“Unraveling the Paradoxes of China’s Trade Imbalances Following the Global Financial Crises”

by

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I. INTRODUCTION

A central policy divide between China and much of the rest of the industrialized world has been whether an undervalued exchange rate for the Renminbi (RMB) should be substantially appreciated in order to offset existing international trade imbalances. The latter reached a staggering 10% of China's GDP in 2008, even though they declined subsequently. With corresponding rapid accumulation of international currency reserves, particularly in dollars, low rates of economic growth and high unemployment outside of China, there has been considerable pressure put on China to appreciate the RMB, with associated resistance by the Chinese authorities. Indeed, a radical adjustment of existing RMB exchange rates appears to be viewed in a number of Western countries as not just a compensatory measure, but almost a panacea, for responding to certain economic woes elsewhere, where the latter have been considerably exacerbated by the subprime and Eurozone financial crises. Nonetheless, a fundamental issue on which such debates are predicated is the extent to which trade imbalances with China may actually be responsive, over given time horizons, to exchange rate adjustments involving the RMB.

Recent research has investigated a number of questions which are pertinent to assessing a central research concern of this paper. This regards how to validly characterize the likely impact of alternative scenarios for RMB appreciation for "rectifying" trade imbalances with China. Notably, recent approaches have sought to control for the central role of China in not only Asian, but also overall international production networks. In this respect, a crucial distinction arises between, on the one hand, Chinese exports and production entailing imported components, or transformed production - mostly from elsewhere in Asia – and, on the other hand, exports based on value added which is generated within China's internal economy. China now constitutes the second most important host country in terms of FDI stocks, and Chinese multinational enterprises account for by far the lion's share of such transformed production and exports. Estimates by Ma and Assche (2010) suggest that MNEs account for fully 80 percent of such activities. This issue has been central to a number of other recent contributions, considering the trade sensitivity of Chinese exports and imports to exchange rate changes. These include papers by Dees (2001), Aziz and Li (2007), Cheung, Chinn and Fujii (2009), Marquez and Shindler (2007), Thorbecke and Smith (2010), as well as Garcia-Herrero and Koivu (2009). Among earlier studies focusing on this question can be noted the work of Cerra and Dayal-Gulati (1999) which estimated aggregate export and import price elasticities, over the period 1983 to 1997, to be highly inelastic with respective values of -.3 and .7. Simulations by Benassy-Quéré and Lahreche-Révil (2003) of the trade effects of a depreciation of the RMB found that whereas exports between China and OECD countries increase, there was an associated reduction of imports coming from emerging economies in Asia, under the assumption that exchange rates within Asia remained constant. Further simulations by Kamada and Takagawa (2005), in this case for the effects of a 10% appreciation of the RMB, suggested only a limited impact on China's exports, while imports were weakly stimulated. Yue and Hua (2002), along with Eckauss (2004), based on periods prior to China's entry into the World Trade Organization, broadly confirmed the results of the foregoing studies; namely, that an appreciation of the RMB can produce a fall in Chinese exports, while Voon and al (2006), using sectoral data covering the period 1978 through 1998, also found similar negative effects.

Early on, Aziz and Li (2007) had cautioned against assessments of China's trade elasticities based "on models whose estimated coefficients largely reflect the China of the 1980s and 1990s are likely to turn out to be wrong, perhaps even dramatically". Indeed their rolling and recursive estimates showed evidence of a break at the turn of the Millenium. While studies relying on more recent data corroborate the foregoing findings regarding the likely impact of a RMB appreciation on Chinese exports, with a sharp rise in elasticities associated with WTO entry, research, including that of Garcia-Herrero and Koivu (2009), as well as Marquez and Shindler (2007), identified a somewhat surprising result, that such an appreciation can actually produce a negative effect also on imports. Recent work, including, notably, by Cheung et al. (2012) confirms the presence of paradoxical effects of movements of the real exchange rate of the Renminbi (REER) on China's aggregate trade flows, especially imports, and endeavours to clarify those effects with a systematic study disaggregating trade flow and aggregate demand. However, they do not manage to explain away the "wrong" sign in the response of (especially manufactured) imports to an RMB real appreciation. In addition, the only way in which they allow for WTO effects is through a step dummy. They also attempt to account for the impact of nominal exchange rate regime changes, but unsuccessfully.

The interest of observers, policy makers, and thus academics is to determine whether, whatever the differentiated responses of disaggregated components of exports and imports to REER movements, in the aggregate China's exports and imports respond in the expected way to their standard determinants. In addition, it is mandatory to disentangle those REER effects in order to determine to what extent the possible "perverse effects" on imports originate in relative price changes, or in nominal effective exchange rate movements. In the latter regard, to the extent that capital controls in China and the non-convertibility of the RMB have undoubtedly introduced important distortions in the Chinese currency's nominal rate, which estimates and simulations of the effects of a nominal exchange rate appreciation need to take explicitly into account. Furthermore, given the structural changes characterizing the Chinese economy and its trade relationships, it is important to assess explicitly whether WTO entry has entailed a regime change, as well as the extent to which there may be associated differential effects on exports, as compared with imports.

The novel perspective offered by the present research is three-fold: in terms of time-span, focus on data processing and measurement, and detection of regime-changes to scrutinize the impact of a real revaluation of the RMB on China's international trade imbalances. Furthermore, the effects of real RMB changes are decomposed in terms of relative price and nominal exchange rage components. Firstly, the longest available data, spanning three decades is used, for exports and imports at aggregate levels, based on quarterly series. Secondly, the issue of the detection of the nature of seasonality of the trade data is addressed, which is, of particular significance, in the case of Chinese data. Indeed, it is surprising that previous work simply assumed that such seasonality has been invariant in China in spite of the well-know structural transformations. The use of time-varying seasonality detection methods offers a means for filter away this potential source of bias in the estimation of trade equations. Another source of bias may come from the activity variable used. Indeed, it is well documented that China's official GDP suffers from very serious measurement biases (Maddison and Wu, 2008). In response, an alternative measure of China's GDP is proposed, which presents the added advantage of being available since the early 1980s, while official data only starts much later in that decade. Thirdly, Markov-switching models, in line with the work of Hamilton (1989, 1994) are tested separately to examine how the determinants of export and import flows are subject to eventual regime changes, which can reemergence over time.

The outline of the rest of this paper is as follows. Section 2 offers an overview of certain salient features characterizing China's international trade, its determinants and related aspects of China's international financial environment over the last three decades. The discussion in this also elaborates further a series of conceptual issues relating to more specific aspects of the overall research problematic. Secton 3 then introduces the empirical methodology appropriate for regime-switching analysis, while in Section 4 the actual econometric estimations are reported and interpreted. A concluding section summarizes the principal contributions of this research, while identifying avenues for further investigation.

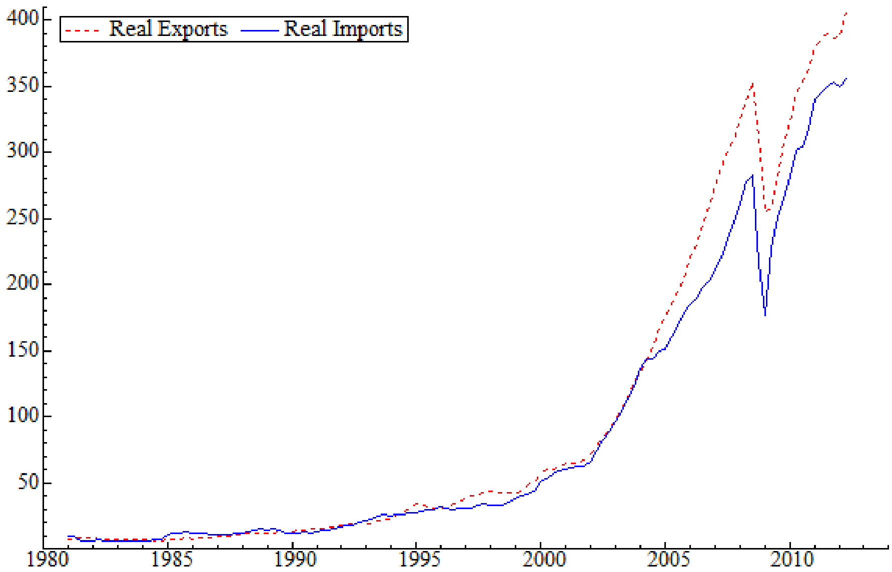
2. Research Problematic, Conceptual Framework and Salient Empirical Observations

As discussed in the introduction, a central research problematic examined here is the extent to which existing studies, aimed at estimating trade-exchange rate and absorption elasticities for China, are based on satisfactory methodological grounds. At issue is whether previous empirical work has validly provided an identification of uniform and stable elasticity estimates, which are applicable over relatively long periods of time; thereby, constituting valid ground for guiding policy debates, including, notably, those concerned with the implications of eventual Renminbi appreciation. More specifically, an initial novel econometric approach is proposed, which relies on a Markov-switching framework, to test to what extent there are identifiable structural changes in different components of Chinese trade regimes. The reported findings, based on quarterly data series, spanning 1982 to 2012, highlight major breaks in the determinants of trade, with regime-specific elasticity estimates, along with the characterization of the length and timing of regimes, differing for export and import flows.

Such temporal specificity in trade and other elasticity estimates are argued to be inextricably linked to profound changes in the internal functioning and international role of the Chinese economy, which are in many respects unique. As illustrated in Figure 2.1, increased trade openness started in the mid-80s and, then, continuously accelerating for both exports and imports from the early 1990s through to the period of the financial crises in roughly 2008. Identified structural breaks in trade elasticity values arguably reflect combinations of underlying economic factors. These are associated with the historical change from an initial state of semi-autarchy in the 1980s to China's current role as one of the pivotal economies in world trade, which includes a preeminent role as the world's second host country in terms of stocks of foreign direct investment. The latter phenomenon has entailed subtle implications for China's trade relations, since it comprises portions of both market servicing and export-driven FDI, which have shifted over time, as China has assumed an increasingly central place in Asian production networks. Related arguments suggesting the distinctive nature of the determinants of China's trade performance include continuous, but not necessarily uniform, catch-up effects to an eventual longer-term steady state, as China has established export niches in a variety of product market across a range of industrialized and other countries, characterized by evolving product quality and technological sophistication. The punctuating effect of China's WTO accession has permitted a much more precipitous catch-up period, as the Chinese economy assumes an increasingly prominent international economic presence.

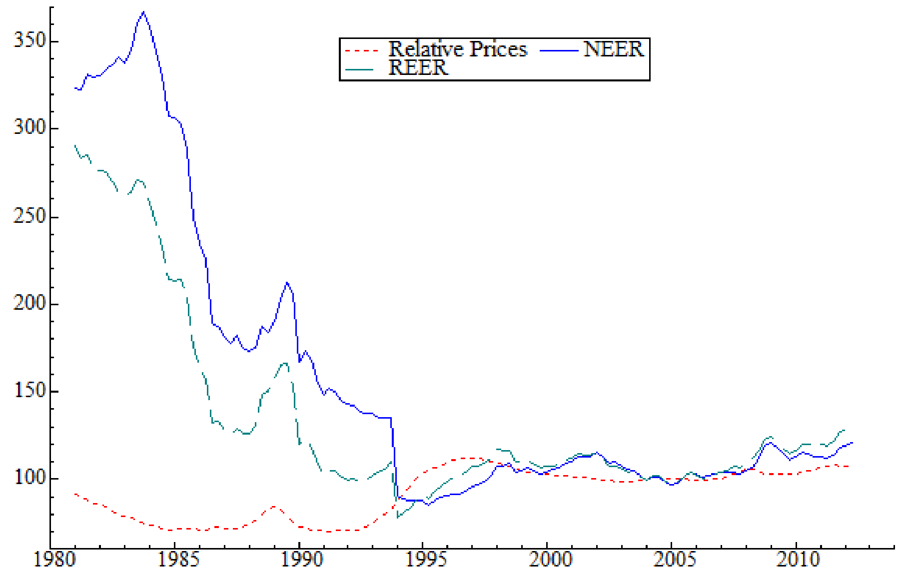
***********************SUBJECT TO REVISION AND EXTENSION**********

Figure 2.1: Real Chinese (seasonally adjusted) Exports and Imports, 1981(I)-2012(II)



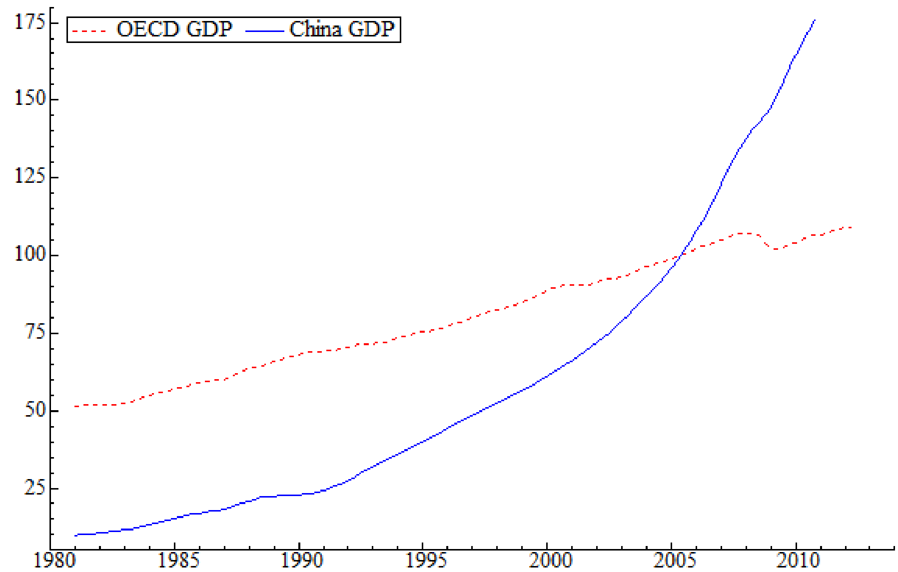
Source: Computed form the IMF's *International Financial Statistics*. Real Chinese exports and imports (in Billion dollars, 2005 constant prices, using as deflator HK export and import unit values and seasonally adjusted, as explained in the appendix).

Figure 2.2. China's Nominal Effective Exchange Rate and Relative Prices: Long and Short-run Perspectives.



A rise in any of these series corresponds to an effective appreciation of the Chinese currency, as well as a rise in Chinese prices with respect to foreign prices. *Source:* Computed form IMF's *International Financial Statistics*.

Figure 2.3: The Relative Evolution of GDP Indices for China and the OECD



Source: OECD Main Economic Indicators and Jia (2011).

3. Methodology and data

Markov-Switching Approach

Prior work in other fields of research relating to China have shown that a regime-switching methodology is well suited to analyzing changes in economic conditions in China. In this respect, the current research builds on parallel analysis which has investigated growth cycles (Girardin (2005)), stock market bull and bear phases (Girardin and Liu (2003) for), as well as -foreign exchange markets (Girardin, 2011) involving the RMB. However, to our knowledge, a Markov switching approach has not been applied to the modelling of determinants of China's trade performance. The strength of the Markov-switching approach is that it detects the rise of regimes which may have been present in the past, even temporarily (Hamilton 1989). The specification of the regime-dependent export equation, which is employed in this instance for three regimes (s=1,.., 3), is a single-step error-correction model as follows:

$$\Delta logX_t = c(s_t) + a_{01}(s_t)\, \Delta logX_{t-1} + a_{02}(s_t)\, \Delta logX_{t-2} + a_{03}(s_t)\, \Delta logX_{t-3} + a_1(s_t)\, \Delta logY^*_{t-1} + a_2(s_t)\, \Delta logNEER^*_{t-1} + a_3(s_t)\, \Delta log(p\text{-}p^*)_{t-1}$$

$$+ a_5(s_t)\, \Delta logM_{t-1} + \alpha(s_t)\, logX_{t-1} + \lambda_1(s_t)\, logY^*_{t-1} + \lambda_2(s_t)\, logNEER^*_{t-1} + \lambda_3(s_t)\, log(p\text{-}p^*)_{t-1}$$

$$+ \lambda_5(s_t)\, logM_{t-1}\, \sigma(s_t)\, \varphi_t \qquad (1)$$

Here, Xt represents China's aggregate real exports in period t, M China's real imports, Y* foreign real GDP (in this case OECD GDP not including that pertaining to Developing Asia), NEER is the Chinese effective nominal exchange rate, defined such that an increased value corresponds to an appreciation of the Renhimbi, while the effective relative price of China vis a vis its trading partners, corresponds to (p-p*), where specific details of the data construction are provided below. In equation (1), the αs are the short-run error correction coefficients, while the βs (=-λ/α) constitute the long run coefficients,. As the level variables are in logarithm, the βs can be interpreted as elasticities. China's imports are included in the export equation in order to account for the supply-side role that, in large part, the former play as essential components, raw materials, or energy used in processed exports.

In the case of the regime-dependent import equation, the specification used is:

$$\Delta logM_t = c(s_t) + a_{01}(s_t)\, \Delta logM_{t-1} + a_{02}(s_t)\, \Delta logM_{t-2} + a_{03}(s_t)\, \Delta logM_{t-3} + a_1(s_t)\, \Delta logA_{t-1}$$

$$+ a_2(s_t)\, \Delta logNEER^*_{t-1} + a_3(s_t)\, \Delta log(p\text{-}p^*)_{t-1} + a_5(s_t)\, \Delta logX_{t-1} + \alpha(s_t)\, logM_{t-1} + \lambda_1(s_t)\, logA_{t-1} + \lambda_2(s_t)\, logNEER^*_{t-1} + \lambda_3(s_t)\, log(p\text{-}p^*)_{t-1}$$

$$+ \lambda_5(s_t)\, logX_{t-1} + \sigma(s_t)\, \mu_t \qquad (2)$$

A_t represents China's domestic absorption (real GDP - real Exports + real Imports). Analogously, China's exports are included in the import equation in order to account for the fact that processed exports generate imports, which are largely used as components, raw materials, or energy.

In a regime-switching model some, or all, parameters depend on an underlying unobservable stochastic variable, s_t, which aims at representing the phases of the variable's regimes (Hamilton; 1989, 1994). The use of this approach enables the assignment of probabilities relating to the likely occurrence of the different regimes. In its most popular version, used here, it is assumed that the process s_t is a first-order Markov process (Hamilton 1989), while higher-order processes are much less frequently used. It is assumed that the regime-generating process is a Markov chain with a finite number of states, governed by constant transition. All coefficients of equations (1) and (2), including the intercept and the variance, are assumed to be regime-dependent. Standard information criteria are used to check the null hypothesis, whether linearity is rejected, and to determine the number of regimes.

An expected maximization algorithm for maximum likelihood estimation is used to obtain estimates of the parameters in such a Markov-switching model (Hamilton 1994). For a given parametric specification of the model, probabilities are assigned to the regimes, conditional on the available information set which constitutes an optimal inference on the latent state of the economy. Hence, it is possible to determine the constant probability of staying in a given regime, when starting from that regime, as well as the probability of shifting to another regime. The classification of regimes and the dating of periods imply that every observation in the sample is assigned to one of the regimes. An observation is assigned to a specific regime when the smoothed probability of being in that regime is higher than 0.5. The smoothed probability is computed by using all observations in the sample.

Banerjee, Dolado and Mestre (1998) suggest working under the null hypothesis of non-cointegration, and testing the significance of the error-correction coefficient. They show that the t-ratio form of the ECM test (on α) may have better power properties, relative to other cointegration tests. They provide critical values based upon the limit distribution of the test. Furthermore, a t-test for significance of γ is a test for the validity of the unit-restriction on the long-run parameter in the cointegrating relationship. An equivalent test consists in examining the joint significance of the level terms based on α and the βs. Kanioura and Turner (2005) show that such a test has higher power than the Engle-Granger residual based test, but lower power than the t-form of the error correction test. Accordingly, the latter test is employed here, using equations (1) and (2). While Pesaran et al. (2001) propose an appealing bounds-testing approach, such methodology is not adapted to the Markov-switching setting.

The long-run relationship may be changing over time rather than being necessarily invariant over the full period of estimation. In other words, the γ coefficients may differ between regimes, but also error correction (α) may operate during some periods and be inactivated in some others, i.e. cointegration may operate in some situations and be "switched off" in others, so that the adjustment towards an underlying long-run equilibrium does not operate any more.[1] Also it is possible that a new long-run equilibrium may then operate as an attractor, and an alternative associated error correction mechanism may be activated. Such an approach has the advantage that it does not require any prior information on the time at which the shift to the new equilibrium occurred. Instead, the data itself will determine the timing of such regime changes.

[1] This is similar in spirit to Markov error correction models developed by Psaradakis et al. 2001.

Unit-root tests, following Philipps-Perron (1988), as well as stationarity tests, in line with Kiatkowski, Phillips, Schmidt and Shin (1992), will be implemented but not reported, since the subsequently reported results imply that all of the variables used are non-stationary in levels, but stationary in first differences.

Data

The quarterly data series for China's exports and import values, covering over three decades from 1981(I) to 2012(II), have been deflated by Hong Kong's export and import unit values, while nominal and effective exchange rates are from the International Monetary Fund's *International Financial Statistics*. The rate of change in relative prices is computed from the difference between the rates of change of REER and NEER, while a relative price index is constructed with - the first quarter of 2004 serving as the base period of reference. The real GDP figures for the OECD come from the Organization for Economic cooperation and Developments *Main Economic Indicators* database. China's quarterly real GDP (published by China's National Bureau of Statistics) starts only in 1987(I). Major drawback of this series are the measurement bias from which it suffers, as suggested by Maddison and Wu (2008), as well as the extreme volatility which characterizes these data, even after allowing for proper seasonal adjustment. Accordingly, for all three reasons, the alternative quarterly real GDP series constructed by Jia (2011) are relied on in the present research.

A major problem faced when using both quarterly data on China's trade flows and Chinese GDP data stems from the seasonality of the series. Typically, standard statistical packages are used to adjust for constant seasonality. However, if seasonality is time-varying, then existing work on China's trade elasticities is at best unreliable, and at worst wholly uninformative, as a result of potentially serious biases. Standard packages like Census X12 do try to account for moving seasonality, but in an imperfect way. Accordingly as reported in the Appendix, stochastic seasonality has been taken fully into account for each of these series, so that the subsequently conducted econometric estimates relate to adjusted data. Time-varying seasonality is indeed present for China's trade flows, while it is largely absent from the GDP statistics of advanced countries. This remark implies that any attempt to relate the two unadjusted series is flawed. In addition the need to adjust for stochastic seasonality is even more pressing when estimating regime-switching models, since when run on improperly adjusted data, such models may simply detect changes in seasonality regimes instead of in the relationships between the time series of interest.

*********SUBJECT TO FURTHER REVISION AND EXTENSION*****************

4. Determinants of China's Trade Flows

Regime-switching Estimates

The export and import equations are estimated over the same periods, starting in early 1982 and finishing in the second quarter of 2012. The estimation of the export equation shows the existence of three regimes over those three decades, while their probabilities of occurrence are represented in Figure 4.1. The first regime was dominant before China's entry into WTO in December 2011, and after the recent global crisis, while regime 3 is characteristic of the post-WTO period, even though it already emerged for around two years just before the East Asian crisis. Regime 2 arose only during four brief spells, which are mostly associated with major crises, potentially impacting international trade, including the Tien An Men incidents, the East Asian Crisis, and the European Debt Crisis.

All regimes show evidence of error correction as shown by the estimated coefficient for X(-1) However, such correction is small during the second regime, as is typical of crises, but the post-WTO error correction is not much larger. The similar long-run relative-price elasticities, are three times larger (in absolute value) for the crisis than the pre-WTO regime, and again three times larger than the former in the post-WTO regime. Generally speaking, movements in the nominal effective exchange rate do not appear to impact China's exports, with the exception of crisis periods, where a one to one effect appears at work. . The long-run effect of OECD GDP, while insignificant in the post-WTO regime, is almost three times larger in the crisis than in the pre-WTO regime. Developing Asia's GDP does matter both in pre and post-WTO regimes, with a coefficient which falls by half over time. Finally, China's imports matter in a similar way in the long run during the post WTO and crisis regimes. In the short run, neither relative price nor nominal exchange rates matter for either the pre, or post, WTO regimes. OECD GDP has a huge impact with the exception of the post-WTO regime, while developing Asia GDP does matter during the pre-WTO crisis periods.

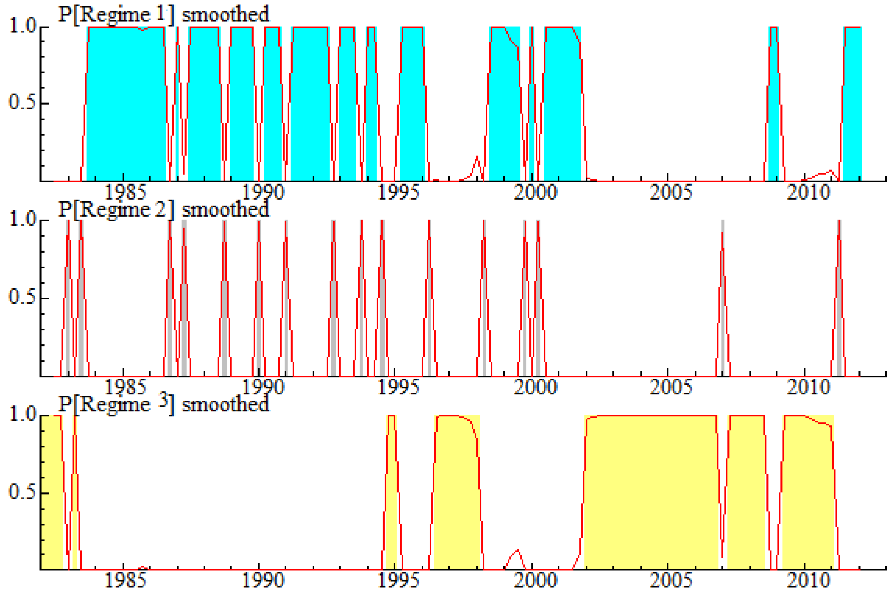
Table 4.1 : Regime-switching Estimates of the Determinants of China's Aggregate Exports

1982(III)-20121(I)	Regime 1		Regime 2		Regime 3	
	Short run	Long run	Short run	Long run	Short run	Long run
Intercept	0.54 (9.68)***		-0.17 (7.44)***		2.99 (9.58)***	
ΔX(-1)	-0.12 (0.88)		0.10 (7.53)***		0.13 (1.90)**	
ΔX(-2)	0.06 (0.51)		-0.05 (9.56)***		-0.04 (0.73)***	
ΔX(-3)	0.36 (2.54)***		0.02 (7.53)***		-0.14 (3.12)***	
Δ (p-p*)(-1)	-0.12 (0.32)		-0.18 (6.98)***		0.09 (0.51)	
ΔNEER(-1)	0.05 (0.62)		0.01 (5.28)**		0.20 (1.72)	
ΔOECD GDP(-1)	5.31		2.98		-0.39	

	(3.98)***		(6.60)***		(0.59)	
∆DEV ASIA GDP(-1)	1.87 (2.44)***		0.63 (5.89)***		-0.28 (0.99)	
∆China's Imports(-1)	2.16 (0.47)		6.81 (7.68)***		8.05 (2.44)***	
X(-1)	-0.39 (5.53)°°°		-0.08 (15.7)°°°		-0.12 (3.98)°°°	
(p-p*)(-1)	-0.18 (2.87)***	-0.46	-0.10 (9.45)***	-1.25	-0.43 (9.56)***	-3.58
NEER(-1)	0.05 (1.32)	-	-0.04 (5.67)***	-0.50	-0.12 (9.57)***	-1.00
OECD GDP(-1)	0.47 (5.51)***	1.20	0.24 (9.29)***	2.98	-0.02 (0.29)	-
DEV ASIA GDP (-1)	0.68 (3.91)***	1.74	-0.03 (6.98)***	-0.37	0.11 (3.59)***	0.91
China's Imports(-1)	0.02 (0.47)	-	0.07 (5.75)***	0.87	0.08 (2.44)***	0.67
σ	3.64 (10.6)***		0.003 (5.08)***		1.19 (9.24)***	
Log Likelihood	AIC		Arch(1)		Normality	
-228.6	4.73		2.11 [0.15]		0.11 [0.94]	

This table reports Markov-switching estimates of equation (1). T-statistics are provide in brackets, while significance levels at the 10% (*), 5% (**) and 1% (***) levels are highlighted. p* is the effective foreign price, and NEER is the number of foreign currency units per RMB. P-values are in square brackets. °°° indicates significance of the error-correction term at the 1% level on the basis of critical values computed by Banerjee, Dolado and Mestre (1998).

Figure 4.1 : Probability of Regimes Explaining China's Aggregate Exports



The estimation of the baseline import equation (3) shows the existence of four, and not three, regimes over the period from early 1982 through 2012(II)), but the third regime is only composed of outliers and, as such, will be neither discussed, nor represented in Figure 4.2. Yet,he timing of these regimes entails striking similarities with those of the export regimes which have just been analyzed. Indeed, regime 1 characterizes the pre-WTO period, while regime 4 represents the post-WTO one. Morever, the pre-WTO regime remerges after the recent crises, as was the case for exports. Furthermore, even more so than for exports, regime 2 represents all major crisis episodes..

Significant error correction, as represented by the coefficient estimate for M-1, is present in all regimes, but especially large in the post-WTO one. . For the pre and post-WTO regimes, the similarity of the qualitative and quantitative long-run trade effects of prices and overall economic activity is remarkable. Indeed, the import elasticities for China's absorption and for processing, linked to exports are both extremely stable. A surprising finding is that pre-WTO China's imports rise by 50% more when absorption rises, in relation to an equal proportional rise in exports. However, the two elasticities converge in the post-WTO regime. In contrast to such stability of activity elasticities, sharp changes characterize the long-run price elasticities. Indeed, while the (negative) relative price elasticity shoots up in absolute value between the pre and post WTO regimes, the nominal exchange rate elasticity vanishes between those two periods. In the short run, the effects of relative price rises and nominal exchnage rate appreciation are mostly opposite to their long-run effects. Indeed, a relative price rise leads to a large short-run rise in imports in both the pre-WTO and most recent regimes, while a nominal appreciation leads in the short run to a fall in imports only in the post-WTO regime.

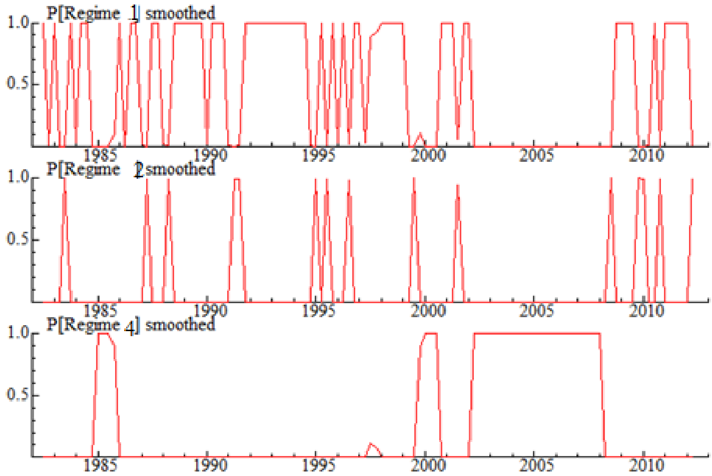
Table 4.2 : Regime-switching Estimates for China's Aggregate Imports

1982(III)-2012(II)	Regime 1		Regime 2		Regime 3		Regime 3	
	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run	Short-run	Long-run
Intercept	-0.30 (0.82)		0.12 (25.0)***		0.23 (11.1)***		7.59 (3.91)***	
ΔM(-1)	0.25 (1.75)		-0.004 (5.95)		-0.08 (20.2)***		-1.22 (4.46)***	
ΔM(-2)	-0.43 (4.59)		-0.02 (37.0)***		0.008 (3.00)***		-0.22 (2.45)***	
ΔM(-3)	0.25 (2.75)***		0.09 (25.3)***		0.14 (18.2)***		-0.16 (1.65)	
Δ (p-p*)(-1)	1.75 (4.67)***		0.71 (9.02)***		0.06 (10.7)***		2.75 (3.94)***	
ΔNEER(-1)	0.04 (0.50)		-0.25 (26.2)***		-0.46 (9.06)***		-0.48 (2.66)***	
ΔChina's Absorption (-1)	0.61 (3.22)***		0.18 (9.02)***		0.45 (19.2)***		-0.17 (1.68)	
ΔChina's exports(-1)	0.25 (1.75)		-0.004 (5.95)***		-0.083 (20.2)***		-1.22 (4.46)***	

M(-1)	-0.65 (8.24)°°°		-0.21 (8.95)°°°		-0.17 (9.10)°°°		-0.87 (7.78)°°°	
(p-p*)(-1)	-0.16 (3.03)***	-0.24	-0.12 (8.28)***	-0.57	-0.08 (21.0)***	-0.47	-1.69 (5.25)***	-1.94
NEER(-1)	0.10 (3.01)***	0.15	0.03 (12.5)***	0.14	0.002 (2.02)**	0.01	-0.15 (1.51)	-
China's absorption (-1)	0.51 (7.22)***	0.78	0.11 (18.5)***	0.52	0.09 (9.46)***	0.53	0.56 (8.59)***	0.64
China's exports(-1)	0.34 (6.73)***	0.52	0.15 (9.41)***	0.71	0.13 (7.40)***	0.76	0.58 (6.40)***	0.67
Sigma	3.67 (10.7)***		0.005 (5.41)***		0.02 (5.40)***		1.66 (7.95)***	
Log Likelihood	AIC		Arch(1)		Normality			
-213.4	4.65		0.02 [0.89]		0.22 [0.89]			

This table reports Markov-switching estimates for equation (2). t-statistics are provided in brackets, with significance levels highlighted at the 10% (*), 5% (**) and 1% (***) levels. P-values are shown in square brackets . °°° indicates significance of the error-correction term at the 1% level on the basis of critical values computed by Banerjee, Dolado and Mestre (1998).

Figure 4.2 : Probability of Regimes for China’s Aggregate Imports



This figure corresponds to the estimates reported in the first three columns of Table 4.2. Regime three, which is largely composed of outliers, is not reported.

5. Conclusion

The resultsof our regime-switching estimates have important implications for the analysis of the effects of exchange rate movements on China’s trade flows. It is essential to disentangle nominal exchange rate from relative-price movements, so that looking at overall REER effects can only generated a blurred picture. While China’s exports were not driven by nominal effective exchange rate movements before WTO, outside crisis periods, such exchange rate movements appear to have become effective in moving Chinese exports, thereafter. In contrast, while relative price movements have been present all along, their impact has been sharply amplified after WTO entry - with a ninefold increase in absolute value. Indeed, after WTO entry, the associated price effects are both six times larger than before , and also three times larger than the effects of nominal exchange rate movements. With respect to imports, the much clamoured, alleged “perverse” impact of real exchange rate appreciation on imports appears in the reported estimates to be solely driven in the long run by relative prices. In contrast, a nominal exchange rate appreciation generates the predicted rise in imports. In addition, there is evidence that any long run effect of nominal exchange rate movements seems to have vanished after China’s WTO entry, even though they seem to have reemerged after the Global Financial crisis. However, in contrast, the short run perverse effect of a nominal appreciation characterized only the immediate post-WTO period. Over all periods relative price rises do appear to generate increased imports in the short run. With respect to long run income elasticities, the extremely high levels detected in some previous work seem to characterize only short-run effects. A key further finding is the impressive stability of long-run income elasticities for imports over the three decades of this study. In addition, contrary to a widely held belief, China’s aggregate imports are equally sensitive to domestic absorption than to exports.

In sum, the use of a regime-switching method has clearly demonstrated that WTO's entry marked a regime change in the specification of China's export and import equations. This implies not only that inferences drawn from linear estimation approaches, which do not allow for such regime changes, should be interpreted with great care, but also that in spite of changes in the magnitudes of elasticities, some of them have been qualitatively remarkably stable especially so on the import side for activity variables.

*********SUBJECT TO REVISION AND EXTENSION************************

Appendix

Adjusting for Stochastic Seasonality in Quarterly Data

First, the methodology of the unobserved-components model is presented and then implemented for quarterly data, in order to detect evolving seasonality in China's trade flows and GDP series.

The structural time-series modeling approach (Engle, 1978), developed by Harvey (1989), is used in order to decompose the logarithm of the series of interest (z) into four components, as follows:

$$z_t = \mu_t + \gamma_t + \nu_t + \varepsilon_t \quad \text{(A1)}$$

$$\mu_t = \mu_{t-1} + \eta_t \quad \text{(A2)}$$

$$\nu_t = \rho_\nu \nu_{t-1} + \xi_t \quad \text{(A3)}$$

Here, the drift is denoted by μ_t, the seasonal by γ_t, an AR(1) component in errors by ν_t, with an autocorrelation coefficient ρ_ν being smaller than one in absolute value, and the irregular is represented by ε_t. The seasonal component, which is a stochastic variable in the general case – γ_t , is then seasonally integrated, even though is is conceivably deterministic. The irregular is white noise, and the seasonal becomes stationary when multiplied by a seasonal summation operator:

$$S(L) = 1+L + L^2+....+ L^{s-1} \quad \text{(A4)}$$

with L being the lag operator, and s the number of seasons (Hylleberg et al. 1990). The use of S(L) ensures that the projection of the seasonal pattern into the future sums to zero over s consecutive time periods. This permits the identification of seasonal patterns which change slowly over time, but in a permanent way (Harvey and Scott, 1994).

The specification of stochastic seasonality, considered here, takes the dummy variable form, such as:

$$S(L)\,\gamma_t = \sum_{j=0}^{s-1} \gamma_{t-1} = \omega_t \quad \text{(A5)}$$

where ω_t is white noise with zero mean and variance σ_ω^2. A special case is one of deterministic seasonality when $\sigma_\omega^2=0$ and trigonometric seasonality is allowed for. This involves smoother changes in the seasonals, but yield a lower likelihood with the same number of parameters. More generally, whenever the variance estimate equals zero, the associated parameter will not be time varying. All disturbances are supposed to be mutually uncorrelated. Model (1), (2) (3) and (5) are estimated by maximum likelihood (Harvey, 1989). Estimates of the components are then obtained by a smoothing algorithm (Koopman, 1993).

The diagnostic tests are reported for unobserved-component models, and pay particular attention to the tests which are based on the auxiliary residuals, i.e. the estimators of the disturbances associated with the unobserved components (which in this case are the level and the irregular). These tests, which are mainly based on skewness and kurtosis, are particularly helpful in yielding information not apparent from the innovations. This is especially important for detecting and distinguishing between outliers and structural changes (Harvey and Koopman, 1992).

The tests for stochastic seasonality are applied to four (logged) quarterly series from 1991 (I) onwards until 2011 for China's real multilateral exports and imports, and GDP, as well as OECD's real GDP. The main feature of these four series is their common pattern of positive seasonality in the last quarter of the year and negative seasonality in the first quarter. The positive seasonality increased for both China's trade flows from the mid-1980s to the mid-1990s and fell back, thereafter, to its initial pattern. Subsequently, some positive seasonality appeared for the third quarter. For China's GDP, the last and first quarterly seasonality both diminished slightly over time, while some negative seasonality is present for the other two quarters. The OECD GDP contrasts with the Chinese trade flow and activity series since the former does not sow evidence of time-variation in its seasonality. Also, the strongly negative seasonality in the second quarter is a specificity of the OECD compared to China.

Figure A.1. Stochastic Seasonal Pattern of China's Real Exports

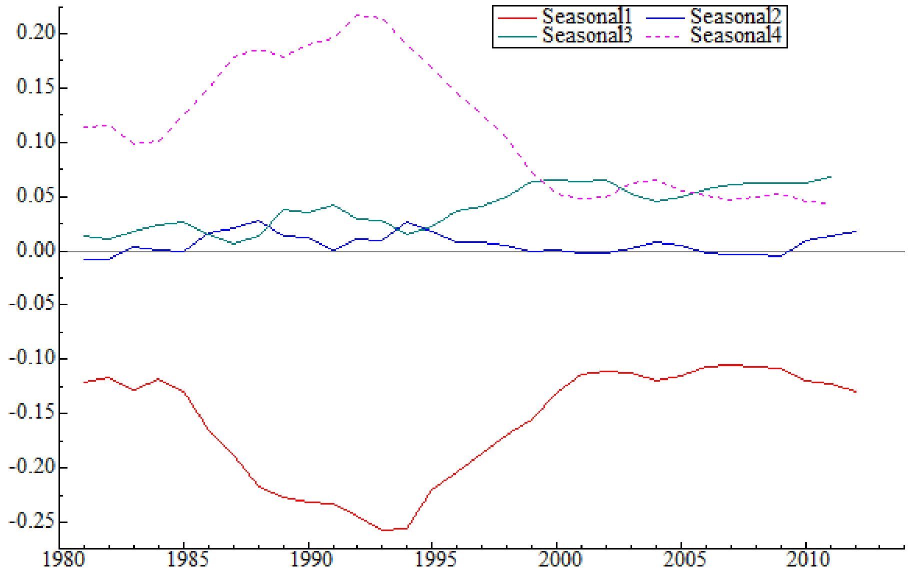


Figure A.2. Stochastic Seasonal Pattern for China’s Real Imports

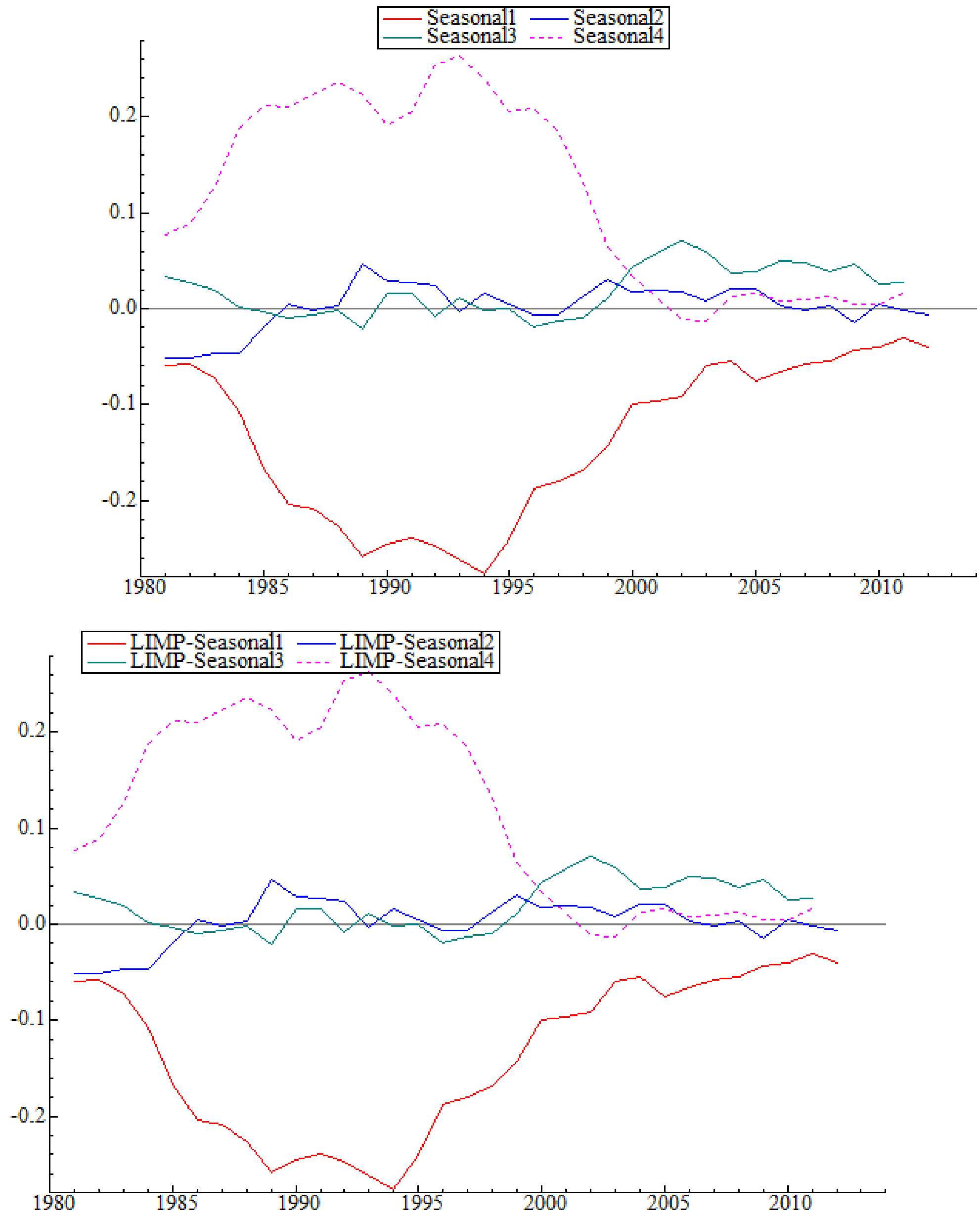
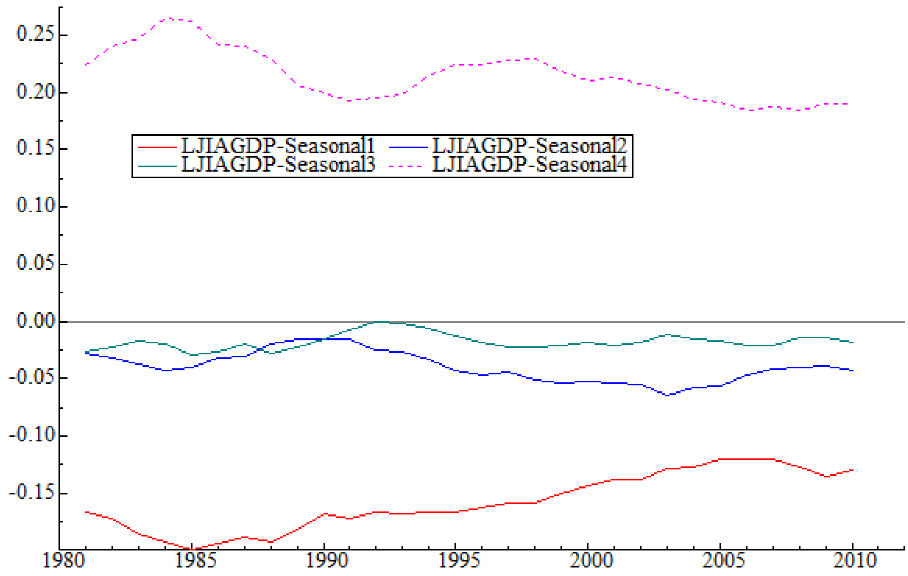
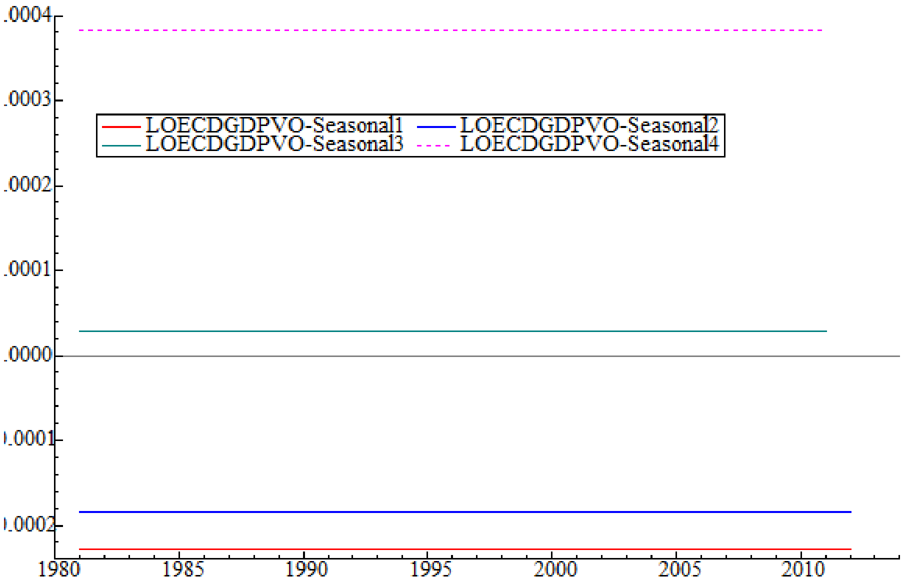


Figure A.3. Stochastic Seasonal Pattern in Jia's (2011) (logged) Quarterly GDP Series



LJIAGDP-Seasonal1
LJIAGDP-Seasonal2
LJIAGDP-Seasonal3
LJIAGDP-Seasonal4
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
1980
1985
1990
1995
2000
2005
2010

Figure A.4. Deterministic Seasonal Pattern OECD Real GDP



References

Aziz, J. and X. Li, China's Changing Trade Elasticities, IMF Working Paper WP/07/266, November 2007.

Banerjee, A., J. Dolado, and R. Mestre, 1998, Error correction mechanism tets for cointegration in a single-equation framework, Journal of Time Series Analysis, 19 (3), 267-83.

Bénassy-Quéré, A. and Lahreche-Revil, A. Trade linkages and exchange rates in Asia : the role of China. CEPII Working paper n°21, 2003.

Cerra, V. and Dayal-Gulati, A. China's trade flows : Changing price sensitivities and the reform process. IMF Working paper 33/1. 1999.

Cheung, Y-W., M. D. Chinn, and E. Fujii, China.s Current Account and Exchange Rate, NBER Working Paper No. 14673, 2009

Cheung, Y.-Wong, M. D. Chinn and X. W. Qian, 2012, Are Chinese trade flows different?, BOFIT Discussion Paper 14/2012.

Dees, S. The Real Exchange Rate and Types of Trade – Heterogeneity of Trade Behaviours in China. Paper presented at the Workshop on China's Economy, CEPII December 2001.

Eckaus, R. S. Should China appreciate the Yuan ? MIT Working paper 04-16. 2004.

Engle, R. F, 1978. Estimating structural models of seasonality. in A. Zellner ed. Seasonal analysis of economic time series. Bureau of Census, Washington D.C., pp. 281-308.

Garcia-Herrero, A. and T. Koivu. China's exchange rate policy and Asian trade, Working papers 282, Bank for International Settlement, April 2009.

Girardin, E. 2005, "Growth-cycle features of East Asian countries: Are they similar?", International Journal of Finance and Economics, 2005, Vol. 10 n°2, 143-156.

Girardin, E. 2011, "A de facto Asian Currency Unit Bloc in East Asia: It Has Been There, But We Did Not Look For It". ADB Institute Working Paper n°262, January.

Girardin, E. and Z. Liu, 2003, "The Chinese stock market: A casino with buffer zones", Journal of Chinese Economic and Business Studies, 2003,Vol 1, n°1, 57-70.

Hamilton, J.D. 1989. A new approach to the economic analysis of non-stationary time series and the business cycle, Econometrica, 57, 357-84.

Hamilton, J.D. 1994. Time Series Analysis. Princeton. Princeton University Press.

Harvey, A. C, 1989. Forecasting, Structural time series models and the Kalman filter. Cambridge University Press, Cambridge.

Harvey, A. C, S. J. Koopman, 1992. Diagnostic checking of unobserved component time-series models. Journal of Business and Economic Statistics 10, 377-89.

Harvey, A. C, A. Scott, 1994. Seasonality in dynamic regression models. Economic Journal 104, 1324-45.

Hylleberg, S., R. F. Engle, C. W.J. Granger, B.S. Yoo, 1990. Seasonal integration and cointegration. Journal of Econometrics 44, 215-38.

Jia, Y., 2011, A new look at China's output fluctuations: Quarterly GDP estimation with an unobserved components approach, Research Program on Forecasting, George Washington University Working Paper 2011-006, December.

Kamada, K. and I. Takagawa 2005, Policy coordination in East Asia and across the Pacific. International Economis and Economic Policy, 2, 275-306.

Kanioura, A. and P. Turner, 2005, The error correction model as a test for cointegration, Applied Economics, 37(3), 265-70.

Kiatkowski, D, P.C.B. Phillips, P. Schmidt, and Y. Shin (1992), Testing the null hypothesis of stationarity against the alternative of a unit root, Journal of Econometrics, 54, 159-78

Koopman, S. J., 1993. Disturbance smoother for state space models. Biometrica 80, 117-26.

Ma, A.C and A. Van Assche. The Role of Trade Costs in Global Production Networks. Evidence From China's Processing Trade Regime. World Bank Working Paper No. 5490, December 2010.

Maddison, A. and H. X. Wu, 2008. "Measuring China's Economic Performance", World Economics, Vol. 9 (2), April-June.

Marquez, J. and J. W. Schindler, "Exchange Rate effects on China's Trade", Review of International Economics, 15(5), 837-853, 2007

Phillips, P. and P. Perron, 1988, Testing for unit roots in time series regressions, Biometrica, 75, 335-46.

Thorbecke, W. and G. Smith, How Would An Appreciation of the RMB and Other East Asian Currencies Affect China's Exports? Review of International Economics, 18 (1), 95-108, 2010.

Yue, C. and Hua, P. Does Comparative Advantage Explain Export Pattern In China? China Economic Review 13, 276-296. 2002.