THE REAL EXCHANGE RATE AND TYPEs OF TRADE

Heterogeneity of Trade Behaviours in China

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1- Introduction

The underlying intuition of this study is that firms exporting products that are imported beforehand are less sensitive to relative price changes than firms exporting goods produced with national inputs. The simple idea is that if the imported inputs are paid at a price determined world-wide and resold at another price determined world-wide, then change in relative prices between the world prices and the national prices will not affect the exporter's strategy. Neither changes in nominal exchange rates will affect the exporter's strategy (if the imported goods is paid in US dollar and resold in US dollar, then movements in exchange rate between the national currency and the US dollar will not affect the export behavior). On the contrary, a firm producing a good with national inputs will benefit or suffer from such movements when it will want to sell it abroad. For instance, a depreciation of the domestic currency will reduce its production costs in US dollar. Passing this reduction through its prices, the firm will be able to sell its good on the world market at a price that will be lower than its competitors. The depreciation of the domestic currency improves automatically its price-competitiveness on external markets.

This study aims at applying this simple idea on the Chinese case. We can classify the exporting firms according two categories: ordinary trade and processing trade[2]. The import content of goods in the first category is lower than the goods of the second category. The statistical distinction is quite easy since the Chinese Customs register exports and imports according to these categories.

The empirical evidence of the central idea will be implemented in two steps. In the first one, export equations will be estimated econometrically for each type of trade with a particular emphasis on the importance of relative prices in the export determination. In a second step, a broader analysis will be provided by including similar estimations for imports and by evaluating the transmission of real exchange rate shocks in a small-scale model of the Chinese trade.

2- Chinese trade and its decomposition between 1994 and 2000

The aim of this section is to observe the behavior of the different types of trade relative to the variation of price-competitiveness and world demand.

Charts 1, 2 and 3 display the Chinese trade variables over the period 1994-2000. Chart 1 shows total exports and imports and the share of foreign firms. The role of foreign funded enterprises have been growing over the period. Currently, they realize almost half of the exports.

Chart 1a: Total exports (USD mds)

[2] « Processing Trade » refers to two specific customs regime :
« 1- Processing and Assembling refers to the type of inward processing in which foreign suppliers provide raw materials, parts or components under a contractual arrangement for the subsequent re-exportation of the processed products. Under this type of transaction, the imported inputs and the finished outputs remain property of the foreign supplier.
2- Processing with Imported Materials refers to the type of inward processing other than processing and assembling in which raw materials or components are imported for the manufacture of the export-oriented products. », *China's Custom Statistics*.

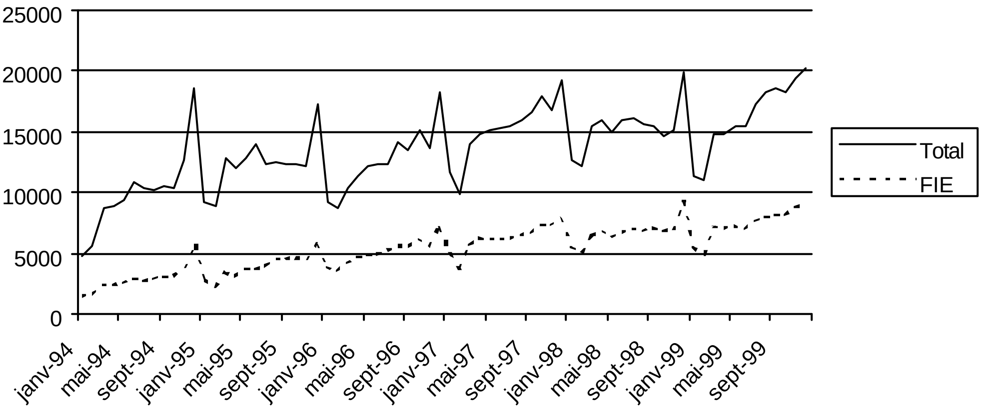
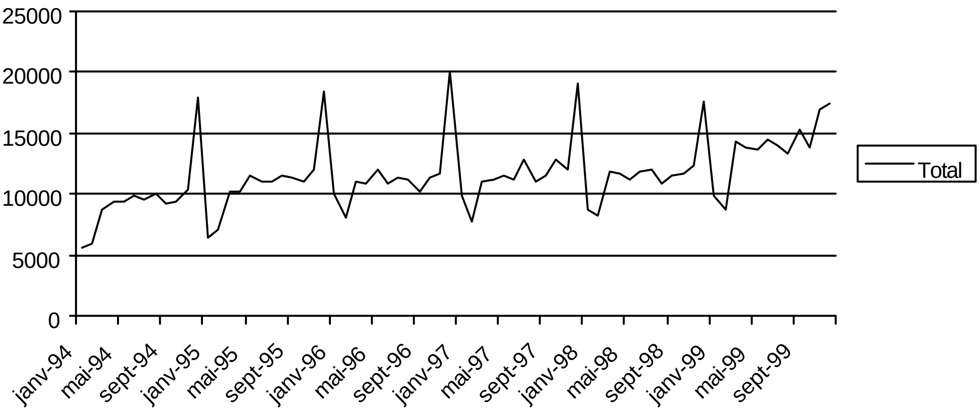


Chart 1b: Total imports (USD mds)



Note: FIE: Foreign-invested enterprises
Source: Chinese Customs Statistics

Chart 2 shows the growing role of processing trade, especially since 1998. Between 1995 and 1996, the shares of ordinary trade and processing trade were approximately equivalent. Since the beginning of the Asian crisis, processing trade is larger than ordinary trade meaning that the financial crisis would have given an advantage to the first type of trade to the detriment of the second one.

Chart 2a: Exports by Customs Regime (USD mds)

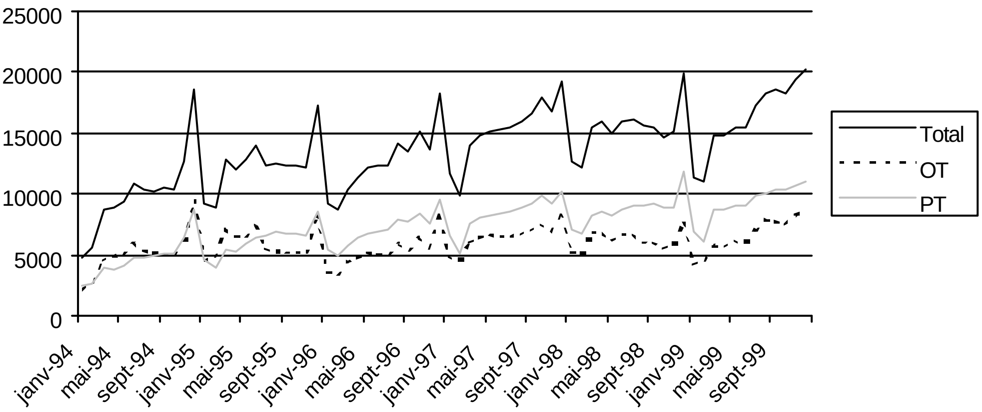
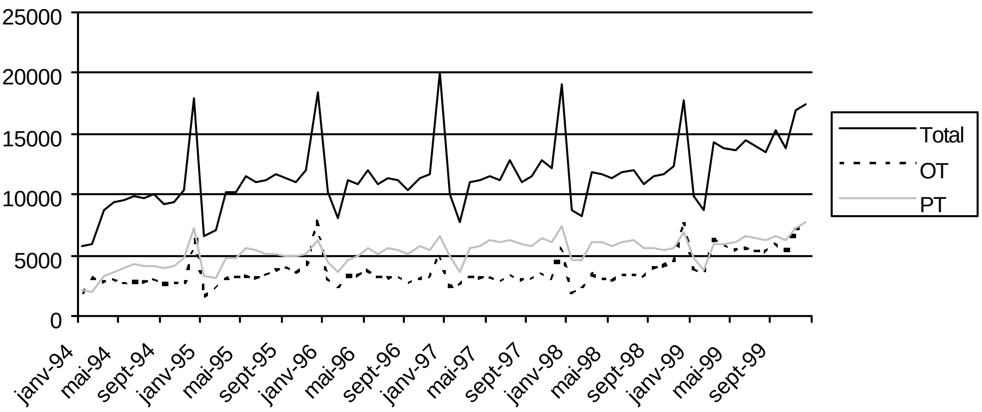


Chart 2b: Imports by Customs Regime (USD mds)

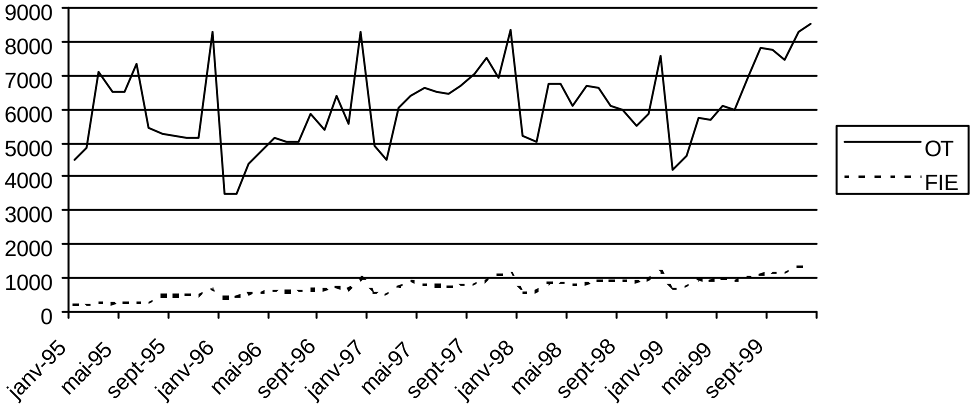


Note: OT: Ordinary Trade
PT: Processing and Assembling + Processing with imported materials
Source: Chinese Customs Statistics

Charts 3 and 4 propose a decomposition of the two main types of exports into domestic and foreign firms. If domestic firms are specialized in ordinary trade, exports of processing goods are mainly realized by foreign firms.

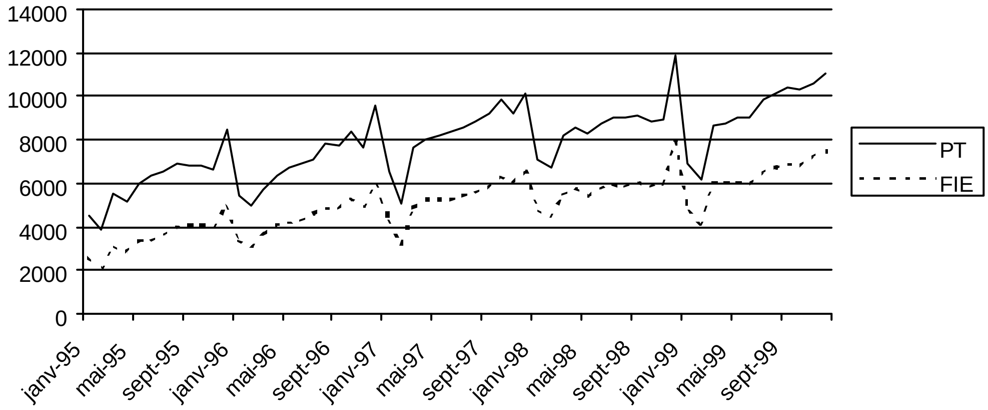
Before implementing the empirical evidence, it is worth defining the indicators of price-competitiveness (i.e. relative prices) and foreign demand of Chinese goods.

Chart 3: Exports – ordinary trade (USD mds)



Source: Chinese Customs Statistics

Chart 4: Exports – Processing trade (USD mds)



Note: FIE: Exportations réalisées par les entreprises à capitaux étrangers
Source: Chinese Customs Statistics

Chart 5 displays an indicator of price-competitiveness, defined as an real effective exchange rate based on consumption prices (it would have been better to build up an indicator based on export prices, but such series are not available in China). This effective exchange rate takes into account bilateral exchange rates and the prices of 15 countries (the US, Canada, France, Germany, Italy, the Netherlands, Japan, Indonesia, the UK, Korea, Hong Kong, Singapore, Taiwan, Malaysia and Thailand). The weight of each country depends on the share of China in their total imports.

The chart indicates a continued appreciation of the Chinese real exchange rate over the period 1994-january 1998. Because of the Chinese price deflation and the nominal appreciation of the Asian currencies, the Chinese price-competitiveness has regularly improved since then.

Chart 5: Real effective exchange rate of China

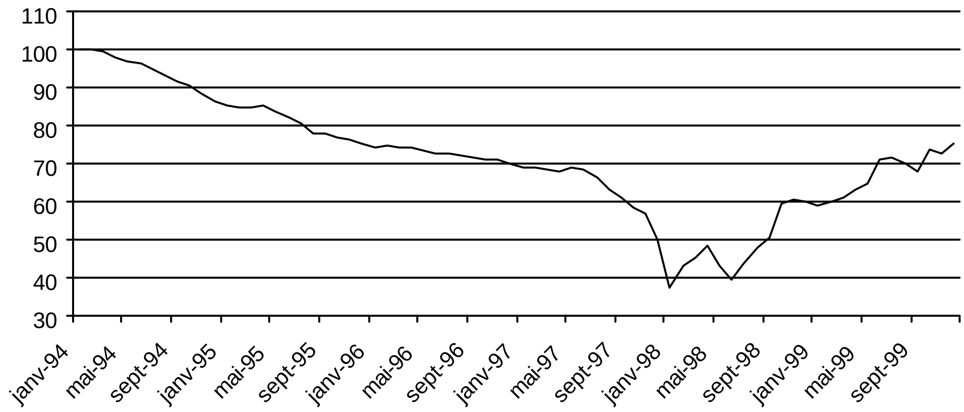
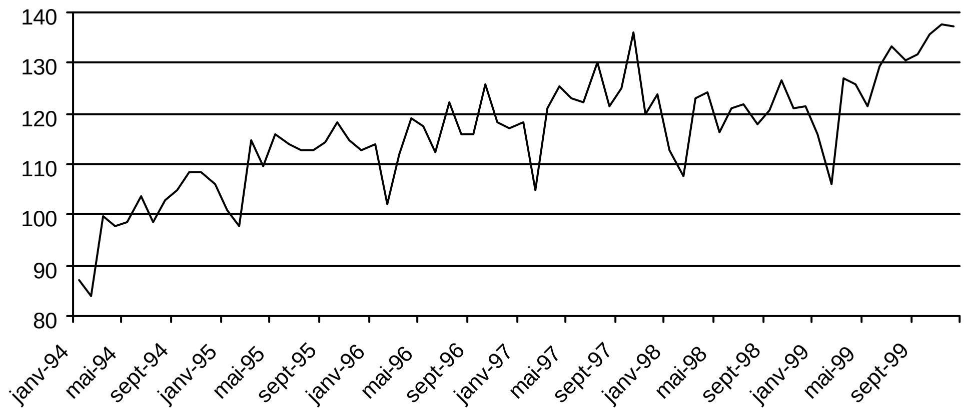


Chart 6 represents the foreign demand of Chinese goods. It is calculated as the weighted sum of imports of the Chinese partners. The weights depend on the share of China in their total imports. Beyond a strong seasonal feature, this chart shows a significant decrease in the Chinese foreign demand during the Asian crisis until the recovery of the Asian countries from the mid-1999.

Chart 6: Foreign demand for Chinese goods



Charts 7 and 8 investigate the effects of the export and import developments in terms of trade balance by type of trade. On the ordinary trade side, one can see that during the Asian crisis, this type of trade suffered from the real exchange rate appreciation. Ordinary imports increased and ordinary exports decreased. The ordinary trade balance deteriorated and became negative during the first quarter of 1999. On the processing trade side, the impact of the Asian crisis seems to have been limited implying no significant effect on the trade account. The trade balance stayed largely positive and even growing over the period 97-99. This can be explained by the fact that exports grew more rapidly than imports over the period. This trade surplus helped China to keep a balanced trade account at the global level.

Chart 7: Ordinary trade (growth and balance)

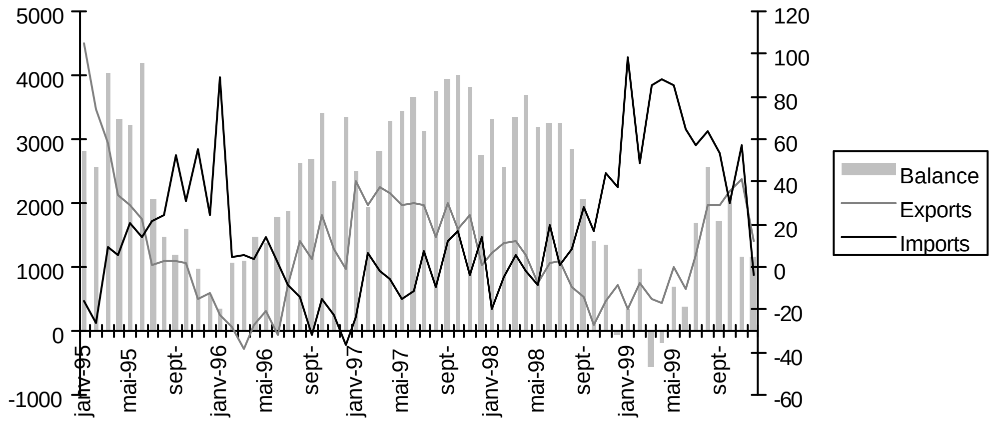
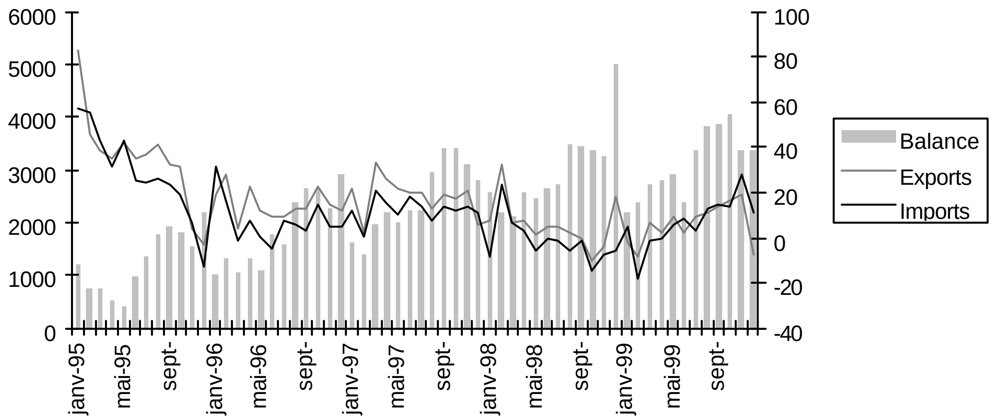


Chart 8: Processing trade (growth and balance)



3- Real exchange rate sensitiveness of the different types of exporting firms

a) How to measure the sensitiveness of exports to real exchange rate?

To estimate the sensitiveness of exports to real exchange rate, let us assume that export supply depends on foreign demand and price-competitiveness, measured by a real exchange rate. We have the following equation:

(1) $X = g_0 Y_W^{g_1} R^{g_2}$

where X is the export volumes, Y_W the foreign demand and R the real exchange rate.
g_1 is the demand elasticity and g_2, the price elasticity.

The real exchange rate is defined as:

(2) $R = \dfrac{P_D}{eP_W}$

where P_D is the domestic price, e the nominal exchange rate and P_W the price of the China's competitors.

As already noticed no relevant data for the Chinese export volumes are available. To estimate the equation (1) we need to deflate the export values by a price. We have chosen to use the domestic price as it is the reference for the Chinese prices to assess the competitiveness of China in the real exchange rate. Hence, the estimates of g_2 can be interpreted as the real exchange rate sensitiveness of exports once deflated by the Chinese domestic price index.

b) Application to the Chinese case

Before estimating export equations, it is necessary to look at the propriety of the series in terms of stationarity. Table 1 presents the ADF statistics for the unit-root tests. These tests reject the null hypothesis of stationarity of the series of exports, real exchange rate and foreign demand. These series being integrated of order 1, long-term relationships can be determined for these different variables. Table 2 presents these cointegrating relationships.

These relationships are based on equation (1). This equation is estimated with a constant, a world demand term and the real exchange rate. This estimation is realized for the three types of trade data (total, ordinary and processing). To account for the strong seasonal movements, we introduce also dummy variables for January and December.

Table 1: Unit roots tests (ADF)

Variable	Specification	Lags	Statistic
Exports $Log(X)$	Level 1st difference	4 10	-1.76 -9.08**
Exports $Log(X_{OT})$	Level 1st difference	4 10	-1.26 -5.65**
Exports $Log(X_{PT})$	Level 1st difference	4 10	-2.85 -13.18**
Foreign demand $Log(Y_W)$	Level 1st difference	2 10	-2.87 -6.33**
Real exchange rate $Log(R)$	Level 1st difference	2 2	-0.77 -5.18**

Note: Critical value at 5% : -3.40 (source : MacKinnon, 1991).
** The unit root hypothesis is rejected at the 5% level.

The first comments from these estimations confirm the main intuition. At the global level, real exchange rate movements have a positive influence on the Chinese exports (elasticity equal to 0.29). This influence is more important if we restraint the estimation to the ordinary trade (elasticity equal to 0.48). On the other hand, exports with a strong content of imports are less sensitive to exchange rate movements (elasticity equal to 0.15). The impact of world demand is significant whatever the type of export. With an elasticity equal to 1.8 for total exports, we can notice that China gain market share at the worldwide level. Concerning the ordinary trade, this elasticity is lower and closer to unity (1.32). For this type of trade, the export behavior is more conform to the usual estimation results for developing countries. On the other side, for processing trade, the elasticity is larger than 2. An increase by 1 % in world demand leads to an increase in this type of exports by 2.23%.

Table 2: Estimation of long-term export equations

Total exports (X) $Log(X) = 3.89 + 1.80 Log(Y_W) + 0.29 Log(R)$ t0 = 4.81 ; t1 = 13.12 ; t2 = 5.08 $R^2 = 0.85$ $s^2 = 0.09$ cointegration test (ADF on the equation error term) : -3.54** (lag 3)
Ordinary exports (XOT) $Log(X_{OT}) = 4.58 + 1.32 Log(Y_W) + 0.48 Log(R)$ t0 =3.56 ; t1 = 6.04 ; t2 = 5.19 $R^2 = 0.64$ $s^2 = 0.15$ cointegration test (ADF on the equation error term): -3.14* (lag 10)
Processing exports (XPT) $Log(X_{PT}) = 1.82 + 2.23 Log(Y_W) + 0.15 Log(R)$ t0 = 2.70 ; t1 = 19.50 ; t2 = 3.07 $R^2 = 0.91$ $s^2 = 0.08$ cointegration test (ADF on the equation error term): -4.10** (lag 8)

A second type of estimation has been realized (see Table 3). By taking into account the dynamic aspects of the export behavior, we can analyze the short-term components of the analysis. To do it, error correction models have been estimated in one step à la Banerjee et al (1993). From the general to the particular, a specification that includes only the significant variables has been defined. The short-term dynamics relative to the real exchange rate being non-significant have been removed. Only the change in world demand has an impact on the short-term dynamics. These estimations give the coefficient of the error correction term. It is always strongly significant confirming the validity of the ECM specification. Its value is large (0.52 for total exports, 0.4 for ordinary trade and 0.68 for processing trade). These results are similar to those found by Girardin (1998).

The export equations have been re-estimated not by type but by stacking the export data for ordinary and processing trade (Table 4). This estimation makes possible to test whether the difference across types of trade is significant or not (Table 5). The dummy variables have been constrained to be equal across Customs regime. The tests have been realized by the likelihood ratio (see Greene, 2000).

Table 3: Estimations of error correction models

Total exports $\Delta Log(X) = 2.23 + 1.33\Delta Log(Y_W)$ $- 0.53(Log(X)_{-1} - 1.70 Log(Y_W)_{-1} - 0.33 Log(R)_{-1})$ t0 = 3.22 ; t1 = 8.50 ; t2 = -6.13 ; t3 = -7.36; t4 = -3.74 $R^2 = 0.89$ $s^2 = 0.07$
Ordinary exports $\Delta Log(X_{OT}) = 2.88 + 1.01\Delta Log(Y_W)$ $- 0.40(Log(X_{OT})_{-1} - 0.80 Log(Y_W)_{-1} - 0.47 Log(R)_{-1})$ t0 = 3.03 ; t1 = 4.75 ; t2 = -5.39 ; t3 = -1.82; t4 = -2.90 $R^2 = 0.84$ $s^2 = 0.10$
Processing exports $\Delta Log(X_{PT}) = 0.63 + 1.64\Delta Log(Y_W)$ $- 0.68(Log(X_{PT})_{-1} - 2.37 Log(Y_W)_{-1} - 0.21 Log(R)_{-1})$ t0 = 1.03 ; t1 = 11.06 ; t2 = -6.63 ; t3 = -15.29 ; t4 = -3.43 $R^2 = 0.89$ $s^2 = 0.06$

We can accept models whose parameters are constrained to be equal across the types of exported goods. The best model retains demand elasticities and price elasticities that are specific to the Customs regime (unconstraint model). In that case, we find with stacked equations the previous results (stronger demand elasticity for processing trade and lower price elasticity). These tests confirm the following result: the firms that export processing goods are more sensitive to world demand than ordinary firms but are less sensitive to relative price movements.

Table 4: Stacked equations

Models Coefficients	E(Yw) constraint E(R) constraint		E(Yw) constraint		E(R) constraint		Unconstraint model	
	coefficient	*T Student*	coefficient	*T Student*	coefficient	*T Student*	Coefficient	*T Student*
Constant_OT	2,81	*2,99*	-0,10	*-0,16*	3,88	*4,44*	2,71	*2,80*
Constant_PT	0,96	*2,31*	1,07	*1,79*	0,42	*0,70*	0,69	*1,15*
E(ΔYw)_OT	1,01	*4,86*	1,39	*6,36*	1,07	*4,97*	1,16	*5,40*
E(ΔYw)_PT	1,22	*8,08*	1,44	*10,24*	1,48	*10,37*	1,50	*10,77*
E(Yw)_OT	0,59	*1,19*	2,10	*8,59*	0,64	*1,81*	1,09	*3,20*
E(Yw)_PT	0,59	*1,19*	2,10	*8,59*	2,33	*9,09*	2,28	*10,45*
E(R)_OT	0,41	*2,20*	0,75	*5,12*	0,24	*2,48*	0,52	*3,94*
E(R)_PT	0,41	***2,20***	0,15	***1,58***	0,24	***2,48***	0,19	***2,22***
ECT_OT	-0,34	***-6,08***	-0,42	***-6,52***	-0,44	***-7,05***	-0,49	***-7,65***
ECT_PT	-0,11	***-2,81***	-0,43	***-5,45***	-0,41	***-5,44***	-0,47	***-6,11***

Notes : E(X) means the elasticity of exports to the variable X.

Table 5: Restriction Tests

H0	Ha	Statistic	Result
E(Yw) constraint	Unconstrained model	13.11595 (Chi2(1))	H0 rejected
E(R) constraint	Unconstrained model	6.573000 (Chi2(1))	H0 rejected
E(Yw) constraint E(R) constraint	Unconstrained model	20.90522 (Chi2(2))	H0 rejected

c) Exports, production process and nationality of the export firm

The previous results conclude that the firm exporting goods with a strong content in imports are less sensitive to relative-price movements than firms exporting ordinary goods. The foreign funded firms are a majority in the processing trade and a minority in the ordinary trade. Is the production process that determines the sensitiveness of export to exchange rate or the nationality of the firms' capital? The previous conclusion may be misleading. Hence, we must verify whether the results do not hide a dichotomy: national firms vs. foreign firms rather than a dichotomy: ordinary trade vs. processing trade.

Appendix 1 presents the different estimations and tests similar to those presented previously but by nationality of the owners of the export firms.

The estimations of long-term equations and error correction models suggest that the elasticties' values (demand and relative price) are different according to the nationality of the firm. The price-elasticities are high and significant for the Chinese firms (even it they export processed goods) whereas for the foreign firms, these elasticities are either non-significant (total exports or processing trade) or with the wrong sign (ordinary trade). By dividing the data into Chinese firms and foreign firms, the tests on parameter constraints according to production process confirm this result. Table 6A shows that once the date classified by nationality, we cannot distinguish the behaviors according to the Customs regime. Besides, the parameters' values show that the elasticities are different according to the nationality. For a Chinese firm, the demand elasticity is close to unity (1.11) and the price elasticity is high and significant (0.43). For the foreign firms, the demand elasticity is higher (2.78) and the price elasticity is not significant. These results as a whole would tend to invalidate the previous conclusions: the nationality of the exporting firm is more important than the production process to determine the exporter's behavior.

However, this conclusion may be too hasty, especially if we look at Charts 3 and 4 again. These charts indicate that the Chinese firms are more specialized on ordinary goods whereas the foreign firms produce mainly processed goods. The previous results could reflect only a problem of trade structure. To untangle this complicated problem, we propose a last test: we divide again the data by Customs regime (total, ordinary, processing), and, for each type of export, we test the difference of the parameters according to the nationality. Table 10A presents the results of retained models by restriction tests. For total trade, the demand and price elasticities are different according to the nationality of the exporting firm, confirming then the previous results. However, for both the ordinary and the processing trade, the nationality of the firm is not important to explain the firms' behavior. We find also the main result of this study: the price elasticity is larger for ordinary trade (0.49 vs. 0.32) whereas the demand elasticity is larger for the processing trade (2.17 vs. 1.58).

4- *Estimation of import equations by Customs regime and closure of a small-scale trade model for China*

a) Estimation of import equations

The previous estimations have been realized for import equations. The goal is to derive for all the estimations a small-scale econometric model for the Chinese trade in order to simulate the impact of a real exchange rate shock on the trade variables.

The import equations have been estimated as error correction models. The long-term equation relates the volume of imports to a domestic demand term (approximated by the industrial production in China, available on a monthly basis) and a relative price indicator (the real effective exchange rate). Let us note that the import price, even if it is not available, has been properly calculated as a weighted average of the export prices of the Chinese trade partners.

Table 6 presents the estimates. Usually, the demand effect is positive and its elasticity is around one. The price elasticity (the competitiveness effect) is negative: an improvement in competitiveness reduces the country's imports. Concerning the estimation of the total import equation, the demand elasticity has the right sign and is close to one (1.04). However, the price elasticity is not significant; the Chinese imports would not be influenced by the change in relative prices. The goods imported by China being weakly substitutable by Chinese goods, the Chinese consumers are likely to buy them whatever the movements of their price relative to the domestic prices.

When distinguishing the imports by Customs regime (ordinary trade vs. processing trade), the picture is different. The reasoning is the same for ordinary imports: they depend only on demand and not on relative prices. Besides, let us note that the demand effect is less than one (0.87) meaning that the increase in the purchase of foreign goods is less than proportional to domestic growth. That may also reflect some trade policy measures that restrain the imports of foreign goods. Concerning imported goods devoted to be re-exported, the relative price effect is negative and significant. The importers of goods that will be processed are very sensitive to the real exchange rate movements.

The effect is the opposite of the one found for exports. How to explain this puzzle? The explanation may be the following. For firms producing and exporting processed goods, they have to define the menu of their inputs. The previous result claims that it is the menu that is sensitive to the real exchange rate movements and not the imported materials. Some materials are imported from abroad. As they export these materials once transformed, a change in relative prices should not affect their behavior. However, among the inputs, some factors can be either imported or bought directly in China. This part of the menu is likely to be very sensitive to the relative prices. If the world prices increase relative to the Chinese prices, the exporting firms of processed goods are likely to increase their purchase of Chinese inputs. On the other side, if the imported inputs are more competitive, their share in the input menu should increase.

Table 6: Estimations of error correction models for imports

Total imports (M)
$\Delta Log(M) = 0.44 + 0.98 \Delta Log(Y/E)$
$-0.69(Log(M)_{-1} - 1.04 Log(Y/E)_{-1} - 0.03 Log(R)_{-1})$
t0 = 0.95 ; t1 = 9.34 ; t2 = -6.98 ; t3 = -12.74; t4 = -0.46
$R^2 = 0.91$ $s^2 = 0.08$
Ordinary imports (M_{OT})
$\Delta Log(M_{OT}) = 0.14 + 0.59 \Delta Log(Y/E)$
$-0.37(Log(M_{OT})_{-1} - 0.87 Log(Y/E)_{-1} + 0.05 Log(R)_{-1})$
t0 = 0.13 ; t1 = 2.79 ; t2 = -3.15 ; t3 = -2.01; t4 = 0.15
$R^2 = 0.81$ $s^2 = 0.16$
Imports for processing trade (M_{PT})
$\Delta Log(M_{PT}) = 0.24 + 0.97 \Delta Log(Y/E)$
$-0.64(Log(M_{PT})_{-1} - 1.09 Log(Y/E)_{-1} + 0.17 Log(R)_{-1})$
t0 = 0.54 ; t1 = 9.87 ; t2 = -6.11 ; t3 = -10.16 ; t4 = 2.04
$R^2 = 0.85$ $s^2 = 0.08$

b) A small-scale model for Chinese external trade

The estimations of export and import equations make possible the building-up of a small-scale model for external trade in China. As we want only to investigate the effect of real exchange rate movements, we also assume that nominal exchange rate is exogenous. A shock on real exchange rate can only be due to a movement in relative prices. The interest of modeling trade from the previous estimate is to investigate the propagation of a shock on real exchange rate on the different categories of the Chinese trade.

The model can be summarized by the following system:

$$
\begin{cases}
X_{OT} = Y_W^{bot} R^{dot} \\
X_{PT} = Y_W^{bpt} R^{dpt} \\
M_{OT} = (Y/e)^{lot} R^{hot} \\
M_{PT} = (Y/e)^{lpt} R^{hpt} \\
R = \dfrac{P_D}{eP_W} \\
TB = P_X(X_{OT} + X_{PT}) - P_M(M_{OT} + M_{PT}) \\
P_X = (P_D/e)^{0.28} P_W^{\ 0.72}
\end{cases}
$$

The trade equations in volume have been written in their error correction form. The estimates displayed in Tables 4 and 6 have been used to parameterize the model elasticities. In addition to the estimated equation, we have also added an equation for export prices (a geometric average of domestic prices and world prices) calibrated from Dees (2001).

c) Simulation of a real exchange rate shock

The simulation concerns a real exchange rate shock leading to a deterioration in the Chinese competitiveness by 1%. This is one of the conclusion of McKibbin and Tang (2000) who predicts a real appreciation of the RMB for the 10 years following the trade liberalization implied by the WTO entry (reduction in Chinese tariff rates from the present level to zero in 2010). Let us note that the nominal exchange rate between the Chinese RMB and the USD is assumed to remain constant and that the real appreciation is only driven by an increase in the Chinese domestic price index.

As the Chinese competitiveness deteriorates, exports decrease and imports increase relative to the baseline simulation (see Chart 9). As ordinary exports are more sensitive to relative prices, they are the most affected by the shock (their volumes decrease by almost 0.5%), whereas the exports of processed goods are more immune to the shock (- 0.2%). On the import side, the effect of the shock is quite limited. The imports of goods for processing trade increase by 0.2% relative to the baseline simulation whereas the increase in ordinary imports is hardly significant (only 0.05%).

In the short-run, due to the increase in the export prices, a short-lived positive effect (only the first month) implies some increase in the trade balance (see Chart 10). However, the long run effect on the trade balance is a loss of net exports equal to 0.1 percentage point of GDP. Our results are lower than the McKibbin and Tang’s (the effect of the trade liberalization implying a real appreciation of 1% has a maximum impact on trade balance equal to -0.3 percentage point of GDP). However, their model is a general equilibrium model with a broader scope (including the effect on GDP and its different components and on real interest rate). The purpose of the present paper is different. We want just to distinguish the effects on trade variables according to their Customs regime. The simulation of the trade model is useful just to quantify what we learnt previously during the estimations and what are the effects when the different equations are stacked as a model. Hence, according to this “*ceteris paribus*” warning, the effect on trade balance is quite substantial. It is mainly due to the impact on the ordinary exports.

This simulation illustrates also part of the Asian crisis story. The devaluation of the Asian competitors led to a real appreciation of the Chinese relative prices (by 17% over September 1997 to September 1998). Over the period the ordinary exports in constant USD (deflated by world prices) fell by 6.2% whereas the processing exports increased by 9%. On the import side, the increase in ordinary imports was equal to 37% whereas processing imports increased by 6%. The real appreciation was clearly beneficial to processing exports, which seemed to be immune to the appreciation. Our model seems then to be relevant to explain movements in exports. Concerning imports, the Asian crisis impact was detrimental to imports of goods devoted to processing industries and beneficial to the ordinary imports. Our model seems to give the opposite result, i.e. processing imports would be more stimulated by the real appreciation than ordinary imports. However, our simulation is only part of the story. We simulate the shock *ceteris paribus*. During the Asian crisis, the demand terms, proved to be significant in our estimations, changed a lot (decrease in world demand and deceleration in domestic activity). Besides, the econometric estimations have shown the importance of dynamic effects in the transmission of shocks. An exogenous shock would influence totally the endogenous variables only after a period ranging from 6 months to one year. The model suggests that the effects of the Asian crisis on the Chinese trade variables have been rather long lasting.

Chart 9: Export and Import responses to a 1% appreciation of the Chinese real exchange rate (percentage deviation from baseline)

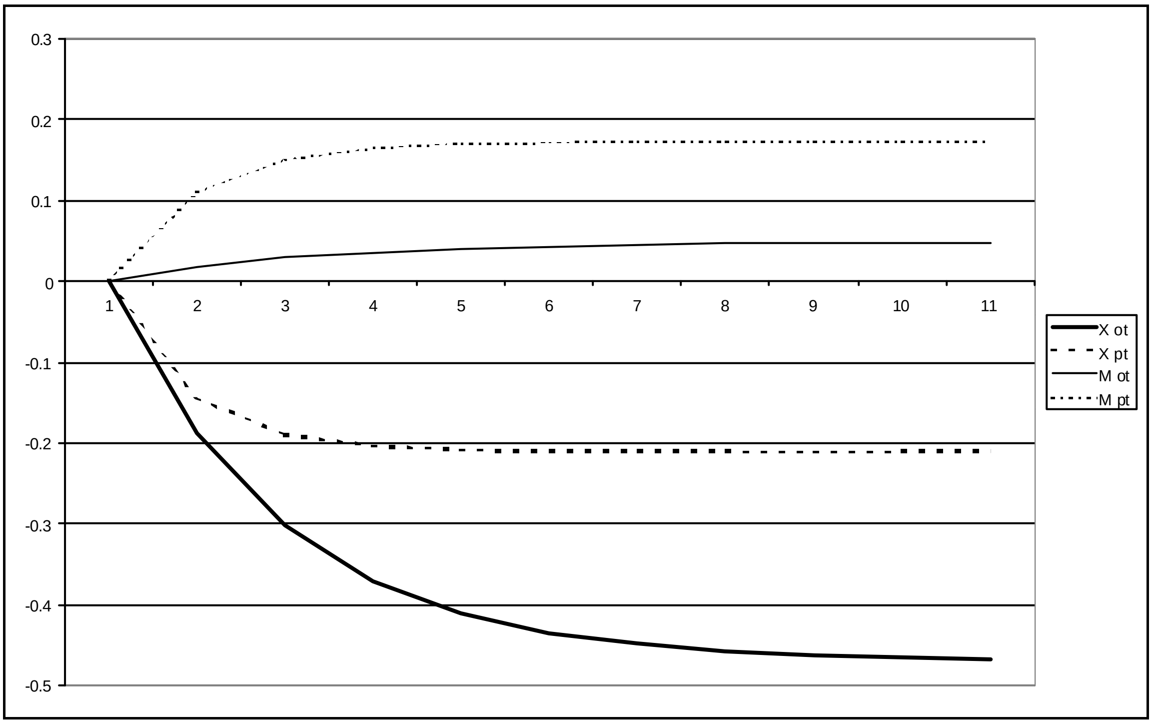
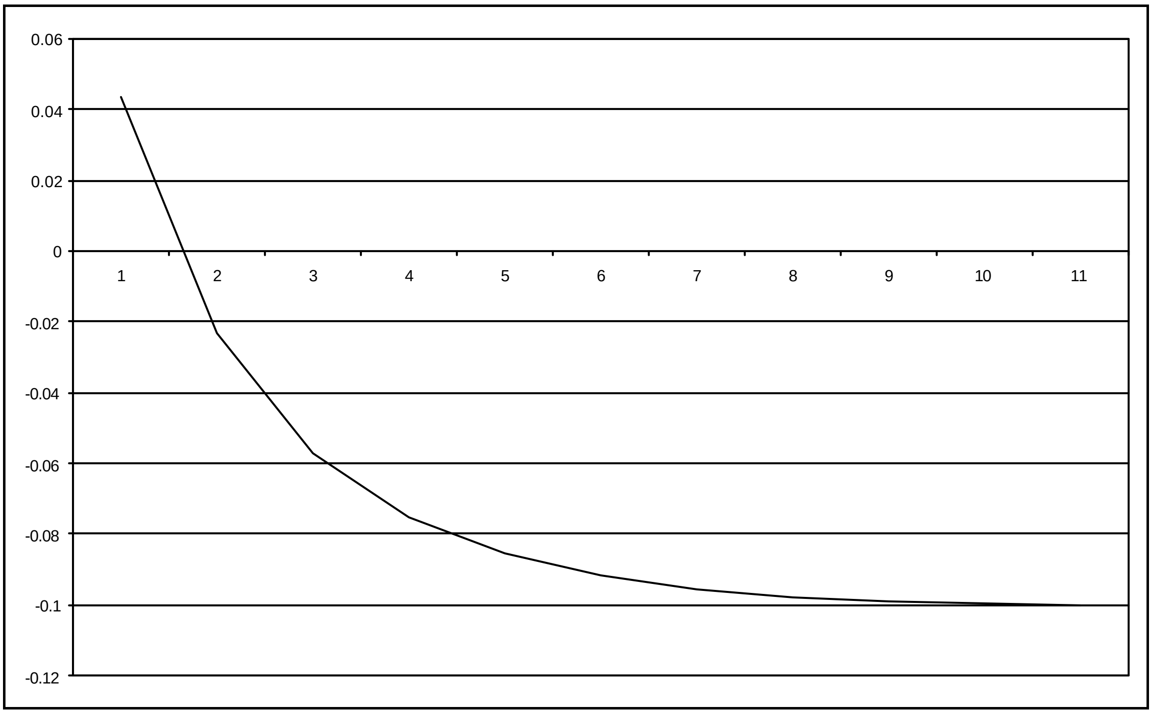


Chart 10: Trade balance response to a 1% appreciation of the Chinese real exchange rate (absolute difference as a percentage of GDP)



5- Concluding remarks

The main conclusion of this paper is that an incomplete investigation of the Chinese trade development can be misleading due to the heterogeneity of the Chinese trade behaviors. The results of the present study claim to look carefully at the different types of trade and to investigate separately their behaviors. The paper also gives some elements to understand why the Asian crisis did not affect apparently the Chinese trade balance. Finally, according to predictions concerning the change in the Chinese competitiveness resulting form the entry in the WTO, a simulation of a small-scale model gives some ideas of the consequences in terms of trade imbalances and in terms of trade regime distribution. The main beneficiary of trade liberalization might be the processing trade. The processing firms should benefit from cheaper imports of foreign goods and relatively cheap labor costs in China. This type of trade should remain competitive at a worldwide level. Concerning the ordinary trade, the predicted real appreciation is likely to be detrimental. China is likely to have some difficulties to compete on this kind of markets.

APPENDIX 1: Exports, production process and nationality of the exporting firm

Table 1A Unit root tests (ADF) for exports of foreign firms

Variable	Specification	Lags	Statistic
Exports by national firms			
Exports $Log(X^D)$	Level 1st difference	2 10	-2.22 -6.78**
Exports $Log(X^D_{OT})$	Level 1st difference	10 10	-1.20 -10.17**
Exports $Log(X^D_{PT})$	Level 1st difference	2 10	-2.22 -6.78**
Exports by foreign firms			
Exports $Log(X^F)$	Level 1st difference	10 10	-1.50 -9.96**
Exports $Log(X^F_{OT})$	Level 1st difference	3 10	-3.09 -5.50**
Exports $Log(X^F_{PT})$	Level 1st difference	10 10	-1.20 -10.17**

Note : Critical value at 5% : -3.40 (source : MacKinnon, 1991).
** The null hypothesis is rjected at the 5% level.

Table 2A: Estimation of long-term relationships

National exporting firms
Total exports (X) $Log\left(X^{D}\right) = 5.29 + 1.31Log(Y_W) + 0.38Log(R)$ t0 = 3.90 ; t1 = 4.90 ; t2 = 3.63 $R^2 = 0.62$ $s^2 = 0.14$ cointegration test (ADF on equation error) : -3.85** (lag 2)
Ordinary exports (XOT) $Log\left(X^{D}_{OT}\right) = 5.29 + 1.18Log(Y_W) + 0.42Log(R)$ t0 =3.17 ; t1 = 3.58 ; t2 = 3.31 $R^2 = 0.52$ $s^2 = 0.17$ cointegration test (ADF on equation error): -3.36* (lag 10)
Processing exports (XPT) $Log\left(X^{D}_{PT}\right) = 3.10 + 1.58Log(Y_W) + 0.33Log(R)$ t0 = 2.94 ; t1 = 7.61 ; t2 = 4.10 $R^2 = 0.74$ $s^2 = 0.11$ cointegration test (ADF on equation error): -3.27** (lag 2)
Foreign exporting firms
Total exports (X) $Log\left(X^{F}\right) = -0.33 + 2.77Log(Y_W) - 0.02Log(R)$ t0 = -0.35 ; t1 = 15.16 ; t2 = -0.27 $R^2 = 0.91$ $s^2 = 0.09$ cointegration test (ADF on equation error): -3.34* (lag 5)
Ordinary exports (XOT) $Log\left(X^{F}_{OT}\right) = -6.22 + 3.85Log(Y_W) - 0.35Log(R)$ t0 =-2.90 ; t1 = 9.02 ; t2 = -2.09 $R^2 = 0.79$ $s^2 = 0.22$ cointegration test (ADF on equation error): -3.27* (lag 4)
Processing exports (XPT) $Log\left(X^{F}_{PT}\right) = 0.09 + 2.60Log(Y_W) + 0.03Log(R)$ t0 = 0.11 ; t1 = 15.96 ; t2 = 0.45 $R^2 = 0.92$ $s^2 = 0.08$ cointegration test (ADF on equation error): -3.79** (lag 5)

Table 3A: Estimations of error correction models

National exporting firms
Total exports $\Delta Log\left(X^{D}\right) = 2.46 + 0.96\Delta Log(Y_W)$ $-0.34\left(Log\left(X^{D}\right)_{-1} - 0.89 Log(Y_W)_{-1} - 0.42 Log(R)_{-1}\right)$ t0 = 2.49 ; t1 = 4.73 ; t2 = -4.41 ; t3 = -1.55; t4 = -2.05 $R^2 = 0.87$ $s^2 = 0.08$
Ordinary exports $\Delta Log\left(X^{D}_{OT}\right) = 2.76 + 0.92\Delta Log(Y_W)$ $-0.34\left(Log\left(X^{D}_{OT}\right)_{-1} - 0.56 Log(Y_W)_{-1} - 0.47 Log(R)_{-1}\right)$ t0 = 2.27 ; t1 = 3.64 ; t2 = -4.33 ; t3 = -0.78; t4 = -1.86 $R^2 = 0.84$ $s^2 = 0.11$
Processing exports $\Delta Log\left(X^{D}_{PT}\right) = 1.18 + 1.07\Delta Log(Y_W)$ $-0.40\left(Log\left(X^{D}_{PT}\right)_{-1} - 1.61 Log(Y_W)_{-1} - 0.35 Log(R)_{-1}\right)$ t0 = 1.39 ; t1 = 5.78 ; t2 = -4.37 ; t3 = -3.66 ; t4 = -2.22 $R^2 = 0.85$ $s^2 = 0.07$
Foreign exporting firms
Total exports $\Delta Log\left(X^{F}\right) = -1.44 + 1.94\Delta Log(Y_W)$ $-0.60\left(Log\left(X^{F}\right)_{-1} - 3.21 Log(Y_W)_{-1} + 0.03 Log(R)_{-1}\right)$ t0 = -1.77 ; t1 = 9.98 ; t2 = -5.15 ; t3 = -12.29; t4 = 0.36 $R^2 = 0.88$ $s^2 = 0.07$
Ordinary exports $\Delta Log\left(X^{F}_{OT}\right) = -0.04 + 0.97\Delta Log(Y_W)$ $-0.19\left(Log\left(X^{F}_{OT}\right)_{-1} - 2.54 Log(Y_W)_{-1} + 0.22 Log(R)_{-1}\right)$ t0 = -0.02 ; t1 = 2.68 ; t2 = -1.95 ; t3 = -1.29; t4 = 0.38 $R^2 = 0.71$ $s^2 = 0.12$
Processing exports $\Delta Log\left(X^{F}_{PT}\right) = -0.92 + 1.89\Delta Log(Y_W)$ $-0.64\left(Log\left(X^{F}_{PT}\right)_{-1} - 2.89 Log(Y_W)_{-1} + 0.07 Log(R)_{-1}\right)$ t0 = -1.18 ; t1 = 10.44 ; t2 = -5.38 ; t3 = -12.11 ; t4 = 0.78 $R^2 = 0.86$ $s^2 = 0.07$

Table 4A: Restriction Tests – National Firms

H0	Ha	Statistic	Result
E(Yw) constrained	Unconstrained model	0.999545 (Chi2(1))	Ha rejected
E(R) constrained	Unconstrained model	0.250963 (Chi2(1))	Ha rejected
Unconstrained model	E(Yw) constrained	0.286478 (Chi2(1))	Ha rejected
Unconstrained model	E(R) constrained	1.035058 (Chi2(1))	Ha rejected

Table 5A: Restriction Tests – Foreign Firms

H0	Ha	Statistic	Result
E(Yw) constrained	Unconstrained model	2.941882 (Chi2(1))	Ha rejected
E(R) constrained	Unconstrained model	1.202973 (Chi2(1))	Ha rejected
Unconstrained model	E(Yw) constrained	0.655509 (Chi2(1))	Ha rejected
Unconstrained model	E(R) constrained	2.394419 (Chi2(1))	Ha rejected

Table 6A: Stacked Equations by firms' nationality *

Models Coefficients	National firms		Foreign firms	
	coefficient	*T Student*	Coefficient	*T Student*
Constant_OT	2.27	*2.16*	-0.97	*-2.16*
Constant_PT	1.41	*1.91*	-0.54	*-0.80*
E(ΔYw)_OT	1.06	*4.40*	1.29	*4.45*
E(ΔYw)_PT	0.95	*5.74*	1.79	*11.18*
E(Yw)_OT	1.11	*2.08*	2.78	*10.87*
E(Yw)_PT	1.11	*2.08*	2.78	*10.87*
E(R)_OT	0.43	*2.26*	0.10	*1.03*
E(R)_PT	0.43	***2.26***	0.10	***1.03***
ECT_OT	-0.40	***-5.88***	-0.34	***-5.70***
ECT_PT	-0.28	***-4.13***	-0.54	***-5.93***

Note : E(X) means the elasticity of exports to the variable X.
* are displayed the results of models accepted by the restriction tests (Tables 4a and 5a)

Table 7A: Restriction Tests – Total trade

H0	Ha	Statistic	Result
E(Yw) constrained	Unconstrained model	5.395370 (Chi2(1))	H0 rejected
E(R) constrained	Unconstrained model	5.980448 (Chi2(1))	H0 rejected
E(Yw) constrained E(R) constrained	Unconstrained model	7.873666 (Chi2(2))	H0 rejected

Table 8A: Restriction Tests – Ordinary trade

H0	Ha	Statistic	Result
E(Yw) constrained	Unconstrained model	0.280578 (Chi2(1))	Ha rejected
E(R) constrained	Unconstrained model	0.620539 (Chi2(1))	Ha rejected
Unconstrained model	E(Yw) constrained	0.394919 (Chi2(1))	Ha rejected
Unconstrained model	E(R) constrained	0.054958 (Chi2(1))	Ha rejected

Table 9A: Restriction Tests – Processing trade

H0	Ha	Statistic	Result
E(Yw) constrained	Unconstrained model	1.005391 (Chi2(1))	Ha rejected
E(R) constrained	Unconstrained model	0.473037 (Chi2(1))	Ha rejected
Unconstrained model	E(Yw) constrained	0.079579 (Chi2(1))	Ha rejected
Unconstrained model	E(R) constrained	0.611933 (Chi2(1))	Ha rejected

Table 10A: Stacked equations by Customs regime

Models Coefficients	Total trade 95 :1-99 :12		Ordinary trade 95 :4-99 :11		Processing trade 95 :11-99 :11	
	coefficient	*T Student*	Coefficient	*T Student*	Coefficient	*T Student*
Constant_D	2.13	*2.25*	1.03	*0.90*	0.19	*0.22*
Constant_F	-0.44	*-0.54*	0.24	*0.44*	0.32	*0.65*
E(ΔYw)_D	1.09	*5.62*	0.89	*3.85*	1.17	*6.82*
E(ΔYw)_F	1.61	*9.00*	0.87	*3.36*	1.42	*9.81*
E(Yw)_D	1.25	*2.68*	1.58	*2.13*	2.17	*5.99*
E(Yw)_F	3.11	*5.85*	1.58	*2.13*	2.17	*5.99*
E(R)_D	0.38	*2.31*	0.49	*2.01*	0.32	*2.67*
E(R)_F	-0.13	***-0.67***	0.49	**2.01**	0.32	**2.67**
ECT_D	-0.38	***-6.04***	-0.32	***-4.87***	-0.50	***-7.16***
ECT_F	-0.29	***-3.93***	-0.15	***-3.57***	-0.29	***-4.99***

Note : E(X) means the elasticity of exports to the variable X.

* are displayed the results of models accepted by the restriction tests (Tables 7a, 8a and 9a)

References

Chou, W.L. (2000), 'Exchange Rate Variability and China's Exports', *Journal of Comparative Economics*, 28, p61-79.

Dées, S. and Lemoine, F. (1999), « Dévaluation du Yuan : une petite impatience peut ruiner un grand projet », *La lettre du CEPII*, n°178.

Girardin, E. (1998), 'La politique de change de la Chine', *Economie Internationale*, N°76, p95-116.

Greene, W.H. (2000), *Econometric Analysis*, 4th edition, Prentice Hall

Lemoine, F. (2000), « The role of foreign direct investment in China's foreign trade expansion », *mimeo*.

MacKinnon, J.G. (1991), « Critical values for co-integration tests », in R.F. Engle and C.W.J. Granger (eds.), *Long-Run Economic Relationships*, Oxford University Press, p267-281.

McKibbin, W.J. and Tang, K.K. (2000), « Trade and Financial Reform in China: Impacts on the World Economy », *The World Economy*, Vol ; 23, No 8, p979-1003.