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SINGAPORE

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SINGAPORE

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June 27, 2017

Approved By
Asia and Pacific Department

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ASSESSING BANKING SECTOR PERFORMANCE[1]

A. Banking Sector Trends

1. **The financial cycle is firming after a prolonged moderation. Credit expanded mildly in** 2016 with both lending to residents and nonresident picking up (Figure 1). The pullback in trade financing since mid-2014 reflected unwinding of RMB carry-trades as the interest differential between the Chinese Renminbi (RMB) and the U.S. dollar narrowed and the Renminbi came under depreciation pressure. Overall lending activity firmed further in 2017:Q1, underpinned by domestic demand for credit, including in the interbank market, and the trade-related sectors. Additionally, a recovery in regional trade and an acceleration in growth momentum in the Eurozone helped support non-bank cross-border lending.

2. **The banking sector remains healthy, backed by high capital, liquidity, provisioning and profitability ratios, and still-low NPLs.** Sector-wide non-performing loans (NPLs) have increased slightly (to 2 percent in 2017:Q1), due largely to stresses in the Oil and Gas (O&G) services sector. Banks have responded by increasing provisions (using forward-looking measures of impairment) and restructuring their loans. This resulted in a slight decline in profitability in 2016, which remained comfortably high. Household NPLs are expected to remain low, aided by past macroprudential policy measures, containing banks' possibly losses on their credit portfolios.

3. **Overall, the banking sector is well-positioned to withstand shocks.** Capital and liquidity positions are sufficiently strong and well above regulatory requirements. The results of the Monetary Authority of Singapore (MAS) annual industry-wide stress test (IWST) confirmed that the banking system is able to withstand severe shocks including a protracted slowdown in China; slowdowns in the Eurozone and Japan, with significant negative spillovers to emerging Asia; and corporate defaults by the banks' largest SMEs and O&G borrowers. Under these scenarios, all banks stay solvent, with their capital adequacy ratios (CARs) remaining above Basel regulatory requirements, despite higher NPL and write-downs.

4. **Capital and liquidity positions of the local banking groups remain strong.** Liquidity coverage ratios (LCR) of all three major banks remained high and rose in 2016:Q4, remaining well above the regulatory limits (Figure 2).[2] Despite a slight increase in NPLs associated with the O&G sector (which nevertheless remained below the average for the banking sector), capital positions too remained strong, reflected in CARs well above the MAS' regulatory requirement of 10 percent.[3] Higher provisions associated with the increase in NPLs as well as compressed net interest margins weighed on banks' profitability in 2016. While new NPL formation and further increases in provisions

[1] Prepared by David Grigorian (APD) and Adeline Yeo (Resident Representative Office).

[2] The minimum all-currency LCR requirement is set at 80 percent as of January 1, 2017, 90 percent for January 1, 2018, and 100 percent for January 1, 2019. The Singapore Dollar LCR should be at least 100 percent.

[3] The rise in NPLs was primarily due to prolonged weakness in the O&G and shipping sectors, due largely to the decline in oil prices and freight rates.

are expected to continue, recovering oil prices and freight rates should cap the pace of NPL formation.

5. **Looking ahead, banks' profitability should benefit from the expected widening of net interest margins and firming of global growth and commodity prices**. Reflecting the downturn in the O&G sector, local banks' profitability declined in 2016, underperforming their regional peers, but improved in 2017:Q1. Additionally, local banks' price-to-book ratios continue to fall behind the regional benchmark MSCI AXJ Financials index and that for regional peers. However, going forward, local banks could see some turnaround in profitability due to following factors:

- The expected rise of US interest rates could steepen Singapore's yield curve which should support banks' interest income despite its potential adverse impact on credit quality.
- Lending appears to be gaining traction, supported by a renewed appetite for loans by China and the Euro area (as economic activity there gathers pace) and domestic demand for loans (reflecting higher demand in the trade-related sectors).
- The O&G and shipping sectors are expected to bottom out, as commodity prices and regional trade activity recover.

Nonetheless, lingering uncertainties surrounding US trade policies and Brexit, and risks of a disorderly deleveraging in China could weigh on the outlook for the banking sector.

B. The Wealth Management Sector

6. **The turnaround in bank's profitability (especially the strong performance in 2017:Q1) is attributed to two factors: an acceleration in credit growth and increases in fee income from wealth management services.** The latter has contributed to 15-30 percent of domestic banks' income. Strong performance of global and regional equities in recent years (particularly in the aftermath of the US elections) provided the wealth management segment a boost, spurring higher sales of unit trusts and other investment products. In 2015, Singapore's assets under management (AUM) grew by 9 percent, compared to 1 percent globally.[4] While official figures are not available for 2016, the strong trend increase in AUM in Singapore seems to have continued in 2016.

7. **Local banks have been a key factor behind the wealth management sector's growth and its main beneficiary.** The AUM of domestic banks grew strongly in 2016, including due to acquisitions of existing operations, while that of large international banks in Singapore grew either more modestly or declined. In November 2016, OCBC acquired Barclay's private banking business in Singapore and Hong Kong SAR.[5] In addition, DBS acquired ANZ's wealth management and retail banking business in five markets (including Singapore and Hong Kong SAR) in October 2016. Finally, OCBC announced plans to buy National Australia Bank's private wealth business in Singapore and Hong Kong SAR in 2017.

[4] "2015 Singapore Assets Management Survey: Singapore—Global City, World of Opportunities," Monetary Authority of Singapore, 2015.

[5] This acquisition helped OCBC's private banking unit—Bank of Singapore—rise four places to rank seventh among Asia's 20 largest private banks in terms of AUM. DBS was ranked sixth, unchanged from a year earlier. UOB was ranked 14th.

8. **According to MAS' 2015 survey of fund managers, the largest share of AUM originated from Asia Pacific (56 percent), following by North America (18 percent), and Europe (17 percent).** The destination of the majority of AUM too was Asia, having attracted 68 percent of the funds. This was followed by Europe (13 percent) and North America (12 percent). Most of the funds under management are invested in equities (43 percent), followed by bonds), alternative investments (20 percent), and collective investment vehicles (10 percent). This distribution remained largely unchanged compared to 2014, with a slight decline in the share of equity in favor of fixed income securities in 2015.

9. **With the Asia and Pacific region projected to grow at healthy rates in the medium term, the prospects for the wealth management sector in Singapore remain strong.** Given the role of the Singaporean banks in the region, the latter are well-placed to capitalize on the growing middle class and the growing demand for wealth management products. Several foreign wealth managers have retreated or are in the process of pulling back from Asian markets, creating opportunities for local banks to expand. In addition, the recent introduction of online asset management platforms (robo-advisers) in Singapore, including for mass-market investors, is expected to further stimulate the sector's growth by broadening the base and providing more opportunities for banks to earn revenue.

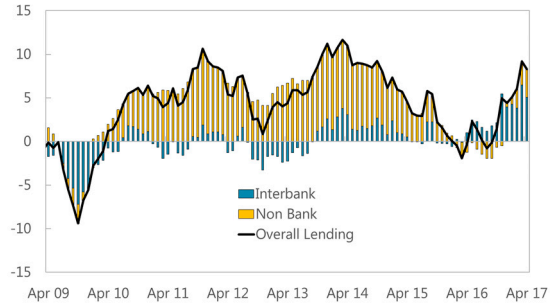
10. **However, risks remain and regulatory vigilance is required.** As the sector continues to grow, reputational and operational risks are likely to increase, including due to potential AML/CFT and interconnectedness concerns. Wealth management and conventional banking operations within the same banking groups should be conducted at arms lengths to reduce risks. In addition, banks and fund managers should steer customers into investment products that are appropriate for their risk tolerance to reduce the potential adverse implications of shocks on investors.

Figure 1. Singapore: Banking System Trends

Lending growth recovered from the fourth quarter of 2016

Contribution to Overall Lending Growth

(In percent, year-on-year)

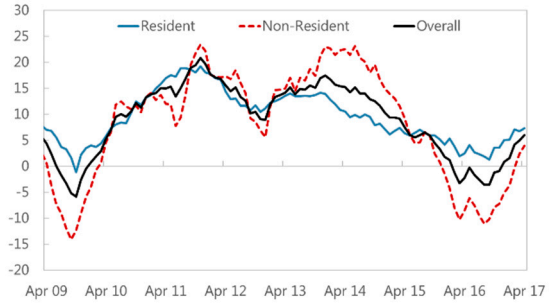


Sources: CEIC Data Company Ltd; and IMF staff calculations.

Lending to both residents and nonresidents bottomed out.

Contribution to Non-Bank Lending by Residency

(In percent, year-on-year)

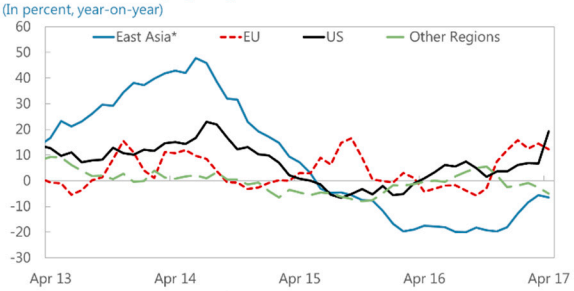


Sources: CEIC Data Company Ltd; and IMF staff calculations.

Cross border lending to the EU and US gathered pace, while the decline in loan growth to East Asia eased.

Non-bank Lending by Region

(In percent, year-on-year)



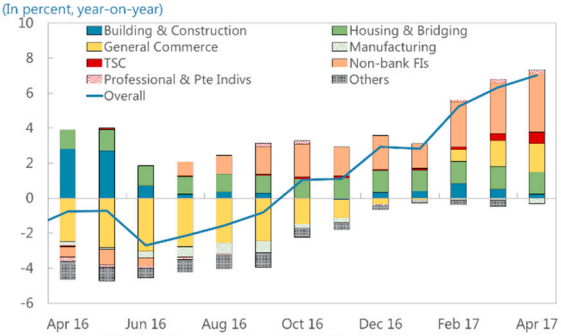
Sources: CEIC Data Company Ltd

*Consists of China, Hong Kong, Japan, South Korea, Taiwan and ASEAN (excluding Singapore).

Amid a broad-based recovery, domestic credit demand continued to be supported by property-related segments.

Contribution to DBU Loans Growth by Sector

(In percent, year-on-year)

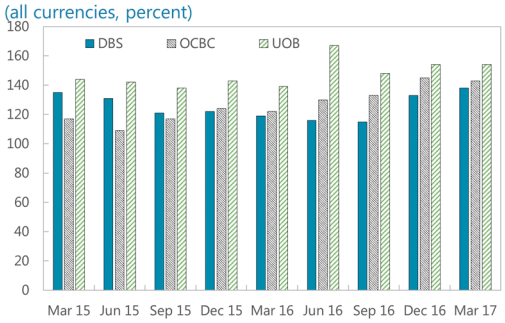


Sources: CEIC Data Company Ltd; and IMF staff calculations.

Figure 2. Singapore's Local Banking Groups: Trends

Local banks' liquidity positions remain strong, with LCRs substantially above 100 percent.

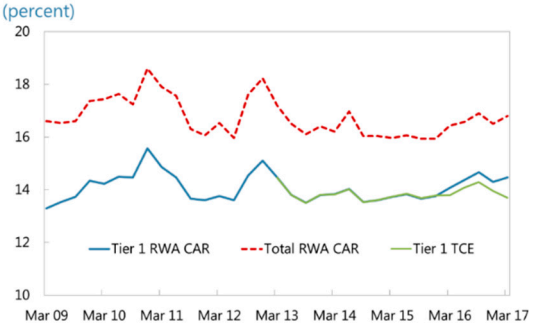
Liquidity Coverage Ratios
(all currencies, percent)



Source: Bloomberg

Capital buffers remain well above MAS regulatory requirements, supported by higher retained earnings.

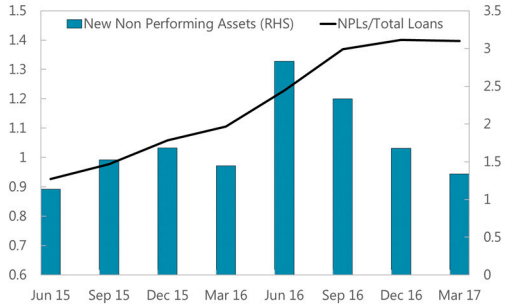
Capital Ratios
(percent)



Source: Bloomberg

NPL ratios stabilized, reflecting a slower pace of increase in new non-performing assets.

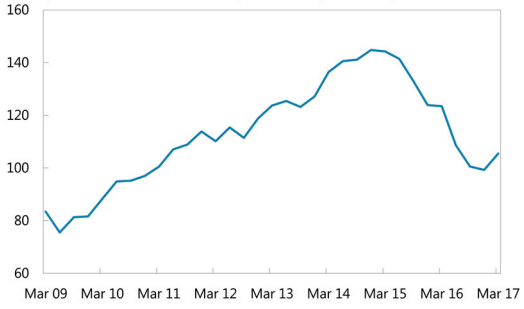
Non-Performing Loans
(Ratio) (SGD Bil)



Sources: Bloomberg, Company Reports

Provisioning coverage rose in Q1 2017, as banks rebuilt provisioning buffers.

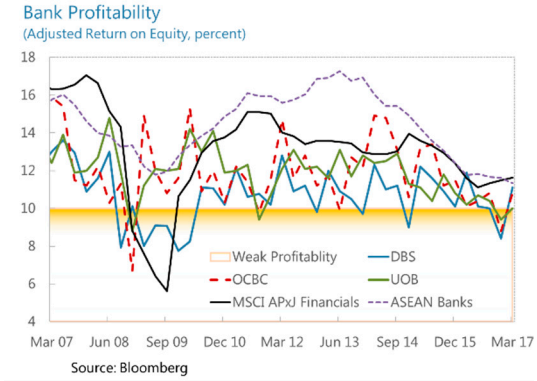
Provisioning Coverage
(Total provisions to total non performing assets, percent)



Source: Bloomberg

Banks' profitability improved in Q1 on rising net fees and interest incomes …

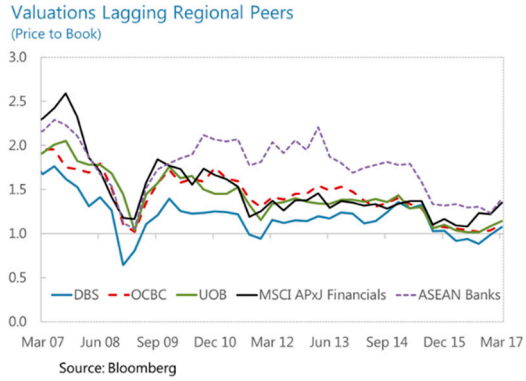
Bank Profitability
(Adjusted Return on Equity, percent)



Source: Bloomberg

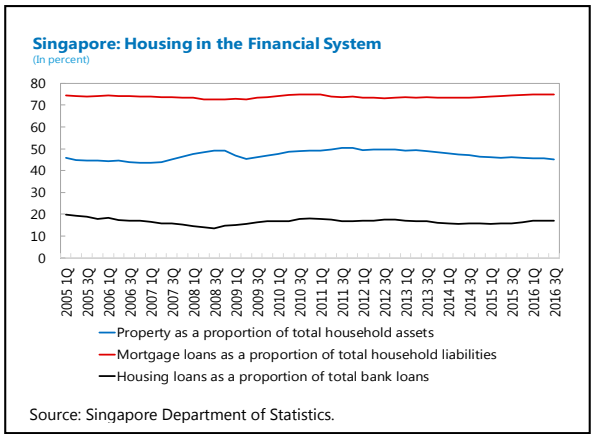
… although valuations continue to trail somewhat behind its more advanced regional peers.

Valuations Lagging Regional Peers
(Price to Book)



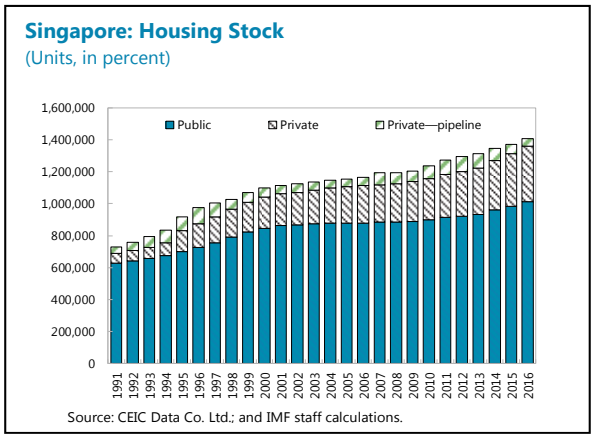
Source: Bloomberg

MANAGING THE PROPERTY MARKET[1]



1. **Property Market.** In Singapore, property market stability is closely linked to macroeconomic and financial stability. Property is the largest component of household wealth, representing about half of total household assets. Mortgage loans account for some three-quarters of total household liabilities, and property-related loans form a substantial portion of banks' loan books. In addition, housing affordability is a key concern for the Singapore public (Lum, 1996 and 2011; Phang, 2015; Phang and others, 2013). Therefore, when property prices rose rapidly shortly after the Global Financial Crisis (GFC), the Singapore authorities responded with a series of macroprudential measures, including fiscal-based measures, to promote a more stable and sustainable property market.

2. **Macroprudential Framework.** While the Monetary Authority of Singapore (MAS) actively manages the exchange rate to address inflation and growth, macroprudential policies (MaPs) target potential financial system vulnerabilities arising from capital flows, credit growth, and asset prices. Several macroprudential tools, related to the housing market, have been used by the authorities in recent years. These have been aimed at safeguarding financial stability and encouraging financial prudence among households. In particular, unsustainably high and rising property prices could create financial stability risks given households' and the banking system's exposure to property. In addition, the combination of low global interest rates and high, and rising, asset prices could lead some households to over-extend themselves financially when purchasing properties, without sufficient regard to longer term debt servicing ability.



3. **Housing Market Segmentation.** Singapore's real estate market is dominated by public housing. While the share of private housing has increased over the years, public housing still accounts for about 74 percent of the housing stock. The government's Housing and Development Board (HDB) builds apartments on government-allocated land and sells them at subsidized prices to eligible Singapore citizens. Apartments can be resold after a minimum occupancy period of five years to other eligible citizens or Singapore permanent residents. In 2015, about 80 percent of residents lived in HDB

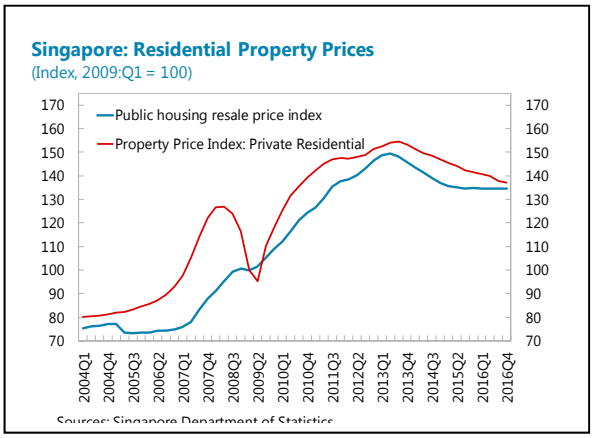
[1] Prepared by Umang Rawat (APD).

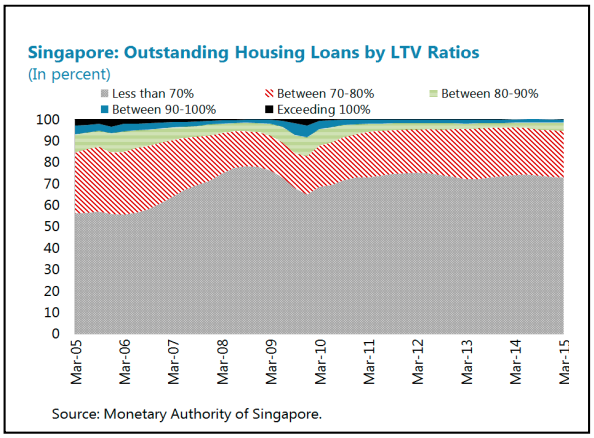
houses. Therefore, the demand in the private housing segment is primarily driven by permanent residents, immigrants, foreigners as well as investments from Singaporean residents.

4. **Macroprudential Measures, including Fiscal-Based Ones.** Since 2009, the MAS has implemented a wide range of measures. These can broadly be grouped into demand and supply side measures. On the demand side, MaPs, including fiscal-based measures, have been used. These measures include loan-to-value (LTV) ceilings, minimum cash payment requirements, caps on loan tenors and the total debt service to income ratio (TDSR), and seller's and buyer's stamp duties. This has been complemented by supply-side measures in form of increased government land sales. Furthermore, these measures were tightened in an incremental and targeted way. Tighter limits are applied to riskier segments of the housing market, such as housing not occupied by its owners, owners of multiple properties, companies, and foreigners. Since a significant share of private housing is owned by foreigners and permanent residents, some measures that targeted riskier segments of the housing market have in effect targeted them. Finally, the authorities view these measures as having both cyclical and structural components. While some measures such as LTV limits and stamp duties are cyclical, the TDSR framework is a structural measure.

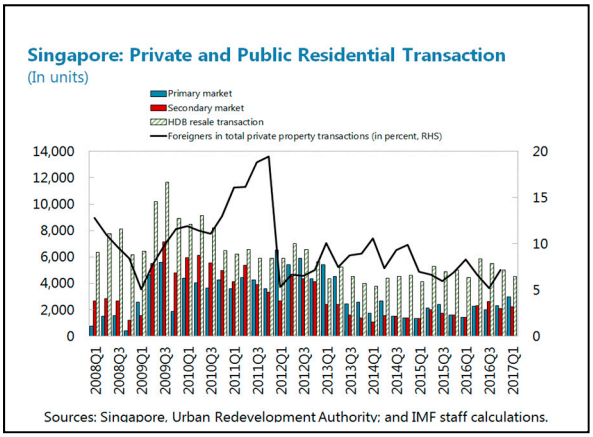
Policy Effectiveness

5. **Macroprudential Measures.** An incremental and targeted approach was undertaken. Between 2010 and 2013, the LTV limit was brought down to 80 percent for housing loans taken with financial institutions and tightened further for borrowers with multiple loans and corporates. In June 2013, the Total Debt Servicing Ratio (TDSR) framework was introduced for all property loans to encourage financial prudence among borrowers and strengthen credit underwriting practices by financial institutions. MaPs, such as LTV limits and the TDSR framework, have directly constrained mortgage lending. These measures also impacted property transactions and property prices through the credit channel. Since the implementation of the MaPs, the share of borrowers with multiple housing loans and the share of housing loans with high LTV ratios have both been decreasing. The TDSR framework has been particularly effective, contributing to prices in the private housing market to decline consistently since 2013:Q4. Monthly private residential property transaction volumes have fallen to about half of the levels during the two years preceding the introduction of the TDSR framework. Finally, new housing loans for private properties have also contracted.





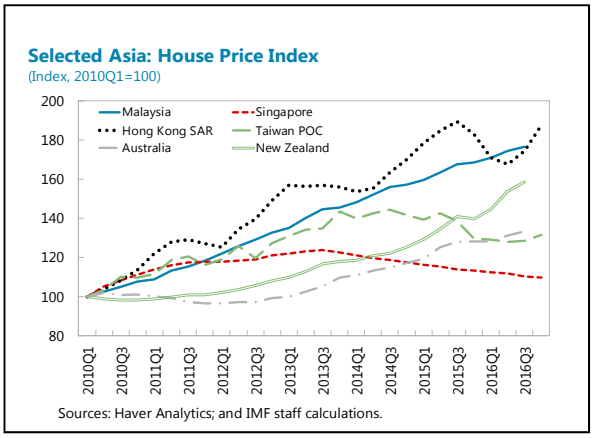
6. **CFM/Macroprudential Measures, including Fiscal-Based Measures.** A seller's stamp duty (SSD), which applied to both residents and non-residents, was introduced in 2010 to discourage speculative flipping of properties. This was followed by an additional buyer's stamp duty (ABSD) in 2011, which applied differentiated rates to residents with multiple properties, and non-residents, in response to a significant surge in inflows to the real estate market.[1] The ABSD rates were raised for both residents and non-residents in 2013 (in combination with the significant further tightening of the macro-prudential measures). Fiscal-based measures as a whole have directly constrained property transactions, with attendant effects on property prices and mortgage loans. The lower share of sub-sales and sales to foreigners suggests that investment demand has been reduced. Furthermore, the differentiated ABSD was associated with a sharp drop in foreign buyers' share of private residential properties in the first quarter of 2012.



7. **Supply-Side Measures.** Land supply, which refers to the government land sales program, has also been an effective tool to manage property prices, with possible spillover effects on property transactions and mortgage loans.

8. **Overall, macroprudential measures, including fiscal-based ones, were tightened incrementally, and in a targeted fashion, also in view of uncertainty about their transmission**. Pure macroprudential measures and non-discriminatory fiscal measures had been tightened significantly before discriminatory fiscal-based measures were introduced. The authorities' targeted approach is informed by efficiency and effectiveness considerations.

9. **International Comparison.** In Hong Kong SAR, Singapore, and Taiwan Province of China, property tightening measures in recent years have achieved different results. Since peaking in 2013, house prices in Singapore have declined gradually to 2010 levels. The impact contrasts with Hong Kong SAR, where prices have continued to rise and mortgage growth has shown no clear downward trend. House price growth has also remained rapid in New Zealand and Australia where tightening

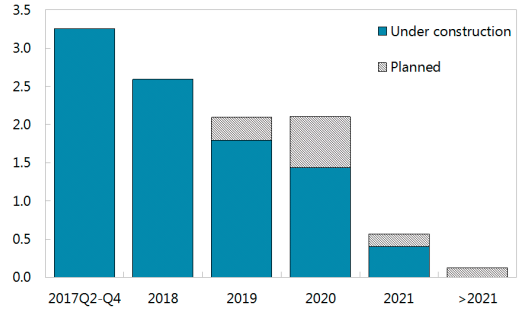


[1] Because of differentiated tax rates on the basis of residency, the additional buyer's stamp duty rates in Singapore is a capital flow management/macroprudential (CFM/MPM) measure that was introduced to address risks stemming from flows into the real estate market. It has been undertaken in tandem with Singapore's macroprudential policy framework to address systemic risks coming from the housing market and so it is also considered a macroprudential measure. The use of CFM/MPM was targeted at reducing demand from foreigners.

began in 2013 and 2014 respectively. Hence, there is significant liquidity in the regional markets calling for continued vigilance and careful calibration of the measures to guard against speculative capital inflows that can hamper financial stability.

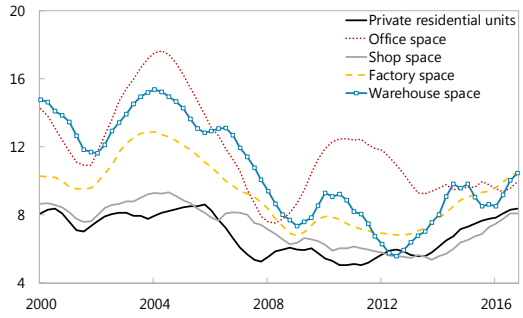
10. **Risks.** While the macroprudential measures, including fiscal-based measures, have been effective in managing property prices in Singapore, the overall financial cycle seems to have turned and employment and credit in the construction sector has been falling. The challenge is therefore to determine the order and speed at which some of these measures could be relaxed. This is important in light of the sustained decline in private residential property prices, subdued economic conditions, a weakening labor market, an increase in the vacancy rates and a large supply of new housing set to come on the market in the coming years. The macroprudential measures, including fiscal-based measures in Singapore have comprised structural (TDSR) and cyclical (LTV limits, stamp duties) features. While the structural elements should be maintained (with possible revisions to limits), cyclical elements could be phased out gradually. In this context, the authorities' decision to lower the seller's stamp duties by four percentage points for each tier (to range from 4 to 12 percent) is welcome. In line with the Institutional View on the Liberalization and Management of Capital Flows, further relaxation of cyclical measures, particularly the discriminatory ABSD, could be considered as systemic risks stemming from the housing sector continue to dissipate. Finally, since household debt remains elevated, property market developments should be monitored carefully and structural measures should not be relaxed until conditions improve markedly.

Upcoming Private Residential Supply Pipeline, end of 2017:Q1
(In percent of 2016 private housing stock)



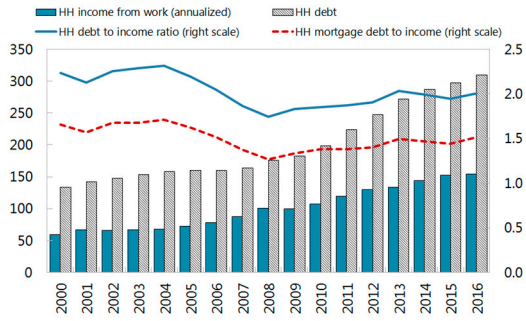
Source: Singapore, Urban Redevelopment Authority (URA).

Singapore: Vacancy Rates By Property Type
(In percent of available stock; 4-quarter moving average)



Source: CEIC Data Co. Ltd.

Singapore: Household Debt and Income
(In billions of Singapore dollars, left scale)



Sources: Singapore Department of Statistics; and IMF staff calculations.

11. Finally, **Singapore's banks are well-positioned to withstand shocks from the property market**, partly as a result of macro-prudential tightening. Average loan-to-value ratios are low, loan-loss coverage is adequate, and capital and liquidity buffers are strong. Households also have healthy balance sheets and well-diversified assets.

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EMBRACING THE FUTURE ECONOMY: STRIVING FOR INNOVATION, AUTOMATION, AND INCLUSION[1]

A high-level committee has recommended a strategy to transform Singapore into a global leader in the new digital age. The report acknowledges the disruptive potential of the new technologies for worker mobility, finance, and manufacturing. In response, and consistent with Singapore's holistic approach to policymaking, the government is proactively facilitating a transition to an innovation-based knowledge economy. It is cognizant that the transition to the new economy can have profound implications on inclusion and inequality. To mitigate this, and consistent with the principles of individual responsibility, equality of opportunity, and sound public finances, the government is providing students and workers with opportunities for life-long learning, acquisition of new-economy skills, and other active labor market policies.

A. Background

1. **Over the past half a century, Singapore has transformed itself from a developing trading center with very limited natural resources to an important trading and financial services hub on the global technological frontier.** Prudent economic management aligned with a longer-term vision; strong institutions and leadership; and relentless efforts at moving up the value chain have together created an environment of steadily improving in living standards. Through early recognition of the growth potential provided by openness to global manufacturing trade and foreign investment; subsequent upgradation to higher value-added activities, including in the services sector; and reforms in the labor, product, and financial markets, Singapore has achieved one of fastest rises in per capita income in the past fifty years.

2. **Singapore's economic growth has been supported by physical factor accumulations, including through accommodation of foreign worker inflows, human capital formation, and productivity improvements through increased reliance on high-tech manufacturing and modern services sectors.**[2] Continuing with this tradition, and in recognition of the evolving changes in demographics, technology and comparative advantages, Singapore is getting ready for yet another transformation of its economy. In that context, announcement of a high-level Committee on the Future Economy (CFE) in October 2015 followed in the footsteps of earlier high-level committees whose reports, issued in 1986, 2003, and 2010, guided policymaking over the past three decades.

[1] Prepared by Gerard Almekinders, Souvik Gupta, and Umang Rawat (all APD).

[2] High-tech manufacturing includes chemicals and chemical products; pharmaceutical and biological products; computer, electronic and optical products; and electrical equipment. Modern services include information and communications; finance and insurance; and business services. Between 1980 and 2016, the combined share of high-tech manufacturing and modern services sector increased from 25 percent of GDP to 40 percent of GDP.

B. The Singaporean Innovation Ecosystem

Innovation and economic growth

3. **Economic theory on endogenous growth highlights the importance of human capital and research and development (R&D) for long-term growth (for example, Lucas, 1988, and Romer, 1986).** Acemoglu and others (2006) argue that for a country which is closer to the technology frontier, innovation, rather than adoption of existing technologies, eventually attains greater importance as a source of productivity growth. When current research is determined by expected arrival of new research that replaces it in future, Aghion and Howitt (1992) discuss that the average growth rate and its variability will be positively related to the size of, but not necessarily productivity of, innovation. However, when there is some learning involved for the new firm before being able to replace the incumbent, Aghion and others (2005) show that a high level of product market competition could induce existing firms that are closer to the frontier to innovate. Fernald and Jones (2014) argue that considering the spillover from research across countries, it is the growth of the overall pool of worldwide researchers, and hence the total global population, that puts an upper limit on long-term growth. In such a scenario, they argue, the shape of the "idea production function" becomes important in moving to a different long-term equilibrium depending on whether innovations are taking place in spurts or waves.

4. **Using a framework developed by Jones (2002), previous staff analysis found that R&D and human capital together contributed about 70 percent of the growth in Singapore's real GDP per capita over 1991–2015 (IMF, 2016a).** Empirical studies have also found positive contributions from R&D on total factor productivity (TFP) growth in Singapore (Wong and Ping, 2016).

Innovation ecosystem and the Singaporean experience

5. **There is no unique definition of an innovation ecosystem, which derives its name from its biological or environmental equivalent.** However, Gobble (2014) summarizes the main aspects of innovation ecosystems as "…dynamic, purposive communities with complex, interlocking relationships built on collaboration, trust, and co-creation of value and specializing in exploitation of a shared set of complementary technologies or competencies."

6. **One of the best-known examples of such an ecosystem is Silicon Valley in the United States.** Other globally-recognized examples include Boston, New York, and Seattle in the United States, Tel Aviv in Israel, and London in the United Kingdom. There is a growing number of locations in Asia, Europe, and Latin America that are also becoming important players in the global innovation landscape.

7. **Among the Asian locations, Singapore is being increasingly recognized as a global hub for R&D collaboration.** In recent years, Singaporean start-ups in the areas of transportation ride sharing, fitness class management, and online food-ordering systems have expanded their reach regionally. Global partnerships are also emerging. These include TechSG (a National University of Singapore and IBM collaboration), the Campus for Research Excellence and Technological Enterprise

(CREATE, a collaboration between local and top-rated global universities), and the Agency for Science, Technology and Research (A*STAR, a partnership with leading global research centers).

8. **In Singapore, following the example of the United States and Israel, the government has played an important role in promoting R&D.** Singapore has used a cluster-based approach in building its R&D ecosystem, with participation from multinational corporations and indigenous companies. Singapore has also established hubs in areas of biomedical research (*Biopolis*), and information and communication technologies (*Fusionopolis*). Guided by various national plans, different government agencies, including SPRING, A*STAR, the National Science Foundation (NSF), and the Economic Development Board (EDB), are actively supporting R&D through enterprise financing and enhancing enterprises' capabilities, including by helping them connect to global players. Moreover, according to some estimates, Temasek and GIC are among the top equity investors in private technology companies globally (CB Insight, 2017). This may have indirectly contributed to strategic thinking within Singapore about the country's future technological landscape.

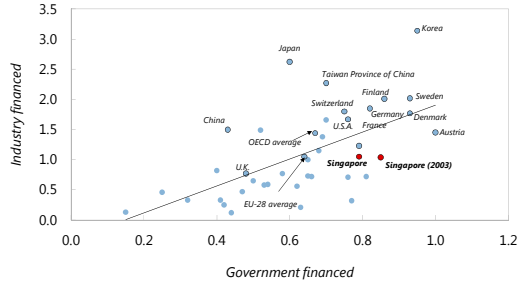
9. **Public budgetary commitments for research and innovation have grown over the years, from S$2 billion (2½ percent of 1991 GDP) under the National Technology Plan 1991–95 to S$19 billion (about 4½ percent of 2016 GDP) under the current Research, Innovation, and Enterprise (RIE) Plan 2016–20.** The RIE ecosystem is spearheaded by a high-level advisory board under the Prime Minister's office with support from the NSF, various ministries (e.g., Trade and Industry, Education, health, and defense), and R&D funding bodies (e.g., EDB, SPRING, A*STAR, and NSF).

10. **The 2017 Budget announced the *StartupSG* scheme to unify the support given to startups, set up an *International Partnership Fund* for co-investing in Singapore-based firms, and a *Global Innovation Alliance* to help Singaporeans network with counterparts in innovation centers globally.** The Monetary Authority of Singapore (MAS) has also recently relaxed certain rules for private venture capital. The MAS itself is actively experimenting with new financial technology (fintech) and providing regulatory sandbox facilities to aspirant innovators (see Box 1).

11. **However, relative to peers with comparable public sector funding-to-GDP ratio of R&D, Singapore's industry-financed research expenditure-to-GDP ratio has historically remained low.** The Global Innovation Index report shows that while Singapore ranks high in terms of innovation inputs, it is among the bottom half in terms of efficiency of innovation. This implies Singapore's innovation output is relatively low compared to the inputs used. This is an important observation given that Singapore is one of the top places globally in terms of doing business; competitiveness; network readiness; innovation; and entrepreneurship (World Bank, 2016a; World Economic

R&D Expenditure: OECD Countries and Selected Other Countries

(In percent of GDP; 2013 or latest available data)



Sources: OECD.Stat; and IMF staff calculations.

Forum, 2016a and 2016b; Cornell University and others, 2016; and Acs and others, 2015). Singapore also has a highly-educated population, with some of its universities already among the top 100 globally (The Times Higher Education World University Rankings 2016–2017).

12. **This raises the question why, despite having favorable conditions for quite some time, Singapore's private-sector led R&D and innovations are beginning to bloom only in recent years.** There is no easy answer to this question. In essence, innovation is about disruption, and breaking away from conventions and rules. The mere existence of the necessary inputs does not necessarily lead to an "eureka" moment. As mentioned earlier, it is a complex interaction among many players and factors, some of which are noneconomic in nature. Thus, the outcome is not always easy to predict. To understand these questions, Frenkel and Maital (2014) proposed studying the following four key dimensions: culture, markets, context, and institutions.

- *Culture*. Shared values, diversity, sense of empowerment, and history of entrepreneurial success play vital roles across innovation ecosystems. Studies have also found important contributions from immigrants in driving innovation, for example, see studies on the United States by Hunt and Gauthier-Loiselle (2008), Moser and others (2014), and Akcigit and others (2017). In the case of Singapore, a rules-based, meritocratic, culturally-diverse society with a stable political environment has imparted confidence and a competitive spirit. However, there may be scope for further instilling a culture of risk taking and accepting failures. The growing reach of digital technologies and Singaporean success stories in recent years could potentially help in further encouraging risk taking. In this context, policies should take a more holistic approach, support new firms, and manage cyclical stabilization of aggregate demand while maintaining cost effectiveness of private risk taking toward innovation, adoption, and adaptation of new technologies.
- *Markets*. Singapore has a small domestic market. But this is somewhat offset by its strong regional and global ties, and proximity to large population centers. However, diverse institutional settings across countries in the region pose challenges to scaling up. The successful experiences of startups in Silicon Valley, Tel Aviv, and Sweden illustrates that improved access to regional markets and necessary funding for scaling up of operations will be important for the Singaporean startups. In addition to continuing with regional integration, in ASEAN and the wider South and South-East Asia region, the ecosystem should be willing to maintain financial support to a continuum from basic research to commercial application of research and avoid the "valley of death" (Jackson, undated): the gap between publicly-funded basic research and industry-funded commercial development. Recognizing some of these challenges, the CFE report, for example, has appropriately highlighted the importance of continued reliance on global integration and more private sector funding to help enterprises scale up and innovate. In fact, such funding is growing in Singapore in recent years. Moreover, as ASEAN chair in 2018, Singapore could spearhead new avenues to encourage people-to-people connectivity in the region.
- *Context*. In Singapore, the R&D agenda is largely government driven, although the ability of different ministries and agencies to work toward common goals, guided by various national

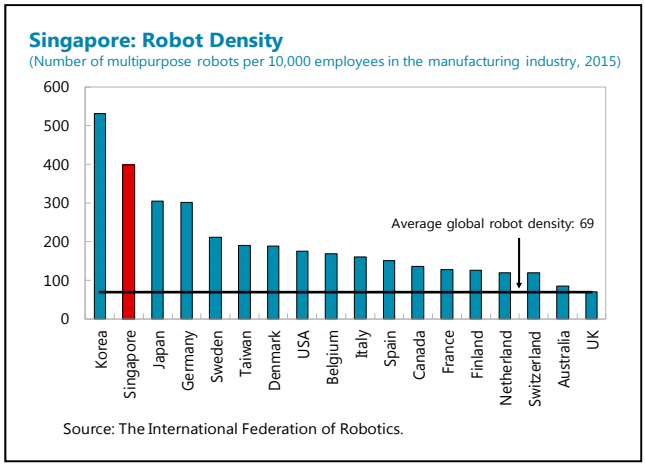
plans, is somewhat unique. The private sector's role has also increased in recent years, including through collaborations within academia and with global players. Identified processes for fostering Singapore's innovation are tilted heavily on the supply-side practices and policies. Researchers have argued that for innovation ecosystems to succeed in "co-creating values", it is also important to allow an equally important role for the demand-side signals. Demand-management policies also help in sustaining the drive for R&D and innovation amid failures (for example, see IMF, 2016b). The authorities are currently focusing on various *Industry Transformation Maps*, and under the RIE 2020, based on existing comparative advantages, public funding will be prioritized in four areas: advanced manufacturing and engineering; health and biomedical sciences; urban solutions and sustainability; and services and digital economy. However, a more general-purpose growth strategies should be considered, rather than focusing on industry specific plans.

- *Institutions.* Singapore is a global leader and center of excellence. However, it is the interplay among all four dimensions of an innovation ecosystem that eventually helps in sustaining its growth. Singapore's high-quality institutions, including protection of intellectual property rights, provide incentives for global players to setup their research centers in Singapore.

13. **To summarize, recent success stories of Singaporean startups bode well for future efforts at innovations and R&D.** However, a cultural shift away from government-driven targeted measures to one more focused on risk taking by the private sector, with appropriate changes in the education system and support from fiscal policy to new firms and also focused on minimizing excessive demand-side fluctuations, could help usher in a new future for Singapore's relatively young new technology startup sector. Improved access to markets in the region and availability of adequate private financing at the matured stage of commercialization and scaling up of new products will support future growth.

C. Automation and Artificial Intelligence: Opportunities and Challenges

14. **The 2016 World Robotics Report forecasts that the number of industrial robots deployed worldwide will increase to around 2.6 million units by 2019, about one million units more than in 2015.** Asia is emerging as the fastest growing market for industrial robots where deployment of robots soared by 70 percent over 2010–15. China, Korea, and Japan lead as the world's largest sales markets for industrial robots. Singapore ranks second, only after Korea, in terms of robot density in manufacturing activities.



15. **The impact of automation has always attracted debate in policy circles.** Predictions that automation will make humans redundant have been made going as far back as the Industrial

Revolution, when the Luddites (textile workers), protested that machines and steam engines would destroy their livelihoods. Subsequently, in the 1930s, Keynes coined the term technological unemployment, as "a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come" (Keynes 1963).

16. **Technology optimists argue that advances in technology may displace certain types of work, but historically they have been a net creator of jobs. In general, every wave of automation and computerization has increased productivity without depressing employment.** Technology pessimists, however, fear that we are headed toward an economic dystopia of extreme inequality and class conflict. Summers (2016), for instance, predicted that a third or more of prime-age American males will be out of work by mid-century in the absence of an aggressive policy response.

17. **While debate on the impact of current and future automation trends on labor market is ongoing, Gregory and others (2016) document a positive effect of automation on the number of jobs.** In essence, reduced production costs result in better market prices, thereby increasing demand and triggering the creation of more jobs.

18. **Is this time different?** Ford (2015) points out in "Rise of the Robots", the impact of automation this time around is broader based. During previous waves of automation, workers could switch from one kind of routine work to another; but this time many workers will have to switch from routine, unskilled jobs to nonroutine, skilled jobs to stay ahead of automation. Another difference is that whereas the shift from agriculture to industry typically took decades, software can be deployed much more rapidly now and across sectors.

19. **The economics literature on the impact of automation on growth, labor market and inequality is growing.** In a seminal paper, Autor and others (2003) categorize tasks as routine and nonroutine and find that automation is associated with a shift of employment out of routine tasks.[3] Recent theoretical literature incorporates robots or automation as a special type of capital that greatly increases the supply of labor services while reducing the marginal product of human labor that competes for employment in the same production tasks.[4]

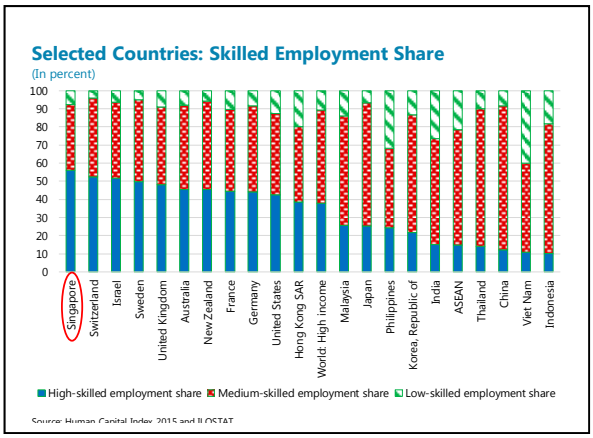
20. **Another trend attributed to automation is the polarization of the labor market, in which wage gains went disproportionately to those at the top and at the bottom of the**

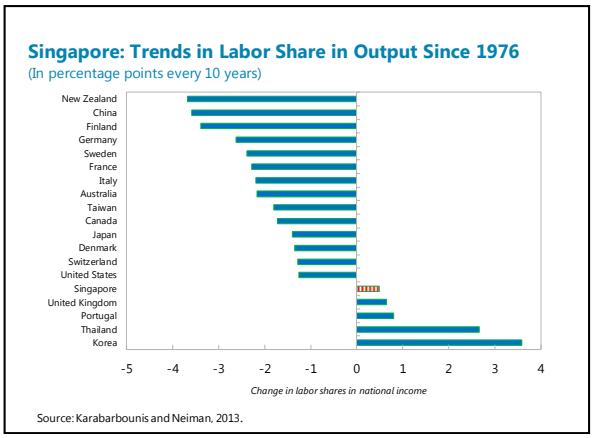
[3] They call a task routine "if it can be accomplished by machines following explicit programmed rules." In contrast, nonroutine tasks are those "for which rules are not sufficiently well understood to be specified in computer code and executed by machines."

[4] Earlier literature has focused on technological change that increases the supply of some factor in efficiency units. In this formulation, skill-biased technological change exacerbates wage inequality if the elasticity of substitution (EOS) between low- and high-skill labor exceeds unity. Similarly, capital-augmenting technological progress lowers or raises labor's share in national income depending on whether the EOS between capital and labor is above or below unity. IMF (2017a) finds that on average, the EOS for the aggregate economy is larger than one for advanced economies, while it is less than one for EMDEs. Sachs and Kotlikoff (2012) show that when the elasticity of substitution between robots and unskilled labor is sufficiently high, an improvement in robot productivity reduces the demand for unskilled workers. This results in lower investment in human capital and robots as well as reduced welfare of the current young generation and all future generations.

income and skill distribution, not to those in the middle (Autor and others 2006; Autor and Dorn 2013; Graetz and Michaels 2015 among others). This can be squared with the evidence on automation of routine versus nonroutine tasks. Nonroutine tasks can be divided into abstract (high skill) and manual (low skill) tasks. Abstract tasks require high level of education and analytical capability and therefore training (lawyers, researchers etc.), while manual tasks require innate abilities and little training (fast food preparers, waiters, home aides etc.). Both these categories are more immune to automation than middle wage, middle education jobs. Feng and Graetz (2015) have a different take on this and consider firms' incentives to automate certain jobs over others. To explain labor market polarization, they contend that low skill workers are shielded from automation not only because some of the tasks they perform are nonroutine, but also because firms will first automate the tasks performed by middle skill workers as these workers are more expensive and require higher training cost.

21. **According to recent estimates by Frey and Osborne (2017), McKinsey Co. (2015), and the World Bank (2016b), anticipated advances in automation threaten 45–57 percent of all jobs in the United States over the next two decades.** Chang and Huynh (2016) find that for ASEAN-5 (Cambodia, Indonesia, the Philippines, Thailand and Vietnam), about 56 percent of all employment has a high risk of automation in the next couple decades. The risks of automation however differ widely across countries, ranging from 44 percent in Thailand to 70 percent in Vietnam. In general, higher skill jobs[5] are at a lesser risk of being automated than medium or low skill jobs. Singapore, with the highest share of high-skilled employment share is therefore more immune to automation risk than other countries. This is also reflected in increasing labor shares of national income in Singapore, while they have been falling in many other advanced economies. According to a study in 2015 by the Centre for Strategic Futures (CSF), Singapore around one-third of the jobs held by Singapore citizens are at risk of automation within 5 to 20 years, based on Frey and Osborne methodology. This is lower than similar estimates for the U.S and other ASEAN countries.





[5] High skill jobs are defined as ISCO groups 1 (managers), 2 (professionals) and 3 (technicians and associate professionals); medium-skill jobs include ISCO groups 4 (clerks), 5 (service and sales workers), 6 (skilled agricultural and fishery workers), 7 (craft and related trade workers) and 8 (plant and machine operators and assemblers); and low-skill occupations consists of ISCO group 9 (elementary occupations).

22. **In assessing the impact of automation, technology pessimists often ignore the issue of the economic response to automation.**[6] While automation renders some jobs obsolete, it complements many others, especially jobs that place a premium on creativity, flexibility, and abstract reasoning. For example, self-driving vehicles may need remote operators to cope with emergencies. Furthermore, some jobs are always likely to be better done by humans, notably those involving empathy or social interaction. An analysis of the British workforce by Deloitte (2015), a consultancy firm, highlighted a profound shift over the past two decades toward caring jobs: the number of nursing assistants increased by 909 percent, teaching assistants by 580 percent, and careworkers by 168 percent.

23. **While labor-saving technological growth, including automation, can replace labor, it also provides avenues to deal with the shrinking labor force in an aging economy like Singapore.** Appendix II (see 2017 Article IV staff report) shows that aging is likely to have a significant impact on growth (particularly under tighter foreign worker policy). Labor-saving technologies can therefore counter the decline in growth both by negating the impact of declining labor force and fall in productivity due to aging.[7]

Policy implications

24. **Education and training.** One key question is if the educational system is adequately preparing individuals for new-economy skills and jobs. An effective way is to reach students as early as elementary school and focus on teaching skills that are advanced, technical, and suitable to give humans an edge over machines, like creativity and collaboration. Furthermore, since no one knows which jobs will be automated later, it may be most important to be adaptable. Singapore provides a great model for this, where the education system is rigorous, placing strong emphasis on technical skills, including vocational education. The authorities' initiatives such as SkillsFuture and life-long learning programs are aiding people to be flexible and adaptable to the changing needs of the new economy. While it is too early to assess the likely impact of these policies, it augments human capital and is therefore a step in the right direction.

25. **Creation of a knowledge economy.** There are substantial first-mover advantages and benefits in the sphere of automation and digital economy. Singapore is favorably placed to reap these benefits and the CFE report along with initiatives to implement its recommendations could place Singapore as a leader in this space. In this respect, the government could aid in boosting the innovation ecosystem, including making it easier to start small businesses and supporting venture capital funds. Automation will create new avenues, particularly in the information and

[6] Acemoglu and Restrepo (2016) consider the economic response to automation by accounting for the creation of new more complex tasks that only human labor can perform. The short- to medium-run impact on absolute labor demand is unclear in their model, but in the long run, labor's share in national income returns to its original level. When labor is divided into high- and low-skill workers, the same restrictions ensure that the skill premium increases in the short run but not in the long run. In contrast, Berg and others (2017) analyze various variants of a model with automation and find robust finding that automation is good for growth, but bad for equality.

[7] IMF (2017b) shows that an increase in the share of older workers is associated with a significant reduction in labor productivity growth. However, the impact is of second order magnitude when compared to the direct effect of shrinking labor force.

communication technology sector, and a vibrant startup environment (as being supported by the Singaporean authorities) will help put the city state in a strong position.

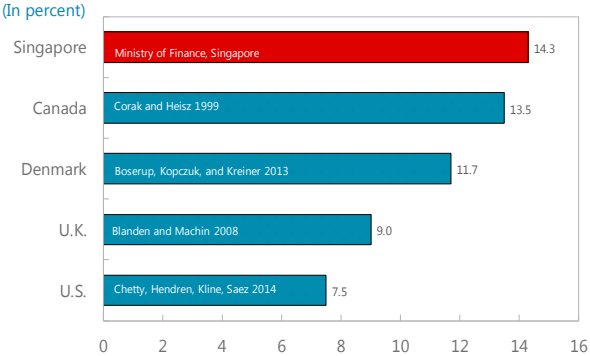
26. **Redistribution.** Technology has the potential to create large wealth, but this wealth could be highly concentrated among a relatively small group of "winners". This begs the question whether the new economy also needs innovative ways to redistribute income and wealth. Bill Gates recently suggested taxing robots (in other words, taxing companies that own robots) and redistributing the proceeds (Quartz interview). Another redistribution concept, is that of universal basic income (UBI), in which the government gives everyone a guaranteed amount of money. While this could discourage people from working, it would also free them to go back to school or do things they are passionate about. While the views on robot taxes and UBI are still evolving, flexible labor market policies (such as upgrading skills of the employed and unemployed, as under various initiatives and schemes introduced by the Singaporean authorities) along with redistribution (unemployment insurance, for instance) may prove effective in facilitating adjustment to the mainstreaming of disruptive technologies and other shocks.

D. A Future of Inclusion

27. **Singapore's consistent application of the principles of individual responsibility, equality of opportunity, and sound public finances has shown remarkable results and can hold important lessons for other countries.** In recent years, this has increasingly been complemented by direct and indirect support for low-income workers and households:

- The emphasis on individual responsibility, along with government incentives—which were enhanced in Budget 2017, has led to one of the highest homeownership rates in the world, with more than 90 percent of resident households owning a home, as well as broad coverage by a fully-funded pension system which holds assets worth 83 percent of GDP.
- The focus on equal opportunity is reflected in the sustained efforts to improve the quality and accessibility of healthcare, education and training, and urban planning. Cross-country comparisons rate Singapore's healthcare system and high school achievements among the best in the world. There are indications that this is raising intergenerational mobility above that in other advanced economies:
- A 2014 Economist Intelligence Unit study found Singapore's healthcare outcomes to be the second highest in a sample of 166 countries, at half the per capita cost of Japan, which recorded the best outcomes. Haseltine (2013) documents how Singapore's healthcare system works and how the government is now proactively expanding healthcare

Social Mobility in Singapore and other Advanced Economies 1/
(In percent)



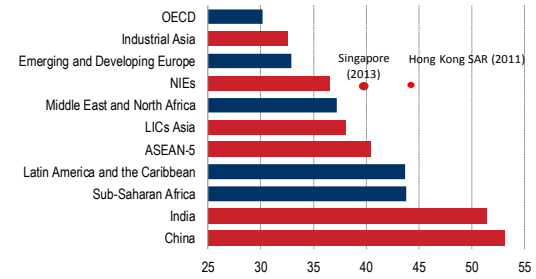
Sources: Adapted from Chetty, Raj. 2015. "Improving Equality of Opportunity in America: New Evidence and Policy Lessons". The Boston Foundation and Budget 2015 Round-Up Speech by Deputy Prime Minister Tharman Shanmugaratnam.
1/ Probability that a child born to parents in the bottom fifth of the income distribution reaches the top fifth of the income distribution.

infrastructure to deal with needs related to population aging.

- The importance assigned to strong high school achievements in the sciences, the *SkillsFuture* program of lifelong learning which continues to be updated and refined, and new initiatives in Budget 2017—acting on the CFE report recommendations—to encourage adoption of new technologies and sectoral and international partnerships, ties in with the growing literature that shows that economic growth is strongly affected by workers' cognitive skills (e.g., Hanushek and Woessmann (2010)) and that better-educated workers will be better able to adapt to new technologies.
- Urban planning focuses on creating integrated neighborhoods where people of different income and ethnic groups live together. The city state's geography along with the high cost of car ownership makes the bulk of Singaporeans use the same public transportation infrastructure which continues to be expanded and upgraded.
- The government is increasingly implementing redistribution measures and programs (e.g., Special Employment Credits, quarterly cash payments ("Silver Support"), subsidies for medical bills for the Pioneer Generation, GST voucher Cash Special Payments, Personal Income Tax Rebates, etc.). And new policy initiatives are typically calibrated to minimize the adverse impact on low income households (e.g., the water tariff increases announced in Budget 2017). As a result, inequality as measured by the Gini coefficient, while higher than in other advanced economies, has been trending down in recent years.

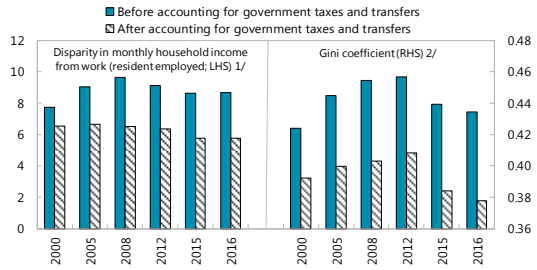
Regional Comparison: Income Inequality Level

(Net Gini Index; in Gini points; year of 2013, or latest, average across regions)



Sources: SWIID Version 5.0; IMF, WEO database; and IMF staff calculations.
Note: ASEAN = Association of Southeast Asian nations; LIC = low-income county; NIE = newly industrialized economy; OECD = Organization for Economic Cooperation and Development

Singapore: Income Inequality



Sources: Singapore Statistics; CEIC Data Co. Ltd.; and IMF staff calculations.
1/ Ratio of monthly household income from work (including employer CPF contributions) per household member at 90th percentile to 10th percentile.
2/ Average of conventional Gini coefficient (including employer CPF contributions) and OECD measures of Gini coefficient that account for household size.

Box 1. At the Forefront of Fintech

Singapore emerged at the top of the league (along with London) in Deloitte's 2016 index capturing how conducive a hub (country or city) is to the growth of Fintech. The high rank reflects Singapore's position as a leading international financial center as well the government support – S$225m committed to the development of fintech ecosystem as well as other initiatives including the regulatory sandbox, cloud computing guidelines, strategic electronic payments, fintech office, the MAS innovation lab, international technology advisory panel and talent development.

Venture capital (VC) investment in fintech has grown in Singapore however remains much lower than in the UK, Germany, and Canada. Many of the larger VC funding in Singapore were concentrated among online payments, remittances or foreign exchange trading platforms. However, activity is shifting from areas such as payments and lending, which have saturated to deep technologies such as blockchain and fast growing areas like insurtech. Singapore offers a distinctive value proposition for fintech development. These include:

- Open banking platform via application programming interfaces (APIs) for faster innovation and integration of new and legacy IT systems within the sector; the MAS has already released several of its data series as APIs to facilitate financial institutions and developers. Open APIS will also increase the efficiency of certain regulatory processes, such as banks' submissions of applications and transactions, which will be key in the promotion of regulatory technology (RegTech);
- The MAS has successfully concluded a proof-of-concept project to conduct domestic interbank payments using distributed ledger technology (DLT) or blockchain. It is aimed to extend the technology to other sectors such as securities trading and settlement and cross border payment using central bank digital currency. As the DLT become scalable, the implications for the conduct of monetary policy and financial stability would need to be properly understood;
- A national KYC (know your customer) utility via expanding Myinfo service to the financial industry, using trusted government collected personal data;
- Financial institutions' cyber resilience through both onsite and offsite supervision. The MAS has revised its Internet Banking and Technology Risk Management Guidelines as well as issued new guidelines on outsourcing risk management including on cloud services;
- Regulatory sandboxes as safe spaces to experiment and roll out innovative products and solutions within controlled boundaries;

While fintech is still at its nascent stage, the regulatory challenges are emerging as the industry grows. For instance, AML/CFT concerns over anonymous cross-border transfers using virtual currencies; framework for governance, supervision and management of algorithms of robo-advisors; regarding APIS, data standards around transaction data, reference data, and more importantly sensitive commercial data; development and coordination on security standards that ensure right level of authentication, authorization and encryption for cyber security. Continued vigilance is warranted as the sector evolves to ensure financial stability and resilience.

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WHAT DRIVES PRIVATE SAVINGS IN SINGAPORE?[1]

Singapore has one of the highest national saving rates in the world, which contributes to its large current account surplus. National savings are driven largely by the private sector, with private savings constituting about 80 percent of national savings and 37 percent of GDP. Using data over the last four decades, this paper empirically examines the factors associated with the high private saving rate in Singapore. Based on time series and panel data analysis, the findings indicate that demographics and per capita income are the most important drivers of private savings in Singapore. While there is no strong evidence of private-public saving substitutability for the full sample period, private savings may have been partially offsetting changes in public savings since the 2000s.

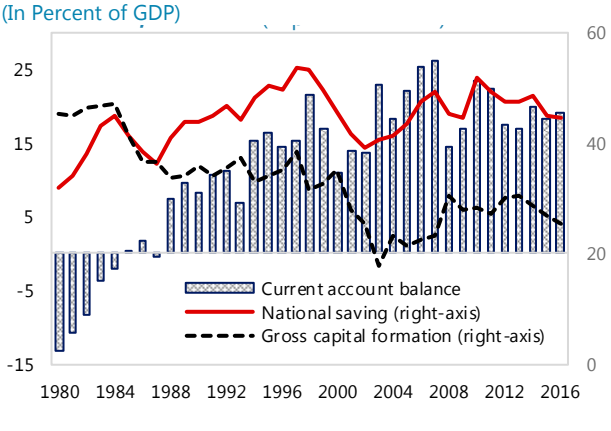
A. Background

1. Singapore's current account balance has been in a persistent surplus since the mid-1980s, which peaked at about 26 percent of GDP in 2007 (Figure 1). While the current account surplus almost halved in the immediate aftermath of the global financial crisis, it rebounded sharply in 2010–11 to 23 percent of GDP. Since then, it has averaged about 18 percent of GDP, largely because of a decline in the services and income balance.

2. From a savings and investment perspective, Singapore's large current account surplus since the early 2000s can be attributed to a rise in national savings, combined with lackluster investment that was sluggish to recover after the Asian financial crisis. National savings fell during the global financial crisis, but recovered in 2011, and have averaged about 46 percent of GDP since then. This ratio is one of the highest among Asian countries—most of which have also been running current account surpluses over the last decade, though of a smaller magnitude than Singapore (Figure 1). As in other Asian countries, however, the main contributor to national

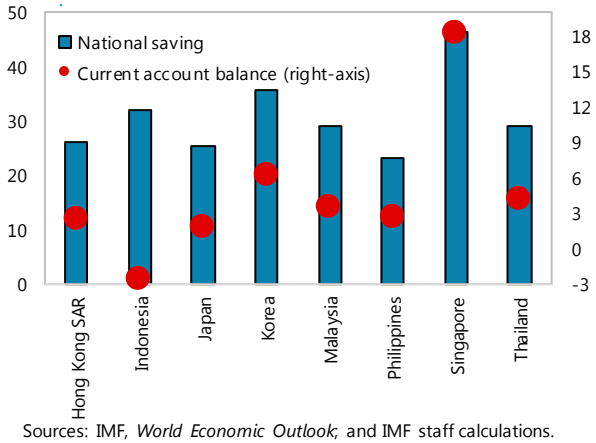
Figure 1. Singapore: Current Account Balance and National Savings

Singapore: Current Account Balance, Saving, and Investment, 1980–2016
(In Percent of GDP)



Sources: CEIC Data Co. Ltd,; and IMF staff calculations.

Asia: Current Account Balance and Saving, 2012–16
(In Percent of GDP)

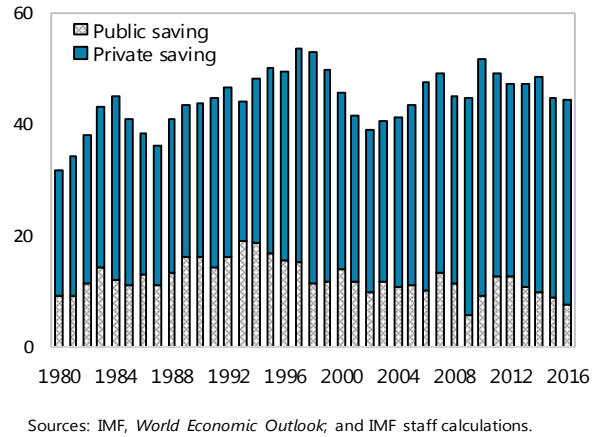


Sources: IMF, *World Economic Outlook*; and IMF staff calculations.

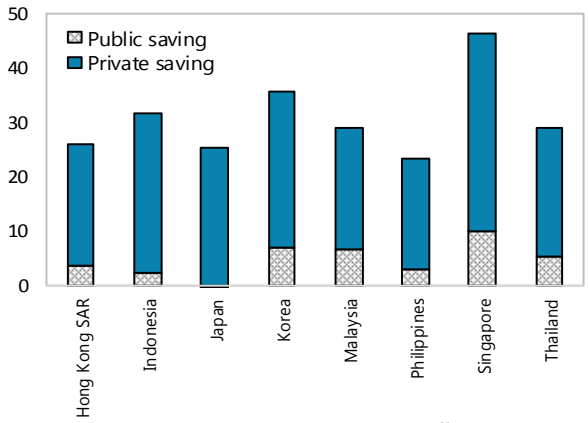
[1] Prepared by Mahvash S. Qureshi (RES).

savings is private savings—with its share in national savings rising steadily from 68 percent in the 1990s to 75 percent in 2000s, and further to about 80 percent in 2012–16 (Figure 2).[2]

Figure 2. Singapore: Public and Private Saving

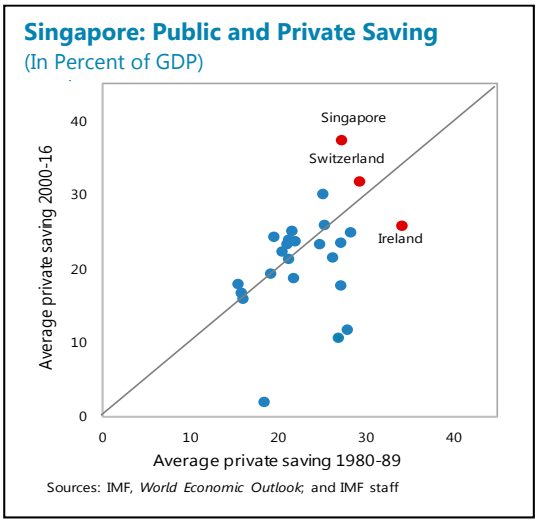


Sources: IMF, *World Economic Outlook*; and IMF staff calculations.



Sources: IMF, *World Economic Outlook*; and IMF staff calculations.

3. Presently at around 37 percent of GDP, Singapore's private saving rate is the highest among other advanced countries. Private savings averaged about 27 percent of GDP in the 1980s, before increasing to 33 percent in the 1990s, and further to 37 percent in 2010-16. The 10 percent of GDP increase in private savings over the last four decades is the sharpest among advanced countries (Figure 3). While some other major global financial centers such as Ireland and Switzerland also have a high private saving rate, for most advanced countries with similar per capita incomes, the average private savings rate is almost one-half of that.



Sources: IMF, *World Economic Outlook*; and IMF staff

4. Why is the private saving rate so high in Singapore? While several explanations have often been put forward to explain Singapore's high private saving rate (such as demographics, high per capita income, global financial center status, a fully funded pension system), a comprehensive empirical analysis on the determinants of private saving has been lacking. In this paper, we address this gap by systematically examining the drivers of private saving in Singapore—taking into account its specific economic and structural features—using data covering the most recent time period (1980–2016). Since disaggregated data of private saving into household and corporate saving is unavailable, we analyze the behavior of total private saving (in percent of GDP).

[2] While the breakdown of national saving into public and private saving is not published officially, estimates are obtained from the IMF's World Economic Outlook database, which calculates public savings from the government's fiscal accounts, with private savings computed as the residual.

5. The analysis focuses on three key questions. First, how important are the macroeconomic and structural drivers of savings (such as demographics, income level, economic growth, public savings) in explaining the private saving behavior in Singapore. Second, has the importance of the various factors changed over time as Singapore has evolved into a rich advanced economy. And third, how does the behavior of private savings in Singapore compare with that of other advanced countries. To examine these questions, we conduct a country-specific time-series analysis of private savings in Singapore, as well as panel data analysis of private saving behavior in a broad sample of advanced economies over 1980–2016.

6. Our findings show that demographics and income per capita are important determinants of private savings in Singapore. Consistent with the life-cycle consumption model, a higher elderly dependency ratio is associated with significantly lower savings, while an increase in the projected age dependency ratio raises savings. Private savings in Singapore tend to rise with the income level and real interest rates, as well as with higher income growth. There is no evidence of substitutability between private and public savings over the full sample, though it appears that over the last decade, private savings may have been partially offsetting changes in public savings.

7. Results based on the panel data analysis suggest that in addition to demographic and macroeconomic variables, structural factors may also be important in explaining private saving behavior. Global financial centers like Singapore tend to have a higher private saving rate. While adequate and comparable data on pension systems across countries is unavailable, there is some evidence that countries with a mandatory defined contribution system have, on average, a higher private saving rate. Controlling for the relevant demographic, macroeconomic, and structural characteristics, Singapore's average private saving rate turns out to be higher (by about 3-5 percent) than other advanced countries, but the "excess" saving seems to have fallen in recent years.

8. The rest of the paper is organized as follows. Section B outlines the analytical framework and estimation model for examining the determinants of private savings in Singapore. Section C presents the country-specific time series estimation results for Singapore, as well as the results obtained from panel data analysis. Section D discusses the policy implications of our findings and concludes.

B. Analytical Framework

9. Given the significant role that savings can play in promoting economic growth by stimulating investment, an extensive body of theoretical and empirical literature investigates the determinants of savings. Earlier literature was dominated by the life-cycle model, which emphasizes the role played by the age structure of the population in determining savings, while later studies have explored the importance of other possible factors (such as public savings, pension systems, income level, financial development, inflation, terms of trade, etc.) in stimulating savings.

Life-Cycle Hypothesis

10. The life-cycle model has been the standard theory for explaining the behavior of consumption (and savings) over time and across countries. The model is built around the saving behavior of a representative agent maximizing the present value of lifetime utility, subject to a budget constraint (which restricts lifetime consumption to be equal to the current net worth and the present value of expected labor income over the working life of the agent). Assuming perfect capital markets and perfect foresight, the model predicts that consumption depends on expected lifetime income (and not on current income) as individuals smooth consumption over their lifetimes. Given the fluctuations in income, saving thus depends on the stage in the life cycle—with individuals being net savers during their working years and dis-savers during retirement (Modigliani, 1986).

11. At the macro level, the obvious implication of the life-cycle model is that a high share of working age population would translate into higher savings as workers provide for their retirement. Conversely, the private (and aggregate) saving rate would decline as the share of elderly population that has reached retirement age increases. Given the rising longevity, however, not only the current but also future age dependency ratio may matter for the saving behavior—while a higher current share of elderly population implies lower savings, a higher share of elderly population in the future would imply higher savings as the population prepares for retirement.[3]

12. The impact of demographics on savings has been well established empirically. Both country-specific and cross-country studies generally find a strong negative effect of the share of elderly population (in relation to working age population) on private savings (e.g., Modigliani and Sterling, 1983; Graham, 1987; Masson and Tryon, 1990; Masson and others., 1998; Athukorala and Sen, 2004). For Singapore, demographics appear to have been an important factor in explaining the saving behavior. Husain (1995), for example, finds that the sharp increase in the share of working age population in total population raised the national saving rate by about 20 percentage points over 1970-92. Similarly, IMF (2006) finds that the rising share of elderly population in total population over the 1990s and 2000s contributed negatively to private savings in Singapore.

13. Based on the life-cycle model, income growth also has implications for savings. With an unchanged savings rate by age group, higher income growth would increase the aggregate income of the working age population (relative to the older age population not earning labor income), thereby raising aggregate savings (Modigliani, 1966). Tobin (1967), however, notes that unchanged saving rates are only consistent with myopic expectations of future income—if workers expect income growth to be permanent, then based on the life-cycle model, such wealth effects may induce more consumption today (for example, if young workers borrow to finance current consumption in view of the high lifetime wealth). Thus, individual saving rates could fall sufficiently

[3] Under the "balanced population growth" assumption, the age structure of the population can be considered as uniquely related to population growth (Modigliani, 1986). Thus, an increase in the population growth rate caused by an increase in age-specific fertility rates will also raise saving by increasing the number of savers relative to the dis-savers. In reality, however, an increase in the population growth rate may raise the number of economically active individuals relative to the retired, but could also be accompanied by an increase in the share of young dependents in the population. The net effect of population growth on saving is thus theoretically ambiguous.

to offset the aggregate saving effects of higher income growth. Empirical literature—including for Singapore (e.g., Lahiri, 1989; Husain, 1995)—has generally documented a significant positive effect of income growth on private (and aggregate) savings.

14. Real interest rate on bank deposits and total wealth may also influence private savings under the life-cycle model. The net effect of interest rates on savings is theoretically ambiguous because of potentially offsetting substitution and income effects. A higher real interest rate increases the present price of consumption relative to the future price, providing an incentive to increase saving. But if the individual is a net creditor in financial assets, a higher real interest rate increases lifetime income, and may increase consumption (reduce saving) through the income effect.[4] Paralleling the theoretical ambiguity, empirical research documents mixed results on the impact of real interest rates on savings (Bosworth, 1993; Schmidt-Hebbel and others, 1992). For wealth, while the theoretical prediction is straightforward—that is, by reducing dependence on current income, higher wealth allows higher consumption (and lower saving)—the empirical evidence is less clear. While several studies find a statistically significant effect of changes in wealth (proxied by changes in house prices given that housing wealth tends to be the dominant form of household wealth) on private saving in advanced countries (e.g., Muellbauer and Murphy, 1997; Benjamin and others, 2004; Case and others, 2005), the association between private residential property prices and the private saving rate is not documented to be statistically strong for Singapore (Phang, 2002; IMF, 2006).[5]

Public-Private Saving Offset

15. Under the Ricardian equivalence hypothesis, public and private savings are perfect substitutes. Any change in public savings is offset by private savings as it will be accompanied by a change in future taxation; public saving will thus not affect national saving (Barro, 1974). Empirical evidence on the private saving offset to government saving is decidedly mixed with studies generally finding limited evidence of a full offset (e.g., Bernheim, 1987; Corbo and Schmidt-Hebbel, 1991; Haque and Montiel, 1989; Mason and others, 1998). This may be because of liquidity constraints faced by the private sector (Hayashi, 1985; Campbell and Mankiw, 1989), or because of the differential effects of different types of government expenditure and revenue on private savings (Callen and Thimann, 1997). In particular, if government investment is viewed as productive, and not expected to require tax increases in the future, it may not generate a response by the private sector. By contrast, government consumption spending, or investment that is not expected to generate future revenues, might induce a larger private saving offset.

[4] The saving behavior of pensions plans enhances the empirical importance of the income effect on private saving. For defined benefit plans, for example, higher interest rates increase the income available to pay pensions, allowing lower contributions (Bernheim and Shoven, 1988).

[5] Given that public homeownership is the dominant option in Singapore, with over 80 percent of Singaporeans living in public housing that is made available to low and middle income households at subsidized prices (but can be re-sold at market determined prices after a minimum period of ownership). Edelstein and Lum (2004) investigate the impact of changes in public house prices on consumption and find some evidence of a positive association.

16. The role played by the public sector in influencing private savings in Singapore is unclear. While some studies report high substitutability between public and private savings, others finding no strong offset by private savings to public savings (Husain, 1995; IMF, 2006). Looking at Figure 2, it appears that part of the problem in detecting a relationship between private and public savings may be the lack of a stable relationship between the two series. Through the 1980s up to the mid-1990s, for example, public and private savings are positively correlated. But this trend appears to change after the Asian financial crisis, and then more recently in the aftermath of the global financial crisis, when public savings declined (as a result of government efforts to stimulate the economy), while private savings remained high.

Pension System

17. Given the life-cycle hypothesis, and the growth in retirement programs, the impact of pension plans on private saving behavior has garnered much academic interest. Several studies argue that the existence of private pension plans imply a net increase in private savings. Economic theory, however, suggests that it may simply reflect a shift in the form of savings as employees covered by pension plans reduce their own direct savings in response to expected retirement benefits. While comparable cross-country data on pension systems is lacking, there is some evidence that individuals reduce their direct saving in anticipation of promised pension benefits, though the offset may not be perfect (Munnell and Yohn, 1991; Bosworth and Burtless, 2004).[6]

18. In Singapore, a key aspect of private savings is the mandatory government-managed Central Provident Fund (CPF). Initiated in 1955, the CPF requires both employees and employers to contribute a certain portion of labor wages to the fund. The contribution rates were originally set at levels (5 percent for both employees and employers) to help individuals finance a basic retirement income. The rates have however increased substantially over time (17 percent for the employer and 20 percent for the employee) as the CPF has evolved into a saving vehicle to help individuals finance housing, health, investment, and other outlays. The sizable mandatory contribution rates have attracted much attention over the years, with critics arguing that they represent a form of "forced saving," which increases the aggregate saving rate of Singapore. The evidence for the forced saving hypothesis is however weak: Husain (1995), for example, finds that changes in the ratio of CPF savings to private disposable income do not impact private savings significantly—suggesting that CPF savings are offset by individuals' voluntary savings. Looking at the data for recent years (2010–16), the correlation between CPF contributions (net of withdrawals) to GDP ratio and the overall private saving rate is close to zero, supporting the earlier finding of an offset by voluntary saving to the mandatory CPF saving.

[6] Among pension plans, a further distinction could be made between defined benefit plans (which promise a specific amount as regular income to an employee during retirement), and defined contribution plans (where instead of the employer guaranteeing a benefit during retirement, employees draw upon their accumulated contributions over their working life during retirement). Since the guarantee of a monthly benefit during retirement is not available in defined contribution plans, it is possible for overall individual savings to be higher under such plans.

Other Factors

19. Several other macroeconomic and structural factors could also potentially affect the private saving behavior:

- *Differences in per capita income level* could be an important factor influencing savings. At subsistence levels, the potential for savings is limited, a rise in per capita income therefore may lead to higher savings. The size of this effect, however, may decline as per capita income rises and may even become negative for rich countries where investment opportunities and growth are relatively lower. Existing studies generally find strong evidence that rising income levels that expand the savings base are associated with private savings. For Singapore also, the rise in income per capita over the years is considered to have significantly affected the private saving rate (Husain, 1995; IMF, 2006).[7]

- *Financial liberalization and development* could lower savings by increasing private sector's access to credit. At the same time, they could also raise the private saving rate by providing more opportunities for saving (McKinnon, 1973; Shaw, 1973). Empirical evidence generally supports a negative relationship between financial liberalization (access to foreign savings) or financial development (proxied by domestic credit to GDP ratio) and private (or national) savings (e.g., Fry, 1980; Giovannini, 1985; Schmidt-Hebbel and others, 1992; Loayza and others, 2000).

- *Inflation* is another factor that may affect saving through several channels. In the life-cycle model, the impact of inflation on saving stems through its effect on the real interest rate (i.e., real returns to saving), but inflation could also impact real wealth (if consumers want to maintain a certain level of wealth relative to income, saving will rise with inflation). Moreover, by increasing uncertainty about future income stream, inflation could lead to higher saving on precautionary grounds as well. Cross-country studies tend to find a positive effect of inflation on the private saving rate in advanced countries (e.g., Mason and others, 1998), but the impact of inflation has been found to be statistically unimportant for Singapore, perhaps because of its historically low inflation rate (Lahiri, 1989; Husain, 1995).

- *Terms of trade improvement* could increase savings (through the Harberger-Laursen-Metzler effect); though recent literature argues that the impact may depend on whether the terms of trade change is transitory or permanent.[8] A transitory change in income should increase savings, while permanent shocks to the terms of trade would have ambiguous effects that should be small in magnitude. The cross-country evidence generally supports the positive association between terms of trade changes and the saving rate; however, existing studies

[7] The income per capital variable for Singapore may be capturing its status as a global financial center as countries with large financial centers tend to have high per capita incomes.

[8] Based on the Harberger-Laursen-Metzler hypothesis, an improvement in terms of trade increases real income and hence saving. The terms of trade effect however may be over and above what is captured by the income growth variable in the model in the face of volatile and unpredictable changes in income associated with terms of trade changes.

find no strong statistical association between terms of trade changes and private savings in Singapore (Lahiri, 1989; Husain, 1995; IMF, 2006).

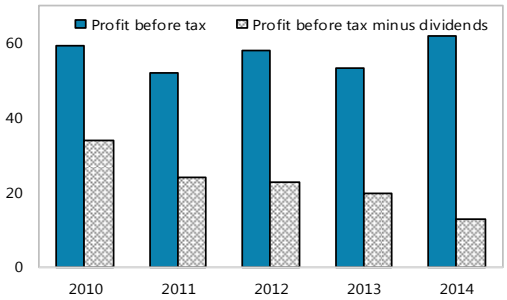
- *Status as a global financial center* could influence the private saving rate, as the private sector self-insures against external financial shocks. Countries with large financial centers in general report a higher private saving rate—in 2016, for example, the average private saving rate in Hong Kong SAR, Ireland, Luxembourg, Singapore, and Switzerland was about 10 percentage points higher than in other advanced countries.[9]
- *Corporate savings* is another channel through which private savings may be boosted. From a theoretical perspective, high corporate profits should not necessarily affect savings since, in the absence of tax distortions and liquidity constraints, household saving would decline to offset any change in corporate saving. Empirical studies, however, generally do not find support of a full offset by households to corporate savings (Poterba, 1991; Auerbach and Hassett, 1991). For Singapore, a breakdown of private saving into corporate and household saving is unavailable, which prevents us from rigorously analyzing their dynamics, but estimates based on the high share of corporate income in total economic output suggest that corporate savings likely play a non-negligible role in contributing to private savings (Figure 4). In fact, if proxied by pre-tax corporate profits (less dividends), corporate profits account for over half of private savings in 2010–14 (Figure 4).[10] While the high corporate saving rate is by no means unique to Singapore—corporate savings have risen globally over the years—a comparison of publicly listed companies reveals that Singapore's corporate profitability (measured as earnings before interest, taxes, and return on assets) is at par with the OECD countries, yet the corporate retained earnings are higher (Figure 5). This could be attributed to a significant presence of foreign multinational corporations (MNCs) in

Figure 3. Singapore: Labor Income and Corporate Profit

Employee Compensation and Gross Operating Surplus, 1980–2016
(In Percent of GDP)

Sources: Singapore Department of Statistics; and IMF staff calculations.

Corporate Profit, 2010–14
(In Percent of GDP)

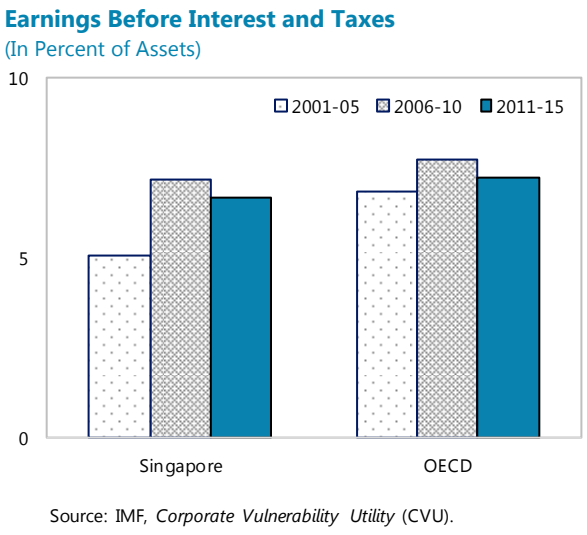


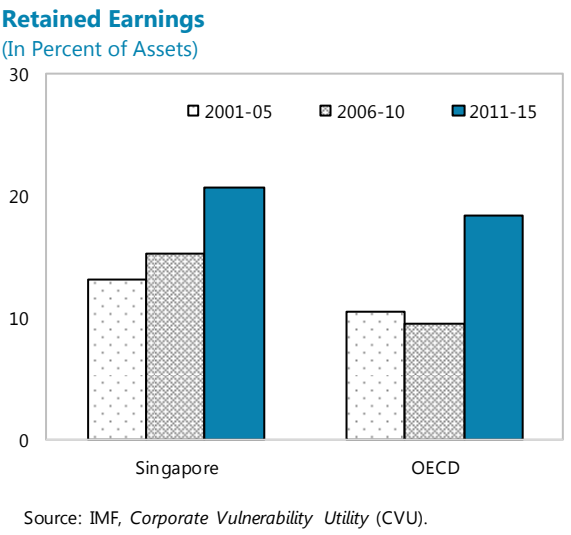
Sources: Singapore Department of Statistics; and IMF staff calculations.

[9] Studies investigating the determinants of current accounts find that, on average, financial centers have 3-3.5 percent of GDP higher current accounts than other economies (Lee and others, 2008; Phillips and others, 2013).
[10] IMF, 2006, estimates that corporate savings (including by government-linked companies are about 25–30 percent of GDP, while household savings are 8–10 percent of GDP (of which net savings through the CPF scheme account for about 2½ percent of GDP).

Singapore, which are more prone than domestic firms to retain a large share of their earnings (Akhtar, 2017).[11]

Figure 4. Singapore: Corporate Profits and Retained Earnings





Empirical Model

20. Drawing on the literature outlined above, we empirically examine the drivers of private savings in Singapore by estimating the following equation:

$$S_t = \alpha_0 + \alpha_1 S_{t-1} + \sum_{j=1}^{J} \beta_j D_{jt} + \sum_{k=1}^{K} \gamma_k X_{kt} + \varepsilon_t \qquad (1)$$

where S_t is private saving in percent of GDP in year t; S_{t-1} is lagged private saving in percent of GDP to capture any persistence in saving behavior; D includes demographic variables such as the share of elderly and working age population in total population, population growth, and projected elderly age dependency ratio; X indicates different macroeconomic variables that may influence private saving such as real income per capita, income growth, public saving (in percent of GDP), real returns to saving (proxied by the real deposit rate), unemployment rate, change in terms of trade, the inflation rate, and financial sector development (proxied by domestic credit in percent of GDP); and ε is the random error term. We estimate eq. (1) for the period 1980–2016 using the ordinary least squares (OLS) methodology with robust standard errors, as well as the Prais-Winsten generalized least squares method to allow for possible first-order serial correlation in the error term.[12]

[11] Beyond the distinct saving behavior of MNCs, recent studies argue that accounting issues related to foreign-owned firms may bias corporate saving estimates. Profits/income earned abroad by "redomiciled public listed companies"—that is, those with major investments elsewhere in the world but headquartered in the domestic economy—would, for instance, be recorded as income of domestic residents (and investment income in the current account) if the profits earned abroad are not paid out as dividends (see FitzGerald, 2013, for a discussion on Ireland). Moreover, investment income earned by domestic firms with substantial foreign portfolio investment would also be recorded as income earned by domestic residents if the firm retained earnings, though part of the reinvested earnings belong to the foreign investors (Mancini-Griffoli and Stoffels, 2012).

[12] We estimate the model in level form, as the hypothesis of a unit root is rejected for the private saving to GDP series. See Appendix Table 1 in the appendix for variable definitions and data sources.

21. In addition to a Singapore-specific private saving function, we also estimate the private saving function for a panel of advanced countries for comparative purposes. While eq. (1) allows us to determine the factors associated with private savings in Singapore, we assess the importance of the different factors relative to other advanced countries by estimating the following equation for a panel of 27 advanced countries:

$$S_{it} = \gamma_0 + \gamma_1 S_{it-1} + D_{it}\theta + X_{it}\vartheta + Z_{it}\delta + \lambda_t + \eta_{it} \quad (2)$$

where S_{it} is private saving in percent of GDP in country *i* in year *t*; S_{it-1} is lagged private saving to GDP; *D* and *X* are matrices including the demographic and macroeconomic variables outlined above, respectively; *Z* includes variables capturing the structural characteristics of the economy that may influence aggregate savings (such as status as a global financial center; the type of pension system); λ reflects time effects to capture the impact of any common global factors on the private saving rate; and η is the random error term. We estimate eq. (2) for the period 1980–2016 using the OLS and Prais-Winsten methods (without and with country-fixed effects), and calculate panel-corrected standard errors to address potential contemporaneous correlation in the error term.

C. Estimation Results

Private Savings in Singapore

22. The estimation results of equation (1) suggest that demographics play a key role in supporting private savings in Singapore. Controlling for other relevant factors, an increase in the share of elderly people in the population by one percentage point lowers the private saving rate by about 4 percentage points, while an increase in the future elderly dependency ratio by one percentage point increases the private saving rate by about 1 percentage point (Table 1, col. [1]). There does not appear to be a statistically significant association between the share of working-age population and private savings in Singapore, but a higher rate of population growth strongly raises private savings—perhaps because it better captures the increase in labor force associated with foreign workers (col. [2]).

23. Higher real deposit rates and higher per capita income induce more savings. A one percentage point increase in the real deposit rate implies about a one percentage point increase in the private saving rate, while quantifying the effect of income per capita suggests that—holding everything else constant—about 15 percent of the rise in the private saving rate in Singapore over 1980 to 2016 could be attributed to the increase in its per capita income. The positive and large coefficient on real income per capita conforms with economic intuition that the propensity to save rises with the income level, but could also be capturing the rise in savings as a result of Singapore's evolution into a global financial center and multinational corporation hub. In addition, higher real GDP growth is also associated with higher savings, suggesting that much of the income gains are perceived to be temporary by the private sector.[13]

[13] The result remains similar if we consider real gross national income per capita growth instead of real GDP growth.

24. For the full sample period, there does not appear to be a private-public savings trade-off. The coefficient on the public saving rate is negative but wholly statistically insignificant, suggesting that there is no private sector off-set from higher public savings over the sample period. This could be because the private sector is unsure about whether (or when) the fiscal surpluses of today will be available to them in the future, or because credit constraints prevent the private sector from borrowing against future distributions of fiscal surpluses (IMF, 2006). It could also be a cultural preference for thriftiness and prudence, with an overly cautious attitude of individuals toward risk and uncertainty.

25. Among other factors, improved business confidence is associated with higher private savings. While this finding may seem counterintuitive as improved economic expectations and lower uncertainty should reduce the need for precautionary saving, it likely reflects the impact of higher corporate income/profits on savings that is positively correlated with business prospects. Higher unemployment rates imply lower savings, presumably because of lower disposable incomes, but the effect is not statistically significant for the full sample period. The effect of other macroeconomic variables such as terms of trade change, credit to GDP ratio, change in credit to GDP ratio, and change in the real house price index (to capture the wealth effect) is also statistically insignificant. There is strong evidence, however, of persistence in private saving behavior—the coefficient on the lagged private saving rate is highly statistically significant in all specifications, implying a half-life of deviation of about one year. These findings are largely robust to the inclusion of a trend term in the model, or addressing potential serial correlation in the error term (Appendix Table 2).

26. Importantly, the effect of several demographic and macroeconomic variables appears to have changed over time. Including interaction terms between the demographic variables and binary variables equal to one for the decades of the 1980s, 1990s, and 2000s (with the post-global financial crisis years, 2010–16, as the reference category), we find that the dissaving effect of a rising share of elderly population is *more* pronounced in the recent period than it was in the 1980s and 1990s (Table 1, col. [4]). At the same time, the impact of an increase in population growth and the projected future elderly dependency ratio is *smaller* in recent years than it was in the earlier decades (cols. [5]-[6]).[14] The stronger impact of population aging in earlier years perhaps reflects tighter credit constraints or a less expansive social safety net then as compared to now.[15] Adding interaction terms between the public saving rate and the binary variables for the various decades, the results show a negative and statistically significant coefficient on the public savings variable (col. [7]). When combined with the coefficients on the interaction terms, however, formal tests find no support for Ricardian behavior in the 1980s and 1990s, but evidence of an offset since the 2000s.

[14] The coefficients on population growth and its interaction terms are individually statistically insignificant, but are jointly statistically significant for the decades of 1980 and 1990—implying that the positive effect of population growth on the private saving rate was larger in earlier decades than in the 2000s.

[15] Although private savings have held up because of the mandatory savings CPF scheme, the liberalization of withdrawal rules over the years could have also impacted the attitude toward savings for precautionary purposes.

Table 1. Singapore: Private Saving Function, 1980–2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged private saving	0.443***	0.490***	0.424***	0.294***	0.448***	0.274***	0.366***	0.418***	0.204***
	(0.096)	(0.107)	(0.139)	(0.062)	(0.101)	(0.063)	(0.062)	(0.084)	(0.068)
Elderly population share	-4.134**	-3.789***	-4.634**	-5.868***	-5.430***	-5.855***	-4.506***	-3.699***	-4.850***
	(1.520)	(1.282)	(2.047)	(1.365)	(1.297)	(1.426)	(1.163)	(1.277)	(1.004)
Working-age population share	0.199	0.273	-0.007						
	(0.446)	(0.443)	(1.144)						
Proj. age dependency ratio	0.719**	0.674**	0.876*	1.161***	1.068***	1.165***	0.534	0.447	0.350
	(0.325)	(0.285)	(0.461)	(0.188)	(0.227)	(0.206)	(0.338)	(0.342)	(0.307)
Population growth	0.848***	0.878***	0.801**	0.632***	0.263	0.642***	0.711***	0.801***	0.345
	(0.205)	(0.217)	(0.333)	(0.202)	(1.082)	(0.187)	(0.220)	(0.203)	(0.231)
Public saving to GDP	-0.113	-0.179	-0.238				-0.567***	-0.252	-0.620**
	(0.216)	(0.217)	(0.272)				(0.191)	(0.172)	(0.263)
Real deposit rate	1.323***	1.434***	1.445***	1.344***	1.305***	1.321***	1.058***	1.391***	1.082***
	(0.254)	(0.246)	(0.341)	(0.238)	(0.273)	(0.238)	(0.228)	(0.242)	(0.205)
Real GDP per capita (log)	10.551***	10.295***	9.526**	13.251***	10.163***	12.878***	19.646***	18.102***	30.224***
	(3.282)	(3.178)	(4.024)	(3.205)	(2.944)	(3.095)	(4.217)	(4.328)	(6.783)
Real GDP growth		0.170*						0.291***	
		(0.098)						(0.064)	
Unemployment rate			-0.366					0.368	-0.701
			(1.075)					(0.489)	(1.158)
Business expectations			0.069**						
			(0.033)						
Elderly population x d1980				0.719*					
				(0.396)					
Elderly population x d1990				0.581*					
				(0.298)					
Elderly population x d2000				-0.094					
				(0.164)					
Populatin growth x d1980					0.864				
					(1.249)				
Population growth x d1990					0.929				
					(1.195)				
Population growth x d2000					-0.031				
					(0.851)				
Proj. age dependency x d1980						0.304*			
						(0.152)			
Proj. age dependency x d1990						0.221**			
						(0.087)			
Proj. age dependency x d2000						-0.030			
						(0.039)			
Public saving x d1980							0.240		
							(0.187)		
Public saving x d1990							0.133		
							(0.202)		
Public saving x d2000							-0.227		
							(0.148)		
Real GDP growth x d1980								-0.063	
								(0.209)	
Real GDP growth x d1990								-0.134	
								(0.233)	
Real GDP growth x d2000								-0.489**	
								(0.179)	
Unemployment x d1980									1.662
									(1.249)
Unemployment x d1990									1.056
									(0.970)
Unemployment x d2000									-1.002
									(0.750)
Observations	37	37	35	37	37	37	37	37	37
Adjusted R2	0.806	0.815	0.779	0.853	0.828	0.854	0.872	0.849	0.897
DW-statistic	2.071	2.143	2.053	2.361	2.415	2.333	2.307	2.226	2.235

Notes: Dependent variable is private saving (in pct. of GDP). d1980, d1990, and d2000 are dummy variables equal to one for the years 1980-89, 1990-99, and 2000-09, respectively, and zero otherwise (the base period is 2010-16). All specifications are estimated with the OLS method, and include a constant. DW-statistic is the Durbin-Watson statistic for serial correlation in the residuals. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

28. Considering the aggregate savings function confirms these results. Both the current and projected elderly dependency ratios play a key role in driving national savings; the impact of these factors has, however, declined since the 1980s (Appendix Table 3). Rising incomes over the years have also contributed to a higher national savings rate. Public savings contribute significantly to national savings with the coefficient indicating a very modest offset by private savings over the full sample period (formal tests fail to reject the hypothesis that the Ricardian equivalence does not hold; col. [1]). Much of this effect, however, stems from the earlier years, and a rise in public savings since the 2000s does not appear to have been statistically significantly associated with a rise in national savings (col. [7]).[16]

Cross-Country Analysis

29. Estimating the private savings function for a panel of advanced countries reinforces the important role played by demographics and the income level. The results obtained from estimating eq. (2) suggest that, consistent with the life-cycle hypothesis, a higher share of elderly population implies a lower private saving rate, while a higher projected age dependency ratio implies greater savings (Table 2). The impact of these variables on the private saving rate is, however, smaller in the estimated panel than it is for Singapore: on average, a one percentage point increase in the share of elderly population in total population lowers the saving rate by about 0.1 to 1 percentage point (depending on whether country-fixed effects are considered), while a one percentage point increase in the projected future age dependency ratio raises the saving rate by about 0.1-0.2 percentage points. Similar to the results reported in Table 1, both higher real per capita income and income growth are strongly associated with higher private savings in the panel estimations (though the effect of per capita income is much larger for Singapore than for other advanced countries). The coefficient on the lagged dependent variable is also significantly positive, providing strong evidence on persistence in private saving behavior.

30. The results suggest a partial but imperfect private sector offset to public savings. The coefficient on the public saving rate is negative and strongly statistically significant, but formal tests reject the Ricardian Equivalence hypothesis. Across specifications, a one percentage point rise in the public saving rate implies a reduction in private savings by about 0.2-0.6 percent of GDP. Among other factors, an improvement in terms of trade, a lower unemployment rate, and a lower credit to GDP ratio are associated with significantly higher private savings, while the coefficient on real deposit rate is statistically insignificant.

31. Structural characteristics also appear to be important drivers of private savings. On average, global financial centers have a significantly higher private saving rate (by about 2 percentage points; Table 2, cols. [6]-[7]), while countries with a defined contribution pension system also have a higher private saving rate by about one percent of GDP. Considering also the size of the economy by including a dummy variable equal to one if the population size is less than 5 million (and zero otherwise), we find the coefficient to be negative and statistically significant at

[16] Jointly considering the coefficients on public saving rate and its interaction term with the dummy variable for the 1980s, we cannot reject the null hypothesis of no Ricardian equivalence (but it is strongly rejected for the years 2000 onward).

the 5 percent level suggesting that controlling for other factors, smaller states have on average a lower private savings rate.

32. While the considered demographic, macroeconomic, and structural factors explain Singapore's private saving behavior, they appear to be only part of the story. Including Singapore in the sample of advanced countries and estimating eq. (2), the obtained results are quite similar to those reported above (Table 3). Adding a country-specific (binary) variable for Singapore in the model, however, we find its coefficient to be significantly positive—indicating that private savings in Singapore are on average about 3-5 percent of GDP higher than in other advanced countries (Table 3, cols. [3], [7]). This result does not change if we include quadratic terms for the age dependency ratio or per capita income to capture any non-linear effects of these variables, or consider additional variables such as the size of the economy, the inflation rate, and public health spending to GDP ratio (to capture the variation in the social safety net across countries). This suggests that beyond the traditional variables considered in the literature, some other factors (such as cultural norms, or aspects of the tax system) that encourage thriftiness may be at play in driving Singapore's high private saving rate. It could also be that the existing variables do not adequately capture Singapore's structural features such as its status as a non-reserve issuing currency global financial hub, its special pension system, and the extent of its social safety net.

33. The unexplained component of Singapore's private saving behavior, however, has been declining over the years. Estimating the specification in Table 3 (cols. [3], [7]) for the different subperiods (1980-89, 1990-99, 20009-09, and 2010-16), the coefficient on the dummy variable for Singapore is the largest for the 1990s and 2000s, but has more than halved since the global financial crisis and is only weakly statistically significant (Table 4, cols. [4], [8]).[17] This suggests that, given Singapore's economic and structural characteristics, its private saving rate may have been less excessive compared to other advanced countries in the recent years than during the pre-global financial crisis years.

[17] This result is confirmed when we consider the residuals from the model estimated in cols. [2] and [6] in Table 3, where the average of the residual has fallen from about 3 percent of GDP in the 1990s to 0.5 percent of GDP since 2010.

Table 2. Singapore: Private Saving Function in Other Advanced Countries, 1980–2016

	OLS				Prais-Winsten			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged private saving	0.805***	0.757***	0.744***	0.552***	0.724***	0.656***	0.641***	0.381***
	(0.026)	(0.033)	(0.032)	(0.035)	(0.031)	(0.041)	(0.039)	(0.035)
Elderly population share	-0.059	-0.085	-0.097*	-0.612***	-0.123**	-0.185**	-0.196***	-0.971***
	(0.049)	(0.054)	(0.052)	(0.071)	(0.052)	(0.074)	(0.069)	(0.113)
Working-age pop. share	0.101**	0.040	0.053	-0.332***	0.045	-0.021	0.010	-0.502***
	(0.045)	(0.038)	(0.039)	(0.094)	(0.048)	(0.050)	(0.055)	(0.112)
Proj. age dependency ratio	0.072***	0.107***	0.118***	0.085***	0.129***	0.174***	0.190***	0.125***
	(0.020)	(0.021)	(0.021)	(0.029)	(0.021)	(0.026)	(0.024)	(0.033)
Population growth	0.011	-0.066	-0.149	0.184	0.132	-0.044	-0.134	0.280
	(0.168)	(0.181)	(0.182)	(0.196)	(0.177)	(0.207)	(0.207)	(0.209)
Public saving to GDP	-0.174***	-0.199***	-0.222***	-0.394***	-0.261***	-0.312***	-0.334***	-0.546***
	(0.025)	(0.034)	(0.032)	(0.036)	(0.029)	(0.043)	(0.039)	(0.036)
Real deposit rate	-0.038***	-0.021	-0.014	-0.005	-0.027*	-0.002	0.011	0.015
	(0.013)	(0.014)	(0.013)	(0.013)	(0.014)	(0.019)	(0.016)	(0.014)
Real GDP per capita (log)	1.682***	1.581***	1.590***	1.483	2.687***	2.277***	2.285***	1.914
	(0.246)	(0.258)	(0.262)	(1.052)	(0.335)	(0.433)	(0.426)	(1.532)
Real GDP growth	0.141***	0.095**	0.096**	0.158***	0.171***	0.137***	0.137***	0.202***
	(0.038)	(0.043)	(0.041)	(0.043)	(0.038)	(0.045)	(0.044)	(0.042)
Terms of trade change		0.075***	0.074***	0.076***		0.071***	0.073***	0.073***
		(0.019)	(0.019)	(0.019)		(0.019)	(0.019)	(0.017)
Domestic credit to GDP		-0.003	-0.002	-0.008***		-0.004	-0.004	-0.019***
		(0.003)	(0.003)	(0.003)		(0.003)	(0.003)	(0.004)
Unemployment rate		-0.081***	-0.087***	-0.119***		-0.136***	-0.150***	-0.144***
		(0.029)	(0.028)	(0.042)		(0.043)	(0.041)	(0.052)
Global financial center		1.211***	1.229***			1.836***	1.908***	
		(0.359)	(0.357)			(0.455)	(0.436)	
Pension system (defined contribution)			0.790***				1.087***	
			(0.262)				(0.419)	
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-fixed effects	No	No	No	Yes	No	No	No	Yes
Observations	923	886	886	886	923	923	886	886
R2	0.861	0.872	0.874	0.902	0.927	0.928	0.928	0.921
No. of countries	27	27	27	27	27	27	27	27

Notes: Dependent variable is private saving (in pct. of GDP). Cols. [1]- [4] are estimated with the OLS method, and cols. [5]- [8] are estimated with the Prais- Winsten method to account for possible first- order serial correlation in the error term. All specifications include a constant. Panel- corrected standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

Table 3. Singapore: Private Saving Function in Advanced Countries Including Singapore, 1980–2016

	OLS				Prais-Winsten			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged private saving	0.847***	0.774***	0.741***	0.555***	0.790***	0.674***	0.633***	0.386***
	(0.024)	(0.030)	(0.032)	(0.033)	(0.028)	(0.038)	(0.039)	(0.034)
Elderly population share	-0.077	-0.113**	-0.067	-0.624***	-0.141***	-0.238***	-0.159**	-0.978***
	(0.051)	(0.056)	(0.052)	(0.073)	(0.053)	(0.068)	(0.068)	(0.110)
Working-age pop. share	0.144***	0.106**	0.054	-0.371***	0.131**	0.117**	0.007	-0.533***
	(0.049)	(0.043)	(0.041)	(0.092)	(0.052)	(0.058)	(0.056)	(0.110)
Proj. age dependency ratio	0.073***	0.123***	0.115***	0.091***	0.113***	0.198***	0.187***	0.137***
	(0.022)	(0.021)	(0.020)	(0.029)	(0.021)	(0.023)	(0.023)	(0.033)
Population growth	0.339**	0.156	0.010	0.308*	0.360**	0.030	0.026	0.354**
	(0.144)	(0.159)	(0.160)	(0.164)	(0.158)	(0.178)	(0.177)	(0.172)
Public saving to GDP	-0.139***	-0.192***	-0.222***	-0.394***	-0.204***	-0.305***	-0.338***	-0.544***
	(0.023)	(0.028)	(0.032)	(0.035)	(0.027)	(0.036)	(0.039)	(0.035)
Real deposit rate	-0.032***	-0.012	-0.011	0.000	-0.031**	0.009	0.015	0.020
	(0.012)	(0.013)	(0.013)	(0.013)	(0.014)	(0.016)	(0.016)	(0.015)
Real GDP per capita (log)	1.330***	1.265***	1.513***	2.450***	2.089***	1.853***	2.239***	3.284***
	(0.216)	(0.233)	(0.254)	(0.803)	(0.280)	(0.387)	(0.430)	(1.135)
Real GDP growth	0.134***	0.083**	0.089**	0.137***	0.152***	0.110***	0.128***	0.172***
	(0.039)	(0.042)	(0.040)	(0.038)	(0.038)	(0.041)	(0.041)	(0.036)
Terms of trade change		0.069***	0.073***	0.074***		0.069***	0.072***	0.072***
		(0.017)	(0.019)	(0.019)		(0.018)	(0.019)	(0.017)
Domestic credit to GDP		-0.004	-0.002	-0.009***		-0.007***	-0.003	-0.019***
		(0.003)	(0.003)	(0.003)		(0.003)	(0.003)	(0.004)
Unemployment rate		-0.082***	-0.088***	-0.110***		-0.152***	-0.152***	-0.142***
		(0.027)	(0.028)	(0.042)		(0.039)	(0.041)	(0.052)
Global financial center		1.440***	1.275***			2.271***	1.992***	
		(0.367)	(0.354)			(0.466)	(0.433)	
Pension system (defined contribution)		0.885***	0.751***			1.557***	1.025**	
		(0.235)	(0.263)			(0.385)	(0.436)	
Singapore dummy variable			3.374***				4.630***	
			(0.677)				(0.872)	
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-fixed effects	No	No	No	Yes	No	No	No	Yes
Observations	960	916	916	916	960	916	916	916
R2	0.865	0.880	0.884	0.910	0.915	0.921	0.921	0.950
No. of countries	28	28	28	28	28	28	28	28

Notes: Dependent variable is private saving (in pct. of GDP). Cols. [1]- [4] are estimated with the OLS method, and cols. [5]- [8] are estimated with the Prais- Winsten method to account for possible first- order serial correlation in the error term. All specifications include a constant. Panel- corrected standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

Table 4. Singapore: Private Saving Function in Advanced Countries: Sub-samples

	OLS				Prais-Winsten			
	1980-89	1990-99	2000-09	2010-16	1980-89	1990-99	2000-09	2010-16
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lagged private saving	0.446***	0.765***	0.659***	0.814***	0.202***	0.708***	0.523***	0.787***
	(0.064)	(0.062)	(0.077)	(0.070)	(0.066)	(0.052)	(0.085)	(0.061)
Elderly population share	0.121	-0.080	0.134*	-0.327**	0.279*	-0.322***	0.108	-0.264*
	(0.090)	(0.092)	(0.068)	(0.141)	(0.153)	(0.123)	(0.076)	(0.147)
Working-age pop. share	0.320***	0.088*	0.429***	-0.165	0.649***	0.140*	0.490***	-0.155*
	(0.095)	(0.052)	(0.114)	(0.104)	(0.120)	(0.071)	(0.128)	(0.093)
Proj. age dependency ratio	0.167***	0.133***	0.114**	0.195***	0.210***	0.206***	0.180***	0.186***
	(0.033)	(0.034)	(0.047)	(0.068)	(0.062)	(0.029)	(0.054)	(0.066)
Population growth	0.409	0.324	-0.343	-0.150	0.204	0.433	-0.399	0.057
	(0.289)	(0.294)	(0.276)	(0.396)	(0.282)	(0.274)	(0.282)	(0.341)
Public saving to GDP	-0.346***	-0.219***	-0.193***	-0.129**	-0.546***	-0.313***	-0.282***	-0.153***
	(0.069)	(0.071)	(0.048)	(0.062)	(0.066)	(0.067)	(0.053)	(0.051)
Real deposit rate	-0.007	-0.021	0.089	0.148*	-0.018	-0.001	0.129*	0.120
	(0.016)	(0.047)	(0.076)	(0.080)	(0.013)	(0.038)	(0.078)	(0.096)
Real GDP per capita (log)	-1.069***	1.081**	3.555***	2.792***	-2.864***	1.966***	5.019***	2.988***
	(0.411)	(0.449)	(0.682)	(0.906)	(0.798)	(0.495)	(0.790)	(0.842)
Real GDP growth	0.170***	-0.017	0.137	0.174***	0.170**	-0.009	0.148*	0.213***
	(0.066)	(0.054)	(0.091)	(0.058)	(0.068)	(0.052)	(0.087)	(0.052)
Global financial center	3.258***	1.886***	1.100	-0.017	3.959***	2.288***	1.829**	0.085
	(0.874)	(0.459)	(0.681)	(0.278)	(0.987)	(0.360)	(0.721)	(0.232)
Pension system (defined contribution)	1.071	0.624**	1.317**	0.764	1.134	0.590*	2.127***	0.600
	(0.676)	(0.280)	(0.540)	(0.517)	(0.948)	(0.301)	(0.658)	(0.445)
Singapore dummy variable	1.803	4.423***	3.608***	1.602	3.648**	4.831***	4.955***	2.102*
	(1.275)	(1.208)	(1.079)	(1.194)	(1.638)	(0.829)	(1.172)	(1.236)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-fixed effects	No	No	No	No	No	No	No	No
Observations	229	258	277	196	229	258	277	196
No. of countries	25	27	28	28	25	27	28	28

Notes: Dependent variable is private saving (in pct. of GDP). Cols. [1]- [4] are estimated with the OLS method, and cols. [5]- [8] are estimated with the Prais- Winsten method to account for possible first- order serial correlation in the error term. All specifications include a constant. Panel- corrected standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

D. Conclusion

34. Private saving in Singapore are amongst the highest in advanced countries. Empirical analysis conducted here shows that consistent with the life-cycle consumption model, Singapore's demographic structure plays a key role in influencing its private savings. A growing share of elderly population is strongly associated with lower savings, while a rise in expected future old age dependency ratio increases savings. In addition, private savings in Singapore are also positively affected by macroeconomic characteristics such as rising real per capita income, real interest rates, and income growth, while higher unemployment rate is associated with dissaving. Over the long run, there is no evidence of public savings being offset by private savings, though it seems that the public-private saving relationship may have changed since the 2000s.

35. Cross-country empirical analysis suggests that Singapore's average private saving rate is about 3-5 percent higher than other advanced countries, even after controlling for relevant factors. Much of this average difference in the private saving rate can, however, be attributed to the private saving behavior in the 1990s and 2000s; the unexplained component of Singapore's private saving rate has almost halved in recent years.

36. Looking ahead, aging is expected to significantly lower private savings. Given the projected rise in the age dependency ratio, however, households may save more in the preceding years for precautionary purposes, thereby contributing to the current account surplus (as discussed in Appendix II of IMF, 2017). Higher incomes through productivity growth are also likely to raise private savings. In addition, given the rising offset in private savings due to changes in public savings, there is a possibility of greater fiscal spending (smaller fiscal surpluses) to contribute to even higher private savings in the medium-term. It would thus be important to anchor expectations of the private sector regarding the future course of fiscal policy.

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Appendix I. Data and Additional Results

Table 1. Singapore: Data Description and Sources

Variable	Description	Sources
Consumer Price Index (CPI)	Index	IMF's WEO database
Domestic credit	Credit to the private sector	IMF's IFS database
Elderly population share	Population aged 65 years and above (in percent of total population)	World Bank's WDI
Global financial center	Binary variable equal to 1 if country is Hong Kong SAR, Ireland, Luxembourg, Singapore, and Switzerland (0 otherwise)	Author's calculations
House price index	Private residential property price index	Singapore's Housing
Inflation	Percentage change in CPI	Author's calculations
National savings	In local currency	IMF's WEO database
Nominal deposit rate	In percent	IMF's WEO database
Nominal GDP	In local currency/in USD	IMF's WEO database
Pension system	Binary variable equal to 1 if pension system in the country has a defined contribution component (0 otherwise)	World Bank's Pension Data
Private savings	In local currency	IMF's WEO database
Public savings	In local currency	IMF's WEO database
Population growth rate	In percent	IMF's WEO database
Projected old age dependncy ratio	20-year ahead projected old-age dependency ratio (in percent)	UN's World Population Prospects
Real deposit rate	In percent. Computed as [(1+nominal	Author's calculations
Real GDP	In local currency	IMF's WEO database
Real GDP growth	In percent	IMF's WEO database
Terms of trade change	In percent	IMF's WEO database
Unemployment rate	In percent	IMF's WEO database
Working-age population share	Population aged between 15 and 64 years (in percent of total population)	World Bank's WDI

Table 2. Singapore: List of Other Advanced Countries in the Sample

Australia	Greece	New Zealand
Austria	Hong Kong, SAR	Norway
Belgium	Iceland	Portugal
Canada	Ireland	Slovenia
Cyprus	Israel	Spain
Denmark	Italy	Sweden
Finland	Japan	Switzerland
France	Luxembourg	United Kingdom
Germany	Netherlands	United States

Table 3. Singapore: Private Saving Function with Prais-Winsten Method, 1980-2016

	(1)	(2)	(3)
Lagged private saving	0.458***	0.515***	0.459***
	(0.088)	(0.096)	(0.129)
Elderly population share	-4.389***	-4.180***	-4.843**
	(1.460)	(1.214)	(1.940)
Working-age population share	0.244	0.331	0.251
	(0.414)	(0.388)	(1.084)
Proj. age dependency ratio	0.798**	0.789***	0.937**
	(0.316)	(0.273)	(0.433)
Population growth	0.898***	0.936***	0.887***
	(0.203)	(0.210)	(0.316)
Public savings to GDP	-0.053	-0.094	-0.126
	(0.205)	(0.197)	(0.256)
Real deposit rate	1.417***	1.578***	1.613***
	(0.269)	(0.260)	(0.355)
Real GDP per capita (log)	9.991***	9.643***	9.391**
	(2.978)	(2.714)	(3.582)
Real GDP growth		0.180*	
		(0.104)	
Unemployment rate			-0.223
			(1.010)
Business expectations			0.065*
			(0.033)
Observations	37	37	35
Adjusted R2	0.847	0.873	0.835
DW-statistic	2.033	2.072	2.022

Notes: Dependent variable is private saving (in pct. of GDP). All specifications are estimated using the generalized least- squares method assuming AR(1) errors, and include a constant. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

Table 4. Singapore: National Saving Function, 1980-2016

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lagged saving to GDP	0.428***	0.600***	0.447***	0.304***	0.469***	0.301***	0.334***
	(0.087)	(0.099)	(0.120)	(0.085)	(0.115)	(0.088)	(0.077)
Elderly population share	-4.778**	-4.069***	-5.281**	-4.996***	-3.868**	-5.134***	-4.906***
	(1.893)	(1.297)	(2.205)	(1.114)	(1.425)	(1.144)	(1.535)
Working-age population share	0.056	0.233	-0.078				
	(0.449)	(0.460)	(1.066)				
Proj. age dependency ratio	0.925**	0.856***	1.093**	0.436**	0.347	0.502**	0.642
	(0.374)	(0.258)	(0.460)	(0.199)	(0.313)	(0.197)	(0.396)
Population growth	0.626***	0.614***	0.538*	0.672***	2.158	0.705***	0.595**
	(0.205)	(0.212)	(0.311)	(0.211)	(1.367)	(0.211)	(0.226)
Public saving to GDP	0.711***	0.485**	0.563*				0.354
	(0.218)	(0.222)	(0.280)				(0.253)
Real deposit rate	1.201***	1.315***	1.347***	0.930***	0.894***	0.913***	1.022***
	(0.272)	(0.201)	(0.314)	(0.225)	(0.282)	(0.230)	(0.230)
Real GDP per capita (log)	8.265**	5.929*	6.734*	23.734***	15.749***	23.087***	18.508***
	(3.494)	(3.231)	(3.889)	(2.998)	(3.721)	(2.998)	(4.928)
Real GDP growth		0.333***					
		(0.110)					
Unemployment rate			-0.397				
			(1.028)				
Business expectations			0.085**				
			(0.035)				
Elderly population x d1980				0.420			
				(0.448)			
Elderly population x d1990				0.083			
				(0.311)			
Elderly population x d2000				-0.531***			
				(0.125)			
Populatin growth x d1980					-1.055		
					(1.563)		
Population growth x d1990					-1.146		
					(1.497)		
Population growth x d2000					-1.914*		
					(1.089)		
Proj. age dependency x d1980						0.241	
						(0.174)	
Proj. age dependency x d1990						0.072	
						(0.094)	
Proj. age dependency x d2000						-0.141***	
						(0.029)	
Public saving x d1980							0.195
							(0.232)
Public saving x d1990							0.057
							(0.242)
Public saving x d2000							-0.252
							(0.175)
Observations	37	37	35	37	37	37	37
Adjusted R2	0.802	0.846	0.745	0.859	0.809	0.855	0.856

Notes: Dependent variable is national saving (in pct. of GDP). d1980, d1990, and d2000 are dummy variables equal to one for the years 1980-89, 1990-99, and 2000-09, respectively, and zero otherwise (the base period is 2010-16). All specifications are estimated with the OLS method, and include a constant. Robust standard errors are reported in parentheses. ***, **, and * indicate statistical signficance at the 1, 5, and 10 percent levels, respectively.

CAPITAL FLOWS TO SINGAPORE: MACROECONOMIC IMPLICATIONS AND POLICY RESPONSES[1]

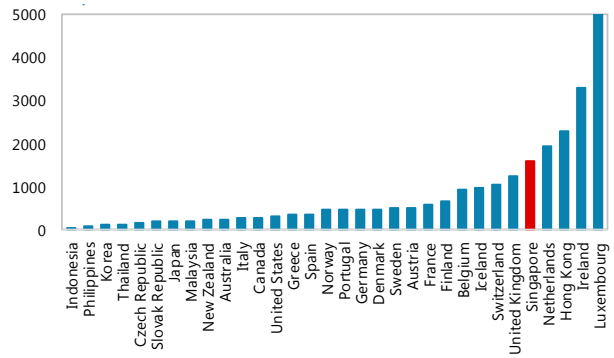
Singapore is a highly financially open economy that has evolved into a competitive regional and international financial hub. The country records large cross-border capital flows, which are highly sensitive to external conditions, but has managed to avoid financial and real crises in the face of external financial shocks. This paper examines the resilience of Singapore's economy by analyzing its experience in managing the untoward consequences of capital flows through the use of different macroeconomic and macroprudential policy tools.

A. Introduction

1. Singapore is a highly financially open economy that has evolved into a competitive regional and international financial hub. Its stock of external assets and liabilities (excluding official reserve assets) has increased dramatically over the years, doubling from about 220 percent of GDP in the 1980s to 560 percent of GDP in the 1990s, and further rising to over 1600 percent of GDP in the 2000s (Figure 1). The country records large cross-border asset flows (i.e., the acquisition of external assets by domestic residents), as well as liability flows (i.e., the acquisition of domestic assets by nonresidents), but has been experiencing persistent capital outflows on a net basis that correspond with its current account surplus (Figure 2).[2]

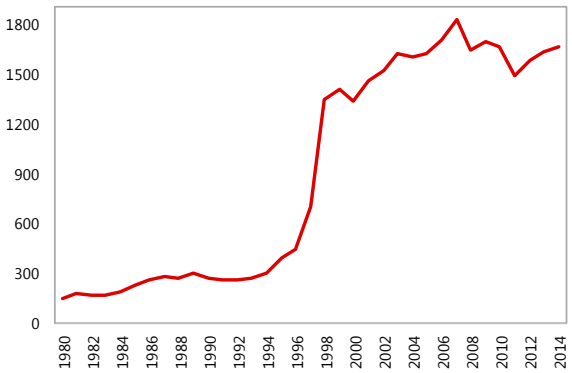
Figure 1. Singapore: Stock of External Assets and Liabilities in Singapore and Other Selected Countries

Stock of External Assets and Liabilities, 2010–14
(In Percent of GDP)



Source: External Wealth of Nations database.
Note: Statistics are averages over 2010-14. Assets exclude official reserves and gold. Y-axis is truncated at 5000 percent of GDP for expositional purposes. Luxembourg's average is 27,376.2 percent.

Singapore: Stock of External Assets and Liabilities, 1980–2014
(In Percent of GDP)



Source: External Wealth of Nations database.

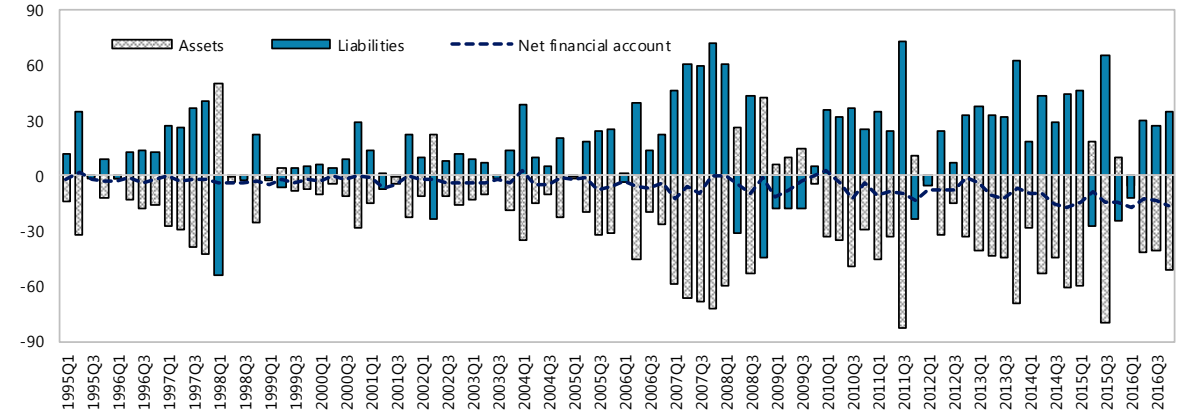
[1] Prepared by Mahvash S. Qureshi (RES).

[2] For ease of illustration, this note follows the BPM5 sign convention of recording financial flows. Thus, positive (negative) values indicate inflows (outflows) in all charts and estimations. Moreover, asset flows exclude official reserve asset flows.

Figure 2. Singapore: Net Financial, Asset, and Liability Flows to Singapore

Net Financial Account

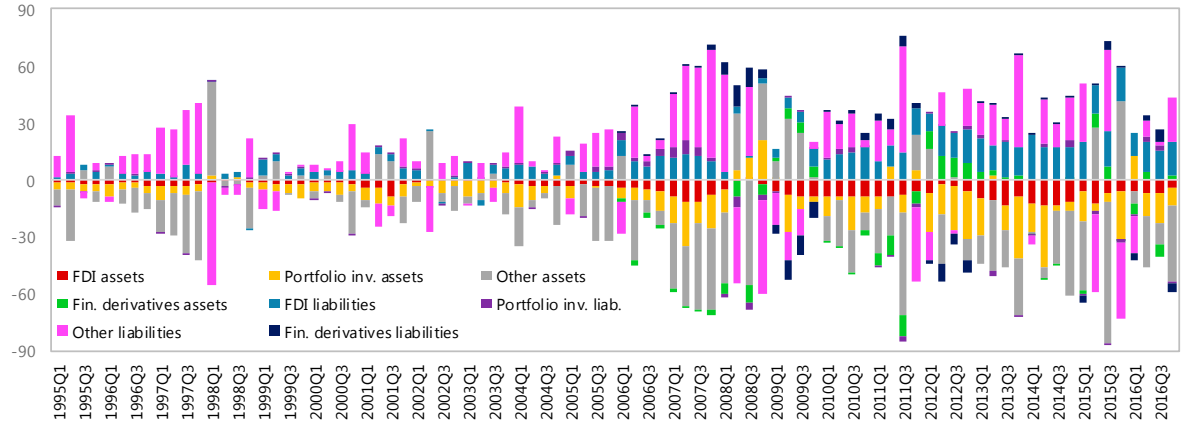
(In USD billion)



Note: Flows are represented in BPM5 terms; negative statistics reflect outflows. Asset flows exclude reserve flows.
Sources: CEIC Data Co. Ltd.; and IMF, *Information Notice System* (INS).

Asset Liability Flows

(In USD billion)



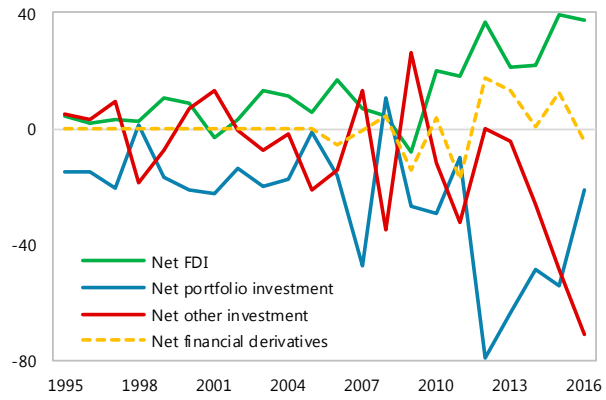
Note: Flows are represented in BPM5 terms; negative statistics reflect outflows.
Sources: CEIC Data Co. Ltd.; and IMF, *Information Notice System* (INS).

2. In terms of the composition of flows, liability flows are dominated by foreign direct investment (FDI) and other investment flows, while asset flows are dominated by portfolio and other investment flows (Figure 2). In general, Singapore experiences net inflows of FDI—much of which is concentrated in the financial, manufacturing, and wholesale and retail trade sectors—that is a more stable type of capital flow, while experiencing net outflows of portfolio investment and other investment (pre-dominantly cross-border bank flows reflecting loans and deposits), which tend to be more volatile forms of capital flows (Figure 3).

3. Given Singapore's position as a global financial center, capital flows to Singapore are strongly related to external conditions. External factors (such as global risk appetite, commodity prices, US real government bond yields, and real output growth in advanced economies) together account for some 42–54 percent of the variation in asset and liability flows (Table 1; cols. [2]-[3]).

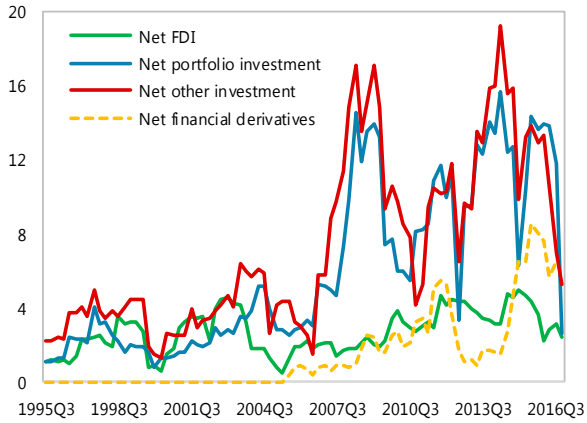
Figure 3. Singapore: Volatility of Net Financial Flows to Singapore

Net Financial Flows by Types
(In USD billion))



Note: Flows are represented in BPM5 terms; negative values reflect outflows.
Sources: CEIC Data Co. Ltd.; and IMF, *Information Notice System* (INS).

Rolling Standard Deviation of Financial Flows
(In USD billion)



Note: 5-quarter rolling standard deviation of net financial flows.
Source: IMF Staff estimates.

4. The impact of these factors on asset and liability flows, however, tends to go in *opposite* directions, suggesting that domestic residents' net acquisition of assets abroad generally offsets changes in non-resident net acquisition of domestic assets. Thus, asset flows are positively related to the VIX index (a common proxy for global market volatility and risk aversion), indicating retrenchment by domestic residents when global risk aversion rises, while liability flows are negatively related to the VIX index, implying a decline in flows by foreign investors with a rise in risk aversion. An increase in commodity prices and real GDP growth rate of advanced economies raises foreign investment in Singapore, but also encourages investment abroad. The effect of China's economic outlook appears to be statistically insignificant when looking at aggregate asset and liability flows, but disaggregated data show that outward FDI and inward portfolio investment flows increase significantly with China's output growth (Table 2).[3]

5. The offsetting movement in asset and liability flows is the reason for Singapore's generally stable net financial flows. Overall, the (unconditional) correlation between net financial flows and liability flows is negative, while that between net financial flows and asset flows is positive and more than twice as large, suggesting that domestic residents play a dominant role in determining the dynamics of net flows in Singapore. Looking at the behavior of flows in Figure 2, and the results reported in Table 1, it is apparent however that the country receives more liability flows when global economic and financial conditions are benign, but greater asset flows when the global financial cycle turns.[4]

[3] The latter result is consistent with several recent studies, which find that spillovers from China's equity market to other equity markets in the region have increased (see, e.g. Shu and others, 2016; MAS, 2016).

[4] While this pattern of capital flows is similar to that observed in other advanced economies and global financial centers, it is in contrast to the experience of most emerging markets in the region, where net financial flows typically mirror liability flows. The impact of global factors on asset and liability flows also tends to be in the same direction in emerging markets, leading to more volatile net flows. (Thus, for example, a rise in real US interest rates or a decline in commodity prices typically reduces both liability and asset flows in emerging markets; see, e.g., Ghosh and others, 2014).

Table 1. Singapore: Financial Flows and Global Factors, 1995-2016

	Net capital flows	Asset flows	Liability flows	Net capital	Asset flows	Liability flows	Net capital flows	Asset flows	Liability flows
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VIX (log)	4.219	12.657**	-8.438*	4.239	12.491**	-8.253	2.203	10.394*	-8.191
	(2.858)	(5.962)	(5.047)	(2.868)	(6.054)	(5.103)	(2.452)	(5.950)	(5.369)
U.S. real govt. bond yield	0.840**	1.467	-0.627	0.839*	1.475	-0.636	0.372	1.024	-0.652
	(0.421)	(1.492)	(1.191)	(0.423)	(1.518)	(1.217)	(0.430)	(1.539)	(1.250)
Commodity prices (log)	4.241**	-8.034	12.275**	4.169**	-7.417	11.586**	16.937***	6.783	10.154
	(1.949)	(5.857)	(5.134)	(1.901)	(5.964)	(5.222)	(3.981)	(10.544)	(9.919)
Real GDP growth in advanced countries	1.963***	-4.890***	6.853***	1.913***	-4.459***	6.373***	1.451***	-4.697***	6.148***
	(0.359)	(1.006)	(1.047)	(0.398)	(1.123)	(1.172)	(0.411)	(1.281)	(1.258)
Real GDP growth in China				0.123	-1.060	1.183	-0.753	-1.961	1.208
				(0.511)	(1.324)	(1.158)	(0.491)	(1.428)	(1.316)
Real GDP growth rate (lagged)							0.139	-0.072	0.211
							(0.167)	(0.406)	(0.414)
Real GDP per capita (lagged)							-35.103***	-37.351	2.248
							(8.734)	(24.007)	(21.641)
Observations	85	85	85	85	85	85	85	85	85
Adjusted R2	0.238	0.415	0.535	0.228	0.413	0.536	0.357	0.416	0.525

Notes: Column headers indicate dependent variables in percent of GDP (three-quarter moving average). Flows are represented in BPM5 terms with positive values indicating "inflows" and negative values indicating "outflows." Real GDP growth rates and real US govt. 10-year bond yield are in percent. Real GDP growth rate in advanced countries is export weighted. Constant and quarter effects are included in all specifications. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1percent levels, respectively.

Table 2. Singapore: Financial Flows by Type and Global Factors, 1995-2016

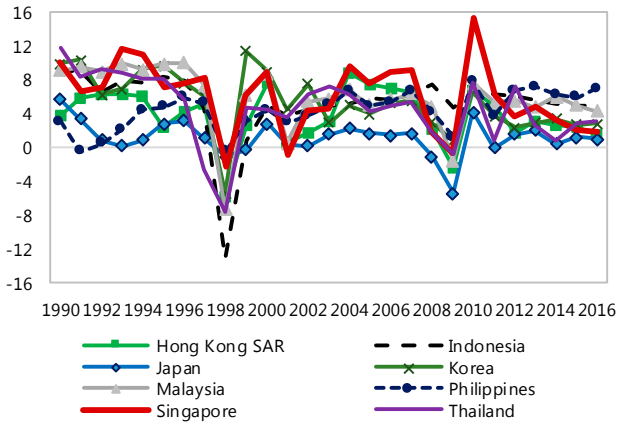
	FDI asset flows	Portfolio asset flows	Other inv. asset flows	FDI liability flows	Portfolio liability	Other inv. liability flows
	(1)	(2)	(3)	(4)	(5)	(6)
VIX (log)	-0.748	6.183	7.766	-3.772*	-3.852***	-4.441
	(2.107)	(3.762)	(5.060)	(1.909)	(1.314)	(4.360)
U.S. real govt. bond yield	-0.192	1.574**	-0.492	-0.080	-0.087	-0.979
	(0.411)	(0.763)	(0.835)	(0.289)	(0.217)	(1.170)
Commodity prices (log)	4.025	-7.393	9.512	-2.392	-9.020***	20.781**
	(3.366)	(5.870)	(9.330)	(2.473)	(2.327)	(7.992)
Real GDP growth in advanced countries	0.107	-0.853**	-4.408***	0.852***	-0.283	4.878***
	(0.406)	(0.427)	(1.342)	(0.270)	(0.191)	(0.947)
Real GDP growth in China	-0.959***	1.237*	-1.481	-0.386	1.616***	0.243
	(0.308)	(0.732)	(1.004)	(0.253)	(0.300)	(1.068)
Real GDP growth rate (lagged)	-0.073	0.483***	-0.467	-0.118	-0.019	-0.121
	(0.170)	(0.156)	(0.472)	(0.129)	(0.065)	(0.286)
Real GDP er capita (lagged)	-19.143***	20.606*	-41.194*	18.607***	15.704***	-36.723**
	(7.158)	(12.367)	(21.912)	(5.321)	(5.521)	(16.848)
Observations	85	85	85	85	85	85
Adjusted R2	0.077	0.165	0.406	0.401	0.458	0.489

Notes: Column headers indicate dependent variables in percent of GDP (three-quarter moving average). Flows are represented in BPM5 terms with positive values indicating "inflows" and negative values indicating "outflows." Real GDP growth rates and real US govt. 10-year bond yield are in percent. Real GDP growth rate in advanced countries is export weighted. Constant and quarter effects are included in all specifications. Robust standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

6. Notwithstanding the large cross-border capital flows, and their sensitivity to global factors, Singapore has managed to avoid financial and growth crises when external financial conditions have deteriorated. During the Asian financial crisis, e.g., Singapore's real GDP declined by about 2 percent as compared to an average decline of 6 percent experienced by other countries in the region (Figure 4). More recently, during the global financial crisis, Singapore had one of the smallest output declines and the sharpest economic recoveries among other global financial centers.

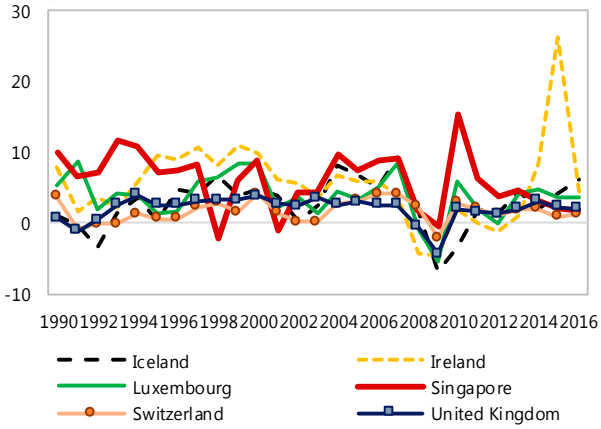
Figure 4. Singapore: Real GDP Growth in Singapore and Selected Countries, 1990–2016

Singapore and Other Asian Countries: Real GDP Growth
(In Percent)



Source: IMF, *World Economic Outlook* (WEO).

Singapore and Other Countries: Real GDP Growth
(In Percent)



Source: IMF, *World Economic Outlook* (WEO).

7. What makes Singapore so resilient to capital flow volatility? This paper examines this question by analyzing Singapore's experience in managing capital flows through different policy tools—monetary, exchange rate, fiscal, prudential, and capital controls.

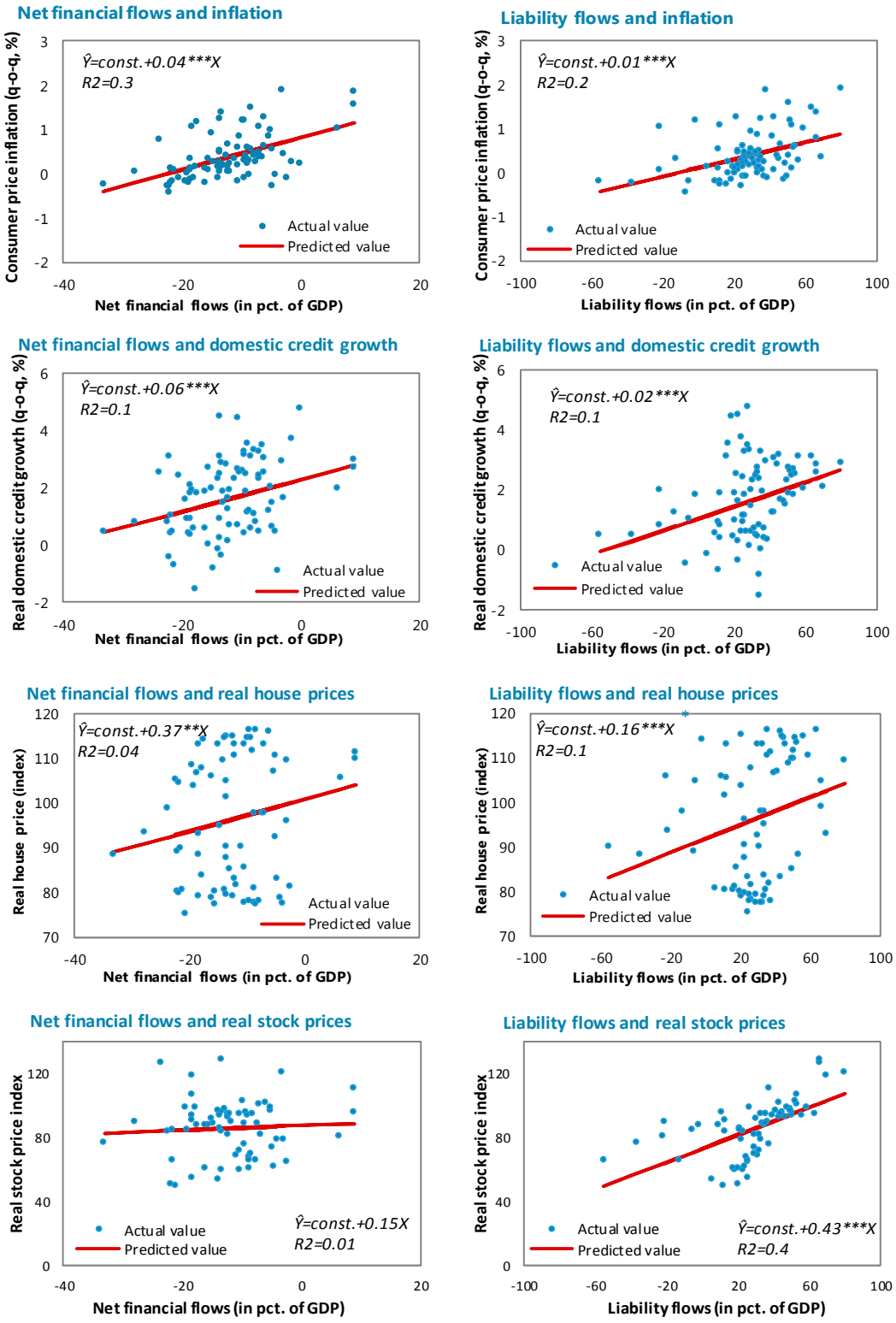
B. Challenges and Policy Response

8. Capital flows can bring myriad benefits (efficient allocation of resources, risk sharing, intertemporal consumption smoothing, financial market development), yet they can also pose macroeconomic and financial risks. The vulnerabilities associated with capital inflows (such as economic overheating; currency overvaluation; credit and asset price booms; balance sheet mismatches) can contribute to the occurrence of a financial crisis when flows ultimately recede.[5] In the context of Singapore, the liberalization of the capital account in the 1970s helped to reap the many benefits of financial openness and catalyzed its evolution into a global financial center. Yet, the cyclical variation in flows has also posed some challenges. The snapshot in Figure 5, for instance, shows that capital flows—especially liability (nonresident) flows—are strongly positively associated with inflation, credit growth, and asset (house and equity) prices in Singapore—suggesting that variations in foreign flows can potentially create domestic economic and financial volatility.[6]

[5] See Ostry and others, 2010; IMF, 2012; Ghosh and others, 2016; and Ghosh and Qureshi, 2016, for a detailed discussion and empirical evidence on the macroeconomic and financial vulnerabilities associated with large capital flows.

[6] The regression results reported in Figure 5 are unconditional correlations, but they remain quantitatively and statistically very similar if domestic variables (such as real GDP growth and real GDP per capita) are included in the model.

Figure 5. Singapore: Financial Flows, Inflation, and Financial Vulnerabilities



Source: IMF staff estimates.

Note: Variables are three-quarter moving averages computed over 1995Q1-2016Q3. All regressions include quarter fixed effects. Robust standard errors are computed. *,**, and *** indicate statistical significance at the 10, 5, and 1 percent levels, respectively.

9. The authorities have, however, remained vigilant to these risks. Over the years, the authorities have pursued a multi-pronged approach to mitigate the untoward consequences of capital flows—deploying policy tools targeting specific risks. They have thus relied predominantly on monetary and fiscal policies to address macroeconomic concerns, and on macroprudential measures to mitigate the financial-stability risks stemming from capital flows.[7]

Monetary Policy

10. The core of the authorities' approach to dealing with the macroeconomic concerns associated with capital flows is the exchange rate-centered monetary policy. Monetary policy in Singapore operates under a "basket-band-crawl" system—under which the Monetary Authority of Singapore (MAS) manages the value of the domestic currency against a basket of currencies within a prescribed policy band centered at a parity. The parity is allowed to adjust in line with economic fundamentals, with the policy band adjusted in tandem.

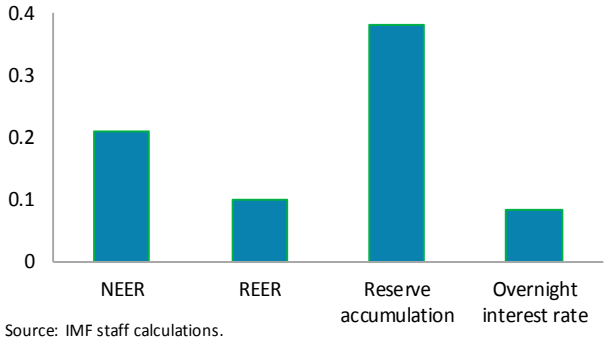
11. Within this "basket-band-crawl" exchange rate policy framework, Singapore's nominal and real effective exchange rates have steadily appreciated, but the central bank has allowed short-run fluctuations in the value of the currency to stabilize inflation and output. The (unconditional) correlation between liability flows and the nominal and real effective exchange rates (NEER and REER, respectively) is thus strongly positive (Figure 6), suggesting that the MAS allows the currency to appreciate during inflow episodes to mitigate inflationary pressures, and lets it depreciate when liability flows recede (which as shown in Table 1 generally corresponds with a downturn in global economic activity with implications for domestic economic growth).[8] During the foreign inflow surge prior to the Asian financial crisis, for instance, the NEER and REER appreciated by about 12 percent and 8 percent, respectively, while in the runup to the global financial crisis, the NEER and REER appreciated by about 10 percent and 8 percent, respectively. Conversely, amid falling foreign inflows and recessionary pressures during the Asian crisis, the NEER and REER depreciated by about 4.5 and 10 percent over 1997Q1-1999Q1, respectively. Similarly, at the peak of the global financial crisis (2008Q3-2009Q1), both the NEER and REER were allowed to depreciate.[9]

[7] The approach of the authorities to the management of capital flows thus accords well with that recommended in the recent academic and policy-oriented literature (Ostry and others, 2010; IMF, 2012; Blanchard and others, 2014).

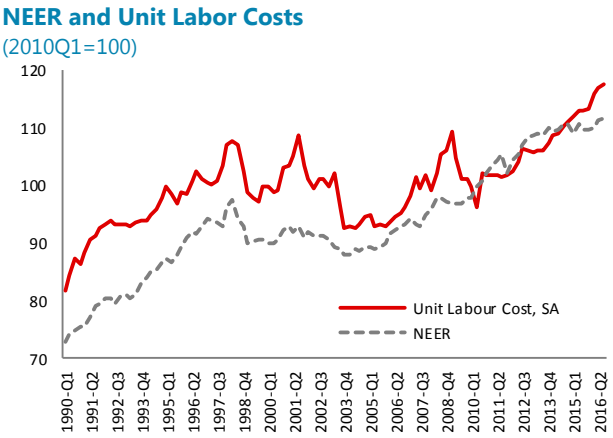
[8] Looking at asset flows, the correlation with NEER/REER is negative, suggesting that the MAS allows the currency to *depreciate* when asset flows rise. This, however, likely reflects the fact that asset flows to Singapore increase when global economic and financial conditions deteriorate (as shown in Table 1), and domestic economic activity is adversely impacted. The MAS then allows the NEER to depreciate to stabilize output and inflation.

[9] Parrado (2004) and IMF (2013) estimate the MAS' monetary policy reaction function using Taylor rule-type equations (with the interest rate replaced with the NEER as the policy instrument), and formally establish that it follows a countercyclical monetary policy stance.

Figure 6. Singapore: Liability Flows and Macroeconomic Policy Response, 1995–2016



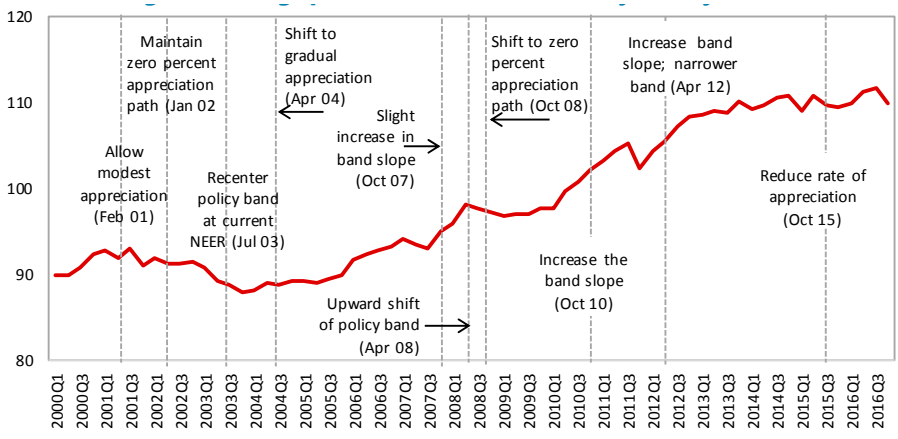
Source: IMF staff calculations.
Notes: Reserve accumulation reflects reserve asset flows with positive values indicating outflows. Correlations are computed over 1995Q1–2016Q4.



Sources: CEIC Data Co. Ltd.; and IMF, *Information Notice System* (INS).

12. Tracing the MAS' monetary policy stance through its Monetary Policy Statements, it is apparent that monetary policy reacts nimbly to changes in the external environment that may impact domestic economic activity. Thus, various forms of adjustments are made to the exchange rate policy through, e.g., changes to the width, slope, and re-centering of the exchange rate band (Figure 7). Within its managed floating framework, however, the MAS also intervenes to dampen excessive volatility in the exchange rate, as is evident from the positive correlation between foreign reserve flows (positive values indicating reserve accumulation) and liability flows (Figure 6). Thus, abrupt large changes in the exchange rate are prevented, while the impact of intervention on domestic liquidity is managed through money market operations (foreign exchange reverse swaps, lending to or borrowing from banks, purchase or sales of government securities and repurchase agreements).[10] With the use of such operations, the MAS is able to inject or drain liquidity from the domestic financial system quickly, thereby fostering orderly money market conditions (Chow, 2008).

Figure 7. Singapore: NEER and Monetary Policy Stance



Sources: Monetary Authority of Singapore; and IMF, *Information Notice System* (INS).

[10] Regressing domestic credit (in percent of GDP) on foreign exchange reserve accumulation (in percent of GDP), the coefficient is large and significantly negative, suggesting that much of the impact of intervention is sterilized.

13. Being a fully open economy, the use of the exchange rate as the intermediate target of monetary policy implies giving up control over domestic interest rates (as postulated by the Mundell-Fleming "trilemma"). Broadly speaking, therefore, interest rates in Singapore have moved in tandem with the U.S. interest rates—though typically staying below the U.S. rates reflecting market expectations of a trend appreciation of the Singapore dollar. Nevertheless, given that the central bank permits some flexibility in the exchange rate, it can exert a limited degree of control over domestic interest rates by varying the amount of liquidity re-injections (injecting less liquidity into the market when the economy is considered to be overheating, and more when it is under performing). This appears to be reflected in the small but positive correlation between short-term interest rates and liability flows in Figure 6.

Fiscal Policy

14. The central bank's swift and flexible monetary policy response to capital flows is aided by a responsive fiscal policy. While the government pursues a highly prudent approach to fiscal management (the fiscal balance to GDP ratio has averaged about 7 percent over 1995–2016), it has been adjusting fiscal policy to deal with large shocks.[11] During the Asian financial crisis, for example, the nominal depreciation of the currency was complemented with a significant rise in public development expenditure; tax, rental and utilities rebates to businesses; rebates to households on Housing and Development Board (HDB) charges and rentals; increased funding for skill training; and lower contribution rates to the Central Provident Fund (CPF)—the government administered compulsory saving scheme. More recently, during the global financial crisis, the government instituted a jobs credit scheme to preserve jobs and a Special Risk-Sharing Initiative (SRI) to ease domestic credit constraints for businesses.[12]

15. The government also supports a flexible wage policy, with annual and monthly variable components of the total wage, to enable companies to adjust to changing economic conditions. As shown in Figure 6, the various business cost-cutting measures during the Asian and global financial crises helped to achieve real adjustment in the exchange rate without necessitating a large or persistent depreciation of the NEER that could have had other ramifications for the macroeconomy.

Prudential Measures

16. To mitigate the financial-stability risks associated with capital flows, Singapore has relied extensively on macroprudential policies. MAS is the financial regulatory and supervisory authority in Singapore, which sets financial regulations and provides guidelines on sound risk management practices to domestic financial institutions. It conducts regular financial system

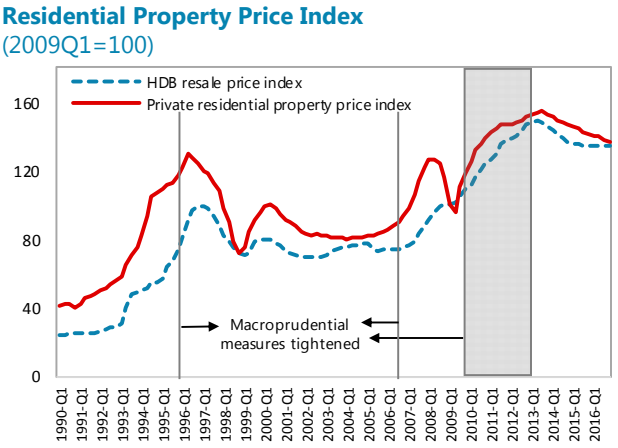
[11] The correlation between annual liability flows and fiscal balance (in percent of GDP) is positive, suggesting a countercyclical fiscal policy stance in the face of foreign inflows that, as shown in Figure 5, tend to be expansionary. This is in contrast to most other countries in the region where fiscal policy tends to be procyclical (Ghosh and others, 2017).

[12] The Jobs Credit Scheme introduced in 2009 provided businesses with a cash grant based on the wages of citizen and permanent resident employees to deter them from laying off workers. The SRI comprised a Bridging Loan Programme and a trade finance module under which the government took 80 percent of the default risk on loans of up to S$5 million, and 75 percent of the risk on trade financing, respectively, to unfreeze credit across the entire supply chain.

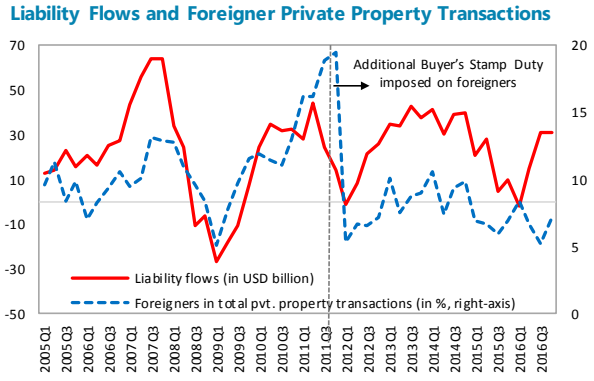
soundness and stability assessments to potential risks arising from external and internal economic developments. The implementation of cyclical macroprudential policies in Singapore to mitigate the financial-stability risks arising from capital flows has thus been aided by a strong financial regulatory and supervisory architecture.

17. While the use of macroprudential policies has attracted much attention since the global financial crisis, Singapore applied macroprudential policies in as early as 1996. The motive behind the measures was to deter speculative activity in the property market, and to dampen the sharp rise in property prices on the back of a foreign inflow surge (Figure 8). Thus, macroprudential measures, including fiscal-based measures, were introduced (such as loan-to-value limits, a stamp duty and capital gains tax on the sale of property within three years of purchase) and restrictions on foreigners from taking on local currency loans to purchase property.[13] Some of these measures were eased when residential property prices declined during the Asian financial crisis, while others were lifted a couple of years later in 2003. A further relaxation of measures—including a reduction in stamp duties, increase in the loan-to-value limit, and reduction in the minimum cash down-payment requirement—ensued between 2003 and mid-2005, as property prices stabilized.

Figure 8. Singapore: Macroprudential Measure and House Prices



Sources: Housing and Development Board; and Urban Redevelopment Authority.



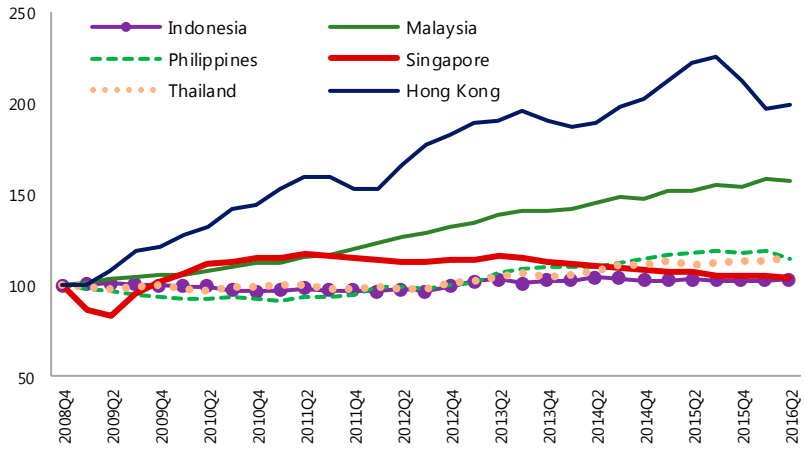
Sources: Singapore Urban Redevelopment Authority, CEIC database, and IMF staff calculations.
Note: Liability flows are three-quarter centered moving averages.

18. Measures were, however, tightened again in the runup to the global financial crisis as foreign inflows soared and speculative activities in the property market increased. The stamp duty concession was withdrawn in mid-2006, and the Deferred Payment Scheme (under which buyers could defer payments until the completion of properties) was disallowed in October 2007. At the peak of the global financial crisis, as private property prices fell, the government took supply-side measures and suspended land sales, while allowing developers more time for the completion

[13] These measures were accompanied by supply-side measures to increase the land supply (see Kim, 2011, and Seng, 2015, for a discussion of the property-related measures deployed during the 1990s). The measures were considered to have been effective in dampening the house price boom, thereby mitigating the impact of the Asian financial crisis when it unfolded.

and sale of their projects. Yet—on the back of low global interest rates, rising capital inflows, and supply shortages in the residential property market—as property prices rose sharply in the second half of 2009, the central bank acted proactively, and disallowed house loan schemes that could encourage speculation (such as interest only loans).[14] Over 2010–13, several other measures were tightened or introduced to stabilize property prices (such as lower LTV limits, a cap on mortgage tenures, an increase in the Seller's Stamp Duty, the imposition of the Additional Buyer's Stamp Duty (ABSD), and the introduction of the Total Debt Servicing Ratio for all property loans). These measures have had an impact on property prices, transaction volumes, housing loan volumes, and the risk profile of housing loans (see Appendix VI of IMF, 2017; Seng and others, 2015), reining in the rise in house prices in Singapore as compared to its regional peers (Figure 9).

Figure 9. Singapore: Real House Prices in Regional Peers
(2008=100)



Source: IMF RES MFD real house price database.

19. Macroprudential policies have also been used as a complement to monetary policy. Thus, along with deploying macroprudential policies to deal with property-related risks, the central bank also adopted some measures in recent years to support monetary policy in curtailing domestic inflationary pressures, and discouraging households from over borrowing. These include financing restrictions on motor vehicle loans such as LTV limits and a cap on the tenure of the loans.

20. It is worth noting that the cyclical variations in prudential measures have been taking place against the backdrop of strong financial supervision. MAS' vigilant financial supervision ensures that domestic banks engage in sound credit practices, and have strong capital and liquidity positions, with no significant currency or maturity mismatches on their balance sheets.[15] On the eve

[14] The measures were taken despite households' strong net asset position and low non-performing loan ratios on mortgages, against a concern that if global interest rates increased or domestic growth faltered, mortgage financing burdens would rise (while household balance sheets would deteriorate if house prices fell; Menon, 2013).

[15] The 2016–17 Global Competitiveness Index ranks Singapore as number 1 and 8 in the regulation of securities and soundness of banks, respectively, in the world (with a score of 6.3 and 6.4 out of a best possible score of 7).

of the Asian crisis, for example, the capital adequacy ratio of Singaporean banks was among the highest in the region; and the level of non-performing loans did not threaten the stability of local banks as substantial provisions had been set aside. Similarly, Singaporean banks remained strong throughout the global financial crisis because of their strong capital and liquidity positions.

Capital Account Policies

21. Singapore dismantled exchange controls through the 1970s—removing all restrictions in 1978—and largely liberalized its capital account to promote the development of an offshore financial market. The setting of the exchange rate as a monetary policy benchmark in the early 1980s, however, was accompanied by the policy of non-internationalization of the Singapore dollar to prevent a speculative attack on the local currency. Under the non-internationalization policy, the international use of domestic currency was restricted to prevent the buildup of offshore deposits of domestic currency that could be used by speculators to short the Singapore dollar. Specifically, the restrictions included consultation with the central bank before extending credit facilities exceeding S$5 million to residents or nonresidents for use outside Singapore.[16]

22. Further steps toward capital account liberalization were undertaken over the 1990s. The consultation requirement was relaxed in 1992, and credit facilities in local currency of any amount were permitted to be extended, provided that the funds were to be used to support economic activities in Singapore (the latter excluded financial and portfolio investments; Kapur, 2007). Concurrently, banks were advised against granting local currency credit facilities to nonresidents for speculating in the local financial and property markets. From 1998 onward, a series of steps were undertaken to further relax the non-internationalization policy, and the current policy (known as "Lending of S$ to Non-Resident Financial Institutions") has only two key requirements: first, financial institutions may not extend credit facilities exceeding S$5 million to non-resident financial entities where they have reason to believe that the proceeds may be used for speculation against the Singapore dollar; and second, that non-resident financial entities must convert Singapore dollar proceeds from loans (exceeding S$5 million), equity listings, and bond issuances to foreign currency before using these funds outside Singapore.[17]

23. Against this background of capital account liberalization, Singapore has not resorted to active use of capital controls to manage capital flow volatility. In fact, it is interesting to note that steps to relax the non-internationalization policy to strengthen Singapore's position as a global financial center were undertaken during the Asian financial crisis in 1998. The MAS has, however, occasionally imposed targeted measures on foreigners to manage house price surges when (at least partly) fueled by liability inflows and purchase of residential property by foreigners such as, for

[16] To avoid circumvention through financial derivatives, credit facilities were defined to cover a broad range of financial instruments, including loans, foreign exchange swaps, interest rate swaps, facilities incorporating options, and forward rate agreements in local currency (Kapur, 2007).

[17] These requirements are not considered as impediments to financial market development, as the Singapore dollar is not a currency commonly used for transactions abroad. Instead they are considered as a basic safeguard against funding of speculative activities (Kapur, 2007; Chow, 2008).

instance, in the runup to the Asian financial crisis, and in the aftermath of the global financial crisis. Thus, as mentioned above, non-residents were prohibited from taking local currency housing loans in 1996, while the ABSD—which imposes a higher stamp duty on foreigners buying property—was imposed in end-2011 (and further tightened in early 2013).[18] These measures were introduced in tandem with a broader package of prudential measures, and had the desired effect of reducing nonresident transactions in the property market and dampening the surge in house prices.

C. Conclusion and Policy Implications

24. Despite being extremely vulnerable to external developments, Singapore has remained resilient to external financial shocks due to the sound management of capital flows. The success of the government's cyclical policy response owes much to Singapore's strong fundamentals—including prudent fiscal management, a credible central bank, a robust financial system, a well-governed corporate sector, and flexible factor markets—that give government the latitude to respond nimbly and counter-cyclically to mitigate the impact of external shocks on the economy.

25. On the macroeconomic front, the central bank mainly relies on monetary policy to stabilize inflation and output. The basket-band-crawl feature of the exchange rate system allows flexibility to respond to the macroeconomic concerns associated with capital flows, while mitigating excessive exchange rate volatility. Fiscal policy is also responsive, especially to large shocks, while a flexible wage policy helps to adjust the real value of the currency without necessitating large movements in the local currency.

26. From the financial-stability perspective, the central bank has remained vigilant to asset price increases and potential mismatches on private sector balance sheets—responding swiftly when these risked creating negative spillovers to the broader economy. The macroprudential policy response has typically operated at both the intensive and extensive margins—involving changes to conventional prudential measures (loan-to-value ratios; mortgage tenure caps; debt servicing ratio), but also an expansion of the toolkit to include fiscal measures (stamp duties; capital gains tax) and supply-side policies. This involves coordination across different government agencies (such as the central bank, the Ministry of Finance, and the Ministry of National Development) that has been achieved efficiently to reach the desired outcome. Moreover, policies have been adopted in a concerted and calibrated manner, with gradual tightening until the risks abated, and subsequent relaxation as the cycle turned.

27. Singapore's holistic and multi-pronged approach to managing capital flows offers important lessons for countries dealing with capital flow volatility. A key takeaway is to act during the boom phase to prevent macroeconomic and financial imbalances from festering—thereby avoiding a hard landing when the global financial cycle turns. This in turn requires good judgment of when to act, and the flexibility and institutional ability to deploy tools to target the

[18] In general, foreign investment in residential and other properties (including vacant land) that have been zoned or approved for industrial or commercial use requires government approval. This, however, does not apply to the purchase of residential units in buildings of six or more stories and in approved condominium developments.

various risks. Moreover, achieving credibility through a consistent macroeconomic policy framework, maintaining adequate buffers, and ensuring a sound banking system are critical to enhancing the resilience of the economy during financial downturns.

28. For Singapore, the challenges posed by capital flows may increase going forward as it strives to become a fintech hub, a regional gateway for renminbi, and the premier wealth management center. Among maintaining sound macroeconomic and financial sector policies, it would need to strengthen the surveillance of potential cross-border financial spillovers, and ensure that financial regulation adapts to innovation, and meets international standards of transparency.

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