

Special Feature B

Is China a Sustainable Source of Demand for East Asia?¹

Introduction

Previous issues of the *Review* have carried special features examining the importance of final demand in advanced developed countries to Asian economies. In the October 2007 issue, the US-Asia decoupling hypothesis was tested using a variety of statistical techniques. While little evidence of structural decoupling was found, it was shown that the two regions could nevertheless experience weaker synchronicity in the short run. A further study in October 2009 arrived at a similar conclusion that the real export growth of Asian economies was still strongly hinged to OECD final demand but indirectly through a complex pattern of cross-border production networks. The sharp decline in trade following Lehman Brothers' collapse in late 2008, in particular, could be mostly attributed to the synchronous and severe contraction of economic activity in the developed countries.²

Asia's dependence on the G3 economies, however, appears to have weakened amidst the recent global financial crisis. The region rebounded strongly even as private consumption and investment growth in the G3 was restrained by the deleveraging process undertaken by households and firms. At the same time, domestic demand in China and other parts of Asia remained robust throughout the crisis period.

The question thus arises as to whether export-driven economies in this region are beginning to diversify their sources of growth, depending less on the G3 and more on China. Trade data for the last two years appear to offer empirical support for such a view, since the region's exports to China recovered much faster than those to the G3. However, analysis of this issue is complicated by the widespread presence of cross-border production networks in Asia and the dual role played by China, both as an assembly base and as a consumer of final products.

This Special Feature uses a pooled regression to ascertain whether China has emerged as an important source of final demand for East Asia (EA-8).³ Given China's dual role as an assembly base and a source of demand, the study focuses on explaining East Asia's real exports of machinery parts and components to the world. The choice of dependent variable was also motivated by the fact that trade flows in Asian countries are heavily influenced by production networks, most of which are located in Asia itself. This modelling framework yields estimates of the differential impact on Asian exports of the Chinese market vis-à-vis the G3, thus allowing counter-factual simulations to quantify the buffer provided by China's stimulus measures to Asian economies during the recovery from the global financial crisis.

¹ This Special Feature was written in consultation with Assistant Professor Davin Chor from the School of Economics, Singapore Management University.

² See also Pula and Peltonen (2009), Athukorala (2010), IMF (2010), Kalra (2010) and Kuroiwa and Kuwamori (2010) for evidence on the continued importance of the developed economies as key sources of final demand for East Asian exports, notwithstanding a secular rise in intra-Asian trade flows.

³ The EA-8 consists of Hong Kong, Indonesia, Malaysia, the Philippines, Singapore, South Korea, Taiwan, and Thailand.

Cross-Border Production Networks and Final Demand

The Role of Cross-Border Production Networks

Over the past decade, trade linkages in East Asia have strengthened significantly alongside the emergence of China as a global manufacturing base. Intra-Asian trade flows expanded at an average annual rate of 13% over the period 2000-09, outpacing world export growth of 8.9% during the same period. The integration of regional trade is most clearly manifested in the rise of cross-border production networks for parts and components used in machinery and transport equipment. In this international form of vertical specialisation, a component is manufactured in one country before being exported to another for testing or assembly, using components imported from yet other countries. The finished product is then transported to the final source of demand, which may reside in countries not involved in the original production chain.

To investigate the determinants of EA-8 exports of machinery parts and components to the world, export data for each country is compiled using the detailed Harmonised System (HS) codes published by Ando and Kimura (2005).⁴ These exports account for about a quarter of total regional trade and are dominated by electronic components and accessories. Notably, the average share of electronics in exports of machinery parts and components ranges from 57% in the case of Thailand to 83% for Malaysia. With regard to the destination, about 45% of such exports were bound for Asia in the early 2000s, while the G3 accounted for another 45%. Over the last few years, however, the share of Asia has risen to almost 60% along with the rapid expansion of

cross-border production networks in the region. In comparison, the share of the G3 has shrunk to less than a quarter.

Ultimately, intermediate inputs into machinery and transport equipment are driven by end-user demand around the world. The analysis here restricts attention to final demand in the Chinese and G3 markets, which are the four largest economies in the world. Retail sales are used as a proxy for private consumption demand, while investment demand is represented by gross fixed capital formation in the G3 and fixed asset investment in the case of China.⁵ Final goods demand is then defined as the sum of consumption and investment expenditures in real terms.

Evolution of EA-8 Exports and Final Demand

EA-8 exports of intermediate parts and components have grown steadily over the past decade except for two large dips during the 2001 IT Downturn and the recent global financial crisis. (Chart 1) The rapid expansion prior to the collapse in 2008 was underpinned by strong G3 final goods demand. When the crisis struck in 2008, G3 demand fell sharply from its peak in 2007 as consumer and business confidence plummeted. The decline was quickly transmitted to the export-dependent economies in Asia and its effects amplified by the proliferation of cross-border production networks in the Asian region, leading to large contractions in the electronics trade and intra-regional exports.⁶

⁴ Machinery and equipment is made up of products in codes HS84 to HS92, comprising general machinery, electric machinery, transport equipment and precision machinery. Parts and components of machinery and equipment are compiled from a list of nearly 150 product categories at the HS 6-digit level. The data is sourced from the Global Trade Atlas. Total exports of such components are used except for Singapore and Hong Kong, where domestic exports are used instead. The export data for the eight economies is denominated in local currency and deflated by export price indices, with the exception of Indonesia and the Philippines, where the producer price index is used.

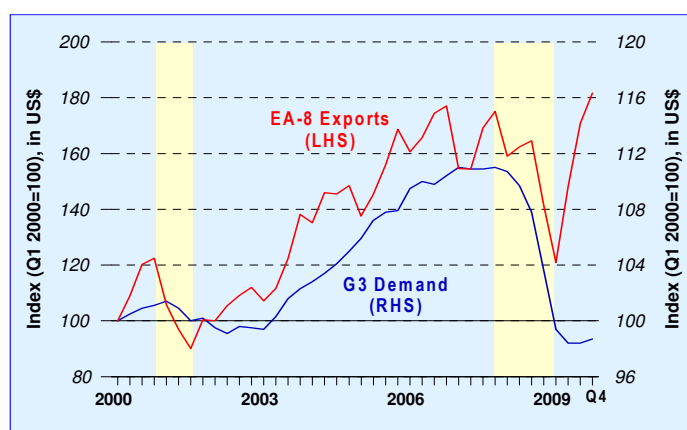
⁵ National income statistics for China are not available on a quarterly basis.

⁶ See Box A in the April 2009 issue of the *Review*.

In contrast to the cutbacks in the G3, strong income growth and a burgeoning consumer market in China – especially in electronic and electrical products – supported the rapid expansion of demand, which strengthened further during the crisis due to the large fiscal stimulus package implemented by the Chinese government. In particular, fixed asset investment surged as the Chinese authorities accelerated the pace of industrialisation and infrastructure building to contain the fall-out from the global downturn on the Chinese economy. (Chart 2)

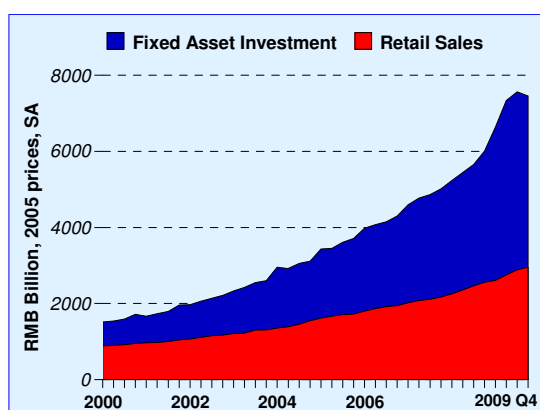
Against this backdrop, East Asia's exports have rebounded decisively since Q2 2009, providing tentative evidence of China's growing role as a source of final demand for the region. In terms of relative importance, China's share of total final goods demand had nearly quadrupled from 6% in 2000 to 23% by 2009, exceeding that of Japan. (Chart 3) Conversely, the share of the US had declined from 44% to 35%.

Chart 1
EA-8 Exports of Machinery Parts and Components
and G3 Final Demand



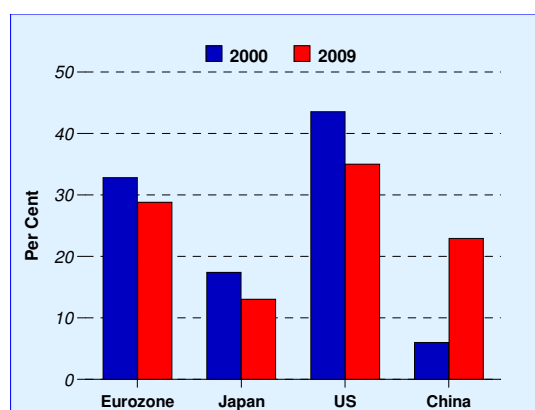
Source: EPG, MAS estimates

Chart 2
Final Demand in China



Source: EPG, MAS estimates

Chart 3
Shares of Total Final Demand*



Source: CEIC and EPG, MAS estimates

* Calculated as shares of combined Chinese and G3 total final demand.

Econometric Methodology

In order to analyse the contribution of China's final demand to East Asia's exports of intermediate goods vis-à-vis that of the G3, it is initially assumed that the respective impact is the same for all EA-8 countries and time periods. (This assumption is investigated further below through rolling regressions.) Hence, a pooled regression is used to explain total exports of machinery parts and components (EX_{it}) of each country i over the period Q1 2000 to Q4 2009.

The key explanatory variables in the regression equation are final goods demand in China and the G3 ($FD_{China,t}$, $FD_{G3,t}$), the price competitiveness of country i as represented by the real effective exchange rate ($REER_{it}$), trade openness ($Open_{it}$) and the size of real GDP (GDP_{it}).⁷ The equation can be expressed as:

$$\begin{aligned} \ln(EX_{it}) = & \beta_1 \ln(FD_{China,t}) + \beta_2 \ln(FD_{G3,t}) \\ & + \beta_3 \ln(REER_{it}) + \beta_4 \ln(Open_{it}) \\ & + \beta_5 \ln(GDP_{it}) + \sum_j (\beta_j seasonal_j) \\ & + \alpha_i Country_{trend} \\ & + \gamma_i Country_{intercept} + \varepsilon_{it} \end{aligned} \quad (1)$$

The trade openness and real GDP variables are included to reflect known factors that may influence the volume of a country's exports. Other unobserved country idiosyncratic effects are subsumed under the country-specific intercepts and linear time trends ($Country_{trend}$, $Country_{intercept}$). To deal with seasonality, a set of quarterly seasonal dummy variables ($seasonal_j$) is also added to the regression.

The relative importance of China and G3 final demand can be indirectly inferred from ordinary least squares estimates of β_1 and β_2 . These parameters are akin to the income elasticities commonly estimated in standard export demand equations.

The estimated coefficient for β_3 is analogous to the price elasticity and it provides an indication of the average sensitivity of Asian exports to the real exchange rate.⁸

Equation (1) is also estimated using a rolling time window to assess how the relative importance of China and G3 final demand has evolved over the past decade, as well as to check on parameter stability. Furthermore, interaction dummies are included to compare the impact of China versus G3 final demand prior to, and during the latest crisis. Accordingly, equation (1) is re-specified as:

$$\begin{aligned} \ln(EX_{it}) = & \beta_0 Crisis + \beta_1 \ln(FD_{China,t}) \\ & + \beta_{11} [Crisis * \ln(FD_{China,t})] \\ & + \beta_2 \ln(FD_{G3,t}) \\ & + \beta_{21} [Crisis * \ln(FD_{G3,t})] \\ & + \beta_3 \ln(REER_{it}) + \beta_4 \ln(Open_{it}) \\ & + \beta_5 \ln(GDP_{it}) + \sum_j (\beta_j seasonal_j) \\ & + \alpha_i Country_{trend} \\ & + \gamma_i Country_{intercept} + \varepsilon_{it} \end{aligned} \quad (2)$$

where the variable $Crisis$ is a time dummy, which takes the value of 1 for the crisis period from Q4 2008 to Q4 2009, and is zero otherwise. In addition to signalling the onset of the sharp decline in trade, the $Crisis$ variable is intended to capture the implementation of the exceptional stimulus by the Chinese authorities to mitigate the impact of the financial crisis on the domestic economy. The coefficients of the interaction terms, β_{11} and β_{21} , thus indicate whether there were significant changes in the final demand elasticities during the crisis period.

⁷ Trade openness is defined as the ratio of total nominal trade to nominal GDP. Data for all the explanatory variables is sourced from CEIC except for the REER series, which is from the IMF.

⁸ Tests of statistical significance on the regression estimates are performed using robust standard errors that take explicit account of potential heteroskedasticity and cross-sectional correlation in the disturbance term.

Results and Inferences

Pooled Estimates

The full sample results for the pooled regression (1) show that the estimated coefficients for final demand are of the right sign and are highly significant. (Table 1) With regard to their magnitudes, a 1% increase in G3 final goods demand is associated with a 1.7% increase in EA-8 exports of machinery parts and components. In comparison, a 1% increase in China's demand raises exports by only 1.4%. The country-specific control variables, such as real GDP and trade openness are also highly significant and of the correct signs.⁹ However, the export elasticity with respect to the real exchange rate is statistically insignificant, indicating that intermediate goods are not sensitive to relative price changes, probably because they contain a high proportion of imported inputs.

Although the results seem to suggest that final demand in China and the G3 economies have a roughly similar impact on regional exports of intermediate goods, it is crucial to note that the estimated elasticity for China could be overstated due to the introduction of stimulus measures by the Chinese authorities during the global recession.¹⁰ Moreover, the relative importance of Chinese final demand compared to the G3 is likely to have evolved over a period of time as trade patterns shifted and economic structures changed.

This issue of parameter instability is further investigated through rolling regressions of equation (1). Chart 4 shows the rolling estimates for China and G3 demand elasticities, β_1 and β_2 respectively, using a 20-quarter fixed window.

Table 1
Regression Results for Equation (1)
Q1 2000 to Q4 2009

Dependent Variable: $\ln(EX_{it})$		
Key Explanatory Variable	Coefficient	Standard Error [^]
$\ln(FD_{G3})$	1.69**	0.44
$\ln(FD_{China})$	1.43**	0.42
$\ln(Open_i)$	0.71**	0.23
$\ln(GDP_i)$	0.91**	0.18
$\ln(REER_i)$	-0.67	0.52
Diagnostics		
R-squared	0.998	
No. of observations	320	
Standard error of regression	0.128	

Source: EPG, MAS estimates

[^] White heteroskedasticity-consistent standard error.

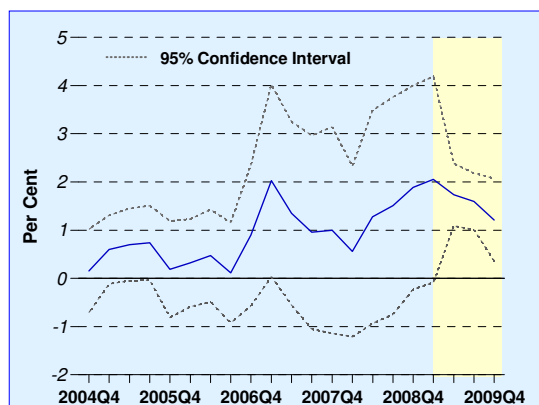
** Significant at the 1% level.

⁹ A potential problem of reverse causality could arise from the use of GDP as a regressor, leading to biased estimates for the regression parameters. However, this is less likely in this instance, given that the dependent variable is exports of a particular group of products, rather than the total exports of a country. Moreover, including lagged GDP (by one period) does not change the results materially.

¹⁰ Conversely, the G3 elasticity would have been higher had it not been for the sharp contraction in G3 final demand during this period.

Chart 4
Rolling Regression Estimates for β_1 and β_2

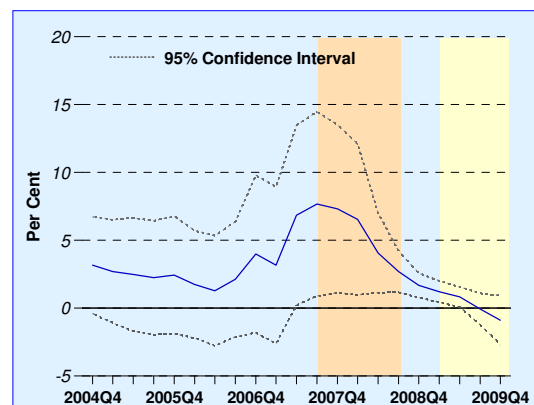
(a) China Final Goods Demand (β_1)



Source: EPG, MAS estimates

Note: Each observation in the chart corresponds to the end-point of a 20-quarter rolling regression.

(b) G3 Final Goods Demand (β_2)



Source: EPG, MAS estimates

Note: Each observation in the chart corresponds to the end-point of a 20-quarter rolling regression.

Two key findings emerge from the rolling regression results. First, there was a discernible pickup in China's final demand elasticity prior to the crisis, even though the 95% confidence interval showed that β_1 was not significant yet. A tentative interpretation for this result is that Chinese domestic demand has been emerging gradually as a source of growth for East Asia during the past decade. Nevertheless, the impact on exports of machinery parts and components is fairly modest compared to G3 final demand, which was boosted by credit-induced booms in the developed world over the period Q4 2006 to Q3 2007.

Second, the Chinese impact became statistically significant during the financial crisis after β_1 reached a maximum value of two in late 2008. In comparison, the sensitivity of EA-8 exports to G3 demand fell considerably and turned insignificant. This switching of roles reflects the part played by China as a pivotal source of support during the global recession, which partially offset the pullback in G3 final demand. The decline in the G3 countries itself might also be viewed as a reversion to the historical norm following the bursting of the credit bubble.

Taken together, the results from the rolling regressions suggest a possible structural break in the final demand parameters some time prior to the global financial crisis. Accordingly, the Quandt-Andrews test for parameter stability with an unknown breakpoint yields a t-statistic of 11.26 at Q1 2005, firmly rejecting the null hypothesis of parameter stability at the 1% level. This in turn suggests a break in the parameters in Q1 2005.¹¹

The break date coincided with the decision taken by the Chinese authorities in December 2004 to rebalance the sources of economic growth by expanding domestic consumption, followed by reforms to the exchange rate regime in Q3 2005. However, it is important not to infer too much from the exact location of the break, given that the test could also detect gradual evolution of the regression parameters. Indeed, these results are consistent with the time-varying coefficients of the rolling regressions.

¹¹ The test considers the value of the largest F-statistic from a sequence of Chow structural change tests on possible break dates in the central 70% of the sample. Critical values are from Andrews (1993).

Crisis Effects

Table 2 reports the results of the augmented specification in equation (2). The findings confirm the earlier observation that there could be a significant difference in the final demand elasticity for China prior to, and during, the crisis years. Specifically, a 1% increase in demand is only associated with an increase of 0.9% in EA-8 exports pre-crisis but during the crisis, the leverage provided by Chinese demand strengthened significantly due to the implementation of the stimulus measures. The additional impact is estimated to be 0.7%, as captured by the interaction dummy $Crisis * \ln(FD_{China,t})$. This brings the overall impact of a 1% increase in China's final goods demand to 1.6% during the crisis period.

In comparison, there is no discernable change in the G3 final demand elasticity during the downturn, given that the variable $Crisis * \ln(FD_{G3,t})$ is not statistically significant.

Instead, a 1% increase in G3 demand is now estimated to have led to an increase of 2.3% in EA-8 exports during the pre-crisis period when accounting for the financial crisis. (Chart 5) Nevertheless, the estimate of the interaction term with G3 demand indicates a moderation in impact with the onset of the crisis.

The results thus confirm that G3 demand has been a more important source of growth than Chinese final demand for EA-8 exports prior to the trade collapse in 2008, as inferred from a much larger elasticity compared to China. This also corroborates earlier findings in the literature on the importance of extra-regional markets for Asian exports. During the financial crisis itself, however, there has been greater synchronisation between China's final demand and EA-8 exports, probably due to heavy pump-priming carried out by the Chinese authorities.

Table 2
Regression Results for Equation (2): Q1 2000 to Q4 2009

Dependent Variable: $\ln(EX_{it})$		
Key Explanatory Variable	Coefficient	Standard Error [^]
$\ln(FD_{G3})$	2.29*	1.08
$Crisis * \ln(FD_{G3})$	-0.67	1.28
$\ln(FD_{China})$	0.87**	0.20
$Crisis * \ln(FD_{China})$	0.71*	0.33
$Crisis$	-0.89	12.2
$\ln(Open_i)$	0.67**	0.23
$\ln(GDP_i)$	0.82**	0.18
$\ln(REER_i)$	-0.72	0.53
Diagnostics		
R-squared	0.998	
No. of observations	320	
Standard error of regression	0.128	

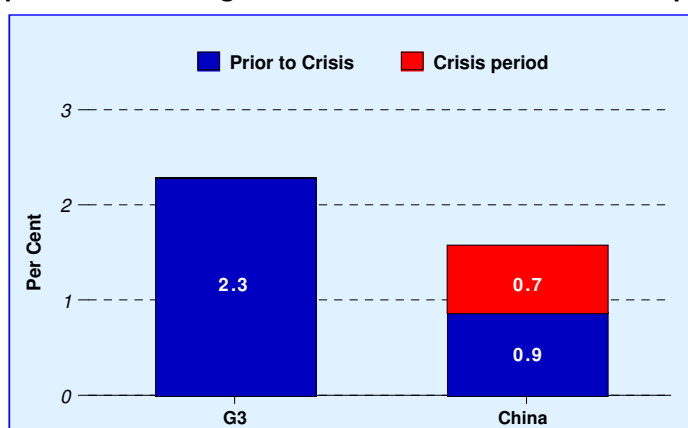
Source: EPG, MAS estimates

[^] White heteroskedasticity-consistent standard error.

* Significant at the 5% level.

** Significant at the 1% level.

Chart 5
Impact of a 1% Change in Final Goods Demand on EA-8 Exports



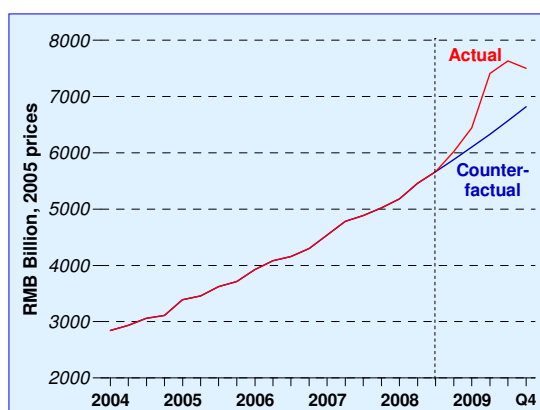
Source: EPG, MAS estimates

Simulation

Using equation (2), a counterfactual simulation is performed to quantify the support provided by China to EA-8 exports of machinery parts and components during the global financial crisis. Under the baseline scenario, the model is simulated using actual values of the explanatory variables. The predicted path of EA-8 exports is then compared with the trajectory generated under a counterfactual scenario, where China's demand is assumed to grow during the crisis at its average historical rate, i.e. in the absence of the government stimulus. (Chart 6)

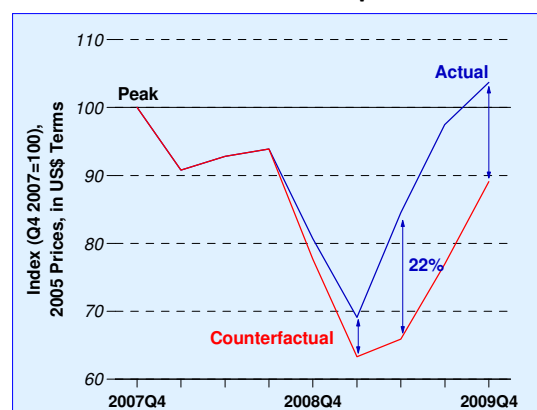
The impact of the stimulus package is then estimated as the percentage deviation of predicted exports under the counterfactual scenario from the projections using the actual evolution of Chinese demand. Chart 7 plots this difference over the crisis period. The results show that EA-8 exports would have declined by 37% from their previous peak at the depth of the crisis in Q1 2009 in the absence of the Chinese stimulus, compared with the actual outcome of a 31% decline.

Chart 6
Simulated China Final Goods Demand



Source: CEIC and EPG, MAS estimates

Chart 7*
Simulated EA-8 Exports



Source: EPG, MAS estimates

* The percentage deviation from the baseline scenario is applied to the actual trajectory of EA-8 exports over the period Q4 2008 to Q4 2009.

It thus appears that China's private consumption and investment spending had been an important source of demand for East Asian exports throughout the crisis period. While the stimulus measures could not completely offset the precipitous decline in G3 demand, they nevertheless served to prop up China's economic growth and stimulate demand for regional exports. In the absence of the discretionary boost to final demand, the ensuing rebound in EA-8 exports would likely have occurred later and would have been more subdued. In particular, the volume of exports would have been 22% below actual during the initial phase of the turnaround and would have been lower than its pre-crisis level by the end of 2009.¹² (Chart 7)

Sum-up

This Special Feature has applied a pooled regression model to analyse the relative importance of final demand in China and the G3 for exports of machinery parts and components to the world from eight East Asian economies. The findings suggest that EA-8 exports were heavily dependent on G3 demand while the Chinese market had a much smaller but rising impact prior to the global financial crisis. However, during the crisis, there is some evidence of weaker synchronicity between East Asia and the G3 economies, which probably reflects the transitory buffer provided by policy-induced demand in China.

The support provided by China during the global downturn should, however, not be taken as conclusive evidence that Chinese final demand has become a sustainable and independent source of growth for the East Asian economies. The heightened impact of China's demand on EA-8

exports might in fact be transitory, given that the bulk of the Chinese stimulus package was geared towards the building of infrastructure. With the completion of these projects, final goods demand in China may well revert to historical trend growth, in the absence of further measures to stimulate private consumption.

Beyond the crisis, ongoing reforms to increase the role of domestic demand will only come about gradually. Nonetheless, in the longer term, the rapidly expanding Chinese consumer market, coupled with its deep regional trade linkages, will provide immense potential for China to contribute to an enduring rebalancing of the global economy.

¹² IMF (2010) also reports similar results. Specifically, the positive spillovers from a lower saving ratio in China on the Asian region would have cushioned the impact of the crisis by about one-third.

References

Ando, M and Kimura, F (2005), “The Formation of International Production and Distribution Networks in East Asia” in Ito, T & Rose, A (eds.), *International Trade*, NBER-East Asia Seminar on Economics, Vol. 14, pp. 177–213.

Athukorala, P (2010), “Production Networks and Trade Patterns in East Asia: Regionalisation or Globalisation”, *ADB Working Paper Series on Regional Economic Integration* No. 56.

Andrews, D (1993), “Tests for Parameter Instability and Structural Change with Unknown Change Point”, *Econometrica*, Vol. 61, pp. 821–856.

IMF (2010), “Leading the Global Recovery: Rebalancing for the Medium Term”, *Regional Economic Outlook: Asia and Pacific*, April.

Kalra, S (2010), “ASEAN: A Chronicle of Shifting Trade Exposure and Regional Integration”, *IMF Working Paper* No. WP/10/119.

Kuroiwa, I and Kuwamori, H (2010), “Shock Transmission Mechanism of the Economic Crisis in East Asia: An Application of International Input-Output Analysis”, *Institute of Developing Economies Discussion Paper* No. 220.

Pula, G and Peltonen, T (2009), “Has Emerging Asia Decoupled? An Analysis of Production and Trade Linkages Using the Asian International Input-Output Table”, *ECB Working Paper* No. 993.