China's Capital Inflow Measures: an Assessment from Goods' Pricing Strategies and the Forward Exchange Rate for the RMB

By

Eric Girardin* (Aix Marseille University, AMSE, CNRS & EHESS) and Moussa Fall (Aix Marseille University, AMSE CNRS & EHESS)**

* Professor of Economics, Faculty of Economics Aix-Marseille University, 14 Avenue Jules Ferry, Aix en Provence 13621, France, Telephone: 33-42914836. Fax: 33-42914873. E-Mail: eric.girardin@univ-aix.fr

** Doctoral Student Faculty of Economics, Aix Marseille University, 14 Avenue Jules Ferry, Aix en Provence 13621, France, Telephone: 33-652460154. E-Mail: emkafall@yahoo.fr

Abstract

China has received massive foreign capital inflows after experiencing capital flight earlier in the last decade. While the prior literature focuses on capital flight measures, this paper offers estimates of capital inflows into China through the misinvoicing of trade. In fact, the widely perceived undervalued Yuan has fueled expectations of a future revaluation of the Chinese currency. Despite the dramatic contraction in the current account surplus over the last few years, capital inflows have been very strong for much of the post-crisis period, leaving the total stock of foreign currency reserves at US$ 3.4 trillion.In a panel gravity modelling framework, 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. In light of the evolution of this rate, which has rather systemically reflected anticipated appreciations of the Chinese currency, it is contended that the persistent Chinese trade imbalances may actually camouflage hidden « hot money » inflows. Our findings provide evidence for export over-invoicing and import under-invoicing, which correspond to underground capital inflows.

Keywords: China, Capital inflows, Export and import prices, Revaluation, Forward exchange rate, Panel data, Trade misinvoicing

1. INTRODUCTION

During the last decade, China has accumulated a non-negligible 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$ 3.4 trillion at last count. China's fixed exchange rate regime and strict capital controls dramatically exacerbated this imbalance, as they prevent the foreign currency and goods markets from converging to equilibrium. Not surprisingly, investors and businesses find arbitrage opportunities and have strong incentives to circumvent capital controls in order to earn a sure profit from exchange rates and interest rates differentials. Indeed, it is contended that the persistent Chinese trade imbalances may actually camouflage hidden « hot money » inflows, reflecting international financial speculation. Private sector analysts estimated that in China, 7 percent of international trade were in fact disguised capital flows in the first five months of 2013.

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.[1] Among them Gunter (1996), the pioneering study in this area, gives estimates of capital flight for the period 1984-1994, and has also identified high domestic financial transaction costs, inappropriate exchange rates, and political incertainty as possible explanations. Following Gunter (1996), 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; see for example, Gunter (2004) 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) analyse trade misinvoicing as a mean 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, they find that misinvoicing is very large in China, 8% of GDP coming into the country from 1998 onwards.The deliberate misinvoicing of exports and imports comprises by far the major channel for the transfer of illicit capital from China. 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,

[1] 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 reffered as capital flight.

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. In fact, 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 unde-rinvoicing 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, namely: data accuracy issue. 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 measurement is in keeping with the most widely accepted causes 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". Furthermore, Bergsten (2004) argues that further RMB revaluation would help China cool its overheated economy, and help stop the inflows of speculative capital. However, Lau et al. (2004) of the Hong-Kong Monetary authority argue that a further RMB revaluation would not necessarily dampen speculative capital flows, but rather invite renewed speculative inflows on the expectation of further strengthening of the currency.

Our empirical study is based on panel gravity modelling frameworks. Empirical literature suggests, when dealing with bilateral trade data such as import and export unit values, to use gravity model in explaining the trade pattern between countries. In line with the literature, we include in the analysis in addition to the forward exchange rate, the following variables: the GDP of China's trade partner countries, the GDP per capita, the distance between China and its 27 trade partners, and a constructed remoteness variable. When we include the forward exchange rate for the Chinese RMB in the specifications of the export unit values and the import unit values, we use a mixed-effects model, which allows a more accurate and intuitive system of identification.

Both specifications show significant evidences in support of the hypothesis formulated in the paper. An expected appreciation of the Chinese RMB has a negative impact on the Chinese export prices 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. The introduction of a common factor in the specifications shows the most significant results for the speculation side in the pricing strategies.

The remainder of the paper 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 draws the methodologies; section 4 contains the principal findings. Section 5 gives the concluding remarks.

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 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 a challenging test. In the case of China, some attempts have been made to measure capital flowing out of the country through different methodologies. However, in our knowledge, any of them offered capital inflows measurements. 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, and then 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 residual method 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 flight (outflows). 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) use the estimates of 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) analyse 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 industrialised and developing countries. They find that misinvoicing is very large in China, 8% of GDP.

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 deliberatly misinvoice the reported amount 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 that the 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 and Macao from world and Chinese trade, trade misinvoicing adjusted gross illicit outflows from China increases from US$ 172.6 billion in 2000 to US$602.9 billion in 2011, a 7.2% rate of growth per annum. When adjustment for Hong-Kong and Macao is included, export under-invoicing amounted to US$ 119.2 billion and import-overinvoicing US$310.8 billion in 2011.

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 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. DATA AND METHODOLOGY

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 offer exclusively amounts of capital inflows into China through the trade unit values. The selection strategy for the commodities is guided by the current pattern of China's trade with its trading partners. In fact, China's imports are essentially intermediate products, inputs, parts and components, and exports are finished goods, and parts and components mostly for the laters to the south

East Asian market. We have selected over thousands of commodoties exported and also thousands of commodities imported. Indeed, we have calculated average prices for 27 commodities grouped by category for exports, and also the same computations for imports by category. The final trade unit values data we use contain unit value information in US$ per ton of 27 exported commodity groupings (more than thousand individuals) and 27 imported commodity groupings (over thousand individuals) to and from 27 countries by China over the period 1999-2009, from the CEPII data base. Unit values are ultimately provided in 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. 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 the trade prices. We also have the GDP per capita, the GDP, and the Distance from China, for 27 Chinese trade partners. Data 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. As here, the bulk of exports are directed to Brazil, we considered only information on Brazil and China to construct the Remoteness variable, (see the appendix for the computation). We have also constructed a common factor variable for the export and the import prices, the computation method will be presented in the econometric methodology.

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 illicite 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.

3.2 METHODOLOGY

For most of the period under investigation, due to continuous Yuan appreciation expectations, China has experienced net hidden capital inflows. "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", Xi (2011).We thus assum that, firms take into account the expected appreciation of the Chinese RMB in their pricing strategy, this can be either a future profitability issue or a speculative behavior. For both purposes, any sensitivity will assess a relationship between the flows of funds through the trade prices and the forward exchange rate for the RMB. For consistency with the prior literature, we first briefly recall how the export and the 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:

$P_t^{m,j} = E_t P_t^{x,j}$ (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: $P_t^m = e_t + mkup_t^x + mc_t^x$ (2)

Following Manova and Zhang (2012), we focus on four country characteristics in particular: size (GDP), income (GDP per capita), distance to China, and overall economic remoteness, to explore how these market features affect Chinese exporters' bilateral prices. However as they precise, 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. In order to assess the extent to which export and import prices are sensitive to an anticipated appreciation of the Chinese RMB, we estimate these two following equations in a gravity model specification:

$$lnP_{ijt}^X = \alpha_{ij} + \gamma_t + \alpha_1 lnNDF_t + \alpha_2 lnGDP/capita_{jt} + \alpha_3 lnGDP_{jt} + \alpha_4 lnDistance_{ij} + \alpha_5 lnRemote_{ijt} + ln\varepsilon_{ijt} \quad (3)$$

$$lnP_{ijt}^M = \alpha_{ij} + \gamma_t + \alpha_1 lnNDF_t + \alpha_2 lnMkup_{ijt}^x + \alpha_3 lnGDP_{jt} + \alpha_4 lnDistance_{ij} + ln\varepsilon_{ijt} \quad (4)$$

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, $lnDistance_{ij}$ the distance between China and a trading partner, $Mkup_{ijt}^x$ the markup, which represent an export price, representing exactly the trade costs. 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 log linearized model is not defined for observations with zero trade. As the bulk of our selected groupings are exported to Brazil, this pattern corresponding to zero trade with the other countries in the sample, the LSDV will show bias results. Another problem is that 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 from its non linear form by using the fixed-effects Poisson Maximum Likelihood estimator with bootstrapped standard error. According to them, since this removes the need to linearize the model by taking logarithms, the problem with zero trade disappears. This model is shown to perform well in small sample. Now applying the Poisson ML estimator as suggest by Westerlund and Wilhelmsson (2009), the two estimated gravity equations can be written as follow:

$$P_{ijt}^{X} = \exp(\alpha_{ij} + \gamma_t) NDF_t^{\alpha 1} GDP/capita_{jt}^{\alpha 2} GDP_{jt}^{\alpha 3} Distance_{ij}^{\alpha 4} Remote_{ijt}^{\alpha 5} \varepsilon_{ijt} \quad (5)$$

$$P_{ijt}^{M} = \exp(\alpha_{ij} + \gamma_t) NDF_t^{\alpha 1} Mkup_{ijt}^{x\alpha 2} GDP_{jt}^{\alpha 3} Distance_{ij}^{\alpha 4} \varepsilon_{ijt} \quad (6)$$

Equations (5) and (6) are based on the gravity model in its original non-linear form and are estimated with the fixed effects Poisson ML estimator which does not suffer from the same biases and inefficiency as the OLS estimation. However, the estimated standard errors can be downward biased, and then we should use bootstrapped standard errors.

4. PRINCIPAL FINDINGS

The two following tables show the effects of countries' destination characteristics on the Chinese average export and import prices, without taking into account the effects of currency movements (here the forward exchange rate for the renminbi) on the firms' pricing strategy.

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

EXPORT PRICES (specification without RMBndf)		
GDP partner	0.00014***	(50.42)
GDP per capita	0.00048*	(1.95)
Remoteness	0.00023***	(3.16)
Distance	0.0003***	(24.76)
Constant	-3.61***	(-7.2)
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(4)$= 2985.7 [0.000]; Logliklihood= -62994.34		

Z values are in parenthesis and p-values between square brackets.These indications ***,*, represent 1%, and 10% significancy level respectively.

We expected in this specification that distance (transportation costs), 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, constructed here by only considering the Chinese and Brazilian GDP and distance as weights. All impacts are significant but are weak considering the coeffients in their absolute value, but compared with the findings of Manova and Zhang (2012), for example, they find (-0.006 for GDP per capita, -0.003 for GDP) in relation to the Chinese average export prices, for their poor destination samples and rich destination samples respectively. The next table shows how the Chinese import prices vary with, distance, China's GDP partner, and the markup (trade costs), here approximated with the export prices.

TABLE III. CHINA'S IMPORT PRICES AND TRADE COSTS

IMPORT PRICES (specification without RMBndf)		
GDP partner	0.004*	(1.78)
Export prices	-0.001**	(-2.42)
Distance	0.0002*	(1.78)
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(4)$= 10.83 [0.0285]; Logliklihood= -1923929.3		

Z values are in parenthesis and p-values between square brackets.These indications **,*, represent 1%, and 5% significancy level respectively.

The average Chinese import prices increases with the countries' origin GDP and distance, and fall with the markup. These weak reactions in both specifications may come from the specificity of the products selected here, and more important, from the aggregation of prices. As already precised in Manova and Zhang (2012), the behavior of aggregate trade prices might not conclusively distinguish between competition, and market destinations' components. For the main objective of this paper, the next results show the relation between the forward exchange rate for the Chinese Renminbi as currency movements

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 adopt a more accurate system of identification in order to capture a speculative behavior. First we assum that, all of the individuals commodity are note 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 mixedeffects estimation provided into Stata. 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 covariances. This technique allows us to use the HP digit codes as "exposure" variable, this means, we use the name of each of the 297 average export prices, and the name of each of the 297 average import prices as individual to use if equal to 1 and not to use if equal to 0. The following table show the average export prices in relation to the exchange rate for the Chinese Renminbi, and the destination countries' market characteristics.

TABLE IV. CHINA'S AVERAGE EXPORT PRICES AND CURRENCY MOVEMENTS EXPECTATION

EXPORT PRICES (specification with currency movements expectation)		
RMBndf	-0.38***	(15.64)
GDP partner	0.0001***	(50.43)
GDP per capita	0.00005**	(2.00)
Remoteness	0.00003***	(15.64)
Distance	0.0003***	(24.64)
Constant	-0.84	(-1.50)
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(12)$= 10159.61 [0.000]; Logliklihood= -62962.17		

Z values are in parenthesis and p-values between square brackets.These indications ***, **, represent 1%, and 5% significancy level respectively.

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 without the forward exchange rate for the RMB, the results are more consistent. The liklihood ratios for the two estimations are of equal amplitude almost, but here, we have more variables and more instruments used as shown by the Wald statistic here, then we can prefer these results. The forward rate dominates all other reactions in absolute value and is highly significant. We have here the expected sign for the RMBndf, because the Chinese currency is quoted per currency unit of foreign currency, we have through the export prices, movement of funds coming into China (export over-invoicing). The manipulation of transfer prices and other invoicing practices represent a straightforward way of disguising capital flows, in terms of reported trade. The non-deliverable forward RMB

exchange rate is generally considered to be a reasonable proxy reflecting expectations regarding future movements in the Chinese currency. The settlement of such contracts has traditionally been made in US dollars due to the unavailability (until recently) of RMBs in Hong Kong in sufficient quantity. A consideration of the impact of an appreciation of the (non-deliverable) forward exchange rate on the Chinese export prices 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. The next table shows the features on the import prices side.

TABLE V. CHINA'S AVERAGE IMPORT PRICES AND CURRENCY MOVEMENTS EXPECTATION

IMPORT PRICES (specification with currency movements expectation)		
RMBndf	0.41	(0.82)
GDP partner	0.00027***	(44.21)
Export prices	0.00023***	(95.97)
Distance	0.00007***	(28.71)
Constant	-7.45*	(-1.90)
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(4)$= 268260.98 [0.000]; Logliklihood= -1991402.3		

Z values are in parenthesis and p-values between square brackets. These indications ***,*, represent 1%, and 10% significancy level respectively.

All effects hold here, and are highly significant except the forward exchange rate for the Renminbi. China's average import prices do not respond significantly to the forward exchange rate, import under-invoicing cannot be evidenced here. These results are more robust than the other obtained without the currency movements expectation, considering the log liklihood and the Wald test.

As the aim of our modelling framework is to capture the speculative side in the pricing strategies of the individual firms, we should particularly pay attention to the common strategy adpoted by the speculators sharing the same information. Here, an expectation of a future appreciation of the Chinese Renminbi. The common factor for the average export prices (cross-sectionally computed) represents the pricing strategy between the different categories selected, it will contain the potential revenue per year and quantity 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 quantity, and also contains the potential magnitude of capital flows involved in imports misinvoicing. Also, one more opportinuty related to the common factor is, it corrects for heterogeneity between firms, category groupings, and countries. Accordingly, all equations will be re-stimated using a common factor in keeping with the method set forth by Gengenbach et al.

(2008). More specifically, the analysis of Gengenbach et al. (2008) considers two alternative assumptions: the common factor F_t is either observed, or not observed. In the case where it is not observed, 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-sample, 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 estimations reported here. The model can be described as follows :

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 (autoregressive moving average) representation of Z_{it}^{+} is given by the following expression: $A_i(L)(Z_{it}^{+} - (\pi^{*}_i)' gt) = c_i(L) £ ^{+}_{i,t}$

This ARMA representation implies that Z_{it} can be written in the following form:

$Z_{it} = \pi_i F_t + E_{i,t}$, where $E_{i,t}$ is independent across the panel horizontally. It can be noted that :

$\overline{Z}_t$, $\overline{\pi}$ and $\overline{E}_{it}$ represent the horizontal averages across the panel of Z_t and E_{it}, and as a result:

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

For more details, see Gengenbach et al. (2008).

The following table shows the average export prices in relation to the destination market characteristics, the effects of currecy movements expectation, when a common factor is included.

TABLE VI. CHINA'S AVERAGE EXPORT PRICES, DESTINATION MARKET CHARACTERISTICS, AND CURRENCY MOVEMENTS EXPECTATION WITH A COMMON FACTOR

EXPORT PRICES (specification with export prices' common factor)		
RMBndf	-1.44***	(-6.47)
GDP partner	0.0011***	(10.91)
GDP per capita	0.00006**	(18.67)
Remoteness	0.00005***	(11.43)
Distance	-0.00008***	(-49.36)
Common Factor	-0.0002***	(-9.17)
Constant	-17.95***	(-5.19)
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(13)$= 24887.10 [0.000]; Logliklihood= -27462.87		

Z values are in parenthesis and p-values between square brackets.These indications ***, **, represent 1%, and 5% significancy level respectively.

The forward exchange rate coefficient remains the highest in absolute value, and significant at the 1% level. All other reactions are significant, distance shows here a negative coefficient contrary to the specification without the common factor. Manova and Zhang (2012) find that distance is negatively related to the average Chinese export prices when the destination markets are poor destinations, and all destinations in their sample. The effect of currency movements on the Chinese export prices is high, and shows here cleary that firms take into acount the forward exchange rate in their pricing strategy, for their future profitability or for speculative facts. The results are more robust than the one obtained without a common factor, more instruments are also used here. The next table shows the results for the average import prices when a common factor is included.

TABLE VII. CHINA'S AVERAGE IMPORT PRICES, CURRENCY MOVEMENTS EXPECTATION, AND TRADE COSTS

IMPORT PRICES (specification with import prices' and export prices common factor)

RMBndf	1.65***	(3.61)
GDP partner	0.0007***	(33.16)
Export prices	0.00012***	(21.62)
Distance	0.00014***	(20.24)
Common Factor (1)	0.00005***	(38.12)
Common Factor (2)	0.00012***	(15.40)
Constant	-28.0***	(-7.48)

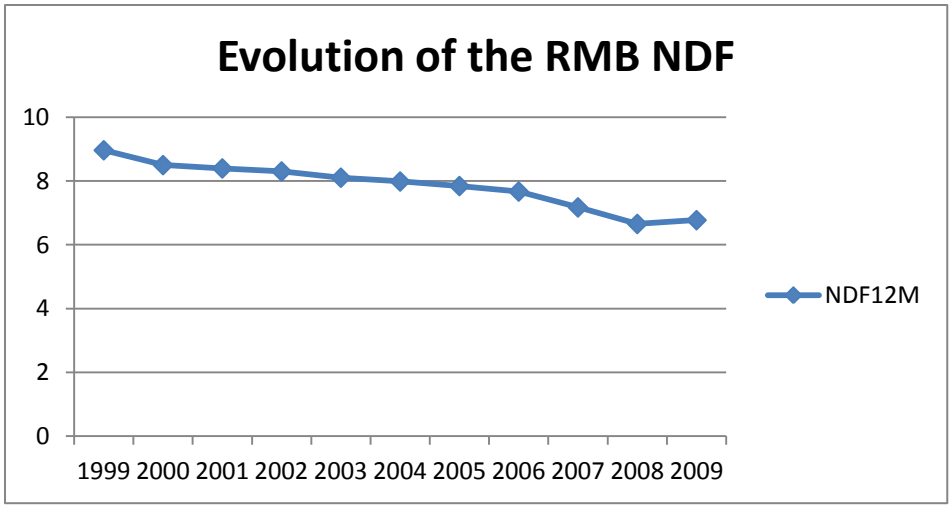
Numb of obs= 297; Numb of groups= 11; Wald $\chi^2(6)$= 0.00000019 [0.000]; Logliklihood= -487353.25

Z values are in parenthesis and p-values between square brackets. Indication ***, represent 1% significancy level. Common factor (1) is import prices' common factor; Common factor (2) is export prices' common factor.

The inclusion of the common factor does not change the direction of the coefficients, we have all expected signs. In fact, the effect of currency movements on the pricing strategy of China's average import prices turns to be highly significant, and is more important in absolute value compared with the precedent estimation without a common factor. The speculative behavior is highly evidenced here, the RMBndf dominates all other effects, the positive coefficient indicates import under-invoicing, so then, capital inflows. More over, the results here are robust, more instruments have been used, and the liklihood ratio 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 exchange rate RMB appreciation. The following figure shows the evolution of the forward exchange rate for the Chinese RMB during the period of analysis.

Figure I. Evolution of the Chinese RMB NDF during the last decade

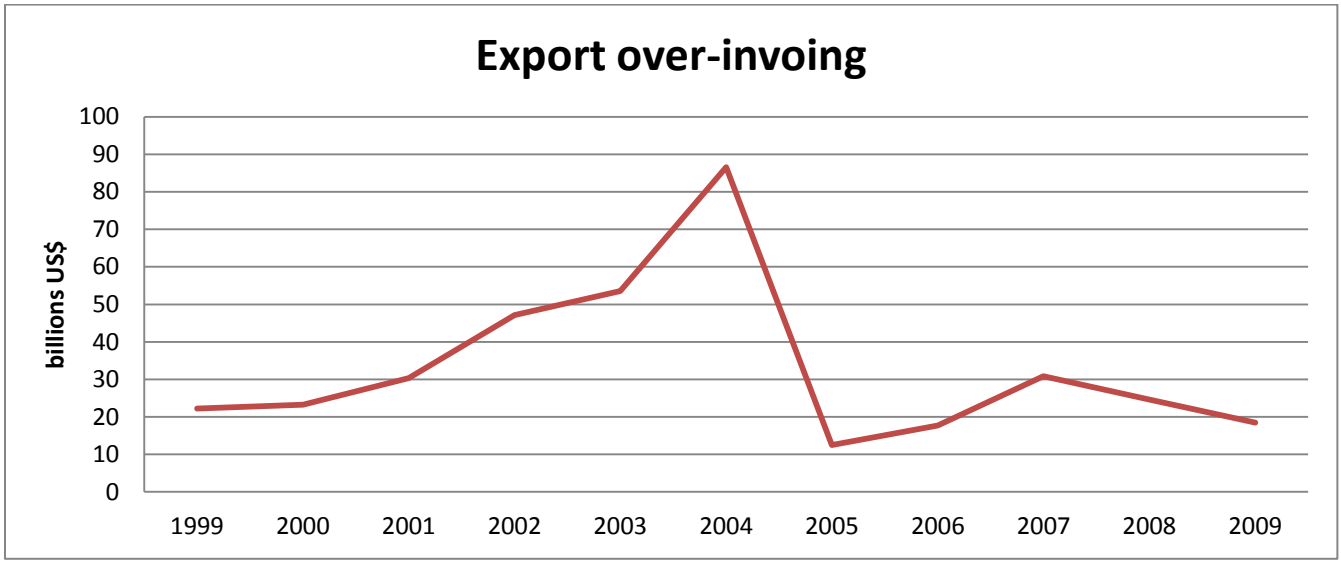


As can be seen on the graph, there were not significant appreciations until 2005 up to 2008, and likely, there were a stabilisation between 2008 and 2009. Furthermore, according to Gu and Mc Nelis (2012), the Chinese RMB NDF movements are driven by its own dynamics and influenced by the Yen/Dollar exchange rate volatility. As the Yen/Dollar rate becomes more volatile, market players bet on further RMB appreciation and the NDF discount deepens. Using a VAR and a Bayesian VAR specification, they find that the volatility of the Yen/Dollar exchange rate has a strong direct effect on the NDF premia, which in turn affects the RMB. Indeed, the volatility of US dollar has increased over the past decade, of course, not only with respect to the Japanese Yen but also to the Euro. Bergsten (2004) argues that further RMB revaluation would help China cool its overheated economy, and help stop the inflows of speculative capital. However, Lau et al. (2004) of the Hong-Kong Monetary authority argue that a further RMB revaluation would not necessarily dampen speculative capital flows, but rather invite renewed speculative inflows on the expectation of further strengthening of the currency. 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. RMB NDFs with the US dollar are liquid, with a typical daily volume of about US$23 billion in 2010 (RBA bulletin (June 2012).

We offer annual capital inflows in a period in which the literature admits that capital was mostly flowing in China due to continuous Yuan appreciation expextations, for example, Xu (2011). We choose annual data because of the enormous problems related to the China's high frequence data. In this regard, we can mention the lot of seasonalities, the outliers, and lumpiness in monthly data. Moreover the commodities selected are not exported in every month to the same destination markets. Furthermore for the Chinese RMB, annual data seems more suitable due to Chinese exchange rate regime. As a recall, China is classified by the IMF as under an "other fixed peg regime", Chinese currency is not flexible so much, so using annual data in both sides prevent as from multiplying the number of observations

without adding further informations. The following figure shows measures of capital inflows during 1999-2009 when there were mostly expectations for the RMB to appreciate.

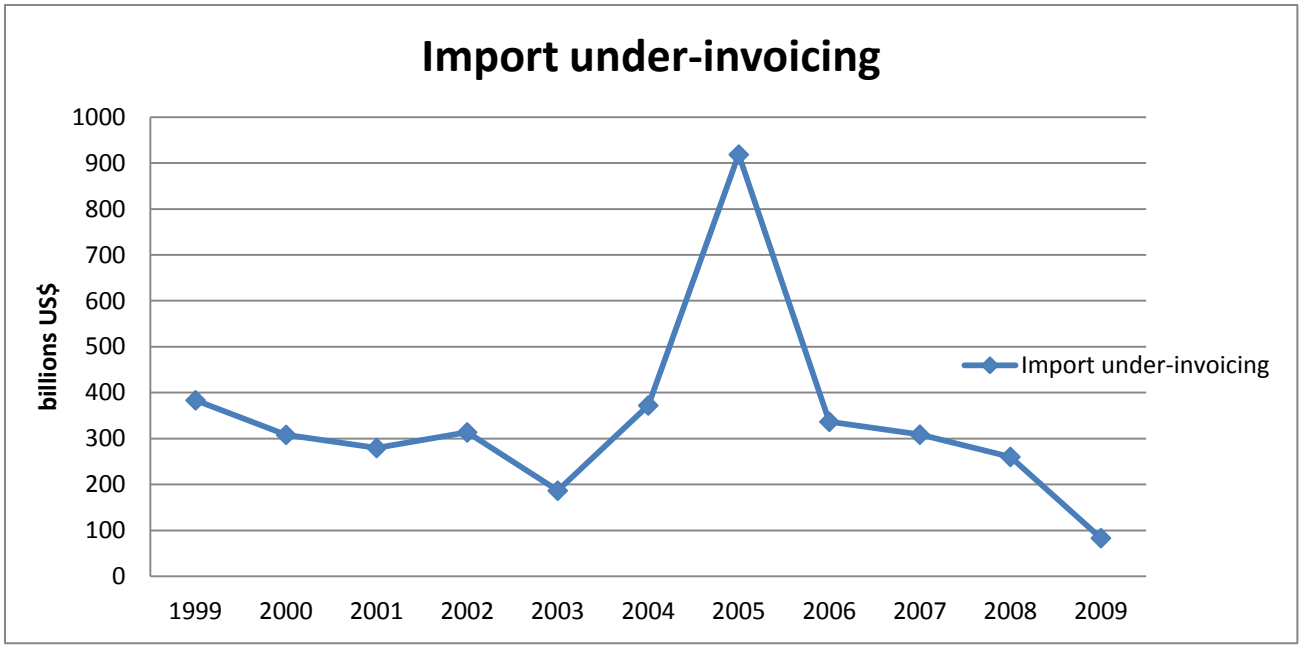
Figure II. Evolution of export over-invoicing in China during the last decade



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 pic in 2005 corresponds to the year when the RMB appreciated, and a year of huge amount traded between China and its partners. Particularly, multinational corporations are suspected by the SAFE (State Administration of Foreign Exchange) of using such flows as a means of arranging for far larger amounts to enter China, relative to their actual investment and other needs. The widely held perception that the Yuan is under-valued (because of the trade surpluses) may feed 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 hitted the world trade.

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



Source: authors' calculations

Indeed in this paper, we have identified an exact motivation behind trade misinvoicing. In fact, the motivation for trade misinvoicing cannot be identified as shown in the literature. The literature focuses on two 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).

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. To the extent that the government fails to collect applicable taxes, the middle and low income groups suffer the consequences. 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 average 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 fail to 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 channelled 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 pressures 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. The volatility of the Yen against the dollar of course, reflects differences in the US and Japanese macroeconomic fundamentals (particularly with respect to saving) while the RMB is linked to a bucket of foreign currencies including the US dollar and the Japanese Yen, the weights of each currency are not revealed. 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). Thus we may expect that the effects of Yen/Dollar volatility will be different in China and in the US. Given these differences, there are strong pressures for the Chinese governement to further appreciate its currency.

5. CONCLUDING REMARKS

The huge amount of foreign currency reserves build up, generated by 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 has fed into expectations of exchange rate revaluation in the future that lead 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. The rest of the literature of capital flight from China offers estimates of capital flowing out of China through different methodologies. In addition to the balance of payments, they have used the residual measure and trade misinvoicing measures.

The current paper 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, as measured on the basis of the relationship between the offshore non-deliverable forward exchange rate for the RMB in Hong-Kong on the china's average export and import prices grouped into 27 categories for more than two thousand individuals, which are the most susceptible to trade misinvoicing in a panel gravity modelling 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 of 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 is accordingly used to calculate figures of capital inflows into China. The amount involved in exports over-invoicing is about 116.75 billions of dollars, and for the imports under-invoicing, the inflows amount to 180.59 billions in 2009. These amounts have been calculated from the total revenue generated by the selected exports, and from the expenses induced by the selected imports. In so doing, we evidence a

clear motivation behind trade misinvoicing, which is speculation, while in the literature, the motivations for the misinvoicing of trade can either be a mean for achieving capital flight and/or for tax evasion.

Finally, this paper provides evidence of the relation between trade pricing by China's businesses and the non-deliverable forward exchange rate for the Chinese RMB in Hong-Kong. In fact, the prices for the commodities selected are sensitive to the common indicated trade bilateral variables, but more to the forward exchange rate for the Chinese RMB. Indeed, both evidences here in this paper: over-invoicing of exports and under-invoicing of imports correspond to flows of funds into China which may contribute to putting pressure on the non-deliverable forward exchange rate which in turn may contribute to transmitting volatility to the Chinese spot foreign exchange and to its financial market. Thus, trade misinvoicing implying capital inflows is rather an additional disturbance working against financial market stability in China.

Appendix A: Capital Flight: Calculations Methodologies

The World Bank Residual Method is calculated as follow: capital flight = ΔExD + NFDI – CAD - ΔIR

ΔExD = change in external debts,

NFDI = net foreign direc investment,

CAD = current account deficit,

$\Delta IR =$ 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 omssions 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 underinvoicing, 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. As in our sample, the bulk of the products included is exported to Brazil, we construct the remoteness considering only the distance between Brazil and China and their GDP respectively as follow:

$$\sum_j \frac{distbr/ch}{GDPbrazil/GDPchina} = \text{Remoteness per year}$$

References

Bai, J. and S. Ng, A panic attack on unit roots and cointegration. Econometrica 72, 1127-1177. 2004

Bergsten, C. F. The Resurgent Japanese Economy and a Japan-United States Free Trade Agreement. 2004. Paper presented to the foreign correspondents' Club of Japan, Tokyo, Japan. May 2012.

Brown, B. Capital flight. In P. Newman, M. Milgate, & J. Eatwell (Eds.), The new Palgrave dictionary Of money and finance, vol. 1, (pp. 294–296). New York: Stockton Press. 1992.

Campa, J.M, Mingez, J.M.G, Goldberg, S.L, Exchange Rate Pass Through To Import Prices In the Euro Area. Federal Reserve Bank of New York Staff Reports, Sep. 2005.

Cheung, Y.W. and X. Qian, Capital flight: China's experience. CESIFO working paper No.2931. January 2010.

Chien-C. L. and Y. B. Chin. Oil prices, nuclear energy consumption, and economic growth. New evidence using a heterogeneous panel analysis. Energy policy, vol 39, issue April 2011.

Cuddington, J. "Capital Flight: Estimates, Issues, and Explanations. Princeton Studies in International Finance, No. 58 1986.

de Boyrie, M. E., Simon Pak and John Zdanowicz, Estimating the Magnitude of Capital Flight Due to Abnormal Pricing in International Trade: The Russia-USA Case, Accounting Forum Journal, 29, pp. 249-270. 2005a

de Boyrie, M. E., Simon Pak and John Zdanowicz. The Impact of Switzerland's Money Laundering Laws on Capital Flows through Abnormal Pricing in International Trade," Applied Financial Economics, 15, pp. 217-230. 2005b

Dev, K. and S. Freitas. Illicit Financial Flows From China and the Role of Trade Misinvoicing. GFI (Global Financial Integrity Report) 2012.

Fisman, J. & S. J. Wei. Tax Rates and Tax Evasion: Evidence from "Missing Imports" in China. Journal of Political Economy, University of Chicago Press, vol. 112(2), pages 471-500, April 2004.

Fung, H. G, Yau. Jot, Zhang, G. Reported Trade figure discrepency, regulatory arbitrage, and round-tripping: Evidence from the China-Hong Kong trade data. Journal of International Business Studies, 2011.

Fung, H.-G., Leung, W. K., & Zhu, J. Nondeliverable forward market for Chinese RMB: A first look. China Economic Review, 15(3): 348–352. 2004.

Gengenbach C., Urbain, J.P., Westerlund, J. Panel Error Correction Testing with Global Stochastic Trends. JEL code: C12, C33. December 2008.

Gunter, R., Capital Flight from the People's Republic of China: 1984–1994, China Economic Review 7 (1996):77–96.

———, Capital Flight from China: 1984–2001, China Economic Review 15 2004:63–85.

Gu and P. D. McNelis. Yen/Dollar volatility and Chinese fear of floating : Pressures From the NDF market. Pacif-Basin Financial Journal, sep. 2012.

I. Patnaik, A. S. Gupta, A. Shah. Trade Misinvoicing: A Channel for defacto capital account openness. Sept. 2008.

Manova K. and Z. Zhang. Export prices across firms and Destinations, mimeo Stanford University. 2012.

Lan, Y. Wu, Y. Zhang, C. Capital flight from China : further evidence. Journal of International Finance and Economics, 2010.

Lau, F., Mo, Y. and Li, K. The impact of a renminbi appreciation on global imbalances and intra-regional trade. Hong-Kong Monetary authority Quaterly Bulletin, pp. 16-26. March 2004.

Ljungwall, Christer and Zijian Wang, Why Is Capital Flowing Out of China? China Economic Review 19 2008: 359–72.

Pesaran, H., Estimation and Inference in Large Heterogeneous Panels With a Multifactor Error structure. Econometrica, 74 (4), 967-1012. December 2006.

Pettis, M. China: Handling hot money like a hot potato. Global Economic Intersection, Feb. 2011.

Reserve Bank of Australia, Bulletin June Quarter 2012.

Roodman, D. How to do xtabond2: An Introduction to Difference and System GMM in Stata. Center for Global Development, Working Paper No 103, December 2006.

Sicular, T. Capital Flight and Foreign Investment: Two Tales from China and Russia, The World Economy 21 1998:589–602.

Westerlund, J. and F. Wilhelmsson. Estimating the gravity model without gravity using panel data, Applied Economics, 1-9. 2009.

Windmeijer, F., A finite sample correction for the variance of linear two-step GMM estimators," Institute for Fiscal Studies Working Papers W00/19, 2000.

World Bank, World Bank Report, Washington, DC: World Bank. 1985.

Wu, F. and L. Tang, China's Capital Flight, 1990–1999: Estimates and Implications. Review of Pacific Basin Financial Markets and Policies 3; 2000:59–75.

Xu, G., Capital flight from China : january 1999 to December 2006. China Peking University, China Center for Economic Research Working Paper, C2007005, 2007.