Global Demographics & Retirement Research

Asia at A Crossroads: Demographics, Economics & Investment

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Appendix D: Vector Autoregression Model

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1. Introduction

Asia's importance to the global economy has grown exponentially in recent years, not least due to the rise of China as a major global player. It now has two-thirds of the world's population and generates 45% of global GDP growth.¹ But its demographics are worsening more quickly than is commonly perceived, threatening future growth and prosperity. Asia is at a crossroads. If its governments wish to fund future economic development and retirement costs, they will need to implement holistic reforms across fiscal and monetary policy, education, health, labour and financial markets. Without these reforms, countries will struggle to avoid lower growth, old-age poverty, inequality and higher debt burdens.

Not all Asian nations will be affected equally or similarly as they have a range of different demographics. In this paper, we highlight the demographic variations across ten select Asian countries and discuss how these affect their growth, GDP per capita, debt, pensions and capital markets. The countries are: **China, Hong Kong, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand.**

Some have the advantage of not having made unsustainable pension promises to their workforces, while others have implemented policies to encourage multiple sources of retirement income. However, many of the emerging Asian countries will need to deepen local capital markets and make better use of asset allocation techniques and risk management, if they are to build a sustainable long-term pensions system and become less vulnerable to global shocks. We summarise our key findings below.

Key Points

- **Demographic Diversity:** Asia is very demographically diverse in terms of people characteristics (i.e. those of "consumers and workers") and standard metrics like population growth, dependency ratios, life expectancy and fertility rates. It has rich aged countries as well as poor young countries, while some countries are growing older before they grow richer. Overall, its populations are no longer growing as fast as the world average and are no longer as young.
- **Demographic Transition:** Asia's demographic transition has had a significant impact on its labour force, growth, consumption, savings, productivity and inflation. While some countries should still reap their demographic dividend (responsible for 30% to 40% of Asian growth in the 1980s–1990s), this cannot be sustained without holistic policy reforms.
- **Economic Growth:** Economic growth is composed of growth in working age population, productivity growth and utilisation growth which is related to changes in the number of hours worked. Asia needs to draw on at least two of these contributing factors to generate sustained economic growth, typically by implementing education, migration and labour market reforms, especially in those countries attempting to escape the middle-income trap.
- **Inflation:** Demographics are a major long-term contributor to inflation from both the demand and supply side. Understanding trends in consumer behaviour, income, wealth across age brackets and other demographic characteristics within Asia is core to understanding its inflation, as well as monetary and fiscal policy.
- **Capital Flows:** Demographics influences current account and capital flows. In a globalised world, we find that Asian economies appear to be more vulnerable to shocks from China, Japan, the US and the EU. Asian economies need to safeguard against projected capital outflows due to changes in policy rates, expected returns and greater stability elsewhere.
- **Pensions:** Asia is in a better position than many Western countries to manage the challenges of an aging population. With high savings rates and long working lives, Asia's social security systems can avoid making the sort of long-term unsustainable promises that have created a burden for Western economies. Instead, Asia can consider different cost-effective insurance and market solutions depending on a country's longevity rates, healthcare systems and the changing lifecycles of consumers and workers.
- **Capital Markets:** Many Asian countries would benefit from deepening their domestic capital markets, transforming local savings into profitable investments that would support retirees, as well as increase the resilience of local assets.

2. Demographics Changes: Consumers and Workers

Asia as A Whole

Population Growth Slower than Average

Asian economies have achieved higher economic growth rates in the recent past largely by capitalising on their favourable demographics, but these trends are now changing. By demographics, we mean the full range of characteristics of Asia's consumers and workers, not just their ages. However, by comparing Asia's population trends with those of the world, we can visualise some of its future challenges and opportunities (Figure 1).



Figure 1: World vs. Asia Population in 2017

Source: UN, State Street Global Advisors (SSGA) Demographics.

Figure 1 shows that Asia's population pyramid has become less of a pyramid, indicating that its younger population is now below the world average. This is different from the 1980s and 1990s when it was more youthful. Back then, above-average population growth contributed significantly to Asia's growing labour force and economic development. Today Asia has a population of 4.5 billion (2017), 60% of the global total and thrice the share of Africa (Figure 2). However, in the last two decades, it has experienced a faster slowdown in population growth than the global average. That trend is set to continue with projected population growth of 0.9% a year until 2020, slower than the world average of 1.1% (Figure 3). Lower population growth translates into lower labour force growth and lower working age population growth, with a lagged effect.

Life Expectancy: Share of Age 80+ Increases Faster than Elsewhere

Asia's life expectancy at birth has increased more rapidly than the world average over the last 30 years. Global life expectancy at birth increased from 63.7 years (1985–1990) to 71.9 years (2015–2020), while the corresponding Asian increase was from 63.6 years to 72.9 years (see Appendix, Figure 28). However, despite its fast increase, life expectancy in Asia still lags behind all regions except Africa.

The Asian 80+ aged population has increased from 15.8 million (36% of the world total) in 1985 to 67.2 million (49% of the world total) in 2017. Figure 4 shows the share of 80+ persons across different regions over the last 30 years. Asia has experienced the highest growth (275%) of any region and this has led to rapid increases in public debt on account of age-related expenditures.







Source: UN, SSGA Demographics.

Figure 4: Share of the 80+ Age Group, 2017 vs. 1985



Source: UN, SSGA Demographics.

These aging trends are likely to continue. According to the UN, Asia's fertility rate is projected to drop quickly from 3.5 children per woman in 1985–1990 to 2.15 children per woman in 2015–2020, much faster than the world average, while Asian life expectancy at birth is projected to increase rapidly from 63.6 years in 1985-1990 to 72.9 years in 2015–2020. This indicates an unprecedented pace and scale of population aging in Asia where countries have very different income levels. Japan, Hong Kong, South Korea and Singapore are rich aged countries in the region. China and Thailand are examples of middle income countries with rapidly growing aging populations that may get old before they get rich. India and Indonesia are younger, poorer countries with a slower pace of aging.

Cross-Country Comparisons

Our ten chosen countries — China, Hong Kong, India, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan and Thailand — exhibit very different demographic profiles. In this section, we examine the differences between them in more detail. Some key differences are listed below:

- Population: China has the largest population (1.4 billion in 2017) while Singapore has the smallest (5.7 million).
- **Age:** Japan and Hong Kong are two of the oldest countries in the world while India, Indonesia and Malaysia have much younger populations that are still growing at a faster pace (Figure 42 and 44).
- **Fertility Rates:** Fertility rates have declined in eight out of ten countries from 1995–2000 to 2010–2015 but increased slightly in Hong Kong and Japan (Figure 43).
- **Old-age Dependency Ratio:** Japan has the highest old age dependency ratio at 42.7 and Indonesia has the lowest at 7.6 (Figure 45). The ratio measures the number of workers relative to the retired population. For insight into the implications for dependency ratios and retirees of changing working age boundaries, please see our paper entitled (*Global Demographics and Retirement Implications*).

Population Growth

Population growth has slowed over the last two decades, with major changes happening in countries such as Hong Kong, India, Malaysia, Singapore and Thailand. Japan is undergoing negative population growth at -0.23% (Figure 42). The total change in population is composed of two components: a) natural population change (births less deaths per 1000) and b) net migration (immigration less emigration per 1000).

Migration is a small component of population change in relative terms in most Asian countries, except in Singapore and Taiwan (Figure 29). Some countries such as China, India and Indonesia have emigration. While immigration (typically people of working age) can slow the aggregate aging of populations, emigration of younger workers can accelerate it.

Aging Trends

However, the key drivers of an aging population are increased life expectancy and a sharp decline in fertility. While Asia as a whole is aging more quickly, we find these component characteristics are not uniform across countries.

Hong Kong and Japan are projected to have 84.2 and 84.0 years of life expectancy at birth respectively in 2015–2020, which is the highest in the world. India lags behind at 68.9 years (Figure 44). In terms of fertility rates (children per woman of child-bearing age), there has been a decline across 8 of the 10 countries from 1995 to 2015 (Figure 43). The sharp decline in Malaysia and India is attributed to several factors: increased availability of contraception, greater female participation in the labour force, higher costs of child rearing and a preference for better educated rather than more children.

Women also tend to have children at earlier ages in countries such as China, India and Indonesia. Their fertility rates peak at earlier age groups (20–24 or 25–29) compared to peaks at 30–34 years in other countries (Figure 30).

Old-Age Dependency Ratio

Together, the increase in life expectancy and the sharp decline in fertility rates have led to a considerable increase in the old-age dependency ratio in Asia. High old age dependency ratios are already associated with causing fiscal unsustainability pressures in older European countries and Japan.

While it is widely known that Japan's old-age dependency ratio has more than doubled from 20.6 in 1995 to 42.7 in 2015 (Figure 45), other Asian countries such as South Korea, Singapore and China are also experiencing a rapid rise in old age dependency ratios. The old age dependency ratio of South Korea has risen even higher than that of Japan in relative terms from 8.4 in 1995 to 17.7 in 2015. India, Indonesia and Malaysia, meanwhile, have relatively young populations. Their old age dependency ratios are lower but rising. Indonesia has the lowest ratio of 7.6 as of 2015.



Figure 5: Share of the 80+ Age Group in Selected Countries

Source: UN, SSGA Demographics.

The share of the very old is also rising very fast in many Asia countries (Figure 5). Within Asia, Japan has the highest share of its population in the 80+ age group, which grew from 1.7% in 1985 to 8.1% in 2017. The share of the oldest-old is also growing rapidly in China, Hong Kong, Singapore, South Korea, Taiwan and Thailand. India, Indonesia and Malaysia have less than 1% of their population in the 80+ age group.

These differences in the age structures of populations have societal and public policy implications such as how to find sufficient resources to fund pensions and health care for the old. Some Asian countries have multiple generations coexisting like never before and this has implications for inter-generational resource allocation and wealth transfer.

Demographic Transition & Demographic Dividend

These are two popular demographic theories applied to countries based on the stage of demographics at which they are at and the contribution of demographics to their growth performance: demographic transition and demographic dividend.

Demographic Transition

The Demographic Transition model is a model of population change attributed to Warren Thompson. It represents the transition from high birth and death rates to low birth and death rates as a country develops from being pre-industrial to having an industrialised economy. Stages of the demographic transition theory are illustrated in Figure 6.

Asian countries are in different stages of the demographic transition. They have different patterns of population growth, age structure and life expectancy. The different demographic stages are associated with different numbers of consumers and workers and thereby have differing implications for economic growth and other factors influencing asset prices.

Younger countries like India, Malaysia, Indonesia and Vietnam are in stage 2. China is in stage 3, South Korea in stage 4 and Japan in stage 5. The stages of demographic transition are also somewhat related to stages of economic development which is broader than just economic growth.

Demographic Dividend

The Demographic Dividend theory² (Bloom and Canning) states that because people's economic behaviour and needs vary at different stages of life changes in a country's age structure can have significant effects on its economic performance. Economies undergoing the demographic transition have an opportunity to capitalise on the demographic dividend, although the process is not automatic. The demographic dividend is delivered through a number of mechanisms. The most important are labour supply, savings and human capital.

Stage 1	Stage 2	Stage 3	Stage 4		Stage 5
High & Fluctuating Death Rates	Falling Death Rates	Falling Death Rates	Low Death Rates		Very Low Birth Rates
High & Fluctuating Birth Rates	 High Birth Rates	 Falling Birth Rates	 Low Birth Rates		Death Rates Higher Than Birth Rates
Stationary Population Numbers	Large Increase In Population	Stable Population Growth	Stable Population		Declining Population/ Ageing
	India, Indonesia, Malaysia, Vietnam, Venezuela, Mexico 	Brazil, China, Thailand, US, UK, France, Chile 	Italy, Russia, South Korea		Japan, Germany

Figure 6: Demographic Transition

Source: Credit Suisse, Demographic Transition Theory, John Caldwell (2006).

First Demographic Dividend

The First Demographic Dividend is triggered by three factors: declining fertility rates in economies with youthful populations leading to faster increases in the numbers of workers, a significant decline in the dependency ratio and rapid growth in per capita income. It typically lasts for decades, but is transitory in nature. The rate of growth of the support ratio — *the number of workers as a ratio of the number of consumers* — is a measure of the First Demographic Dividend.

Figure 7 shows that support ratios have declined sharply in most countries except in India. Moreover, most countries are experiencing noticeable negative growth rates of support ratios. South Korea has experienced the largest drop from 1.9% to -0.4% followed by Singapore and Hong Kong. In contrast, Malaysia still enjoys a higher growth rate at 0.8% in 2017. India and Indonesia also have positive growth rates in their support ratios.

This First Demographic Dividend period appears to be over for Japan, China, Hong Kong, Singapore and South Korea, while younger countries such as India, Indonesia and Malaysia should still benefit from it.

Second Demographic Dividend

The Second Demographic Dividend arises as a response to the challenge of population ageing.³ Anticipated increases in the share of the population who are retirees induce individuals, firms and governments to accumulate capital, which can translate into productivity growth. If the capital is invested in the domestic economy, the result will be capital deepening and more rapid growth in output per worker. If the capital is invested abroad, the result will be an improvement in the



Figure 7: Growth Rate of the Support Ratio (No of Workers per Consumer) (%)



current account and an increase in national income. In either case, per capita income will grow more rapidly than it would otherwise. The second dividend is not transitory in nature, as population ageing may produce a "permanent" increase in capital and therefore in per capita income.

Contribution to Growth

The size of the demographic dividends depends on trends in population structure, how much people produce and consume at each age, how a society supports its elderly, and hence how much capital is accumulated. The realisation of the dividends, however, and their contribution to economic growth depends on the effectiveness of policy implementation.

Andrew Mason calculated the value of first and second demographic dividends in his 2005 paper. In East and Southeast Asia, from 1970 to 2000, the contribution of the first dividend to growth in GDP per effective consumer was 0.59% a year, while the second dividend contributed 1.31% a year. Overall, these dividends contributed 1.9% a year to actual economic growth of 4.32% a year. Hence demographics could explain about 44% of the growth that took place in GDP per effective consumer in East and Southeast Asia from 1970 to 2000. Similarly, both demographic dividends contributed 0.79% a year to actual economic growth of 1.88% a year in South Asia. J. Williamson (2013) finds supporting evidence for the above statistics.

Labour Force Participation

As mentioned above, we view demographics as the characteristics of workers and consumers. Worker (labour) characteristics of a population affect the production of goods and services that in aggregate make up a nation's GDP. Here we look at how labour force participation has changed across the ten countries and in the next section we consider what that means for economic growth.

While total labour force participation rates have declined in Hong Kong, China, India, Japan, Taiwan and Thailand over the last 25 years, they have risen in the remaining nations (Figure 31). Sharp declines in male labour force participation rates have occurred across all countries (Figure 8), a trend similar to that in developed countries. The decline in Hong Kong's male labour force participation rate of 11% between 1990 and 2015 is larger than in other countries. Indeed, it is so dramatic that, despite its female labour force participation rate rising by 8%, its total labour force participation rate fell by 3%. Note that Hong Kong is older than Japan based on median age.

The overall labour force participation rate for women remained low, despite some increases in high income countries such as Hong Kong, Singapore, South Korea and Taiwan. China had the highest female labour force participation rate (62.4%) and India the lowest (27.3%) in 2015. Figure 32 shows that the gender gap in labour force participation



Figure 8: Labour Force Participation Rates, Male vs. Female

Source: ILO, SSGA Demographics.

has reduced in most countries but not the two largest — China and India — implying greater potential for catch-up, productivity and economic growth. Despite considerable improvements in female education, barriers persist to closing the gender gap in Asia. These include social and cultural norms which emphasise women's domestic responsibilities, limit their mobility and restrict their choices of work.

Labour force participation rates vary by age as well as by gender and country. While male participation rates for age groups 25–34, 35–44 and 45–54 are similar, rates decline for old age groups, according to ILO data. In some countries, the decline is very dramatic; in Taiwan, the rate dropped by 82.3% from its peak (25–34 age group) to its trough (65+ age group). Changes and levels of female participation rates are less uniform. Indonesia's and India's female labour force participation is low and peaks for older age groups (35–44 and 45–54). China, Hong Kong, Singapore and Taiwan peaks for age group 25–34. Japan and South Korea exhibit M-shape patterns, with women leaving labour force during childbearing years and re-entering later as their children grow up.⁴

3. Economic Growth

In this section, we examine how different patterns of worker characteristics, including labour force participation, in Asia affect the region's economic growth.

The Middle Income Trap

The Middle Income Trap is the name given to a theory espoused by Gill and Kharas (2007).⁵ It seeks to explain why many emerging countries struggle to make the transition from being middle to high income and instead get squeezed between low-wage, low-income competitors in mature industries and rich-country innovators embracing technological change.

Slower growth in middle-income countries in recent years, and imminent demographic aging across large parts of East Asia, has increased the fear of middle-income traps. The authors note that East Asia may find it difficult to maintain a high pace of convergence due to lack of economies of scale.

Ha and Lee (2016) also show that in the early stages of development, Asia's fast demographic transition raised the support ratios that created a huge demographic dividend, thereby encouraging Asia's fast convergence and economic development. However, in later stages, the lower fertility which accompanies economic development leads to falling support ratios and a negative demographic dividend. If the support ratio falls to a level too low to catch up, then the economy can get into a non-convergence trap.

Economies with low support ratios and middle incomes such as China and Thailand are likely to fall into the trap if they do not increase GDP growth quickly or fail to raise fertility to more sustainable levels. Japan, South Korea, Hong Kong and Singapore face similar traps, even though they are classified as high-income.⁶ Countries can alleviate the problem to some degree through increased investment in human capital at cheaper cost relative to income and by slowly extending average retirement ages.

Real GDP, GDP Per Capita and Population Growth

It is also important to consider how real GDP growth and real GDP per capita growth (i.e. without inflation) link to population growth rates. While GDP reflects total output, GDP per capita is a measure of living standards. Figure 9 presents the trends of real GDP growth, GDP per capita growth and population growth. Real GDP growth is the sum of real GDP per capital growth and population growth in percentage terms. The per capita real GDP growth rate is significantly lower than real GDP growth rates in Singapore, Malaysia, India and Indonesia due to their high population growth rates.

Demographic Decomposition of Growth

Real GDP growth is comprised of three demographic components:

- a) Working-age population growth (population aged 15-64 years)
- b) Labour productivity growth (real GDP/hours worked)
- c) Labour utilisation growth (hours worked/working-age population)

As Figure 10 shows, the contribution of working age population growth was very significant in explaining overall real GDP growth in Singapore and Indonesia from 1988 to 2017 and in Hong Kong and Malaysia from 1988 to 1997. However in Japan, South Korea, Taiwan and Thailand, labour productivity growth contributed the most to real GDP growth from 1988 to 2017. In Japan, the working age population growth fell during 1998–2017 and dragged overall real GDP growth down.

Figure 38 (Appendix) shows shorter-term growth rates including 5-year annualised, 3-year annualised and 1-year. Some countries such as Japan, South Korea and Taiwan are experiencing low rates of growth. South Korea's and Taiwan's short-term growth rates are significantly lower than their annualised rates over the last 10–15 years.





Source: IMF, SSGA Demographics.



Figure 10: Real GDP Growth Decomposed



Source: UN, GGDC, SSGA Demographics.

Increasing Labour Productivity Growth

In future, these ageing countries will not be able to rely on working age population growth to boost overall real GDP growth. Instead, they will have to increase labour productivity growth by implementing reforms that encourage more young workers and women into the workplace. They will have to complement this with lifelong education and training reforms in order to enhance the working skills of the entire work force, especially the young and the old.

Education is crucial to enhancing labour productivity and determining how much demographic potential can be translated into economic growth. Workforces will need modern technology, work-relevant skills and adaptability to achieve higher productivity. Figure 33 (see Appendix) presents the differences across educational attainment for Asian countries and we note that educational attainments are related to human capital strengths as well.

4. Inflation

Basic economic theory suggests that inflation can be caused by demand factors (from consumers, firms and the public sector) or by cost factors (related to inputs such as oil prices or wages). This chimes with our broad interpretation of demographics as pertaining to consumers who contribute to demand side inflation and workers that contribute to supply side inflation. Recent research points to demographics playing a major role in explaining inflation.

Aging Population and Lower Inflation

For example, research by the Bank of International Settlements (2016)⁷ found a strong link between trend inflation (the average rate at which prices increase over a multi-year period) and the age structure of the population. The bigger the proportion of young and old within a total population, the higher inflation is. The research found that baby boomers increased inflation by an estimated 6% over 1955–1975 and lowered it by 5% over 1975–1990. Juselius and Takats (2018)⁸ found that accounting for the age structure leads to lower estimates of endogenous inflation persistence and that the role of inflation expectations in an age of "inflation-targeting" by central banks may have been overstated.

Older cohorts prefer to work less and generate higher rates of return from their savings with lower inflation. St Louis Fed research shows that voting patterns and the influence of larger old-aged cohorts on redistributive policies leads aging countries to exhibit low observed rates of inflation.⁹ The observed effect may differ from what one might expect in theory (i.e. that younger populations spend more leading to higher inflation, while older ones spend less leading to lower inflation).

Figure 11 shows that there is a relatively high positive correlation between proportion of younger people in the Japanese population and the rate of inflation.

Deutsche Bank's Long-Term Asset Study (2018),¹⁰ "The History and (Future) of Inflation", by Jim Reid attributes the unprecedented inflation of the 1960 and 1970s to the concurrent population explosion. Slower population growth in the 1980s and slower wage growth, thanks to a surge in working age populations and abundant cheap labour from China, led to lower inflation trends throughout the 1990s and into the 21st century.

Figure 39 in the Appendix compares the annualised inflation rates across our ten countries over the periods Q2 1980–Q2 2000 and Q3 2000–Q2 2018. All of the countries experienced significant declines in inflation during the second period. Indonesia was the most inflationary country, followed by India. In particular, during the first period 1980–2000, annualised inflation rates were high for Indonesia and India at 11.1% and 8.9% respectively. By contrast, Japan, Singapore and Taiwan have had very low rates of inflation. During the second period 2000–2018, Japanese annualised inflation was 0.1%.





Source: World Bank, UN, SSGA Demographics.

Aging and the Equilibrium Interest Rate

According to Stanley Fischer (2017), beyond its effect on the size of the labour force and trend growth, the aging of a population can work to lower the equilibrium interest rate. As households near retirement, they tend to save more, anticipating having to run down their savings after they leave the labour force. Federal Reserve Board economists estimate that the higher saving by near-retirement households could be pushing down the longer-run equilibrium federal funds rate relative to its level in the 1980s by as much as 75 basis points.¹¹

Nonetheless, the impact of demographics on nominal economic variables can be difficult to pin down. Realised inflation is a consequence of complex interactions between demand and supply side factors, inflationary expectations and monetary policy. What we can say is that demographic trends clearly influence the economic environment within which monetary policy operates, as variables such as labour force size, consumption, savings and productivity feed through into growth and inflation.

Consumption as a Determinant of Inflation

Consumption is one of the most important determinants of inflation, in particular of demand side inflation. It is not just the number of consumers that is important, but how and what they consume. The way Asian people consume today is very different to how they used to consume in the past, thanks to freer international trade, more efficient transport, new technologies, new marketing techniques and demographic changes. The share of aggregate private consumer expenditures varies across countries with different economic structures. It ranges from 66.4% in Hong Kong to 37.1% in China for 2015. As shown in Figure 37 (see Appendix), household consumption accounts for a lower share of GDP in most Asian countries compared to the past, reflecting the current high rate of savings, much of which is precautionary saving in the absence of sufficient social protection schemes.¹² For example, in China, household consumption has fallen from 49.7% in 1985 to 37.1% in 2015.

Smaller Households

In addition, there is a noticeable increase in smaller sized households in Asia. There are multiple contributing factors that include: delayed marriage, delayed child-bearing, decline in the number of couples with children and an increase in the number of single parent families. In Japan and South Korea, over half of the households have only one or two members (Figure 34). As in many developed countries, the majority of single and two-member households are those belonging to retired or nearly retired households. This shift in family structure has major implications for consumer behaviour as single men and women consume differently, delayed marriage and child-bearing generally lead to higher expenditures on childcare and housing, and elderly people living alone have relatively higher demand for healthcare and long-term care.

The Old Versus The Young

Consumption expenditures also vary significantly by age group and country. Figure 12 shows the level of consumption per capita among older people (aged 65+) relative to the level of consumption per capita among those of working age (25–64 years). Older people consume more than working-age adults in Japan (1.3), Hong Kong (1.2), Singapore (1.2), India (1.1) and Taiwan (1.04), reflecting higher levels of wealth relative to younger generations. Other countries have experienced a slight decline in the level of consumption at older ages. Older Chinese tend to consume less as some family resources are diverted to young dependents.¹³

What People Buy

In terms of what they consume, Asian countries are also very diverse. In Japan, there is an increase in alcohol and tobacco consumption as people get older. The proportion spent on alcohol and tobacco by the 50+ age group is double that of the under 30s. In China, people spend the most on food and non-alcoholic beverages throughout the age groups (nearly



Figure 12: Relative Level of Consumption Per Capita for Age Group 65+ to Age Group 25-64, 2017

Source: NTA Network (2017) NTA Indicators, SSGA Demographics.



Figure 13: Average Household Personal Disposable Income (PPP, Constant 2015 Prices), USD'000

2001 2017

Source: Oxford Economics, SSGA Demographics.

30% of their expenditures). They also spend almost 10% on clothing and footwear, which is one of the highest among the EMG6 countries and significantly higher than all the G6 countries.¹⁴

In addition to family structure and age composition, a major determinant of consumption is the personal disposable income of households. The increase in GDP per capita across many Asian economies has also translated into higher personal disposable income — China has had the highest increase in contrast with Japan that has seen a marginal decrease (Figure 13).

It is important to track the number of households, their changing ages, family structures, incomes and wealth levels to arrive at a good estimate of aggregate consumer demand. That demand in combination with the supply of goods and services gives us the core inflation determinants which, in net response to monetary policy, yield realised inflation.

5. Capital Flows, Debt and Trade

This section looks at the interaction between savings, debt, trade and capital flows as demographics can influence these areas as well.

Savings Already High in Asia

Savings are important from both a national and an individual perspective. From a national perspective, the difference in aggregate savings and investments affects a country's current account and capital flows. This was a major hypothesis and contention by William Poole while attempting to explain world trade and global capital flows. Previous empirical research¹⁵ done by us validates this hypothesis. Capital flows were also a major contributory factor in explaining the recent credit crisis in developed market economies, as argued by R. Rajan in his book *Fault Lines*.

On an individual basis, savings of individuals and households need to provide for their uncertain retirement in the absence of guaranteed DB pensions. Household savings are already high in Asia and the elderly are the most reliant on personal savings for financing consumption after retirement. Of our ten countries, Singapore has the highest gross national savings of 46.5% of GDP in 2017, followed by China at 45.8% while Hong Kong has the lowest rate of 25.4% (based on IMF data).

Debts Increase Significantly

Figure 14 shows that public debts as a share of GDP have increased significantly in six out of the ten countries: China, Japan, Malaysia, Singapore, South Korea and Taiwan. Japan has the highest public debt to GDP ratio of 236.4% in 2017.

Figure 15 illustrates the correlation between old age dependency ratios and public debts in the ten countries over 2000–2015 at five year intervals. The relationship between old age dependency ratios and public debts is relatively strong at 68.1%.

This is an area that Asia needs to watch out for as ageing has typically led to higher debt burdens in developed economies, creating fiscal sustainability strains which have multi-year and multi-generational impact. External debt burdens becoming too onerous have also been responsible for past crises in Asia.

No Decoupling: Increased Sensitivity to External Forces Post GFC

Decoupling is often narrowly interpreted as a question of whether Emerging Asia (East and South East Asia) can maintain its high growth rates. In a broader sense, it is about the evolving nature of macroeconomic interdependence between countries in the region and traditional economic powers. Given the region's growing economic influence in the world and share of global GDP growth, it is also about global business cycles.

Post the Global Financial Crisis (GFC), policy makers and researchers asked themselves if emerging markets could decouple from developed markets, thereby providing a countercyclical offset to the downturn of advanced economies.¹⁶ To test the level of interregional and intraregional macroeconomic interdependence of Asian countries, we have used a Vector Autoregression (VAR) model to analyse the impact of relevant structural shocks over two different periods. We have used output growth shocks from the US, the EU and Japan as proxies for external shocks, and China as a proxy for a regional Asia shock and other individual Asian countries as proxies for local shocks.





Figure 15: Relationship between Old Age Dependency Ratio and Public Debt



Source: UN, IMF, SSGA Demographics.

Source: IMF, SSGA Demographics.

Figure 16: Share of GDP Growth Variances

From 1980 Q2-1996 Q4



From 1999 Q1-2018 Q2



Source: Oxford Economics, SSGA Demographics.

Our model follows methodology used for decoupling by the Asian Development Bank and the IMF. The US, the EU, Japan and China outputs are treated as exogenous to an individual Asian country as the economy of the latter is much smaller than those of the former. The model assumes that China output growth is unaffected by individual Asian countries but is affected by the output changes over the business cycles of the US, the EU and Japan. We use quarterly data and estimates for two periods: 1980 Q2–1996 Q4 and 1999 Q1–2018 Q2, as well as a constant term and 4 lags. As a measure of output growth, we use GDP at constant prices in local currency.

Figure 16 shows the output growth variances (the average share of eight countries excluding China and Japan across 10 quarters) due to both external and domestic factors. The impact on output growth variance from external factors has increased significantly since the Asian crisis, especially from the US. The US share increased the most from 5.2% to 10.5% over the two periods. The shares of the EU and China increased by half to 11.7% and 8% respectively in the second period. The share of Japanese output growth has shrunk from 8.6% to 7.5%. The share of local shocks declined from 73.1% to 62.3%. Among the individual Asian countries, the impact of an external output shock (from the US, the EU and Japan) increased sharply for Singapore (+22%), Malaysia (+20.7%), Taiwan (+18.9%) and Thailand (+11.6%). The impacts of a China output shock increased significantly for Hong Kong (+14.4%) and Taiwan (+9.4%).

The Global Financial Crisis (GFC) has led to a sharp increase in business cycle co-movement between Asia and major advanced economies. Figure 17 illustrates the rolling correlations of quarterly business cycles between China and advanced countries such as Japan, Italy, France, Germany, the UK and the US.

We observe that business cycle correlations increase sharply during periods of crisis. From Q4 1995 to Q4 2017, China's cycle correlations with the US, the UK and Japan were at their greatest during the GFC and, with Germany, Italy and France, were at their largest post the GFC.

Figure 40 (see Appendix) represents the correlations of GDP growth rates. The intra-regional and inter-regional correlations of the ten Asian countries rose noticeably after the Asian crisis. Within the region, some economies are more correlated with others such as China with Hong Kong, Malaysia, Taiwan and Singapore or India with Thailand. Since the Asian crisis, these correlations have ranged from 50% to 90%.

In terms of inflation, the intraregional correlations of Asian economies are also diverse, ranging from -30% to 60% post the Asian crisis (Figure 41). After the crisis, China's inflation became more positively correlated with most other economies except Japan and Taiwan. In contrast, the correlations of most other economies have slightly declined.



Figure 17: Business Cycle Correlations - China vs. Advanced Countries

Source: OECD, SSGA Demographics; the correlation in Q4 1995 is calculated as the average correlation between China and the US over a 12-quarter period ending in Q4 1995.

Trade and Foreign Investment

Asia's economic integration and rise as a major producer and trading partner is reshaping the global economic landscape. According to IMF data, Asia and the Pacific accounted for 44.6% of global gross domestic product at purchasing power parity in 2017, up from 24.7% in 1985. China alone accounted for 40% of the region's total output in 2017. According to the WTO, Asia also accounted for 32.1% of world merchandise trade, up from 26% in 2006.

This transformation has occurred as countries, in particular China, have opened up to the world and become essential links in global supply chains. However, this can only be enhanced if more areas of the economy are opened up to overseas investors and corporations.

We can measure the openness of an economy by the sum of exports and imports as a ratio of GDP. Figure 37 in the Appendix shows that Hong Kong has the highest share of exports and imports as a percentage of its GDP (389%) while Japan has the lowest share (36%). From 1985-2015, Asian countries have seen the openness of their economies increase significantly in relative terms, especially India (13% to 42.2%), Thailand (49.1% to 126.6%) and China (21% to 40.5%), with exports benefiting more than imports.

Asia's high dependence on exports has been accompanied by significant progress in the diversification of its export destinations. Figure 18 and Figure 19 show the composition of the ten countries' exports and imports by destination. The US accounted for just 15% of these countries' total exports in 2015, down from 22% in 1995.

Foreign direct investment (FDI) has played an important role in promoting intraregional and interregional trade in Asia. Growth in inward FDI to the ten countries has been remarkable, rising from USD 156bn in 2000 to USD 460bn in 2016. China and Hong Kong already account for the largest shares of inward FDI (37% and 25% in 2016 respectively). India has the highest increase of inward FDI of roughly 12 times over 16 years.



Figure 18: Selected Countries' Exports (% of Total Exports)

Source: World Bank, SSGA Demographics.

Figure 19: Selected Countries' Imports (% of Total Imports)



1995 2015

Source: World Bank, SSGA Demographics.







Source: World Bank, SSGA Demographics.

The flipside of having stronger trade and FDI linkages is that these can become channels for the transmission of economic shocks. If Asian countries have strong intraregional links and China has considerable trade with advanced countries, a slowdown in the West will potentially have a negative impact on China and Asia.

A stable macroeconomic environment of low inflation and prudent fiscal balances with modest levels of debt will help sustain high growth. It will also allow room for policy makers to use a range of macroeconomic levers in order to maintain stability whenever necessary.

6. Retirement and Pensions

Asian countries not only need to focus on ways to maximise growth and shield against external shocks in order to increase prosperity; they also need higher growth to fund adequate pension provision and manage longevity risk specific to their varying demographic profiles.

Longevity Risk

Longevity risk¹⁷ is the risk that future mortality and life expectancy will differ from current estimates. Longevity risk manifests as either specific risk unique to each individual or as aggregate risk. The latter arises from uncertainty about overall rates of population mortality. Specific longevity risk can be diversified by pooling; however, aggregate longevity risk cannot be diversified away.

Individuals, annuity providers, corporate pension funds and governments alike are all carriers of longevity risk. Individuals risk outliving their assets post-retirement, life insurance providers risk not meeting their actuarial assumptions and corporate pension plans and governments risk promising overly-generous benefits that they cannot afford.

Healthcare Expenditure

As Asia ages, there is an increased need to focus on conditional life expectancy at age 60, which measures the length of remaining life at that age. This helps to measure how large pension and healthcare expenditures need to be. Over the last 20 years, life expectancy at age 60 has increased across all countries but more significantly in developed countries such as Japan, Hong Kong, Singapore and South Korea (Figure 35). Life expectancy at age 60 is highest in Japan (26.4 years) and lowest in India (18.1 years) in 2015–2020.

Asia is also experiencing rapid epidemiological change, partly driven by population aging, higher incomes and urbanisation. Ageing per se aside, knowing how the disease profile is changing and whether people are experiencing healthy aging is key to understanding changing demographics and the implications for health expenditure.

Healthy life expectancy at birth takes into account age-specific mortality, morbidity and functional health status. Figure 36 shows that Singapore has the highest healthy life expectancy at 76.2 years (2016) while India is the lowest at 59.3 years. Similar to life expectancy at age 60, there is a general increase in healthy life expectancy across all countries between 2000 and 2016.

As people are living longer, non-communicable diseases are becoming the leading causes of deaths in Asia, with China leading the way. Non-communicable diseases include cardiovascular disease, diabetes, and cancer which are chronic conditions and are the top killers for those aged 60 and above in Asia according to the WHO's Global Burden of Diseases. The next most common causes of death in Asia are communicable diseases such as tuberculosis and respiratory problems. These diseases are not just common in younger and less developed Asian countries such as India and Indonesia but also account for a large proportion of deaths in richer countries such as Singapore.

Japan is the most aged country in the world but its health expenditure per capita is lower than South Korea and some major developed countries (the US, France, Germany and Italy) due to the efficiency of its healthcare system. In contrast, lower levels of per capita health expenditure in India and Indonesia to some extent explain their lower longevity. The per



Figure 22: Health Expenditure

Source: World Bank, SSGA Demographics.

Source: World Bank, SSGA Demographics.

Malaysia Singapore

Thailand

South

Korea

capita health expenditure in these two countries is only one-third of the corresponding level in China (Figure 21), a country that relatively under-spends on health care.

The majority of the health expenditures in Singapore, India and Indonesia are borne privately. The Japanese government spends the highest share of GDP on health amongst the selected Asian countries, while governments in India and Indonesia spend the lowest (Figure 22).

Sustainable Pension Systems

As healthcare provision varies, so does that of pensions in Asia. Different countries exhibit significant heterogeneity in terms of generosity, degree of redistribution and assumptions of risk between individuals and governments.¹⁸ Social pensions are more significant in some countries such as China, South Korea and Thailand. As regards mandated schemes, countries such as Indonesia, Malaysia and Singapore offer Defined Contribution (DC) schemes managed by the public sector that allow withdrawals for purposes other than retirement, including housing. Hong Kong has taken the DC route but opted for private, competitive management. In China, there are notional-defined contribution (NDC) accounts schemes in addition to small-scale DC schemes. As a result, these countries have not been accumulating large unfunded pension liabilities.

Figure 23: Asia's Pension Systems

		N	landated Savings for	Pensions	
	Social Pensions	Scheme Types	Target Benefit	Civil Servants	Voluntary Pensions
China	Significant	NDC, DC	High	Parallel	Limited occupational pensions, growing informal sector
Hong Kong	Small	DC	Low	Integrated	scheme
Japan	Small	DB	Low	Integrated	Significant occupational pensions
South Korea	Significant	DB	Low	Parallel	
Malaysia	Small	DC	Low	Parallel	Some voluntary savings within mandatory provident system
					Limited occupational and personal pensions
Singapore	None	DC	Low	Integrated	Some voluntary savings within mandatory provident system
Thailand	Significant	DB	Low	Parallel	Limited occupational pensions

Source: World Bank, OECD, SSGA Demographics.

Figure 24: Gross Pension Replacement Rates, Average Earner, 2016 or Nearest Years







Male
Female

Source: OECD, SSGA Demographics. Latest available data for Hong Kong, Malaysia, Singapore and Thailand refer to 2012. Others refer to 2016

However, the opposite is true for countries that have gone the DB (Defined Benefit) route. In a previous report assessing twelve Emerging Market pension systems,¹⁹ we grouped different systems into three different categories based on common characteristics. As populations age, the reform and evolution of pension systems becomes an ever more important aspect of financial and social structures. Pension reforms have been the cause of political debates, discontent and unrest in both developed countries (Greece, Italy, France and Germany) and in emerging markets (Brazil, Mexico, Argentina and Hungary).

Figure 24 shows the gross pension replacement rate, which is the ratio of gross pension entitlements to gross preretirement incomes. China, India and Indonesia have relatively high gross pension replacement rates (above 55% for both male and female workers) among the ten countries, whereas Hong Kong, Japan and Malaysia offer very low gross pension replacement rates, below 35%.

While replacement rates provide a good indicator of pension promises, they only look at the benefit level at the point of retirement. By looking at the gross pension wealth, we also have a view on the stock of future flows of pension benefits. Gross pension wealth is defined as the total value of the lifetime flow of pension benefits relative to an individual's gross annual earnings. We note that China, India and Indonesia are the highest in terms of gross pension wealth while Hong Kong, Japan, Malaysia and Singapore are the lowest (Figure 25).

These indicators reflect the public pension promises relative to individual income levels that influence the fiscal sustainability of a country. Among Asian countries, Japan is the oldest country and also the earliest adopter of DB schemes while other countries are relatively younger and introduced their schemes fairly recently such as Hong Kong (2001) and South Korea (1988). As a result, Japan is faced with much greater pension promises compared to other Asian countries.

Asian non-OECD countries tend to have lower retirement ages than OECD countries due to lower life expectancy. However, as people are living longer in Asia, we believe that retirement ages should be extended in line with life expectancy increases and people should be encouraged to continue working after 65, even part time. Moreover, governments should incentivise individuals to both save and invest more by giving them more information about how much they will need to fund their retirement.

7. Capital Markets²⁰

How much people save and invest can have a significant impact on capital markets. Several academic studies have investigated the relationships between demographic variables and stock and bond prices. Some studies focus on the US and attribute part of the increase in stock prices in the 1980s and 1990s to the increasing demand for financial assets by the Baby Boomers, the post-war generation who were in their prime saving years during this period.

The predictability of demographic variables for bond yields is strong and fairly similar across advanced countries, but strong mainly for stocks in the US.²¹ Bakshi and Chen (1994)²² studied and tested the relationship between demographic changes and asset prices in the US during 1900-1990. They used average age, along with consumption growth data, to explain stock and T-bill returns (thereby risk premia) and found that average age had a significant effect.

Ang & Maddaloni (2003)²³ found weak evidence in the US that demographic changes predict future equity risk premia, but strong evidence in favour of predictability for other developed countries. Further, they found that the demographic variables that predict equity risk premia in the US are different from those that predict equity risk premia in other developed markets.

Some Asian capital markets have grown significantly relative to their GDP (Figure 26). For example, the market capitalisation of listed domestic companies as a proportion of GDP has more than tripled in China within a decade (from 18% in 2005 to 65% in 2016). In terms of debt capital markets, Japan is still the largest with 13.3 trillion USD, equivalent to 276% of its GDP, followed by China with 12.5 trillion USD (104% of its GDP in 2017). See Figure 27.



Figure 26: Market Capitalisation of Listed Domestic Companies (% of GDP)

Source: World Bank, SSGA Demographics.

Figure 27: Debt-to-GDP Ratio (%)



Source: BIS, IMF, SSGA Demographics. Debt data is sourced from BIS. India, Indonesia, South Korea and Taiwan debt data refer to domestic debts. Others refer to total debts. GDP data is sourced from IMF.

These studies suggest demographic features play a role in determining investor and saver behaviour, albeit a complex one that also encompasses differences in risk aversion, the size of stock and bond markets, financial market access, education and institutional features. For that reason, it is especially important for countries with ageing populations to consider the impact of future savings and investments on their capital markets, as well as on their economies and pension provision.

8. Conclusion

This report highlights the demographic differences across ten selected Asian economies and relates demographics to growth, GDP per capita, debt, pensions and capital markets. The aim is to draw parallels between countries where possible, but also to demonstrate where different demographic features require the implementation of different policy solutions. Investors can use the information to help make long-term decisions about which countries are likely to display the most sustainable growth patterns over the next five to ten years.

The changing dynamics of people flows, capital flows and the interdependencies within the region and the rest of the world pose significant challenges to Asian growth and investments. Given these pressures, we believe all ten countries need holistic reform across economic policy, education, health, labour and financial markets if they wish to avoid lower growth and be able to adapt to demographic forces in a balanced way that allows them to provide better economic and financial well-being for their older citizens.

The experience from developed economies that have been ageing over the last couple of decades in Europe and Japan is that ageing-related public expenditures account for nearly 20%+ of GDP. In the EU28, nearly 80% of tax revenues get apportioned to old-age, disability and long-term care. Countries in Asia without legacy pension promises have an opportunity to avoid the mistakes of Western economies and build sustainable pension systems, as long as they can achieve sufficient economic growth to be able to afford these given how much faster some Asian societies are now aging.

Key to enriching older populations for many countries is the deepening of capital markets to attract local and international savings, as well as to manage longevity risk and protect against the current account and capital flows affected by demographics and geopolitics. This is especially important as our data shows greater interdependencies and synchronisation across business cycles in the post GFC period.

Countries, pension funds and insurance providers will also need to consider demographic differences when creating retirement solutions, which should be based on the changing life cycles of consumers and workers. These characteristics feed into the demand for goods, housing and other assets as well as into measures of supply such as GDP growth, GDP per capita, capital/labour ratios and productivity. In such a context, risk management tools are becoming increasingly important, as well as greater portfolio flexibility and diversification.

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Appendix A: Demographic Profiles



Figure 28: World and Regional Life Expectancy at Birth (Years)

Source: UN, SSGA Demographics.



Figure 29: Population Change Decomposition



Natural Population Change
Net Migration

Source: UN, SSGA Demographics.



Figure 30: Age-specific Fertility Rates (Births per 1000 Women), 2015-2020

Source: UN, SSGA Demographics.

Figure 31: Total Labour Force Participation Rate (%), 2015 vs. 1990





Figure 32: Gender Differences in Labour Force Participation Rates (%), 2015 vs. 1990



Source: ILO, SSGA Demographics.



Figure 33: Educational Attainment, Age Group 25-64 Years, (%), 2010

Source: Barro & Lee, SSGA Demographics.



Figure 33: Educational Attainment, Age Group 25-64 Years, (%), 2010 (Cont'd)

Source: Barro & Lee, SSGA Demographics.

Figure 34: Share of Household by Household Size (% of Total Households)





Singapore







Source: China NBS, Euromonitor, Bernstein analysis, Singapore Department of Statistics, Statistics Korea, SSGA Demographics.



Figure 36: Healthy Life at Birth (Years)



Source: UN, SSGA Demographics.

Appendix B: Economic Structure, Correlation and Decoupling

Figure 37: Structure of GDP in Asia (% of GDP)

	China		Hong K	ong	Indi	ia	Japa	n
	1985	2015	1985	2015	1985	2015	1985	2015
Final Consumption	63.9	51.1	68.5	76	79.5	69.4	67.1	76.5
Household	49.7	37.1	61.5	66.4	68.3	59.1	52.9	56.6
Government	14.2	14	7	9.6	11.2	10.3	14.2	19.9
Gross Capital Formation	39.9	45.4	21.5	21.5	23	32.9	29.7	23.9
Net Exports	-3.8	3.5	10	2.4	-2.4	-2.4	3.2	-0.4
Exports	8.6	22	103.9	195.9	5.3	19.9	14.1	17.6
Imports	12.4	18.5	93.9	193.5	7.7	22.3	10.9	18
Trade	21	40.5	197.8	389.4	13	42.2	25	35.6

	Malaysia		Singapore		South Korea		Thailand	
	1985	2015	1985	2015	1985	2015	1985	2015
Final Consumption	69.6	67.2	58.6	47.3	66	64.1	74.5	66.2
Household	54.5	54.1	45.2	36.7	55.2	49.1	61	48.9
Government	15.1	13.1	13.4	10.6	10.8	15	13.5	17.3
Gross Capital Formation	25.3	25.1	41.1	26.8	32.6	28.9	28.2	22.2
Net Exports	5.1	7.6	0.3	25.9	1.4	6.9	-2.7	11.6
Exports	55.1	70.9	152.4	177.9	27.3	45.3	23.2	69.1
Imports	50	63.3	152.1	152	25.9	38.4	25.9	57.5
Trade	105.1	134.2	304.5	329.9	53.2	83.7	49.1	126.6

Source: World Bank, SSGA Demographics.

		Annualised Real GDP G	Growth (%)		
1980–2018	1980–2000	2000-2018	Last 5 years	Last 3 years	1-year
10.0	10.1	9.3	7.0	6.8	6.7
4.5	5.4	3.5	2.9	3.0	3.5
6.1	5.6	7.2	7.5	7.3	8.2
5.6	5.7	5.5	5.0	5.2	5.3
1.9	2.9	0.8	1.1	1.2	1.0
5.7	6.4	4.8	5.1	4.7	4.5
6.3	7.5	5.0	2.9	2.9	3.9
6.1	8.3	3.8	3.0	3.0	2.8
5.6	7.4	3.3	2.3	2.2	3.3
5.0	6.3	4.0	3.2	4.1	4.6
	1980–2018 10.0 4.5 6.1 5.6 1.9 5.7 6.3 6.1 5.6 5.7 5.3 6.1 5.6 5.7 5.3 6.1 5.6 5.6 5.6 5.0	1980-2018 1980-2000 10.0 10.1 4.5 5.4 6.1 5.6 5.6 5.7 1.9 2.9 5.7 6.4 6.3 7.5 6.1 8.3 5.6 7.4 5.0 6.3	Annualised Real GDP C 1980–2018 1980–2000 2000–2018 10.0 10.1 9.3 4.5 5.4 3.5 6.1 5.6 7.2 5.6 5.7 5.5 1.9 2.9 0.8 5.7 6.4 4.8 6.3 7.5 5.0 6.1 8.3 3.8 6.5 7.4 3.3 5.6 7.4 3.3 5.6 7.4 3.3 5.6 7.4 3.3	Annualised Real GDP Growth (%) 1980–2018 1980–2000 2000–2018 Last 5 years 10.0 10.1 9.3 7.0 4.5 5.4 3.5 2.9 6.1 5.6 7.2 7.5 5.6 5.7 5.5 5.0 1.9 2.9 0.8 1.1 5.7 6.4 4.8 5.1 6.3 7.5 5.0 2.9 6.1 8.3 3.8 3.0 6.1 8.3 3.8 3.0 5.6 7.4 3.3 2.3 6.1 8.3 3.4.0 3.2	Annualised Real GDP Growth (%) Last 5 years Last 3 years 1980–2018 1980–2000 2000–2018 Last 5 years Last 3 years 10.0 10.1 9.3 7.0 6.8 4.5 5.4 3.5 2.9 3.0 6.1 5.6 7.2 7.5 7.3 5.6 5.7 5.5 5.0 5.2 1.9 2.9 0.8 1.1 1.2 1.9 2.9 0.8 1.1 1.2 1.9 7.5 5.0 2.9 2.9 1.0 5.7 5.0 2.9 2.9 1.0 7.5 5.0 2.9 2.9 1.0 7.5 5.0 2.9 2.9 1.0 8.3 3.8 3.0 3.0 1.0 8.3 3.8 3.0 3.0 1.0 5.0 6.3 4.0 3.2 4.1

Figure 38: Real GDP Growth, Q2 1980-Q2 2018 and Sub-periods

Source: Oxford Economics, SSGA Demographics.

Figure 39: Inflation, Q2 1980-Q2 2018 and Sub-periods

			Annualised CPI Cha	inge(%)		
	1980-2018	1980–2000	2000-2018	Last 5 years	Last 3 years	1-year
China	4.7	7.1	2.3	1.8	1.8	1.8
Hong Kong	4.5	7.1	1.8	2.7	2.3	2.2
India	7.6	8.9	6.2	5.0	4.2	4.8
Indonesia	9.1	11.1	7.0	5.0	3.7	3.3
Japan	0.9	1.6	0.1	1.0	0.2	0.6
Malaysia	2.9	3.5	2.3	2.5	2.4	1.3
Singapore	1.9	2.1	1.6	0.4	0.1	0.3
South Korea	4.4	6.1	2.6	1.3	1.4	1.5
Taiwan	5.6	7.4	3.3	2.3	2.2	3.3
Thailand	5.0	6.3	4.0	3.2	4.1	4.6

Source: Oxford Economics, SSGA Demographics.

Figure 40: Correlation of GDP Growth for Different Time Horizons

a. Pre-Asian Crisis (1980 Q2-1996 Q4)

	China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand	US	EU
China	1.0	0.8	0.0	-0.1	0.0	0.4	0.8	-0.2	0.9	0.0	0.0	0.2
Hong Kong		1.0	-0.4	0.1	0.0	0.5	0.7	0.0	0.6	0.1	0.0	0.1
India			1.0	-0.5	0.0	-0.2	-0.2	-0.1	0.0	0.6	0.0	0.1
Indonesia				1.0	-0.2	0.2	0.0	0.0	0.0	-0.5	0.0	-0.2
Japan					1.0	-0.1	-0.1	0.2	0.0	0.1	0.1	0.3
Malaysia						1.0	0.5	-0.1	0.3	0.0	0.0	0.0
Singapore							1.0	-0.2	0.6	0.0	0.0	0.2
South Korea								1.0	-0.2	0.1	0.1	0.2
Taiwan									1.0	-0.2	0.1	0.2
Thailand										1.0	0.0	0.2
US											1.0	0.3
EU												1.0

b. Post-Asian Crisis (1999 Q1–2018 Q2)

China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand	US	EU
1.0	0.8	-0.2	-0.1	0.0	0.8	0.5	0.0	0.9	-0.2	0.2	0.0
	1.0	-0.1	-0.1	0.1	0.8	0.5	0.1	0.8	0.1	0.2	0.2
		1.0	-0.7	0.0	-0.4	-0.2	-0.1	-0.2	0.8	0.0	0.0
			1.0	0.1	0.2	0.1	0.2	0.0	-0.7	0.1	0.0
				1.0	0.2	0.3	0.2	0.1	0.1	0.4	0.6
					1.0	0.6	0.3	0.8	-0.3	0.3	0.2
						1.0	0.4	0.6	-0.1	0.3	0.3
							1.0	0.1	-0.1	0.4	0.5
								1.0	-0.2	0.3	0.2
									1.0	0.0	0.1
										1.0	0.6
											1.0
	China 1.0	China Hong Kong 1.0 0.8 1.0 1.0	China Hong Kong India 1.0 0.8 -0.2 1.0 -0.1 1.0 1.0 -0.1 1.0	China Hong Kong India Indonesia 1.0 0.8 -0.2 -0.1 1.0 -0.1 -0.1 -0.1 1.0 -0.1 1.0 -0.7 1.0 -0.7 1.0 1.0	China Hong Kong India Indonesia Japan 1.0 0.8 -0.2 -0.1 0.0 1.0 -0.1 -0.1 0.1 1.0 -0.1 0.0 0.0 1.0 -0.1 0.0 0.0 1.0 -0.1 0.0 0.1 1.0 -0.7 0.0 1.0 1.0 -0.7 1.0 0.1 1.0 -0.7 1.0 0.1 1.0 -0.1 1.0 1.0	China Hong Kong India Indonesia Japan Malaysia 1.0 0.8 -0.2 -0.1 0.0 0.8 1.0 -0.1 -0.1 0.1 0.8 1.0 -0.1 -0.1 0.1 0.8 1.0 -0.1 -0.1 0.1 0.2 1.0 -0.7 0.0 -0.4 1.0 0.2 1.0 -0.7 0.0 0.1 0.2 1.0 0.2 1.0 -0.7 1.0 0.1 0.2 1.0 0.2 1.0 -0.7 -0.1 1.0 0.1 0.2 1.0 1.0 -0.7 -0.1 1.0 1.0 1.0 1.0	China Hong Kong India Indonesia Japan Malaysia Singapore 1.0 0.8 -0.2 -0.1 0.0 0.8 0.5 1.0 -0.1 -0.1 0.1 0.8 0.5 1.0 -0.1 -0.1 0.1 0.8 0.5 1.0 -0.1 0.0 0.8 0.5 1.0 -0.1 0.1 0.8 0.5 1.0 0.07 0.0 -0.4 -0.2 1.0 0.1 0.2 0.1 0.2 0.1 1.0 0.1 0.2 0.3 1.0 0.6 1.0	China Hong Kong India Indonesia Japan Malaysia Singapore South Korea 1.0 0.8 -0.2 -0.1 0.0 0.8 0.5 0.0 1.0 0.1 -0.1 0.1 0.8 0.5 0.1 1.0 -0.1 -0.1 0.1 0.8 0.5 0.1 1.0 -0.1 0.0 0.4 -0.2 -0.1 1.0 0.1 0.2 0.1 0.2 -0.1 1.0 0.1 0.2 0.1 0.2 -0.1 1.0 0.1 0.2 0.3 0.2 -0.3 0.2 1.0 0.4 -0.5 1.0 0.6 0.3 -0.4	China Hong Kong India Indonesia Japan Malaysia Singapore South Korea Taiwan 1.0 0.8 -0.2 -0.1 0.0 0.8 0.5 0.0 0.9 1.0 0.1 -0.1 0.1 0.8 0.5 0.1 0.8 1.0 -0.1 -0.1 0.1 0.8 0.5 0.1 0.8 1.0 -0.1 0.01 0.8 0.5 0.1 0.8 1.0 -0.1 0.0 -0.4 -0.2 -0.1 -0.2 1.0 0.1 0.2 0.1 0.2 0.0 0.1 0.2 0.0 1.0 0.1 0.2 0.3 0.2 0.1 0.8 0.8 0.8 0.8 0.8 0.8 0.1 0.4 0.6 0.3 0.8 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	China Hong Kong India Indonesia Japan Malaysia Singapore South Korea Taiwan Thailand 1.0 0.8 -0.2 -0.1 0.0 0.8 0.5 0.0 0.9 -0.2 1.0 0.0 -0.1 0.0 0.8 0.5 0.0 0.9 -0.2 1.0 -0.1 -0.1 0.1 0.8 0.5 0.0 0.9 -0.2 1.0 -0.1 0.0 0.8 0.5 0.1 0.8 0.1 1.0 0.0 -0.4 -0.2 -0.1 0.2 0.3 0.2 0.0 -0.7 1.0 0.1 0.2 0.3 0.2 0.1 0.1 0.1 1.0 0.6 0.3 0.8 -0.3 0.8 -0.3 1.1 0.6 0.3 0.1 -0.1 0.1 -0.1 1.1 0.1 0.1 0.1 1.0 0.1 -0.1 0.2<	China Hong Kong India Indonesia Japan Malaysia Singapore South Korea Taiwan Thailand US 1.0 0.8 -0.2 -0.1 0.0 0.8 0.5 0.0 0.9 -0.2 0.2 1.0 0.1 -0.1 0.1 0.8 0.5 0.1 0.8 0.1 0.2 1.0 -0.1 -0.1 0.1 0.8 0.5 0.1 0.8 0.1 0.2 1.0 -0.1 0.1 0.2 0.1 0.2 0.1 -0.2 0.8 0.0 1.0 -0.7 0.0 0.4 -0.2 0.1 0.2 0.1 0.4 0.4 1.0 0.1 0.2 0.3 0.2 0.1 0.4 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.4 0.4 0.4 0.4 0.4 0.5

c. Change in Correlation after Asian Crisis

	China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand	US	EU
China	0.0	0.0	-0.2	0.0	0.0	0.4	-0.2	0.2	0.0	-0.2	0.2	-0.2
Hong Kong		0.0	0.3	-0.2	0.1	0.3	-0.2	0.2	0.2	0.0	0.2	0.0
India			0.0	-0.2	0.0	-0.2	-0.1	0.0	-0.2	0.2	0.0	-0.1
Indonesia				0.0	0.2	0.0	0.1	0.1	0.0	-0.2	0.1	0.3
Japan					0.0	0.3	0.4	0.1	0.1	0.0	0.3	0.3
Malaysia						0.0	0.1	0.4	0.5	-0.2	0.2	0.2
Singapore							0.0	0.6	0.0	-0.1	0.3	0.2
South Korea								0.0	0.4	-0.1	0.3	0.3
Taiwan									0.0	0.1	0.2	0.0
Thailand										0.0	-0.1	-0.2
US											0.0	0.3
EU												0.0

Source: Oxford Economics, SSGA Demographics.

Figure 41: Correlation of Inflation Pre- & Post-Asian Crisis

a. Pre-Asian Crisis (1980 Q2–1996 Q4)

	China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand
China	1.0	0.0	-0.6	0.1	-0.1	0.1	-0.1	-0.1	-0.2	-0.1
Hong Kong		1.0	0.2	0.1	0.3	0.5	0.5	0.4	0.4	0.3
India			1.0	-0.1	0.1	-0.1	0.2	0.1	0.3	0.3
Indonesia				1.0	0.1	0.4	0.3	0.3	0.3	0.1
Japan					1.0	0.1	0.3	0.4	0.3	0.5
Malaysia						1.0	0.6	0.5	0.4	0.2
Singapore							1.0	0.6	0.3	0.4
South Korea								1.0	0.7	0.6
Taiwan									1.0	0.5
Thailand										1.0

b. Post-Asian Crisis (1999 Q1–2018 Q2)

China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand
1.0	0.3	-0.3	0.2	-0.3	0.2	0.3	0.4	-0.2	0.1
	1.0	0.0	-0.1	0.2	0.1	0.2	-0.1	0.0	0.1
		1.0	-0.1	0.3	0.0	0.3	-0.1	0.6	0.1
			1.0	-0.2	0.3	0.1	0.1	-0.2	0.0
				1.0	0.3	0.1	0.0	0.5	0.3
					1.0	0.3	0.3	0.2	0.3
						1.0	0.4	0.3	0.3
							1.0	-0.1	0.4
								1.0	0.4
									1.0
	1.0	I.0 0.3 1.0 1.0	India India 1.0 0.3 -0.3 1.0 0.0 1.0 1.0 1.0 1.0	India Indin India India <th< td=""><td>China Hong Kong India Indonesia Japan 1.0 0.3 -0.3 0.2 -0.3 1.0 0.0 -0.1 0.2 1.0 0.0 -0.1 0.3 1.0 -0.1 0.3 1.0 -0.1 0.3 1.0 -0.2 1.0</td><td>Cinina Holing Koling Initia Indunesta Japan Maraysta 1.0 0.3 -0.3 0.2 -0.3 0.2 1.0 0.0 -0.1 0.2 0.1 1.0 -0.1 0.3 0.0 1.0 -0.1 0.3 0.0 1.0 -0.1 0.3 0.0 1.0 -0.2 0.3 1.0 -0.2 0.3 1.0 -0.2 1.0</td><td>Cinina Hoing Koing Initia Initial Sapari Wataysta Singapore 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 1.0 0.0 -0.1 0.2 0.1 0.2 1.0 -0.1 0.3 0.0 0.3 1.0 -0.1 0.3 0.0 0.3 1.0 -0.1 0.3 0.0 0.3 1.0 -0.2 0.3 0.1 0.3 0.1 1.0 -0.2 0.3 0.1 1.0 0.3 0.1 1.0 0.3 0.1 1.0 0.3 0.1 1.0 0.3 1.0 0.3 1.0 1.0 0.3 1.0 1.0 1.0</td><td>Cinina Hoing Koing Huita Indunesia Sapan Wataysta Singapore Soluti Korea 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 0.4 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.2 0.3 0.1 0.1 1.0 -0.2 0.3 0.1 0.0 1.0 0.3 0.1 0.0 0.3 0.3 1.0 0.3 0.3 0.3 0.3 0.3 1.0 0.3 0.3 1.0 0.4 1.0</td><td>Cinina Hoing Koing Initia Indivision Salaria Maraysia Singapore South Korea Frankain 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 0.4 -0.2 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 0.0 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 0.0 1.0 0.0 -0.1 0.3 0.0 0.3 -0.1 0.6 1.0 -0.1 0.3 0.0 0.3 0.1 0.1 -0.2 1.0 -0.2 0.3 0.1 0.0 0.5 -0.1 -0.2 -0.3 0.3 0.3 0.2 -0.1 -0.2 -0.3 0.3 0.3 0.2 -0.1 -0.2 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1</td></th<>	China Hong Kong India Indonesia Japan 1.0 0.3 -0.3 0.2 -0.3 1.0 0.0 -0.1 0.2 1.0 0.0 -0.1 0.3 1.0 -0.1 0.3 1.0 -0.1 0.3 1.0 -0.2 1.0	Cinina Holing Koling Initia Indunesta Japan Maraysta 1.0 0.3 -0.3 0.2 -0.3 0.2 1.0 0.0 -0.1 0.2 0.1 1.0 -0.1 0.3 0.0 1.0 -0.1 0.3 0.0 1.0 -0.1 0.3 0.0 1.0 -0.2 0.3 1.0 -0.2 0.3 1.0 -0.2 1.0	Cinina Hoing Koing Initia Initial Sapari Wataysta Singapore 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 1.0 0.0 -0.1 0.2 0.1 0.2 1.0 -0.1 0.3 0.0 0.3 1.0 -0.1 0.3 0.0 0.3 1.0 -0.1 0.3 0.0 0.3 1.0 -0.2 0.3 0.1 0.3 0.1 1.0 -0.2 0.3 0.1 1.0 0.3 0.1 1.0 0.3 0.1 1.0 0.3 0.1 1.0 0.3 1.0 0.3 1.0 1.0 0.3 1.0 1.0 1.0	Cinina Hoing Koing Huita Indunesia Sapan Wataysta Singapore Soluti Korea 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 0.4 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.1 0.3 0.0 0.3 -0.1 1.0 -0.2 0.3 0.1 0.1 1.0 -0.2 0.3 0.1 0.0 1.0 0.3 0.1 0.0 0.3 0.3 1.0 0.3 0.3 0.3 0.3 0.3 1.0 0.3 0.3 1.0 0.4 1.0	Cinina Hoing Koing Initia Indivision Salaria Maraysia Singapore South Korea Frankain 1.0 0.3 -0.3 0.2 -0.3 0.2 0.3 0.4 -0.2 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 0.0 1.0 0.0 -0.1 0.2 0.1 0.2 -0.1 0.0 1.0 0.0 -0.1 0.3 0.0 0.3 -0.1 0.6 1.0 -0.1 0.3 0.0 0.3 0.1 0.1 -0.2 1.0 -0.2 0.3 0.1 0.0 0.5 -0.1 -0.2 -0.3 0.3 0.3 0.2 -0.1 -0.2 -0.3 0.3 0.3 0.2 -0.1 -0.2 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1 -0.1

c. Change in Correlation after Asian Crisis

	China	Hong Kong	India	Indonesia	Japan	Malaysia	Singapore	South Korea	Taiwan	Thailand
China	0.0	0.3	0.3	0.1	-0.2	0.1	0.4	0.4	-0.1	0.2
Hong Kong		0.0	-0.2	-0.2	-0.2	-0.4	-0.3	-0.5	-0.3	-0.2
India			0.0	0.0	0.2	0.1	0.1	-0.2	0.2	-0.2
Indonesia				0.0	-0.3	-0.1	-0.2	-0.2	-0.5	-0.1
Japan					0.0	0.2	-0.2	-0.4	0.2	-0.2
Malaysia						0.0	-0.3	-0.2	-0.1	0.1
Singapore							0.0	-0.2	0.0	-0.1
South Korea								0.0	-0.7	-0.1
Taiwan									0.0	-0.1
Thailand										0.0

Source: Oxford Economics, SSGA Demographics.

China Hong Kong

India

Appendix C: Core Demographic Indicators



Figure 42: Population Growth (% per Annum)

Indonesia Japan Malaysia Singapore South Korea Taiwan Thailand 1 2 3 Children Per Woman

Source: UN, SSGA Demographics.

Figure 44: Life Expectancy at Birth (Years)



Figure 45: Old Age Dependency Ratios (Number. of Aged 65+ Years per 100 People Aged 15–64 Years)



Source: UN, SSGA Demographics.

Appendix D: Vector Autoregression Model

We assume that an economy is described by the following equation:

$$y_t = A_1 y_{t-1} + \dots + A_n y_{t-n} + C x_t + \varepsilon_t$$
 (Equation 1)

Where

 $y_t = (y_{1t}, \dots, y_{Kt})$ is a kx1 vector of endogenous variables.

 $x_{t} = (x_{1t}, ..., x_{dt})$ is a dx1 vector of constants.

 $A_1 \dots A_n$ are k x k matrices of lag coefficients to be estimated.

C is a k x d matrix of constant coefficients to be estimated.

 $\varepsilon_{+} = (\varepsilon_{1t}, ..., \varepsilon_{Kt})$ is k x 1 structural disturbances.

The disturbances are contemporaneously correlated, but are uncorrelated with their leads and lags and uncorrelated with all of the right-hand side variables in equation 1.

4

Figure 43: Fertility Rate (Children per Women)

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