



## Is East Asia's Economic Fate Chained to the West?<sup>1</sup>

*Alyson C. Ma and Ari Van Assche*

**Abstract:** This paper analyzes to what extent East Asia's integration into global value chains (GVCs) has made the region more vulnerable to business cycle shocks in the West. We identify different channels through which business cycle shocks in the West can propagate to East Asian countries via global value chains. We next demonstrate that standard measures of external dependence are biased since they do not adequately capture the effects of these various GVC channels. Finally, we apply our framework to gain new insights into the role of GVCs in triggering East Asia's trade collapse during the Global Recession of 2008-2009.

**Keywords:** Global value chains, supply chain shock, external dependence, East Asia, Global Recession

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### 1. Introduction

In the past few decades, East Asia has become a key player in the global value chains (GVCs) of products that are consumed in Western markets. Many income-sensitive, high-technology products that can be found on the shelves of Best Buy in the United States or FNAC in France incorporate components produced in Japan, the Asian Dragons (Hong Kong, Rep. of Korea, Singapore and Taiwan), in the five largest ASEAN countries (Indonesia, Malaysia, Philippines, Thailand and Vietnam) and in China.

Among many academics and policymakers in East Asia, this trend has led to growing concern that the region is becoming more vulnerable or "coupled" to business cycle movements in the West. Economic downturns in the West, so they argue, can reverberate globally through supply chains, leading to significant export reductions and economic contractions in East Asia. This concern has been fueled further by the results of a number of recent empirical studies. Using the Asian International Input-Output table, Pula and Peltonen (2011a) estimate that East Asia's dependence on export markets has steadily risen since 1995. Similarly, Athukorala and Kohpaiboon (2010) analyze East Asia's changing trade patterns and conclude that the region's trade dependence of the rest of the world has increased in the past few decades. This rising trade dependence is found to have increased the region's macroeconomic dependence on the West. Park et al. (2011) estimates that, since the 1997/98 Asian Financial Crisis, the real economic interdependence between East Asia and the West has significantly increased. Dees and Vansteenkiste (2007), in contrast, argue that the East Asian economic region remains largely decoupled from the West.

In this paper, we investigate to what extent and through which channels East Asia's integration into GVCs has affected its economic dependence on Western markets. We conduct our analysis in four steps. First, we use international trade data to document East Asia's growing role and changing position in GVCs

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(section 2). Second, we discuss the various types of channels through which idiosyncratic shocks can internationally propagate and even magnify through GVCs (section 3). Third, we analyze how traditional measures of a country's exposure to external demand shocks are biased since they inadequately capture the transmission channels of these idiosyncratic shocks (section 4). Finally, we apply our framework to analyze the role of GVCs in East Asia's trade collapse during the Global Recession of 2008-2009 (section 5).

## 2. East Asia's role in GVCs<sup>2</sup>

The organization of international production has fundamentally changed in the past few decades. Thanks to reductions in communication costs, transportation costs and other trade barriers, many firms have sliced up their supply chains, and have dispersed their production activities across multiple countries. At the same time, they have outsourced large portions of their supply chain activities to external firms. As a result, the production process of consumer goods now involves many firms that are located in various countries across the globe, giving rise to GVCs.

An implication of the rise of GVCs is that international trade is increasingly dominated by trade in tasks (within GVCs) instead of trade in goods (Grossman and Rossi-Hansberg 2008). Currently, trade in intermediate inputs accounts for roughly two-thirds of international trade (Johnson and Noguera 2012). In addition, countries rely more and more on imported inputs to produce their exports. For instance, Hummels et al. (2001) use input-output tables for 14 countries and estimate that the import content on average accounted for nearly 21% of the exports value in 1990. Using more recent data, Miroudot and Ragoussis (2009) estimate that the average import content of exports has risen from 26% in 1995 to 31% in 2005.

GVCs have expanded asymmetrically across industries, predominantly emerging in durable goods sectors and less in nondurable goods and services. Miroudot and Rigoussis (2009) estimate that the import content embodied in key durable goods exports such as electronics and automobiles represented more than 40% of exports value in 2005. For services, they estimated import content to amount to less than 15%.

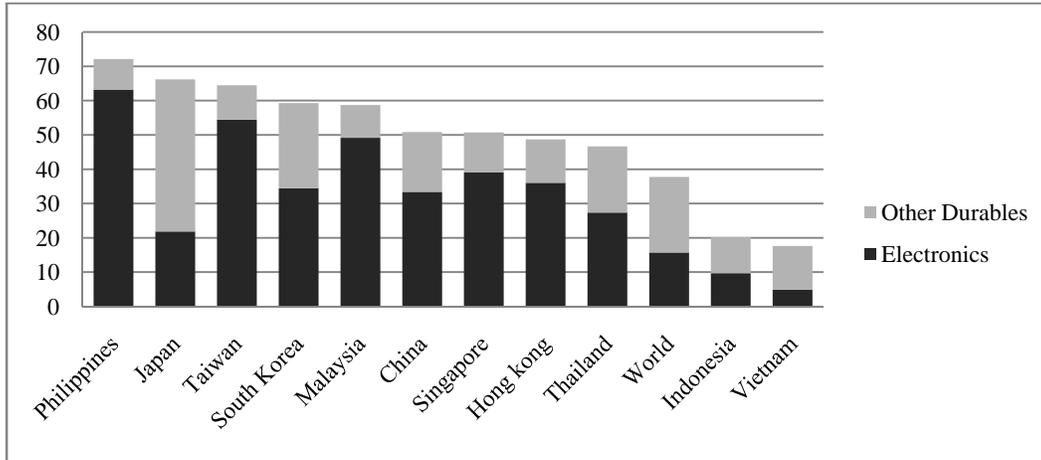
Within durable goods sectors, East Asian economies have taken on a key role in the GVCs, effectively turning the region into the "factory of the world". Trade patterns reflect East Asia's growing dominance in durable goods sectors. From 2000 to 2007, East Asia's share in world durable goods exports has grown from 35% to 42%. The growth in the share of the world's durable goods exports is not only due to its overall trade expansion, but also due to its specialization in durable goods trade. As shown in figure 1, the exports of East Asian economies are more heavily concentrated in durable goods than the rest of the world. With the exception of Indonesia and Vietnam, the share of durable goods exports in total exports exceeded 45% for all East Asian countries in 2007. This is largely due to East Asia's key role in the GVCs of electronics. Electronics constituted more than half of durable goods exports in 2007 for the region, except for Vietnam, Indonesia and Japan.<sup>3</sup>

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<sup>2</sup> Our data sources and definitions are presented in Appendix A.

<sup>3</sup> Gangnes and Van Assche (2010, 2012) provide a detailed discussion of East Asia's role in electronics value chains.

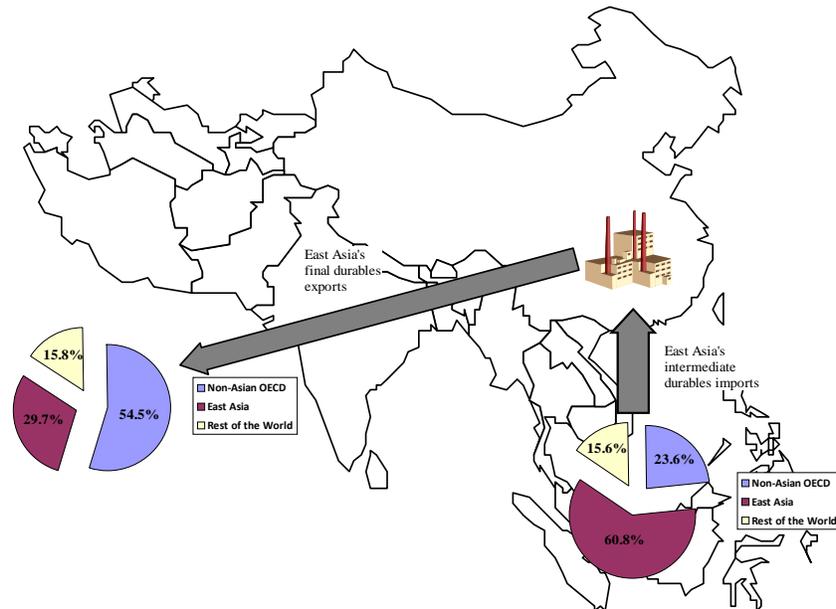
**Figure 1. The share of durable goods and electronics products in total exports, various East Asian economies, 2007**



*Data Source:* authors' calculations, using CEPII BACI data.

While durable goods trade has clustered in East Asia, the final consumption of durable goods has remained concentrated in North America and Europe. We can see this by dissecting East Asia's durable goods trade into intermediate and final goods trade. Figure 2 demonstrates that East Asian countries heavily trade intermediate goods among each other to produce durable final goods. Indeed, 61% of East Asia's intermediate durables were imported intra-regionally in 2007. In contrast, 55% of East Asia's exports of final durable goods were destined to non-Asian OECD countries in 2007.

**Figure 2. Source and destination of East Asia's durable goods trade, 2007**

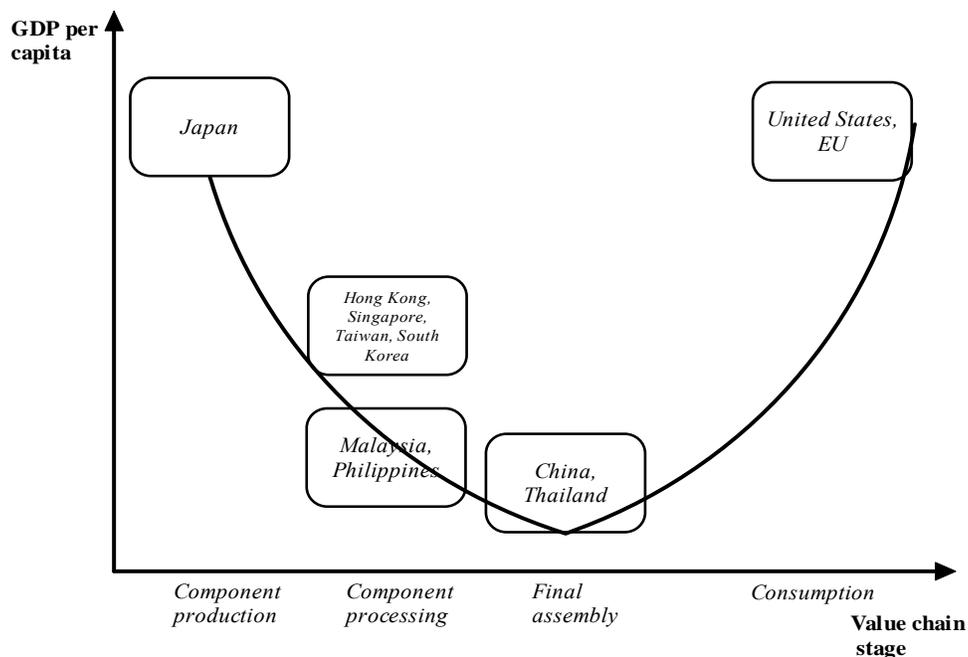


*Data Source:* CEPII BACI Trade data.

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Within East Asia, economies play different roles in GVCs depending on their level of economic development. As is shown in figure 3, the most developed economy, Japan, specializes in the upstream production of sophisticated intermediate goods such as semiconductors. This is reflected in its trade patterns. In 2007, Japan disproportionately imported intermediate durables when compared to the rest of the world (see appendix B). The high-income Asian dragons (Hong Kong, Rep. of Korea, Singapore and Taiwan) and Malaysia (but also the Philippines), in turn, are located in the middle of the chain where they specialize in the processing of intermediate goods. While they disproportionately import intermediate durables, intermediate goods also make up a larger-than-average share of their durable goods exports. The middle-income countries China and Thailand specialize in the downstream assembly of final durable goods.<sup>4</sup> They disproportionately import intermediate durables, and specialize in the export of final durable goods. Finally, the high-income Western economies U.S. and E.U. serve as dominant markets for final goods, intensively importing final goods from abroad.

**Figure 3. Stylized structure of GVCs in Durable goods**



*Source:* Authors' calculations using CEPII BACI data.

Plotting the countries according to their position in GVCs (x-axis) and their level of development (y-axis) gives rise to the well-known smiley shape that has been identified for the value chains of electronics products (Mudambi 2008). Upstream stages such as design, R&D and production of sophisticated components are generally located in developed countries, while manufacturing and especially final assembly activities are relocated to developing countries. Finally, the downstream activities marketing and consumption once again take place in developed countries.<sup>5</sup>

<sup>4</sup> In Appendix B, we explain the methodology used to determine countries' positions in GVCs.

<sup>5</sup> In line with the smile of value creation, Antràs et al. (2012) find that countries with stronger institutions and relative skill abundance specialize in downstream industries.

### 3. GVCs and the international propagation of shocks

East Asia's growing integration into GVCs has increased the region's exposure to idiosyncratic supply chain shocks. A well-known empirical regularity in macroeconomics is the "trade-comovement puzzle." This states that country pairs that trade more with each other experience higher business cycle correlation (Frankel and Rose 1998). Recent empirical studies find that GVC linkages are a key driver of the trade-comovement puzzle (Burstein et al. 2005, Ng 2010), and especially in North-South trade (di Giovanni and Levchenko 2010). Four types of idiosyncratic supply chain shocks can be transmitted through GVC linkages: supply shocks, demand shocks, credit shocks and trade friction shocks. We consider them in turn.

**Supply shocks.** Consider the following example to explain the propagation of *supply shocks* along GVCs. Suppose that in figure 3 there is a sudden negative shock in the supply of Japanese components that reduces Japan's exports to the Asian dragons. If these components are not highly substitutable, the Asian dragons will not be able to process their components, therefore requiring them to reduce their exports to the final assembly platforms China and Thailand. The final assembly platforms, on their turn, will not be able to assemble as many final goods, thereby reducing their final goods exports to the consumer markets in the U.S. and E.U. The just-in-time nature of many GVCs implies that the speed of transmission across the chain can be almost instantaneous (de Backer 2011). As a result, the negative supply shock can lead to a synchronized trade decline for all GVC participants. This is precisely what happened in the aftermath of the 2011 Tohohoku earthquake and tsunami (Escaith et al. 2011). As soon as the disaster hit, the production of Japanese intermediate components dried up, creating a disruption of international supply chains in the automotive and electronics industry, and affecting the price and availability of these goods around the world.

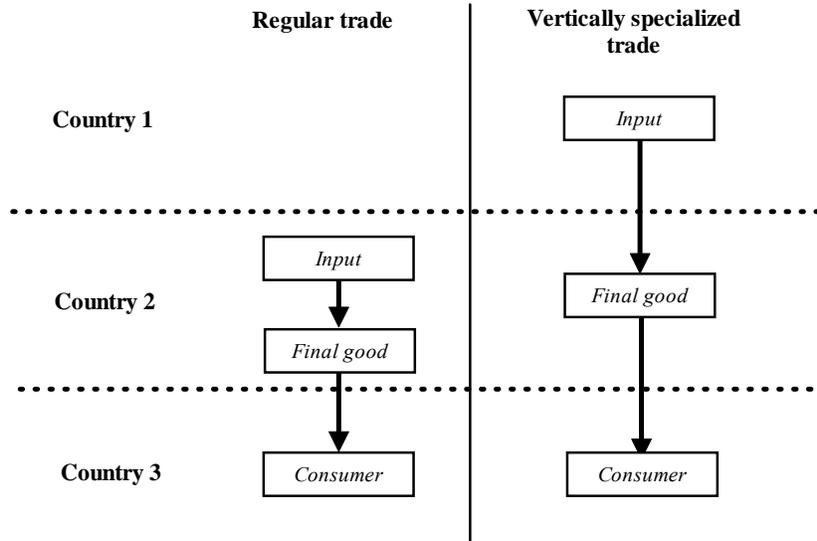
**Demand shocks.** GVCs can also transmit *demand shocks* across value chain participants. To see this, consider once again figure 3. Suppose there is a sudden decline in U.S. or E.U. demand for final durable goods. This would decrease the demand for imports from the final assembly platforms China and Thailand. In turn, since these final assembly platforms heavily rely on imported components, they would react to the negative demand shock by importing fewer components from the Asian dragons. Moreover, the Asian dragons would react to the shock by importing fewer inputs from the next upstream stage, Japan. As a result, the negative demand shock can lead to a sudden, synchronized trade decline throughout the East Asian region. A demand shock may even amplify as it moves up the GVC due to inventory adjustments (Alessandria et al. 2010, 2011, Altomonte et al. 2012). The logic for such a *bullwhip effect* is the following. Businesses typically face forecast errors in their sales against which they try to shelter by building safety stocks of inventories. When a downstream firm is confronted with a drop in demand for its final products, its first reaction is then to run down its inventories, therefore more than proportionally reducing its orders of upstream components. The upstream component processor, on its turn, reacts to the amplified drop in demand by also running down its inventories, leading to an even larger drop in the demand for imported components. As this inventory adjustment process propagates upstream, the demand shock continues to amplify.

**Credit shocks.** GVC linkages can additionally transmit *credit shocks* along the chain. In international business, exporters routinely rely on external capital to cover substantial upfront costs that cannot be financed out of retained earnings or internal cash flows from operations. Indeed, a survey conducted by the World Bank finds that firms typically finance about 20% of their working capital with trade credit

from banks or from their suppliers (Raddatz 2010). In addition to extensively using trade credit as a source of funds, most firms simultaneously grant credit to their customers (Fabbri and Klapper 2008). In GVCs where firms rely on each other for credit, a shock to the liquidity of one firm may cause a chain reaction in which other firms also get in financial difficulty (Kiyotaki and Moore 1997). Raddatz (2010) finds empirical support for the presence and relevance of credit shocks. Using data for 43 countries and 378 manufacturing industries pairs from 1980-2000, he estimates that an increase in the use of trade credit along the input-output chain linking two industries results in an increase in their output correlation.

**Trade friction shocks.** Besides acting as a vehicle for transmitting idiosyncratic shocks internationally, trade within GVCs is also more sensitive to system-wide *trade friction shocks* than regular trade. To illustrate this, consider figure 4. The left panel shows a traditional trade pattern where a product is entirely produced in country 2 and then exported to country 3 for consumption. The right panel shows a vertically specialized trade pattern within a GVC. Country 1 produces inputs and exports them to country 2. Country 2 uses the imported inputs to produce a final good. Finally, country 2 exports its output to country 3 for consumption. In the GVC, the input produced in country 1 ends up crossing borders two times, leading to a multiplication of trade frictions. Hummels et al. (2001) and Yi (2003) use this argument to explain how global tariff reductions can lead to a disproportionate growth in vertically specialized trade. But the converse is also true: a world-wide increase in trade frictions could lead to a magnified decrease in trade within GVCs. Using Chinese data, Gangnes et al. (2011) provide evidence that trade within GVCs is indeed more sensitive to global oil price shocks than regular trade.

**Figure 4. Regular versus vertically specialized trade**



*Source:* Gangnes et al. (2011).

#### 4. GVCs and East Asia's exposure to external demand shocks

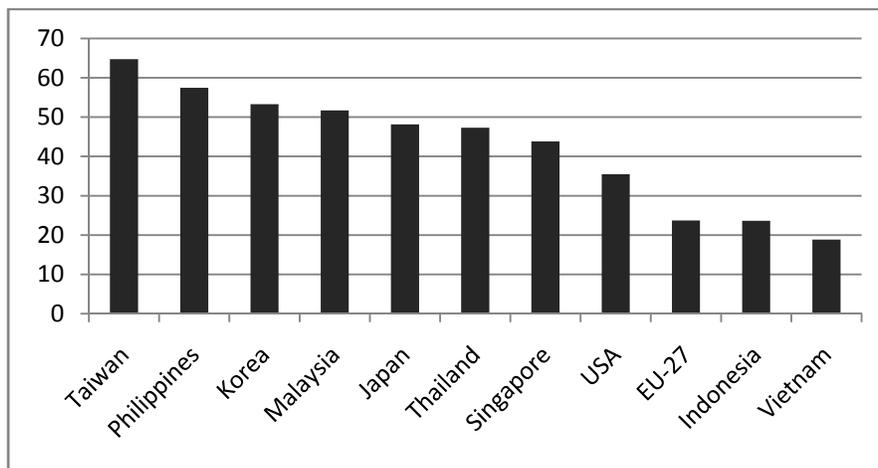
The rise of GVCs and their role in transmitting idiosyncratic supply chain shocks imply that traditional measures of a country's economic exposure to external demand shocks are biased. The standard way to measure a country's economic exposure through trade to an external demand shock is the amount of

bilateral exports normalized by GDP. According to this measure, a country such as Malaysia whose exports of goods to the U.S. amounts to 19% of its GDP is considered more vulnerable to a U.S. recession than Taiwan for which exports to the U.S. are only 10% of its GDP.

The export-to-GDP ratio inaccurately measures a country's exposure to external demand shocks for two reasons. On the one hand, there is a downward bias (*indirect exports bias*) since the measure only considers a country's direct bilateral exports, while ignoring indirect exports through third countries. On the other hand, there is an upward bias (*import content bias*) since the measure ignores countries' reliance on imported inputs to produce its exports. In this section, we provide empirical evidence of these two biases and investigate the true trade exposure of East Asian countries to U.S. and E.U. demand shocks.

**Indirect export bias.** The export-to-GDP ratio may underestimate a country's exposure to external demand shocks since it only considers a country's direct bilateral exports, while ignoring indirect exports through third countries. This leads to an *indirect exports bias*. As we have seen above, a significant portion of East Asian countries' exports are first sent to other East Asian countries before being ultimately exported to the West for final consumption. These indirect exports are also vulnerable to demand shocks in the West, and may even become amplified upstream due to the bullwhip effect. We can illustrate the importance of the *indirect exports bias* with data from China's processing trade regime.<sup>6</sup> Under this customs regime, firms located in China receive duty exemptions on imported inputs, but only if the processed goods are subsequently exported. As a result, all processing imports from East Asia by definition are indirectly exported to other countries. Figure 5 shows East Asia's importance as a supplier of inputs to China's processing trade regime. For all East Asian economies except Indonesia and Vietnam, more than 40% of their exports to China in 2007 were processing inputs. For Taiwan it amounted to almost 70% of their exports to China.

**Figure 5. Percent of exports to China that are processing inputs, 2007**



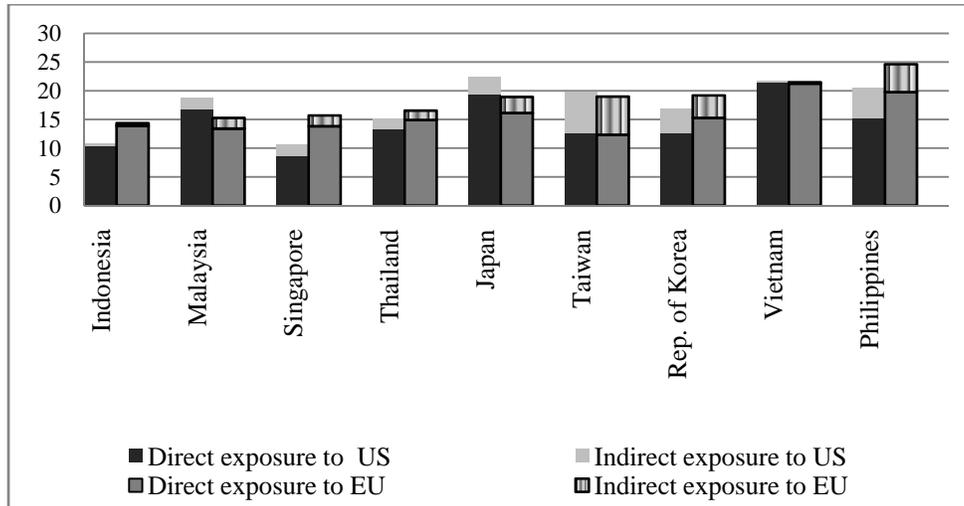
**Source:** Authors' calculation using China Customs Statistics. The data are adjusted to correct for Hong Kong re-exports. See Ma et al. (2009) for the correction procedure.

<sup>6</sup> We only gauge the size of indirect exports through China here. East Asian countries may also indirectly export through other countries, increasing the indirect exports bias even more.

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More than 25% of China's processing exports were destined for the U.S. and E.U. each. As a result, accounting for indirect exports significantly increases the East Asian countries' export-to-GDP ratios. Taiwan's export exposure to the U.S. increases by more than 7% when indirect exports through China's processing trade regime are taken into account (see Figure 6). For most other East Asian countries the export exposure increases with 1-5%. The results for East Asian countries' export exposure to the E.U. are similar.

**Figure 6. Direct and Indirect Exports to the U.S. and E.U. as a share of GDP, 2007**



**Source:** Authors' calculation using China Customs Statistics and CEPII/BACI data. The data are adjusted to correct for Hong Kong re-exports.

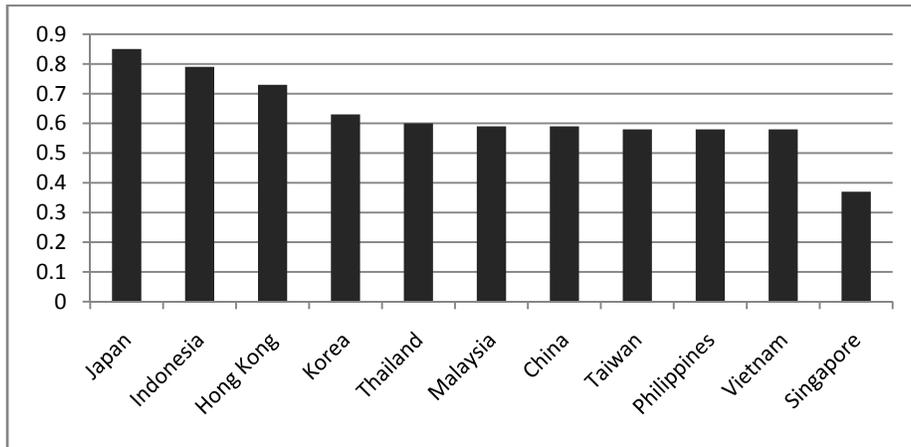
**Import content bias.** The bilateral export-to-GDP ratio may also overestimate a country's exposure to external demand shocks since it ignores countries' reliance on imported inputs to produce its exports. This leads to an *import content bias*. A country's exports value not only captures the value produced in the country (domestic value added) but also the value of the imported components embodied in the exports. When estimating a country's economic exposure to external demand shocks, one should only consider domestic value added. Any negative impact on the imported components is transmitted to the countries located upstream in GVCs. Johnson and Noguera (2012) provide an estimate for the size of *import content bias*. By combining input-output tables and bilateral trade data, they find that world-wide the domestic value added share of exports is only 73%. In other words, 27% of world exports are the value of imported inputs embodied in these exports. Across East Asia, the domestic value added share varies widely, ranging from a low 37% for Singapore to a high 85% for Japan (see figure 7).

To correct for the *indirect export* and *import content biases*, Johnson and Noguera (2012) estimate the value added content of bilateral trade. That is, they estimate the value added produced in a country *i* that is ultimately consumed in country *j*. As is shown in figure 10, they find that a country's value added exports to the U.S. can differ significantly from its gross exports to the U.S., depending on their location in the GVC.<sup>7</sup> Japan's value added exports to the U.S. exceed gross exports because (i) it relies little on imported inputs for its exports and (ii) it has large indirect exports to the U.S. by supplying intermediates to other

<sup>7</sup> Johnson and Noguera (2012) do not provide estimates for value added exports to the E.U.

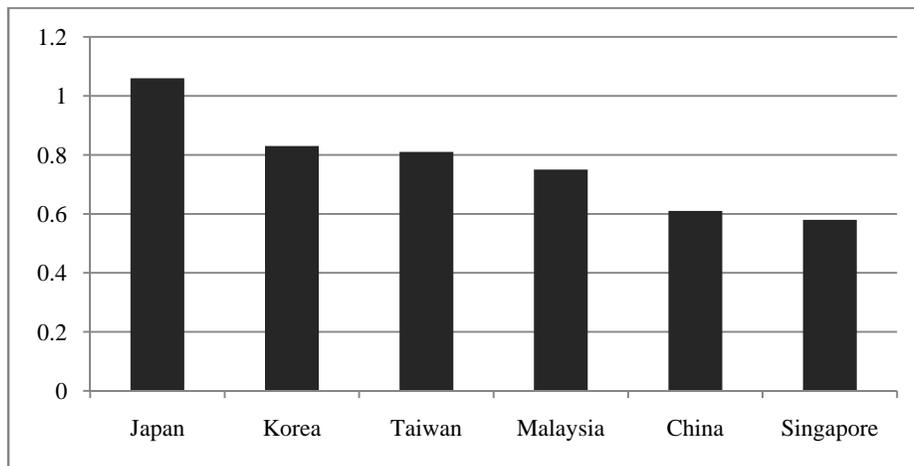
East Asian countries. In contrast, for all other East Asian countries the value added exports to the U.S. is less than gross exports. China’s value added exports to the U.S., for example, is only 60% of its gross exports because (i) it heavily relies on imported components for its exports and (ii) as a final assembly platform has relatively little indirect exports to the U.S.

**Figure 7. Share of domestic value added in total exports, 2004**



*Source:* Johnson and Noguera (2012)

**Figure 8. Ratio of value added exports to gross exports to the U.S., by country, 2004**



*Source:* Robinson and Noguera (2012)

## 5. GVCs and the great trade collapse

We can apply our framework to gain new insights into East Asia’s trade collapse during the Global Recession of 2008-2009. East Asia’s trade collapse during the crisis was largely driven by a large negative demand shock for durable goods in the West that was rapidly transmitted and amplified through GVCs. System-wide increases in trade frictions associated with evaporating credit further intensified the collapse, but did not lead to a systematic propagation of credit shocks throughout GVCs.

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The trade collapse in 2008-2009 differed from other episodes of trade declines after financial crises in three respects: its *suddenness*, *severity*, and *synchronicity* (Abiad et al. 2011, Baldwin 2009). In the first quarter of 2009, world trade dropped more than 30 percent compared to the first quarter of 2008. This trade collapse hit all countries simultaneously: with the lone exception of Egypt, all economies experienced a drop in trade during this period. East Asia was among the hardest hit regions, with East Asian economies' exports dropping between 20% and 40% in the first quarter of 2009 compared to the same period a year earlier.

The disproportionate rise of GVCs in durable goods sectors helps explain the increased vulnerability of trade to business cycle shocks. Since components are cross-hauled and double-counted multiple times in GVCs, the rise of GVCs has raised the weight of durable goods in trade compared to its weight in GDP. Bems et al. (2010) estimate that durable goods prior to the crisis had grown to almost 40% of trade, but amounted to only 10% of final demand. Given that consumers during a recession first and foremost hold off their purchases of durable goods, the transmission of demand shocks along GVCs of durable goods can induce trade to drop disproportionately compared to GDP.

Recent studies have provided ample evidence that such an asymmetric demand shock (also called a *composition effect*) was the main culprit of the trade collapse during the Global Recession. Bems et al. (2010) estimate that between 2008 and 2009 the demand for durable goods fell by 32% in the U.S. and 23% in the E.U.-15, whereas demand for nondurables and services fell by less than 4%. Using the global input-output table from Johnson and Noguera (2012), they find that the changing composition of final demand accounted for 70% of the decline in trade relative to GDP. Using a more elaborate structural model, Eaton et al. (2011) similarly find that asymmetric demand changes account for 80% of the global decline in the trade-to-GDP ratio during the crisis.

In line with the *bullwhip effect*, there is also evidence that demand shocks have been amplified upstream during the Global Recession. Using Chinese processing trade data, Ma and Van Assche (2011) find that processing imports across industries contracted more severely than processing exports in the first quarter of 2009 compared to a year earlier. As is shown in figure 9, with the exception of "motor vehicles", all durable goods sectors lie to the right of the 45 degree line, suggesting that processing imports dropped by a larger percent than processing exports. Similarly, Altomonte et al. (2012) used French firm-level data to show that trade in intermediates during the crisis overreacted to the final demand shock. Both results suggest that inventory adjustment along value chain may have contributed to the great trade collapse. This is confirmed by Alessandria et al. (2011), who find that two-thirds of the decline in U.S. automobile imports during the crisis can be attributed to firms running down their inventories rather than a fall in final sales of autos.

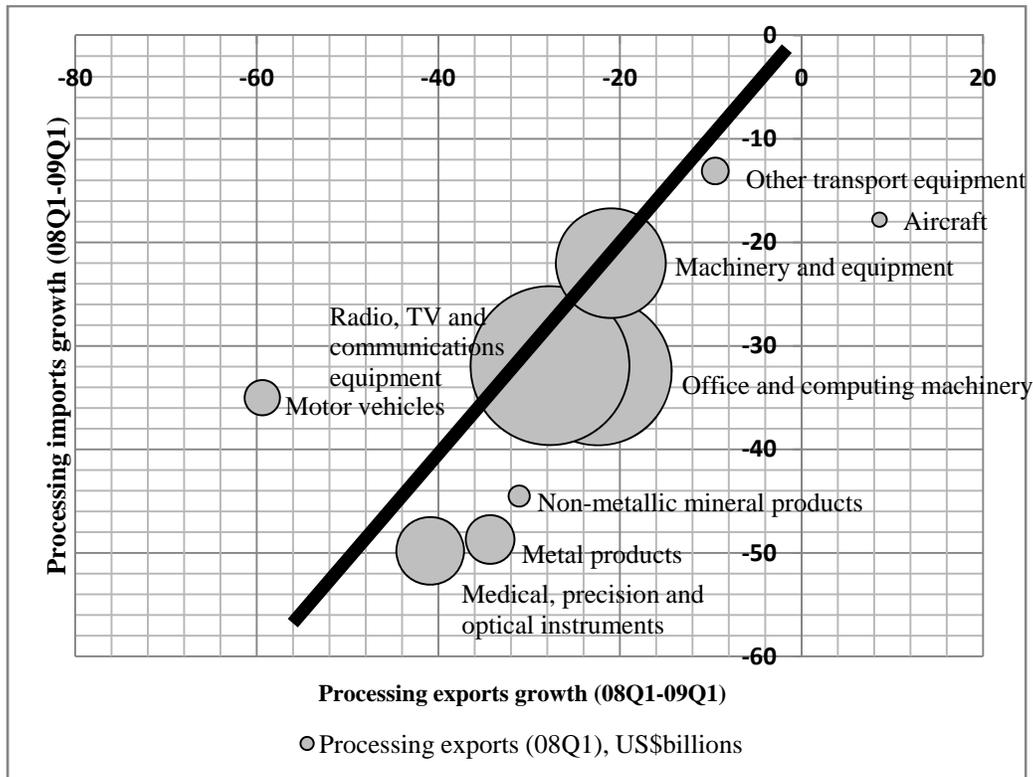
The system-wide rise of *trade frictions* associated with evaporating credit, increasing non-tariff barriers and home bias in government stimulus plans further intensified the trade collapse (Jacks et al. 2009, Eaton et al. 2011). For instance, the credit crunch at the height of the crisis resulted in a severe reduction in the availability of external finance. This hit international trade particularly hard since exporters are heavier users of trade finance than domestic firms (Ahn et al. 2011).<sup>8</sup> Chor and Manova (2011) indeed find that

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<sup>8</sup> There are at least three reasons why exporters need more working-capital financing (Ahn et al. 2011). First, exporting entails important fixed costs such as the learning about export market profitability and about regulatory compliance. Second, exporting

during the crisis, countries with higher interbank rates and therefore tighter credit availability cut back their exports to the U.S. more. Using Belgian and French firm-level data, respectively, Behrens et al. (2013) and Bricongne et al. (2012) also find that credit constraints during the crisis significantly worsened the export positions of financially constrained firms. As we have discussed above, the system-wide rise of such trade frictions should disproportionately affect trade within GVCs. To our knowledge, however, no study has empirically verified this.

**Figure 9. Bullwhip effect in China’s processing trade regime**



*Source:* Authors’ calculations using China Customs Statistics

There is no evidence, however, that the financial crisis propagated *credit chain effects* through GVCs. Had there been strong credit chain effects, one should observe that trade during the crisis fell significantly along the extensive margin, as firms systematically terminated trade relations due to liquidity problems. Behrens et al. (2013) and Bricongne et al. (2012) find no evidence of this for Belgian and French firms, with most of the trade adjustment occurring at the intensive margin. To our knowledge, no study has conducted such analysis for East Asian firms.

## 6. Concluding remarks

In this paper, we have analyzed to what extent East Asia’s integration into GVCs has made the region more vulnerable to Western business cycle shocks. We have discussed the mechanisms through which different types of supply chain shocks can propagate along value chains. Furthermore, we have

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tends to take longer than domestic transactions because of the longer time lags associated with international trade. Third, exporting is a more risky activity than domestic activities alone.

demonstrated how standard measures of external dependence are biased since they do not adequately take into account GVC trade. Finally, we have applied our framework to investigate which role GVCs played in triggering East Asia's trade collapse during the Global Recession of 2008-2009.

East Asia's export dependence on Western markets will likely start to decline in the post-crisis era. With incomes throughout the region rising faster than in the West, China's domestic market expanding rapidly, and the three free trade agreements of China, Japan and South Korea with the ASEAN entering into force, a rising share of the demand for East Asian output should shift intra-regionally in the decades to come.<sup>9</sup> This rebalancing process, however, will likely be gradual and lengthy. As a result, the processes described in this paper through which demand shocks in the West will reverberate throughout the East Asian region through GVCs can be expected to continue for years to come.

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<sup>9</sup> In a recent paper, Pula and Paltonen (2011b) find evidence that in 2009 the previous trend of growing export dependence has reversed and the share of value added originating from intra-regional demand has increased substantially. However, it is unclear if this is a true trend reversal or a temporary effect related to the crisis.

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### Appendix A

#### Country coverage:

Our analysis has focused on the following East Asian economies that are most often identified as being part of global value chains:

- Japan
- *Asian Dragons* : Hong Kong, Taiwan, South Korea, Singapore
- *ASEAN-4*: Thailand, Philippines, Indonesia, Malaysia
- China and Vietnam

#### Trade classification:

Relying on the United Nations' Broad Economic Categories (BEC) classification, we use the following table to distinguish between durable and non-durable goods, and to further dissect between intermediate and final goods.

**Table A1. United Nation's BEC Code**

BEC code	Description	Durable/Non-durable	Intermediate/Final
1	Food and beverages	Non-durable	
2	Industrial supplies not elsewhere specified	Non-durable	
3	Fuels and lubricants	Non-durable	
41	Capital goods (except transport equipment)	Durable	Final
42	Parts and accessories of capital goods (except transport equipment)	Durable	Intermediate
51	Passenger motor cars	Durable	Final
52	Transport equipment	Durable	Final
53	Parts and accessories of transport equipment	Durable	Intermediate
61	Consumer Durables	Durable	Final
62	Consumer Semi-durable	Non-durable	
63	Consumer Non-durable	Non-durable	
7	Goods not elsewhere specified	Non-durable	

We use the following HS 4-digit codes to identify electronics:

4-digit HS code	Description
8469	Typewriters & word processing machines
8470	Calculating & account machines, cash registers etc
8471	Automatic data process machines; magn reader etc
8473	Parts etc for typewriters & other office machines
8504	Elec trans, static conv & induct, adp pwr supp, pt
8514	Industrial or lab elec furnaces etc, parts
8517	Electric apparatus for line telephony etc, parts
8518	Microphones; loudspeakers; sound amplifier etc, pt
8519	Turntables, record & cassette players etc.
8520	Magnetic tape & other sound recorders
8521	Video recrdng/reproduc appar wheth/nt video tuner
8522	Parts and accessories for items 8519 to 8521
8523	Prepared unrecorded media (no film) for sound etc.
8525	Trans appar for radiotele etc; tv camera & rec
8526	Radar apparatus, radio navig aid & remote cont app
8527	Reception apparatus for radiotelephony etc
8528	Tv recvrs, incl video monitors & projectors
8529	Parts for television, radio and radar apparatus
8530	Electric signal, safety or traffic control equip
8531	Electric sound or visual signaling apparatus, pts
8532	Electric capacitors, fixed, var or adj (preset) pt
8533	Electrical resistors except heating resistors, pts
8534	Printed circuits
8535	Electrical apparatus for switching etc, ov 1000 v
8536	Electrical apparatus for switching etc, nov 1000 v
8540	Thermionic, cold cathode or photocathode tubes, pt
8541	Semiconductor devices; light-emit diodes etc, pts
8542	Electronic integrated circuits & microassembl, pts
8543	Electrical mach etc, with ind functions nesoi, pts
9006	Photographic still cameras, flash apparatus etc
9009	Photocopy apparatus & thermocopy apparatus; pts
9013	Liquid crystal devices nesoi; lasers; opt appl; pt
9014	Direction finding compasses & navig inst etc, pts
9015	Survey, hydrogr, meteoro etc inst; rangef etc, pts
9018	Medical, surgical, dental or vet inst, no elec, pt
9021	Orthopedic appl; artif body pts; hear aid; pts etc
9022	X-ray etc apparatus; tubes, panels, screen etc, pt
9023	Inst, appts&models,for demonstrational use& parts
9024	Machines etc for testing mech prop of material, pt
9025	Hydrometers, thermometers, pyrometers etc; pts etc
9026	Inst etc measure or check flow, level etc, pts etc
9027	Inst etc for physical etc anal etc; microtome; pts
9030	Oscilloscopes, spectrum analyzers etc, parts etc
9031	Machines, nesoi in chapter 90; profile project, pt
9032	Automatic regulating or control instruments; parts

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9101	Watches, wrist, pocket etc, prec metal or cld case
9102	Watches, wrist, pocket etc, case not prec nor clad
9103	Clocks with watch movt, excluding inst panel clock
9105	Clocks, with clock mvts oth than inst panel etc
9207	Musical instruments with sound electric prod etc

### Appendix B

To determine a country's position in the GVC, we first calculate for each country a set of revealed comparative advantage (RCA) indices:

- Final durable export RCA:  $\frac{\text{Share of final durables exports in country } i\text{'s total exports}}{\text{Share of final durables exports in world total exports}}$
- Int. durable export RCA:  $\frac{\text{Share of int. durables exports in country } i\text{'s total exports}}{\text{Share of int. durables exports in world total exports}}$
- Final durable import RCA:  $\frac{\text{Share of final durables imports in country } i\text{'s total imports}}{\text{Share of final durables imports in world total imports}}$
- Int. durable import RCA:  $\frac{\text{Share of int. durables imports in country } i\text{'s total imports}}{\text{Share of int. durables imports in world total imports}}$

This leads to table B1:

**Table B1. Trade specialization patterns, various East Asian economies, 2007**

	RCA Indices			
	Intermediate goods		Final goods	
	Exports	Imports	Exports	Imports
United States	1.13	0.85	0.87	1.15
European Union	0.90	0.90	1.10	1.10
Japan	1.15	1.02	0.85	0.98
Hong Kong	1.05	1.26	0.95	0.74
Singapore	1.10	1.42	0.90	0.58
Rep. of Korea	1.10	1.14	0.90	0.86
Taiwan	1.33	1.22	0.66	0.78
Indonesia	0.93	1.03	1.07	0.97
Malaysia	1.16	1.48	0.84	0.52
Philippines	1.49	1.65	0.51	0.35
Thailand	0.91	1.26	1.09	0.74
China	0.70	1.21	1.30	0.79
Vietnam	0.64	0.83	1.36	1.17

*Source:* Authors' calculations, using CEPII BACI data.

We can distinguish between four positions in GVCs:

- **Final assembly platforms** heavily rely on imported inputs to assemble and export final goods. They therefore should have an *intermediate import*  $RCA > 1$  and a *final export*  $RCA > 1$ .
- **Component processors** heavily rely on imported inputs to process and export intermediate goods. They therefore should have an *intermediate import*  $RCA > 1$  and an *intermediate export*  $RCA > 1$ .
- **Component producers** intensively export intermediate goods while relying to a limited extent on imported inputs. They therefore should have an *intermediate export*  $RCA > 1$  and an *intermediate import*  $RCA$  that is not significantly larger than 1.
- **Consumers** disproportionately import final goods. They therefore should have a *final import*  $RCA > 1$ .

### About the Authors

Alyson C. Ma is an Associate Professor of Economics at the University of San Diego. Her main area of research is international trade with a focus on the Chinese economy. She has published in topics pertaining to China's role in the global value chain, foreign direct investment and wage inequality across Chinese provinces, market structure and pricing strategy in China's automobile industry, and the impact of U.S.-China trade on employment and wages in the U.S.-Mexico border region.

Ari Van Assche is an Associate Professor of International Business at HEC Montreal, and a research fellow at the Montréal-based research centers CIRANO and IRPP. He holds a BA and an MA in Chinese studies from the Katholieke Universiteit Leuven and a PhD in economics from the University of Hawaii at Manoa. His research focuses on the organization of global value chains and their implication for trade and competition policies. On this topic, he has published widely in academic journals and has consulted for various Canadian and international governmental organizations including DFAIT, the Asian Development Bank and the World Bank.

### Contact Information

Alyson C. Ma, University of San Diego and Ari Van Assche, HEC Montréal.  
Email: ari.van-assche@hec.ca.