IIMB-WP No. 605/2020

WORKING PAPER NO: 605

Financial Fragility in Housing Finance Companies

V. Ravi Anshuman
Professor
Finance & Accounting
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
anshuman@iimb.ac.in

Rajdeep Sharma
Doctoral Student
Finance & Accounting
Indian Institute of Management Bangalore
Bannerghatta Road, Bangalore – 5600 76
rajdeep.sharma18@iimb.ac.in

Year of Publication – March 2020

We acknowledge the helpful comments on this paper from Dr. Krishnamurthy Subramanian, the Chief Economic Advisor of India.

Financial Fragility in Housing Finance Companies

Abstract

This study examines the financial fragility of the Non-Banking Housing Finance Companies (HFCs) sector. We show that the liquidity crunch in HFCs stemmed their over-dependence on short-term wholesale funding. While such reliance worked well in good times, it generated significant short-term debt rollover problems for HFCs during times of stress. The root cause of the inability of HFCs to roll over commercial paper (CP) subscribed by the Liquid Debt Mutual Fund (LDMF) sector was the exacerbation of the ALM problem due to asset side shocks. Anticipating defaults, investors in the CP market resorted to excessive redemptions, which, in turn, exacerbated the rollover risk of HFCs. We develop a robust tool (Health Score) to estimate financial fragility in an HFC and find that it can predict the constraints on external financing (or rollover risk) faced by these firms.

Keywords: shadow banking, HFC, liquid debt mutual funds, rollover risk, redemption risk, short-term wholesale funding, asset liability mismatch, financial and operating resilience, health score, cumulative abnormal returns

JEL Classification: G01, G14, G23, C23

1. INTRODUCTION

To quote (Ghosh et al., 2012), "Shadow banking comprises a set of activities, markets, contracts and institutions that operate partially (or fully) outside the traditional commercial banking sector and are either lightly regulated or not regulated at all. A shadow banking system can be composed of a single entity that intermediates between end-suppliers and end-users of funds, or it could involve multiple entities forming a chain". Shadow banks do not have explicit access to central bank liquidity. The shadow banking system is highly levered with risky and illiquid assets while its liabilities disposed to "bank runs".

The Non-Banking Financial Companies (NBFC) sector is lightly regulated as compared to the traditional banking system consisting of public and private sector banks and other financial institutions. However, the regulation in NBFC sector has evolved over time with prudential norms discouraging deposit-taking by NBFC (Reserve Bank of India (RBI), 1998) and encouraging the entry of non-deposit-taking NBFCs (RBI, 2006). The combination of these two effects has led to a steady decline in the share of deposits and increase in wholesale funding in the funding sources of the NBFCs. The wholesale funding sources of the NBFCs comprise mainly of banks (primarily via term loans and rest through non-convertible debentures and commercial paper) and debt mutual funds (via non-convertible debentures and commercial paper).

The liquidity crunch in the shadow banking system in India took shape in the wake of defaults on loan obligations by major NBFCs. Two subsidiaries of Infrastructure Leasing & Financial Services (IL&FS) defaulted in the period from June to September 2018, while Dewan Housing Finance Limited (DHFL) defaulted in the period from June to August 2019. Both these entities defaulted on non-

convertible debentures and commercial paper obligations for amounts of approximately Rs. 1500-1700 crores.

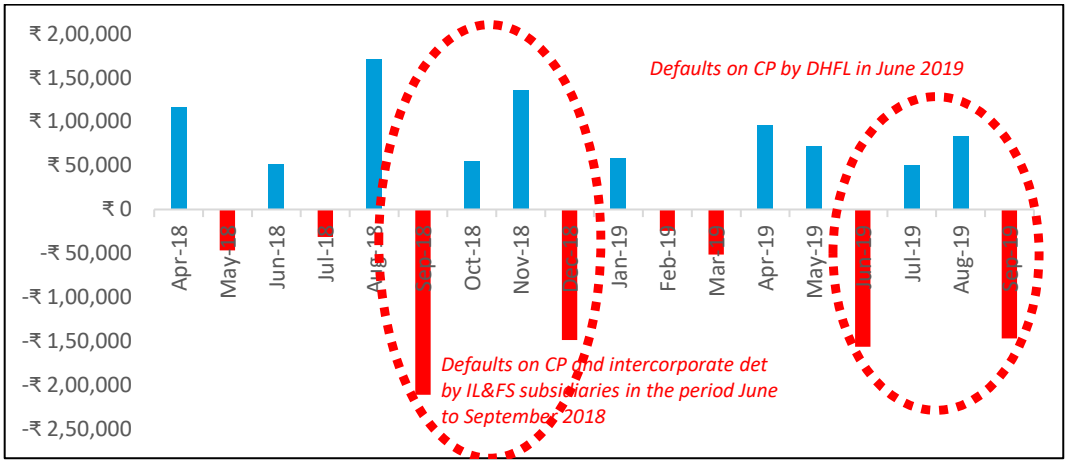
IL&FS and DHFL defaulted because they were unable to rollover their commercial paper and non-convertible debenture obligations when payments were due, and they were not able to arrange funding through alternate sources. Every NBFC faces Rollover Risk to some extent due to uncertainty in the future evolution of interest rates or market conditions. Rollover Risk is, therefore, a key source of risk to the financial stability of individual NBFC and to the shadow banking system in general as this risk can quickly spill over to the wider sector due to the interconnectedness to the other segments of the financial sector, and eventually to the real sector. Given the short tenor of commercial paper compared to non-convertible debentures, Rollover Risk is largely driven by the inability of a financial firm to roll over commercial paper, which is subject to renewal on a frequent basis.

In response to the defaults, mutual funds started selling off their investments in the NBFC sector to reduce exposure to stressed NBFCs. A case in point is DSP Mutual Fund selling DHFL commercial papers (CPs) worth Rs. 300 crores at a steep discount in September 2018.[1]

Panic-stricken investors in debt mutual funds started pulling out their investments in these funds rapidly. Coinciding with the news of defaults by IL&FS and DHFL being known to the wider market, the months of September 2018 and June 2019 saw the highest net outflows from liquid debt mutual funds (LDMFs) and money market funds, as shown in Figure 1.

[1] Economic Times article titled "DHFL Paper Sale by DSP triggered panic" dated 22nd September 2018.

Figure 1: Net Inflows – Liquid Debt Mutual Funds (LDMFs) & Money Market Funds (Rs. Crore)



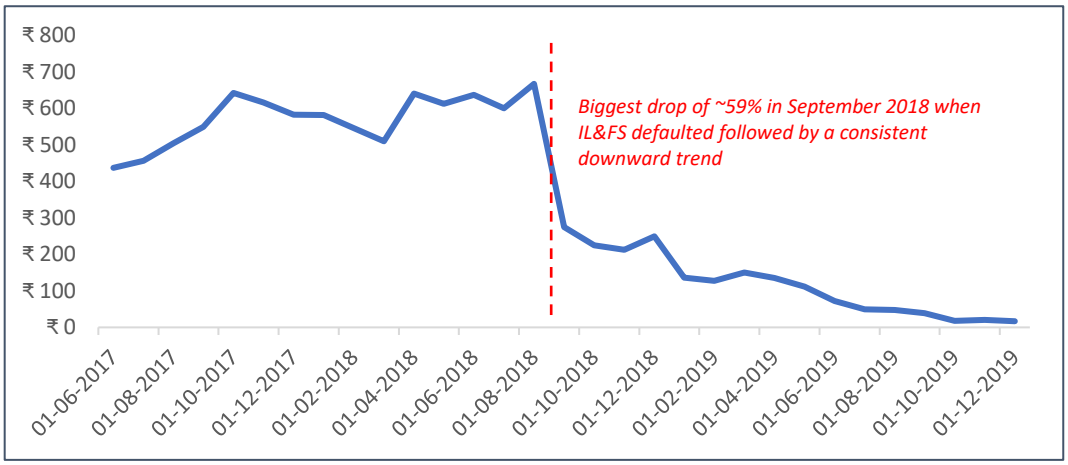
Source: ACE-MF Database, based on a sample of prominent LDMFs

On June 4, 2019, the net asset value of debt funds, which held debt instruments issued by DHFL, fell by 53% in one day when news about its default became public.[2] The drop in net asset value was due to the twin effects of debt mutual funds writing off their investments in stressed NBFCs and asset sales at fire sale prices to meet unexpected high redemptions.

The impact of these defaults was not limited to debt markets. There was a sharp decline in the equity prices of DHFL as equity market participants anticipated repayment troubles at these firms a few months in advance of actual defaults. As illustrated in Figure 2, DHFL had a consistent downward trend in equity prices from May 2018. Interestingly, the plot shows that DHFL's equity price dipped by ~59% in September 2018 even though actual defaults eventually happened much later in June 2019. Equity investors feared that the high exposure of DHFL to IL&FS could further stretch the finances of the housing finance company.

[2] NewsClick article titled "Mutual Funds in Trouble as Housing Finance Firm DHFL Defaults on Debt Repayment" dated 6th June 2019.

Figure 2: Trend in Equity Price (DHFL)

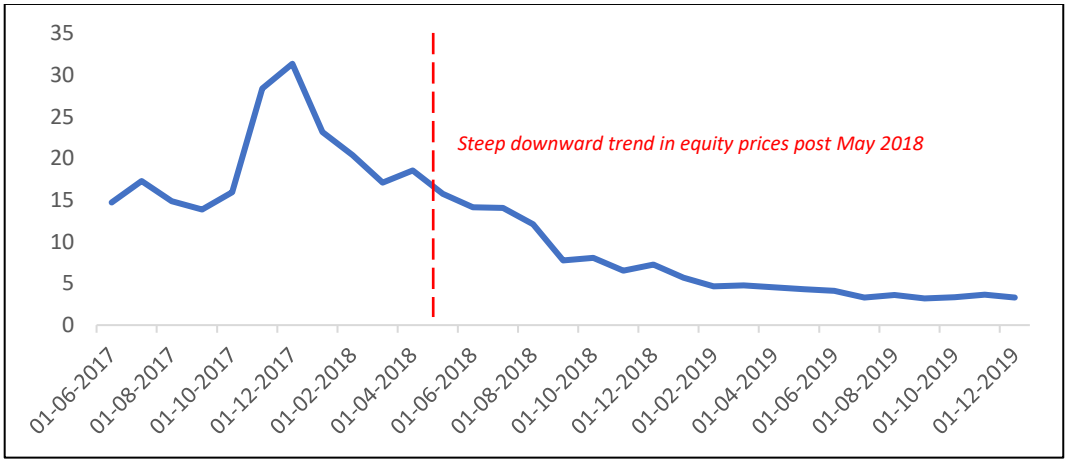


Source: Bloomberg

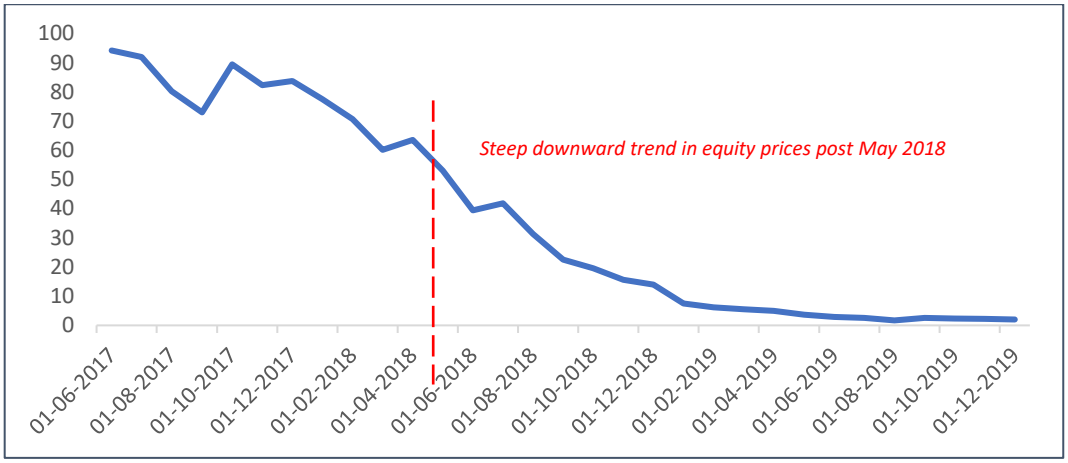
Figure 3 illustrates the trend in equity prices for the three listed subsidiaries of IL&FS. All of them exhibited a consistent downward trend around and post defaults by the IL&FS subsidiaries.

Figure 3: Trend in Equity Price (July 2017- December 2019)

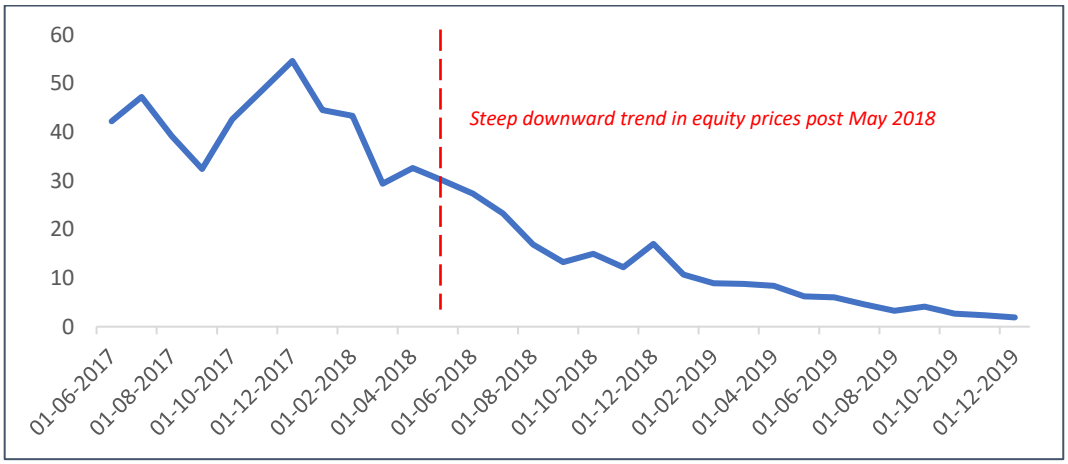
IL&FS Investment Managers



IL&FS Transportation Networks Ltd.



IL&FS Engineering and Construction Company Ltd.



Source: Bloomberg

We, therefore, find evidence that both debt and equity investors suffered a massive erosion in wealth due to the defaults. To get a sense of the quantum of losses, debt mutual funds with exposure to IL&FS lost approximately Rs. 4000 crores after adjusting for recoveries in the aftermath of defaults.[3] Debt mutual funds, facing increasing redemptions, were hesitant to finance the NBFC sector. This, in

[3] LiveMint article titled "Debt Mutual Funds: Quantum of Loss and Solace" dated 29th April 2019.

turn, led to the difficulty of NBFCs to raise funds, which took a toll on the overall credit growth in the Indian economy and a decline in GDP.

Given the significant economic impact of the liquidity crisis on the national economy, it would be a fruitful exercise to investigate whether there were any early warning signs of stress in the NBFC sector. Our focus in this paper is on one of the most important segments of the NBFC sector in India, namely, Non-Banking Housing Finance Companies (HFCs).

In this paper, we analyse the Rollover Risk of a sample of HFCs with the objective of identifying the firms that are most vulnerable during periods of liquidity crunch in the wholesale funding markets. We develop an index to estimate the financial fragility of the HFCs and find that it can predict the constraints on external financing (or refinancing risk) faced by these firms. Using the index, we also estimate the financial fragility of the HFC sector. We call this index the Health Score, which ranges between -100 to +100 with higher scores indicating higher financial stability of the firm.

The Health Score employs information on the key drivers of refinancing risk such as Asset Liability Management problems (ALM), excess reliance on short-term wholesale funding (Commercial Paper) and balance sheet strength of the HFCs. We find that the level of interconnectedness of the HFC sector with the LDMF sector is too low to affect refinancing risk of HFCs, unlike the Retail-NBFC sector which was excessively interconnected (Anshuman et al., 2020). We demonstrate that the Health Score can serve the critical role of predicting refinancing related stress faced by the financial firms in advance. It can serve as an important monitoring mechanism to prevent such problems in future. Furthermore,

disaggregating the components and examining their trends can shed light on how to regulate HFCs.

On running fixed-effects panel regression models of change in Health Score on second quarter Cumulative Abnormal Returns (Q2_CAR) of the HFC stocks, we find statistically and economically significant results. Specifically, we observe that change in Health Score is a significant predictor of future abnormal returns of these stocks.

Other than its utility as a leading indicator of stress in the HFC sector, the Health Score can also be used by policy makers to allocate scarce capital to stressed HFCs in an optimal way to alleviate a liquidity crisis.

To summarize, redemption pressure faced by debt mutual funds is akin to a "bank run", which is a characteristic of any crisis in the financial sector. The redemption pressure gives rise to refinancing risk (Rollover Risk) for HFCs, thereby affecting the real sector. The extent of refinancing risk faced by HFCs is fundamentally driven by their reliance on short-term wholesale funding. We analyze the mechanisms through which the reliance on short-term wholesale funding is manifested with an aim to develop a quantifiable measure (Health Score) that can predict stress in the HFC sector.

The rest of the discussion is organized as follows. Section 2 posits a framework for understanding the determinants of Rollover Risk faced by any NBFC. Section 3 provides a brief description of our dataset. Section 4 details the key drivers of Rollover Risk of the HFC sector. Section 5 explains the methodology of computing Rollover Risk of HFCs, illustrates the trends in Rollover Risk for HFCs. We also

present the econometric model and the key results. Section 6 concludes with important policy implications from our analysis.

2. ROLLOVER RISK – POTENTIAL DETERMINANTS

In the context of the liquidity crisis in the NBFC sector, we build a conceptual framework based on the following insights:

(i) NBFCs raise capital in the short-term (1-3 months) commercial paper (CP) market at a lower cost, as compared to the long term (5-10 years) non-convertible debenture (NCD) market but face the risk of rolling over the CP debt at short frequencies of a few months.[4] The frequent repricing exposes NBFCs to the risk of facing higher financing costs and, in the worst case, credit rationing. We refer to such refinancing risks as Rollover Risk.

(ii) When an asset-side shock reduces expected future cashflows for an NBFC, it adversely affects the ALM problem in the NBFC and thereby risk perceptions about the NBFC.

(iii) Such a shock amplifies the NBFC's problems when its liability structure is over-dependent on short-term wholesale funding such as commercial paper, which requires frequent refinancing.

(iv) The LDMF sector is a primary source of short-term wholesale funds in the NBFC sector.[5] This interconnectedness is a channel for the transmission of

[4] For one of the largest HFCs, the rate of interest on CP was 7.01% - 8.00% while that on NCD was 10.01% – 11.95%, as of 31 March 2019.

[5] The share of CP issued by NBFCs that are subscribed to by mutual funds was the highest (79.7% as of 31 March 2019) among all classes of subscribers (Retail-NBFC Credit Trends: ICRA Report, July 2019). Among mutual funds, LDMFs have the highest share of investments in CP (~80% on average), which is highlighted in Figure 11, sub-section 3.2. Together, these two facts suggest that the LDMF sector is a primary source of short-term wholesale funds in the NBFC sector.

systemic risk from the NBFC sector to the LDMF sector. Shocks in the NBFC sector may lead to concerted redemptions by investors in the LDMF sector at fire-sale prices. Faced with this situation, LDMFs may withdraw funding to the NBFC sector when refinancing is due. Such a reinforcing cycle can quickly turn into a vicious cycle, leading to a liquidity crisis in the NBFC sector. More technically, systemic risk is transmitted from the NBFC sector to the LDMF sector and vice-versa, i.e., interconnectedness causes systemic risk transmission between an NBFC sector and the LDMF sector.

(v) In general, if the quantum of defaults is large enough (as was the case with IL&FS and DHFL), it can spread panic among the investors in CP leading to concerted redemptions in the LDMF sector (systemic risk within the LDMF sector). Moreover, the liquidity crunch in an NBFC adversely affects risk perceptions about other NBFCs when they are due for rolling over their CP obligations. Hence, Rollover risk, initially contained within a few NBFCs may rapidly spillover and affect the entire NBFC sector (systemic risk within the NBFC sector).

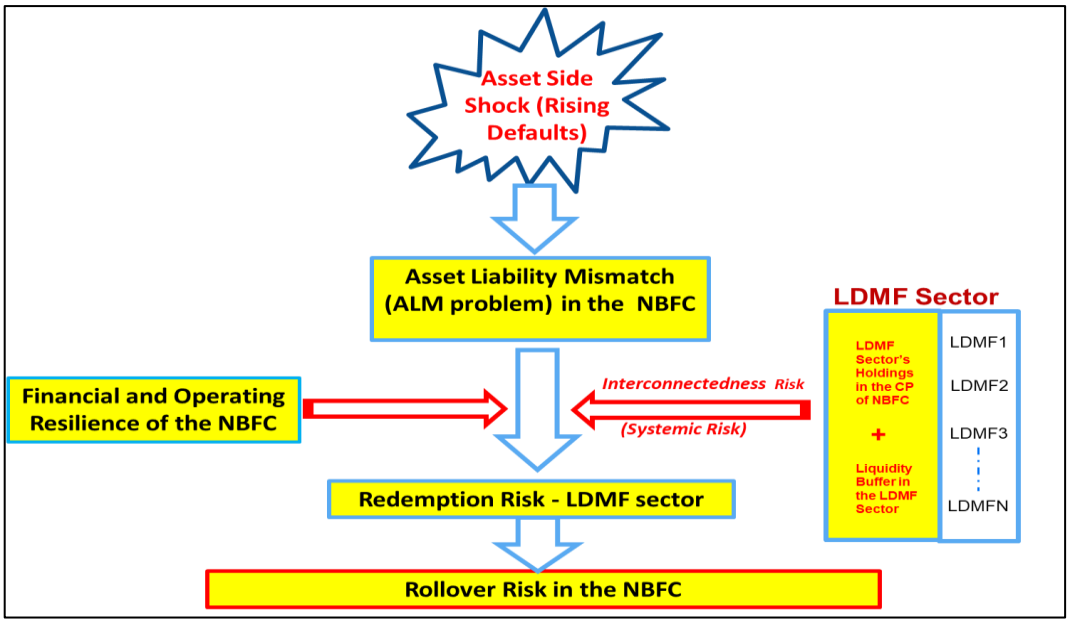
(vi) The key drivers of the redemption problem in the LDMF sector, and thereby the Rollover Risk problem in the NBFC sector, are threefold: The first risk stems from the magnitude of the ALM problem in the NBFC. The second risk originates from the interconnectedness of the NBFC with the LDMF sector. This risk depends on the extent to which an NBFC relies on short-term wholesale funding and the liquidity buffers in the LDMF sector to absorb redemption pressure. The third risk stems from the inherent resilience of the NBFC, as reflected in the strength of the balance sheet, which allows it to absorb shocks in the first place.

(vii) These three risks work in tandem to cause Rollover Risk. At the time of refinancing their CP obligations, the NBFCs having stronger balance sheets are successful in rolling over CPs, albeit at a higher cost. Other NBFCs with weaker balance sheets face higher default probabilities and find it difficult to access the CP market at affordable rates or are unable to raise money at all, i.e., they are unable to avoid default.

(viii) At the most fundamental level, the root cause of the liquidity crisis in the NBFC sector can be traced to the over-dependence of NBFCs on the short-term wholesale funding market. This factor works through two channels, a direct channel and an indirect channel. First, an increase in short-term wholesale funding causes a direct effect by increasing the amount of funding that is subject to frequent repricing, and therefore, Rollover Risk. Second, there are indirect effects in that an increase in short-term wholesale funding influences the two key drivers of Rollover Risk - it worsens the ALM mismatch problem and increases the degree of interconnectedness of the NBFC sector with the LDMF sector. In addition, if the NBFC's balance sheet strength is suspect, Rollover Risk is further exacerbated. In short, over-dependence on short-term wholesale funding has direct and indirect impact on Rollover Risk.

Figure 4 illustrates the drivers of Rollover Risk in the NBFC sector. Redemptions pressures in the LDMF sector are exacerbated when NBFCs face an asset-side shock and experience an ALM problem, which gets compounded due to interconnectedness and lack of balance sheet resilience. Faced with redemption pressures, the LDMF sector is reluctant to roll over loans to the NBFC sector (Rollover Risk), causing a liquidity crunch in the NBFC sector.

Figure 4: Rollover Risk Schematic (NBFC Sector)

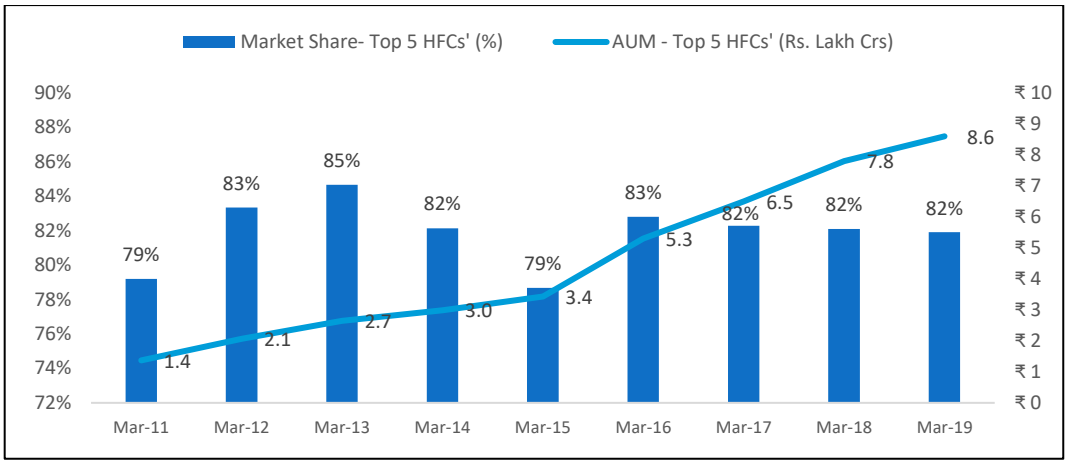


3. DATA

3.1. HFCs

The five largest HFCs considered in this paper are Housing Development Finance Corporation (HDFC), LIC Housing Finance (LICHFL), India Bulls Housing Finance (IBHFL), Dewan Housing Finance (DHFL) and PNB Housing Finance (PNBHFL). From Figure 4, we see that the five HFCs control on average ~82% of the non-banking housing finance sector with an on-book portfolio of INR 8.6 trillion. These five HFCs, therefore, are representative of the non-banking housing finance sector in India. Figure 5 plots the market share and Assets under Management (AUM) of the five largest HFCs in our sample.

Figure 5: Market Share & AUM (Rs. Crores)



Source: Indian Mortgage Finance Market: ICRA Reports, November 2018, March 2019, June 2019.

In addition to data on ALM, we collect data on several other metrics from the annual reports of these five HFCs from March 2011 till March 2019. Summary Statistics for the sample of five HFCs is reported in Table 1.

Table 1 : Summary Statistics (HFCs)

The following table presents the summary statistics of key balance sheet metrics of the five largest HFCs from March 2011 till March 2019. Loan Book is the total loans outstanding in INR crores. CP as a % of Borrowings is the share of commercial paper in borrowings. Housing Loan (% of Loan Book) is the share of loans given to individuals for purchase of property as a proportion of total loan book. The remaining metrics are self-explanatory. All the metrics are computed as of 31st March in each financial year.

Variables	Obs.	Median	Mean	Std. Dev	Min.	Max.
Loan Book (Rs. Crs)	45	77,813	1,08,063	1,03,469	3,167	4,61,913
CP as a % of Borrowings	45	5.56%	6.10%	5.25%	0.00%	19.20%
Cash as a % of Borrowings	45	3.20%	4.44%	4.46%	0.29%	21.48%
Housing Loan (% of Loan Book)	45	73.04%	77.12%	9.48%	61.47%	96.00%
Gross NPA (% of Loan Book)	45	0.77%	0.76%	0.32%	0.20%	1.84%
Capital Adequacy Ratio (%)	45	16.67%	16.86%	2.28%	12.55%	21.60%

All the five HFCs in our sample were listed on National Stock Exchange (NSE) or Bombay Stock Exchange (BSE) or both. IBHFL got listed by the end of fiscal year 2012 and PNBHFL got listed by the end of fiscal year 2016 while the other three HFCs were listed prior to the start of our sample period. For our regression analysis, we collect data on weekly stock prices of these five HFCs starting from

March 2011 till March 2019. IBHFL was listed in 2012 while PNBHFL was listed Concurrently, we also collect data on NIFTY 500 index for computing abnormal returns for these stocks. The source of data for the equity prices is Bloomberg.

3.2. Liquid Debt Mutual Funds

For understanding the degree of interconnectedness of the HFC sector with the LDMF sector, we collect data on the month-on-month portfolio holdings of the top fifteen LDMFs in the HFC sector and their overall corpus from March 2014 till March 2019. The top fifteen LDMFs control ~70% of the AUM of the LDMF sector and is representative of the risks emanating out of the HFC and LDMF sector interlinkages.

4. DRIVERS OF ROLLOVER RISK (HFCs)

HFCs rely on short-term financing to fund long-term investments (~15-20 years housing loans). This reliance on short-term funding causes an asset liability management (ALM) problem because asset side shocks expose these firms to the risk of being unable to finance their business. However, HFCs with robust balance sheets can withstand external financing constraints for longer periods. In the context of the HFC sector, we analyze the key drivers of Rollover Risk as follows: -

4.1. Asset Liability Management (ALM) problem

This risk arises in most financial institutions due to a mismatch in the duration of assets and liabilities. Liabilities are of much shorter duration than assets which tend to be of longer duration, especially loans given to the housing sector (duration of 15-20 years on average). If cash flows from the long-term assets are inadequate to meet its immediate debt obligations, the HFC can still repay its obligations by

issuing fresh CP to avoid defaulting. However, such a refinancing strategy works well only when there are no asset side shocks or liability side shocks.

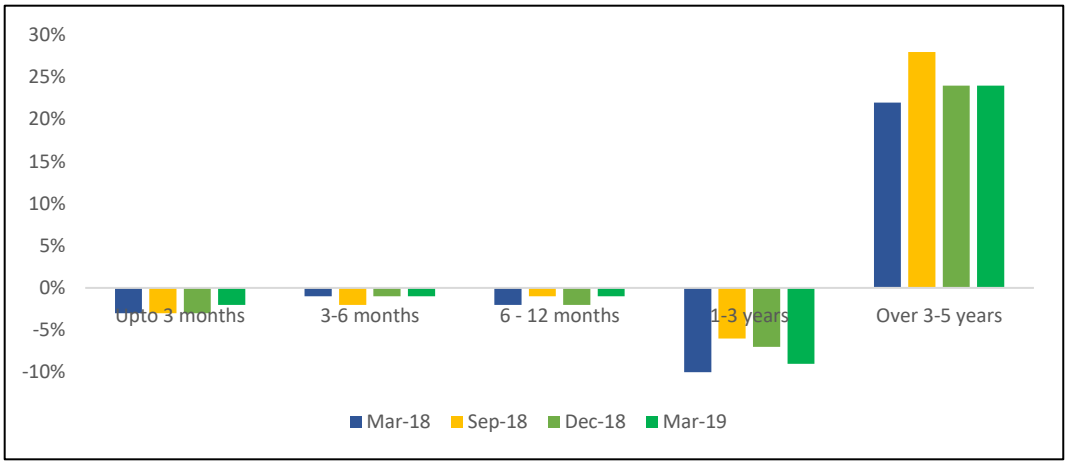
During periods of stress, there may be a significant drop in periodic cash flows that would normally arise from an HFC's long-term assets. This exacerbates Rollover Risk. When an adverse asset-side shock reduces the HFC's expected future cashflows, it adversely affects the ALM problem in the HFC and thereby risk perceptions about the HFC. The ALM problem also increases the likelihood of defaults. The ALM problem becomes worse as the share of CP in the wholesale funding mix increases. Also, as the share of shorter duration CP in the wholesale funding mix increases, we expect to observe asset liability mismatch to be more pronounced in the less than 1-year tenure buckets. Thus, an asset-side shock amplifies the HFC's problems when its liability structure is over-dependent on short-term wholesale funding such as CP, which requires frequent refinancing. When the time for refinancing the CP obligations comes, the HFC's having higher default probabilities (on account of ALM problem), find it difficult to access the CP market at affordable rates or are unable to raise money at all. Inability to arrange alternate funding sources soon enough can lead to actual defaults by these HFCs.

If the quantum of defaults is large enough (as was the case with IL&FS and DHFL), it can spread panic among the investors in CP leading to a liquidity crunch in the sector. The liquidity crunch affects other relatively safer HFCs when they have to rollover their CP obligations. Hence, Rollover Risk, initially contained within few HFCs, may rapidly spill over and affect the entire sector.

Figure 6 illustrates that the ALM risk is problematic for HFCs based on a quarter-on-quarter comparison of trends in ALM for the sector. Short term liabilities (up to maturities of 3 years) for the HFC sector are clearly greater than

their assets in these maturity buckets. Therefore, HFCs face significant Rollover Risk due to their ALM mismatch problem.

Figure 6: ALM Profile (HFC Sector)



Source: Indian Mortgage Finance Market: ICRA Reports, November 2018, March 2019, June 2019.

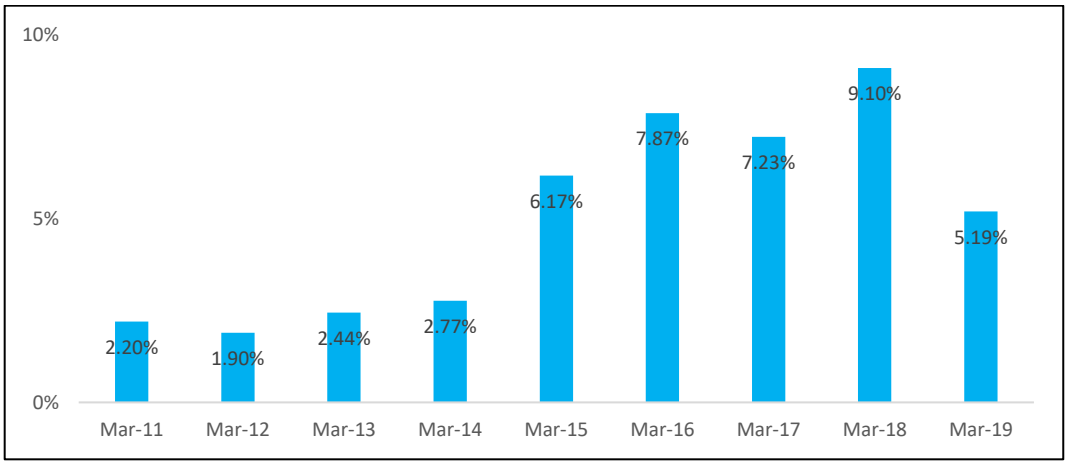
4.2. Reliance on Short-Term Wholesale Funding

Hahm, Shin and Shin (2013) have found that legacy banks with more reliance on deposit funding are safer than banks that depend heavily on wholesale funding. Defaults on wholesale funding obligations by Infrastructure Leasing and Financial Services (IL&FS) in September 2018 and more recently by Dewan Housing Finance Limited (DHFL) in June 2019 exposed the risks of heavy reliance on wholesale funding sources, consistent with the findings of Hahm, Shin and Shin (2013).

The sources of wholesale funding for the HFCs are bank loans, non-convertible debenture (NCD) and commercial paper (CP) which are subscribed to by debt mutual funds and a small fraction of public deposits. Within wholesale funding, bank loans and public deposits are relatively stable sources of funding while NCD and CP are more volatile. In addition, increased share of CP in the wholesale funding mix worsens the asset liability mismatch in the shorter tenor buckets for the HFC.

Figure 7 plots the reliance on short-term wholesale funding (CP as a percentage of liabilities) for the sample of five HFCs.

Figure 7: Commercial Paper as a percentage of Liabilties



Source: Annual Reports 2011-2019, HFCs

We observe a steep jump in the share of CP in the wholesale funding mix post 2013-14 and the level was highest by the end of 2017-18, which coincided with the period these HFCs started facing refinancing related problems. On average, the level of CP as a percentage of liabilities was 5%-6.5%. In addition to the greater exposure to repricing risk, the 5%-6.5% exposure is sufficiently high to impact Rollover Risk adversely by inducing asset liability mismatch in the shorter tenor buckets. However, compared to Retail-NBFCs, the exposure to short-term wholesale funding is not high enough to affect Rollover Risk of HFCs adversely through its interconnectedness with the LDMF sector (Anshuman et al., 2020).

4.3. Risks from Interconnectedness

Interconnectedness between the NBFC and LDMF sector is a channel for the transmission of systemic risk from the NBFC sector to the LDMF sector. Shocks in the NBFC sector may lead to concerted redemptions by investors in the LDMF sector at fire-sale prices. Faced with this situation, LDMFs may withdraw funding to the NBFC sector when refinancing is due. More technically, systemic risk is

transmitted from the NBFC sector to the LDMF sector and vice-versa, i.e., interconnectedness causes systemic risk transmission between an NBFC sector and the LDMF sector.

In general, if the quantum of defaults is large enough (as was the case with IL&FS and DHFL), it can spread panic among the investors in CP leading to concerted redemptions in the LDMF sector (systemic risk within the LDMF sector). Moreover, the liquidity crunch in an NBFC adversely affects risk perceptions about other NBFCs when they are due for rolling over their CP obligations. Hence, Rollover risk, initially contained within a few NBFCs may rapidly spill over and affect the entire NBFC sector (systemic risk within the NBFC sector).

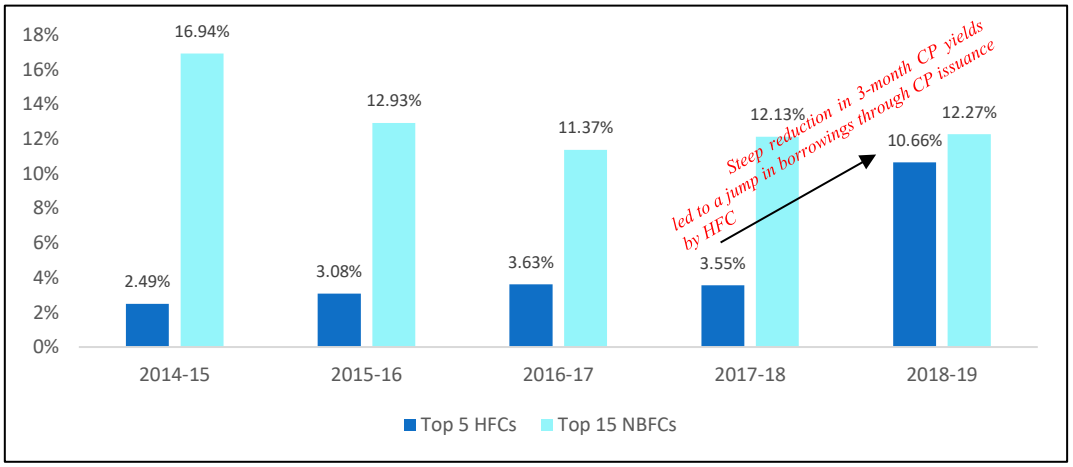
Interconnectedness Risk is a measure of the transmission of systemic risk between an NBFC and the LDMF sector that arises from two factors. First, if the LDMF sector, on average, holds concentrated positions in the CPs of a specific *stressed* NBFC, it may lead to a greater redemption risk from their own investors who fear rise in default probabilities due to deterioration of asset quality of the NBFC. We measure this factor by the LDMF sector's average exposure to CP issued by the NBFC.

Second, LDMFs are subject to run risk or redemption risk from their investors if their cash holdings do not account for extreme tail events. Thus, low levels of cash holdings in the LDMF sector, on average, diminish the ability of the LDMF sector to absorb redemption pressures.

We refer to the combined impact of these two factors as the Interconnectedness Risk, which increases the likelihood of concerted redemption by investors across the entire LDMF sector, leading to fire sales of LDMF assets. These redemptions increase Rollover Risk in a vicious cycle for the stressed NBFCs.

To shed light on the first factor driving Interconnectedness Risk, we provide a comparison of the average dependence of the HFC and Retail-NBFC sector on the LDMF sector, as shown in Figure 8. This dependence is measured by the average of the ratio of commercial paper of the *specific* HFC/ Retail-NBFC held by the LDMF sector and the total commercial paper holdings of the LDMF sector in the overall HFC/Retail-NBFC sector. We then average the dependence over the HFC/Retail-NBFC sector and track the figures from 2014 till 2019.

Figure 8: YoY Average Dependence of HFC/Retail-NBFC Sector on the LDMF Sector



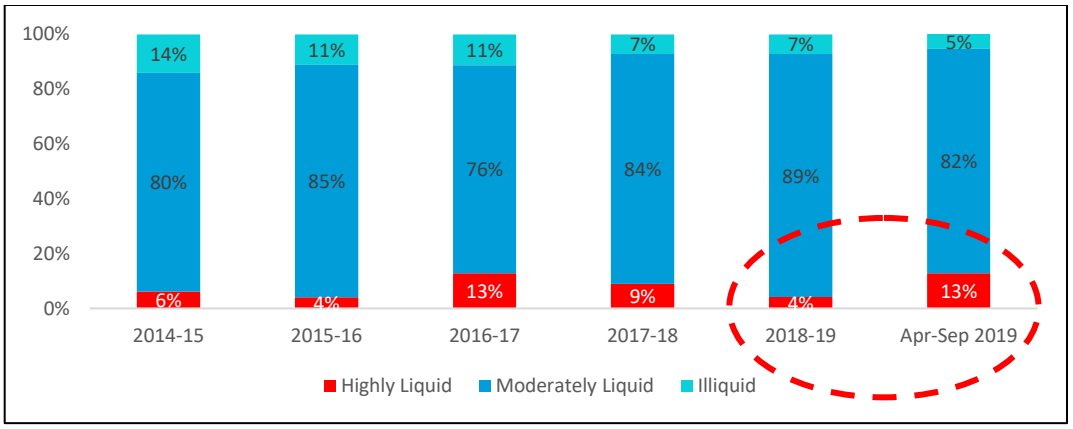
Source: ACE-MF Database

The average dependence for the Retail-NBFC sector from March 2014 till March 2019 was 13.13% while the average dependence for the HFC sector was 4.68% during the same period. Although the average dependence of the HFC sector had spiked in financial year 2019, the dependence was lower than that of Retail-NBFCs in four out of five years.

Turning to the second factor driving Interconnectedness Risk, we plot the asset class wise holdings of the LDMFs in our sample from March 2014 till March 2019, as shown in Figure 9. The proportion of highly liquid investments such as cash, G-secs etc., is a measure of the Liquidity Buffer in the LDMF sector. Higher the Liquidity Buffer, lower is the redemption risk faced by the LDMFs and by extension the Rollover Risk faced by Retail-NBFCs. We observe a steep jump in the average

level of highly liquid investments of LDMFs post the IL&FS and DHFL defaults, probably in anticipation of higher than usual redemptions.

Figure 9: Liquidity Buffer of Top Fifteen LDMFs (percentage of AUM)



Source: ACE-MF Database

*Note: Highly liquid investments include cash and cash equivalents, G-secs, T-bills, Bills rediscounting and cash management bills. These are the most liquid investments having the lowest liquidity risk. Moderately liquid investments include certificates of deposits (CD) and commercial paper (CP). Illiquid investments include corporate debt, (NCD), deposits, floating rate instruments and pass-through certificates/securitized debt.

Given the low average dependence of the HFC sector on the LDMF sector throughout the period, the liquidity buffer in the LDMF sector was sufficiently high to absorb redemption pressures arising out of asset side shocks in the HFC sector. Therefore, Interconnectedness Risk is *not* a major driver of Rollover Risk for the HFC sector when compared to the Retail-NBFC sector.

4.4. Financial and Operating Resilience

Liquidity crunch in debt markets often leads to credit rationing. Credit rationing results when firms with robust financial and operating performance get access to credit while the less robust ones are denied credit. Firms with robust financial and operating performance can withstand a prolonged period of liquidity crunch if they choose not to raise funds from debt mutual funds. Thus, the financial and operating resilience of HFCs allows it to absorb asset side shocks.

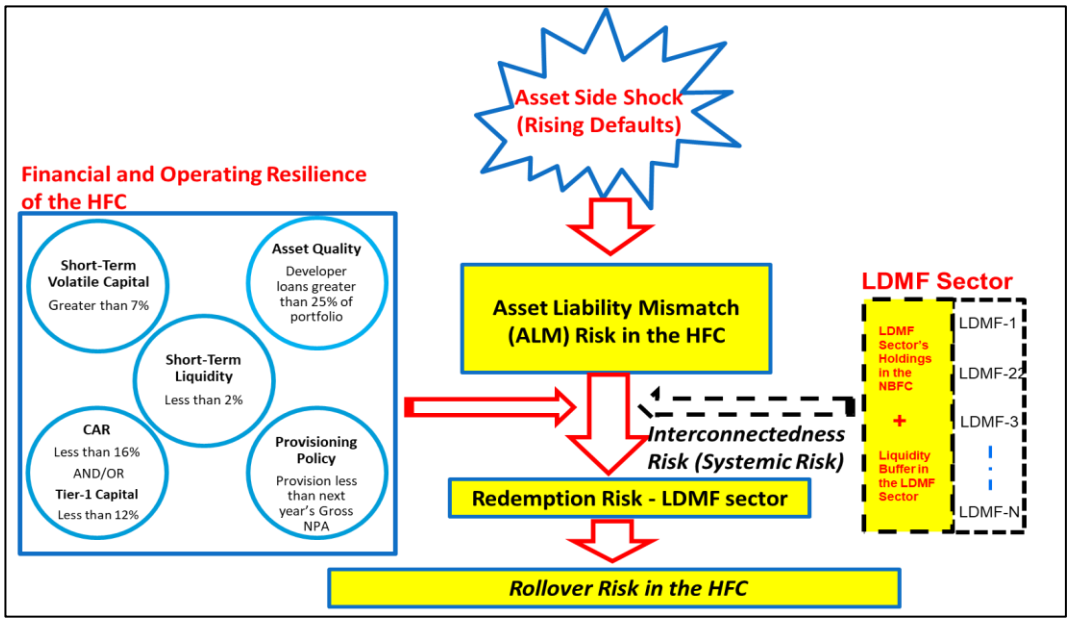
Measures of financial resilience of HFCs are commercial paper (CP) as a percentage of borrowings, Capital Adequacy Ratio (CAR) and provisioning policy, while measures of operating resilience are cash as a percentage of borrowings and loan quality.

To develop policy implications, we employ financial metrics to estimate the drivers of Rollover Risk and weigh them appropriately based on their relative contribution to Rollover Risk. This procedure helps us generate a measure of the health of the HFC. We call this measure the Health Score, which is an indicator of potential rollover risk issues faced by the HFC. The validity of this indicator as a predictor of future performance is also tested using market data.

4.5. Rollover Risk Schematic

Figure 10 is a schematic of the various drivers of Rollover Risk for the HFC sector. ALM Risk and the Financial and Operating Resilience are strong effects while Interconnectedness Risk is a weak effect.

Figure 10: Rollover Risk Schematic (HFCs)



Solid Red Arrows - Strong Effect
*Dotted **Black** Arrows – Weak Effect*

5. DIAGNOSTIC TO ASSESS FINANCIAL FRAGILITY (HFCs)

In this section, we develop a methodology to estimate a dynamic health index for an individual HFCs (We refer to this index as the Health Score) using data on the five HFCs in our sample from March 2011 till March 2019. We also estimate the Health Score for the HFC sector during the same period. Our overall finding is that the Health Score for the HFC sector exhibited a declining trend post 2014. By the end of 2018-2019, the health of the overall sector had worsened considerably.

Finally, we demonstrate that the change in Health Score is a significant predictor of future abnormal returns of the stocks of the five HFCs. The Health Score, therefore, can serve as a timely indicator of future performance of these firms and, by extension, the overall sector.

5.1. Key Metrics affecting Health Score of HFCs

Based on the relative contribution to Rollover Risk, we combine the key drivers of Rollover Risk for HFCs into a composite measure (Health Score). ALM Risk and Financial and Operating Resilience are the most important constituents of the Health Score of HFCs, as described earlier in Section 4. We compute the financial and operational resilience of an HFC based on five balance sheet-based metrics. Along with each metric we briefly explain the channel through which the metric affects Rollover Risk. There may be metrics other than the ones considered in this paper that may explain Rollover Risk of HFCs, but we have tried to capture the most important ones in this paper.

Metric 1 captures ALM Risk, while Metrics 2-6 capture the Financial and Operating Resilience of HFCs. Metrics 2, 5 and 6 are measures of Financial Resilience and Metrics 3 and 4 are measures of Operating Resilience for the HFCs.

Metric 1 – Asset Liability Management (ALM) Profile – ALM Profile is computed as the difference between contractual cash inflows and contractual cash outflows across the less than 1-year, 1-3 years, 3-5 years and more than 5 years buckets. This difference is normalized by dividing the difference by total assets for meaningful comparison across years. Negative asset liability gap in short tenor buckets can lead to defaults if there is a shock to the asset/liability side and the firm is unable to roll over its debt obligations. If the company is managing the duration of assets and liabilities well, we would expect the asset liability gap to be positive for all the buckets in any given year. A negative gap in any bucket is risky for the HFC if it is unable to arrange funding to meet the shortfall. However, the negative gap in buckets is exceedingly riskier for shorter tenures. During periods of stress, there may be a significant drop in periodic cash flows that would normally arise from their long-term assets, leading to a depletion of their cash buffers or they may be unable to tap the CP market due to liquidity crunch. This exacerbates Rollover Risk.

Metric 2 – Short-Term Volatile Capital (CP as a percentage of Borrowings) – CP, being shorter duration loans, are subject to frequent refinancing. The frequent repricing exposes HFCs to the risk of facing higher financing costs and, in the worst case, credit rationing. High level of CP increases the quantum of funding required to be refinanced and thereby increased Rollover Risk. In addition, financing of long-term housing loans with CP leads to negative asset liability gap in the shorter tenor buckets. This is a risky strategy if the company is unable to roll over CPs when there is liquidity shock to the CP market.

Metric 3 – Asset Quality (Ratio of Retail Loans to Overall Loans) - Given the repayment structure and the purpose for which the loans are extended, retail loans

(loans to individual borrowers for purchase of property) are generally of higher credit quality than loans extended to real estate developers (both residential and commercial). NPA for retail loans was, on average, ~1% while NPA for developer loans was, on average, ~4%, from March 2011 till March 2019. If the asset mix is skewed towards developer loans, it is a potential risk to the HFC. Further, asset side shocks such as real estate sector slowdowns can lead to rising NPAs which worsen the ALM Risk.

Metric 4 – Short-term Liquidity (Cash as a percentage of Borrowings) - During asset side shocks slowdowns, we expect HFCs to find it relatively difficult to raise money from debt mutual funds. If there is a negative asset liability gap in the shorter tenure buckets, an adequate amount of short-term liquidity protects the HFC from defaulting on its obligations during real estate shocks or liquidity crunch in debt capital markets. HFCs who maintain adequate buffer and do not have asset liability mismatch are able to survive through the stress period as they can meet their obligations without having to tap the wholesale funding market. This implies that they have much lower Rollover Risk.

Metric 5 – Provisioning Policy - If the HFC is adequately provisioning for loans which it perceives to be sub-standard or doubtful, we would expect Gross NPAs in any year to be lower than provisioning made at the end of the previous year. If it is the other way around, it implies that either defaults were higher than expected or that the management is not provisioning adequately for earnings management. Provisioning adequately also safeguards the HFC if loan defaults spike due to asset side shocks.

Metric 6 – Capital Adequacy Ratio (CAR) - As per regulatory norms HFCs must hold a minimum of 12% of risk-weighted assets (RWA) in Tier-I and Tier-II capital.

Also, Tier-I capital should be a minimum of 8% with Tier-II capital not exceeding 100% of Tier-I capital. Tier-II capital is of lower quality than Tier-I capital due to its composition of assets that are difficult to liquidate. Hence, keeping CAR fixed, HFCs with higher levels of Tier-I capital have lower risk of defaulting on its obligations. An adequate level of CAR protects the HFC from defaulting on its obligations if there is an asset liability gap in any of the buckets (especially in the shorter tenures).

5.2. Health Score Computation

We assign weights to each of the six metrics defined in sub-section 5.1. The assigned weights are subjective, and the sum of the weights is 100 points. To capture the relative contributions of each of the metrics to rollover risk, we assign maximum weight of 50 points to ALM Profile (metric 1), 20 points to metric 2,10 points each to metrics 3-4 and 5 points each to metrics 5-6. For each of the five HFCs and against each of the metrics 1-6, we compute a score which reflect the relative contribution of that metric towards the rollover risk score for the HFC. The maximum possible score for a metric is the weight assigned to that metric (for example, 50 for ALM Profile). We compute the rollover risk scores at the end of each financial year from March 2011 till March 2019 for each of the five HFCs in our sample and for the overall sector. It is important to note that the scores are representative of the Rollover Risk of individual HFCs and the sector as of 31st March in each of the financial years. Mentioned below is a brief description of the scoring methodology for each of the metrics 1 to 6.

ALM Profile (Metric 1) - Asset liability mismatch is progressively less dangerous as we move from the short tenor to the long tenor of the buckets. Hence, weights assigned to each tenure of ALM buckets are 24 (< 1 year), 12 (1-3 years), 8 (3-5

years) and 6 (> 5 years) for a total weight of 50. The differential weighting scheme has been designed to reflect the relative importance of managing the asset liability gap in each bucket. The computed score corresponding to each bucket in the ALM Profile is positive of assigned weight if the asset liability gap in that bucket is positive and the negative of weight assigned if otherwise. The computed score obtained by an HFC for the ALM Profile metric as of 31st March in each financial year is computed by adding up the computed score assigned to each of the ALM buckets. Higher scores on metric 1 imply lesser Rollover Risk faced by the HFC.

Threshold level for Metrics 2-4

For each of the metrics 2-4, we determine an endogenously determined threshold level. The threshold level is determined by taking the average of the values of the metric for all HFCs across all years from 2011 till 2019. For metrics 3 and 4, we adjust the average (upward and downward respectively) to arrive at the threshold. Taking the average across HFCs and across all years for computing the threshold gives us a reasonable proxy for the rollover risk contribution of the metric for an average risk HFC in normal market conditions.

Short-Term Volatile Capital (Metric 2) – The threshold level for short-term volatile capital (CP as a percentage of Borrowings) is 6.07%. Rather than imposing a strict threshold, we define a range for the threshold level of short-term volatile capital. In our case, the range selected is 6.07% - 6.98% (we allow 15% deviation from the threshold level on the higher side). We also set an upper bound i.e. the maximum allowed deviation to 9.10% which is 50% higher than the threshold level. If an HFC as of 31st March in each financial year has CP as a percentage of borrowings less than the threshold level of 6.07% or is within the range of 6.07% - 6.98% we assign a score of +20 to the firm for Metric 2. This implies that the short-

term volatile capital is low for the HFC. If an HFC as of 31st March in each financial year has CP as a percentage of borrowings more than 9.10%, we reckon that the short-term volatile capital for the HFC is very high and therefore, assign a score of -20 to the firm for Metric 2. If an HFC as of 31st March in each financial year has CP as a percentage of borrowings more than 6.98% but less than or equal to 9.10%, we penalize the HFC for excessive short-term volatile capital by imposing a linearly declining score as short-term volatile capital goes up from 6.98% to 9.10%. For example, if an HFC as of 31st March in each financial year has CP as a percentage of borrowings equal to 7.62%, the score assigned is +8 against short-term volatile capital for the firm as of 31st March in that financial year. The score is the contribution of short-term volatile capital towards Rollover Risk for the HFC. Higher scores on Metric 2 imply lesser Rollover Risk faced by the HFC.

Asset Quality (Metric 3) - If an HFC as of 31st March in any financial year has a share of developer loans greater than 25% of the overall loan book, the score assigned is -10 and +10 if otherwise. The threshold level is determined by observing the average level of the ratio for all the five HFCs in all the years in our sample and then rounding up the average to the nearest whole number. The score is the contribution of short-term volatile capital towards rollover risk for the HFC. Higher scores on Metric 3 imply lesser Rollover Risk faced by the HFC.

Short-Term Liquidity (Metric 4) – The threshold level for Cash as a percentage of Borrowings is 2%. The threshold level is determined by observing the average level of the ratio for all the five HFCs in all the years in our sample and then adjusting the average downwards to be more conservative. If an HFC as of 31st March in any financial year has Cash as a percentage of Borrowings less than 2%, the score assigned is -10 and +10 if otherwise. The score is the contribution of short-

term liquidity towards rollover risk for the HFC. Higher scores on metric 4 imply lesser Rollover Risk faced by the HFC.

Provisioning Policy (Metric 5) – If the level of provisions (as a percentage of loan book) for a HFC as of 31st March in any financial year is less than the Gross NPA (as a percentage of loan book) as of 31st March of the subsequent financial year, the score assigned is -5 and +5 if otherwise. The score is the contribution of provisioning policy towards Rollover Risk for the HFC.

Capital Adequacy Ratio (Metric 6) – For each of the five HFCs, we observe the capital adequacy ratio (CAR) as of 31st March in each financial year. The threshold for overall CAR is 16%. We incorporate the higher quality of Tier-I capital by imposing a penalty of -3 to the computed score if Tier-I capital is less than 12%. Hence, we have the following 3 possible computed scores for CAR: -

- If CAR >= 16% and Tier-I capital >= 12%, then computed score is 5
- If CAR >= 16% and Tier-I capital < 12%, then computed score is 5–3=2
- If CAR <16% and Tier-I capital < 12%, then computed score is -5
- If CAR <16% and Tier-I capital >= 12%, then computed score is -5

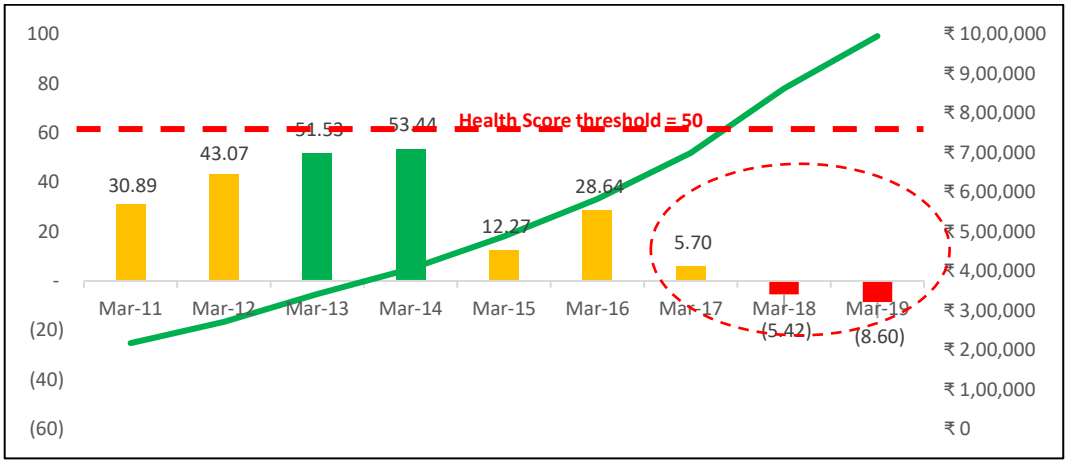
Higher scores on Metric 6 imply lesser Rollover Risk faced by the HFC.

After computing the scores of each of the metrics 1-6 for every HFC as of 31st March in each financial year from 2011 till 2019, we simply add the scores obtained against each metric to arrive at the Health Score of the HFCs. These scores represent the Rollover Risk of the HFC as of 31st March in each financial year. The Health Score can range from -100 to +100 with higher scores representing lower Rollover

Risk. A Health Score of 0 is a neutral score, not risky, but not too safe either. We use a benchmark of 50, above which the individual HFC/Sector may be deemed sufficiently safe. In Appendix A, we demonstrate the computation of Health Score of DHFL as of 31st March 2018.

For computing the Health Score for the HFC sector as of 31st March in any financial year, we compute the weighted average (weighted by AUM of the HFC) of the scores obtained against each of the metrics 1-6 and add them up. This procedure is repeated for each of the financial years from 2011 till 2019. Weighing the scores by AUM gives more weight to Health Scores of the larger HFCs in our sample. Figure 11 plots the trends in Health Scores for the HFC sector as on 31st March each year from 2011-2019. The bars represent the Health Scores (Red – Score <= 0, Amber – 0 < Score < 50 and Green – Score >= 50) while the line represents the AUM in Rs. Crores.

Figure 11: Health Score and Portfolio Trends (HFC Sector)



Source: Annual Reports of top 5 HFCs (2011-2019)

The start of the decrease in Health Scores for the HFC sector followed soon after the real estate sector slowdown in 2013-14.

Figures 12 and 13 plot the trends in the constituent metrics of the Health Score i..e. ALM Profile and Financial and Operating Resilience.

Figure 12: ALM Profile (HFC Sector)

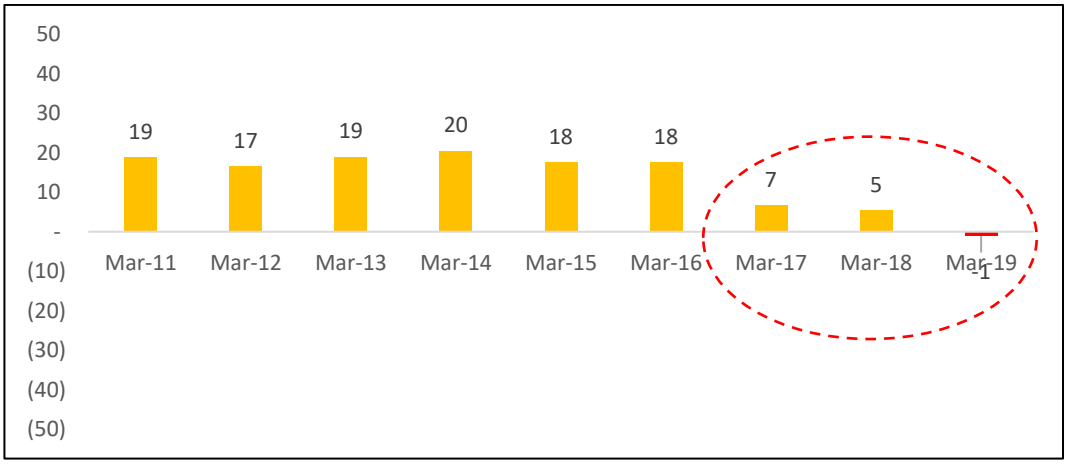
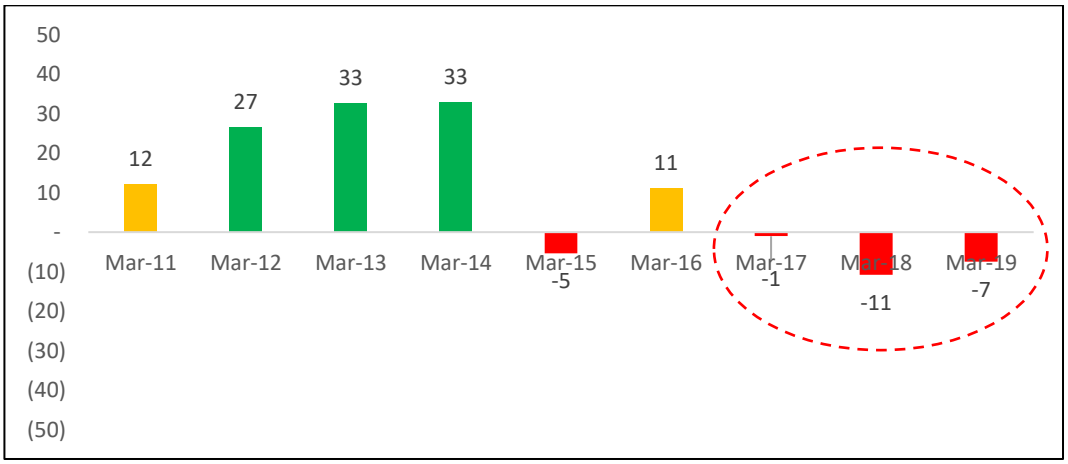


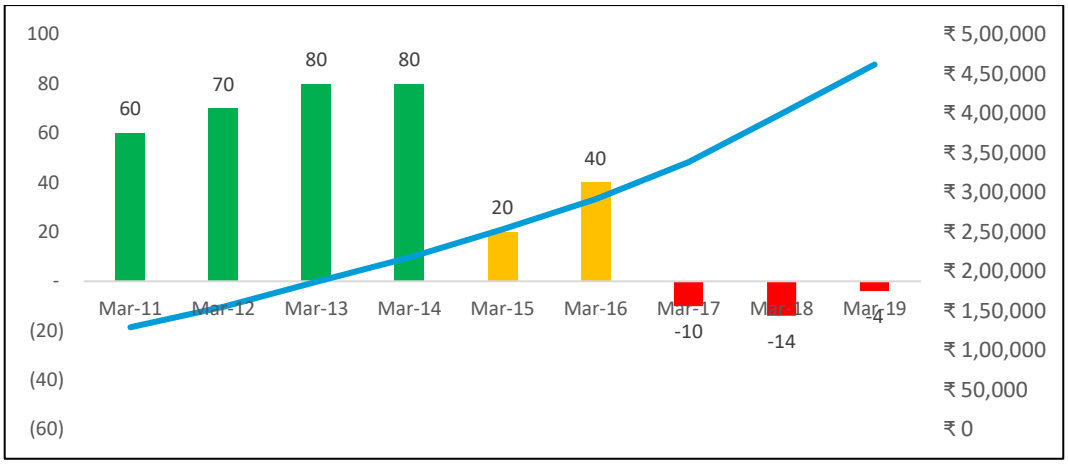
Figure 13: Financial and Operating Resilience (HFC Sector)



The decline in scores on the metrics ALM Profile and Financial and Operating Resilience (Metrics 2-6) was concurrent with the decline in Health Scores of the HFC sector.

Figure 14-18 plot the trends in Health Scores as on 31st March each year from 2011-2019 for each of the five HFCs in our sample. For each plot, the bars represent the Health Scores (Red – Score <= 0, Amber – 0 < Score < 50 and Green – Score >= 50) while the line represents the AUM in Rs. Crores.

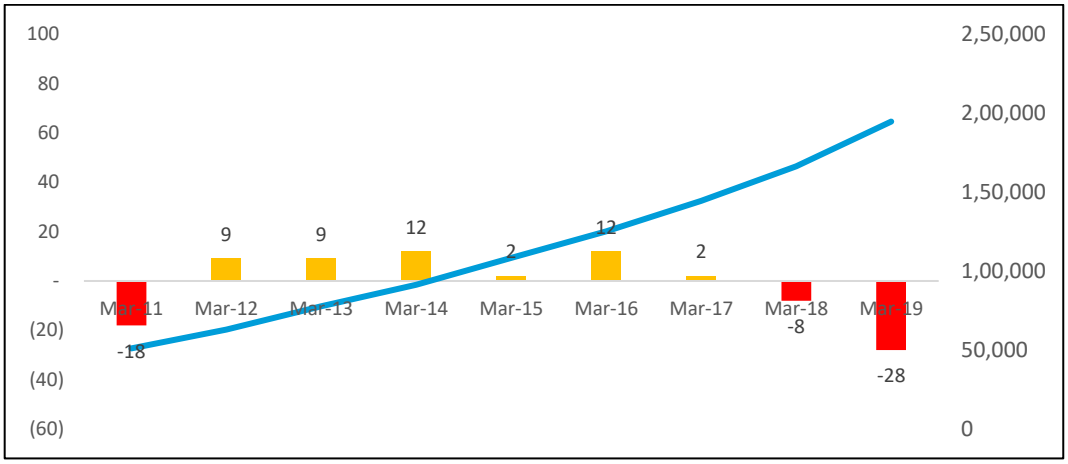
Figure 14: Health Score and Portfolio Trends (HDFC)



Source: Annual Reports of HDFC (2011-2019)

The Health Score of HDFC declined steeply post 31 March 2016.

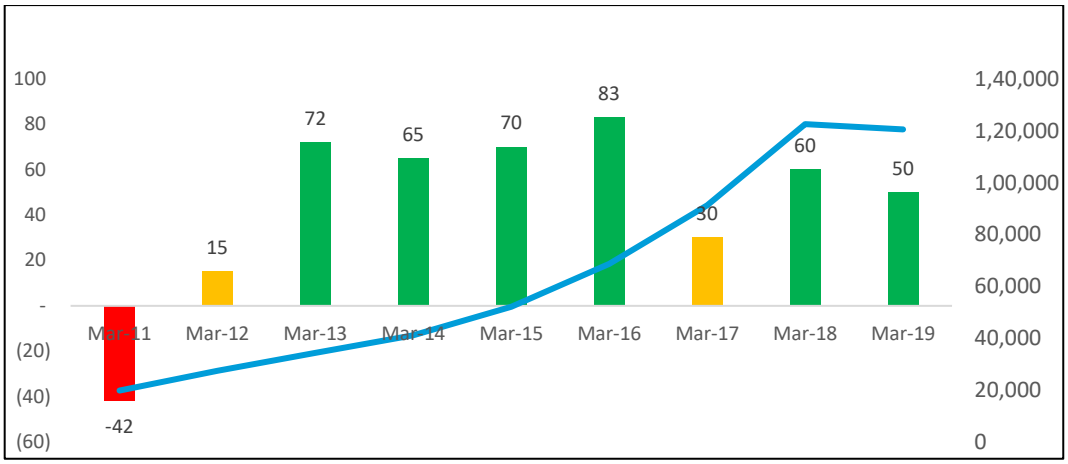
Figure 15: Health Score and Portfolio Trends (LICHFL)



Source: Annual Reports of LICHFL (2011-2019)

The Health Score of LICHFL was consistently low throughout the period and declined steeply post 2016.

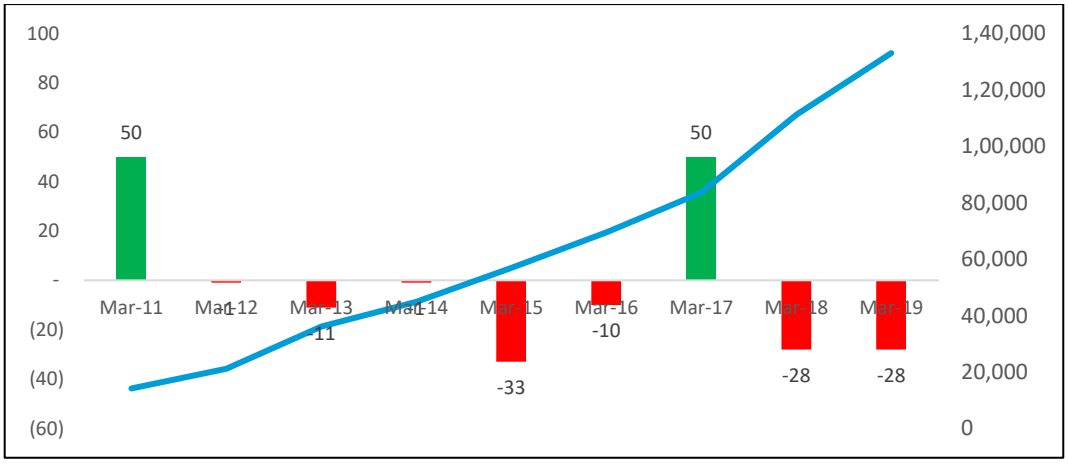
Figure 16: Health Score and Portfolio Trends (IBHFL)



Source: Annual Reports of IBHFL (2011-2019)

The Health Score of IBHFL rose post 2011-12 but declined after 2015-2016

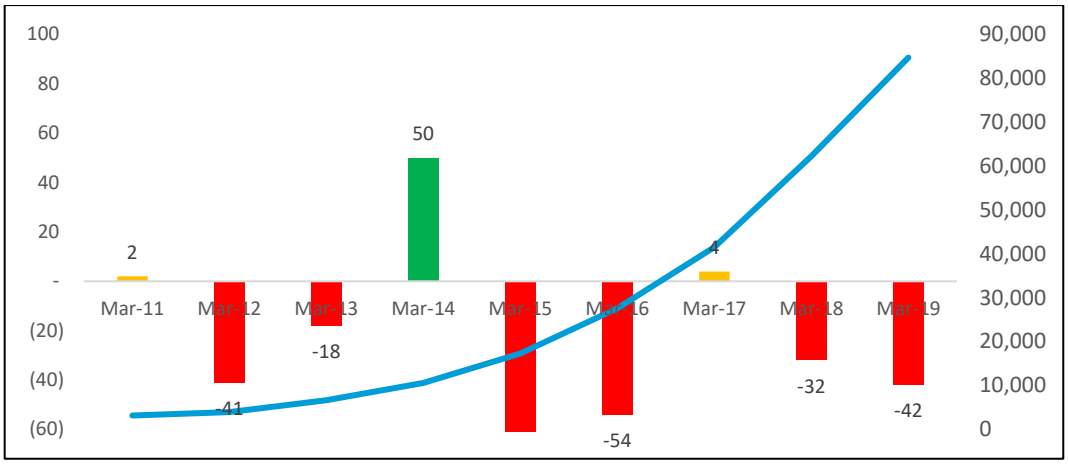
Figure 17: Health Score and Portfolio Trends (DHFL)



Source: Annual Reports of DHFL (2011-2019)

The Health Score of DHFL was consistently low throughout the period with a sharp decrease in 2017-2018. In September 2018, DSP Mutual Fund sold NCDs, issued by DHFL, worth 300 crores at fire sale prices in the wake of ratings downgrade of IL&FS papers and partly due to redemption pressure. The sharp decline in the Health Score of DHFL by the end of 2018-2019 was an early warning signal for the impending liquidity issues eventually faced by DHFL.

Figure 18: Health Score and Portfolio Trends (PNBHFL)



Source: Annual Reports of PNBHFL (2011-2019)

Except for 2013-2014, PNBHFL had consistently low Health Scores with sharp declines in 2014-2015 and 2017-2018.

5.3. Predictive Power of Health Score

We attempt to understand whether the year-over-year (YoY) change in Health Score of individual HFCs has any predictive power on future abnormal stock returns of these firms. This test is useful in validating the Health Score as an early warning signal.

The annual reports for each financial year are generally released in the period from July to August each year. The dates of release, however, vary for each of the HFCs. Information in the annual reports that provide insights on the Health Score of the HFC should gradually reflect in the share price over horizon of a few months as the information is absorbed by active traders. If our Health Score is a forward-looking measure of the prospects of the HFCs, the YoY change in Health Score should explain future abnormal returns of their stocks.

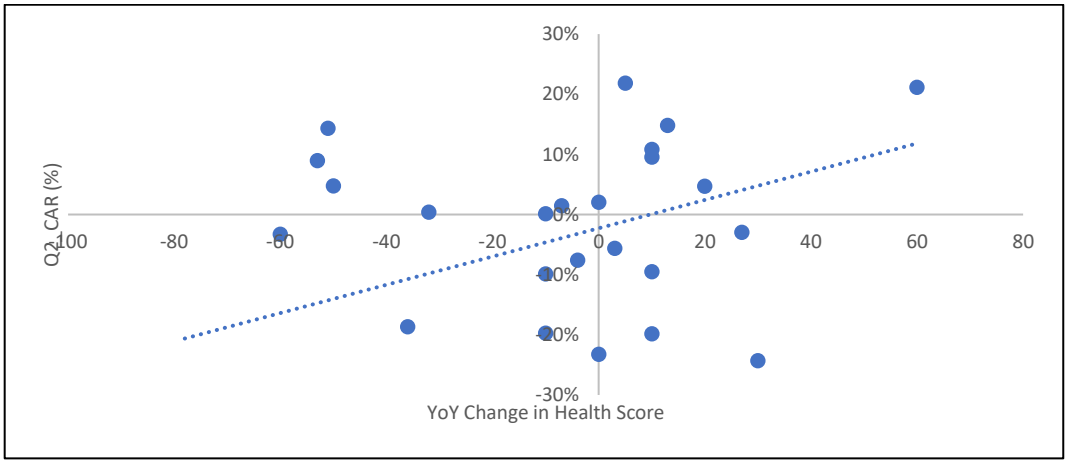
Given the uncertainty on the date of release of annual reports of the HFC and the time required for the information to be reflected in future stock price movements/returns of these firms, we estimate the price effect using the cumultaive

return of an NBFC's stock from July to September (Q2) of each year from 2011 till 2018. We subtract the contemporaneous NIFTY 500 index returns to compute the abnormal returns on a weekly basis. The cumulative abnormal return (Q2_CAR) is calculated by adding the weekly abnormal returns every week from July to September (~ 12 weeks in a year).

Q2_CAR is calculated in this way for all the five HFCs for each year from 2011-2018. Based on the year of listing of the five HFCs in our sample we obtain a set of 32 Q2_CAR values and the corresponding Health Scores of individual HFCs.

Figure 19 shows a scatter plot of Q2_CAR and YoY Change in Health Score of the HFC sector in our sample. The positively sloped trend line in the scatter plot confirms our ex-ante expectation that an improvement in the YoY Health Score should result in an increase in future short-term cumulative abnormal returns of the HFC stocks.

Figure 19: Cumulative Abnormal Returns (Q2_CAR) vs YoY Change in Health Score



Source:Bloomberg

The scatter plots demonstrate the utility of the Health Score as an early indicator of stress in the HFC sector. To further validate its predictive power, we run a "fixed

effects" panel regression model (Model I) of Q2_CAR on YoY change in Health Score of the five HFCs.

The regression model (Model I) is specified as follows: -

$$\boldsymbol{CAR_{i,t} = \beta_0 + \beta_1 \times \Delta Health\ score_{i,t} + \epsilon_i + u_{i,t}}$$

where *i* denotes individual HFC and *t* denotes financial year end. $\boldsymbol{\epsilon_i}$ is the firm "fixed effect" which controls for unobservables such as corporate governance and other factors that might explain future abnormal returns of the HFC stocks and $\boldsymbol{u_{i,t}}$ is the white noise disturbance term.

We also run an additional "fixed effects" panel regression model (Model II) of Q2_CAR on YoY change in Health Score of the five HFCs and an interaction term of Change in Health Score and IL&FS Defaults. IL&FS Defaults is a dummy variable which is equal to 1 in the period from July to September 2018 and 0 otherwise. The coeffcient on the interaction term captures the additonal effect on Q2_CAR of the HFC stocks during the period of IL&FS defaults.

The regression model (Model II) is specified as follows: -

$$\boldsymbol{CAR_{i,t} = \beta_0 + \beta_1 \times \Delta Health\ Score_{i,t} + \beta_2 \times \Delta Health\ Score_{i,t}\ x\ IL\&FS\ Defaults + \epsilon_i + u_{i,t}}$$

Table 2 reports the results of the estimated regression models.

Table 2: Regression Results – Q2_CAR on Change in Health Score

Dependent variable is cumulative abnormal returns (Q2_CAR) and the independent variable is Year-over-Year change in Health Score of the five HFCs in our sample in Model I and including the interaction term of change in Health Score and IL&FS Defaults in Model II. Estimation method is "fixed effects" panel estimation in which each portfolio has its own intercept term. The numbers in parenthesis is the standard error of the coefficient estimate.

Regression Results		
	Dependent variable:	
	Abnormal Returns - (I)	Abnormal Returns - (II)
Change in Health Score	0.002*	0.001
	(0.001)	(0.001)
Change in Health Score x IL&FS Default		0.005*
		(0.003)
Observations	27	27
R^2	13.10%	25.20%
F Statistic	3.160* (df = 1; 21)	3.372* (df = 2; 20)

*p<0.1; **p<0.05; ***p<0.01

The estimated fixed effects are positive for HDFC and IBHFL and negative for LICHFL, DHFL and PNBHFL in Model I, positive for HDFC, IBHFL and PNBHFL and negative for LICHFL and DHFL in Model II. From Model-I, we observe that if the change in Health Score (with respect to the previous financial year end) for any HFC increases by 10 units in any financial year , the Q2_CAR for the 3-month period from July to September (around the date of release of annual reports) increases by 2 percentage points which is economically significant. The coefficient (β_1) of the Year-over-Year change in Health Score is also statistically significant at 10% level of significance.

From Model II, we observe that if the change in Health Score for any HFC increases by 10 units for any financial year , the Q2_CAR for the 3-month period from July to September (around the date of release of annual reports) increases by 1 percentage points and by 6 percentage points ($\beta_1 + \beta_2$) around the period of IL&FS defaults (i.e. July to September 2019). The signs of β_1 and β_2 are also

consistent with ex-ante expectations that increase in Health Score (reduced Rollover Risk) leads to future positive abnormal returns.

We have limited number of observations (27) for the dependent and independent variable and we estimate 7 coefficients including 5 firm "fixed effects". The degrees of freedom for our regression model is low (21). Hence, 10% level of statistical significance of β_1 suggests that change in Health Score is a strong predictor of future abnormal returns of the HFC stocks. Typically, when the number of independent variables is large compared to total number of observations, principal component analysis (PCA) is a way around the high dimension regression problem (multicollinearity). PCA essentially computes a linear combination of the independent variables which becomes the new independent variable. This reduces the number of independent variables to one variable and results in higher degree of freedom of the regression model.

Our Health Score computation is intuitively like PCA, where we combine information on the six metrics (6 independent variables) some or all of which may individually explain future abnormal returns. In Model II, however, introducing the additional interaction term imposes a further restriction on the degrees of freedom (20) which makes it even harder to detect significant relationships. For robustness, we also run "fixed effects" panel regression models of Q2_CAR on Health Score of all five HFCs, Q2_CAR on change in Health Score (excluding IBHFL from the sample) and Q2_CAR on Health Score (excluding IBHFL from the sample). All the models report positive sign on β_1, which is consistent with our main model. The results are listed in Appendix B.

6. CONCLUSION

This article investigates the key drivers of Rollover Risk of the HFC sector in India motivated by the current liquidity crunch faced by the shadow banking system. The above analysis suggests that firms in the HFC sector are susceptible to Rollover Risk when they rely too much on the on the short-term wholesale funding market for financing their investments in the real sector.

Using a novel scoring methodology, we quantity the Rollover Risk for a sample of HFCs which are representative of the HFC sector. The Health Score of the HFC sector exhibited a declining trend post 2014. By the end of 2018-2019, the health of the overall sector had worsened considerably. The above findings suggest that the Health Score provides an early warning signal of impending liquidity problems. We find significant evidence that equity markets react favourably to increase in Health Score of the individual HFCs, thereby confirming the ability of Health Scores to predict stress in the sector.

Our analysis provides a dynamic leading indicator of the financial health of firms in the NBFC sector, after incorporating the macroprudential externalities of their investment and financing decisions. Regulators can employ the Health Score to detect early warning signals of impending Rollover Risk problems in individual HFCs. Downtrends in the Health Score can be used to trigger greater monitoring of the HFC. Furthermore, an analysis of the trends in the components of the Health Score can shed light on the appropriate corrective measures that should be applied to reverse the adverse trends. Policy makers intending to revive the shadow banking channel of growth can use this analysis to efficiently allocate liquidity enhancements across firms (with different Health Scores) in the HFC sector, thereby arresting financial fragility in a capital-efficient manner.

APPENDIX A

Health Score Computation of DHFL for the financial year 2017-18

Table 3 reports the ALM Profile of DHFL as of 31st March for the period 2011-2019.

Table 3: ALM Profile [(Assets – Liabilities)/Total Assets] (DHFL)

Year	< 1 year	1-3 years	3-5 years	>5 years
Mar-11	6.23%	-16.78%	-10.20%	30.93%
Mar-12	-7.01%	-14.95%	-7.38%	36.91%
Mar-13	-9.15%	-17.43%	-10.27%	45.15%
Mar-14	-9.31%	-18.52%	-6.62%	41.04%
Mar-15	-15.63%	-15.72%	-8.90%	47.58%
Mar-16	-13.29%	-13.62%	-10.32%	44.86%
Mar-17	2.96%	-16.33%	-8.27%	26.29%
Mar-18	-7.59%	-16.37%	-1.78%	32.51%
Mar-19	-7.66%	-16.54%	-1.80%	32.85%

As on 31st March 2018, the asset liability gap in all buckets except for >5 years was negative. Therefore, the score for Metric 1 assigned to DHFL is -38 points (-24-12-8+6=-38).

Commercial Paper as a percentage of Borrowings (Metric 2) as of 31st March 2018 was 6.53% which is within the range of 6.07% - 6.98%. Hence, the score for Metric 2 assigned to DHFL is +20 points.

The share of developer loans for DHFL (Metric 3) as of 31st March 2018 was 27% which is greater than the threshold of 25%. Hence, the score for Metric 3 assigned to DHFL is -10 points.

Cash as a percentage of Borrowings (Metric 4) as of 31st March 2018 was 2.66% which is greater than the threshold of 2%. Hence, the score for Metric 4 assigned to DHFL is +10 points.

The level of provisions (as a percentage of loan book) for DHFL as of 31st March 2017 was 0.81% which was lesser than the Gross NPA (as a percentage of loan book) of 0.96% as of 31st March 2018. Hence, the score for Metric 5 assigned to DHFL is -5 points.

Capital Adequacy Ratio (Metric 6) for DHFL as of 31st March 2018 was 15.3% which is lesser than the threshold of 16%. Moreover, the share of Tier-I capital was 11.5% which is also lesser than the threshold of 12%. Hence, the score for Metric 6 assigned to DHFL is -5 points.

Thus, the Health Score for DHFL as of 31st March 2018 is the sum of the scores for Metrics 1-6 which is equal to -38+20-10+10-5-5 = -28 points.

APPENDIX B

Results of additional panel regression models

Table 4: Regression Results (Q2_CAR on Change in Health Score (excluding IBHFL))

Dependent variable is cumulative abnormal returns (Q2_CAR) and the independent variable is Year-over-Year change in Health Score of the four HFCs (excl. IBHFL) in our sample in Model I and including the interaction term of change in Health Score and IL&FS Defaults in Model II. Estimation method is "fixed effects" panel estimation in which each portfolio has its own intercept term. The numbers in parenthesis is the standard error of the coefficient estimate.

Regression Results		
	Dependent Variable:	
	Abnormal Returns - (I)	Abnormal Returns - (I)
Change in Health Score	0.003**	0.001
	(0.001)	(0.001)
Change in Health Score X IL&FS Default		0.007**
		(0.003)
Observations	22	22
R^2	23.80%	49.10%
F Statistic	5.315** (df= 1; 17)	7.713*** (df= 2; 16)

*p<0.1; **p<0.05; ***p<0.01

Table 5: Regression Results (Q2_CAR on Health Score)

Dependent variable is cumulative abnormal returns (Q2_CAR) and the independent variable is Health Score of the five HFCs in our sample in Model I and including the interaction term of Health Score and IL&FS Defaults in Model II. Estimation method is "fixed effects" panel estimation in which each portfolio has its own intercept term. The numbers in parenthesis is the standard error of the coefficient estimate.

Regression Results		
	Dependent Variable:	
	Abnormal Returns - (I)	Abnormal Returns - (I)
Health Score	0.002	0.002
	(0.001)	(0.001)
Health Score X IL&FS Default		0.0003
		(0.003)
Observations	32	32
R^2	9.00%	9.00%
F Statistic	2.571 (df= 1; 26)	1.241 (df= 2; 25)

*p<0.1; **p<0.05; ***p<0.01

Table 6: Regression Results (Q2_CAR on Health Score (excluding IBHFL))

Dependent variable is cumulative abnormal returns (Q2_CAR) and the independent variable is Health Score of the four HFCs (excl. IBHFL) in our sample in Model I and including the interaction term of Health Score and IL&FS Defaults in Model II. Estimation method is "fixed effects" panel estimation in which each portfolio has its own intercept term. The numbers in parenthesis is the standard error of the coefficient estimate.

Regression Results		
	Dependent Variable:	
	Abnormal Returns - (I)	Abnormal Returns - (I)
Health Score	0.002	0.001
	(0.001)	(0.001)
Health Score X IL&FS Default		0.013**
		(0.005)
Observations	26	26
R^2	11.80%	31.40%
F Statistic	2.806 (df= 1; 21)	4.575** (df= 2; 20)

*p<0.1; **p<0.05; ***p<0.01

REFERENCES

V. Ravi Anshuman and Rajdeep Sharma, "Financial Fragility in Retail-NBFCs", *IIMB Working Paper,* 2020

Chernenko, S., and Sunderam A., “Frictions in Shadow Banking: Evidence from the Lending Behavior of Money Market Mutual Funds”, *The Review of Financial Studies,* 2014

Hahm, Shin and Shin, “Non-core bank liabilities and Financial Vulnerability”, *Journal of Money, Credit and Banking,* 2013

Acharya V.V., Khandwala H., and Oncu T.S., “The growth of a Shadow Banking system in emerging markets: Evidence from India”, *Journal of International Money and Finance,* 2013

Ghosh, S., del Mazo I.G., and Inci O. R., “Chasing the Shadows: How significant is shadow banking in emerging markets?”, *Economic Premise, Washington, World Bank,* 2013

M.T Kusy and W.T Ziemba, “A Bank Asset and Liability Model”, *Working Paper,* 1983

S. Bokhari, D. Geltner and A. Minne, “A Bayesian Structural Time Series Approach to Constructing Rent Indexes: An Application to Indian Office Markets”, *Working Paper,* 2017