speculative inflows into China. China also experienced earlier massive capital outflows that were widely studied by economists but measures of capital inflows have been rather ignored. In our knowledge, only Gunter (2004) has reported inflows of US$14 billion in 2001 with the balance of payments method, and Patnaik et al. (2008), through trade misinvoicing calculation, indicate that trade misinvoicing represented 8% of China's GDP from 1998 onwards. The rest of

the literature calculating capital flows in China offers estimates of capital flowing out of China through different methodologies. In addition to the balance of payments, the residual method and trade misinvoicing are generally used to compute amounts flowing in and out of China.

The current chapter has offered estimates of capital flowing into China through the misinvoicing of trade. We have measured the impact of an anticipated appreciation of the Chinese currency, on the basis of the effect of the offshore non-deliverable forward exchange rate for the RMB in Hong-Kong on china's average export and import prices. We considered products grouped into 27 categories for more than two thousand individual goods, which are the most susceptible to trade misinvoicing. We used a panel gravity modeling framework, which is tested by a mixed-effects model, that allows a more accurate and intuitive system of identification.

Our findings show clear evidence in support of the hypothesis formulated in this paper. Actually, trade misinvoicing facilitates capital inflows into China with the aim of speculating on the Chinese currency. In fact, in the gravity settings, all the products are not used to move money, and if a product is used to move money, it cannot be used the next year. This model shows highly significant results and allows us to compute amounts of hidden inflows into China through the period 1999-2009. The amounts have been calculated from the total value of the selected exports, and from the total value of the selected imports. In so doing, we identify a clear motivation behind trade misinvoicing, which is speculation on the Chinese currency, while in the literature the motivations for the misinvoicing of trade can either be a mean for circumventing quantities' restriction, moving illicit capital and/or for tax evasion.

Finally, this chapter provides evidence of the overestimated China's trade surpluses between 1999 and 2009 due to hidden capital inflows. This idea that China's trade surpluses may actually camouflage hidden capital inflows still

persist. Such an issue is still topical since, according to private sector analysts in China, 7% of international trade were in fact disguised capital inflows during the first five months of 2013.

Appendix A: Capital Flight: Calculations Methodologies

The Residual Method (based on the current account) is calculated as follow: capital flight = ΔExD + NFDI – CAD - ΔIR

ΔExD = change in external debts,

NFDI = net foreign direct investment,

CAD = current account deficit,

ΔIR = The change in international reserves.

There is outward (inward) capital flight when the recorded sources of funds given by increases in external debts and net FDI inflows are larger (smaller) than the recorded uses of funds given by Current Account Deficit and International Reserves accumulation.

The Balance of Payment measures: the Cuddington method illustrates this measure:

Capital flight = S_t NB + E and O, the measure emphasizes the role of short term capital in defining capital flight.

S_t NB is the non bank private short term capital outflow, and E and O is the error and omissions entry reported in the balance of payments account. The errors and omissions term is common measures of unrecorded capital movement.

The GFI GER (Gross Excluding Reversals) methodology

Method of calculating gross illicit outflows defined as export under-invoicing plus import over-invoicing. In other words, GER calculations are based on the sum of discrepancies between (i) a country's exports and world imports from that country and (ii) a country's imports and world exports to that country. The absolute value of the export under invoicing, which is a negative estimate under (i), is added to import over invoicing to arrive at a GER estimate. All cost of insurance and freight (c.i.f.) values are converted to a free-on-board (f.o.b.) basis by netting out the cost of insurance and freight (at 10 percent of import value).

Appendix B: Chinese Trading Partners

Australia, Austria, Belgium, Brazil, Canada, France, Germany, Hong-Kong, Indonesia, Italy, Japan, Korea, Luxembourg, Malaysia, Taiwan, Russia, Thailand, Singapore, Sweden, United Kingdom, United States, Norway, Denmark, Finland, Spain, Vietnam, Philippines.

Appendix C : The Remoteness Computation

The remoteness is called the multilateral resistance terms to trade, as is standard in the literature. It is constructed in the form of a weighted average of a country's bilateral distance to all other countries in the world, using countries' GDP as weights. A destination is remote in economic terms if it is geographically isolated from most other nations or is close to small countries but far away from big economies.

$$\sum_j \frac{distcountry/ch}{GDPcountry/GDPchina} = \text{Remoteness per year}$$

a) *Appendix D : The selected groupings*

Exports

(1) Mounting fittings and similar articles for motor vehicles of base metal
(2) Machinery and apparatus for isotopic separation and parts theoref
(3) Parts of nuclear reactors
(4) Parts of central heating boilers (iron or steel)
(5) Parts of reaction engines
(6) Machinery for the industrial preparation or manufacture of food or drink
(7) Parts and accessories of textile Machinery
(8) Machine for assembling electronic or electronic Lamp
(9) Nuclear reactors
(10) Parts of civil engeening Mining and public works and cranes
(11) Machinery for industrial preparation
(12) Parts and accessories for bicycles
(13) Electric Motors
(14) Parts of electric power Machinery
(15) Telephone sets
(16) Parts of electrical apparatus for line telephony
(17) Semiconductor devices
(18) Parts of electronic integrated circuit and micro assemblies
(19) Motor vehicles for transport
(20) Parts for Tractors motors cars and accessories
(21) Parts of microphones, television image
(22) Mineral substances
(23) Base metal and concentrates
(24) Chemical elements doped for use in electronics, in Disc wafers or similar forms
(25) Iron or nonalloy steel semi finishes products
(26) Intermediate products of cobalt metallurgy
(27) Parts of household or laundry type washing Machines

The selected groupings for imports

(1) Iron or nonalloy steel semi finishes products

(2) Wire

(3) Cobalt mattes and other intermediate products of cobalt metallurgy

(4) Machines foe assembling electronic or electronic lamp

(5) Parts of the apparatus for sound records and parts of television image

(6) Electric conductors

(7) Electrical machines and apparatus

(8) Motor vehicles for transports

(9) Parts for tractors motors cars and accessories

(10) Parts of electrical capacitors

(11) Parts of television picture tubes

(12) Other electric valves and tubes

(13) Semiconductors devices

(14) Electronic integrated circuits

(15) Micro assemblies

(16) Parts of electronic integrated circuits and micro assemblies

(17) Parts of electrical apparatus for line telephony

(18) Parts of electric accumulators

(19) Electric generators

(20) Parts of machinery for industrial preparation

(21) Processors and controllers whether or not combined with memories

(22) Parts and accessories of the machines of heading

(23) Other apparatus for transmissions

(24) Other devices, appliances and instruments (liquid crystal devices)

(25) Portable automatic data processing machines (weighing not more than 10kg)

(26) Storage units

(27) Other parts suitable for use solely, other than aerial and aerial reflectors of all kinds, others.

General Conclusion

China's trade surpluses ballooned during the last decade, reaching 10% of its GDP in 2008, even though declining after in the wake of the great recession, subsequent to the world financial crisis beginning in 2007. With rapid accumulation of foreign reserves, particularly in US dollar, China's current account surpluses raise many questions and concerns. Indeed, there is a plethora of academic research on the Chinese trade imbalances.

This thesis investigates in three chapters the drivers of China's international trade. In the first chapter, we investigate the extent to which a revaluation of the Chinese currency contributed in a meaningful way to the shrinking of its trade surpluses. We use panel data on exports and imports for the multinational and domestic firms in China, disaggregated for 29 provinces. The use of disaggregated trade data not only facilitates more sophisticated econometric analysis, but also allows for distinctive regional effects. Notably, in this regard, it is likely that both trade price and income elasticities may differ substantially for coastal regions, relative to those in the interior, in light of the quite different historical evolution of their degrees of openness to international trade and foreign direct investment. In addition to the usual trade determinants, we explore in this chapter, the impact of China's nominal exchange rate, relative prices, and domestic absorption on its trade balance. The dynamic panel analysis applied here uses the methodology proposed by Arellano and Bond (1991) in order to analyze the panel covering 29 provinces and the period 1996-2012, separated in two samples of eleven years both, to account for the likely structural break after Chinese WTO membership. The findings in this chapter point out clearly that there are provincial cross-border effects on China's

international trade flows. Indeed, there are sharp differences in the elasticities of trade determinants between regions. We then, in chapter 2 investigate the China's provincial cross-border effects on its international trade flows. We conduct the analysis through two separated samples as in the second chapter to take into account the dynamics in China's decentralization policies. The first one span the period 1996-2006, the second one begins from 2002 which marks the China's WTO accession, and ending in 2012. We use a spatial lag and spatial error model according to the statistic tests conducted in this study. We construct three spatial weight matrices as fundamental determinants of China's provincial exports and imports. We are interested specifically in the connection between provinces and its impact on exports to and imports from Chinese trading partners, while breaking down the exports and imports trade flows to distinguish between foreign owned and Chinese owned firms. The first weight matrix (spherical distance) measures the impact of the spatial connections of the Chinese 28 provinces on its international trade flows. The second weight matrix uses the nautical miles to measure the impact of maritime connections on trade flows for the provinces along the coast. The last spatial weight matrix measures the river connections and their effects on trade for provinces in the Yangtze valley. The analysis reveals strong evidence of spatial effects on China's international trade.

In the last chapter, we set forth a new approach to measure capital inflows into China disguised as true trade transaction, to go further in our study on China's trade imbalances. In fact, private sector analysts estimated that in China, 7% of international trade were disguised capital inflows in the first five month of 2013. Indeed, the widely held perceived undervalued Yuan because of the trade surpluses feeds into expectations of a future revaluation of the Chinese currency. Businesses and investors interested in financial speculation, use regular trade flows to bring capital in China, circumventing capital control in

place. In fact, China's current account is actually suspected to camouflage hidden money inflows, reflecting international financial speculation. We use trade prices of two thousand individual commodities which are more susceptible to trade misinvoicing for export and import and have investigated their sensitivity to a future revaluation of the Chinese currency as represented by the non-deliverable forward exchange rate for the RMB in Hong-Kong. This approach is in line with the widely accepted causes of capital inflow in China which is speculation on the RMB. We adopt a panel gravity modeling, augmented with a mixed-effects model to calculate amounts of hidden inflows into regular trade flows. The findings in this chapter show that China's trade surpluses are indeed overestimated.

The results of this thesis give helpful insights in understanding the factors behind the dynamics of China's international trade during the last two decades.

First, the choice to separate the sample into two parts in the first two chapters highlights the fact that China's trade pattern changed after the WTO membership. In fact, as shown in chapters 1 and 2, the elasticities of determinants of Chinas' exports and imports are higher during the second sample beginning in 2002. Indeed, this approach points out the need to use Markov-switching models to examine how the determinants of export and import flows are subject to eventual regime changes, which can reemergence over time as stated in Girardin and Owen (2014).

Furthermore, we show with disaggregated trade data the necessity to take into account separately the effects of nominal exchange rate and relative prices on exports and imports flows. In fact, to the extent that capital controls in China and the non-convertibility of the RMB have introduced important distortions in the Chinese currency's nominal rate, which estimates and simulations of the effects of a nominal exchange rate appreciation need to take explicitly into account.

Secondly, in chapter 2 we show the need to account for the spatial effects in determining the extent to which China's trade balance may be responsive to exchange rate adjustments involving the RMB. In fact, China's provincial cross-borders have significant effects on exports and imports; the effects vary given that trade flows are those of the domestic firms or multinational implanted in China, and also whether the provinces are located in the coast or in the Yangtze valley. We show that spatial effects are more present in the Yangtze valley than in the coastal area, and we have more negative impacts for the multinational firms than for the domestic firms. The latter fact leads to the conclusion that China's domestic market integration is slowed down by the competition in trade between its domestic firms. The spatial effects are less important as determinants of China's trade flows in the second sample. China's domestic infrastructure investments have facilitated goods transportation within China, as for example, the rise of the central China, which is a major transportation and logistics hub, linking the wealthy and more developed eastern region with the lesser developed but resource rich western region. Furthermore, the spatial effects are less present in the coastal area because these provinces have much more connections with other countries than with other provinces in China.

Thirdly, we show in this thesis, the need to take into account capital flowing into China in terms of regular trade flows and overestimating its trade surplus. In fact, in line with the literature of trade misinvoicing in China, we propose in this thesis a new approach to measure hidden capital inflows. Indeed, the widely held perceived undervalued Yuan because of the trade surplus feeds into expectations of a future revaluation of the Chinese currency, which leads to international financial speculation. In fact, in chapter 3, we show that in China, the prices for some commodities exported and imported are sensitive to the non-deliverable forward exchange rate for the RMB in Hong-Kong, which has rather reflected anticipated appreciation of the China's RMB. The relationship between

the forward exchange rate and the prices for the commodities selected in this chapter are used on nominal exports and imports to calculate amounts of capital inflows disguised as true trade surpluses.

Finally, the results of this thesis suggest further insights to broaden our understanding of China's trade flows' determinants. In fact, depending on trade data used, specifically when distinguishing between those trade flows for the multinational and domestic firms in China, the cross border effects may give important insights on the state of integration of the Chinese domestic market and also, integration involving China's domestic market with countries which have common border with China. Indeed, the balk of multinational firms implanted in China originates from Hong-Kong and or Taiwan. Considering these facts may lead to further implications. We keep it for our future work.

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