

Why Are Exports to East Asia Growing So Rapidly?

— A Structural VAR Approach in Search of Non-China Factors —

Hitoshi Sasaki

July 2004

Remarkable strength of exports to East Asia

Japan's economy is on a gradual recovery track. The driving force is exports: in particular, those to East Asia have been increasing rapidly. Looking at developments in real exports by region (Chart 1), exports to East Asia have recorded an increase of about 7-8 percent every term on a quarter-to-quarter basis, corresponding to increases of up to a little over 30 percent at annual rates, with the exception of a drop in the second quarter due to effects of the SARS epidemic.

Chart 1 Japan's Real Exports (breakdown by region)

	2003CY		s.a. q/q % chg.			
	1Q	2Q	3Q	4Q	2004 1Q	
United States	<24.6>	-7.4	0.5	-1.4	2.6	2.7
EU	<15.3>	4.5	1.6	1.7	3.9	9.8
East Asia	<44.9>	6.9	-1.0	7.1	8.4	8.8
China	<12.2>	16.9	2.3	9.2	5.3	11.0
NIEs	<23.5>	4.6	-3.3	7.4	12.1	8.1
ASEAN4	<9.2>	2.2	0.7	4.1	3.5	7.7
Real Exports		-0.3	1.0	3.4	6.4	4.1

Note: Share of each region in 2003 is shown in angle brackets.

Sources: Ministry of Finance, "The Summary Report on Trade of Japan"; Bank of Japan, "Corporate Goods Price Index."

Two main reasons can be pointed out for the strength of exports to East Asia. The first reason is the expansion of China's domestic demand. In the lead up and subsequent to its accession to the World Trade Organization (WTO) at the end of 2001, China has accelerated its opening market policies. Under these circumstances, its income has increased mainly in urban areas along the coast, giving a boost to consumption demand in these regions. Capital formation, such as extensions to production facilities or investment in large-scale construction projects, including the Olympics in Beijing and the

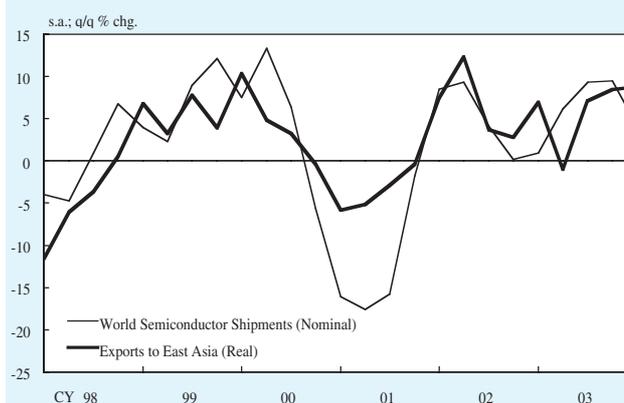
International Exhibition in Shanghai, is also brisk. Needless to say, the high growth of China's economy has been stimulating the East Asian region as a whole.

The second reason is a characteristic of the international division of labor: a world economic recovery led mainly by IT-related demand is likely to induce an increase in Japan's exports, particularly those to East Asia. This paper aims to investigate this second reason further.¹

World IT-related demand and U.S. economy

Two points should be taken into account when considering Japan's exports to East Asia within the framework of the present international division of labor: one is world IT-related demand; and the other is the U.S. economy.

Chart 2 World Semiconductor Shipments and Japan's Exports to East Asia



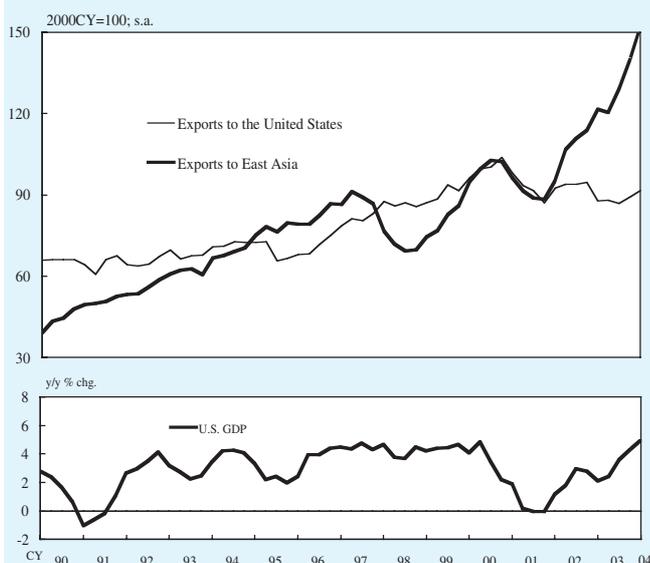
Sources: WSTS Inc., "World Semiconductor Trade Statistics"; Ministry of Finance, "The Summary Report on Trade of Japan"; Bank of Japan, "Corporate Goods Price Index."

To begin with, there is a close relationship between world IT-related demand, as captured by the World Semiconductor Trade Statistics (WSTS), and Japan's exports to East Asia (Chart 2). Exports to

East Asia increased markedly in those periods when IT-related demand expanded: the IT investment boom in 1999-2000; the inventory restoration during the first half of 2002 after the adjustment phase following the IT boom had run its course; and the growth of the market for digital home appliances in 2003.

It is well-known that the international division of labor characterizing the production processes for IT-related goods is highly developed, with processes being divided worldwide into stages such as machine-parts, intermediate goods, and final products. Under this system, the East Asian region, including growing China, plays a leading role in the production, processing and assembly of machinery parts suitable for mass production, such as DRAMs. Parts and intermediate goods are actively traded within the region, and then final products are exported to world markets, including the United States and Europe. Within this context, Japan's comparative advantage is in exports of upstream goods, such as skill-intensive parts and semiconductor fabrication machines and equipment. What this international division of labor means is that, when world IT-related demand expands, Japan's exports display a strong tendency to increase towards the processing and assembly base in East Asia rather than towards final markets for finished products.

Chart 3 Japan's exports to the United States and East Asia



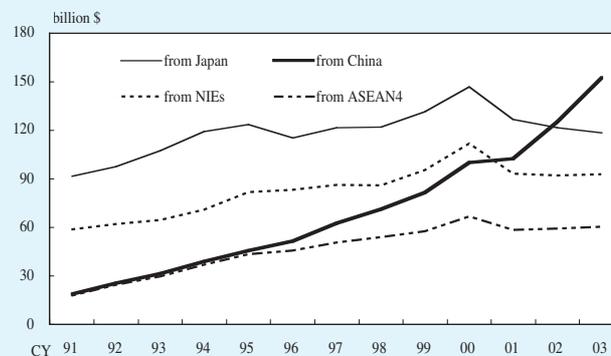
Sources: Ministry of Finance, "The Summary Report on Trade of Japan"; Bank of Japan, "Corporate Goods Price Index"; U.S. Department of Commerce, "National Income and Product Accounts."

We also see that Japan's exports to East Asia are clearly more sensitive to a recovery in the U.S. economy than previously, which partially overlaps the above-mentioned point. Comparing Japan's exports to the United States with those to East Asia (Chart 3), the latter is seen to follow a more pronounced upward trend throughout the period of observation. Since 2002 in particular, although exports to the United States have remained, on the whole, broadly flat during the U.S. economic recovery, those to East Asia have increased substantially.

Although, as will be mentioned later, it is too early to conclude that all of these contrasts represent irreversible structural changes, judging from the breakdown of U.S. imports (Chart 4), it is certain that some obvious changes have occurred in recent years. U.S. imports from China have recently been accelerating, and these imports comprise a wide variety of items, including both non-durable goods such as apparel, miscellaneous goods and toys, and also durable goods such as PCs and home electric appliances. On the other hand, U.S. imports from Japan have registered hardly any increase during the past 10 years. In fact, in nominal terms, they have actually inched down over the last 3 years. Imports from other Asian economies such as NIEs or ASEAN4 have recently peaked.

This recent trade structure suggests the increasing importance of a transmission channel that runs from a U.S. economic recovery to Japan's economy via China, or sometimes via other East Asian economies.

Chart 4 U.S. Imports (breakdown by region)



Source: U.S. Census Bureau, "U.S. Trade in Goods and Services."

Outline of the structural VAR model

The following parts of the paper make use of a structural VAR model to investigate the idea that both an expansion of world IT-related demand and a recovery in U.S. economy are likely to induce a rise in Japan's exports to East Asia.

A VAR (Vector Autoregression) model captures time-series data on multiple variables in the form of a system in which they mutually affect one another, either simultaneously or with a time lag. Thus a VAR model estimates quantitative relationships, i.e. parameters, among variables so that the estimated parameters offer the best fit to the actual data. Setting up this kind of model enables one to quantify the impact of a new movement (called a shock) originating in one of the variables at period t , upon every other variable in the system (including itself) from period $t+1$.

This paper estimates a VAR model consisting of five variables: (i) world IT-related demand (world semiconductor shipments, as mentioned above); (ii) U.S. economic conditions (U.S. real GDP); (iii) Japan's exports to the United States; (iv) Japan's exports to East Asia; (v) the exchange rate (the yen's real effective exchange rate). The sample period runs from 1992/1Q to 2003/4Q.² If successfully estimated, this model can be used to perform various simulations. For instance, given an artificial shock to world IT-related demand at period t , one can simulate how much Japan's exports to the United States and also to East Asia respond to the shock from period $t+1$.

However, there is a problem in estimating the model: if we attempt to capture all of the possible mutual effects for as many as five variables, we would have to estimate too many parameters given the number of data observations at our disposal. Without enough data relative to the number of parameters to be estimated, it is in general difficult to obtain reliable estimation results. Here we have data for only twelve years (48 periods on a quarterly basis). We are therefore left with no alternative but to reduce the number of parameters to be estimated. Reductions in the number of parameters may be achieved by embedding in the model some prior relationships among the variables. These

relationships, or surely the specific absence of a relationship, can be predetermined without data analysis, by appeal to economic theory or common knowledge. These pre-determined relationships among variables are called prior restrictions, and a VAR model which makes use of such prior restrictions is called a structural VAR model. This estimation method is frequently used, since it has the advantage not only of reducing the burden of VAR estimation, which generally tends to be heavy, but also of incorporating into the model relationships among variables that are consistent with economic theory.

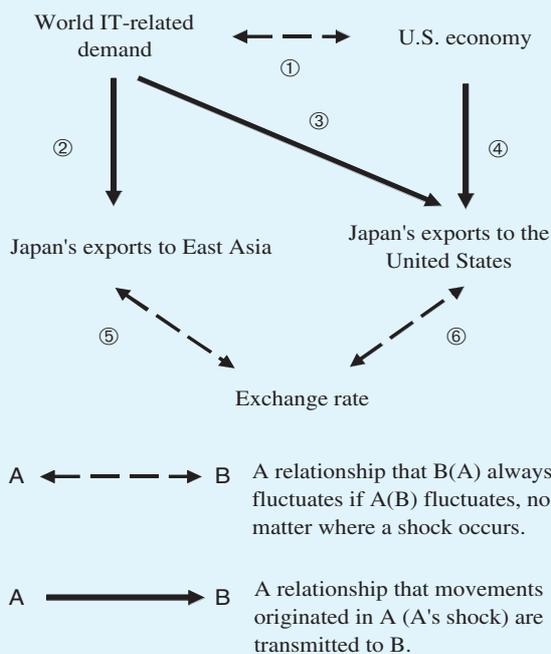
It is this structural VAR model that is used in the analysis here. Where theory suggests that there is no simultaneous relationship between two variables (i.e. developments in variable X at period t have no effect on variable Y during that period), prior restrictions are imposed so that the relevant parameter is not estimated. In other words, the parameter concerned is set to zero. Specifically, restrictions are imposed as follows:

- (1) With five variables, one may posit ten conceivable simultaneous relationships between pairs of variables (this is the number of ways of choosing two out of five variables, without replacement). However, we assume that only the following three relationships have economic validity.
 - U.S. economy ↔ world IT-related demand
 - Japan's exports to the United States ↔ the exchange rate
 - Japan's exports to East Asia ↔ the exchange rate
- (2) When a shock to world IT-related demand occurs, it is assumed to have simultaneous effects only on Japan's exports to the United States and to East Asia.
- (3) When a shock to the U.S. economy occurs, it is assumed to have a simultaneous effect only on Japan's exports to the United States.

Chart 5 illustrates the above prior restrictions. For example, assume that a shock increasing world IT-related demand occurs unexpectedly at period t . In this case, the immediate changes in period t are an improvement in the U.S. economy (channel ①) and

an increase in Japan's exports both to East Asia and to the United States (channels ② and ③). To give another example, if a positive shock to the U.S. economy occurs at period t , it induces a rise in world IT-related demand (channel ①) and in Japan's exports to the United States (channel ④), but Japan's exports to East Asia do not increase at period t .³ Of course, this mechanism restricts only simultaneous fluctuations following a shock to one of the variables at period t . The shock is assumed to affect all variables in the system from period $t+1$, once the variables begin to move.⁴ In the above example, the assumption is that a shock to the U.S. economy is potentially transmitted to all the variables in the system, including Japan's exports to East Asia, from the next period onwards.

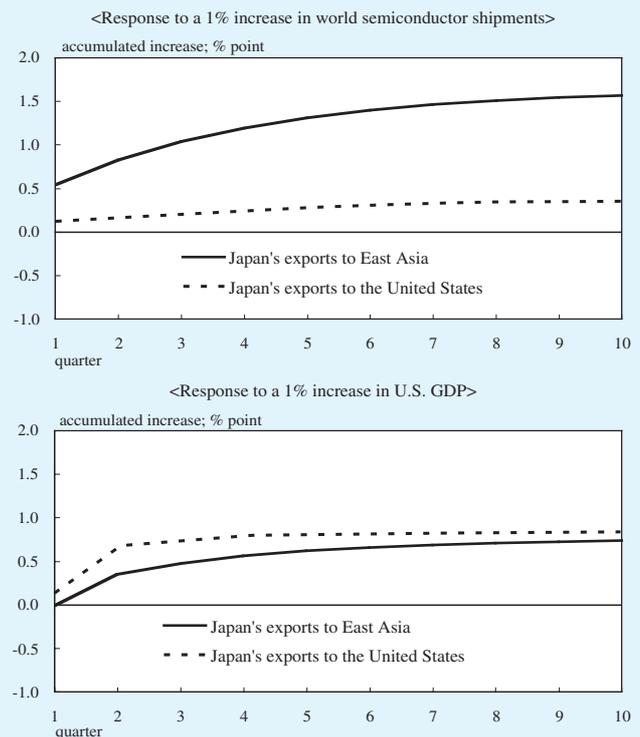
Chart 5 Diagram of Restrictions Imposed in the Structural VAR Model



Simulation results

A shock simulation is then performed based on the estimated structural VAR model above-mentioned. More concretely, the simulation investigates to what extent a positive shock (an increase) of one percent applied to either world IT-related demand (world semiconductor shipments) or the U.S. economy (real GDP) in the first period, cumulatively augments Japan's exports to both East Asia and to the United States as time passes (Chart 6).

Chart 6 Simulation Results



Looking first at the effects of a positive shock of one percent to world IT-related demand, we see that Japan's exports to the United States rise, but that the rate of increase is relatively small. On the other hand, Japan's exports to East Asia rise substantially, and by the third or fourth quarter the accumulated increase exceeds one percent, i.e. it exceeds the scale of the initial demand shock. This suggests that the effects of an expansion in world IT-related demand on Japan's exports to East Asia are augmented through a variety of channels, such as via stronger activity in the East Asian region and the transmission of the U.S. economic boom to East Asia. The latter channel is discussed further below.

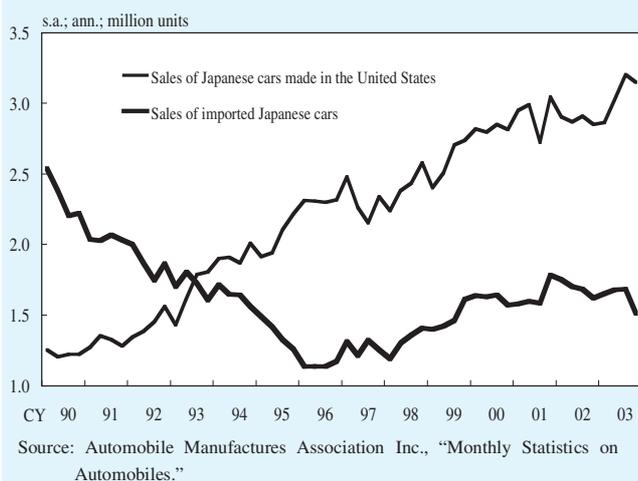
Turning next to the effects of a one percent positive shock to U.S. GDP, Japan's exports to the United States naturally increase by a relatively large amount. What is more interesting is that Japan's exports to East Asia also rise gradually, with something of a time lag, and that the final scale of the increase is almost as large as that of Japan's exports to the United States.⁵ This simulation result brings into sharp relief the observation that, with the international division of labor in its present shape, a boom in the U.S. economy is likely to cause an increase in Japan's exports to East Asia.

Implications of the analysis, and some caveats

The analysis above confirms that, with the recent international division of labor, expansions in world IT-related demand and/or recovery in the U.S. economy have a significant role to play in ensuring the steadiness of Japan's exports to East Asia.

On the other hand, it is still somewhat difficult to interpret the results of the above structural VAR analysis regarding Japan's exports to the United States. According to the analysis, one of the primary effects of a recovery in the U.S. economy should be to strengthen Japan's exports to the United States. However, in reality, the U.S. economic recovery that has been underway since 2002 has hardly had any impact on Japan's exports (Chart 3). This seems to require further investigation.

Chart 7 Sales of Japanese Automobiles in the United States

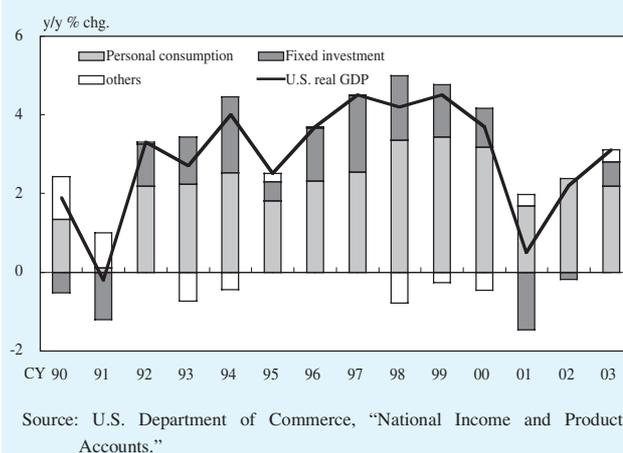


The structural VAR analysis performed here has one noteworthy limitation: it assumes that the structure of the world economy has not altered during the past twelve years (i.e. during the sample period). In reality, the rapid expansion of U.S. imports from China and their increased weight in overall U.S. imports is a relatively recent phenomenon (Chart 4). In addition, Japan's exports of automobiles,⁶ which account for a large part of Japan's overall exports to the United States, are significantly influenced by developments in trade frictions and the related long-run strategies adopted by Japanese car makers. In recent years, the trend of Japanese car manufacturers transferring production facilities over to the United States has become more pronounced.

Thus U.S. imports of automobiles directly from Japan have been unlikely to increase significantly even when U.S. demand for Japanese cars has expanded (Chart 7). For these reasons, the estimated VAR model, which captures only the average shape of the trade structure over the past twelve years, possibly underestimates the current impact of an increase in U.S. demand on Japan's exports to the United States.⁷

Also this model may not properly capture one of the channels through which Japan's exports to the United States may rise in the near future. The analysis here has U.S. economic conditions represented solely by U.S. GDP. One of the characteristics of the increase in Japan's exports to the United States in the late 1990s and 2000 was the considerable contribution of fixed investment to U.S. GDP growth (Chart 8). This contrasts with the current U.S. recovery which has basically been led by personal consumption. Japan has a comparative advantage in the exports of capital goods. When fixed investment takes over from consumption as the driving force of the U.S. economy, the result may well be a rise in Japan's exports to the United States. Moreover, with demand for digital home appliances expanding, Japan's competitiveness in terms of consumption goods may also recover to some extent.

Chart 8 U.S. Economic Growth



Concluding remarks

Summing up, Japan's exports directly to the United States are on the whole unlikely to grow significantly, because goods are increasingly flowing from Japan to the United States 'via East Asia'. However, drawing concrete conclusions regarding future developments in Japan's exports to the United States is complicated by

the presence of factors such as automobile exports and the difficulty of forecasting demand for capital goods. By contrast, future developments in Japan's exports to East Asia can be predicted more clearly. They are expected to continue to increase steadily for some time, assisted also by rapid economic growth in China, which was outside the scope of this paper. However, one of the implications of the current analysis is that even Japan's exports to East Asia are influenced to some extent by U.S. economic conditions. Moreover, the extent of this influence may be underestimated by the analysis above, which captures only the average shape of the trade structure over the past twelve years. The outlook for the U.S. economy is still of the greatest interest for Japan, whose economy is not strong enough to realize a continuous self-sustaining recovery that depends solely on its domestic demand.

each of these sub-samples is then insufficient for a reliable estimation of the parameters.

Bank of Japan Review is published by the Bank of Japan to explain recent economic and financial topics for a wide range of readers. This report, 2004-E-1, is a translation of the original Japanese issue, *Economic Commentary 2004-02*, published in February 2004. The views expressed in the Review are those of the authors and do not necessarily represent those of Bank of Japan. If you have comments and questions as well as requests for hard copies, please contact Seisaku Kameda, Senior Economist, Research and Statistics Department (seisaku.kameda@boj.or.jp). *Bank of Japan Review E-series* and *Bank of Japan Working Paper E-series* can be obtained through the Bank of Japan's Web site (<http://www.boj.or.jp>).

¹ For the first of these reasons (the expansion of China's domestic demand), see Hitoshi Sasaki and Yuko Koga [2003] "Trade between Japan and China: Dramatic Expansion and Structural Changes" (<http://www.boj.or.jp/en/ronbun/03/rkt03e03.htm>), which also explains the expansions in both exports and imports between Japan and China.

² All the variables are log-transformed first differences. The series of world semiconductor shipments, originally in nominal terms, is transformed into real terms using prices of electronic parts etc. taken from the U.S. Producer Price Index. All the variables except the exchange rate are seasonally adjusted.

³ The channel of influence from world IT-related demand to Japan's exports to East Asia (channel ②) is limited to fluctuations originating in world IT-related demand. Fluctuations in world IT-related demand that are mediated via the U.S. economy do not occur within the same period. They are transmitted only from the next period.

⁴ No prior restrictions are imposed on the lagged relationships among variables. Mutual effects for subsequent realizations of all five variables completely depend on the data and the set up of the estimation. The number of time lags in the estimated VAR model is set to one, judging from a statistical criterion called the AIC (Akaike Information Criterion), which is frequently used in these kinds of estimations. Even in the model with only one lag, once a shock occurs, its effects are successively transmitted to variables in the next period, two periods after, and so forth.

⁵ The fact that Japan's exports to East Asia do not respond at all in the first period is due to the imposition of the prior restriction (3).

⁶ Exports of automobiles including their parts account for about 40 percent of Japan's nominal exports to the United States in 2003.

⁷ One possible remedy for this problem is to divide the sample into two parts, e.g. into halves. However, a more serious problem then appears, in that the number of observations in