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## Export and Import Elasticities for Japan: New Estimates

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# **Export and Import Elasticities for Japan:**

## **New Estimates**

by

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### **Abstract**

This paper re-examines aggregate and disaggregate import and export demand functions for Japan. This re-examination is warranted the country has undergone substantial structural transformation, particularly with regard to the East Asian production chain. In the long run, non-fuel goods imports are highly income sensitive, while the price elasticity is near unity. Goods exports are similarly income sensitive. The price elasticity is around 0.7. In these preferred specifications, the Marshall-Lerner conditions hold, so that an exchange rate depreciation results in an improved trade balance.

**Keywords:** imports, exports, elasticities, competitiveness, unit labor costs.

**JEL Classification:** F31, F41

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## **1. Introduction**

This paper examines the relationship between Japanese aggregate trade flows, real exchange rates and incomes. While this literature has a long and venerable history, a re-examination is justified, as some of the most recent work on this subject cast doubt on the existence of a stable link between relative prices and trade flows. Moreover, the substantial structural change that has occurred since the 1990's – in particular the “hollowing out” of Japan's industrial base – suggests that previous estimates of the sensitivity of Japanese trade flows to exchange rates may have changed. This concern has been amplified by the recent advent of an annual trade deficit (see Figure 1). Moreover, some observers have pinned hopes for a resumption of Japanese growth on then yen depreciation and resulting expenditure switching that has occurred since the latter part of 2012.

The analysis relies upon the Johansen procedure, which is used to determine whether cointegrating relations exist, and how trade flows respond to deviations in long run relationships. Special attention is focused on how the results differ depending upon the exact measure of the exchange rate used and the composition of the trade variable examined.

The results indicate that there is a statistically significant relationship between exports of goods, rest-of-world income and the real exchange rate. The unit labor cost deflated measure of the dollar yields the strongest evidence of cointegration. For Japanese imports, there appears to be some evidence of cointegration, although the plausibility of the results depends on the category of imports examined.

## 2. Theory and Literature Review

The empirical specification is motivated by the traditional, partial equilibrium view of trade flows. Goldstein and Khan (1985) provide a clear exposition of this “imperfect substitutes” model. To set ideas consider the algebraic framework that Rose (1991) uses. Demand for imports in Japan and the Rest-of-the-World (RoW) is given by:

$$(1) \quad D_{Imp}^{Jpn} = f_1^{Jpn}(Y^{Jpn}, P_{Imp}^{Jpn})$$

$$(2) \quad D_{Imp}^{RoW} = f_1^{RoW}(Y^{RoW}, P_{Imp}^{RoW})$$

where  $P_{Imp}$  is the price of imports relative to the economy-wide price level. The supply of exports is given by:

$$(3) \quad S_{Exp}^{Jpn} = f_2^{Jpn}(P_{Exp}^{Jpn})$$

$$(4) \quad S_{Exp}^{RoW} = f_2^{RoW}(P_{Exp}^{RoW})$$

Note that the price of imports into Japan is equal to the price of foreign exports adjusted by the real exchange rate.

$$(5) \quad P_{Imp}^{Jpn} = E \times P_{Exp}^{RoW}$$

where  $E$  is the nominal exchange rate in Japanese yen per unit of foreign currency, and the real exchange rate is

$$Q = \frac{E \times P^{RoW}}{P^{Jpn}}$$

where  $P$  represents the aggregate level of prices. An analogous equation applies for imports into the rest-of-the-world. Imposing the equilibrium conditions that supply equals demand, one can write out import and export equations (assuming log-linear functional forms):

$$(6) \quad Imp_t = \beta_0 + \beta_1 q_t + \beta_2 y_t^{Jpn} + \varepsilon_{1t}$$

$$(7) \quad Exp_t = \delta_0 + \delta_1 q_t + \delta_2 y_t^{RoW} + \varepsilon_{2t}$$

where  $\delta_1 > 0$  and  $\delta_2 > 0$  and  $\beta_1 < 0$  and  $\beta_2 > 0$ .

One can interpret equations (6) and (7) as semi-reduced form equations. Consider equation (6); this expression collapses the relationship between the relative import price and imports (equation 1) and the relationship between the exchange rate and relative prices (equation 5) into one equation. To the extent that one takes the real exchange rate as “more exogenous” than the relative price of imports, this approach makes more sense when the economic question at hand is “what is the response of imports to a one percent change in the real exchange rate?”

The literature on Japanese trade equations is large. In this review, I focus on those studies conducted in the cointegration framework, largely because the earlier econometric literature pertains to much earlier data samples. In addition, recent work has relied on more powerful econometric techniques, such as the multivariate maximum likelihood estimation procedure of Johansen (1988). In conjunction with additional data, this procedure has provided more evidence of cointegration than obtained in previous studies (e.g., Rose, 1991).

The analysis most closely related to this one is an exhaustive study conducted by Hooper et al. (2000). They find evidence of cointegration for both Japanese exports and imports over the 1960-1994 period, using relative prices (either import or export prices relative to broad deflators) or a real effective exchange rate. For the relative price specifications, they find unitary income elasticities for both exports and imports. For price elasticities, exports respond with unit elasticity, while import demand is relatively more inelastic, at 0.3.

When using the IMF's real exchange rate measure, the income elasticity for exports ranges from 1.5 to 2.8, while the price elasticity ranges from 0.7 to 1.8. For imports, the income elasticity ranges from 1 to 4, while the price ranges from 1 to 11; the high end estimates pertain to specifications allowing lags of first differences over two years.<sup>1</sup>

Crane, et al. (2007) update the Hooper et al. (2000) approach using data up to 2006. They find that for Japan, the import income elasticity is 1.94, while imports appear to be (relative) price insensitive. For exports, they find that the income elasticity is 1.7, while the elasticity with respect to the exchange rate is about 0.3.

### **3. Data and Estimation**

#### ***3.1 Data***

For measures of trade flows, data on real imports and exports of goods and services (2005 chain weighted yen) were obtained. These series are depicted in Figures 2 and 3. Domestic economic activity was measured by Japanese GDP in 2005 Chain weighted yen. Foreign economic activity was measured by Rest-of-World GDP, calculated by chain-weighting real growth rates expressed

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<sup>1</sup> Results reported in the appendix to the working paper version (Hooper et al, 1998).

in real domestic currency units. This measure rest-of-world GDP is weighted by Japanese exports to major trading partners.

Two different exchange rate indices were utilized. The first is the most ubiquitous – the IMF’s CPI deflated index. The second is the IMF’s trade-weighted real exchange rate deflated using unit labor costs. Both series are shown in Figure 3 (rescaled to equal 0 in 1990q1). (A third measure, a PPI deflated rate is not available for most of the sample.)

The CPI-deflated measure is probably the less desirable on a priori grounds since it incorporates the prices of many non-traded goods that are unlikely to be relevant to flows of traded goods (although they might be indicative of costs of services).

The second measure merits some more detailed discussion. The unit labor cost deflated measure is best thought of as an empirical proxy for “cost competitiveness”. It is an imperfect measure, at best, measuring labor costs, rather than total costs. To see how this variable is related to the PPI based index, consider a markup model of pricing:

$$(8) \quad p_t^T = \log[(1 + \mu) \left(\frac{W_t}{A_t}\right)]$$

where  $p^T$  is the log nominal price of tradable goods,  $\mu$  is percentage markup,  $W$  is the nominal wage rate,  $A$  is labor productivity per hour.  $W/A$  is therefore unit labor cost. Re-expressing the real exchange rate

$$(9) \quad q_t = e_t - p_t^{Jpn} + p_t^{RoW}$$

using equation (8) for prices yields:

$$(10) \quad q_t^{ULC} = e_t - (w_t^{Jpn} - a_t^{Jpn}) - (w_t^{RoW} - a_t^{RoW})$$

(holding markups constant). In this case, the real exchange rate is the nominal rate adjusted by wages and productivity levels. As productivity levels rise, the real dollar cost of production falls, while rising wages cause an appreciated real dollar. This definition of the real exchange rate also fits in with a Ricardian model of trade (Golub, 1994). The drawback of this measure as constructed by the IMF is that it includes only relative manufacturing labor costs for other industrial countries, and hence omits important trading partners, including China.

### ***3.2 Estimation***

Estimation is implemented on data spanning a period of 1990q1-2012q3 (data availability goes back to 1980, but I truncate it to a later period to focus on the period encompassing the period of structural change in the industrial sector.) This period spans three episodes of yen appreciation and two episodes of yen depreciation. (I also examine a shorter period that ends before the great recession.)

The Johansen (1988) and Johansen and Juselius (1990) maximum likelihood procedure is implemented in order to test for cointegration and identify the cointegrating vector.<sup>2</sup> For the import system, the procedure estimates the following vector error correction model:

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<sup>2</sup> See Banerjee et al. (1993) for additional discussion. Chinn (2005) implements the approach described below.



$$\Delta Imp_t^{Jpn} = \gamma_{10} + \varphi_1 (Imp_{t-1}^{Jpn} - \beta_1 q_{t-1} - \beta_2 y_{t-1}^{Jpn}) + \gamma_{11} \Delta Imp_{t-1}^{Jpn} + \gamma_{12} \Delta q_{t-1} + \gamma_{13} \Delta y_{t-1}^{Jpn} + e_{1t}$$

(11)

$$\Delta q_t = \gamma_{20} + \varphi_2 (Imp_{t-1}^{Jpn} - \beta_1 q_{t-1} - \beta_2 y_{t-1}^{Jpn}) + \gamma_{21} \Delta Imp_{t-1}^{Jpn} + \gamma_{22} \Delta q_{t-1} + \gamma_{23} \Delta y_{t-1}^{Jpn} + e_{2t}$$

$$\Delta y_t^{Jpn} = \gamma_{30} + \varphi_1 (Imp_{t-1}^{Jpn} - \beta_1 q_{t-1} - \beta_2 y_{t-1}^{Jpn}) + \gamma_{31} \Delta Imp_{t-1}^{Jpn} + \gamma_{32} \Delta q_{t-1} + \gamma_{33} \Delta y_{t-1}^{Jpn} + e_{3t}$$

For exports, the system estimated is:

$$\Delta Exp_t^{Jpn} = \gamma_{40} + \varphi_4 (Exp_{t-1}^{Jpn} - \delta_1 q_{t-1} - \delta_2 y_{t-1}^{Row}) + \gamma_{41} \Delta Exp_{t-1}^{Jpn} + \gamma_{42} \Delta q_{t-1} + \gamma_{43} \Delta y_{t-1}^{Row} + e_{4t}$$

(12)

$$\Delta q_t = \gamma_{50} + \varphi_5 (Exp_{t-1}^{Jpn} - \delta_1 q_{t-1} - \delta_2 y_{t-1}^{Row}) + \gamma_{51} \Delta Exp_{t-1}^{Jpn} + \gamma_{52} \Delta q_{t-1} + \gamma_{53} \Delta y_{t-1}^{Row} + e_{5t}$$

$$\Delta y_t^{Row} = \gamma_{60} + \varphi_6 (Exp_{t-1}^{Jpn} - \delta_1 q_{t-1} - \delta_2 y_{t-1}^{Row}) + \gamma_{61} \Delta Exp_{t-1}^{Jpn} + \gamma_{62} \Delta q_{t-1} + \gamma_{63} \Delta y_{t-1}^{Row} + e_{6t}$$

Two test statistics for testing the alternative of cointegration against the null of no cointegration are calculated: the trace and the maximum eigenvalue statistic. Both are referred to, although generally they will agree on the existence of a cointegrating relationship, and the number of cointegrating vectors.

There are also additional specification issues related to the allowance for constants and trend terms in either the data or the cointegrating vector. I estimate two specifications -- a model with deterministic trends allowed in the data, but not in the cointegrating vector, and another with a restricted linear deterministic trend in the cointegrating vector.

The procedure provides estimates of the long run coefficients (the  $\beta$ 's and  $\delta$ 's) as well as the reversion coefficients (the  $\phi$ 's). The reversion coefficients are of interest for a number of reasons. First, the reversion coefficients on the trade flows should be negative, and statistically significant, indicating that imports and exports respond to a disequilibrium in the cointegrating relationship by closing the gap. Second, to the extent that one would like to interpret the estimated coefficients as it would be useful to be able to interpret the trade flows as responding to exogenous movements in the other variables, while the reverse is not true. Technically speaking, this is equivalent to weak exogeneity of these two variables, i.e., statistically insignificant reversion coefficients for the exchange rate and income.

### ***3.3. Empirical Results***

Over the sample period, all the series fail to reject the unit root null hypothesis at the 10% level, with the exception of goods exports. That series fails to reject at the 3% level. Hence, I treat all the relevant series as integrated.

Table 1 reports the results for imports of goods and services. Results for the specification incorporating the CPI deflated real exchange rate are shown in columns 1 and 2, and for the unit labor cost deflated specification, in columns 3 and 4. The trace and maximum eigenvalue statistics indicate evidence for cointegration, although using the conservative 1% significance levels leads to mixed evidence regarding the exact number in most instances.<sup>3</sup>

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<sup>3</sup> One could adjust for finite sample critical values, as in Cheung and Lai (1993). In the case of this study, the specifications include sufficiently few lags so that the inferences would not change if accounting for degrees of freedom.

One notable feature of the results is that the income elasticities are usually quite high – around 2.9 to 7.7. Interestingly, when a restricted deterministic trend is incorporated into the cointegrating vector (column 4), the income elasticity drops to a more plausible value, with imports increasing secularly about 1.6% per year. The high elasticities – greater than those reported by Crane, et al. (2007) – is consistent with the rising import penetration associated with “hollowing out” process. The price elasticities are also distributed over quite a wide range – from 0.2 to 2.2.

The reversion coefficients in the lower panel of Table 1 indicate that imports respond to disequilibria in the long run import relationship, at a rate ranging between 3% to 20% per quarter. In general, the real exchange rate and Japanese GDP do not respond to disequilibria. Only in one instance does the real exchange rate respond (the ULC deflated series, in column 4); to the extent that productivity and wages might respond to import growth, this outcome is not too implausible. The response of GDP to disequilibria (in column 3) makes less sense, although it is quantitatively small.

Japanese imports are heterogeneous, and there is reason to believe that certain components might behave differently than others. Energy commodity imports might exhibit different sensitivities to income and price variables, due to intrinsic differences or due to pricing of energy commodities in dollars. In Table 2, results based upon goods imports excluding mineral fuels are reported.

The results are similar to those found in Table 1. There is evidence of at least one cointegrating vector. The income elasticity ranges from 2.9 to 6.7. The price elasticity ranges from 0.2 to 1.0.

In column 4, a deterministic time trend coefficient is statistically significant, and implies a 2.4% per annum trend increase in non-fuel imports. The reversion coefficients indicate that disequilibria are closed fairly quickly.

The analogous regression results for exports of goods and services are reported in Table 3. Overall, the results are much more favorable toward a finding of cointegration. The sensitivity of exports to the real exchange rate is between 0.4 to 0.7 when using the CPI deflated measure, and slightly higher – 0.3 to 0.4 – when using the ULC deflated measure. Income elasticity estimates range from 1 to 4, with marked sensitivity to the inclusion of a time trend.

The reversion coefficients indicate that export flows respond to disequilibria in the long run export relationship, and pretty rapidly: 42% to 76% per quarter. Rest-of-world GDP also responds, which seems counter-intuitive. However, the response is quantitatively small. The real exchange rate appears to be weakly exogenous for exports.

One implication of the exchange rate coefficient estimates is that the Marshall-Lerner condition sometimes does not hold in the long run; this is particularly true if one takes the unit labor cost specifications as the preferred ones.

As previously discussed, the CPI deflated real exchange rate conform to the concept of “price competitiveness”, while the unit labor cost deflated measure is more closely linked to “cost competitiveness”. The fact that the use of this measure results in such low elasticities is somewhat surprising. Typically, one would think that unit labor costs should be strongly related

to trade flows. One possible reason for the weakness of the link is that this measure focuses on trading patterns and productivity trends of manufacturing sectors in twenty other industrial countries (Zanello and Desruelle, 1997), and over the most recent period, trends relative to other *developing countries* – most importantly China – have become relatively more important.

#### **4. Tracking the Great Recession Trade Collapse**

It's reasonable to inquire whether these estimates are robust to the exclusion of the trade downturn of 2008-09. In Table 4, estimates using CPI deflated exchange rates are reported for non-fuel goods imports and goods exports. The estimates in column 1, for imports, indicate a fairly high sensitivity to real exchange rate changes (an elasticity of almost 2), with a high secular rate of import growth – almost 6% per year. One can use the import equation (alone) to simulate what the model predicts for the 2008Q1-2012Q4 period. The actual and forecast (log) levels are shown in Figure 5. (A dynamic forecast, which uses all three equations would do much worse, missing the entire decline, and overpredicting the actual imports by the end of the sample.)

When the export equation is estimated over the 90Q1-07Q4 period, the estimated (restricted) time trend is not significant. Hence, I report the no-trend result in column 2. Then the income elasticity is about unity, and the exchange rate elasticity about 0.5 – not far from the overall export (goods and services) elasticities reported by Crane, et al. (2007).

Simulating the export equation (once again incorporating ex post values of the right hand side variables) yields the projection in Figure 6. The simulation tracks the actual level of log exports, although by the end of the sample, an underprediction of 6% results.

These results suggest that the Great Recession data points do not drive the estimates obtained.

## **5. Conclusions**

There are several significant findings to be gleaned from this analysis. First, a stable long run relationship exists for Japanese goods exports, the real exchange rate and rest-of-world income. In contrast, Japanese goods imports are quite difficult to model. The long run income elasticities are particularly sensitive to the treatment of deterministic trends.

It may be useful to summarize at this point what has been learned in revisiting this subject.

On the export side, the estimated export price and income elasticities are in line with those reported by Crane et al. (2007) (although the price elasticity is a bit lower). On the import side, my estimates of the income elasticity are substantially higher, suggesting that over time Japan is increasingly penetrated by imports.

With the export price elasticity about 0.7 for the preferred specification, and the import price elasticity equal to about unity, then the Marshall-Lerner conditions hold. A yen depreciation should result in an improvement in the real trade balance, at least in the long run. Exports respond fairly quickly, while the half life of a deviation for imports is a bit over a year.

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**Table 1: Total Goods Imports**

	Pred	CPI defl [1]	CPI defl [2]	ULC defl [3]	ULC defl [4]
Trace		44.55***	58.35***	39.73***	56.30***
L-stat		24.65***	24.70*	23.85**	27.89**
CR's		1,1	2,0	1,0	1,0
q	(-)	-2.223*** (0.489)	-1.458*** (0.336)	-0.389*** (0.130)	-0.154* (0.080)
y	(+)	7.679*** (0.918)	5.709*** (1.628)	5.254*** (0.327)	2.897*** (0.528)
time			0.002 (0.004)		0.004*** (0.001)
lag		2	2	2	2
N		91	91	91	91
Smpl		90Q1-12Q3	90Q1-12Q3	90Q1-12Q3	90Q1-12Q3
Imp		-0.034*** (0.011)	-0.053*** (0.016)	-0.098*** (0.032)	-0.202*** (0.046)
q		-0.032 (0.019)	-0.036 (0.028)	0.058 (0.058)	0.187** (0.086)
y		0.005 (0.004)	0.007 (0.007)	0.028*** (0.012)	0.016 (0.019)

**Notes:** "Coeff" is the coefficient from equation (6) or (7). "Pred" indicates predicted sign. "Trace" ( $\lambda$ -max) is the trace (maximum eigenvalue) test statistic for the null of zero cointegrating vectors against the alternative of one. CR is the number of cointegrating relations implied by the asymptotic critical values for the trace,  $\lambda$ -max statistics and 1% significance level. Critical values assume no exogenous regressors. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Lag is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. \*(\*\*)[\*\*\*] denotes significance at the 10%(5%)[1%] level.



**Table 2: Goods Imports ex. Fuel**

	Pred	CPI defl [1]	CPI defl [2]	ULC defl [3]	ULC defl [4]
Trace		56.30***	58.20***	38.68***	56.13***
L-stat		27.90**	26.35**	24.78**	28.82**
CR's		1,0	2,0	2,0	1,0
q	(-)	-0.154* (0.080)	-0.994*** (0.260)	-0.588*** (0.182)	-0.227*** (0.103)
y	(+)	2.897*** (0.527)	4.952*** (1.262)	6.742*** (0.459)	3.401*** (0.675)
time			0.005 (0.003)		0.006*** (0.002)
lag		2	2	2	2
N		91	91	91	91
Smpl		90Q1-12Q3	90Q1-12Q3	90Q1-12Q3	90Q1-12Q3
Imp		-0.202*** (0.046)	-0.112*** (0.027)	-0.104*** (0.031)	-0.223*** (0.048)
q		0.187** (0.086)	-0.026 (0.034)	0.016 (0.041)	0.098 (0.067)
y		0.016 (0.019)	0.010 (0.008)	0.019*** (0.009)	0.012 (0.014)

**Notes:** "Coeff" is the coefficient from equation (6) or (7). "Pred" indicates predicted sign. "Trace" ( $\lambda$ -max) is the trace (maximum eigenvalue) test statistic for the null of zero cointegrating vectors against the alternative of one. CR is the number of cointegrating relations implied by the asymptotic critical values for the trace,  $\lambda$ -max statistics and 1% significance level. Critical values assume no exogenous regressors. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Lag is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. \*(\*\*)[\*\*\*] denotes significance at the 10%(5%)[1%] level.

**Table 3: Goods Exports**

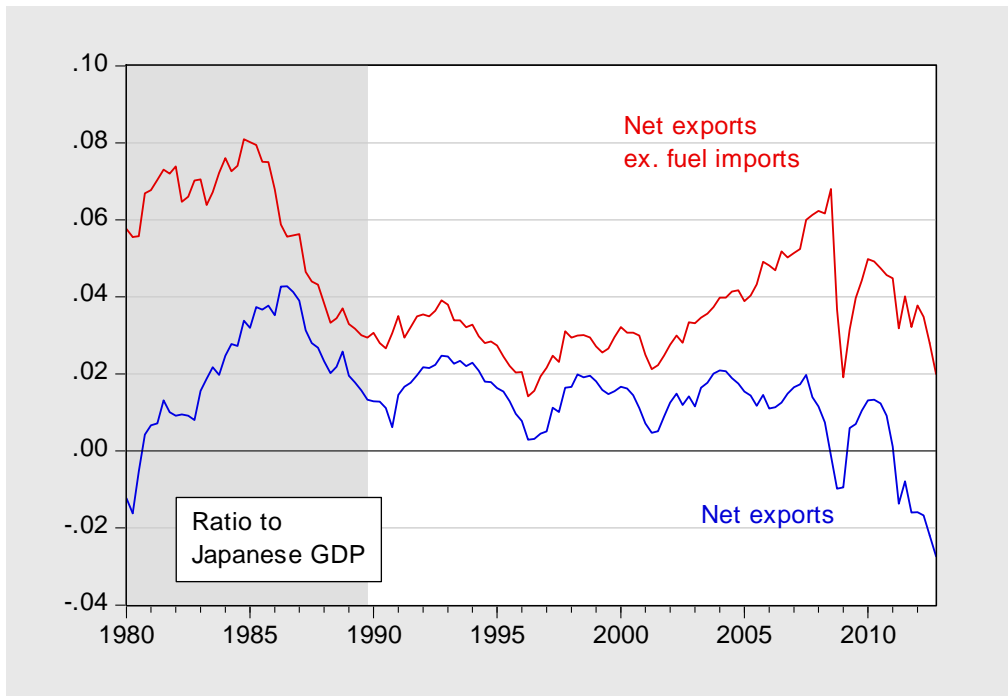
	Pred	CPI defl [1]	CPI defl [2]	ULC defl [3]	ULC defl [4]
Trace		42.54***	73.29***	49.27***	81.61***
L-stat		34.98***	53.02***	44.76***	64.18***
CR's		1,1	1,1	1,1	1,1
q	(+)	0.364*** (0.067)	0.658*** (0.099)	0.293*** (0.036)	0.426*** (0.047)
y	(+)	1.043*** (0.032)	3.985*** (0.957)	1.051*** (0.023)	2.179*** (0.609)
time			0.049*** (0.009)		0.031*** (0.006)
lag		2	2	2	2
N		91	91	91	91
Smpl		90Q1-12Q3	90Q1-12Q3	90Q1-12Q3	90Q1-12Q3
Imp		-0.593*** (0.095)	-0.423*** (0.061)	-0.756*** (0.103)	-0.603*** (0.074)
q		-0.024 (0.107)	0.020 (0.071)	-0.120 (0.134)	-0.063 (0.101)
y		-0.012*** (0.004)	-0.013*** (0.002)	-0.017*** (0.004)	-0.019*** (0.003)

**Notes:** "Coeff" is the coefficient from equation (6) or (7). "Pred" indicates predicted sign. "Trace" ( $\lambda$ -max) is the trace (maximum eigenvalue) test statistic for the null of zero cointegrating vectors against the alternative of one. CR is the number of cointegrating relations implied by the asymptotic critical values for the trace,  $\lambda$ -max statistics and 1% significance level. Critical values assume no exogenous regressors. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Lag is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. \*(\*\*)[\*\*\*] denotes significance at the 10%(5%)[1%] level.

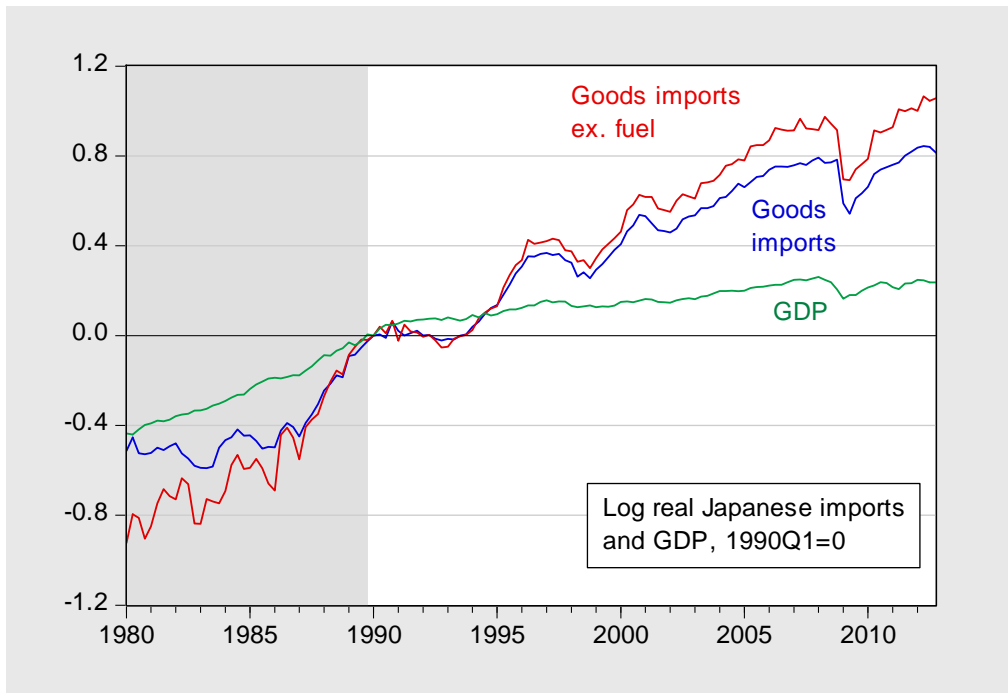
**Table 4: Imports and Exports,  
Truncated Sample**

	Pred	Imports ex.-fuel CPI defl [1]	Exports CPI defl [2]
Trace		57.33***	30.11**
L-stat		28.82**	23.96**
CR's		1,0	0,0
q	(-)	-1.990*** (0.414)	0.483*** (0.081)
y	(+)	2.889*** (2.843)	1.043*** (0.054)
time		0.015* (0.008)	
lag		2	2
N		72	72
Smpl		90Q1-07Q4	90Q1-07.4
Imp		-0.064*** (0.015)	-0.250*** (0.055)
q		-0.016 (0.021)	0.149 (0.119)
y		0.006 (0.004)	-0.002 (0.003)

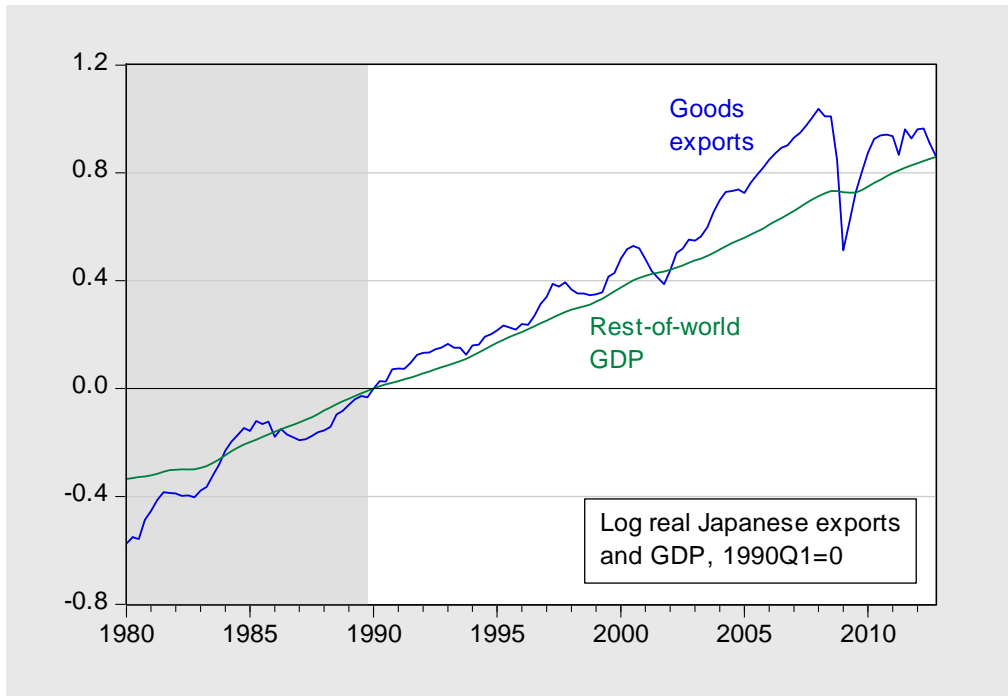
**Notes:** "Coeff" is the coefficient from equation (6) or (7). "Pred" indicates predicted sign. "Trace" ( $\lambda$ -max) is the trace (maximum eigenvalue) test statistic for the null of zero cointegrating vectors against the alternative of one. CR is the number of cointegrating relations implied by the asymptotic critical values for the trace,  $\lambda$ -max statistics and 1% significance level. Critical values assume no exogenous regressors. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Lag is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. \*(\*\*)[\*\*\*] denotes significance at the 10%(5%)[1%] level.



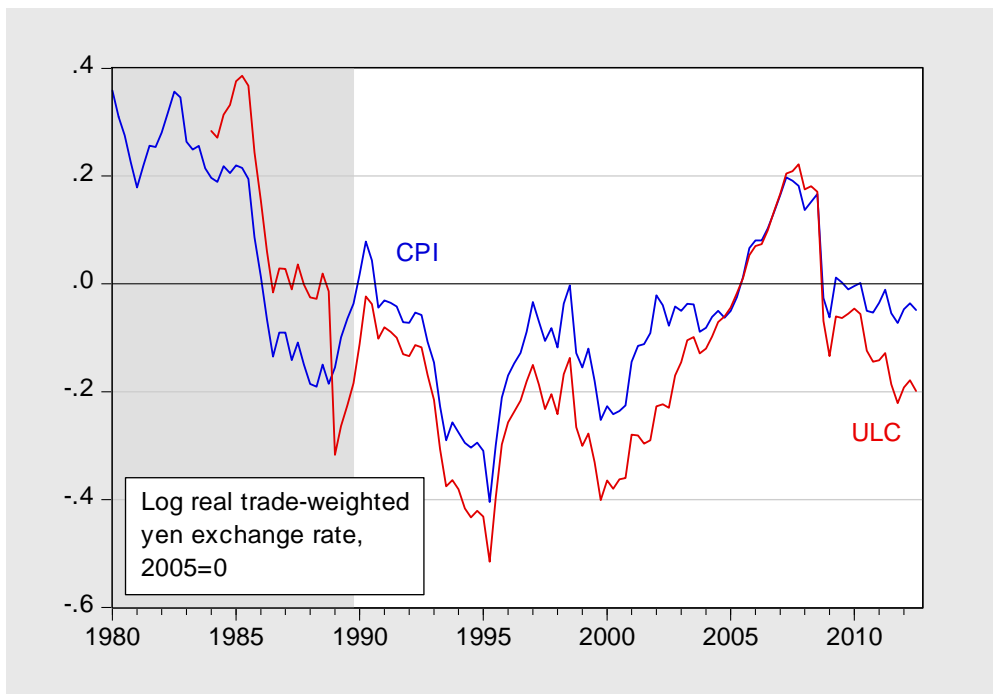
**Figure 1:** Net exports to GDP and net exports ex. mineral fuels imports to GDP. Source: OECD and author's calculations. Gray shading denotes data not included in regressions.



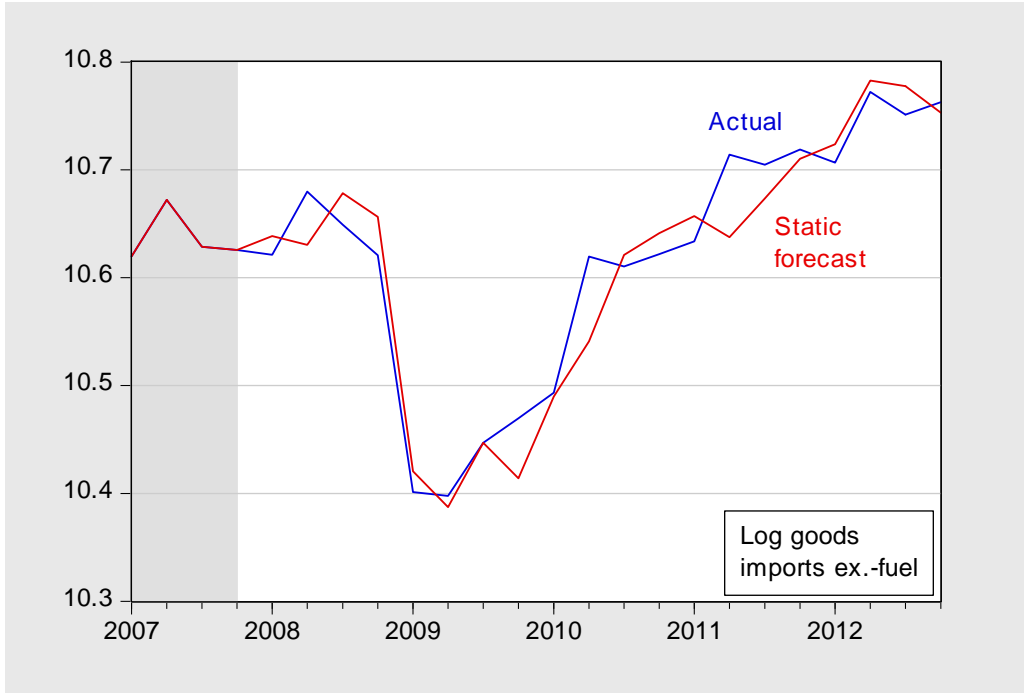
**Figure 2:** Log real goods imports and goods imports ex. mineral fuels, and real GDP, in billions of Ch.2005 yen. Source: OECD, and author's calculations. Gray shading denotes data not included in regressions.



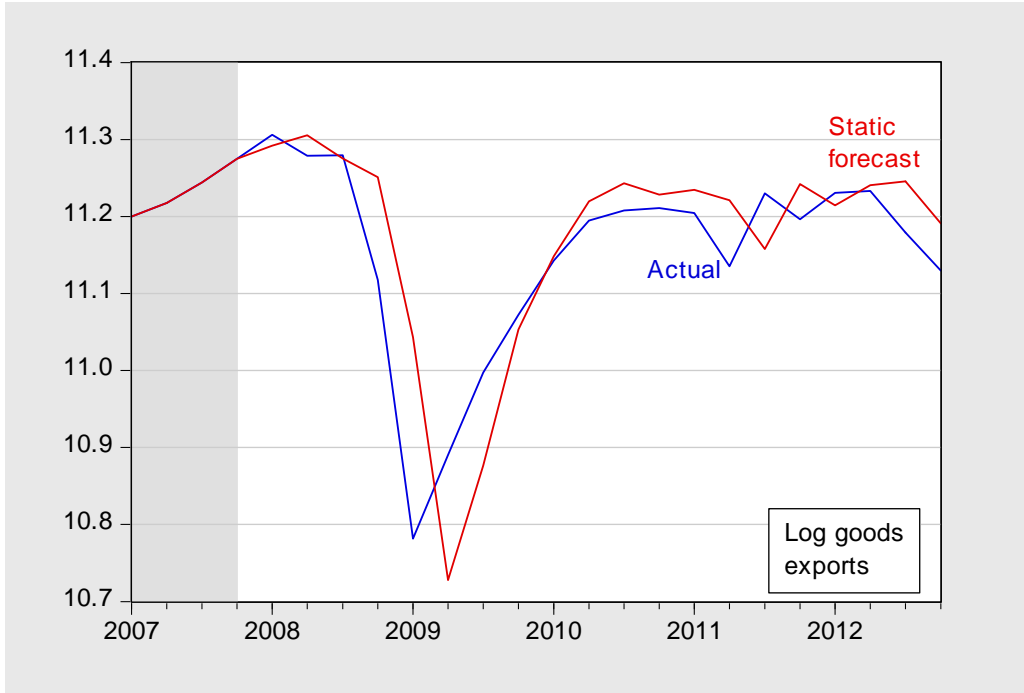
**Figure 3:** Log real goods exports, in billions of Ch.2005 yen, and real Rest-of-World GDP. Source: OECD and author's calculations. Gray shading denotes data not included in regressions.



**Figure 4:** Log real CPI deflated exchange rate of the yen (blue) and unit labor cost deflated rate (red), 2005=0. Source: IMF. Gray shading denotes data not included in regressions.



**Figure 5:** Log real goods imports ex.-mineral fuels, and static ex post simulation. Gray shading denotes in-sample data.



**Figure 6:** Log real goods exports, and static ex post simulation. Gray shading denotes in-sample data.