

## 2 The Singapore Economy

### Confronting The Challenges To Growth

*Faced with a weakening external environment, domestic economic activity has been lacklustre over the past six months. The external-facing industries bore the brunt of the cyclical slowdown, although there were some upsides to certain oil-related industries. Meanwhile, domestic-oriented activities remained resilient.*

*The outlook for the global economy has softened since the April 2015 Review. A confluence of persistent regional headwinds and limited positive spillovers from the US recovery will cap growth in the external-oriented sectors. However, pockets of activity within the oil-related and other selected exportable industries, as well as steady growth in the domestic-oriented sectors, should shore up the overall growth outcome. Apart from cyclical factors, the ongoing reconfiguration of regional supply chains could weigh on the trade-related industries, although stronger trade linkages with emerging economies may confer some countervailing support. On balance, the Singapore economy is expected to see growth of 2–2.5% in 2015, with risks tilted to the downside. A similar growth outcome is anticipated for 2016.*

*Looking further ahead, as Singapore progresses into the next phase of economic restructuring, growth will have to be driven by productivity gains that are underpinned by knowledge and skill upgrades. As such, technology and innovation-intensive activities will play an increasingly important role in propelling Singapore to the new economic frontier. With Asia's push into the manufacture of advanced products set to continue, Singapore is expected to feature in the high-tech goods and services space. Investment in the digital economy, as well as a complementary labour force with the requisite skillsets, will be critical.*

## 2.1 Recent Economic Developments

### Persistent Global Headwinds

Over the last half year, the Singapore economy has navigated through a challenging external environment. Overall growth was tepid, with the trade-related industries bearing the brunt of a slowdown in regional economies and a dip in intra-regional trade. Idiosyncrasies in the oil trade also led to mixed outcomes in the oil-related industries. Despite the muted external backdrop, visitor arrivals saw a turnaround, which benefited the consumer-facing services sectors. Meanwhile, other domestic-oriented activities, such as healthcare, remained a source of support for growth.

#### Growth momentum in the Singapore economy slowed over the past six months.

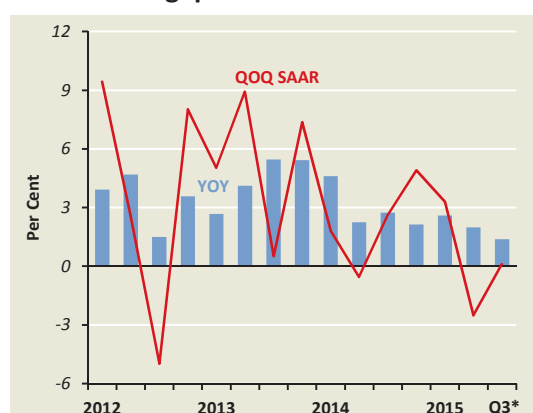
Domestic economic activity eased significantly over the last two quarters. (Chart 2.1) Following a contraction of 2.5% q-o-q SAAR in Q2, the latest *Advance Estimates* pointed to continued weakness into Q3 with provisional growth of 0.1%. In level terms, activity was 0.2% higher than in the last quarter of 2014.

The sluggish performance of the domestic economy largely reflected the deterioration in the external environment. Despite some improvement in the US economy in Q2, persistent headwinds from the regional economies weighed on most production and trade-related services. Industry-specific factors also led to varying outcomes across the oil-related industries, which are plugged into different parts of the global oil supply chain. EPG's Economic Activity Index underscored the intensity of negative external forces on trade-related sectors over recent quarters, while activity in domestic-oriented sectors generally held up. (Chart 2.2)

#### A pullback in the global IT industry, coupled with slowing regional trade, took a toll on the domestic electronics cluster.

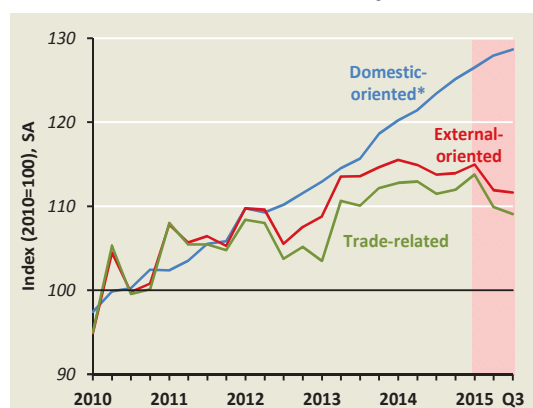
The weakness in the trade-related industries was particularly pronounced in the IT segment. The global IT industry has been trending down in recent quarters amid a worldwide slowing in PC demand. Within Asia, there has been a discernible step-down in intra-regional trade flows since the beginning of this year, particularly those associated with the IT supply chain. A number of the ASEAN-4 and NEA-3 economies witnessed shrinking electronics export volumes in Q2 which, in some cases, persisted into early Q3.

Chart 2.1  
Singapore's GDP Growth



\* Advance Estimates.

Chart 2.2  
EPG's Economic Activity Index



Source: EPG, MAS estimates

Note: The Economic Activity Index is a composite index that tracks the performance of the domestic economy. It aggregates a set of coincident and high-frequency indicators across the major sectors of the economy.

\* Readings for Q3 2015 are based on an average of Jul–Aug data.

Being a key node in the regional IT supply chain, Singapore's manufacturing industry has also been affected. Domestic electronics output recorded a steep 5.0% q-o-q SA fall in Q3 2015, following a decrease of 1.7% in the preceding quarter. Notably, production of computer peripherals saw a sharp pullback in Q3, contracting for the second consecutive quarter. The dismal outcome in IT output in turn generated negative spillovers into semiconductor-related segments within the precision engineering cluster.

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**Meanwhile, non-oil tradable services turned in a muted performance.**

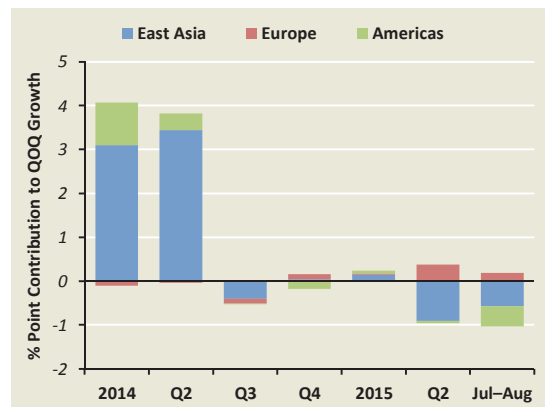
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The cyclical slowdown was likewise evident among the trade-related services sectors. Abstracting from oil-related activities, non-oil sea cargo volumes were weak, with sea container throughput contracting in Q3, following two consecutive quarters of negative growth. More broadly, the shipping industry has been undergoing a period of consolidation as it continues to be plagued by oversupply and depressed freight rates. A recent example is the formation of two major shipping alliances, 2M and Ocean Alliance, which have in turn impacted domestic port activities due to the consolidation of some of their port calls elsewhere.

The financial services industry was also buffeted by regional headwinds. The offshore financial intermediation segment posed a persistent drag as credit demand from the region—the main driver of ACU non-bank loan growth—remained weak. (Chart 2.3) Loans to East Asia fell by an average of 0.8% m-o-m in Jul–Aug, similar to Q2.

In addition, the sentiment-sensitive cluster had to contend with a series of negative confidence shocks to global financial markets over the last few months. Most recently in August, rising concerns over the weakness in the Chinese economy contributed to a heightened degree of risk aversion. According to EPFR Global, investors withdrew US\$14.4 billion from Asia ex-Japan equity funds in August alone, outpacing the rate seen during the “taper tantrum” in 2013. Nevertheless, the forex segment registered better performance in Q3 as increased volatility in the currency markets lifted trading activity. Daily forex turnover rose by an average of 10.8% m-o-m SA in Jul–Aug, compared to 0.3% in Q2.

**Chart 2.3**  
**ACU Non-bank Lending**



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**After a soft patch in Q2, some oil-related industries picked up strongly into Q3, shoring up sequential growth in the overall economy.**

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Despite the general weakness in the external-oriented industries, oil-related activities rebounded robustly in early Q3, after a dip in Q2. However, the performance was very uneven across the supply chain. Table 2.1 lists the activities associated with the upstream, midstream and downstream segments of the oil supply chain.

The strong aggregate outturn in Q3 for oil-related industries stemmed largely from the midstream segment. (Chart 2.4) Specifically, oil export and cargo volumes registered healthy expansions of 6.7% and 13.3% respectively in Q3, turning around from the contractions in Q2. Possible reasons for this include China's stockpiling of crude oil for its strategic reserves amid further declines in oil prices, as well as speculative trading of fuel oil used for air-conditioning, due to an unusually hot summer in the Middle East.

In contrast, the upstream marine & offshore engineering industry languished for the third consecutive quarter, due to delays in rig deliveries and a slowdown in new orders as global oil and gas exploration activities fell off in response to low energy prices. (Chart 2.4)

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**Demand for consumer-facing services strengthened into Q3.**

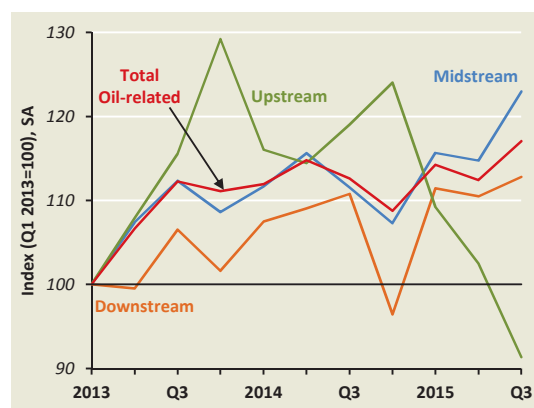
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The hospitality sector was the bright spot in the economy. Visitor arrivals recovered in Q2 2015 after declining in the preceding quarter, and surged by 7.5% m-o-m SA in July, led mainly by tourists from China. This rebound could, in part, be attributed to promotional efforts by the Singapore Tourism Board since May this year. In particular, \$20 million had been earmarked for a marketing campaign to attract visitors from key markets such as China, Indonesia and India. In tandem with the uptick in arrivals, hotel occupancy rates rose to 87% SA in Jul–Aug after averaging 83% in Q2. The pickup in the tourism industry in turn generated positive spillovers into the domestic retail sector, with overall retail sales volumes (excluding motor vehicles) seeing good gains across discretionary and essential purchases in Jul–Aug.

**Table 2.1**  
**Oil-related Industries by Segment**

Segment	Industry
Upstream	Marine & Offshore Engineering
Midstream	Oil-related Transport & Storage
	Oil Wholesale Trade
Downstream	Petroleum
	Petrochemicals

**Chart 2.4**  
**Real Oil-related Activities in Singapore**



Source: EPG, MAS estimates

Note: The Index of Industrial Production (IIP) of petroleum and petrochemical products is used to capture activities in the downstream segment, while the IIP of marine & offshore engineering is used for the upstream segment. In the midstream segment, oil wholesale trade is measured by total oil exports in real terms, while oil transport refers to sea cargo (oil products) handled.

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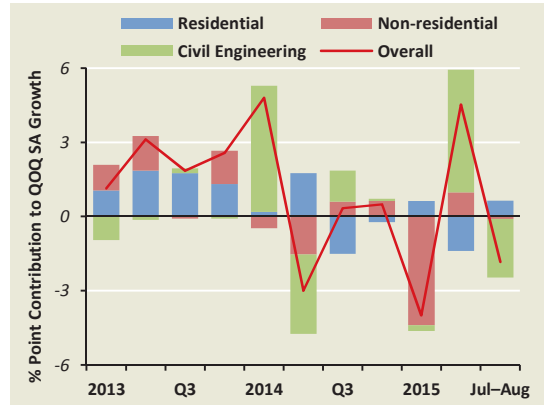
**Domestic-oriented industries remained broadly supportive of overall growth.**

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Domestic-oriented activities generally held steady over the past two quarters. After a strong performance in Q2 underpinned by robust civil engineering works, momentum in the construction sector eased to -0.8% q-o-q SAAR in Q3, due to a temporary pause in infrastructural developments as well as public non-residential works. (Chart 2.5)

Meanwhile, supply-side expansions continued to meet increased demand for essential services such as healthcare. For example, the phased opening of Ng Teng Fong General Hospital at the end of June expanded hospital capacity by bringing on-stream new outpatient facilities and approximately 500 additional beds. The subsidies from the Pioneer Generation Package also provided greater access to outpatient services for elderly citizens, resulting in higher utilisation of healthcare services.

**Chart 2.5**  
**Certified Construction Payments**



Source: EPG, MAS estimates

## 2.2 Economic Outlook

### Modest Growth Amid A Challenging External Environment

*The overall outlook for the global economy has softened since the April 2015 Review. While the US economy is likely to expand at a steady pace, US import demand has been more muted in this current cycle. Concomitantly, regional headwinds have intensified recently, and are likely to persist. Taken together, the Singapore economy will be weighed down by weakness in the external-oriented sectors in the next few quarters. However, there will be tentative support from pockets of activities within the oil-related and some other manufacturing industries, as well as steady growth in the domestic-oriented sectors. Apart from cyclical factors, the trade-related industries continue to grapple with structural challenges, including the ongoing reconfiguration of regional supply chains. Nonetheless, stronger linkages with emerging nodes in the regional supply chains should provide some offset. On balance, GDP growth in Singapore is likely to come in at around 2–2.5% for 2015 as a whole, with risks tilted towards the downside. The economy is expected to expand at a broadly similar pace next year.*

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**Cyclical challenges will continue to weigh on the Singapore economy.**

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The external environment is likely to remain challenging in the quarters ahead. While the recovery in the US economy has gained some traction, the strength of the recovery may not filter down as strongly to import demand this time round. Meanwhile, the region will have to contend with challenges arising from China's slowdown and tighter external financing conditions.

Given Singapore's close linkages with the region, the external-oriented sectors are likely to remain sluggish. Apart from cyclical downtrends, the domestic IT industries will have to confront the effects of ongoing reconfigurations in regional supply chains. Nonetheless, Singapore's strengthening linkages with emerging economies, such as Vietnam, in regional supply chains could provide some support at the margins. Supply-side expansions in some manufacturing industries could also help to augment activity.

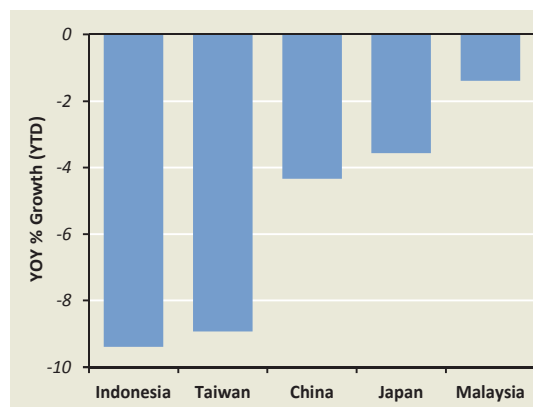
Going forward, oil trading should remain buoyant. Arbitrage opportunities in the market could persist in the months ahead, keeping demand for cheaper crude oil strong. Further, the domestic-oriented industries will benefit from firm demand for essential services such as healthcare and education. Overall, GDP growth in Singapore is likely to come in at around 2–2.5% in 2015, with risks tilted towards the downside. The economy is expected to grow at a broadly similar rate next year.

### Weakness in Singapore's major trading partners will dampen domestic growth.

The slowdown in our major regional trading partners, such as China, Indonesia and Malaysia, will impact negatively on Singapore's near-term GDP growth. These three economies have experienced a moderation in GDP growth this year, expanding by 5.7% y-o-y on average in H1, compared to 6.1% in 2014. (See Section 1.2.) Concomitantly, total imports (in nominal US\$ terms) into these economies has, on average, contracted by about 16% since the start of this year.

Collectively, these three economies account for a third of Singapore's goods exports and are also significant sources of demand for services such as tourism. (Table 2.2) Given this, Singapore's export performance this year has been weighed down by softening demand from the regional economies, with NODX contracting in the first nine months of the year. (Chart 2.6)

**Chart 2.6**  
Singapore's Major Regional NODX Markets (Jan–Sep 2015)



**Table 2.2**  
Singapore's Economic Linkages with China, Indonesia and Malaysia

	(% of Singapore's Total)		
	China	Indonesia	Malaysia
Domestic Exports	11.9 (2)	8.9 (3)	12.1 (1)
Re-exports	13.4 (2)	9.9 (4)	11.8 (3)
Visitor Arrivals	11.4 (2)	20.0 (1)	8.2 (3)
FDI into Singapore*	1.9 (15)	0.4 (28)	3.2 (10)
Overall Economic Exposure to Final Demand (% of Singapore's GDP)	6.2	3.4	2.3

Source: OECD-TiVA Database (2011) and EPG, MAS estimates

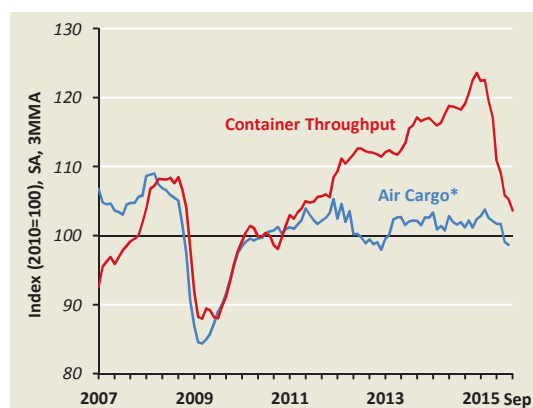
Note: Figures in parentheses refers to the country's ranking in terms of its share of the total.

\* FDI data is only available up to 2013 while domestic exports, re-exports and visitor arrivals are updated to 2014.

The demand for Singapore's external-oriented services will also remain lacklustre. With intra-regional trade flows likely to remain muted in the near term, Singapore's port traffic and other ancillary logistics activities are expected to turn in modest performances for the rest of the year. Air cargo volumes, for instance, recorded its lowest reading since December 2012. Container throughput has also weakened significantly since the beginning of the year. (Chart 2.7)

Notwithstanding the uptick in visitor arrivals over the last six months, persistent softness in the regional economies could temper tourist arrivals for the rest of the year and into 2016. This would have a knock-on effect on the retail and food & beverages industries. In fact, the share of shopping as a percentage of

**Chart 2.7**  
Singapore Air Cargo Volume and Container Throughput



Source: EPG, MAS estimates

\* Data is available up to August 2015.

tourism receipts has been declining over the last three years, from a high of 22% in Q4 2011 to 17% in Q4 2014. Increased regional penetration of established brands and the growing prevalence of online retailing are some of the challenges facing domestic retailers.

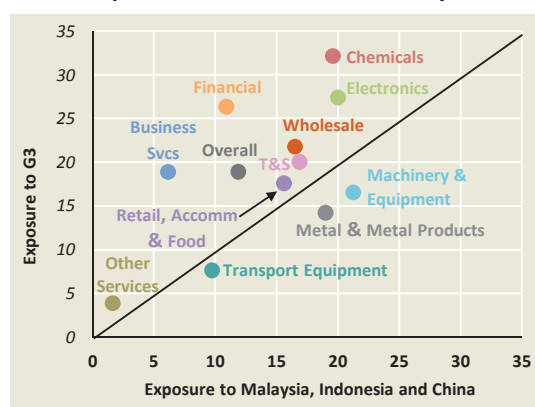
**Singapore may not be able to leverage fully on the recovery in the US economy.**

While regional activity is expected to remain weak, the G3 could provide some countervailing support in the near term. Collectively, G3 final demand accounts for about 20% of Singapore’s overall value added, compared to 12% for the regional economies, and most local industries have a higher exposure to final demand in the G3 than the regional economies. (Chart 2.8)

The US economy, in particular, is expected to be the main driver of G3 growth. However, the step-up in US GDP growth, from an annual average of 2.0% over 2012–14 to 2.7% y-o-y over Q3 2014 – Q2 2015, has been largely consumption-driven, and mainly met by domestic supply. In comparison, growth of goods and services imports was weak, averaging only 0.7% over the same period. (Chart 2.9) Consequently, any boost from a resurgent US economy could be more muted than before. (See Special Feature A for an analysis of how Singapore’s trade elasticities have evolved in recent years.)

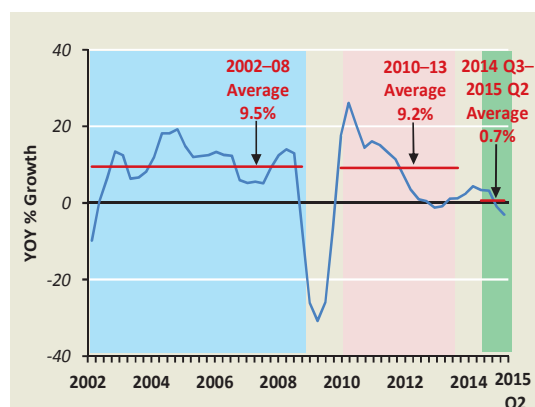
Notably, the sectoral breakdown in Table 2.3 shows a sharp pullback in US imports of oil and chemicals over the past year. The steep fall in imports of oil and chemicals has been driven by declining product prices and the growth of the shale gas industry in the US. The development of logistics and infrastructure has enabled US shale resources to be economically extracted and transported. This has reduced US reliance on imports to meet their energy needs. Indeed, there is some evidence of reshoring in the US chemicals sector, which has experienced stronger growth in employment of 1.4% in 2014 compared to its historical average of -1.3% over 2000–14. Furthermore, the chemicals sector saw an uptick in domestic industrial production alongside a moderation in the growth of outward direct investment from a high of 14.4% in 2011. (Chart 2.10)

**Chart 2.8**  
Singapore’s Exposure to the Region and G3  
(% of Sectoral Value Added)



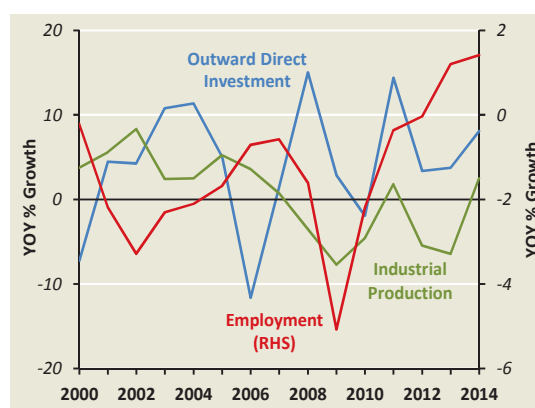
Source: OECD-TiVA Database (2011) and EPG, MAS estimates

**Chart 2.9**  
US Imports



Source: Bureau of Economic Analysis

**Chart 2.10**  
US Chemicals Sector Employment, Industrial Production and Outward Direct Investment



Source: CEIC and Bureau of Economic Analysis



**Table 2.3**  
**US Imports by Sector**

Sector	(Average YOY % Growth)	
	Q1 2001 – Q2 2015	Q3 2014 – Q2 2015
Finance & Insurance Services	8.7	-2.4
Wholesale Trade	5.4	0.2
Business Services	10.5	3.9
Electrical & Optical Equipment	2.3	2.3
Chemicals & Non-metallic Mineral Products	9.0	-23.4
Transport & Storage	4.3	4.9
Retail Trade; Hotels & Restaurants	4.4	8.2
Other Manufacturing, Mining & Primary Products	5.1	6.0
Machinery & Equipment	6.1	7.0
Other Services	6.0	-1.3
Basic Metals & Fabricated Metal Products	8.8	5.9
Transport Equipment	5.3	6.4
<b>Total</b>	<b>5.4</b>	<b>0.7</b>

	Below-trend and contracting
	Below-trend, but positive growth
	At or above trend

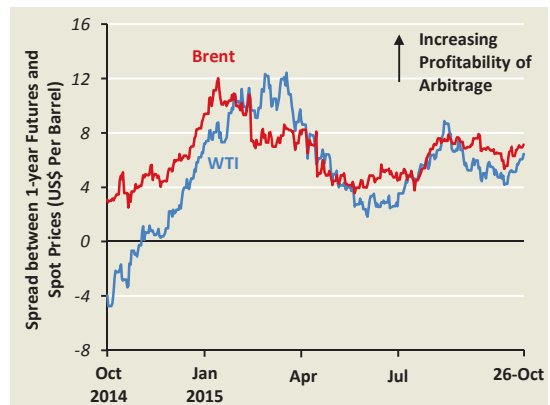
Source: Bureau of Economic Analysis and EPG, MAS estimates

### Pockets of oil-related activities may provide some lift to headline growth ...

As witnessed in recent months, declining oil prices have been a boon to the midstream segments of the oil-related industries. Going forward, stockpiling should continue to lend support to oil trading, as long as arbitrage opportunities remain.<sup>1</sup> (Chart 2.11) Furthermore, the build-up in China's strategic crude oil reserves is expected to continue, given the scheduled opening of more storage facilities in H2 2015.

The outlook is more circumspect for downstream petroleum and petrochemical production. When global crude oil prices saw another bout of weakness in Jun–Aug 2015, Singapore benefited from a step-up in its oil terms of trade, as import prices of crude oil fell more sharply than export prices of refined products. (Chart 2.12) However, this could be short-lived as refined product prices typically mirror the trend of crude oil prices, albeit with a lag. Moreover, should oil prices start to rise, the terms of trade could reverse. Indeed, the oil terms of trade saw a pullback

**Chart 2.11**  
**Arbitrage Opportunities in the Oil Markets**



Source: Bloomberg

<sup>1</sup> The current crude oil market is in “contango”, in that the futures price is above the current price. Traders can purchase oil at cheaper rates from the spot market, store it and gain from selling forward contracts at the higher price.

in Feb–May 2015 following the initial spike at the turn of the year, as oil prices recovered mildly during this period. More broadly, in light of the regional economic slowdown, oversupply in the petrochemical segment and scheduled plant maintenance shutdowns in H2 2015, activity in the downstream segments is expected to remain subdued.

Meanwhile, upstream oil & gas (O&G) production, in particular Singapore’s marine & offshore engineering (M&O) segment, has been hit hardest by developments in the global oil market. According to the latest *Survey of Business Expectations of the Manufacturing Sector*, sentiment among M&O manufacturers has taken a turn for the worse since the previous quarterly survey. New-build orders for offshore rigs and support vessels in Singapore’s shipyards are anticipated to remain weak in the coming quarters amid the global cutback in O&G capital expenditure.

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**... while supply-side expansions could shore up manufacturing output.**

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Although activity in the manufacturing sector has been lacklustre recently, supply-side expansions, particularly in the chemicals segment, should augment the cyclical uplift from improved demand in the G3. For instance, the gradual ramping up of production at German firm Evonik should provide a boost to the specialty chemicals sector. Despite the headwinds in the petrochemical industry, some firms, such as Shell, have also been expanding their operations in Singapore, with a medium-term view to leverage on growing regional demand.

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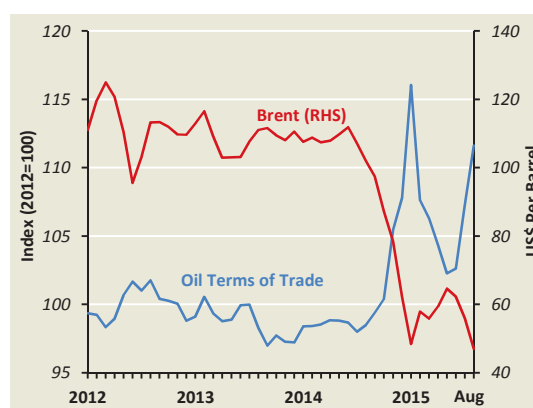
**Domestic-oriented activities, especially essential services, will remain a source of support.**

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The domestic-oriented sectors will continue to see positive growth, albeit at a slower pace. These sectors can be further divided into essential services, such as healthcare, education and telecommunication, and more cyclically-sensitive sectors like retail trade, construction, and financial & business services.

Essential domestic services will be lifted by increased government expenditure in the healthcare and education sectors. Conversely, the cyclically-sensitive sectors could witness some moderation in the quarters ahead, particularly in property-related sectors. The continued weakness in the private real estate segment will have negative spillovers into construction,

**Chart 2.12**  
**Brent Oil Price and Oil Terms of Trade**



Source: Bloomberg and EPG, MAS estimates

architectural & engineering services, and domestic lending. However, there will be increased building activity from government infrastructure projects, such as Changi Airport Terminals 4 and 5. Box A examines the longer-term relationship between Singapore's housing and business cycles, and characterises the impact of the residential property cycle on construction employment.

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**Over the medium term, the rise of Vietnam and the rest of CLMV will lead to a shift in Asia's trade patterns ...**

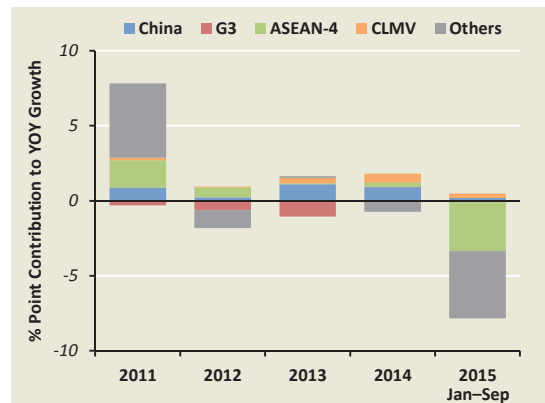
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Aside from cyclical factors, Singapore also has to respond to the ongoing changes in global supply chains. As highlighted in the April 2015 *Review*, the growing centrality of China's manufacturing sector in the region's production network will have a profound impact on companies' operations across different geographical locations. Specifically, the step-up in China's capabilities in the IT intermediate goods space has led to some slowdown in imports from the rest of the region, including Singapore. Nonetheless, China's internalisation of their midstream production could be mitigated somewhat by the strengthening trade linkages with emerging nodes in regional supply chains. Chart 2.13 shows that CLMV (Cambodia, Lao PDR, Myanmar and Vietnam) was the main source of support for Singapore's exports thus far this year. More broadly, across the region, the share of ASEAN-4 exports to CLMV economies has doubled to around 4% over the last 10 years.

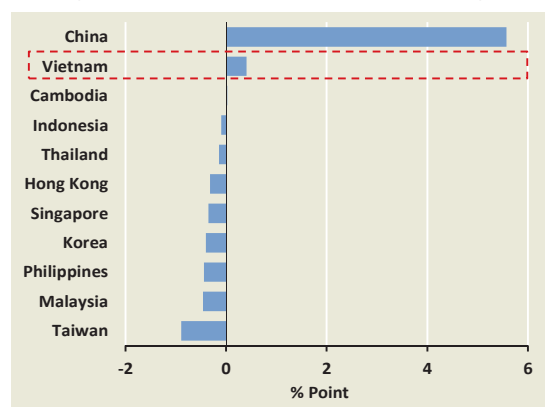
The integration of CLMV into regional production networks has led to some changes in Asia's trade patterns. In particular, the rapid rise of Vietnam has made it a bright spot in the region. Bucking the broader regional trend, the increase in Vietnam's export market share in the G3 was the second largest after China between 2006 and 2013. (Chart 2.14)

In the early 2000s, Vietnam's role in the region's production networks was marginal and largely based on the manufacture of lower-value consumption goods such as apparel and footwear. Post-2010, however, Vietnam features as a prominent production node between China, NEA-3 and the end-markets of the US and the EU. These flows are concentrated in electronics, with a strong emphasis on the mobile phone segment. In light of significant investment inflows from firms such as Samsung Electronics, LG Electronics, Intel and Foxconn Technology,

**Chart 2.13**  
**Singapore's Total Exports by Region**



**Chart 2.14**  
**Change in Export Market Shares in the G3 (2006–13 ave minus 2000–05 ave)**



Source: UN Comtrade and EPG, MAS estimates

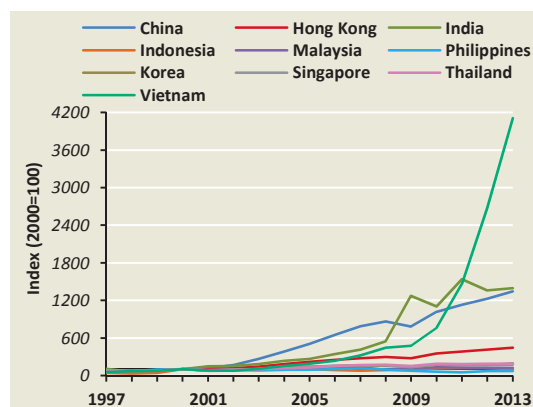
Vietnam's importance in the region's electronics trade network should increase. (Chart 2.15)

### ... which should confer benefits to Singapore's domestic exporters and wholesalers.

The integration of CLMV, particularly Vietnam, into Asia's trade networks has benefited Singapore both directly and indirectly. Vietnam's growing role as an electronics assembly hub does not pose a direct competitive threat to Singapore's IT manufacturers at present. The low degree of electronics export similarity shows that Singapore and Vietnam IT exporters are not competing in the same product space. (Chart 2.16) While Singapore's electronics export basket largely comprises semiconductors, Vietnam's comparative advantage lies in the manufacturing and assembly of mobile communication devices and office equipment. (Chart 2.17) Leveraging on such complementarities, Singapore's semiconductor exporters received a significant boost from the surge in Vietnam's tech trade, with both domestic and re-exports of semiconductors to Vietnam increasing by seven and fifteen times respectively in 2014, as compared to 2010. Upon completion of the assembled products in Vietnam, Singapore subsequently imports and re-exports finished goods, such as mobile phones and PCs.

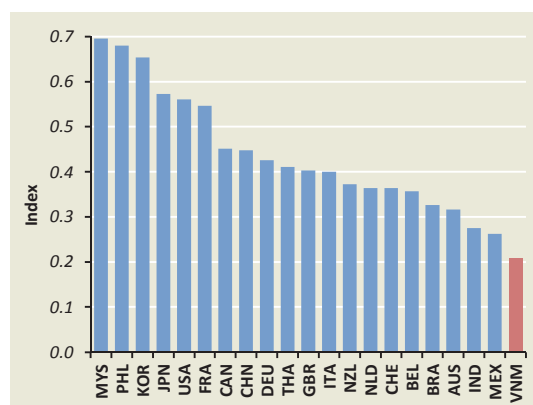
Going forward, deeper economic integration among the ASEAN members, spurred by the ASEAN Economic Community (AEC) initiative, should transform the region into a competitive market with the free flow of goods, services, investment, skilled labour and capital. Apart from Vietnam, countries such as Cambodia, Lao PDR and Myanmar also stand to gain from the expansion of low-cost, labour-intensive manufacturing. In turn, this heralds new opportunities for Singapore and other ASEAN exporters, which extend beyond the trade in electronics. For instance, increased investment activity in CLMV could support greater demand for refined oil exports as energy requirements rise in line with their industrialisation drive. Further, the boost to incomes in CLMV will raise the purchasing power of households in these countries, which bodes well for Singapore re-exporters plugged into the consumption goods space.

**Chart 2.15**  
Asia's Electronics Exports



Source: UN Comtrade and EPG, MAS estimates

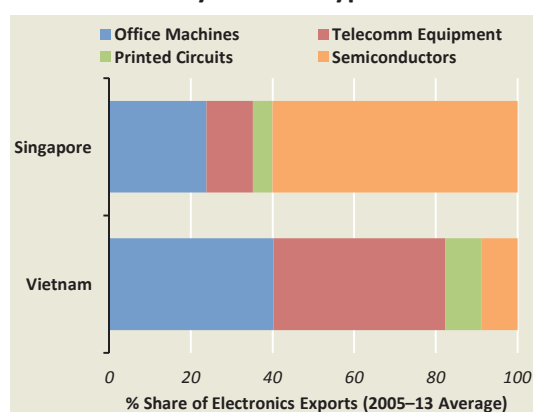
**Chart 2.16**  
Singapore's IT Export Similarity Index (2013)



Source: UN Comtrade and EPG, MAS estimates

Note: The IT export similarity index measures the extent to which an economy's electronics export structure resembles that of another. The higher the index, the more similar an economy's IT exports are to those of Singapore. The analysis was based on SITC definitions at the 4-digit level.

**Chart 2.17**  
Singapore's and Vietnam's IT Exports by Product Type



Source: UN Comtrade and EPG, MAS estimates

## Box A Housing and Business Cycles in Singapore

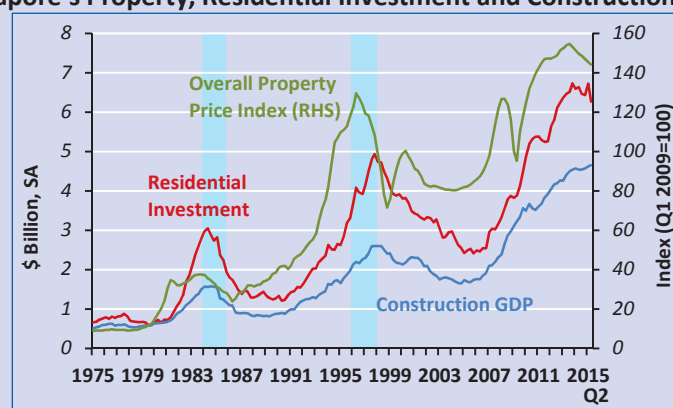
### Introduction

This Box investigates the relationship between housing and business cycles in Singapore. The nexus between the property market and macroeconomic outcomes has increasingly been the subject of academic study as well as a focus of government and central bank policies, due in part to the experiences arising from the GFC. Among researchers, Leamer (2015), for example, concluded that housing is the single most critical component of the US business cycle.<sup>1/</sup> Policymakers have also been made aware that asset cycles, in particular developments in the housing market especially when accompanied by a credit boom, can present significant financial stability risks as well as contribute to and worsen an economic downturn.

### *Housing has a longer cycle and is generally not synchronised with Singapore's overall business cycle.*

Over the past four decades, the Singapore housing market has expanded at a sustained pace, alongside population and economic growth. During the period from 1975 to 2014, real housing investment (both public and private) rose at a compounded annual growth rate of 5.9% and led to overall construction output growth of 5.6%. An examination of the movements in these aggregates indicates two distinct peaks in the housing cycle: in 1984–85 and in 1996–97. (Chart A1) These turning points appear to correspond with, but slightly lag, the cycles in property prices, as developers react to price movements by increasing or decreasing the supply of new housing.

**Chart A1**  
Singapore's Property, Residential Investment and Construction Cycles



To compare the housing cycle with the overall business cycle, the trend components in real GDP and real residential investment are removed using the Corbae-Ouliaris (2006) frequency domain filter.<sup>2/</sup> The resultant series suggests that there have only been two major housing cycles in Singapore, although smaller downturns are evident in the mid-2000s and in recent quarters. (Chart A2) As for the business cycle, the Singapore Department of Statistics' Composite Coincident Index is used as the reference series to identify the turning points in Singapore's growth cycle.<sup>3/</sup> Among the nine growth recession episodes identified for the Singapore economy, the contribution of residential investment to overall GDP growth was modest or countercyclical, with the exceptions of the 1985 recession and the Asian Financial Crisis of 1997–98. (Chart A3)

<sup>1/</sup> He showed that nine out of the eleven recessions in the US over the period 1950–2014 were preceded by a slowdown in the housing market, and that the housing market was characterised by a volume-driven rather than a price-driven cycle.

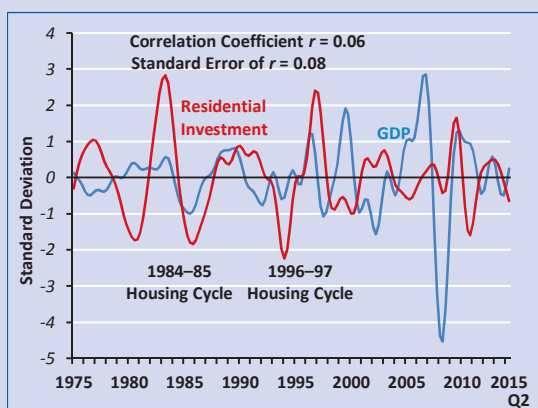
<sup>2/</sup> This technique has the advantage of preserving observations at the end-points. See MAS (2009) for an explanation of frequency domain extraction techniques.

<sup>3/</sup> The Composite Coincident Index aggregates five real macroeconomic indicators—GDP, Index of Industrial Production (IIP), Non-oil Domestic Exports (NODX), Total Employment and Retail Sales Index, excluding motor vehicles—and tends to move in tandem with the general business cycle and GDP. See MTI (2012).

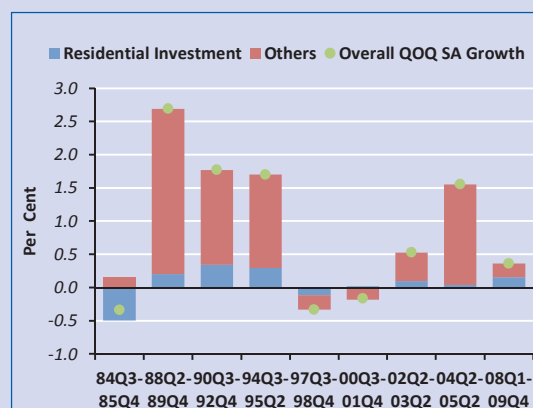
That the two cycles do not coincide is a reflection of the strong role played by external factors in Singapore's growth outcomes, with export demand, on average, accounting for three-quarters of total demand. Indeed, the correlation coefficient between the cyclical components of residential investment and GDP is weak at 0.06, which is statistically insignificant. Concomitantly, the share of residential investment in overall GDP has been on a secular decline, falling from a peak of 20% in Q2 1984 to around 6.5% in Q2 2015.

The desynchronised behaviour of the housing cycle in Singapore *vis-à-vis* the general business cycle can be attributed, in part, to the occasional use of public construction as a countercyclical stabilisation tool during periods of weak growth. For instance, during the GFC, the Singapore government announced in its FY2009 Budget that it would be increasing public sector construction that year, proceeding with contracts worth \$18–20 billion, including spending on MRT and road transport networks. It also brought forward \$1.3 billion worth of wide-ranging construction projects, including HDB lift upgrading works and the building of park connectors.

**Chart A2**  
Cyclical Components of Singapore's Housing and Business Cycles



**Chart A3**  
Contribution of Residential Investment to GDP Growth During Downturns



***Despite being volume-driven, the impact of housing cycles on the labour market has been limited.***

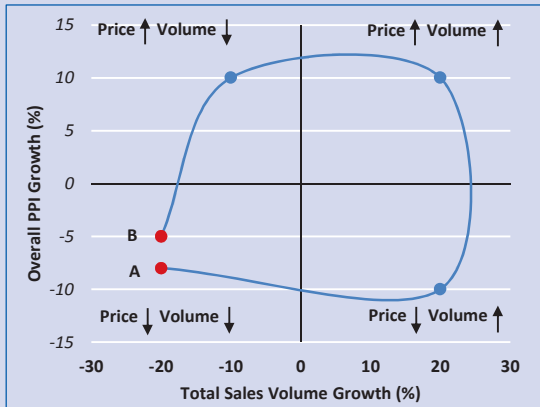
The standard demand-supply model of the housing market suggests that, faced with weakness in demand, house prices will fall and volumes will tend to be maintained by price cuts. However, Leamer (2015) argued that the inefficient price discovery process in the US housing market creates a mismatch of price expectations between buyers and sellers. In addition to informational inefficiencies, price adjustments are hindered by high transaction costs, infrequent trades and the locational fixity and indivisibility of housing. This in turn leads to larger changes in sales volumes and accordingly, the housing cycle in the US can be characterised as a volume cycle, and not a price cycle. As depicted in the phase diagram in Chart A4a, a stylised volume-driven housing cycle moves in a counter-clockwise manner from a trough (labelled A) through its peak and to a new trough (labelled B), and is associated with larger changes in sales volumes relative to price movements.

To examine if this is the case for Singapore, the URA private residential property price index (PPI) is plotted against the annual change in total private residential sales volumes from 1997–2003, and a similar counter-clockwise movement is observed. (Chart A4b) Property prices in Singapore fell after 1997 and thereafter, volumes recovered strongly and drove the increase in prices, which was relatively muted in comparison with the rise in volumes. Subsequently, volumes fell for an extended period during the downswing phase before prices followed suit. The larger-than-expected volume adjustments seen in Singapore likely reflect the active role of local developers in managing their available-for-sale inventories over the property cycle. Typically, developers would hold back on releasing new units for sale during cyclical downswings so as to preserve their profit margins.

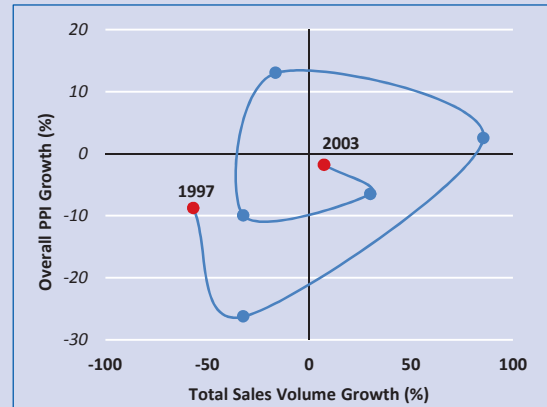
A volume-led housing cycle implies a relatively larger adjustment in sales transactions compared to price changes during turning points in the cycle. Consequently, construction output and the number of workers

employed in the sector could be subject to larger swings as housing demand adjusts through the quantity of homes sold, leading to structural displacement of workers in the construction sector.

**Chart A4a**  
Stylised Phase Diagram for the Housing Market



**Chart A4b**  
Phase Diagram for Singapore's Housing Market (1997–2003)



However, Singapore's construction workforce is generally able to adjust flexibly to changes in demand, without a discernible impact on local employment. This is shown by the strong linear relationship between investment in construction & works and employment. (Chart A5) Movements along the fitted regression line have been accommodated by the largely transitory foreign workforce in the construction sector, which is subject to quotas tied to ongoing construction projects.<sup>4/</sup> During a downturn, as housing sales and construction activity decline, foreign workers are laid off, so there is no increase in resident unemployment in the housing sector. Hence, Singapore does not experience the large booms and busts in construction employment typically seen in countries with a volume-driven housing cycle.

**Chart A5: Construction Investment and Employment**



Source: EPG, MAS estimates

**Sum-up**

This Box has reviewed the characteristics of fluctuations in the Singapore housing market, as proxied by real housing investments. There are three key findings. First, Singapore's housing cycle has a longer duration than, and is generally not synchronous with, the overall business cycle. Second, the housing cycle appears to be volume-driven, with changes in sales volumes of new and resale homes leading price changes around the turning points. Finally, despite being volume-driven, the impact of housing cycles on the domestic labour market has been limited, as Singapore's construction employment has been able to adjust flexibly to fluctuations in the residential property market.

<sup>4/</sup> Construction projects are subject to Man-Year Entitlement quotas, which stipulate limits on the number of workers employable depending on the total value of the project.

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## 2.3 The New Economic Frontier

### The Rise Of Technology And Innovation

*The technology and innovation cluster will play an instrumental role in fostering the Singapore economy's upgrade to a new production frontier. Over the last decade or so, Asia has made significant headway as a production base for high-tech products. This expansion is likely to persist, with Singapore contributing high-tech and high-value goods and services, supported by a vibrant technology and innovation cluster. Against this backdrop, capital inputs associated with the digital revolution, such as ICT hardware, software, and R&D, will be the key drivers of economic activity in the future. At the same time, given the crucial role of intellectual capital in the next phase of development, the labour force will need an appropriate mix of relevant technical expertise and soft skills in order to meet the demands of the frontier industries.*

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#### A closer look at the role of technology and innovation in Singapore's long-term development path.

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The next phase of Singapore's economic development will be characterised by a knowledge- and skills-based economy, with the associated productivity gains overcoming Singapore's supply-side constraints. In this regard, the development of the technology and innovation cluster is critical, as it has important implications for Singapore's long-term economic growth. This section provides an overview of the external production landscape in the high-tech space, before turning to the contribution of such activities to the domestic economy. The resource requirements, including capital and labour, will be discussed in the latter part of the section.

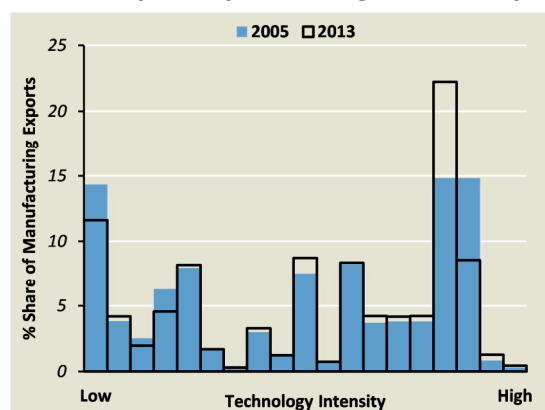
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#### Production of high-tech products will continue to reside in Asia.

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Asia has seen a step-up in its importance in global trade over the past decade as China and other fast-growing regional economies became an integral part of global supply chains. Concomitantly, Asia's export profile has seen a significant transformation. Ranking Asia's merchandise exports by technological intensity shows that Asia's production landscape followed a broadly bimodal profile in the mid-2000s, with low-tech and high-tech products forming twin peaks in the distribution. (Chart 2.18) By 2013, however, Asia's export profile appeared more skewed, with a greater concentration in high-tech goods. This trend will likely increase, with some Asian exporters gradually specialising in areas such as niche pharmaceutical drugs, industrial robots and satellite equipment.

**Chart 2.18**  
Asian Exports by Technological Intensity



Source: BACI-CEPII and EPG, MAS estimates

Note: Adopting the methodology employed by the OECD, the classification of the products into technological tiers is based on the direct R&D intensity of a specific product class. This classification provides insights into the relative changes in knowledge intensities of an economy, which is often mirrored in shifts in trade patterns.

Over the past decade, exporters from NEA-3, China and India have made significant headway in the production of high-tech goods, with such products accounting for a larger proportion of their export baskets in 2013 compared with 2005. (Chart 2.19) The shifts by regional producers into higher value-added goods should pave the way for further deepening in intra-Asian trade flows, as greater opportunities for specialisation enlarge the scope for gains in trade. Preliminary evidence shows a positive correlation between the level of product sophistication—proxied by R&D intensity—and the number of international production stages. (Chart 2.20) As the push by NEA-3, China and India into the high-tech space gains traction, the number of production stages spanning multiple locations should increase, giving rise to a larger volume of intra-industry trade flows.

At the same time, in the low-tech segment, Asia will assume the roles of investor, producer and consumer. China’s growing investment in East Asia, which accounted for 60% of its outward direct investment in 2008–12 on average, will expand the production capabilities of the ASEAN-4 and CLMV economies in low-tech industries. Producers in these countries will stand to gain, anchored by firm regional demand for basic consumption goods as shown by a sizeable import share of low-tech consumer goods for most Asian economies. (Chart 2.21) Such trends will provide a fillip to intra-Asian trade flows.

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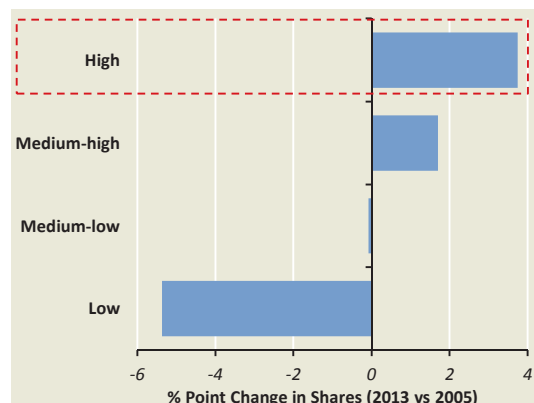
**Singapore stands to benefit from the increased trade in high-tech goods and services ...**

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The growth in regional trade will bring about a closer integration of the Asian economies. Successful implementation of the Trans-Pacific Partnership would also open up new markets for exporters from the region. Singapore’s role in a highly-liberalised and integrated global economy will be as a supplier of high-tech and high-value goods and services, supported by a vibrant domestic technology and innovation cluster. In fact, over the past two decades, Singapore’s exporters have scaled the value chain, exporting more complex products while becoming more integrated into the region’s supply chain. (See Box B.)

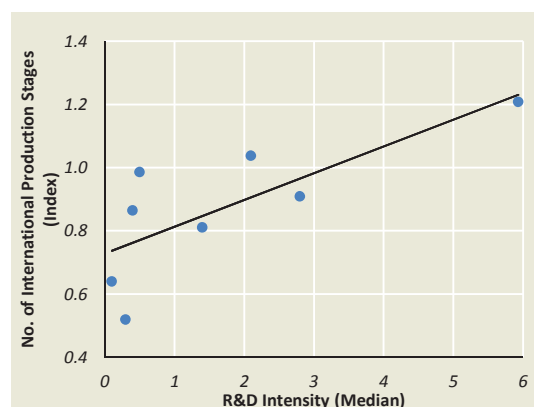
Firms that engage in activities related to technology and innovation span across the manufacturing and services sectors, and range from electronics and pharmaceuticals, to architectural & engineering,

**Chart 2.19**  
**Exports of NEA-3, China and India**  
**by Technology Intensity**



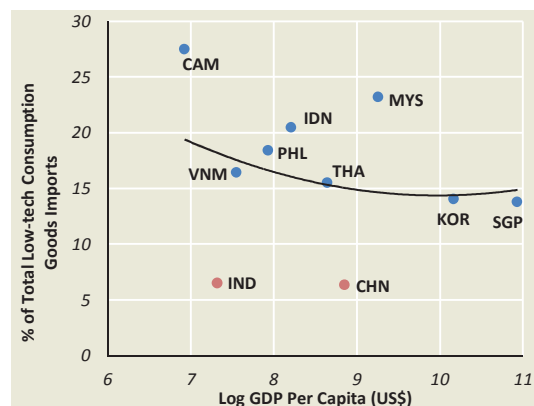
Source: BACI-CEPII and EPG, MAS estimates

**Chart 2.20**  
**Product Sophistication & Number of**  
**International Production Stages**



Source: OECD Global Value Chains indicators, OECD Directorate for Science, Technology and Industry and EPG, MAS estimates

**Chart 2.21**  
**Asia’s Share of Imported Low-tech**  
**Consumption Goods (2013)**



Source: UN Comtrade, IMF World Economic Outlook Database and EPG, MAS estimates

and professional, scientific & technical services. The information & communications industry also plays a central facilitating role by providing the necessary infrastructure (mainly the Internet, but also telecommunications technologies) and facilitating the growth of e-commerce.

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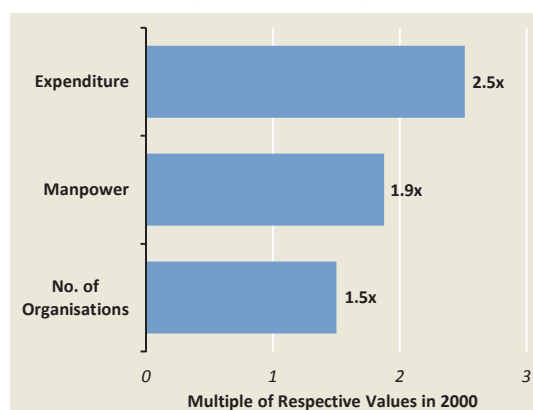
**... with its new industrial structure shaped by technology- and innovation-intensive activities.**

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EPG estimates show that technology and innovation activities, taken together, already accounted for around 18% of Singapore's real GDP in 2014. While the ongoing reconfigurations in the domestic electronics industry could weigh on these activities in the short term, this cluster will play a critical role in bringing the Singapore economy to a new production frontier with increased R&D activities and intensive use of cutting-edge technology.

Cross-country comparisons show that relative to other advanced economies, Singapore's aerospace, pharmaceuticals, and electronics industries have lower R&D intensity, and are focused on the *production* of these high-tech products. For example, Singapore's R&D intensity in the electronics space averaged 9.5% in 2009–13, lower than Korea's 25%.<sup>2</sup> However, electronics accounted for a relatively higher share of nominal manufacturing value added in Singapore (28%) as compared to Korea (19%). Creating a vibrant R&D ecosystem is a long-term endeavour and requires continued efforts by both the public and private sectors. For its part, the Singapore government has pledged to enable the development of R&D and innovation capabilities under the Research, Innovation & Enterprise (RIE) plans.<sup>3</sup> Such consistent and firm support has resulted in steady growth in domestic R&D activities over the past decade, as measured by total expenditure, manpower employed and the number of organisations performing R&D. (Chart 2.22) The recent opening of Fusionopolis Two, as part of the research and innovation hub located in one-north, provides further opportunities for interdisciplinary collaboration in the manufacturing sector.

**Chart 2.22**  
Measures of R&D Activity in Singapore  
(2013 vs 2000)



<sup>2</sup> R&D intensity is defined as the ratio of business expenditure on R&D to nominal value added. For Korea, electronics R&D intensity and share of nominal manufacturing value added is based on the latest available estimates in the OECD Structural Analysis Databases from 2006–10.

<sup>3</sup> The RIE 2015 plan was unveiled in 2010 and committed \$16.1 billion of public funds over 2011–15 to further boost R&D and sustain the competitive edge of the economy. The next five-year plan (RIE 2020) will be announced soon and is expected to place a greater emphasis on innovation clusters such as additive manufacturing, advanced robotics and the Internet of Things.

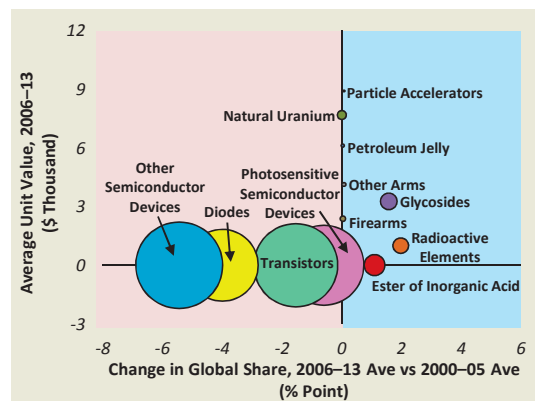
The nature of activity within the manufacturing sector will change over the medium term. The move towards higher-value production is making steady progress, with domestic manufacturers gaining global market share in many niche products, ranging from military-related equipment, biomedical products, to speciality chemicals, which command a high price premium in the world market. (Chart 2.23) Major electronics manufacturers are also upgrading their production capabilities, with Micron’s new US\$4 billion fabrication facility, specialising in innovative 3D NAND flash, set to open in 2017. The intensive use of technology in such niche production activities would further complement the rise of manufacturing-related services such as chip design and R&D, which were discussed in previous issues of the *Review*.

These shifts in economic activity will transform industrial and corporate profiles, bringing about fundamental changes in the characteristics of capital and labour inputs which will be needed to meet the demands of the new economy. The composition and quality of these factors of production will have to be enhanced, as technology and innovation activities come to the fore.

**In the new economy, capital will increasingly be defined by ICT and intellectual property assets ...**

On the capital front, Singapore already has one of the highest capital-to-labour ratios in the world. (Chart 2.24) Looking ahead, capital inputs associated with the digital revolution, such as ICT hardware, software, and R&D, will be the key drivers of the future Singapore economy. However, the adoption of ICT capital is currently not widespread throughout the corporate sector, with a significant number of SMEs not owning a computer nor having a presence on the web. (Chart 2.25) In particular, sectors such as health, social & other services, construction, and transport & storage rank relatively low in these ICT adoption indicators. Nevertheless, there has been some recent improvement, with the overall proportion of businesses using computers and having a website each increasing by 3% points in 2014 from the previous year, due in part to the \$500 million ICT for Productivity and Growth programme announced in Budget 2014, which was targeted at SMEs. The Smart Nation initiative, which seeks to harness ICT, networks and data to support better living and create more business opportunities, will also have a profound effect on the way that technology is used by households and firms.

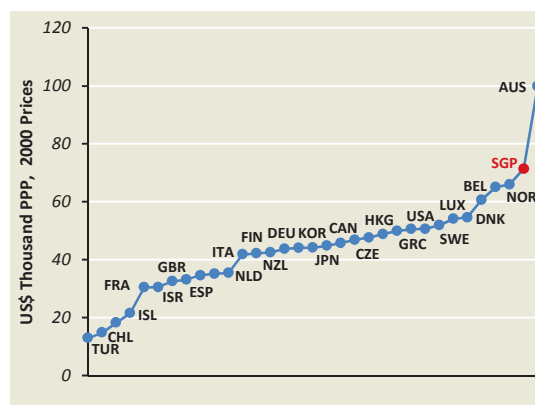
**Chart 2.23**  
Changes in Singapore’s Global Export Share By Product Type



Source: EPG, MAS estimates

Note: Size of bubbles refers to the value of direct exports (2006–13 average).

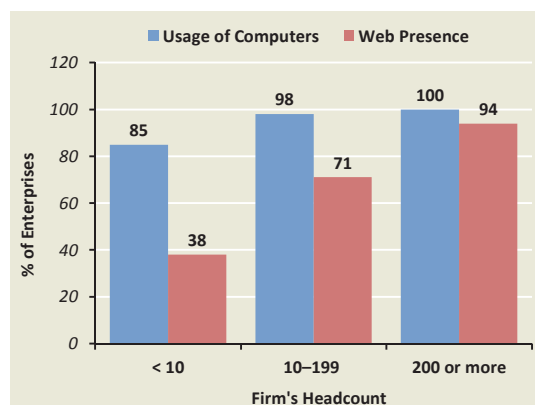
**Chart 2.24**  
Capital Per Worker (2014)



Source: The Conference Board Total Economy Database

Note: The definition of capital excludes buildings and construction.

**Chart 2.25**  
Business Usage of Computers & Web Presence (2014)



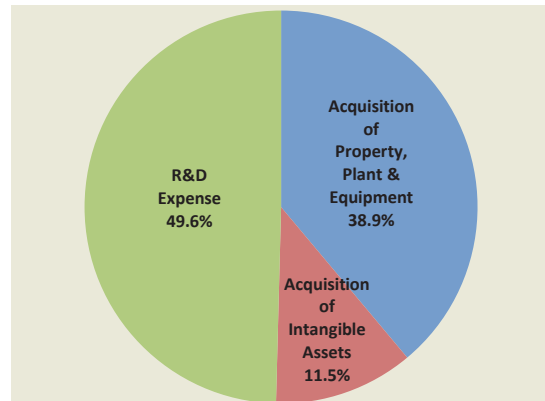
Another form of capital that will drive medium-term growth is intellectual property. Major US IT firms, spanning both IT manufacturing and services, devote a large proportion of their capital expenditures to R&D and the acquisition of intangible assets. (Chart 2.26) This reflects the broader move towards capital- or asset-light investment as tech firms spend relatively less on physical capital including property, plant and equipment. A similar trend can also be observed in Singapore at the macro level, where the share of intellectual property products in total real capital stock (excluding construction & works) has gradually increased to just over 20%.<sup>4</sup> (Chart 2.27) There is a strong impetus to grow investments in this area as intellectual property will be a key form of capital in the knowledge-intensive and innovation-driven economy of the future.

**... while workers will need to possess a complex mix of hard and soft skills.**

Given the crucial role of intellectual capital, R&D and ICT in the next phase of Singapore's economic development, the labour force will need to have the relevant technical expertise for these frontier industries. In particular, graduates with science, technology, engineering and math (STEM) related qualifications will be a key component of Singapore's human capital stock. Over the last decade, almost three quarters of the new occupational codes created in the domestic labour market were in STEM-related fields, reflecting the growing importance of technology and innovation in today's dynamic work environment.

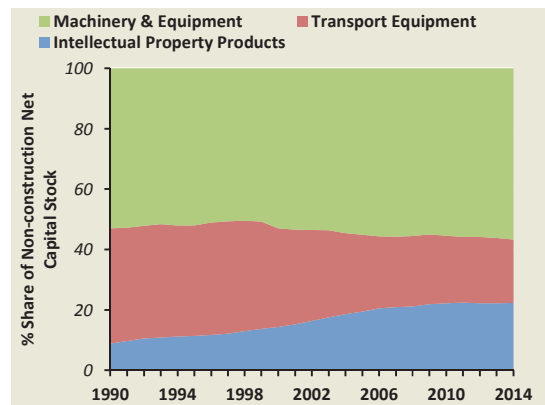
As Singapore moves towards the new frontier, the increasing demand for skilled workers in the technology and innovation cluster will need to be addressed. In addition to the minimum requirement of a STEM-related degree, many job vacancies in these fields now require post-graduate qualifications, substantial work experience, a creative and design background as well as other soft skills such as leadership and communications. Therefore, it will take focused effort over time to ensure that the typical resident worker masters the multi-disciplinary mix of technical, innovative and soft skills required in these new jobs. The launch of the SkillsFuture initiative, which will help Singaporeans develop and master skills in new growth clusters, is therefore, an important step to prepare the labour force for a rapidly changing work environment.

**Chart 2.26**  
Average Capital Spending Patterns of Major US IT Firms



Source: Companies SEC Filings Form 10-K (FY 2013/14/15)

**Chart 2.27**  
Composition of the Capital Stock in Singapore



<sup>4</sup> Intellectual property products comprise R&D and software investment. R&D expenditure is recognised in national accounts as a form of GFCF and is accumulated as an intangible capital asset.

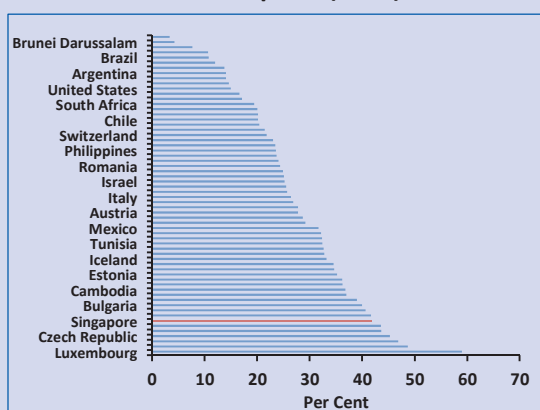
## Box B

Singapore's Export Elasticities: The Role of Global Value Chains and Economic Complexity<sup>1/</sup>

## Introduction

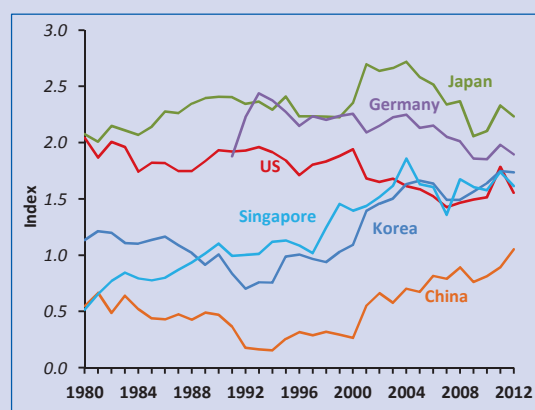
Singapore's highly open economy plays an integral role in regional and global supply chains. Its exports and production rely heavily on foreign content. (Chart B1) Over time, Singapore has successfully moved up the value chain, exporting more sophisticated and complex products. (Chart B2) This Box explores the size and determinants of Singapore's export elasticities at the disaggregated industry/product level to understand the impact of integration into global value chains (GVCs) and the complexity of export products. Exploring the heterogeneity of Singapore's exports with respect to GVC integration and economic complexity is important in understanding the ongoing structural change in Singapore's economy and the tilt of exports towards more sophisticated products. (Charts B3 and B4) Structural change in the composition of Singapore's exports could also have important implications for monetary policy transmission.

**Chart B1**  
Foreign Value-added Share of  
Gross Exports (2011)



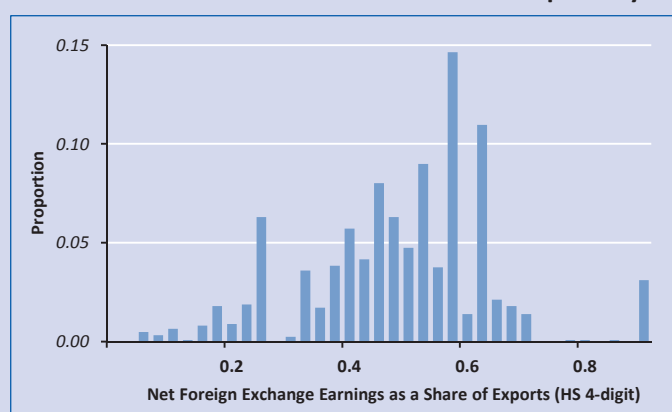
Source: OECD Statistics

**Chart B2**  
Index of Economic Complexity:  
Selected Countries



Source: Hausmann *et al.* (2011) and The Atlas of Economic Complexity database

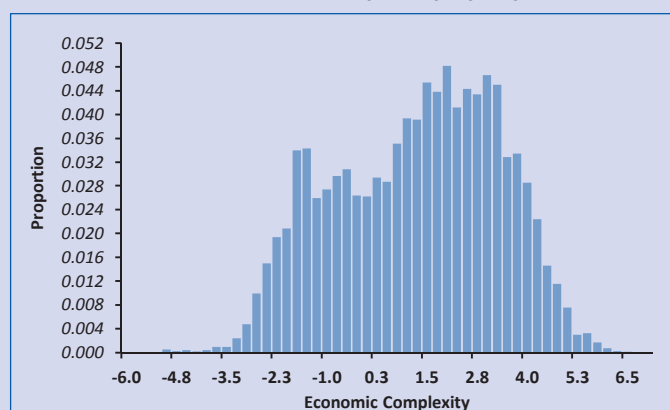
**Chart B3**  
Distribution of Domestic Value-added Share of Exports by Product



<sup>1/</sup>

This Box was contributed by Elif C. Arbatli and Gee Hee Hong from the IMF. It is based on Arbatli and Hong (2015) and a shorter version of it was published in IMF (2015b). The views in this Box are solely those of the authors and should not be attributed to the IMF or MAS.

**Chart B4**  
**Distribution of Economic Complexity by Export Products**



In GVCs, intermediate output cross borders multiple times and feature complex input-output linkages, with important implications for trade elasticities. For instance, recent analytical and empirical studies point to the importance of distinguishing between gross versus value-added (net of imported inputs) trade data in estimating trade elasticities.<sup>2/</sup> In related work, IMF (2015a) distinguishes between GVC and non-GVC-related trade in assessing trade elasticities and finds that a country's position in GVCs (upstream versus downstream position) plays an important role. Similarly, other studies have found that as backward participation or the import content of exports increases, exchange rate pass-through and trade elasticities decline (Koopman *et al.*, 2010; Riad *et al.*, 2012). This is due to the foreign content in a downstream country's exports, which mitigates the impact of exchange rate changes, given that an appreciation makes exports more expensive but also implies cheaper imports.<sup>3/</sup>

The economic complexity of a country's export products is also relevant in assessing price and demand elasticities. The notion of economic complexity used in this Box follows Hausmann and Hidalgo (2009), where product complexity is defined by the number of countries that export the product and the diversity of those countries' exports. If a product is produced by a small number of countries and if those countries have a diverse export product mix, the economic complexity of the product is measured to be higher. One can conjecture that the producers of more complex products enjoy higher pricing power and demand for such products may be relatively inelastic with respect to price.

### **Methodology**

Trade elasticities for Singapore's export volumes are estimated using gross trade data from the UN Comtrade Database for about 1,180 individual products for the 1989–2013 period at annual frequency. Interaction terms are used to capture the effects of integration in global value chains and economic complexity on relative price and demand elasticities. In particular, the following equation is estimated using a fixed effects panel regression model:

$$exp_{i,t} = c_{1,i} + \beta rp_{i,t} + \gamma y_{i,t}^{TP} + \delta (IV_{i,t} * rp_{i,t}) + \theta (IV_{i,t} * y_{i,t}^{TP}) + e_{i,t}$$

where  $exp_{i,t}$  denotes export volumes for individual products at the level of 6-digit HS codes. The relative price variable  $rp_{i,t}$  is calculated as Singapore's export price divided by the average global import price of the same product that year. Each 6-digit price is calculated by dividing the total trade value (in US\$) by total quantity available from the data source. Foreign demand  $y_{i,t}^{TP}$  is calculated as a weighted average of demand by Singapore's trading partners, whereby the weights are the shares of Singapore's exports to

<sup>2/</sup> See Johnson and Noguera (2012a, 2012b, 2014), Bems and Johnson (2015).

<sup>3/</sup> Similar findings were reported for Belgium (Amiti *et al.*, 2014), Switzerland (Fauceglia *et al.*, 2014) and the US (Powers and Riker, 2013).

different trading partners at the HS 2-digit product group level. Trading partners' demand is estimated by total imports of the country in US\$, divided by the US GDP deflator. All variables enter in logarithmic form.

The effects of GVC integration and economic complexity were captured separately through two interaction terms with relative price and demand variables,  $IV_{i,t}$ . To explore the role of GVCs, sector-specific information on the domestic value content of Singapore's exports from input-output tables were linked to different export products, allowing for the construction of a product-specific measure of the domestic value-added content.<sup>4/</sup> As for economic complexity, the index from Hausmann *et al.* (2011) was used to match Singapore's export products with complexity at the HS 4-digit level.<sup>5/</sup>

## Results

Table B1 presents regression estimates using domestic value-added share in exports as an interaction variable. As discussed earlier, Singapore's exports have a high import content. However, there exists substantial heterogeneity in the import intensity of exports. Consistent with our expectations, the higher the domestic value-added share of exports, the higher is the absolute value of the price elasticity of exports. The impact of domestic value-added share on demand elasticity is negative, indicating that products with higher domestic value added also demonstrate lower demand elasticity.

**Table B1**  
Effect of Domestic Value-added Share on Export Elasticities

Variables	$\log(\text{Export Volume})$
<i>Constant</i>	12.14*** (0.450)
$\log(\text{Relative Price})$	-0.179*** (0.0249)
$\log(\text{Foreign Demand})$	0.262*** (0.0221)
$\log(\text{Relative Price}) * \log(\text{Domestic Value Added})$	-0.0841* (0.0472)
$\log(\text{Foreign Demand}) * \log(\text{Domestic Value Added})$	-0.122*** (0.0170)
<i>R-squared</i>	0.404
<b>No. of Observations</b>	67,059

Note: Standard errors are in parentheses.

\* Statistically significant at the 10% level.

\*\* Statistically significant at the 5% level.

\*\*\* Statistically significant at the 1% level.

<sup>4/</sup> Industry characteristics obtained from Singapore's input-output tables were matched with the HS 4-digit level product codes. When there is a match between a certain product code and multiple input-output industry codes, a weighted average of the input-output industries was used, with the exports of that industry used as weights.

<sup>5/</sup> The complexity index for individual products is available at the HS 4-digit level for 1995–2012, which allows one to match Singapore's export products with the index of complexity. All 6-digit products under the same 4-digit product code were assumed to have the same complexity. For years where there is no product-level economic complexity index, it was assumed that it is the same to the closest available year.



Baseline regressions for export volumes using the full sample imply a weak relationship between economic complexity and trade elasticities. However, within Singapore's major individual product groups, there is a significant and large effect of product complexity on price elasticities. It is important to look at the sensitivity of trade elasticities within individual groups because Singapore's trade is concentrated in a few major product groups and there is significant product heterogeneity within those segments. For instance, within the pharmaceuticals group, price elasticities decline with product complexity. (Table B2) This relationship is somewhat weaker for the other three product groups. The relationship between complexity and demand elasticities is relatively small within individual product groups.

**Table B2**  
**Effect of Economic Complexity on Trade Elasticities for Major Product Groups**

Product Groups	Machinery, Mechanical Appliances & Computers	Electrical Machinery & Telecomm. Equipment	Organic Chemicals	Pharmaceuticals
Variables	<i>log(Export Volume)</i>	<i>log(Export Volume)</i>	<i>log(Export Volume)</i>	<i>log(Export Volume)</i>
<i>Constant</i>	32.14*** (3.059)	10.87*** (1.332)	2.983*** (0.420)	10.46*** (0.840)
<i>log(Relative Price)</i>	-0.513*** (0.0122)	-0.510*** (0.0196)	-0.187*** (0.0167)	-0.656*** (0.165)
<i>log(Foreign Demand)</i>	-0.933*** (0.136)	0.169*** (0.0595)	0.639*** (0.0195)	0.0996* (0.0573)
<i>log(Relative Price) *</i> <i>log(Economic Complexity)</i>	0.00781** (0.00353)	0.0176** (0.00718)	0.0235*** (0.00556)	0.135** (0.0541)
<i>log(Foreign Demand) *</i> <i>log(Economic Complexity)</i>	0.00406** (0.00171)	0.00638** (0.00280)	0.00503*** (0.00187)	0.0420** (0.0171)
<i>R-squared</i>	0.874	0.918	0.974	0.942
<b>No. of Observations</b>	7,269	3,195	4,502	226

Note: Standard errors are in parentheses.

\* Statistically significant at the 10% level.

\*\* Statistically significant at the 5% level.

\*\*\* Statistically significant at the 1% level.

### Conclusion

Singapore's exports have been increasingly integrated in GVCs and are growing more complex. These features are important in understanding export elasticities. Product-level analysis of export volumes and prices shows that products with higher import content tend to have lower export price elasticities. Economic complexity is also found to be an important determinant of export elasticities, with more complex products having lower price elasticities, especially in the machinery, mechanical appliances and computers and pharmaceuticals segments. The use of the exchange rate in Singapore's monetary policy framework suggests that evolving trade elasticities could play an important role in driving changes in its monetary policy transmission.

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