

## Global Value Chains and Risk: A Development Perspective in the Asia-Pacific

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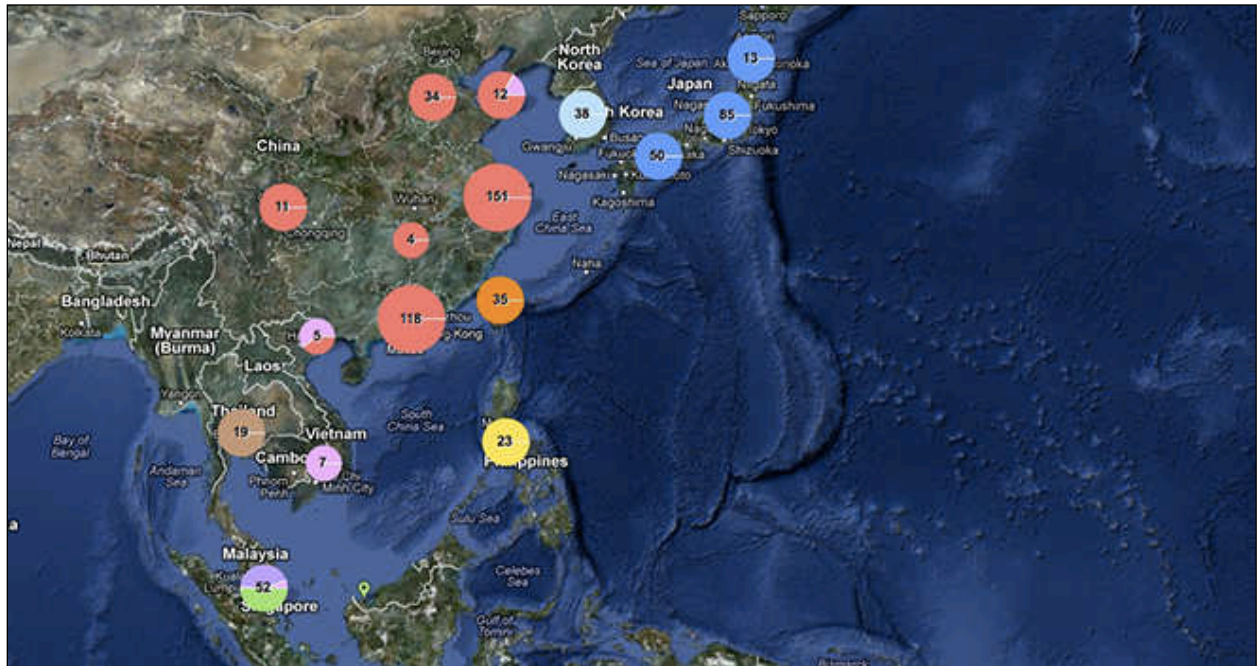
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<sup>1</sup> This note was prepared at the request of UNESCAP, and is based on research originally conducted for the Asia-Pacific Economic Cooperation (APEC): Shepherd et al. (2014); Shepherd and Cattaneo (2014); Shepherd and Archanskaia (2014); and Shepherd and Tsigas (2014). In this note, the term “Asia-Pacific” denotes the member economies of APEC unless otherwise stated. The analysis discussed here could be applied to the Asia-Pacific more broadly, for example the member countries of UNESCAP, but the additional data collection required is beyond the scope of this note.

# 1 INTRODUCTION

Global and regional value chains (VCs) are increasingly common in the world economy, and are ubiquitous in the Asia-Pacific. VCs are commonly used as production platforms for consumer electronics, such as Apple’s iPhone (Figure 1), transport equipment like cars and light trucks, and even services in sectors such as business and professional services. A VC consists of a linked network of trade and production that cuts up the production process, and spreads it across a range of locations. In its broadest definition, a VC includes “the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond”.<sup>2</sup>

Figure 1: Selected Apple suppliers in the Asia-Pacific. Numbers indicate numbers of firms.



Source: <http://appleinsider.com/articles/13/02/15/supply-chain-visualization-shows-how-apple-spans-and-impacts-the-globe>.

Cross-border VCs rely on trade and investment linkages across economies. Typically, a lead firm develops the value chain with a number of counterparties involved in tasks such as component supply and final assembly. Those counterparties, along with the lead firm in some cases, then engage additional rounds of contracts with other suppliers of goods and services, and so on as the process proceeds upstream. The end result is a complex network of trade and investment relationships. The hallmarks of the VC business model are lean production—with inventories kept very low—and rapid and repeated movements of goods across borders as value is added at different points in the chain.

The purpose of this note is to examine recent research on the issue of risk as it pertains to VCs, particularly those with a cross-border dimension. As will be seen, risk can be a key consideration in location decisions within VCs, and thus can act as an important driver of trade and investment flows. The next section provides a conceptual overview of VC risk, focusing on its core dimensions and their potential operationalization through a simple and transparent approach to measurement.

<sup>2</sup> <https://globalvaluechains.org/concept-tools>.

Section 3 implements that approach using data for the Asia-Pacific, and a number of comparator groups. It therefore provides a comparative overview of VC risk levels in the region. Section 4 then focuses on the important policy issue of what the public sector can do to mitigate, respond to, and help manage VC risk: in other words, the flipside issue of VC strength. The final section concludes with a discussion of recent research findings from a development policy point of view.

## 2 WHAT IS VALUE CHAIN RISK?

Trade and investment links are the lifeblood of global and regional VCs. Risk in a broad sense is therefore an important consideration for lead firms considering developing a VC-based production platform that crosses international borders. Foreign direct investment (FDI) in particular involves significant sunk costs, and firms may hold back from investing if they perceive the host economy business environment as too risky. Investors crave certainty, and the ability to effectively manage risk. Economies where risk is low can expect to see stronger inward investment flows—including VC-related FDI—than economies where risk is high.

VC risk is a broad concept, encompassing a range of interlinked factors. As international businesses, VCs are subject to all the usual risks inherent in doing business, such as natural disasters, market fluctuations, and policy reversals that negatively affect them. In addition, the international nature of VCs means that certain risks are heightened, such as those linked with international transactions. Foreign exchange risk is an example.

In considering the concept of VC risk, it is not enough to consider a VC as a set of linear, point-to-point transactions. Doing so would be an unduly restrictive approach, and it would neglect a key characteristic of the VC model that affects its risk profile: VCs are networks, and that has import implications for the types of risk to which they are subject, and the ways in which negative shocks are propagated through them from one economy to another.

The first aspect of the network structure of VCs that is important from a risk perspective is the issue of systemic risk. The Global Financial Crisis (GFC) highlighted the importance that key network actors can play because they act as a nexus for a large number of interlinked contracts. The failure of one link in the chain can have severe repercussions for businesses that form part of the VC system, and in extreme cases such as the GFC, even business and other economic actors that are seemingly far removed from the source of the disturbance. As Acemoglu et al. (2012) have recently shown on a theoretical level, aggregate (system-level) fluctuations in activity can originate in agent-specific shocks that are transmitted throughout the system via an input-output network. VCs fit this model of shock propagation very well, which means that the issue of systemic risk needs to be taken seriously within a broader approach to assessing and managing VC risk.

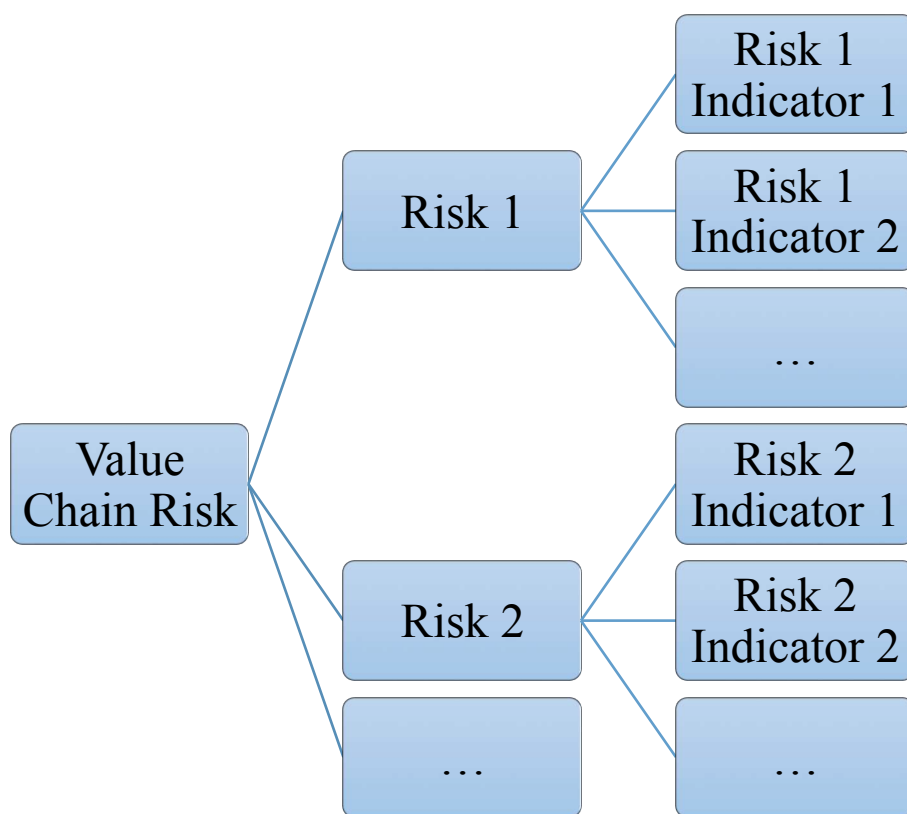
A second dimension of risk that is specific to network structures like VCs is the importance that particular links in the chain can have for the chain's overall ability to function. Certain linkages can be critical, in the sense that if a negative shock occurs that affects their performance, that shock propagates rapidly and very strongly throughout the rest of the VC. An example is the 2011 Thai floods, which seriously affected a global hub of hard disk drive production, and had significant implications for the broader consumer electronics market, including personal computers and other devices. Economies of scale tend to drive the location of activity in a small number of hubs, but risk management by firms partly offsets that tendency with a drive to build redundancies (multiple sourcing) into the VC. The reason for doing so is to minimize the risk of critical disruptions, under the assumption that most negative shocks are geographically localized; systemic shocks such as the GFC are an obvious exception to the more general principle.

As can be seen, conceptualizing VC risk is not an easy task. Shepherd et al. (2014) discuss previous attempts in the literature to analyze and measure risks affecting international economic transactions, but conclude that none provides a comprehensive yet simple and transparent approach to considering and measuring VC risk. The authors therefore propose a novel approach, in which they identify five primary dimensions of VC risk:

1. **Natural Disaster Risks:** the possibility that economic activity may be impeded by natural disaster.
2. **Logistics and Infrastructure Risks:** the set of disruptions that can occur to supply chain processes when the markets or actors that connect supply chain operators to each other do not perform as expected.
3. **Market Risks:** economic fluctuations that disrupt prices, output, or other economic fundamentals.
4. **Regulatory and Policy Risks:** unexpected changes in regulatory stance, or inconsistency in enforcement, can increase business uncertainty, and thus the transaction costs associated with value chain processes.
5. **Political Risks:** the possibility that economic activity may be impeded by the occurrence of political or violent conflicts inside or outside the economy.

Each category of VC risk is proxied by the simple average of a small number of data series that are taken to be representative of broad trends in each economy. It is impossible to cover all indicators that could conceivably affect risk, because the result would be a complex, non-transparent set of measures. The objective in proceeding with a small number of series is to keep the analytical approach and aggregation scheme—simple averages—as transparent and policy-relevant as possible (Figure 2).

Figure 2: VC risk aggregation scheme.



Source: Shepherd et al. (2014).

## 2.1 Natural Disaster Risks

Natural disasters have the potential to cause significant disruption to VCs. They can make it more difficult and costly to move goods across borders, or they can negatively impact—or even shut down—output in important production centers. There are many potential sources of natural disaster risks, but not all can be catalogued in an analytical exercise that emphasizes simplicity and transparency. Shepherd et al. (2014) therefore choose three indicators based on a statistical analysis of a wider dataset. The three indicators, which are broadly representative of natural disaster risks in the Asia-Pacific, are:

1. Total number of people affected by floods per year and per 100,000 population.
2. Total number of people affected by storms per year and per 100,000 population.
3. Total number of people affected by earthquakes per year and per 100,000 population.

The essence of natural disasters is that they occur unexpectedly, and not necessarily every year. It is important to adopt a long-term perspective in measuring natural disaster risk. The above three indicators are therefore averaged over the 20 year period 1992-2012 to produce the natural disaster risks index, which then feeds into the overall VC risk calculation.

## 2.2 Logistics and Infrastructure Risks

This category of VC risk refers to the possibility of disruption to the overall production process due to performance problems localized in the set of economic agents that connect VC operators to each other. Infrastructure is one important element of this category of risk: if an important road link is

disrupted due to poor maintenance, it slows down movements of goods, and also makes them more expensive and subject to greater uncertainty. Service provision is also important. It is only when infrastructure and service providers both perform well that VC operators can connect with each other seamlessly and reliably.

With these points in mind, Shepherd et al. (2014) choose the following representative indicators to summarize performance in the area of logistics and infrastructure risks:

1. Quality of trade and transport infrastructure (sourced from the Logistics Performance Index).
2. Percentage of shipments that do not meet logistics' firms internal quality criteria (also sourced from the Logistics Performance Index).

Statistical analysis using a wider range of data sources shows that these two series are broadly indicative of an economy's overall performance in this risk category.

### 2.3 Market Risks

The concept of market risks refers to economic fluctuations that disrupt prices, output, or other economic fundamentals. Such fluctuations can of course have significant impacts for the functioning of global and regional VCs, as the Global Financial Crisis showed. Although VCs are typically quite resilient to the occurrence of market risks—more on this below—this category is important for an overall understanding of the range of risk factors that enter into the decision making process in lead firms looking at forming trade and investment links across national borders.

Market risks are numerous, and it is impossible to capture all of them in a single, transparent index. Based on statistical analysis of a broader dataset, Shepherd et al. (2014) identify the following data as having particular explanatory power in terms of an economy's general market risk profile:

1. Instability of the Consumer Price Index (five year simple average).
2. Sovereign ratings (average of the three components from Moody's, Standard and Poor's, and Fitch).
3. Net international investment position as a percentage of GDP.

### 2.4 Regulatory Risks

Unexpected changes in regulatory stance have the capacity to affect VC performance, and can require adaptations in otherwise efficient business models. Examples of particularly problematic areas include: deviations from international norms; protectionism; and inconsistent enforcement of regulations in practice. All of these changes upset business certainty, and can therefore disrupt VC activities.

In principle, regulatory risks could be assessed using a wide range of data sources on particular aspects of regulation and the processes surrounding it. However, the World Bank's Worldwide Governance Indicators make the job much easier, by providing ready-made aggregations of a large number of data points relevant to governance, including two core dimensions that are of particular pertinence from the point of view of regulatory risks:

1. Rule of law index.
2. Control of corruption index.

Prior to use, both indices are rescaled so that higher scores indicate less effective governance, i.e. a higher level of risk.



## 2.5 Political Risks

Political instability, including acts of terrorism and armed conflict, as well as peaceful disruptions to the political process, can have serious implications for VC activity. Instability is a source of risk and uncertainty for business, and can add to the overall cost associated with cross-border transactions, in particular due to decreases in reliability.

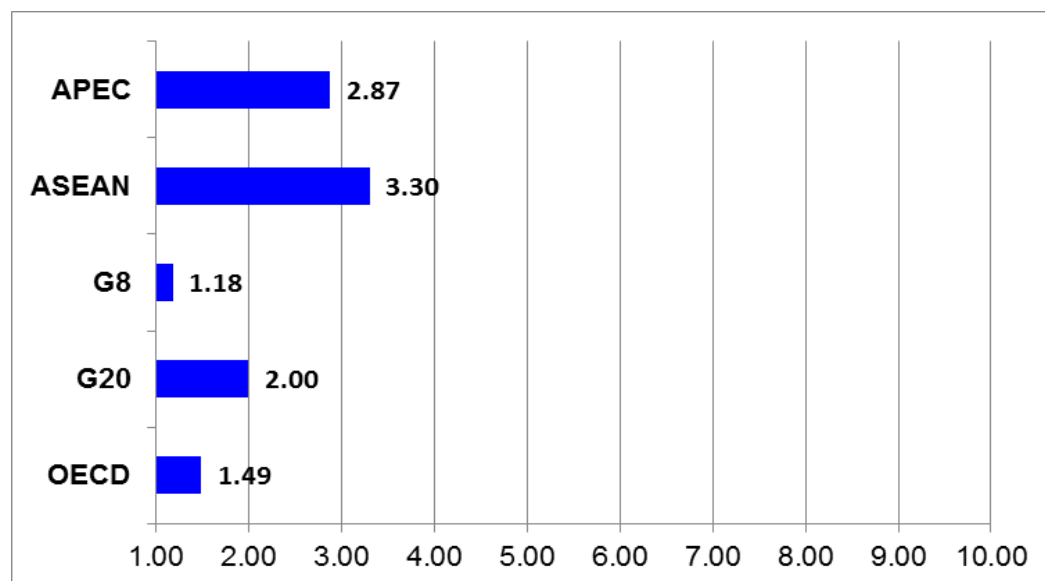
The Worldwide Governance Indicators again provide a ready-made series that aggregates a large number of individual data sources that deal with political risks as they are defined here. Shepherd et al. (2014) therefore use the political stability and absence of violence index from that dataset as their indicator of political risks. As in the case of regulatory risks, the indicator is rescaled prior to use so that a higher score indicates greater risk.

## 3 VALUE CHAIN RISK IN THE ASIA-PACIFIC REGION

The previous section set out the Shepherd et al. (2014) approach to defining and measuring VC risk in the Asia-Pacific. This section presents an analysis of results in comparative perspective. Two overlapping Asia-Pacific regions are considered: APEC and ASEAN. APEC contains a mix of a developed and developing economies from around the Pacific Rim, whereas ASEAN's geographical focus is much narrower (Southeast Asia) and its membership limited to developing economies, with the exception of Singapore (depending on the definition of “developing” that is used). To give an idea of the Asia-Pacific region's performance relative to other groups, scores are also presented for the G-8 group of industrialized economies, the G-20 economies, and the OECD economies. All scores are scaled to range between one (last risky) and ten (most risky).

Figure 3 presents results for natural disaster risk. APEC and ASEAN have the highest scores of any of the groups for which data are presented, which means that they have the highest risk profile in this area. This result is not surprising in light of the fact that many Asia-Pacific economies are subject to significant natural disaster risk. The contrast with the two groups of developed countries (the G-8 and the OECD) is striking: this element of VC risk is much lower in those groups than in the Asia-Pacific. Moreover, the difference between the APEC and ASEAN scores suggests that developing economies may fare worse than developed ones in relation to natural disaster risk, as ASEAN—which is made up almost exclusively of developing economies—has a noticeably higher score than APEC.

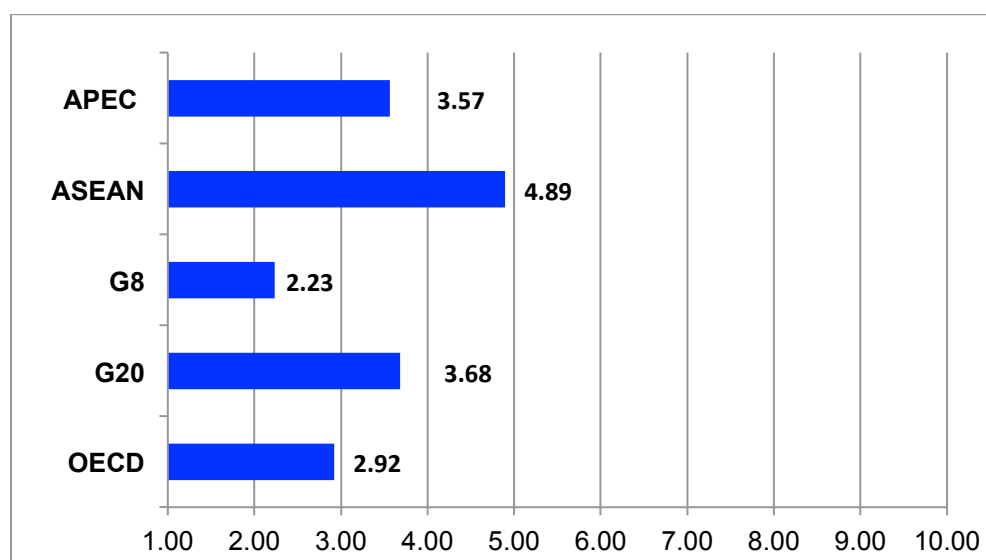
Figure 3: Natural disaster risk assessment for the Asia-Pacific in comparative perspective.



Source: Shepherd et al. (2014).

Results for logistics and infrastructure risk (Figure 4) do not display the same pattern as those for natural disaster risk. APEC's score is lower than that of the G-20—a group that also contains a mix of developed and developing economies—but ASEAN's is again the highest of any of the groups. The difference between APEC and the developed economy groups (the G-8 and the OECD) is less striking than in the case of natural disaster risk. This finding suggests that although logistics and infrastructure risk is lower in some of the other groups relative to the Asia-Pacific, the difference is not as marked as for the previous VC risk category.

Figure 4: Logistics and infrastructure risk assessment for the Asia-Pacific in comparative perspective.

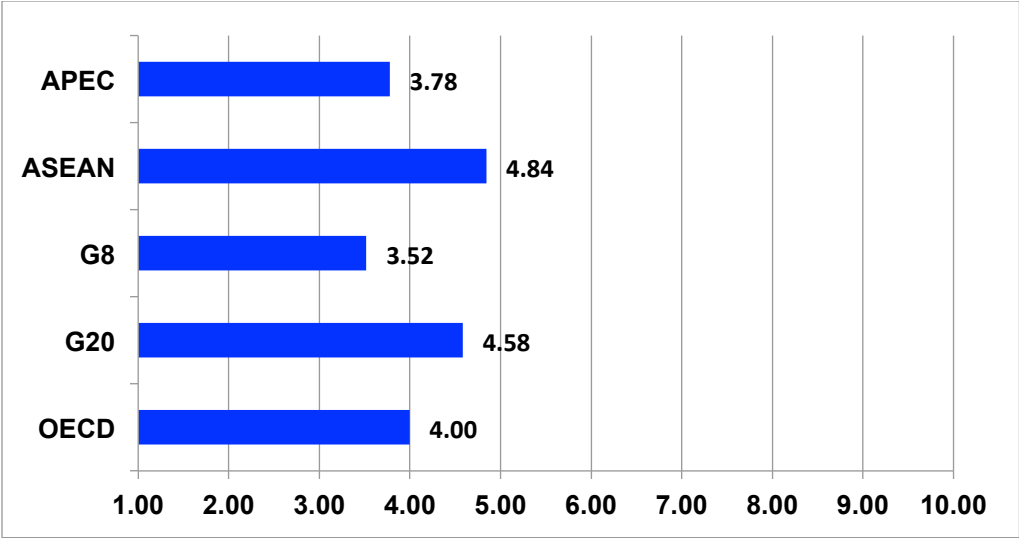


Source: Shepherd et al. (2014).



Market risks are analyzed in Figure 5. In this case, the pattern of results is quite different from those observed in the two previous cases. APEC's level of market risk is lower than that of the G-20 and the OECD, and is not much higher than that of the developed economy G-8 group. By contrast, ASEAN's score is the highest of any of the comparator groups. These results suggest that market risk is relatively limited in some Asia-Pacific economies, but it is a more serious issue in others. Indeed, many Asia-Pacific economies have given particular attention to the mitigation of market risks following significant negative events, such as financial or currency crises.

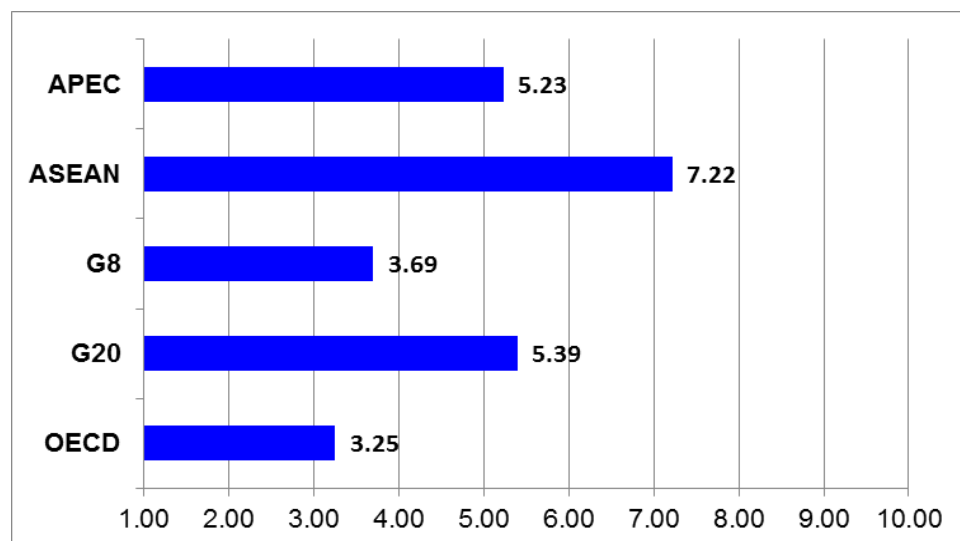
Figure 5: Market risk assessment for the Asia-Pacific in comparative perspective.



Source: Shepherd et al. (2014).

Figure 6 shows results for regulatory risk. APEC's score is comparable to that of the G-20, but ASEAN again has the highest score of any of the groups. The developed economy groups have considerably lower risk profiles in this area. This pattern of results suggests that this type of VC risk might be a particular issue for developing economies in the Asia-Pacific region, although some other economies have put in place relatively stable systems for designing, implementing, and enforcing regulation.

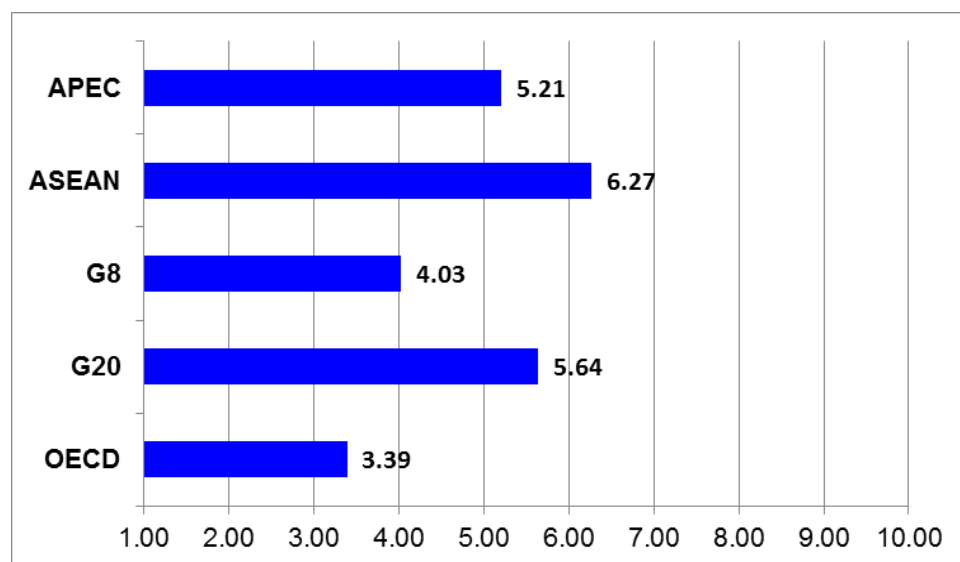
Figure 6: Regulatory risk assessment for the Asia-Pacific in comparative perspective.



Source: Shepherd et al. (2014).

The final category of VC risk is political risks (Figure 7). ASEAN again has the highest score of any of the groups, but APEC's score is lower than that of the G-20. The two developed economy groups both have significantly lower scores. As for the other categories of VC risk, this pattern of results suggests that political risks are significant in at least some parts of the Asia-Pacific, and are likely of particular concern in developing economies.

Figure 7: Political risk assessment for the Asia-Pacific in comparative perspective.

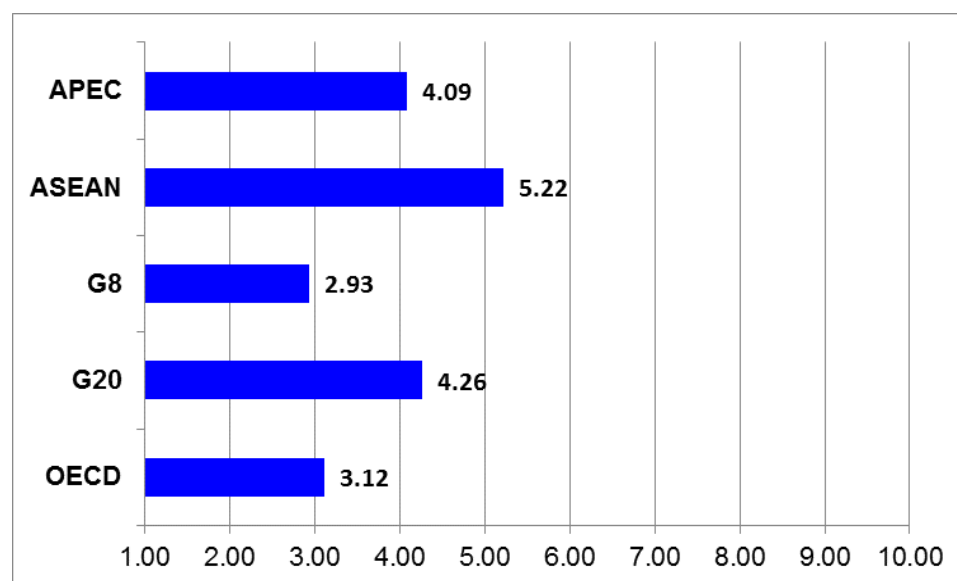


Source: Shepherd et al. (2014).

In addition to analyzing each category of VC risk separately, Shepherd et al. (2014) also aggregate the five indices into an overall measure of VC risk by using a simple average. Results are in Figure 8. The pattern of scores across groups is, of course, reflective of the above discussion. Overall, ASEAN is the riskiest group for VCs to operate in, but APEC is less risky than the G-20. The two

developed economy groups are significantly less risky than any of the groups that include developing economies. In an overall sense, Figure 8 suggests that the Asia-Pacific as a whole is subject to a moderate degree of VC risk. Of course, the average masks considerable variation from one economy to another—see the Appendix to Shepherd et al. (2014) for a discussion of individual economy scores in each area, and overall. The general conclusion to be drawn is that VC risk is a significant issue for business in the Asia-Pacific. Of course, VCs are well developed in the region, which suggests that the private sector is adept at managing these risks. However, there is much that the public sector can do to help lower an economy’s VC risk profile, and thereby promote the expansion of trade and investment linkages related to VC development.

Figure 8: Overall VC risk assessment for the Asia-Pacific in comparative perspective.



Source: Shepherd et al. (2014).

## 4 MANAGING VALUE CHAIN RISK: WHAT CAN THE PUBLIC SECTOR DO?

The analysis in the previous section focused exclusively on risk factors. Some risks, such as natural disasters, are exogenous, and there is essentially nothing the public or private sectors can do to prevent their occurrence. However, other elements of risk, such as political risks and regulatory risks, are directly subject to public sector action. For example, policies designed to reduce corruption prevalence and improve the governance environment can boost performance in those two areas. A first way in which the public sector can act to promote an environment of low VC risk—which favors the development of global and regional VCs—is to analyze the risk factors studied above, identify those that are directly amenable to government action, and design policies to improve performance. The key unifying factor in this approach is certainty: as discussed at the outset, investors crave certainty, and the public sector can help promote VC-linked investment by developing a business climate that is stable and certain. Such an environment is conducive to the growth of global and regional VCs.

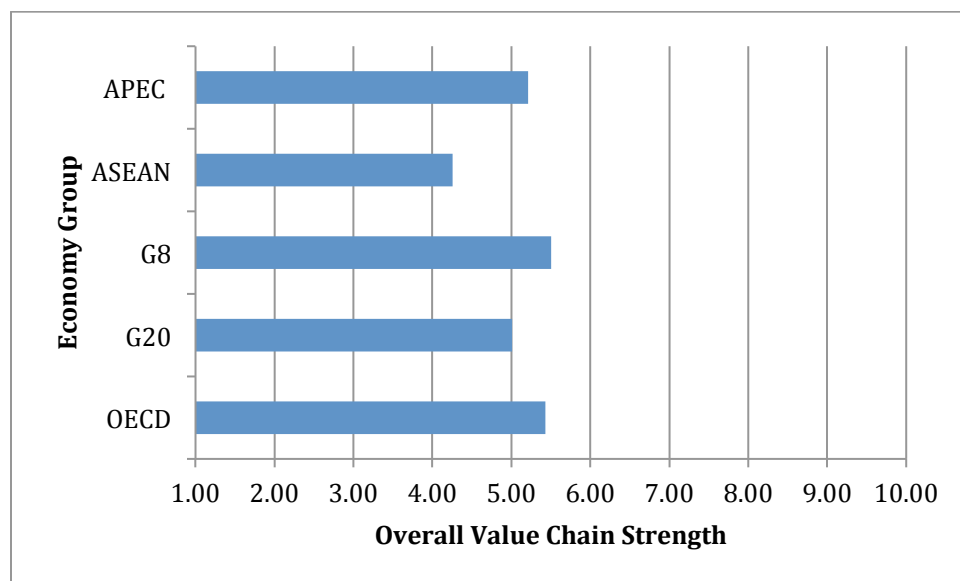
For those risks that are not directly amenable to public sector action—such as natural disasters, and some random or external economic fluctuations—the key intervention for the private sector is in terms of risk management and mitigation. In many respects, risk management is primarily a private

sector activity, and cross-border VCs are skilled in this aspect of doing business. However, there are also steps that the public sector can take to assist the private sector in responding to risk and managing it effectively. For example, development of effective emergency response capacity is a way of managing natural disaster risks: when a negative event occurs, effective emergency response enables government to re-establish conditions of law and order, and restore public services, relatively quickly. More generally, a rapid, effective public sector response to the occurrence of shocks can help the private sector regain its pre-shock footing, with minimum disruption to economic outcomes of importance, such as employment and earnings.

Shepherd and Cattaneo (2014) examine these issues in detail. As the flipside of VC risk, they propose a similar approach to analyzing and measuring VC strength: an economy's ability to respond to the occurrence of particular categories of VC risk. They use the same quantitative approach as in Shepherd et al. (2014) to produce indicators of VC strength in the same categories as the VC risk indicators discussed above. The paper provides a full explanation of data and sources, and is not reproduced in detail here.

Figure 9 presents results for the overall VC strength indicator developed in the paper. The contrast with the overall VC risk indicator is instructive. Even compared with developed economy groups, the Asia-Pacific performs relatively well in the area of VC strength. APEC's score is higher than that of the G-20, and is not too much lower than the scores for the G-8 and the OECD. ASEAN, by contrast, has a noticeably lower score. This pattern of results is suggestive of two main findings. First, Asia-Pacific economies have developed significant capacity in the area of managing and responding to VC risk. Although risk is overall moderate in comparative perspective, strength is relatively high. Second, the contrast between APEC and ASEAN again suggests that although that capacity is fairly general across the region, it is not universal. In particular, developing economies appear to be subject to higher levels of VC risk than their developed counterparts, and at the same time their capacity to respond to the occurrence of those risks is more constrained. There is a clear case for the public sector to redouble its efforts in the two ways identified at the beginning of this section, in order to help the business community continue to develop VC business models across the region.

Figure 9: Overall VC strength assessment for the Asia-Pacific in comparative perspective.



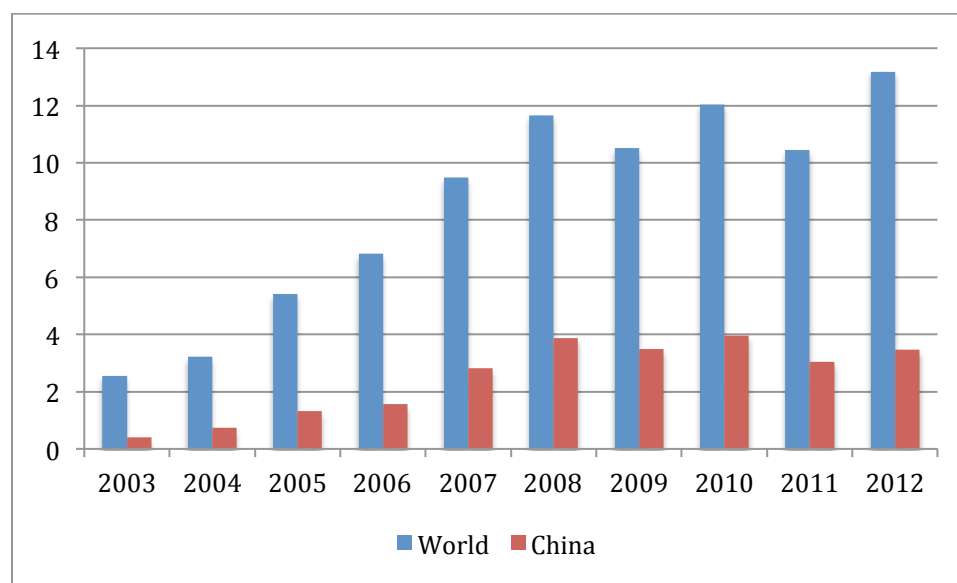
Source: Shepherd and Cattaneo (2014).

The Thai floods of 2011 provide a good case study of the way in which a developing Asia-Pacific economy can respond to the occurrence of a natural disaster. Those floods were the world's fourth costliest natural disaster at the time. Thailand suffered its worst flooding in more than 50 years from July through December 2011. Over six million hectares of land were affected, along with 13 million people. From a VC point of view, the floods had a particularly serious impact on consumer electronics, because Thailand is a major world hub for hard disk drive production. As a result of the floods, production fell by 77% based on a month-to-month annual comparison for November 2011.

The effects of the Thai floods were quickly felt throughout the Asia-Pacific as a result of the trade and investment linkages at the core of the VC business model. The entire personal computer industry was affected by the drop in hard disk production. Two channels were of particular importance: a reduction in margins for downstream industries, and higher consumer prices. Indeed, hard disk prices had nearly tripled by November 2011, because Thailand prior to the floods accounted for 40% of global production.

In light of the scale of this natural disaster and its initial economic effects, the subsequent response is notable for its robustness. Productive capacity was re-established relatively quickly. Although exports fell significantly in 2011, by 2012 they had already exceeded their pre-flood peak (Figure 10). Indeed, export growth in 2012 was so rapid that the final number was arguably back on the pre-flood trend—a remarkable performance. However, the price effects of the production disruption were more persistent: hard drives were still 1.6 times more expensive in mid-2012 than they were before the shock.

Figure 10: Thai Exports of Storage Units (HS 847170) by Destination, USD Billion, 2003-12.



Source: Shepherd and Cattaneo (2014).

The Thai floods are just one example of robust responses to the occurrence of VC risk in the Asia-Pacific. (Shepherd and Cattaneo, 2014 also examine the GFC and the Great Tohoku Earthquake.) VCs in the region are remarkable for their capacity to “bounce back” quickly, even from severe disruptions. Typically, six to 12 months is all that is required for pre-shock levels of production and trade to be restored, or even exceeded. Even more significantly, VC risks when they occur certainly disrupt VC operation, but they typically do not break the chain. Significant investment costs are involved in the establishment of global and regional VCs, and that makes lead firms much less likely to break relationships with suppliers and other parties when risks occur. Rather, they absorb the shock, and tend to work with their VC partners to ensure that the network can operate at full capacity again as quickly as possible.

These examples show that although VC risk is a significant issue in the Asia-Pacific, there is good reason to believe that the private and public sectors together are performing relatively strongly when it comes to managing and responding to those risks. Of course, performance varies significantly from one economy to another, and is typically stronger in more developed economies. However, as the Thai example shows, it is possible for a developing economy to respond effectively to a major natural disaster, and keep its companies’ VC relationships in place. There is much to be learned from this and similar examples from around the region as to best practice for economies in terms of mitigating VC risk and building VC strength.

## 5 CONCLUSION AND IMPLICATIONS FOR DEVELOPMENT POLICY

VC activity is strong and increasing in the Asia-Pacific, particularly in East and Southeast Asia. Strong economic linkages are being put in place between developed and developing economies, and among developing economies themselves. The ability to join VCs, and move up within them to higher value added activities, is high on the development policy agenda. Under the right circumstances and policy settings, VCs have the capacity to bring trade, employment and income, and even technology transfer to developing economies. However, to benefit from these processes, it is important to create a business climate that is conducive to VC activity. The insights from this note,

and the research it summarizes, highlight some important areas in which the public sector can play an active role with this objective in mind.

Risk is a key consideration for lead firms when they establish VCs, and in particular when they make specific investments in them. All firms involved in VCs are constantly managing risk in a wide variety of areas. The public sector can help make that process easier and less costly for firms in two ways, as noted above. First, it can identify risk factors that are directly related to public sector performance, such as regulatory and political risks, and it can take steps to create a climate of greater certainty in those areas. Second, the public sector can develop robust and efficient response capabilities to deal with those risks, like natural disasters, that it cannot directly control. A combination of these two approaches can make it easier for VCs to develop and expand, and in particular to enter markets where they are currently under-represented, such as some of the less developed and more isolated economies in the Asia-Pacific.

From a development policy point of view, dealing with risk is also important because of its capacity to promote relation-specific investments. Those investments are a key way of enabling economies to move up value chains to higher value added activities. For example, the level of investment required to form an arm's length relationship with a component supplier is relatively small. By contrast, the investment required developing a research and development platform to be used for product design is much higher. Reduced risk is one factor—and of course, there are many others—that can help make it attractive for lead firms to make large, specific investments. And as has been shown above, those investments tend to result in strong VCs that are remarkably resilient even to the occurrence of major shocks.

Of course VC risk and strength are together only one part of broader efforts to leverage VCs for development. A number of other policy implications of the rise of the VC business model, and its extension to new areas, also need to be highlighted. In labor surplus economies, such as some poorer developing economies, even participation in low value added processes such as final assembly can have significant economic and developmental benefits as a source of wage income, a way of reducing unemployment, and an incentive for people to enter the formal labor market. However, it is important that VC operators work in an environment that is conducive to the development of backward linkages both within the economy, and externally. The development of such linkages helps expand the benefits of VC activity beyond those immediately involved in a particular task, to include other sources of upstream production. A stable, conducive business environment is key.

On the flipside, it is important to note that VCs are subject to external, as well as internal, risks, and in particular to systemic risks. As a result, they can sometimes adjust labor demand very sharply, with serious implications for development policy. Social safety nets should be an important objective for developing economies looking to leverage VCs for development, to ensure that the most vulnerable are protected, and preferably kept within the structure of the formal economy, when risks occur.

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