Why World Exports Are so Susceptible to the Economic Crisis

--The Prevailing "Export Overshooting" Phenomenon

Especially in Taiwan

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This paper provides some evidence of the "export overshooting" phenomenon, i.e., the unusual large deviation of exports from their long-run level. We show that export overshooting occurred across our sample of countries during the 2001 and 2008 economic crises. The extent of overshooting, however, is more severe in Taiwan than in other nations and it is also true in those industries with high income elasticity. The bullwhip effect is indeed the driving force behind the phenomenon of export overshooting. Broadly speaking, we find that Taiwan's increased susceptibility to economic crisis can be attributed to an increase in cross-border vertical specialization, outsourcing of downstream production of Taiwan's export manufacturing and a concentration of Taiwan's exports in high-tech products that are sensitive to demand shocks and business cycles.

1. Introduction

In the years leading up to the summer of 2007 when the ensuing U.S. subprime crisis began to unfold, the world saw a period of relative calm and prosperity after the recovery from the dot-com bubble burst in the early 2000s. While the major industrialized nations grew at a modest pace of one to three percent per annum, the rise of the BRIC and other emerging markets gave great impetus to the world's economic progress and spurred high growth in world trade. But the subprime loan problem quickly gave way to a broad global crisis marked by slowing economies and dried-up liquidity with unprecedented reach. The scope and devastating impacts of the global financial crisis were greater than anyone had anticipated. Like a game of dominos, the financial crisis started in the United States and spread to the rest of the world. It first lacerated the world's financial systems then jolted and knocked out the real economy. No country was immune to it. Not the "Wealthy Country Club" with member countries such as the United States, Germany, and Japan. Not the usually resilient East Asian NICs. Not even the up-and-coming powerful BRIC group. Among those, countries with a strong export orientation and opened up most to the world, especially Japan and the East Asian NICs, were hit the hardest.

Figure 1 and 2 clearly show the impacts of the financial crisis of 2008 on the volume of world exports for a sample of eleven countries consisting of major advanced industrialized countries, the Asian NICs and the emerging market economies. World exports began to fall in the second half of 2008 and quickly rebounded towards the end of the first half of 2009, forming a narrow V-shaped pattern of growth trajectory. The dramatic collapse in world exports is not without historical precedence as the same V-shaped pattern was also observed during the dot-com crisis surrounding 2001. In effect, both crises had led to economic downturns which in turn resulted in high levels of unemployment and a sharp fall in global demand and international trade.

It is worth noting that during the economic downturns surrounding 2001 and 2008, the contraction in world exports was far greater than that of world GDP, as revealed in Table 1 and 2. In 2001, while real world GDP still grew at 1.77%, growth of total exports for the countries in our sample had already turned negative and contracted at a rate of -6.21%. In contrast, the overall export performance was much

worse in the recent economic downturn, with the total exports shrinking at an astounding rate of 25.68% a year after the crisis broke out. Meanwhile real world GDP suffered only a mild decline and growth slowed down to -2.14% in 2009.

Another noteworthy observation was that Taiwan appeared to exhibit a relatively narrower V-shaped export growth pattern than the others in the group. That is, Taiwan was amongst the first to contract and also the first to recover in exports. Even though all of the eleven nations studied had displayed a similar pattern of ups and downs in export growth and were highly influenced by the two economic crises, the crises seemed to have a greater impact on Taiwan's export performance (Figure 1 and 2). In fact, the contractions in Taiwan's exports were the most severe both in terms of timing and magnitude, and Taiwan's recovery was also amongst the most speedy, particularly in the 2008 crisis. Importantly, in the two economic crises, Taiwan delivered one of the worse export performances among the nations.

A number of papers has identified that fluctuations in exports are highly correlated with the changes in worldwide demand, effective exchange rate, the volatility of exchange rate (see for example, Boug and Fagereng, 2010; Sapir and Sekka, 1995), and FDI (Zhang and Song, 2000; Sharma, 200). These determinants (hereafter referred to as the fundamental factors) are shown to be able to govern adequately the behavior of the export growth performance of a country in the long run. The fact that the decline in world exports was much greater than the decline in world GDP suggests that the force causing exports to deviate from their long-run trend may have been further magnified by some other factors not accounted for in the short-run dynamics. In other words, the surprisingly large declines in exports could not have been predicted by the historical relationships linking exports to the fundamental factors.

Based on what we have observed, we formulate several testing hypotheses. Specifically, we look for evidence that addresses the "export overshooting phenomenon" (i.e., the unusual large deviation of exports from their long-run level) during times of economic duress as well as evidence that shows the extent of overshooting was larger in Taiwan than in other countries. Moreover, we offer some explanations for why overshooting occurs and why Taiwan might be especially susceptible to shocks when compared with other countries.

The group of countries being studied in this paper includes three Asian NICs, namely Taiwan, Korea, and Singapore; several Asian emerging market economies, namely China, Indonesia, Malaysia, Philippines, and Thailand; and Taiwan's major trading partners, namely U.S., EU and Japan. The time span being studied in this paper covers the period from 2000 to 2009.

The structure of the paper is as follows. Section 2 begins with a comparison in terms of causes and economic impacts of the two economic crises. Section 3 describes the structural changes in Taiwan's exports over time and explains what produced the changes. In addition, several testable hypotheses are derived in Sections 2 and 3 based on the revealed trends and patterns of exports during the crisis periods. These hypotheses are then tested in Section 4 using an error correction panel regression model, and we examine in a dynamic context how exports respond to external shocks, for different country groups and also across industry groups. Some explanations as to why when facing economic crisis, exports will overshoot its long-run trend and why Taiwan's export performance is among the worse are provided in Section 5. Finally, we summarize our findings and offer conclusions in the last section.

2. Impact of Economic Crisis on Exports

The two economic crises are triggered by different events. The first economic crisis occurred during 2000-2002 and was a direct result of the internet bubble (also referred to as the dot-com bubble) busting in 2000 and the 9/11 terrorist attacks on the U.S. soil in 2001. The second crisis was the recent 2008 global financial crisis originated from the subprime crisis and led to a massive global economic downturn. But the two economic crises may be interconnected as argued by Lin (2008). This is because the easy-credit monetary policy adopted by developed countries is believed to be an important catalyst of the subprime crisis, to minimize the duration and depth of the ensuring recession following the 2001 crisis.

In retrospect, the internet bubble, a speculative bubble covering roughly the period 1998-2001, was originated from the accelerated growth in internet sectors and related industries. Because of the "get big fast" strategy adopted by the new internet-based companies and the market confidence on the profitable future of these companies, the internet bubble saw rapid run-ups in market valuations on these

companies (Valliere and Peterson, 2004). When the bubble burst in 2000, it was followed by an equally rapid collapse of the markets and led to bankruptcy of many internet firms and huge losses in stock markets. The United States, in particular, suffered from a severe economic downturn with unemployment reaching new heights.

The bubble had an important impact on the wealth and the spending habit of consumers, especially those in the developed countries. People spent more because they felt richer with their overvalued assets; but when their wealth was suddenly reduced once the bubble burst, they scaled back on discretionary spending. Changes in discretionary spending are a result of the so-called "wealth effect," which turns out to have important implications for the growth of international trade and the global economy. To many export-oriented countries, this surge in discretionary spending in developed countries, especially in high-tech products, was for a long time a major source of global demand for their exports. After the 9/11 attack, countries with a heavy reliance on the exports of high-tech products such as Japan, Singapore, South Korea, and Taiwan saw the global demand for ICT products slowing in a weak economic outlook. Similarly, the exports of other Asian countries such as Malaysia and Philippines, who are part of the integrated ICT production/supply chain system in the region, were also negatively affected. China, meanwhile, still managed to experience positive growth in exports as the volume of Chinese high-tech exports was relatively small at that time and hence the impacts were limited.

Different from the export contractions as seen in 2001, which is largely due to a collapse in external demand for ICT output, a shrunken export demand in 2008 was truly global as a result of a great economic recession not seen since the early 1930s. In varying degrees, this great economic recession affected virtually every industry and business sector. The reason why the recent economic downturn has far-reaching consequences lies in the rapid proliferation of speculative financial innovations fueled by a torrent of cross-board capital flows that further quickened the speed of contagion worldwide (Hu 2009). As a consequence, the economic impacts of a lowered level of world income were felt around the globe, and a collapse in the export demand across the board quickly followed. That includes a plunge in global demand for the Chinese output.

Although the causes of the two crises are different, exports contracted largely

due to the declines in worldwide demand, which has been shown in the literature to be one of the most significant fundamental factors. As shown in Table 1 and 2, world trade fell more rapidly than output in varying degrees across nations. In the 2001 crisis, the growth rate of world GDP slowed to 1.77% from 4.30% in the previous year, while the exports in Japan and Taiwan fell by -16.87% and -15.83%, respectively. In the meantime, growth in the Chinese and European exports remained strong, reaching as high as 6.98% and 1.42%, respectively. In contrast, in the 2008 crisis world GDP fell -2.14% from the previous year but exports fell more rapidly within a range of from-17.36% to -28.61%. With these observations and the distinct V-shaped patterns in exports, we suspect that exports may have fallen much more rapidly to an extent far exceeding what can be entirely attributed to the changes in fundamental factors. Thus, we have the following hypothesis:

Hypothesis 1: During crisis, exports overshoot the deviation bands allowed by the long run equilibrium relationship governed by the fundamental factors.

In the two episodes of fast falling export demand, the impacts were much greater in the 2008 crisis, for the contagion was more severe and truly global, leading to a much weaker global demand (Sun, 2009). The drying up of trade credit and traders' overreaction to a possible collapse in demand made the situation even more serious in the 2008 crisis (Athukorala and Kohpaiboon, 2009). However, a variety of economic stimulus packages were put in place to lessen the negative impact thanks to the quick and coordinated responses from the world's governments to contain the spread and further worsening of the crisis. It is therefore reasonable to believe that exports would rebound more quickly in the 2008 crisis than in the 2001 crisis. And in fact, they did as observed in Figure 1 and 2. Thus, we have:

Hypothesis 2: Although the degree of export contractions was much sharper in the 2008 crisis than in the 2001 crisis, the number of months it took for exports to bottom out is smaller in the 2008 crisis than that seen in the 2001 crisis.

Moreover, because industries were affected to varying degrees by the two crises and their recovery dynamics was also different, we examine how exports were impacted at the industry level by classifying a country's manufacturing industries into two groups, Group A and Group B, based on industry characteristics. Group A

consists of industries whose production activities tend to be capital- or technology-intensive in nature. Specifically, Group A includes chemical, metals, electronics, machinery, electrical equipment, ICT (information, communications and technology), transportation, and precision instruments. The demand for Group A is highly income elastic, and consumer spending on such products tends to follow the ebb and flow of the economy. Spending decreases during economic downturns and increases when the economy expands. Notice that developed countries are the major buyers of Group A. On the other hand, Group B, which consists of all remaining industries,[1] tends to be labor-intensive and of necessity in nature. While developing countries are the major consumers of Group B, developed countries may reduce their consumption as a result of an increase in income.

Hypothesis 3: Group A's capital- or technological-intensive exports tend to increase with the levels of OECD income, while Group B's labor-intensive exports tend to increase with the levels of Non-OECD income.

3. FDI, Outsourcing, Industry Structures and Taiwan's Exports

Over the last few decades, Taiwan has achieved miraculous growth and has since been roundly lauded for being one of the East Asian Tigers that also include South Korea, Hong Kong and Singapore. Its successful export-led economic growth model has been well documented and followed by many developing countries. But things appear to have changed over the course of the last decade. The average compound growth rate for Taiwan's exports for the period of 2000-2007 was only 7.17%, a marked slowdown from the growth rates of 12.87% and 8.5% achieved during the high growth periods of 1981-1990 and 1990-2000. A rapid increase in the nation's outward direct investment (FDI), the prevalence of export outsourcing practice by the Taiwanese exporters as well as the nation's being excluded from the deepening regional economic integration process within Asia may all contribute to a worsening of Taiwan's export performance.

From the 1980s onwards, Taiwan saw a wave of overseas investment expansion, with the United States and the Southeast Asian countries being the major recipients of

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[1] They are textiles, apparel, plywood product, paper, furniture, rubbers and plastics, metal products, nonmetal products, basic metal, printing, chemical materials, chemical products, and petroleum.

Taiwan's FDI.[2] But after the lifting of the ban on indirect investment in China by the Taiwanese government in the early 1990s, the vast majority of Taiwan's FDI flooded into China for reasons of low-cost labor and cultural proximity. In 1993, China became the largest recipient of Taiwan's FDI; and by 2005, China had already attracted more than half of Taiwan's accumulative outward investment over the decades.

Prior to 1995, almost all of Taiwan's export orders were processed locally and exported out of Taiwan directly. However, because of the rising labor and land costs at home, the Taiwanese firms gradually lost their competitive edge in labor-intensive goods. To regain competitiveness, many Taiwanese firms chose to relocate the production of their labor-intensive goods and low-end production processes to low-wage countries in Southeast Asia and China, while keeping under the control of the parent firms in Taiwan other activities such as R&D, upstream production, marketing and export order processing. Part of the export orders received was therefore filled by (or outsourced to) the parent firms' overseas affiliates and local firms in the third countries. As Taiwan's FDI started to multiply, the outsourcing ratio increased. Since this practice is mainly limited to export orders, it is referred to as export outsourcing, a term coined by Liu et al. (2007).

The increasing reliance on export outsourcing is evident in an ever shrinking proportion of export orders filled at home. Indeed, the proportion of orders filled by domestic sources had decreased over time, from 85.37% in 2000 to 53.87% in 2007. As a consequence, not only Taiwan's export growth has slowed down but its export structure has also shifted toward upstream industries over time.[3] Having upstream firms as the dominant type of firms in Taiwan may have important implication on Taiwan's increasing sensitivity to external shocks in exports.

Similar to other countries, Taiwan's exports also exhibited a V-shaped pattern

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[2] By 1990, the United States and the Southeast Asian countries accounted for 43.5% and 35.03% of Taiwan's accumulative FDI, respectively.

[3] According to Liu & Lu (2007), more than 80% of Taiwan's export outsourcing was done in China, while the remaining was distributed among countries in Southeast Asia and in other regions. And in order to effectively manage and control overseas production and export activities, a large part of the export outsourcing activity (close to 80%) was carried out by subsidiaries and affiliate firms in the host country. This is distinctly different from the outsourcing practice used by the Western MNEs, which employ mostly local firms or foreign firms in the host country.

during the crisis period. For eight months before the crisis broke out with the exception of July 2008 (only 7.9%), the nation's exports had been able to post double-digit growth. But in September 2008 the situation was quickly reversed, and in just a short time the export markets rapidly deteriorated. The nation saw its export revenues fell almost by half in just four months. By January 2009, the contraction finally let up and the slide came to a stop at -44.1%. While still posting in the red, the Taiwanese export sector gradually improved its position in the following months. And by November, export growth had turned positive for the first time since crisis, rising to 19.35%. In terms of export orders, as the impacts of the crisis propagated through the economy, export orders showed a similar decline and fell to their lowest point in January 2009 at -41.67%; and since then, the sharp decline in export orders also began to slow down.

From the foregoing discussion, it must have become clear that the fall in Taiwan's total exports was rather dramatic and larger in magnitude than the fall in its exports orders. In effect, export growth recovered more slowly than export orders. By December 2009 when export orders had already bounced back to the pre-crisis level (102% of December 2007), exports were only stabilizing around 15% below their level in December 2007. This suggests that the Taiwanese exporters may have relied more on export outsourcing to weather the financial storm.

To sum up then, there are notably differences in how Taiwan was impacted by the 2008 crisis, compared to other countries' experiences (Table 3). The differences are summarized as follows: (1) In terms of the timing of experiencing negative growth since the crisis broke out, Taiwan was affected by the crisis much earlier than any other country in the group. Taiwan reported negative growth in exports in September 2008. But neither the European Union nor Singapore were affected until a month later, and for that matter, the United States, Japan, and China did not begin to contract until November. (2) In terms of the degree of export contractions, Taiwan had the most severe decline among the countries in the group. Its growth rate of exports dropped to -44.1%, the lowest point in eight years, while Japan reported a comparable decline of -43.92% two months later. The contractions were evidently far worse than those of United States (-26.33%), South Korea (-34.53%) and China (-26.34%). (3) In terms of the timing of bottoming out, Taiwan started its recovery most early, bottoming out in

January 2009 while Japan did not until March. The United States and European Union did not reach the bottom until April, and China and Malaysia did not until May.

In fact, the above-mentioned differences were also observed in Taiwan's export performance during the dot-com crisis, although in a somewhat less clear picture (Figure 1 and 2). Thus, we have:

Hypothesis 4: Compared to the other countries in the group, Taiwan's export performance during the crisis periods is characterized by a quicker and sharper drop in exports. Nevertheless, its exports bounced back more quickly than the others in the group.

4. Empirical Model and Results

To examine how exports adjust to shocks, we need to explicitly model their adjustment by introducing a priori long-run equilibrium relationship, with the hypothesis that there exists an error correction mechanism that makes the short-run deviations to converge on a long-run trend. Therefore, modeling a long-run export performance in the context of adjustment to external shocks is inherently dynamic.

Assume export performance, E_{it}, is affected by a set of fundamental factors and some global shocks, denoted as Z_{it} and *Crisis*, respectively. Let the short-run relationship among EX_{it}, Z_{it} and *Crisis* follows an autoregressive-distributed lag model:

$$EX_{it} = \alpha_0 + \alpha_1 Z_{i,t} + \alpha_2 Z_{it-1} + \alpha_3 EX_{it-1} + \alpha_4 Crisis_t + \varepsilon_{i,t} \qquad (1)$$

where EX_{it} *(i=1, ...N, t=1, ..., T)* is country *i*'s exports in log form at time t. *Crisis*, which includes *2001Crisis* and *2008Crisis*, is a period dummy used to capture the common shocks from the 2001 and 2008 crisis. $\varepsilon_{it}(= v_i + u_{it})$ includes country-specific variables v_i and the stochastic error term u_{it}, where the former is to reflect country-specific effect stemming from cross-country differences in endowment, technology, etc.

Two problems may arise, when using panel data regression techniques to determine the dynamic relationships between of EX_{it} and Z_{it} as indicated in

Equation (1).[4] First, we run into the endogeneity problem due to the difficulty of identifying the unobserved country-specific effects such as technological progress in a dynamic setting, in which case the right-hand side variables are not orthogonal to each other. Second, the problem of persistence occurs because EX_{it} and Z_{it} tend to be highly persistent over time with their respective lagged values and are often jointly determined, which is often the case for economic research using time series of macroeconomic variables.[5]

An error correction model therefore is adopted, which can be used to solve for these two problems. Most importantly, it has the advantage of allowing us to examine the short-run and long-run dynamics of the relationship between EX_{it} and Z_{it}, and this feature becomes very useful especially in the context of examining how exports behave when an external shock is present.

$$\Delta EX_{it} = \alpha_1 \Delta Z_{it} + \eta ERROR_{it-1} + \alpha_4 Crisis_t + \varepsilon_{it} \tag{2}$$

where Δ indicates first difference, $ERROR_{it-1}(= EX_{it-1} - \phi_0 - \phi_1 Z_{it-1})$ is the error correction term, $\phi_0 = -\alpha_0/(1-\alpha_3)$, $\phi_1 = -(\alpha_1 + \alpha_2)/(1-\alpha_3)$, and $\eta = -(1-\alpha_3)$. In equation (2), ΔZ_{it} captures the short-run effects while $ERROR_{it-1}$ describes the long-run dynamics. Exports could deviate from the long-run equilibrium relationship due to random shocks in the short run, but it eventually converges to the equilibrium when shocks are absent. The error correction coefficient (η), which is negative for such a convergence to occur, therefore measures the speed of adjustment toward the long-run equilibrium.

Crisis is used to see whether there exists excessive adjustment in exports that cannot be explained by the effects of short-run and long-run dynamics. If the coefficient of *Crisis* is significantly different from zero, then there exists the "export overshooting" phenomenon. We indicate the beginning of a crisis using the timing of export growth once it turns negative. That is, a crisis begins once negative export growth is present in any of the countries in our sample. For example in the 2001 crisis, Taiwan was the country whose exports fell earlier than other countries, so the month when Taiwan's export growth first turned negative is defined as the starting month of

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[4] See Yasar et al. (2006), Bond (2002) and Mairesse et al. (1999).
[5] The Durbin Watson statistics, which is 0.35 for regression (1), suggests the existence of autocorrelation.

the downturn, which was January 2001. The subsequent months of the crisis period are defined as follows: *Crisis2001*= 2 if February 2001, *Crisis2001*= 3 if March 2001…., and *Crisis2001*=18 if June 2002, when the U.S. was the last country to resume positive growth in exports. By adding *Crisis* and its square term (*Crisis_SQ*), we are able to figure out, on average, how many months it took to reach the trough of the contraction in growth. *Crisis2008* can be similarly defined with the starting month to be September of 2008 (see Table 5).

The set of fundamental factors Z_{it} affecting a country's export performance includes world demand, effect exchange rate, volatility of exchange rate, and FDI flows. Here, world GDP is used to measure the world demand. As a larger world GDP is expected to boost a country's exports, we expect a positive relationship between the two variables. The effective exchange rates, which are trade weight-based measures with weights being time-varying, are obtained from the Bank for International Settlements. Since the appreciation of a country's currency lowers the competitiveness of its exports, we expect the impact of an increase in *EER* on exports to be negative.

The volatility of effective exchange rate (ρ) is used to capture the impact of exchange-rate uncertainty, where ρ is constructed as the moving average of the deviation of EER from its mean over the last twelve months:

$$\rho = [\frac{1}{12}\sum_{j=1}^{12}(EER_{t-j} - \overline{EER_t})^2]^{0.5} \tag{3}$$

Theoretically, the impact of exchange rate volatility on exports may be positive or negative depending on the assumption made with respect to risk preference (De Grauwe, 1988). For risk-averse exporters, higher exchange rate volatility increases the extent of uncertainty and thus negatively impacts exports. On the contrary, for those who are risk-loving, higher exchange rate volatility is often associated with higher exports. Moreover, when exports are considered as an option by exporters, exports may increase with exchange rate volatility (Boug and Fagereng, 2010). Since exporters may be able to reduce or hedge against exchange rate uncertainty, the linkage between exchange rate volatility and exports may be insignificant (Solakoglu, 2008).

FDI is another factor affecting exports. Whether or not FDI contributes to the export performance depends on the motive of FDI. Tariff-jumping FDI, which aims at

host market, may not help the host country to expand exports. Export-oriented FDI, on the other hand, uses host country as an export platform and may contribute to the exports of host countries. Since aggregate FDI is used, of which motivations cannot be identified, we have no prior expectation of the sign of FDI.

To see whether Taiwan has experienced a much deeper impacts as compared to other countries, the interaction of Taiwan dummy with the two crisis variables are included (i.e., *TW*Crisis2001* and *TW*Crisis2008*). Also, several square terms (2001*Crisis_SQ*, 2008*Crisis_SQ*, *TW*Crisis2001_SQ* and *TW*Crisis2008_SQ*) are added in the regressions to capture the V-shaped nature of the impacts.

We first run the long-run regression $EX_{it} = \phi_0 + \phi_1 Z_{it} + \varepsilon_{it}$ to derive the error correction term ($ERROR_{it-1} = EX_{it-1} - (\hat{\phi}_0 + \hat{\phi}_1 Z_{it-1})$), which is then used to run Regression (2). The definition and descriptive statistics of the variables are summarized in Table 4, while the Error Correction Model results for Regression (2) are reported in Table 5. Three regression results are provided: specification (1) reports the results for the full sample (the Group 11); specifications (2) and (3) summarize the results for Group A and Group B.

4.1 Results for the Full Sample

Table 5 shows that the world GDP and FDI inflows have positive effects, which conform to our expectation. The volatility of effective exchange rate, which has mixed results in the literature (De Grauwe, 1988), is shown to have positive impact on exports. The real effective exchange rate (EER) is insignificant in the full sample. The error correction term (*ERROR*) is negative and statistically significant, suggesting that there exists a long-run relationship between export performance (*EX*) and fundamental factors (*Z*), and that the gap between *EX* and those explained by *Z* can be closed through the error correction mechanism. The speed of the short-run correction (η) is -0.16, indicating, on average, about 16% of the gap is corrected in each month.

The negative signs of 2001*Crisis and 2008Crisis* but positive signs of their square terms show the remarkable V-shaped effects of two crises on exports, supporting Hypothesis 1 that exports had contracted excessively during the economic downturns such that shrinkage in world demand and changes in other fundamental factors were insufficient to explain the fluctuations in exports. The V-shaped pattern, however, is significantly deeper and narrower in the 2008 crisis than in the 2001 crisis

for the full sample. That is to say, exports contracted more rapidly but also rebounded more quickly in the 2008 crisis. The numbers of months it took for the economic crises to bottom out were 9.59 and 7.89 months for the 2001 crisis and 2008 crisis, respectively (see Table 9). This supports Hypothesis 2 as discussed in Section 2.

Table 5 also shows that Taiwan was badly hit by the two economic crises in the sense that the extent of export contraction is larger for Taiwan than for other countries, but its exports also bounced back more quickly than other countries, which is consistent with Hypothesis 4 discussed in Section 3. The numbers of months it took for Taiwan's exports to bottom out were 8.75 and 7.33 months for the 2001 crisis and the 2008 crisis, respectively.

4.2 Results for Group A and Group B

When the sample is divided into two groups, Group A and Group B, the results are somewhat different. World GDP has no significant impact on the exports of Group B, which tends to be of necessity in nature. The real effective exchange rate (EER), which is insignificant in the full sample, turns out to be negative for Group A but positive for Group B. This suggests that Group A may be more sensitive to price competition than Group B, and the depreciation of EER is effective in expanding the exports of Group A.

The adjustment speed (η) associated with the error correction term is also different across different industry groups; it is much faster for Group B (-0.37) than that for Group A (-0.16). This implies that Group B is more stable than Group A in its export trend, which is consistent with the fact that Group A is highly income elastic and tend to have large oscillations around the trend.

While the exports were hit harder for Group A than for Group B in the 2001 crisis, the opposite is true in the 2008 crisis. This may be due to the fact that the financial crisis was more widespread such that it affected almost every country in the world. But in both crises, Group A bottomed out more quickly than Group B. Comparing (2) and (3) in Table 6 shows that while Taiwan was hit harder than other countries for Group A in both crises, Taiwan is not significantly different from other countries for Group B.

For the robust check, we divide the full sample into two subsamples, the Asian

countries (Table 6) and the developed countries (Table 7)[6]. The results are qualitatively the same in terms of the signs of impact except *Crisis2001*. It shows that within the Asian countries, Taiwan's export contraction in 2001 crisis is no different from other Asian countries. The number of months it took for the export contraction to bottom out for these specifications is summarized in Table 9.

To see how demand from OECD and non-OECD countries affects the export performance of Group A and Group B, we use OECD GDP and non-OECD GDP in place of world GDP. The results for the Asian sample are reported in Table 8. It shows that the demands from OECD and non-OECD countries affect the export performance of each group in a different manner. For Group A whose output tends to be more sophisticated and highly income elastic, OECD demand has a positive impact on the export growth of Asian countries, while non-OECD demand has a negative impact. For Group B whose output tends to be more labor-intensive and of necessity in nature, the opposite is true; that is, non-OECD demand matters to the export performance of Group B. The results are consistent with the fact that developed countries tend to be big buyers of Group A's output while developing countries are the major consumers of Group B's.

5. Some Possible Explanations

Why did the export contraction significantly overshoot its long-run trend when an economic crisis occurred? Why did exports fall much deeper and yet bounce back much more quickly in the 2008 crisis than in the 2001 crisis? Why were Taiwan's exports so susceptible to economic crises and appearing more so in 2008 when compared to other countries? All these observations may very well be explained by the so called Forrester effect on demand variability, a phenomenon well known in the optimization of supply chain and inventory control systems.

Forrester effect suggests that demand variability increases as one moves up a supply chain. It is a feedback mechanism set forth by external shocks to the supply chain where small fluctuations in demand at the retailer end are dramatically amplified as they proceed up the chain. Such an effect may be caused by the demand forecast updating that reflects not only the need to replenish the stocks to meet the requirements for future demands but also the need for safety stocks which are

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[6] Developed countries are the U.S., EU and Japan, and the remaining eight are collected under the "Asian countries."

considered necessary because of the large demand uncertainty and fluctuation (Lee, et al., 1997). As a result, the readjustment of demand forecast by the upstream manager is often greater than the change of demand in the downstream. Similarly, periodic ordering (which makes suppliers face a highly erratic stream of orders), special sales promotion (which triggers irregular buying pattern of customers), and rationing (which occurs when demands exceed supply) may all distort demand information (Lee, et al., 1997). Inaccuracies and volatility of orders from the retailer to the primary suppliers therefore cause relatively greater readjustments at each point of the chain. Apparently, the amount of safety stock contributes significantly to the Forrester effect. As in the visual metaphor of cracking a bullwhip, demand in the chain fluctuates in a continuous and long lasting oscillatory movement upstream; therefore, it is also labeled the bullwhip effect.

To make things clear, consider a 10% drop in retail sales. In order to deplete the surplus stocks and reduce inventory given now there is a weaker sales outlook, orders placed by retailers to wholesalers one step upstream in the chain will thus decrease by more than 10%, say 15%. The decrease in demand amplifies and propagates through the chain as upstream firms react in much the same way as the downstream firms do, trying to adjust their stock level and empty the pipeline. Hence the longer the chain is, the more pronounced the upstream demand amplification (or the larger the oscillatory movement) will become. This will result in an even greater decrease, say 20%, in purchase orders to the suppliers further upstream in our example.

The "export overshooting" phenomenon as seen in the 2001 and 2008 crises, in essence, captures the bullwhip effect. While the world real GDP fell only mildly 1.77% and -2.14% in 2001 and 2009, exporting countries, constituting the upper stream end of the supply chain, had experienced a much greater fall in exports (-6.21% and -25.68%, respectively). Apparently, the overcorrection of the demand forecast by every entity of the supply chain was in deed the force at work that causes exports of the manufacturing goods to fall more than the decline in demand at the retailer end of the chain. When the economy recovered, the bullwhip effect also worked in much the same way but in the opposite direction; exports bounced back by a much larger extent than an increase in demand as every entity of the supply chain increased its safety stocks to meet unexpected increase in demand. This can be observed from the 2001 crisis. When the world demand recovered, even though world

GDP only grew slightly, from 1.77% in 2001 to 2.07% and 2.67% in 2002 and 2003, the exports of the eleven countries had already grown at an astonishing rate of 4.46% and 15.06%. In deed, the "export overshooting" phenomenon can therefore be regarded as the magnified version of the bullwhip effect at work, caused by the worldwide economic crises.

When production becomes more specialized vertically around the world, the length of a supply chain increases, so does the bullwhip effect (or the extent of overshooting). As discussed above, bullwhip effect causes modest changes at one end of the chain to be magnified with a fast-cascading impact when reaching the other end. This suggests that the longer the supply chain, the larger the demand swings for the upstream end of the supply chain. As the degree of cross-border vertical specialization increases over time, this helps explain why the overshooting phenomenon was more pronounced in the 2008 crisis than in the 2001 crisis. The findings from Vlasenko (2009) that firms' inventory levels were quickly deteriorating in the 2008 crisis at a faster speed than the average rate in the previous recessions also provide some evidence of overcorrection in the supply system. This in turn, we believe, causes the extent of overshooting (bullwhip effect) to increase in the 2008 crisis than in the 2001 crisis.

Compared with the other Asian countries, Taiwan's export sector is the most vulnerable to such debilitating effect; this is mostly due to the large outward direct investment and extensive export outsourcing practice taken up by the Taiwanese firms. Firms that receive international orders subcontract the downstream or labor-intensive assembly processes to overseas Taiwanese firms or a third country. That process enables Taiwanese firms to concentrate on the manufacture of the upstream intermediate inputs. Upstream component makers and suppliers now therefore make up a major part of Taiwan's export sector and therefore were at the upstream end of such amplification effects when the crisis hit.

In addition to the bullwhip effect, Taiwan's export performance is also highly influenced by the type of products it exports. More than 70% of the nation's exports are highly income elastic (Group A), and these products see greater sales volatility during times of economic upheaval. Demand quickly falls as consumers stop or delay purchases and consumption of such product group when they see a decline in their

real income. There is also a difference across industries with distinct features. Different from the other product groups, high income elastic products are more capital-intensive and have a rather sophisticated production process. This means that compared to labor-intensive product, the supply chain is relatively longer and the exports are therefore more susceptible to the bullwhip effect. A mixture of these factors, as we have seen, contributed to the fast decline in exports. As a consequence, Taiwan's exports were hit the hardest among the Asian NICs, both in terms of the timing and magnitude.

6. Concluding Remark

This paper provides some evidence of the "export overshooting" phenomenon, i.e., the unusual large deviation of exports from their long-run level. We show that export overshooting had occurred in the 2001 and 2008 economic crises. In fact, it prevailed in all of the eleven countries in our sample that represent different income groups: developed countries, Asian NICs, and emerging market countries. All of them had experienced an excessive fall in exports. Moreover, the extent of overshooting is shown to be more severe in Taiwan than in other countries. And it is also more severe in those industries with high income elasticity of demand.

We argue that the bullwhip effect was indeed the driving force behind the "export overshooting" phenomenon. Because of the overcorrection in demand forecast by every entity of the supply chain, exporting countries, which were at the upper stream end of the supply chain, faced a much greater demand oscillation than the demand in the retailer end. As a result, exports fell more than demand at the retail end; but when the economy recovered, exports also bounced back by a larger extent than a change in final demand. The export overshooting phenomenon discussed in this paper may therefore be regarded as a magnified version of the bullwhip effect in world exports, which were triggered by large negative aggregate demand shocks, resulting from the global economic crises.

As production becomes more vertically specialized across countries over time, the supply chain becomes longer accordingly. This helps explain why the extent of overshooting was greater in the 2008 crisis than in the 2001 crisis. And while vertical disintegration of production can also be used to explain the export overshooting phenomena of Taiwan, it alone is insufficient to explain why Taiwan was more

susceptible to economic crisis than other Asian countries. It is argued in this paper that the common practice of export outsourcing has caused Taiwan's production bases to shift towards the upstream end of the supply chain. Such structural shift exposes Taiwan further to the risks of rapid and large demand variability. Moreover, as Taiwan geared toward more high-tech export manufacturing activities for which demand is highly income elastic, its sensitivity to demand shocks and business cycles also increased.

References

Authukorala, P.C. and Kohpaiboon, A. (2009) Intra-Regional Trade in East Asia: The Decoupling Fallacy, Crisis, and Policy Challenges. ADBI Working Paper Series No. 177.

Balassa, B. (1990) Incentive Policies and Export Performance in Sub-Saharan Africa. *World Development,* 18(3), 383-391.

Bhaskaran, M. and Ghosh, R. (2010) Global Economic and Financial Crisis Impact on Developing Asia and Immediate Policy Implications. ADB Regional Forum.

Boug, P. and Fagereng, A. (2010) Exchange Rate Volatility and Export Performance: A Cointegrated VAR Approach. *Applied Economics,* 42(7), 851-864.

De Grauwe, P. (1988) Exchange Rate Volatility and the Slowdown in Growth of International Trade. IMF Staff Papers No. 35, 63-84.

Hu, S.C. (2009) Global Financial Crisis: Lessons for Taiwan. Memo.

Grobar, L.M. (1993) The Effect of Real Exchange Rate Uncertainty on LDC Manufactured Exports. *Journal of Development Economics,* 41, 367-376.

Kutan, A. M and Goran, V. (2007) Foreign Direct Investment and Export Performance: Empirical Evidence, Comparative Economic Studies.

Klau, M. and Fung, S.S. (2006) The New BIS Effective Exchange Rate Indices. *BIS Quarterly Review*, 51-65.

Lin, J. Y. (2008) The Impact of Financial Crisis on Developing Countries. World Bank.

Liu, B.J., Lu, A. and Tung, A.C. (2007) Export Outsourcing: Cost Disadvantage and Reputation Advantage. In Yotopoulos, P.A.and Romano, D. (eds.), *The Asymmetries of Globalization*, London: Routledge, 108-125.

Liu, B.J. and Lu, A. (2007) The Economic Impact of Export Outsourcing and Policy Implication. Research Report, Council for Economic Planning and Development, Executive Yuan, R.O.C. (Taiwan).

Sapir, A. and Sekkat, Kh. (1995) Exchange Rate Regimes and Trade Prices: Does the EMS matter? *Journal of International Economics,* 30, 75-95.

Zhang, K. H. and Song, S. (2000) Promoting Exports: The Role of Inward FDI in China. *China Economic Review*, 11, 385-396.

Solakoglu, M.N., Solakoglu, E.G. and Demirag, T. (2008) Exchange Rate Volatility and Exports: A Firm-level Analysis. *Applied Economics*, 40, 921-929.

Sun, M. (2009) China: Unscathed through the Global Financial Tsunami. *China & World Economy,* 17(6), 24-42.

Valliere, D. and Peterson R. (2004) Inflating the Bubble: Examining Dot-Com Investor Behavior. *Venture Capital,*6(1), 1-22.

Vlasenko, P. (2009) Have Firms Become Better Equipped to Handle Recession? American Institute for Economic Research. http://www.aier.org/research/briefs/1366-have-firms-become-better-equipped-to-handle-recessions

Table 1:   2000-2009 Growth Rates of GDP for OECD, Non-OECD, and World; %

Year	OECD	Non-OECD	World
2000	4.02	5.69	4.30
2001	1.32	3.74	1.77
2002	1.58	4.15	2.07
2003	1.90	5.86	2.67
2004	3.05	7.62	3.97
2005	2.59	7.09	3.53
2006	2.96	7.92	4.03
2007	2.64	8.26	3.89
2008	0.42	5.96	1.71
2009	-3.41	1.84	-2.14

Source: Global Insight. Annual growth rates were calculated using the quarterly real GDP series.

Table 2: 2000-2009 Growth Rates of Exports By Country; %

Year	Whole Sample	TWN	CHN	USA	SGP	MAS
2001	-6.21	-16.87	6.89	-6.58	-11.65	-10.14
2002	4.46	7.13	22.24	-4.94	2.85	5.86
2003	15.06	11.29	34.65	4.57	27.93	7.22
2004	21.34	21.10	35.39	12.43	24.15	26.50
2005	12.73	8.81	28.41	10.58	15.54	11.83
2006	15.14	12.89	27.15	13.86	18.39	13.56
2007	15.76	10.12	25.67	11.91	10.11	9.62
2008	12.82	3.63	17.30	12.13	12.94	13.30
*2009	-25.68	-24.10	-18.70	-20.12	-26.22	-29.52

Year	EU	THA	KOR	IDN	PHL	JPN
2001	1.42	-5.28	-12.67	-9.34	-15.57	-15.83
2002	6.56	5.68	8.00	1.49	9.13	3.45
2003	16.73	17.00	19.29	6.82	2.78	13.12
2004	20.16	20.99	30.97	17.24	9.78	19.98
2005	10.20	13.13	12.04	19.66	3.59	5.14
2006	11.61	18.91	14.43	17.67	14.70	8.60
2007	16.83	24.88	14.14	13.20	6.88	10.47
2008	12.88	9.03	13.60	20.09	-2.48	9.50
*2009	-22.76	-17.36	-17.06	-22.01	-26.91	-28.61

*Up to the 3rd quarter of 2009.

Source: World Atlas. Statistics were constructed using the monthly merchandise trade series.

Table 3: Variation in Timing and Duration of Impacts across Countries

	TWN		USA		EU		JPN		SGP		KOR	
The first recorded negative growth rate after crisis	Sep-2008	-1.64%	Nov-2008	-4.76%	Oct-2008	-3.73%	Nov-2008	-16.11%	Oct-2008	-5.19%	Nov-2008	-19.45%
Bottom out	Jan-2009	-44.11%	Apr-2009	-26.33%	Apr-2009	-35.76%	Mar-2009	-43.92%	Jan-2009	-40.38%	Jan-2009	-34.53%
The first recorded positive growth rate after bottoming out	Nov-2009	19.35%	n.a.	n.a.	Nov-2009	14.35%	Nov-2009	1.83%	n.a.	n.a.	Nov-2009	18.14%
Compound Growth Rate, 2000~2008	6.72%		6.46%		11.90%		6.32%		11.88%		11.85%	

	CHN		MYS		THA		IDN		PHL		VNM	
The first recorded negative growth rate after crisis	Nov-2008	-2.24%	Oct-2008	-6.73%	Oct-2008	-4.19%	Nov-2008	-1.81%	Oct-2008	-14.57%	Nov-2008	-7.23%
Bottom out	May-2009	-26.34%	May-2009	-35.89%	Jan-2009	-34.44%	Jan-2009	-34.95%	Jan-2009	-40.64%	Jul-2009	-28.21%
The first recorded positive growth rate after bottoming out	n.a.	n.a.	n.a.	n.a.	Nov-2009	19.53%	Oct-2009	13.46%	n.a.	n.a.	n.a.	n.a.
Compound Growth Rate, 2000~2008	24.39%		9.29%		12.66%		10.39%		3.21%		19.77%	

Source: Calculated using the monthly merchandize trade series from World Atlas.

Table 4:   Variable Statistics and Definition--Full Sample

Variables	Definition	Mean	Standard Deviation
EX	Monthly exports, in log	9.90	1.08
EX_A	Monthly exports for Group A, in log; including chemical, metals, electronics, machinery, electrical equipment, ICT (information, communications and technology), transportation, and precision instruments	9.41	1.20
EX_B	Monthly exports for Group B, in log; including textiles, apparel, plywood product, paper, furniture, rubbers and plastics, metal products, nonmetal products, basic metal, printing, chemical materials, chemical products, and petroleum	8.77	1.11
GDP_world	World GDP, quarterly, in log	10.70	0.08
GDP_oecd	OECD GDP, quarterly, in log	10.46	0.06
GDP_xoecd	Non-OECD GDP, quarterly, in log	9.16	0.18
ρ	Volatility of effective exchange rate, in log	-3.47	0.58
EER	Effective exchange rate, in log	4.62	0.10
FDI	Cumulative inward direct investment (10^6 billions)	0.068	0.147
Crisis2001	$=i$, if the ith month of 2001; $= 12+j$, if the jth month of 2002, j=1, 2…, 6; =0 otherwise	1.54	4.08
Crisis2001_SQ	Square term of Crisis2001	18.97	59.43
Crisis2008	=1, if 9/2008; =2, if 10/2008; =3, if 11/2008; =4, if 12/2008;=4+i, if the ith month of 2009; =0, otherwise	1.11	3.17
Crisis2008_SQ	Square term of Crisis2008	11.25	37.70
TW*Crisis2001	Cross term of Taiwan dummy and Crisis2001	0.15	1.37
TW*Crisis2001_SQ	Square term of TW*Crisis2001	1.90	19.64
TW*Crisis2008	Cross term of Taiwan dummy and Crisis2008	0.11	1.05
TW*Crisis200_SQ	Square term of TW*Crisis2008	1.12	12.62

Table 5:   Error Correction Model

| Dependent variable: | Full Sample | | Group A | | Group B | |
| Δ EX | (1) | | (2) | | (3) | |
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
ERROR Correction	-0.16	(0.01)***	-0.16	(0.01)***	-0.37	(0.02)***
Δ GDP_World	1.18	(0.35)***	2.04	(0.48)***	-0.13	(0.57)
Δ EER_volatility/100	0.78	(0.37)**	0.17	(0.50)	0.02	(0.61)***
Δ EER	0.006	(0.03)	-0.08	(0.04)**	0.24	(0.05)***
Δ FDI	0.12	(0.04)***	0.06	(0.05)	0.20	(0.06)***
Crisis2001	-0.05	(0.003)***	-0.05	(0.004)***	-0.04	(0.004)***
Crisis2001_SQ/100	0.28	(0.02)***	0.30	(0.02)***	0.20	(0.03)***
Crisis2008	-0.10	(0.007)***	-0.09	(0.009)***	-0.12	(0.01)***
Crisis2008_SQ/100	0.67	(0.04)***	0.57	(0.06)***	0.76	(0.07)***
TW*Crisis2001	-0.02	(0.01)**	-0.02	(0.01)**	-0.0001	(0.01)
TW*Crisis2001_SQ/100	0.12	(0.05)**	0.13	(0.06)**	0.03	(0.08)
TW*Crisis2008	-0.03	(0.01)***	-0.05	(0.01)***	-0.01	(0.01)
TW*Crisis2008_SQ/100	0.29	(0.07)***	0.37	(0.10)***	0.07	(0.12)
constant	0.11	(0.01)***	0.07	(0.02)***	-0.16	(0.02)***
R-Square: Within	0.8178		0.7007		0.6624	
R-Square: Between	0.0850		0.0662		0.0008	
R-Square: Overall	0.2900		0.1916		0.0969	
No. of Observations	1172		1172		1172	
No. of Countries	11		11		11	

Table 6:　Error Correction Model-- Asian Countries

	Full Sample (1)		Group A (2)		Group B (3)	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
ERROR Correction	-0.19	(0.02)***	-0.18	(0.02)***	-0.42	(0.03)***
Δ GDP_World	1.81	(0.43)***	3.00	(0.61)***	-0.39	(0.75)
Δ EER_volatility	0.01	(0.005)**	0.01	(0.01)	0.01	(0.01)
Δ EER	-0.13	(0.04)***	-0.27	(0.06)***	0.21	(0.07)***
Δ FDI	-0.17	(0.39)	-0.90	(0.56)	0.12	(0.66)*
Crisis2001	-0.06	(0.003)***	-0.06	(0.004)***	-0.05	(0.01)***
Crisis2001_SQ/100	0.31	(0.02)***	0.34	(0.03)***	0.20	(0.04)***
Crisis2008	-0.10	(0.01)***	-0.07	(0.01)***	-0.12	(0.01)***
Crisis2008_SQ/100	0.63	(0.05)***	0.54	(0.08)***	0.76	(0.10)***
TW*Crisis2001	-0.01	(0.01)	-0.01	(0.01)	0.006	(0.01)
TW*Crisis2001_SQ/100	0.07	(0.05)	0.06	(0.07)	0.004	(0.09)
TW*Crisis2008	-0.03	(0.01)***	-0.04	(0.01)***	-0.02	(0.02)
TW*Crisis2008_SQ/100	0.26	(0.08)***	0.31	(0.11)***	0.14	(0.14)
constant	0.10	(0.04)**	0.54	(0.02)***	0.18	(0.03)***
R-Square: Within	0.8170		0.6843		0.6451	
R-Square: Between	0.6003		0.3309		0.0482	
R-Square: Overall	0.3014		0.1879		0.1295	
No. of Observations	851		851		851	
No. of Countries	8		8		8	

Table 7:   Error Correction Model-- Developed Countries

	Full Sample (1)		Group A (2)		Group B (3)	
	Coeff.	Standard Error	Coeff.	Standard Error	Coeff.	Standard Error
ERROR Correction	-0.20	(0.04)***	-0.22	(0.04)***	-0.27	(0.04)***
Δ GDP_World	1.08	(0.55)**	1.69	(0.59)***	0.74	(0.53)
Δ EER_volatility/100	0.34	(0.54)	-0.64	(0.58)	0.03	(0.52)***
Δ EER	0.38	(0.06)***	0.43	(0.06)***	0.30	(0.05)***
Δ FDI	0.14	(0.03)***	0.09	(0.034)***	0.19	(0.03)***
Crisis2001	-0.04	(0.004)***	-0.04	(0.005)***	-0.04	(0.004)***
Crisis2001_SQ/100	0.22	(0.03)***	0.20	(0.03)***	0.18	(0.03)***
Crisis2008	-0.11	(0.01)***	-0.10	(0.01)***	-0.12	(0.01)***
Crisis2008_SQ/100	0.70	(0.07)***	0.62	(0.07)***	0.77	(0.06)***
constant	0.09	(0.02)***	0.06	(0.02)***	0.36	(0.04)***
R-Square: Within	0.8606		0.8480		0.8499	
R-Square: Between	0.8004		0.3639		0.3543	
R-Square: Overall	0.6576		0.7850		0.7848	
No. of Observations	321		321		321	
No. of Countries	3		3		3	

Table 8:   Error Correction Model-- Asian Countries

	Group A (1)		Group B (2)	
	Coeff.	Standard Error	Coeff.	Standard Error
ERROR Correction	-0.178	(0.02)***	-0.41	(0.03)***
Δ GDP_oecd	5.03	(0.77)***	-6.47	(0.93)***
Δ GDP_xoecd	-1.36	(0.49)***	4.17	(0.59)***
Δ EER_volatility/100	1.22	(0.68)*	0.70	(0.82)
Δ EER	-0.27	(0.06)***	0.17	(0.07)***
Δ FDI	-0.97	(0.56)*	0.69	(0.646)
Crisis2001	-0.06	(0.005)***	-0.03	(0.01)***
Crisis2001_SQ/100	0.36	(0.03)***	0.13	(0.03)***
Crisis2008	-0.06	(0.01)***	-0.17	(0.01)***
Crisis2008_SQ/100	0.45	(0.08)***	1.06	(0.10)***
TW*Crisis2001	-0.01	(0.01)	0.006	(0.01)
TW*Crisis2001_SQ/100	0.06	(0.07)	0.007	(0.09)
TW*Crisis2008	-0.04	(0.01)***	-0.02	(0.02)
TW*Crisis2008_SQ/100	0.31	(0.11)***	0.14	(0.14)
constant	0.12	(0.03)***	0.03	(0.03)
R-Square: Within	0.6862		0.6711	
R-Square: Between	0.2963		0.0484	
R-Square: Overall	0.2259		0.1420	
No. of Observations	851		851	
No. of Countries	8		8	

Table 9:   Number of Months to Bottom Out

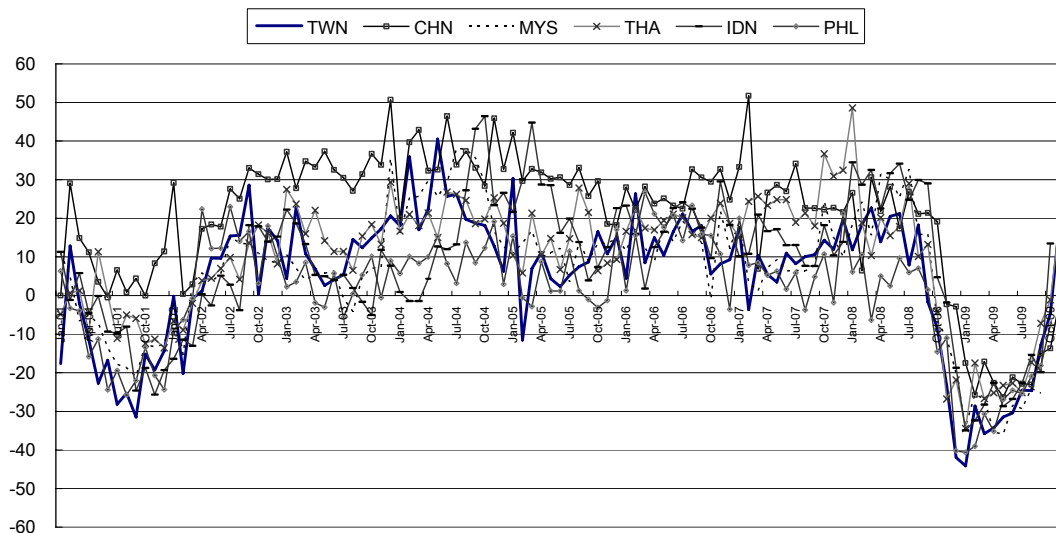|	Full Sample	Group A	Group B
Full Sample			
Crisis2001	9.59	9.14	11.15
Crisis2008	7.89	7.68	7.96
TW*2001Crisis	8.75	8.49	-
TW* Crisis2008	7.33	7.10	-
Asian Countries			
Crisis2001	9.34	8.73	11.63
Crisis2008	7.71	7.24	8.11
TW*2001Crisis	9.34	-	-
TW* Crisis2008	7.71	7.13	-
Developed Countries			
Crisis2001	10.06	10.19	10.14
Crisis2008	7.97	8.01	7.79

Note: Asian Sample includes China, Indonesia, Korea, Malaysia, Philippines, Singapore, Thailand, and Taiwan.

Figure 1: Export Growth 2000-2009, %
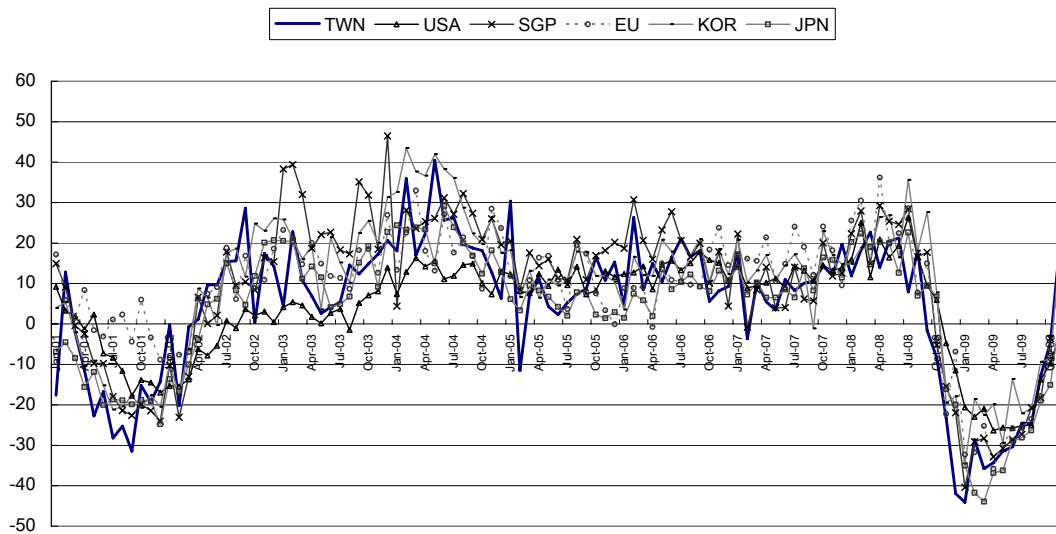
Source: World Trade Atlas

Figure 2: Export Growth 2000-2009, %

Source: World Trade Atlas