



# PEOPLE'S REPUBLIC OF CHINA— HONG KONG SPECIAL ADMINISTRATIVE REGION

## FINANCIAL SECTOR ASSESSMENT PROGRAM

June 2021

### TECHNICAL NOTE—INVESTMENT FUND SECTOR LIQUIDITY STRESS TESTING

This Technical Note on Investment Fund Sector Liquidity Stress Testing for the People's Republic of China–Hong Kong Special Administrative Region FSAP was prepared by a staff team of the International Monetary Fund as background documentation for the periodic consultation with the member country. It is based on the information available at the time it was completed in June 2021.

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June 7, 2021

## TECHNICAL NOTE

INVESTMENT FUND SECTOR LIQUIDITY STRESS TESTING

Prepared By  
**Monetary and Capital Markets  
Department**

This Technical Note was prepared by IMF staff in the context of the Financial Sector Assessment Program in People's Republic of China—Hong Kong Special Administrative Region, led by Ananthakrishnan Prasad. It contains technical analysis and detailed information underpinning the FSAP's findings and recommendations. Further information on the FSAP can be found at

<http://www.imf.org/external/np/fsap/fssa.aspx>

# CONTENTS

Glossary	3
<b>EXECUTIVE SUMMARY</b>	<b>4</b>
<b>INTRODUCTION</b>	<b>6</b>
<b>STRUCTURE OF THE HKSAR FUND INDUSTRY</b>	<b>8</b>
A. Liquidity Relevant Trends in the HKSAR Fund Industry	8
B. Methodology of the Fund Stress Test	9
<b>LIQUIDITY STRESS POTENTIAL IN THE HKSAR FUND INDUSTRY</b>	<b>13</b>
A. Liquidity Stress Potential in Mutual Funds Authorized in Hong Kong SAR	13
B. Liquidity Stress Potential in Mutual Funds Domiciled in Hong Kong SAR	15
C. Price Impact Generated by Liquidity Stress Potential of Mutual Fund Sector	17
<b>CONCLUSIONS AND POLICY RECOMMENDATIONS</b>	<b>19</b>
<b>FIGURES</b>	
1. Structure of Fund Industry	23
2. Main Results of Fund Liquidity Stress Test	24
3. Cross-Sectional Results of Fund Liquidity Stress Test I	25
4. Cross-Sectional Results of Fund Liquidity Stress Test II	26
5. Additional Results of Fund Liquidity Stress Test	27
<b>TABLES</b>	
1. Key Recommendations	5
2. Descriptive Statistics of HKSAR Mutual Fund Industry and Respective Stress Test Samples	8
3. Basle III Liquidity Coverage Ratio Haircuts	11
4. Estimates for Liquidity Shortfalls of the Mutual Fund Industry Authorized in HKSAR	14
5. Estimates for Liquidity Shortfalls of the Mutual Fund Industry Domiciled in HKSAR	16
6. Price Impact Estimates	19
References	28

## Glossary

AQLA	Adjusted High Quality Liquid Assets
BIS	Bank for International Settlements
CIS	Collective Investment Schemes
CVM	Comissão de Valores Mobiliários
CU	Convertibility Undertakings
ETF	Exchange Traded Fund
FSAP	Financial Sector Assessment Program
FSB	Financial Stability Board
FX	Foreign exchange
HKD	Hong Kong Dollar
HKEx	Hong Kong Stock Exchange
HKMA	Hong Kong Monetary Authority
HKSAR	Hong Kong Special Administrative Region
HQLA	High Quality Liquid Assets
IOSCO	International Organization of Securities Commissions
MC	Mainland China
MOU	Memorandum of Understanding
NAV	Net Asset Value
NBFI	Non-bank Financial Intermediation
SFC	Securities and Futures Commission
USD	United States Dollar
y/y	year-on-year

## EXECUTIVE SUMMARY<sup>1</sup>

**The Hong Kong Special Administrative Regime (HKSAR) is home to a fast-growing and highly international investment fund industry.** The public investment fund industry authorized in HKSAR has grown rapidly from US\$628 billion in 2008 to US\$1.6 trillion in net asset value (NAV) in 2020. The locally domiciled sector grew from US\$121 billion in early 2015 to almost US\$155 billion in 2020. Open-end funds authorized for sale in HKSAR are substantially invested in foreign assets and significantly invested in by non-HKSAR residents and are therefore reactive to international liquidity and price conditions. Locally domiciled funds invest their portfolios in both local and overseas assets markets, while they are overwhelmingly funded by HKSAR investors.

**This note examines the HKSAR investment fund industry's exposure to liquidity stress—a topic that has become more relevant globally in recent years.** In the past three years, instances of liquidity stress have materialized in individual investment funds or groups of funds globally. The same period saw major market price corrections in late 2018 and early 2020. Even if neither episode generated any serious challenge to the resilience of the HKSAR fund industry, they point to the importance of an operative and efficient framework for monitoring mutual funds' exposure to liquidity stress. To gauge such exposure this note assesses, from a macroprudential perspective, the resilience of the HKSAR fund sector to liquidity stress scenarios (i.e., redemption shocks) and subsequently evaluates the impact of forced asset sales on prices in underlying asset markets.

**Fund liquidity stress tests suggest that although redemption shocks may force HKSAR funds to sell liquid and/or illiquid assets, such sales are unlikely to substantially affect asset prices.** Funds domiciled in HKSAR appear better protected against extreme liquidity shocks and hence less vulnerable than their international peers active in HKSAR, in part due to their higher cash buffers.

**The analysis identifies some potential weaknesses in HKSAR funds, which are of particular interest for the sector's prudential liquidity risk management and supervision.** The following points are key:

- *Liquidity shortfalls and potential spillovers.* Under an adverse scenario of redemptions equivalent to the worst percentile of each fund's historical net flows, one fifth of HKSAR authorized funds unable to meet redemptions fully with cash (adjusted high quality liquid assets (AQLA)) would need to sell illiquid assets of more than 16 (12) percent of their portfolios. The corresponding weak tail of funds with a domicile in HKSAR is less vulnerable, being forced to sell non-cash assets of at least 12 percent of their portfolios. Such considerable shortfalls may generate spillover effects to other financial entities, including HKSAR's sizable fund of funds industry, with direct portfolio exposures, credit commitments or reputational links to respective funds. Initially idiosyncratic liquidity stress could be transmitted to a broader subset of HKSAR's financial industry.

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<sup>1</sup> This technical note was prepared by Frank Hespeler (IMF/MCM).

- *Cross-border risk exposures.* The HKSAR investment industry's sizeable international links imply that HKSAR investors and financial entities are vulnerable to cross-border market and liquidity risks. These vulnerabilities arise from large international portfolio exposures as well as from the large presence of foreign-based investment funds authorized to market their shares in HKSAR. Higher liquidity shortfalls found for fund shares not denominated in HKD highlight *a)* additional liquidity risks accepted by HKSAR investors in addition to FX market risks and *b)* the dependence of funds with substantive non-HKSAR investor bases on foreign liquidity conditions.
- *Data gaps.* The Securities and Futures Commission (SFC) collects fund data for the purpose of monitoring the liquidity of public funds and conducts, where appropriate, deep dive analysis of funds suspected to be prone to liquidity pressure. The need to run stress scenarios with commercial data, however, demonstrated potential gaps in the availability of data on the composition of fund portfolios and their liquidity characteristics. Such lack of data may impede efficient prudential risk management, both at the macro and micro level.

**The main policy recommendations pertain to closing the data gaps and working more closely with home supervisors of funds not supervised directly by the SFC.** While HKSAR authorities adhere to international standards concerning the regulation and supervision of investment funds and contribute actively to international discussions about risks related to the industry, some additional action would be conducive to mitigate the weaknesses identified above:

- To **address the information deficiencies** identified, HKSAR authorities are encouraged to close gaps in the data required for fund liquidity risk monitoring, automate the data collection and step up their analytic involvement in liquidity risk monitoring.
- HKSAR authorities could **benefit from intensifying their cooperation with home supervisors** of funds authorized for sale in HKSAR, but not supervised in HKSAR.
- HKSAR authorities should continue to dedicate **special monitoring attention** to funds identified by liquidity stress tests as particularly vulnerable.

<b>Table 1. Hong Kong SAR: Key Recommendations</b>	
<b>Recommendations and Authority Responsible for Implementation</b>	<b>Time<sup>1</sup></b>
<b><i>Systemic Risk Oversight and Institutional Arrangement</i></b>	
The HKMA and the SFC are encouraged to integrate the quantitative monitoring and stress testing of funds' liquidity into their supervisory monitoring and evaluation frameworks, actively communicating with the fund industry on related risks and taking advantage of latest international progress around the use of macro-prudential tools. A perspective on contagion between funds with scarce liquidity could help to mitigate contagion potential and therefore complement the intensified monitoring framework the SFC has in place for respective funds.	MT
As far as not already available, the SFC is encouraged to increase the granularity of fund level data used in its sectoral risk assessment and arrange mechanisms for electronic and automated data collection/delivery from the supervised fund industry.	MT
<sup>1</sup> Immediate (within 1 year); ST Short term (within 1-2 years); MT Medium Term (within 3-5 years).	

## INTRODUCTION

**1. The HKSAR's investment fund industry has grown fast over the past 10-15 years and is highly interconnected.** The investment fund industry in HKSAR is large, with a size of US\$1.6 trillion assets under management in Q2 2020 by funds offering their shares to investors in HKSAR and US\$155 billion by funds domiciled in HKSAR. The industry's total assets under management has grown rapidly from US\$628 billion in 2008 for funds licensed in HKSAR and from US\$121 billion in early 2015 for funds domiciled in HKSAR. Overseas domiciled funds are substantively invested in foreign assets and receive funding from non-HKSAR residents and are therefore reactive to international liquidity and price conditions. Locally domiciled public funds invest some 55 percent of their portfolio in foreign assets, while their shares are overwhelmingly held by HKSAR residents.

**2. Liquidity stress events in recent years may warrant close macroprudential monitoring of investment funds.** In the last two years, some specific investment funds and groups of funds globally have experienced instances of liquidity stress. Also, in late 2018 and in 2019, on account of global trade tensions, and in early 2020, on fears from the fallout of the global corona virus pandemic, major market price corrections took place, which adversely affected investment funds' net asset value and caused panic among investors, leading to sudden outflows from some funds. Such instances of potentially large and sudden outflows point to the importance of an operative and efficient framework for monitoring mutual funds' exposure to liquidity stress. In view of the volatility in local and international financial markets caused by the COVID-19 outbreak, the HKSAR authorities have intensified their monitoring of open-end funds beyond regular monitoring efforts and will, where appropriate, further enhance their fund data reporting requirements from time to time. These efforts showed that HKSAR funds so far effectively used liquidity risk management tools such as swing pricing, redemption charges and deferral gates and avoided any fund suspensions. Hence the industry has remained resilient to past market stresses, including the March 2020 financial market turmoil caused by the COVID-19 pandemic.

**3. HKSAR authorities adhere to international standards for the regulation and supervision of investment funds and participate in international discussions of risks related to this industry.** Following applicable recommendations by the International Organization of Securities Commissions (IOSCO), the SFC requires fund managers to regularly perform stress testing exercises and to maintain appropriate action plans on how to meet the liquidity needs discovered in such exercises. The SFC reviews the adequacy of these exercises, also in relation to funds' risk management policies and frameworks, by conducting regular inspections. The SFC also contributes regularly to discussions in IOSCO and the Financial Stability Board (FSB) about the role of non-bank financial intermediation (NBFIs), related financial stability risks and how to address those risks.

**4. In this context, this note examines, from a macroprudential perspective, liquidity stress scenarios for the HKSAR investment fund sector, and assesses the sector's capacity to cope with such situations.** The note is structured as follows. The note first provides some context on the structure of the investment fund industry in HKSAR. Subsequently, it describes the methodology used for the liquidity stress test. Next, the results of the liquidity stress test are presented for public funds authorized to sell shares in HKSAR (including overseas domiciled funds

and locally domiciled funds) and funds locally domiciled in HKSAR. A further exercise discusses the potential price impact generated by funds which are forced by liquidity stress to sell off parts of their portfolio in respective asset markets. The last section draws conclusions and recommends appropriate policy reactions.

**5. To summarize, the analysis finds that HKSAR funds are susceptible to shortfalls in liquidity if hit by substantive redemptions, and while the price impact of forced asset sales is very small, there may be spillover effects to other funds.** Specifically:

- *Redemption shocks, liquidity shortfalls and price impact of forced sales.* Capital withdrawals of customers can potentially expose the HKSAR fund industry to substantive liquidity needs. Attempts to cover such liquidity needs through the sale of assets do not appear, however, to generate significant adverse price pressure in related asset markets. This may be due to the fact that HKSAR fund investors are served by two different fund groups. First, investors are able to buy shares from overseas domiciled funds which are authorized to sell shares in HKSAR but are neither domiciled in HKSAR, nor primarily focused on HKSAR assets or clients. Second, investors can invest in funds domiciled in HKSAR. While the entire HKSAR fund industry, which comprises the two different groups, displays some vulnerability to severe redemption shocks, the volume of assets which it would need to sell in such case remains too limited to be likely to generate substantive downward effects on asset prices in international financial markets. Similar findings hold for the group of funds domiciled in HKSAR. The limited size of this segment of locally domiciled funds renders a broader price impact on HKSAR asset markets and on international asset markets virtually negligible.
- *Spillover effects between funds.* Funds particularly vulnerable to redemption shocks may amplify those shocks, by threatening the liquidity of other funds, e.g. funds of funds, through direct portfolio exposures and reputational side effects. Weaker tails in both fund industries appear to be vulnerable to such degree that any materialization of extreme redemption requests could imply liquidity stress for entities invested in funds belonging to those weaker tails. This is particularly relevant since funds of funds domiciled in HKSAR account for 12 percent of HKSAR's entire local fund industry. Beyond direct portfolio exposures, however, liquidity commitments or reputational externalities between funds can play a similar role. Overlaps between fund portfolios could also transmit price impacts generated by idiosyncratic redemption stress to other funds and financial entities, even if the limited size of the price impacts identified suggests only very modest risks around such second round effects. Hence funds belonging to the more liquidity stress sensitive tails of the industry could very well act as amplifiers derailing other funds and therefore propagate initially idiosyncratic liquidity stress to a wider part of the industry.

## STRUCTURE OF THE HKSAR FUND INDUSTRY

### A. Liquidity Relevant Trends in the HKSAR Fund Industry

**6. The predominantly foreign-based fund industry accessible to investors in HKSAR continues to grow despite recent volatility.** The US\$1.6 trillion fund industry authorized in HKSAR continues on a medium-run growth path, even as temporary fluctuations imply volatility around the trend. While the entire fund industry authorized in HKSAR saw, in line with global trends, its assets grow in 2019 by 17 percent, it lost in the first half of 2020 4.2 percent of its assets. Still, the accumulated growth over the last 5 and a half years stood at an impressive 22 percent (Fig. 1.1). Latest available data for the fund industry domiciled in HKSAR, which is at US\$155 billion much smaller than the industry accessible to HKSAR investors, reconfirm this picture with a growth of -3 percent over the first half of 2020 (Fig. 1.2). Concentrating on main asset classes and interpreting index funds and funds of funds as vehicles mainly invested in stock markets, the mutual fund industry authorized and domiciled in HKSAR displays roughly comparable distributions across asset classes (Table 2). As of March 2020, 2728 Collective Investment Schemes (CIS) were authorized in HKSAR, of which 2135 were unit trusts and mutual funds. Almost half of those were equity funds, with bond funds representing a fifth, and diversified and index funds both representing close to a tenth.

**Table 2. Hong Kong SAR: Descriptive Statistics of HKSAR Mutual Fund Industry and Respective Stress Test Samples**

Fund types	Funds authorized in HKSAR		Sample for funds authorized in HKSAR		Funds domiciled in HKSAR		Sample for funds domiciled in HKSAR	
	USD billion	Percent of total assets	USD billion	Percent of total assets	USD billion	Percent of assets	USD billion	Percent of total assets
Values Q2 2020								
<i>Total</i>	1608	100	1514.6	100	155.2	100	72.8	100
Bond Funds	570	35.5	394.9	26.1	31.3	20.2	17.9	24.5
Equity Funds	696	43.3	767.5*	50.7*	46.0	29.7	31.5*	50.4*
Diversified	154	9.5	130.6	8.6	15.9	10.2	15.2	20.91
MMFs	21.9	1.4	69.0	4.6	7.9	5.1	3.7	5.0
Fund of Funds	19.7	1.2	NA	NA	18.2	11.7	NA	NA
Index Funds	147	9.1	NA	NA	35.8	23.1	NA	NA
Guaranteed Funds	NA	NA	NA	NA	0.1	0.0	NA	NA
Hedge Funds	NA	NA	9.7	0.6	NA	NA	0.1	0.1
Other specialized Funds	0.20	0.00	56.4**	3.7**	NA	NA	0.0**	0.0**
Unspecified	NA	NA	82.5	10.1	NA	NA	4.4	6.1

Sources: SFC, MorningStar and IMF Staff calculations.  
Notes: \*= Include index funds and fund of funds, \*\* = Include guaranteed funds

**7. The HKSAR fund industry is heavily invested abroad, in particular funds not focused on equities.** Funds authorized in HKSAR and those among them domiciled in HKSAR appear to invest the majority of their assets abroad: around 70 percent of assets of the fund industry authorized for sale in HKSAR and about 55 percent of assets of the local fund industry are allocated to foreign jurisdictions, with a wide heterogeneity across fund types belonging to the locally domiciled industry, as the domestic focus of equity funds is, at 43 percent, much higher than that of other fund types (Fig. 1.4). Mainland China (MC) and the US appear as the most preferred single foreign jurisdictions, but the Asia Pacific Region, exclusive of MC, has an even higher weight in the geographical allocation of portfolios.<sup>2</sup> In terms of asset classes, equities and bonds dominate the local fund industry making up respectively some 51 and some 28 percent of the entire industry's portfolio, with the residual almost completely allocated to fund shares, mainly through funds of funds, accounting for around 16 percent of the local industry (Fig. 1.5).

**8. HKSAR funds recently reduced the average quality of their credit portfolios.** The credit risk profiles of the local industry display evidence of search-for-yield with the ratios of high yield and/or unrated debt slightly trending up for funds domiciled in HKSAR (Fig. 1.6) as well as for funds authorized for sale in HKSAR. Funds in both universes would therefore tend to trend towards lower high-quality liquidity buffers, a finding which available data for funds authorized for sale in HKSAR corroborates, augmenting the potential for liquidity stress in case of massive redemption shocks.

**9. Fixed-income assets gained attractiveness in the HKSAR fund universe.** On the margin funds domiciled in HKSAR invest increasingly in fixed-income asset classes, as HKSAR interest rate levels remain competitive in a global context (Fig. 1.5). This local aspect of search-for-yield raises the attractiveness of bond funds, also compared to less risk geared MMFs, accessible in HKSAR to investors, with the share of bond funds in the respective universe increasing from 34.5 to 35.5 percent over the last two and half years (Fig. 1.1) (The share of MMFs continued to increase from 1.3 to 1.4 percent in the same period).

## B. Methodology of the Fund Stress Test

**10. The liquidity fund stress test for HKSAR builds on the existing toolkit of FSAP liquidity stress tests.** The methodology used for the fund liquidity stress test in HKSAR follows the approach of previous FSAP fund liquidity stress tests conducted in Luxembourg, Ireland, Sweden, the US, Brazil (IMF 2018) and Thailand (IMF 2019b). Hence the stress results to be provided do not factor in any mitigating actions, such as funds' liquidity management tools or regulatory measures, when assessing the capacity of funds' liquidity buffers to cover redemption requests.

**11. Stress tests involve the calibration of redemption shock metrics, the quantification of liquidity buffers, the determination of additional liquidity needs and the estimation of asset price impacts of potential asset sales.** Fund stress test procedures involve four particular steps. First, redemption shock metrics are computed based on historical flow data for the sector of open-end mutual funds. Second, the liquidity of each fund is gauged using appropriate available liquidity

<sup>2</sup> See SFC 2019, p. 21.

metrics. Third, redemption shocks and metrics for available liquidity are used to diagnose whether a fund can cope with the level of the assumed redemption shocks and, if not, how much additional assets would need to be sold beyond the available liquidity in order to meet the redemption shock fully. Fourth, the final step attempts to estimate the impact of the potential asset sales assessed in step three on asset prices in respective markets. To implement these four steps, several methodological choices need to be decided upon, which will be discussed in the following paragraphs.

**12. Redemption shocks are calibrated in three scenarios as the first, third or fifth percentiles of a fund's historical flow data.** In the first step, the question arises whether the redemption shock which a fund needs to face should be modelled i) heterogeneously across funds, ii) homogeneously across certain fund industry sections or iii) homogeneously across the entire fund industry. Previous FSAPs often used mixed approaches, calibrating alternative fund redemption shocks for the three approaches (e.g. Thailand FSAP 2019, Brazil FSAP 2018, among others). As, however, the heterogeneous calibration appears to fit better with the heterogeneity of estimates for individual flow-return relationships (Fig. 5.5-5.6) and, in addition, with the multiplicity of styles within investment portfolio mandates, the heterogeneous approach was prioritized. The resulting shocks are sufficiently severe, in particular as the assumption of their simultaneous realization imposes a severity of the industry wide shock not observed in the flow-return relationships. In order to evaluate the robustness of results, three shock scenarios are distinguished: a severe scenario calibrated as the worst percentile of outflows observed in a fund's available historic flow data measured at monthly frequency over the period between January 2000 and October 2020, a middle scenario calibrated to the third percentile of the respective distribution and finally a mild scenario calibrated to the fifth percentile of the same distribution.<sup>3</sup>

**13. Liquidity buffers are gauged through a range of metrics, including HQLA and cash buffers.** In the second step, the quantification of liquidity buffers requires additional conceptual design decisions. Following the approach presented in IMF 2019a three alternative liquidity metrics were employed: the metric gauging high quality liquid assets (HQLA), the related metric adjusted high quality liquid assets (AQLA) and the narrower concept of cash liquidity. The concept of the HQLA proxy follows the Basel III principles for the calculation of the liquidity coverage ratio. For each asset class a haircut is applied, which represents the fraction of assets presumably not sellable on short notice (Table 3). The choice of three alternative metrics was motivated by the purpose to provide additional robustness, as limitations in data availability i) did not allow for the computation of HQLA metrics for the sample of funds domiciled in HKSAR and ii) in some cases distorted the HQLA metrics even in the larger sample of funds authorized in HKSAR, in particular when zooming down into cross-sectional subgroups.

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<sup>3</sup> In detail for each fund a time series of redemption shocks is computed by using expanding rolling windows with the smallest window spanning from January 2000 to January 2006 and the windows thereafter expanding stepwise by one month. Flow data are converted to flows in percent of past NAVs and the resulting data are winsorized at absolute values of 50 percent to eliminate any distortions from outliers in the data.

**Table 3. Hong Kong SAR: Basel III Liquidity Coverage Ratio Haircuts**

Rating Grade	AAA	AA	A	BBB	BB	B	Below B	Unrated
Cash				0				
Sovereign Debt	0	0	15	50	100	100	100	100
Corporate Debt	15	15	50	50	100	100	100	100
Residential Mortgage	25	25			100			
Equity				50				
Municipal Debt	50	50	50	50	100	100	100	100

Source: Bank for International Settlements.  
Note: Based on high level principles.

**14. To provide robustness in the empirical results, the HQLA metric is modified to an alternative metric, allowing individual funds more flexibility in liquidity management.** The AQLA metric provides additional robustness in terms of the behavioral reaction of individual funds, as funds may have more liquid assets on hand than apparent in the HQLA metric. To this purpose, the AQLA metric balances short positions with available long positions in available, potentially less liquid, portfolio components, thereby effectively allowing the fund to borrow liquid assets to finance illiquid positions. Similarly liquid long positions in excess of the entire portfolios value are curtailed, since liquidity financing by borrowing through short positions in illiquid assets appears unsustainable and unreasonable. These adjustments to the original HQLA metric are implemented subsequently starting with short or excess long positions in the most liquid portfolio component and descending the liquidity-ranked order of the portfolio components

$$\hat{x}_i = \begin{cases} x_i + \min(-x_i, \sum_{n \neq i} x_n) - \sum_{j=1}^{i-1} \max(\hat{x}_j - x_j, 0) & \text{if } x_i < 0 \\ x_i & \text{if } 0 \leq x_i \leq 1, \\ x_i + \min(0, \sum_{n \neq i} x_n) - \sum_{j=1}^{i-1} \min(\hat{x}_j - x_j, 0) & \text{if } x_i > 1 \end{cases}$$

where  $\hat{x}_i$  denotes the adjusted portfolio component (as a fraction of the entire portfolio),  $x_i$  is the unadjusted portfolio component and the indexes  $n$  and  $i$  denote the number of portfolio components and the liquidity rank of the specific component to be computed respectively.

**15. Liquidity need or shortfall metrics quantify the volume of assets in need to be sold.**

The third step consists in the determination of liquidity shortfalls or needs, i.e. assets in need to be sold to serve a redemption shock. The use of multiple liquidity concepts implies also multiple liquidity shortfall metrics, which are distinguished on base of the underlying liquidity metric as liquidity shortfalls on a cash, HQLA or AQLA basis. Beyond the size of liquidity shortfalls, the issue also includes the question of how sales needs are distributed across a fund's existing portfolio. Typically fund stress tests distinguish two approaches: the waterfall approach, which assumes that liquid assets are sold first, and the pro-rata approach, which leaves the structure of the portfolio

intact.<sup>4</sup> The stress test for HKSAR puts the emphasis on the waterfall approach and ignores pro rata sales. The less accommodative nature of pro-rata sales is nevertheless accounted for when analyzing price impacts (see below), as liquidity needs in the non-cash asset liquidity concept are allocated to the maximal amount possible to the different asset classes analyzed, hence effectively exceeding the impact which would have been generated by pro-rata sales.

**16. Price impact of potential sales of assets, liquid as well as illiquid, are assessed using historical price movements per unit of transaction volume observed.** In the fourth and final step, the price impact of rapid asset sales by investment funds is assessed with the Amihud ratio reporting the average price reaction per unit of transaction value over the last 12 months (Amihud 2002).<sup>5</sup> As the limited available data on transaction values in HKSAR asset markets did not allow for a full-fledged analysis of the price impact across all asset market segments, selected estimates are presented for asset markets, where data proved to be sufficient.

**17. As an additional robustness test, fund-level regressions were used to quantify the sensitivity of flows to returns.** The models employed OLS-regressions of individual fund flows, measured as percentage of previous assets, on current returns, past returns, past flows, fund size and an intercept. To capture non-linearities, the squared fund size, a dummy for negative contemporaneous returns, the interaction of this dummy with current returns and the interaction of fund size with past returns were included as well. A minimum time series length of 29 observations was required for a fund to be included into the set of funds for which regressions were run.<sup>6</sup>

**18. While stress test samples are representative in terms of assets, effective sample sizes are contingent on data available for the computation of liquidity proxies.** As illustrated in Table 2 the samples used for the stress testing of the HKSAR fund industry are fairly representative in terms of assets, covering 87 percent of assets of the industry authorized in HKSAR or 47 percent of assets for the industry domiciled in HKSAR. Data requirements for the computation of proxies for high quality liquid assets, however, can imply substantial further reduction in effective sample sizes, while for the less demanding liquidity proxy cash, effective samples tend to remain higher. The data employed in the stress test cover all relevant available data items from 3019 funds authorized for sale in HKSAR and from 474 funds domiciled in HKSAR at some time between January 2000 and October 2020. While data were obtained in monthly frequency, some data items, in particular data on credit quality, display strong quarterly seasonality. Hence results are reported at quarterly frequency.

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<sup>4</sup> The choice of liquidity buffers as thresholds for defining liquidity stress already favors the waterfall approach, assuming implicitly that liquidity buffers are completely used for serving redemption shocks before turning to the remaining less liquid part of the portfolio.

<sup>5</sup> The price impact is hence assessed by static partial equilibrium analysis, as the behavior of relevant market participants beyond investment funds is assumed to be unchanged. This assumption does not allow for the quantification of the entire price change in the market but only of the price change due investment funds' additional asset sales.

<sup>6</sup> For robust analysis two other model versions were run, dropping first the last and subsequently the two last variables from the regressions. Results remained qualitatively robust.

## LIQUIDITY STRESS POTENTIAL IN THE HKSAR FUND INDUSTRY

**19. To acknowledge the substantive presence of international funds in HKSAR, stress tests are conducted separately for funds authorized to sell shares in HKSAR and funds incorporated in HKSAR.** First a stress test is run for the wider universe including all funds holding a license allowing them to market their fund shares in HKSAR, irrespective of where those funds are domiciled. The majority of this industry, i.e. 90 percent of its assets, is actually made up by offshore funds not domiciled in HKSAR. Second, the focus is narrowed down to the fund industry located in HKSAR, which consists only of funds which have their legal domicile in HKSAR and are therefore fully regulated by HKSAR authorities.

### A. Liquidity Stress Potential in Mutual Funds Authorized in Hong Kong SAR

**20. The HKSAR fund industry displays a sizeable potential for liquidity shortfalls.** Funds authorized for sale in HKSAR faced in Q1 2020 an aggregate liquidity shortfall in non-cash assets of 4.9 to 13 percent of the industry's assets, or US\$67 billion to US\$180 billion in absolute numbers, depending on the severity of the underlying scenario (Table 4). When liquidity shortfalls are measured by the HQLA or AQLA concepts, respective shortfalls in illiquid assets were between 0.3 and 3.8 percent of the industry's assets, or US\$4 billion to US\$52 billion in value. While the time series data to be discussed below suggest some variance over the last 4 years, observed levels remained at comparable levels and Q1 2020 values range for most metrics in the upper half of respective ranges. The most severe scenario produces therefore liquidity shortfalls which are in relative terms well above the ones observed in IMF 2019a for the global fixed-income fund industry.

**21. More than one third of the assets managed by funds authorized for sale in HKSAR are vulnerable to situations in which respective funds may not be able to serve redemption requests by the sale of assets readily available for fast liquidation.** Over the last four years, some 19 to 42 percent of the assets of funds authorized in HKSAR were managed by funds not capable of satisfying redemption requests equal to the worst percentile of their respective individual historic flow data by exclusively disposing of HQLA assets (Fig. 2.3). Reducing the severity of redemption shocks from the severe to the middle (mild) scenario, lowers the share of affected assets to 8 to 32 (6 to 30) percent, implying that in both cases still up to almost one third of the fund industry's assets is potentially vulnerable to liquidity stress. If the more restrictive concept of cash is used to define the liquidity buffers immediately available for serving redemption requests, the share of affected assets within the fund industry authorized in HKSAR would increase to values in between 83 and 91 percent for the most severe scenario and remain with 79 to 82 (73 to 80) percent somewhat lower in the two milder scenarios.

**Table 4. Hong Kong SAR: Estimates for Liquidity Shortfalls of the Mutual Fund Industry Authorized in HKSAR**

Liquidity metrics	Severe scenario			Middle scenario			Mild scenario		
	Sample	Sector		Sample	Sector		Sample	Sector	
Values Q1 2020	USD billion	USD billion	Percent of total assets	USD billion	USD billion	Percent of total assets	USD billion	USD billion	Percent of assets
HQLA	46	52	3.76	16	19	1.34	14	15	1.12
Adj. HQLA	22	25	1.80	6	6	0.45	3	4	0.28
Cash	159	180	13.04	85	97	7.02	59	67	4.86

Sources: MorningStar, SFC and IMF Staff calculations.

**22. Depending on the severity of the redemption scenarios and the liquidity metrics used, the average fund authorized in HKSAR and unable to fully serve a redemption shock with liquid assets would have needed to sell illiquid assets of up to 18 percent of its portfolio.**

Within the last four years funds authorized in HKSAR and facing redemption shocks which they could not serve with HQLA assets alone would have been on average forced to sell illiquid portfolio components in between 8 to 18 percent of their assets if hit by the severe redemption scenario (Fig. 2.1).<sup>7</sup> For the same scenario the liquidity need in non-cash assets would have been between 15 and 17 percent of their assets. Assuming the middle (mildest) redemption scenario these values would drop to 5 to 9 (or 3 to 8) percent of assets in case that funds would be forced to sell less liquid non-HQLA assets, or to 9 to 10 (7 to 8) percent of assets to be sold in form of non-cash assets respectively.

**23. A weak tail of funds authorized in HKSAR would experience particularly severe liquidity shortfalls in case of redemption stress.** The distribution of liquidity shortfalls across funds authorized in HKSAR and unable to satisfy redemptions with available liquid portfolio components is heterogeneous: weak tails of particular vulnerable funds can be identified for all redemption scenarios and for all alternative liquidity buffers. For the severe redemption scenario and the most accommodative liquidity concept, the weakest quintile of funds consists in the overwhelming majority of funds with a liquidity shortfall higher than 16 percent of their assets (Fig 2.5). The respective tail for the stricter cash liquidity concept starts also at a liquidity shortfall of 16 percent but spreads out much further into higher shortfall terrain. Such levels of liquidity shortfalls would put respective funds under severe liquidity pressures.

**24. Funds authorized in HKSAR and with their primary share classes denominated in foreign currencies appear more vulnerable to liquidity stress than those primarily denominated in HKD.** Funds authorized in HKSAR and with their primary share class denominated in foreign currencies, in particular in some currencies of the Asian-Pacific region, display on average higher liquidity shortfalls than funds denominating their primary share classes in HKD (Fig. 3.1.). This

<sup>7</sup> Respective time series data for Q2 and Q3 2019 are distorted by a few outlier funds, i.e. funds displaying massive shortfalls due to very large negative positions in cash and have been interpolated for these observations. An alternative filtering for outliers does not change these results qualitatively.

pattern holds independent of the liquidity concept employed or the scenarios applied. Similarly, funds primarily denominated in HKD and not able to serve redemption shocks with liquid assets (cash) need to sell smaller proportions of their portfolios in form of illiquid (non-cash) assets (Fig 3.3). This echoes the finding in HKMA 2019 that in distressed market conditions flows in local currency EM bond funds tend to react in a more volatile way to FX volatility than flows to their hard currency peers.

**25. Fixed-income funds tend to be more exposed to cash liquidity stress than other fund types.** Fixed-income funds authorized in HKSAR, except for those geared towards higher risks, tend to face lower average liquidity shortfalls in AQLA assets than mutual funds in general. Fixed-income funds' cash liquidity buffers, however, fall shorter of liquidity needs in case of redemption shocks than the respective shortfalls of their mutual fund peers. (Fig. 3.5 and 4.1).

**26. Smaller funds face higher potentials for liquidity stress than larger funds.** Liquidity shortfalls on a cash basis in smaller funds exceed the ones for larger funds in all three scenarios. Liquidity shortfalls in AQLA assets corroborate this result for funds unable to serve the liquidity shocks exclusively either with liquid assets or AQLA assets (Fig. 4.3 and 4.5).

**27. Funds domiciled in HKSAR are less vulnerable to severe shocks than funds domiciled elsewhere and marketing their fund shares in HKSAR.** Average liquidity shortfalls of HKSAR domiciled funds unable to satisfy the redemptions of the severe scenario exclusively by cash are lower than respective shortfalls in funds domiciled elsewhere. In the milder scenarios, however, respective shortfalls are comparable to international peers, or even somewhat higher (Fig. 5.1). Higher cash holdings of funds domiciled in HKSAR appear to protect better against extreme liquidity shocks, but do not insulate as well against milder liquidity shocks (Fig. 5.2).

## B. Liquidity Stress Potential in Mutual Funds Domiciled in Hong Kong SAR

**28. Funds domiciled in HKSAR appear less vulnerable to liquidity stress than their international peers.** With relatively scarce data available on the mutual fund industry domiciled in HKSAR, the analysis of liquidity shortfalls could be only conducted for the more restrictive liquidity concept of cash. However, this facilitates at least a comparison to the results for the mutual fund industry offering their shares for sale in HKSAR. Funds domiciled in HKSAR faced in Q4 2019 liquidity shortfalls on a cash basis of between US\$8.6 billion and US\$15.7 billion, depending on the assumed redemption scenario. In terms of asset shares these corresponded to shortfalls from 4.9 to 8.5 percent of the total industry's assets (Table 5). Funds domiciled in HKSAR appear therefore less prone to face liquidity stress than their international peers marketing fund shares in HKSAR. Their vulnerability level, however, still exceeds the one observed for the global fixed-income industry in IMF 2019a.

**29. A majority of funds domiciled in HKSAR need to sell non-cash assets in case of severe redemption shocks.** Some 70 percent of the assets of open-ended mutual funds domiciled in HKSAR are potentially affected by a lack of sufficient cash (or cash equivalents) to serve the redemption requests assumed in the three redemption scenarios. In the last four years substantive fluctuations around this level were observed. For the severe scenario values fluctuated between 68

and 95 percent of the sector's assets, while respective values in the two milder scenarios ranged between 62 and 94 percent of assets (Fig. 2.4). While being volatile, the proportion of affected assets tended most times to exceed respective values for funds authorized in HKSAR.

**Table 5. Hong Kong SAR: Estimates for Liquidity Shortfalls of the Mutual Fund Industry Domiciled in HKSAR**

Liquidity metrics	Severe scenario			Middle scenario			Mild scenario		
	Sample	Sector		Sample	Sector		Sample	Sector	
Values Q4 2019	USD billion	USD billion	Percent of total assets	USD billion	USD billion	Percent of total assets	USD billion	USD billion	Percent of assets
HQLA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Adj. HQLA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cash	7.1	15.7	8.53	4.9	10.7	6.17	3.9	8.6	4.98

Sources: MorningStar, SFC and IMF Staff calculations.

**30. Funds domiciled in HKSAR face smaller shortfalls in cash than their foreign peers authorized to sell shares in the city.** Average liquidity shortfalls of funds domiciled in HKSAR and being unable to serve redemption shocks completely with cash remained in the severe scenario about one third lower than those observed for their international peers. For the mild scenario they ranged around a similar level than the ones for international funds marketing their shares in HKSAR. On average, respective liquidity shortfalls were between 9.1 and 11.8 percent of assets for a severe redemptions shock and in similar but around 1.5 (2.5) percentage points lower ranges for the medium (mild) scenario (Fig. 2.2).

**31. A weak tail of funds domiciled in HKSAR experiences particularly high liquidity shortfalls on a cash basis.** Reflecting the lower level of liquidity shortfalls on cash basis of HKSAR domiciled funds compared to their international peers, also the weak tails of funds with positive liquidity shortfalls belonging to the highest quintile of their respective industry distribution start at lower levels (Fig. 2.6). For the severe scenario funds contributing to the highest shortfall quintiles feature at least shortfalls in excess of 12 percent of their assets, while for the medium and mild scenario respective funds display at least shortfalls in excess of 8 percent of their assets. As funds of funds are a substantive market segment within the industry (Table 2), their potential portfolio exposure to shares of such particularly vulnerable funds may create spillover channels within the domestic fund sector and generate amplification potential for liquidity stress.

**32. Like their international peers, funds domiciled in HKSAR tend to experience higher shortfalls, if they offer their shares in foreign currency, are smaller and are geared towards fixed-income or riskier assets.** In terms of cross-sectional distributions of their liquidity shortfalls on a cash basis, mutual funds domiciled in HKSAR display similar patterns as their international peers. Funds with primary share classes denominated in foreign currencies, particularly Asian-Pacific ones, look more prone to liquidity stress than those primarily denominated in HKD (Fig. 3.2 and 3.4). Fixed-income funds tend to face higher liquidity shortfalls on average (Fig. 3.6. and 4.2). Finally small

funds, i.e. those with NAVs below US\$500 million, domiciled in HKSAR appear more vulnerable than their larger peers (Fig. 4.4. and 4.6).

### C. Price Impact Generated by Liquidity Stress Potential of Mutual Fund Sector

**33. Compared to respective asset markets' size and turnover, liquidity shortfalls faced by the fund industry domiciled in HKSAR appear manageable, implying limited price impacts.** In Q4 2019 the HKSAR domiciled fund industry invested more than half of its portfolio in equities, of which slightly more than 40 percent were domestic stocks. Hence it would have been able to place its entire sales need of US\$15.7 billion of non-cash assets in the US\$3.8 trillion domestic stock market.<sup>8</sup> This would have resulted in an estimated 0.9 percentage points downward reaction in stock prices, a negligible reaction in particular if the low materialization probability is considered as well (Table 6).<sup>9</sup> Similarly funds domiciled in HKSAR held in Q4 2019 around 25 percent of their portfolios as fixed-income assets, of which almost 15 percent were allocated to domestic debt markets. Thus they would have been able to sell a maximum US\$8.11 billion on a market which had a size estimated from US\$277 billion to US\$365 billion.<sup>10</sup> The price impact of such sales is estimated as a 65 bps drop in respective bond prices, again a marginal reaction in a market where monthly price decreases of such size were at least occasionally observed. For equity markets these findings correspond with the results of Lam et al. 2011, who reports a nonnegligible but limited impact of market liquidity on HKSAR stocks' excess returns over the risk-free rate, as well as with the conclusion in SFC 2018 that creation or redemption of ETF shares do not materially impact turnovers in HKSAR stock markets.<sup>11</sup>

**34. Redemption-driven asset disposals of funds authorized in HKSAR generate virtually no downward moves in international stock prices and only limited downward moves in international bond prices.** For the fund industry authorized in HKSAR, a need to sell US\$52 billion in illiquid assets in international equity markets would not be likely to impact substantively on stock prices. If affected funds were to sell their entire liquid equities plus their entire liquidity shortfall on an AQLA basis, that is a volume of US\$52 billion, to global equity markets US\$, i.e. when following a waterfall liquidation strategy (Fig. 5.3), the respective price impact would be -0.1 bps and hence negligible in size. If, alternatively, the industry were to offload its entire non-cash asset shortfall of US\$180 billion in equity markets (Fig. 5.4), the impact on equity prices would be a mere -0.3 bps. Sales of funds' entire liquid bond portfolios plus their shortfalls on AQLA basis, adding up to US\$145

<sup>8</sup> Funds domiciled in HKSAR held in Q4 2019 around US\$38 billion in domestic equities, so in an extreme case they would have been able to attempt covering their entire liquidity need of US\$15.7 billion by selling domestic equities, assuming they would choose so and would not be prevented by any internal rules on their portfolio compositions.

<sup>9</sup> To compute this value the total return index of the Hang-Seng-Index was combined with the turnover value of the entire universe of stocks traded at HKEx.

<sup>10</sup> The lower value is the sum of the value of the outstanding securities issued by the Exchange Fund and the outstanding in the residual HKD debt markets. The higher value is the outstanding debt issued by HKSAR residents as reported by Bloomberg.

<sup>11</sup> See the changes in the signs of coefficients in liquidity across size and liquidity quintiles in the regression of Lam et al. (2011).

billion, to international bond markets are estimated to generate a price impact of -1.1 percent. The even stricter assumption that funds would sell assets equivalent to their entire liquidity shortfall on an AQLA basis, again US\$180 billion, in international bond markets, would reduce international bond prices by 1.3 percent (Table 6).<sup>12</sup> As monthly price movements in international equities and bonds exceed 1 percent regularly, such price reactions do not appear to impede the proper functioning of respective markets, even if not being completely negligible.<sup>13</sup>

**35.** Low sensitivities of fund flows to portfolio returns render funds' liquidity relatively invulnerable to price shocks and limit second-round effects of redemption shocks. In line with the results of past FSAPs, sensitivities of net flows to and from HKSAR funds to portfolio returns display substantive heterogeneity across the industry. While on sector average, fund flows show limited sensitivities to past fund returns, -0.007 for funds authorized in and 0.0125 for funds domiciled in HKSAR, sensitivities found for individual funds range over an interval from -0.5 to 0.5 and some 54 (60) percent of funds authorized (located) in HKSAR display non-positive sensitivities. This highlights that past returns are relevant for intra-sectoral flows, as investors use returns as a benchmark for allocating their capital to competing fund vehicles. However, past fund returns appear to be largely uninformative for the determination of aggregate flows to the entire fund industry in HKSAR. Hence, the aggregate fund sector neither appears particularly vulnerable to price shocks nor to second-round effects of redemption shocks.

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<sup>12</sup> Price impacts of pro-rata sales were not analyzed separately but would be milder than those for the concentration of asset sales on either the equity market or the bond market segments reported in the main text.

<sup>13</sup> Forced sales by funds authorized in HKSAR might motivate other funds, including funds authorized in HKSAR or others, to sell the very same assets. Such second round effects are not included in the price impacts presented. However, the probability of primary and secondary round effects of forced sales by a subset of funds exceeding the effects of synchronous forced sales by all funds licensed in HKSAR, for which price impacts are presented in Table 6, can be assumed to be negligible. Similarly, the likelihood of primary and secondary effects of synchronous sales by all HKSAR licensed funds would be even lower than the already unlikely event of a full materialization of the first round effects presented in this note. Hence, second round effects are neglected in the presented figures.

**Table 6. Hong Kong SAR: Price Impact Estimates**

Price impact estimates, (Percent of initial price)				
	Equity markets		Bond markets	
	Domestic	Global	Domestic	Global
Values Q1 2020 (authorized), Q4 2019 (domiciled)	Funds domiciled in HKSAR	Funds authorized in HKSAR	Funds domiciled in HKSAR	Funds authorized in HKSAR
Sale of non-cash assets	-0.9	-0.003	-0.6	-1.3
Waterfall sales of AQLA		-0.001		-1.1

Sources: Bloomberg L.P., Haver Analytics, HKMA, MorningStar, SFC, and IMF Staff calculations.

Note: For the computation of the Amihud ratio, trading volumes in HKSAR equity markets are gauged by the turnover in the Hang-Sen Index, those in global equity markets are proxied by the turnover in the MSCI World Index. Trading volumes in HKSAR bond markets are the ones reported by HKMA for all CMU issues in HKSAR's secondary markets, while those for international bond markets are approximated by scaling up trading volumes in shares of an index ETF following the Barclays Global-Aggregate Total Return Index for international debt markets with the market capitalization ratio of the ETF and the index. Such scaling up may result in a downward bias in the price sensitivity in international debt markets, as the secondary market in respective ETF shares may be more active than the secondary markets for its portfolio components. For the waterfall sale scenarios, however, sale volumes were set to liquid assets available for sale in the respective asset class plus the volume of remaining sales needs in illiquid assets, irrespective which asset class would be used for these sales. The reported results are hence upward biased estimates for price impacts. Nonetheless, it should be acknowledged that potential second round effects or asset sales by funds not facing liquidity shortfalls as well as other entities could augment total price impacts, even of the likelihood of the accumulation of such event is deemed to be very small.

## CONCLUSIONS AND POLICY RECOMMENDATIONS

**36. Open-end mutual funds authorized for selling their shares in HKSAR and/or domiciled in HKSAR can be vulnerable to liquidity stress.** Under the severe scenario of redemptions equal to the worst percentile of each fund's history of monthly net flows from January 2000 to October 2020, funds authorized in HKSAR faced an average liquidity shortfall in illiquid assets ranging between 2 and 5 percent of their assets in the 4 years prior to March 2020. Based on Q1 2020 values, the US\$1.6 trillion industry would have been forced to sell US\$52 billion of potentially illiquid assets. If only cash and its equivalents are regarded as liquid the respective shortfall would have been US\$180 billion. Funds domiciled in HKSAR displayed average liquidity shortfalls on a cash basis of 7 to 10 percent of their portfolios, which translated in Q4 2019 into the need to sell US\$15.7 billion in non-cash assets for the entire US\$160 billion industry domiciled in HKSAR. Relative to these average estimates, primary fund shares denominated in foreign currencies face somewhat higher shortfalls than HKD denominated primary fund shares, while smaller funds display higher shortfalls than larger funds. Fixed-income funds and funds geared towards riskier asset markets appear more prone to liquidity stress. Finally, the weaker tails of the fund industry are particularly vulnerable, with respective funds authorized in HKSAR forced to sell non-cash assets of more than

16 percent of their portfolios, while their domestic peers would need to sell non-cash assets in excess of 12 percent of their portfolios.

**37. Forced asset sales, owing to funds' liquidity shortfalls, are unlikely to generate asset price fluctuations beyond levels observed at least occasionally.** Liquidity shortfalls force funds, both those domiciled in HKSAR and those holding a license for marketing their shares in HKSAR, to sell assets: in the most severe scenario funds authorized in HKSAR need to sell US\$52 billion in illiquid assets and US\$180 billion in non-cash assets, while the smaller fund industry domiciled in HKSAR needs to sell US\$15.7 billion in non-cash assets. As non-cash asset sales exceed maximal waterfall sales of liquid and illiquid assets in size, they define generous estimates for the price impacts implied by respective sales. For funds authorized in HKSAR these are estimated as -0.3 bps in global equity and -130 bps in global bond markets. For funds having their domicile in HKSAR price impacts on local markets are estimated to -90 bps for equity and -65 bps for bond markets. Price fluctuations of such size are frequently observed under normal market conditions.

**38. Residual risk pockets within the HKSAR fund industry call for regulatory and supervisory attention.** Notwithstanding the limited potential for adverse price impacts, direct portfolio exposure of other financial institutions, including funds of funds, committed credit lines and reputational spill-over effects, including within fund families, imply that liquidity stress can still spread across the industry and beyond. The presence of weaker funds with extraordinarily high liquidity shortfalls generates hence potential for pockets of financial stability risks. Recent trends to increasing risk acceptance in HKSAR's fund sector, including the city's fixed-income funds, corroborate such risk potential. HKSAR authorities should therefore continue to actively engage in prudential monitoring, prevention and mitigation. Recent initiatives in reaction to financial market stress generated by the COVID-19 pandemic, including the stepping up of SFC's monitoring of liquidity in public HKSAR funds via enhanced reporting duties of funds, in particular also covering data on large redemptions, provide encouraging examples for the responsiveness of SFC in this respect. On the basis of this enhanced monitoring and surveillance SFC could trace the brunt of almost US\$2 billion outflows, or around 4 percent of NAV, experienced by the bond and mixed fund industry domiciled in HKSAR during March 2020 to a small subset of five funds, all of which were able to avoid redemption suspensions through the use of liquidity risk management tools. Even though, such risk concentration on a few entities suggests the need for constant vigilance in the surveillance of financial stability risks.

**39. International links have the potential to add to liquidity vulnerabilities of funds providing their services in HKSAR.** In the context of HKSAR's highly internationally connected financial system, higher liquidity vulnerabilities found for funds not primarily denominated in HKD indicate the relevance of FX risks and exposures to foreign liquidity conditions for funds offering their services in and/or operating in HKSAR. Another vivid example are substantial portfolio exposures of HKSAR domiciled bond funds to MC's debt markets, also in the ETF space. Similarly, considerable correlations found between the returns of more vulnerable funds domiciled in HKSAR and those of their peers active in HKSAR but domiciled in either Luxembourg and Ireland (cross-correlations between the asset-weighted average returns of these groups stand at 0.77 and 0.68 respectively) point to the potential for spillover effects between particularly vulnerable funds.

**40. The presence of a sizeable fund industry neither domiciled nor directly regulated domestically imply some financial stability risks for HKSAR.** Beyond very limited potential for liquidity stress induced adverse price reactions, the presence of risk pockets in the fund industry and spillovers from funds active but not domiciled in HKSAR to funds domiciled there implies a set of specific financial stability risks for HKSAR. First, instances of large-scale withdrawals from distressed offshore funds active in HKSAR can generate excess liquidity at HKSAR investors, which, if domestically invested, can potentially push up asset prices, in particular in HKSAR's narrower fixed-income markets. Secondly, if involving currency conversion, such liquidity effects generate appreciation pressure for the HKD, calling for purchases of US dollars or sales of HKD by HKMA for the case that the HKD bounces at the lower end of the convertibility zone, as is did frequently since April 2020. Thereby required convertibility undertakings (CU) of HKMA tend to lower interest rates, potentially loading additional valuation risks in domestic asset prices. Thirdly, the links pointed out in paragraph 38 add spillover potential to the risk factors impacting on domestic financial stability.

**41. HKSAR authorities are encouraged to close gaps in the data required for fund liquidity risk monitoring, automate respective data collection and step up their analytic involvement in liquidity risk monitoring.** Even if there is no strong evidence for imminent systemic liquidity risks in the HKSAR mutual fund industry, supervisors and regulator are still recommended to consider a set of possible action points. This would include for domestic funds:

- a. Beyond SFC's collection of data on redemptions exceeding prespecified thresholds (daily and weekly frequency) and data on flows and liquidity profiles of fund assets (quarterly frequency), limitations in publicly available data on fund liquidity call for supervisory collection and/or dissemination of additional granular fund data. Subject to proportionality, these data could include information on portfolio compositions, portfolio components' credit ratings, liquidity metrics for assets, geographical and currency exposures. In particular the time series length of publicly available fund flow data could be extended at relatively low costs for supervisors. A best practice example for the collection and dissemination of investment funds data is available in the Brazilian securities market regulator CVM.
- b. As far as data is already collected by supervisors, potential resource restrictions in data handling could be resolved by automated procedures for data collection, data analysis and data dissemination.
- c. HKSAR authorities could further increase their analytic efforts in the evaluation of fund specific and systemic liquidity risk monitoring, with the aim to discuss respective issues with the industry and to flag sector-wide issues publicly. Currently, the SFC evaluates the potential for liquidity mismatches based on all data collected and engages in additional inquiries if a mismatch is diagnosed. Respective inquiries look into whether and how liquidity risk management tools were deployed and how potential redemptions pressures were to be managed. According to SFC the few cases in which liquidity management tools were activated so far, did not constitute any significant redemption pressures. Quantitative liquidity risk monitoring, to be developed in lock-step with international efforts on further progress in related macroprudential tools, could provide valuable complementary information for such assessment.

**42. HKSAR authorities could benefit from continued close cooperation with home supervisors of funds authorized for sale in HKSAR, but not supervised in HKSAR.**

Recommendations for specific policy action include:

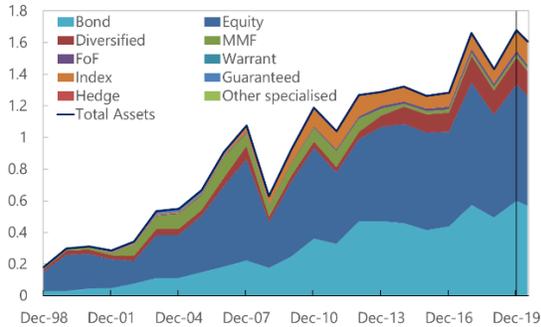
- a. The potential lack of information available to HKSAR supervisors could be resolved through enhanced data exchange arrangements with home supervisors to the extent practicable, with the aim to improve HKSAR authorities' information on and understanding of risk profiles implied for HKSAR investors invested in respective fund products. Existing MOUs with foreign home supervisors provide a framework for such data exchange, which may be extended beyond its current discretionary use.
- b. The regular exchange of analytic results and risk profile assessments with home supervisors would strengthen the information base of both parties. Such exchange could also increase the sensitivity of home supervisors to risk aspects specifically related to HKSAR investors and provide home supervisors with insights from a market fraction of their supervised entities, in which liquidity risks appear relatively limited compared to the rest of the industry.
- c. The comparatively higher vulnerability of investment funds selling their shares in HSAR, but not being supervised there, should be addressed by appropriate monitoring for spillovers of non-domestic risk to HKSAR.

**43. HKSAR authorities should continue to dedicate special monitoring attention to funds identified by liquidity stress tests as particularly vulnerable.** The SFC is encouraged to continue its practice of conducting internal in-depth analysis on funds found to be prone to elevated liquidity risks. Such analytic efforts, which could also include the evaluation of explicit and/or implicit portfolio overlaps and similar linkages, are likely to inform ways to reduce vulnerabilities from spillover from the weak tails of funds identified in the industry domiciled in HKSAR as well as in the industry authorized to sell their shares in HKSAR. Respective results could be either achieved by supervisory monitoring or by an incentive compatible and binding delegation of respective tasks, as well as the mandatory disclosure of respective results to supervisors to individual fund managers.

**Figure 1. Hong Kong SAR: Structure of Fund Industry**

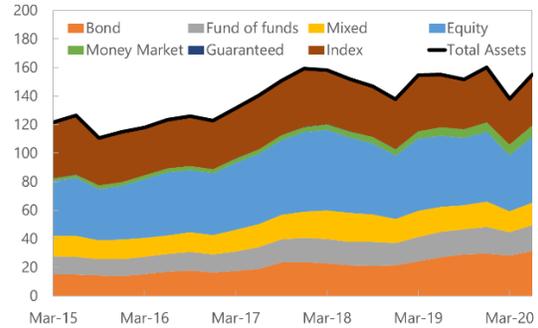
While HKSAR residents have local access to a 1.6tn fund industry...

**Assets of HKSAR Authorised Fund Industry**  
(USD trillion)



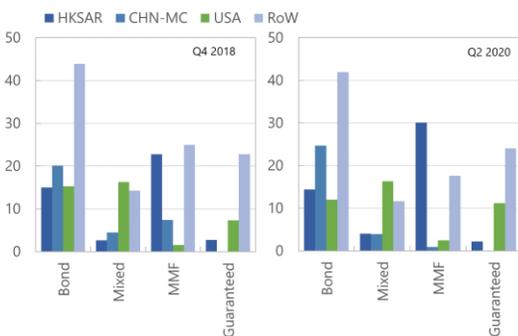
... the industry with a domicile in the city only manages close to one tenth of this volume.

**Assets of HKSAR Domiciled Fund Industry**  
(USD billion)



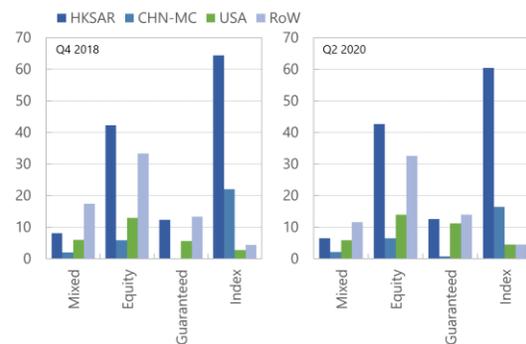
Marginal reallocations to foreign asset markets in fixed-income exposures ...

**Fixed Income Exposure by Region**  
(Percent of Assets)



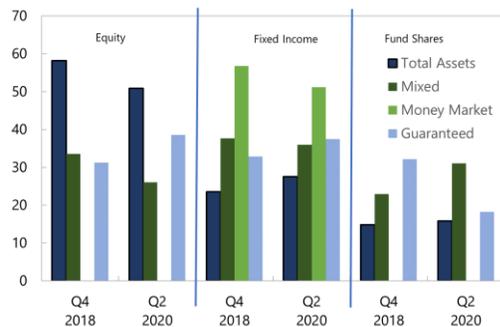
... and equity exposures of some fund sectors point to rising relevance of currency and/or foreign market risks.

**Equity Exposure by Region**  
(Percent of Assets)



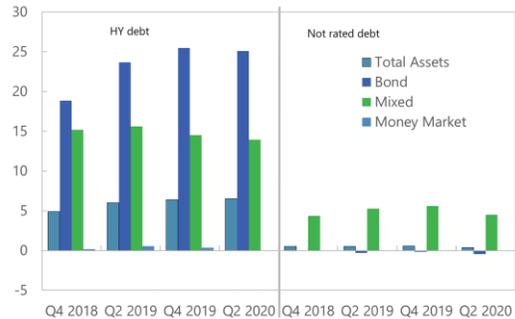
Allocations moving to fixed-income assets...

**Main Asset Class Exposure for Selected Fund Types**  
(Percent of Assets)



... and to lower debt qualities may proliferate higher vulnerability to periods of liquidity stress.

**Debt Exposure by Rating Quality**  
(Percent of Assets)



Sources: SFC and IMF Staff Calculations.

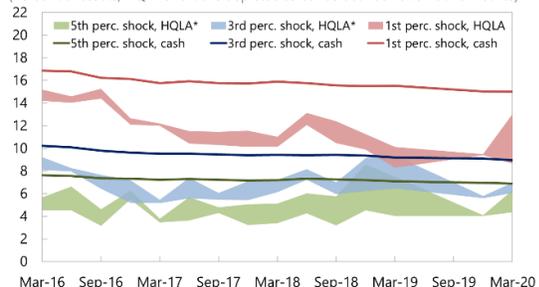
Notes: Vertical line in panel 1 denotes change from annual to semi-annual frequency. Panels 3-6 report data for selected types of funds domiciled in HKSAR.

**Figure 2. Hong Kong SAR: Main Results of Fund Liquidity Stress Test**

Average liquidity shortfalls in HQLA/cash if unable to meet redemption shocks are substantive for funds authorized in HKSAR...

**Average shortfalls if hit by redemption shock and unable to serve with cash/HQLA**

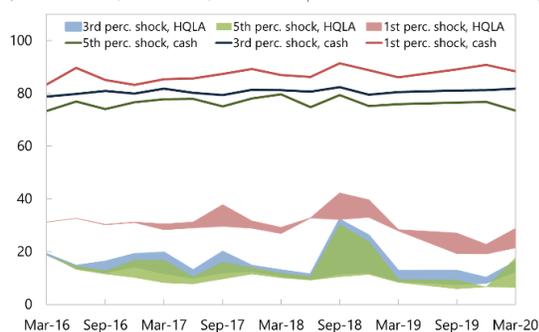
(Percent of assets, HQLA shortfalls depicted as bands between alternative metrics)



The share of fund assets affected by liquidity shortfalls remained stable and is higher for shortfalls in cash,

**Share of assets affected by liquidity shortfalls**

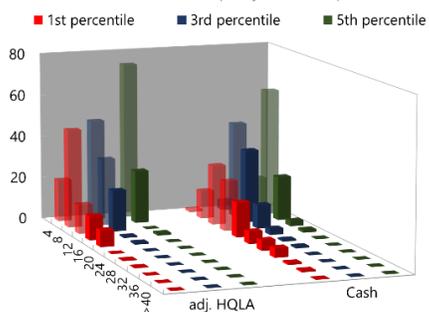
(Percent of assets, values for HQLA shortfalls depicted in bands of alternative metrics)



A tail of assets managed by HKSAR authorized funds appears particularly responsive to liquidity stress irrespective of the shortfall metrics used,...

**Empirical distributions of liquidity shortfalls, 2020: Q1**

(Y-axis: percent of affected assets; X-axis: liquidity shortfall in percent of assets)

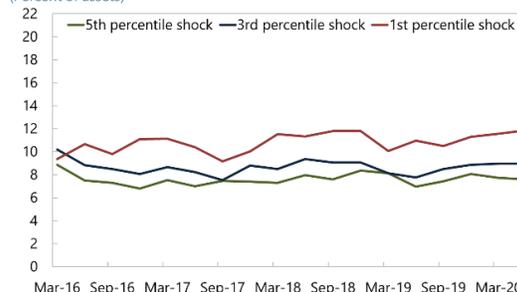


Note: Solid bars contribute to the highest quintiles of shortfalls.

... and exceed the average liquidity shortfalls on cash basis of their peers domiciled in HKSAR.

**Average shortfalls if hit by redemption shock and unable to serve with cash**

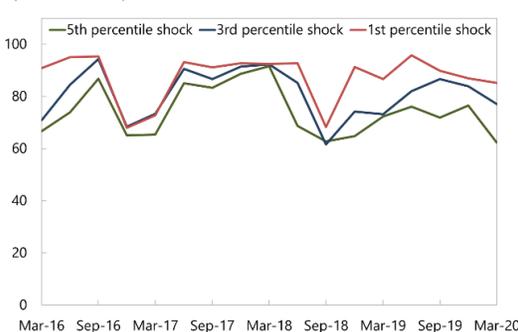
(Percent of assets)



...as cash buffers exceed HQLA buffers. Among funds domiciled in HKSAR a smaller share of assets is affected.

**Share of assets affected by cash liquidity shortfalls**

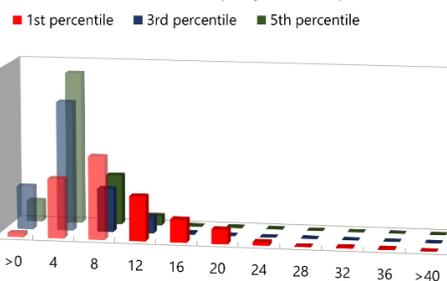
(Percent of assets)



..., with a similar pattern holding for funds domiciled in HKSAR, albeit on a lower shortfall level.

**Empirical distributions of cash liquidity shortfalls, 2020: Q1**

(Y-axis: percent of affected assets; X-axis: liquidity shortfall in percent of assets)



Note: Solid bars contribute to the highest quintiles of shortfalls.

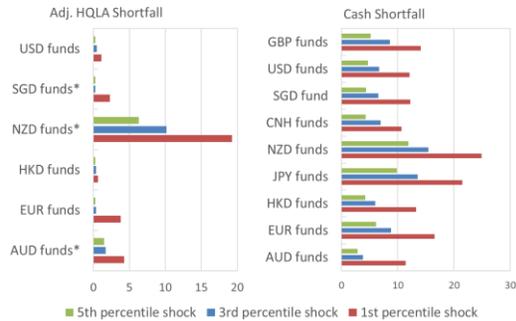
Sources: MorningStar and IMF Staff Calculations.

Notes: Panels 1, 3 and 5 report values for funds authorised in HKSAR, panels 2, 4 and 6 report values for their domestic peers. Panels 5 and 6 depict the set of funds not being able to meet redemptions. \* = Values for Q2 and Q3 2019 have been smoothed by interpolating as aggregate data were distorted by a few outliers.

**Figure 3. Hong Kong SAR: Cross-Sectional Results of Fund Liquidity Stress Test I**

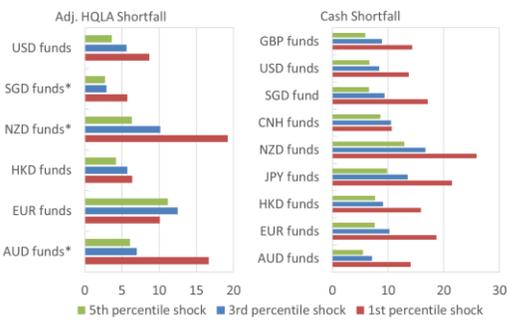
*Funds denominated in foreign currencies, especially some Asian-Pacific ones, are more vulnerable to liquidity stress...*

**Average Shortfalls if Hit by Redemption Shock, 2020: Q1**  
(Percent of assets)



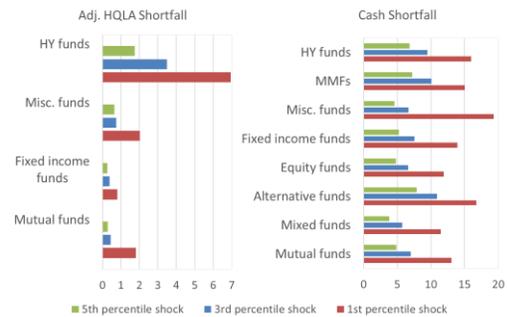
*Funds not able to serve redemption requests with HQLA (cash) and denominated in HKD need to sell less illiquid (non-cash) assets than many foreign currency funds.*

**Average Shortfalls if Hit by Redemption Shock and Unable to Serve With Cash, 2020: Q1**  
(Percent of assets)



*Funds invested in fixed income or primarily geared towards riskier portfolios are stronger affected by...*

**Average Adj. HQLA/Cash Shortfalls if Hit by Redemption Shock, 2020: Q1**  
(Percent of assets)

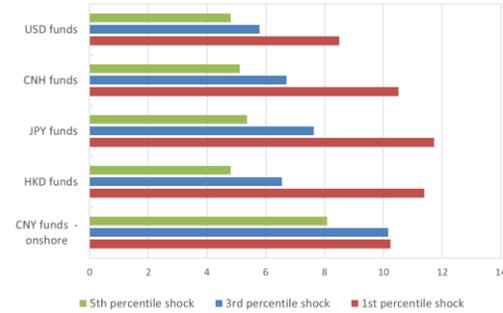


Sources: MorningStar and IMF Staff Calculations.

Notes: Panels 1, 3 and 5 report values for funds authorised in HKSAR, panels 2, 4 and 6 report values for their domestic peers. \* = values may not be representative due to low entity numbers

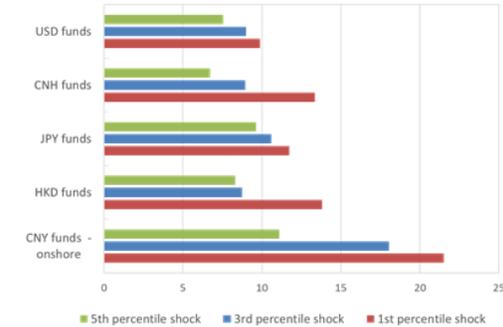
*...irrespective of whether they are domiciled in HKSAR or outside.*

**Average Cash Shortfalls if Hit by Redemption Shock, 2019: Q4**  
(Percent of assets)



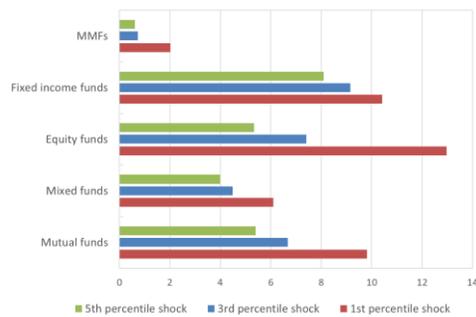
*This comparative strength of funds authorized in HKSAR and denominated in HKD does not carry over to their locally domiciled peers in all scenarios.*

**Average Cash Shortfalls if Hit by Redemption Shock and Unable to Serve With Cash, 2019: Q4**  
(Percent of assets)



*... liquidity stress than most of their peers, with this pattern holding for both funds authorized and domiciled in HKSAR.*

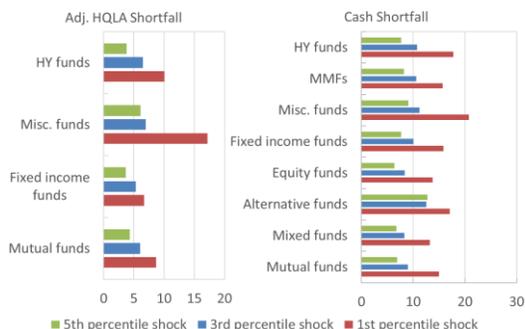
**Average Cash Shortfalls if Hit by Redemption Shock, 2019: Q4**  
(Percent of assets)



**Figure 4. Hong Kong SAR: Cross-Sectional Results of Fund Liquidity Stress Test II**

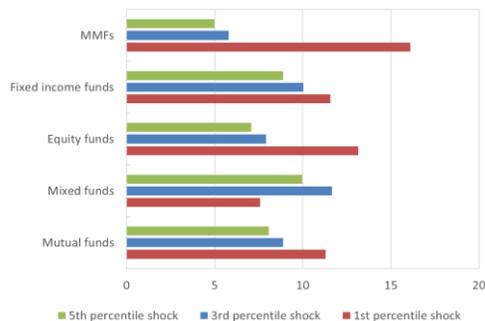
*Fixed income funds unable to serve redemption shocks with HQLA need to sell less illiquid assets than other fund types; but if unable to cover redemptions with cash ...*

**Average Shortfalls if Hit by Redemption Shock and Unable to Serve, 2020: Q1 (Percent of assets)**



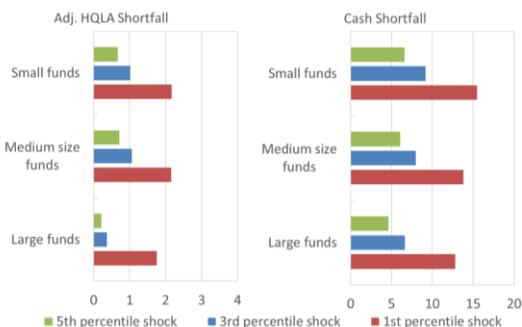
*... they do need to liquidate more non-cash assets as other types. Similarly, their HKSAR domiciled peers are forced to sell more non-cash assets than other fund types.*

**Average Shortfalls if Hit by Redemption Shock and Unable to Serve With Cash, 2019: Q4 (Percent of assets)**



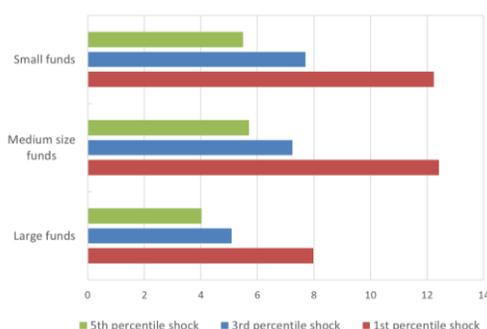
*Smaller funds authorized in HKSAR are more vulnerable to liquidity stress than their larger peers, ...*

**Average Shortfalls if Hit by Redemption Shock, 2020: Q1 (Percent of Assets)**



*... with the same pattern also holding for funds domiciled in HKSAR*

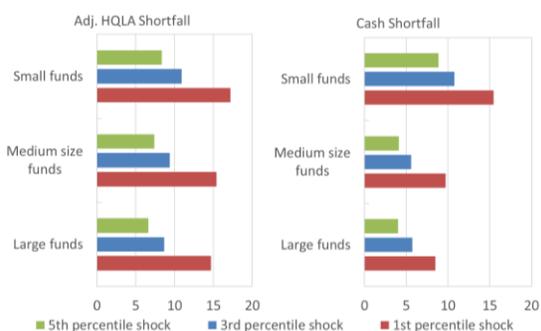
**Average Cash Shortfalls if Hit by Redemption Shock, 2019: Q4 (Percent of assets)**



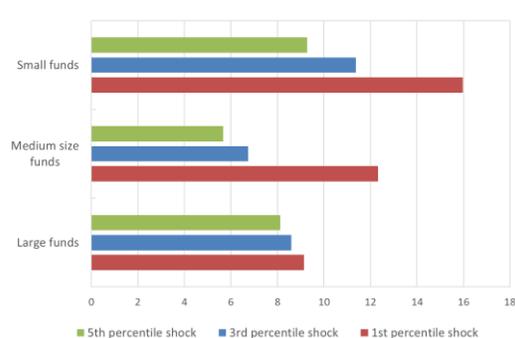
*Among funds authorized in HKSAR, smaller funds tend to need to sell more illiquid (non-cash) assets on top of ...*

*... their HQLA (cash) buffers in order to meet redemption shocks. Funds domiciled in HKSAR display a similar pattern.*

**Average Shortfalls if Unable to Serve Redemption Shock, 2020: Q1, (Percent of Assets)**



**Average Shortfalls if Hit by Redemption Shock and Unable to Serve with Cash, 2019: Q4 (Percent of assets)**



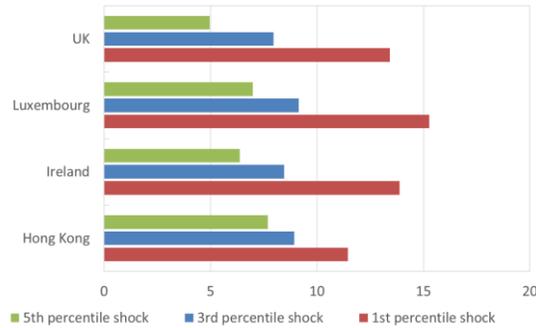
Sources: MorningStar and IMF Staff Calculations.

Notes: Panels 1, 3 and 5 report values for funds authorised in HKSAR, panels 2, 4 and 6 report values for their domestic peers. Large funds = funds with assets over US\$1 billion, Medium size funds = funds with assets from US\$0.5 billion to US\$1 billion, Small funds = funds with assets up to US\$0.5 billion

**Figure 5. Hong Kong SAR: Additional Results of Fund Liquidity Stress Test**

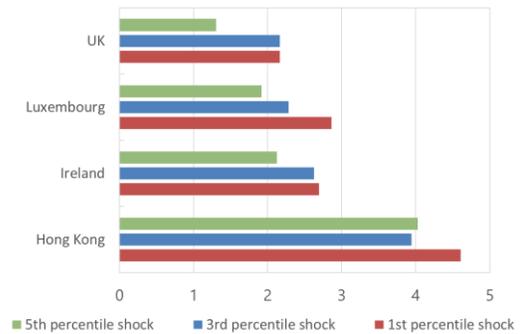
*HKSAR domiciled funds appear less vulnerable to severe liquidity stress than European funds marketed here, ...*

**Average Cash Shortfalls if Unable to Serve Redemption Shock, 2020: Q1** (Percent of assets)



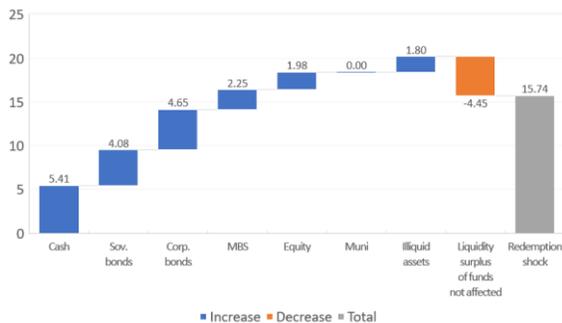
*... as they hold higher cash buffers.*

**Average cash position if not able to serve redemption shock, 2020: Q1** (Percent of assets)



*Funds authorized in HKSAR face little need to sell illiquid assets as they can dispose liquid bonds and equities, ...*

**Composition of Waterfall Sales in Assets Eligible for AQLA, Funds Authorized in HKSAR, 2020: Q1** (Percent of assets)



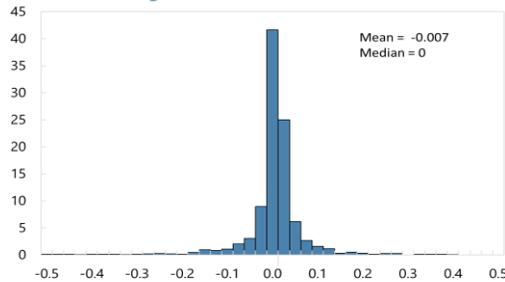
*... but need to sell substantive amounts on non-cash assets when hit by redemption shocks.*

**Composition of Waterfall Sales in Non-cash Assets, Funds Authorized in HKSAR, 2020: Q1** (Percent of assets)



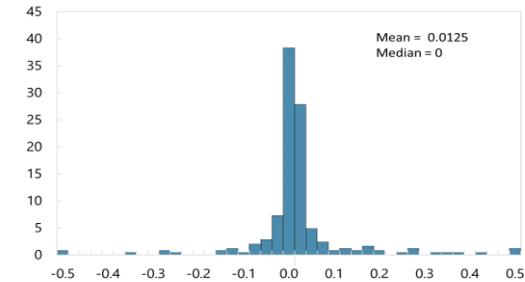
*The average fund authorized for selling shares in HKSAR displays little sensitivity of its flows to past returns, ...*

**Distribution of Estimated Flow Sensitivity to Past Returns, Funds registered in HKSAR**, (Percent of funds)



*... and similarly for a majority of funds domiciled in HKSAR flows do not react positively to past returns.*

**Distribution of Estimated Flow Sensitivity to Past Returns, Funds located in HKSAR**, (Percent of funds)



Sources: MorningStar and IMF Staff Calculations.

Notes: Panels 3-4 report data for the severe scenario. Panels 5-6 report OLS estimates of coefficients for past returns evaluated at the 1st percent significance level in fund-specific regressions of net flows on contemporaneous returns, a dummy for positive contemporaneous returns, the interaction of these two, the first lag in returns, the first lag in net flows, the ln of NAV, the ln of squared NAV, the interaction of the first lag in returns with the ln of NAV and a constant. At least 29 observations are required to include a fund into the sample.

## References

- Amihud, Yakov 2002, "Illiquidity and Stock Return: Cross-Section and Time-Series Effects", *Journal of Financial Markets*, Vol. 5 No. 1, pp.31-56.
- HKMA, 2019, "Half-Yearly Monetary and Financial Stability Report", September 2019, Hong Kong SAR.
- IMF, 2019a, "Global Financial Stability Report October 2019 – Lower for Longer", Washington DC.
- IMF, 2019b, "Thailand – Financial Sector Assessment Program: Technical Note – Risk Assessment", IMF Country Report No. 19/318", Washington DC.
- IMF, 2018, "Brazil – Financial Sector Assessment Program: Technical Note on Stress Testing and Systemic Risk Analysis", IMF Country Report No. 18/344", Washington DC.
- Lam, Keith S.K. and Lewis H.K. Tam 2011, "Liquidity and Asset Pricing: Evidence from The Hong Kong Stock Market.", *Journal of Banking & Finance*, Vol. 35, pp. 2217-2230.
- SFC, 2019, "Asset and Wealth Management Activities Survey 2018", Hong Kong.
- SFC, 2018, "Research Paper on Hong Kong ETF Market and Topical Issues in the ETF Space", Hong Kong.