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1. Introduction

1.1 Background on shadow banking and systemic risk

It is agreed by the popular discourse on the Global Financial Crisis (GFC) of 2007/8, that the extension of liquidity support to the shadow banking markets (e.g. asset-backed securities, money market instruments, and commercial paper) prevented a full-scale meltdown of the global financial system (Adrian and Ashcraft 2012:20, Mehrling et al. 2013:16, Pozsar et al. 2010:1-2). The growth of the shadow banking system, which (in the US) is bigger than the regular banking system[1], also contributed to information gaps concerning the distinguishability of illiquid and insolvent entities (Judge 2016:867). These information gaps were further widened by the interconnectedness between regular banks and shadow banks – either through committed lines of credit from commercial banks, or because shadow banks are sometimes sponsored and/or operated by commercial banks themselves (which are thereby committing regulatory arbitrage, i.e. making profits by circumventing certain parts of regulation imposed on the regular banking system) (Tucker 2012:1-2). In summary, shadow banking became increasingly connected to commercial banking through the channels of 1) securitization, 2) propriety trading, and 3) granting credit to non-bank financial institutions (Oganesyan 2013:4).

In order to restore the functioning of financial markets and the reinvigoration of the economy, major central banks (including the Federal Reserve (henceforth "Fed"), the European Central Bank (ECB), the Bank of Japan (BOJ) and the Bank of England turned to unconventional monetary policies, including (but not limited to) forward guidance, introduction of negative interest rates, credit easing (Moenjak 2014:110) and quantitative easing (Dell'Ariccia et al. 2018:3–5). However, the aim behind these "unconventional" measures can be seen as the Fed essentially evolving from a liquidity backstop for the banking system to a liquidity backstop for the entire dealer system by the outright purchase of mortgage-backed securities (MBS) and other asset-backed securities (ABS). Whereas in normal times this central backstop merely operates to support the market, the Fed in essence **became** the market during the Global Financial Crisis, as no other institutions would (or could) make markets for the vast amount of mortgage-backed securities anymore (Mehrling et al. 2013:9).

In analyzing the different stages of the Global Financial Crisis (see Figure 1) we can gain a better understanding of which part of the shadow banking system influenced, respectively accelerated, the course of the crisis. Two key turning points are of special importance here – the collapse of Bear Stearns in March 2008, and the failure of Lehman Brothers and AIG in September 2008 (Mehrling 2011:1-3). Before the collapse of Bear Stearns, the Fed tried to calm the al-

[1] The G-20 Financial Stability Board (FSB) estimated the global shadow banking system's size at almost USD 70 trillion, or 25% of global financial intermediation (Moe 2015:3-4).

ready prevalent stress signals in the markets with lowered interest rates in order to provide backstop funding liquidity. When that failed, it moved on to classical Lender of Last Resort (LOLR) practices via the Term Auction Facility (TAF, green) respectively Term Security Lending Facility (TSLF, blue). These measures did not influence the liabilities side of the Fed's balance sheet (Figure 1, bottom), which should drastically change when Lehman and AIG went under, and the Fed essentially assumed the role of Dealer of Last Resort (DOLR) in the money market and later in the capital market (via the outright purchase of mortgage-backed securities). Furthermore, the Fed also assumed a quasi-international Lender of Last Resort role by establishing swap arrangements (Central bank liquidity swaps, orange) with other major central banks in order to backstop liquidity in the Eurodollar markets (Nakaso 2017:11-12).

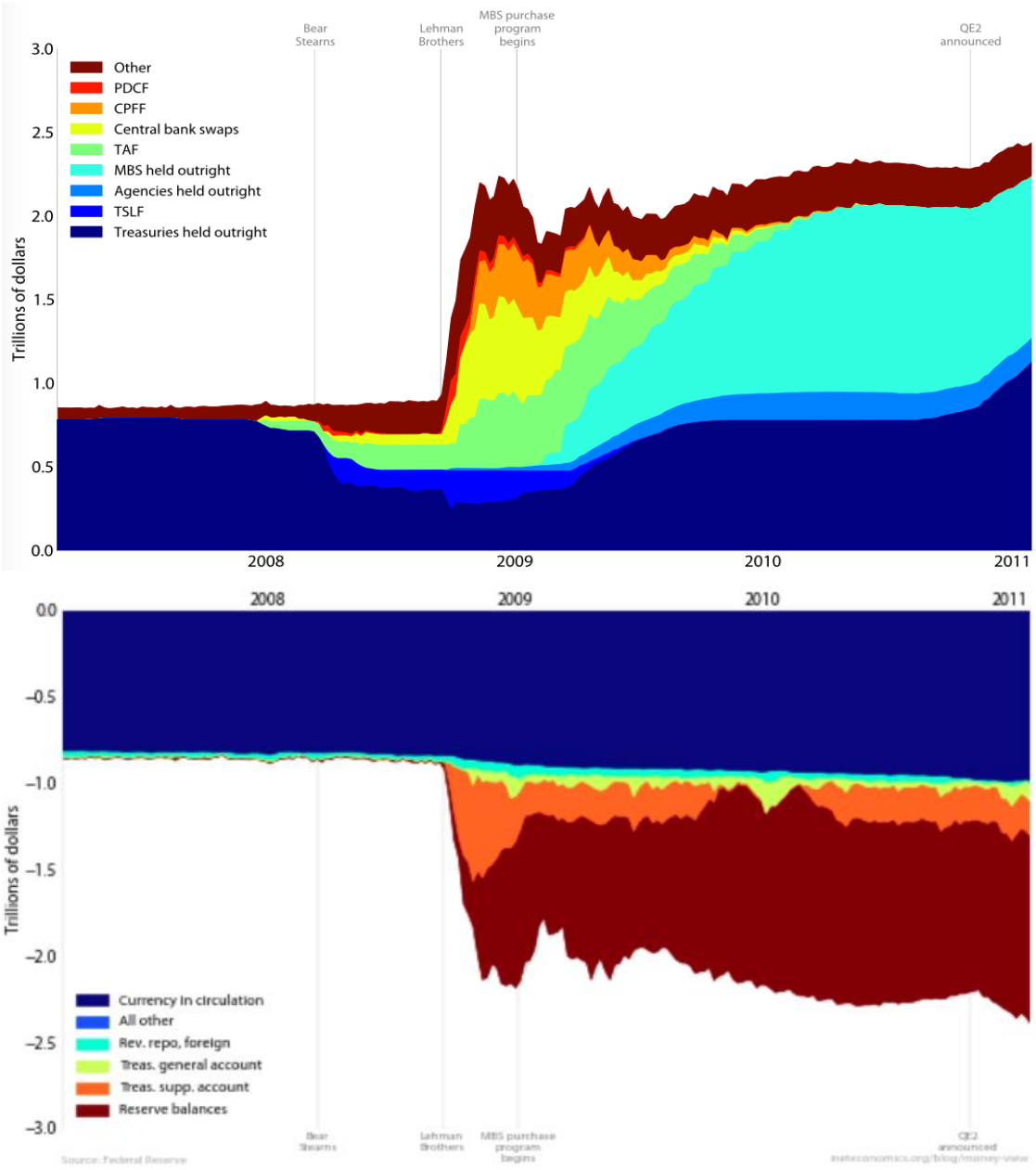


Figure 1: Balance Sheet of Federal Reserve during GFC.

Source: Neilson 2012.

The exact way in which the shadow banking system triggered the Global Financial Crisis can be described in a simplified form as follows: shadow banking entities such as Structured Investment Vehicles (SIVs) were making a profit based on the bid-ask spread of asset-backed securities and AAA-tranches of mortgage-backed securities. To finance these operations, shadow banks used their asset holdings as collateral to raise funding in the money markets (usually from money market mutual funds (MMMFs[2])) via repo. However, the Lehman default caused a run on money market mutual funds after investors realized that it was actually possible to **lose** money in a money market mutual fund – as an effect of this development, money market mutual funds refused to roll over funding of the shadow banks' repo operations. After this dry-up of liquidity, commercial banks and investment houses (either out of legal or reputational reasons) rolled over the funding of associated shadow banking entities and therefore acted as a private liquidity backstop for the shadow banking system. Alas, similar to private clearing houses in the pre-deposit insurance era of regular banks, this private liquidity put was not enough to quell the panic and, in the end, required the large (public) coffers of the Fed respectively the US Treasury (Judge 2016, Wray 2012).

1.2 Research Question

In the years since the GFC, the shadow banking system has seen growth to levels that surpass the pre-crisis ones. The International Monetary Fund (IMF) has identified Emerging Markets and Developing Economies (EMDEs) as central in the growth of risks associated with shadow banking, singling out China as main contributor (IMF 2018:69). In addition, the issue of (a lack of) global dollar funding – and therefore, by the global nature of the world's current financial system, Foreign Exchange (FX) swap, Eurodollar and repo markets – has exposed vulnerabilities in several Asian funding markets (Pozsar and Sweeney 2020:2).

Based on recent developments in shadow banking, especially with regard to the importance of emerging markets, the aim of this thesis is to trace the development of the sector's influence on systemic risk in East Asia, with a focus on real estate in emerging market and developing economies (EMDEs). For this reason, the research interest is formulated as follows:

"What are the similarities and differences in the development of shadow banking in the real estate sectors of China, South Korea and the United States since the Global Financial Crisis in 2007/8 and their implications for systemic risk?"

[2] The terms money market mutual fund (MMMF) and money market fund (MMF) are used interchangeably throughout this thesis.

While the Covid-19 pandemic has exposed and, in some cases, exacerbated cracks in the financial system, these strains were already existent pre-pandemic. The IMF has addressed the issues of rising vulnerabilities in China, emerging markets, and frontier economics as well as dollar funding as a source of financial vulnerability twice in 2019 (IMF 2019a, 2019b). Furthermore, both the Fed and the People's Bank of China have engaged in massive liquidity injections – US dollar (USD) 420 billion respectively USD 4.24 billion - via reverse-repo as early as September/October 2019 (Harris 2019, Zhou and Galbraith 2019). In this regard, the simultaneous cutting of interest rate and raising of the ceiling of the Bank of Korea's lending support facility (BOK 2019:27-28) could be interpreted as a kind of foreshadowing for the 'unlimited' repo operations the bank held from March until July 2020, thereby for the first time dabbling in quantitative easing (Yonhap 2020).

The previously introduced research question is relevant in more than one way. First, shadow banking essentially is the natural form of banking for a global (financial) system, as both regular banks and non-bank financial intermediaries fund (parts of) their lending activities in the (short-term) money market. Ban and Gabor (2016:902-903) support this view insofar as they identify shadow banking as large and systemically important pillar of global finance with shadow banking assets accumulating USD 36 trillion in 2015, amounting to roughly 60% of global GDP. This means, that shadow banking is not a temporary fluke of the financial system but that it is here to stay.

Second, the selection of the respective country cases specified in the research question serves a distinct purpose: The United States are included for a number of reasons, the most decisive ones being 1) the long-term role of the US dollar (USD) as a global reserve currency, 2) the importance of the US shadow banking sector as the epicenter of the Global Financial Crisis as well as the diversification of shadow banking actors and activities, and 3) as a benchmark for measurement of possible systemic risks by shadow banking to the global financial system.

The South Korean case is of relevance because the country is right on the edge between emerging market and developed economy, which is also a factor for South Korea's financial system being among the most developed and internationally connected in Asia (IMF 2020a:1). In this respect, South Korea can serve as an example for other Emerging Markets and Developing Economies, e.g. China, how to address issues of financial (in)stability that stem from the shadow banking sector. Similar research has been done with respect to South Korea's corporate bond market and its implications on China's bond market development (Park 2004).

China was included for a variety of reasons, the most important being the leading role that China's shadow banking sector has taken among shadow intermediation's overall accelerated growth in Emerging Markets and Developing Economies. Furthermore, trading volumes in

China's bond market – the third largest worldwide – are tightly correlated with repo market volumes, which suggests that most purchases are financed with short-term borrowing and is therefore susceptible to changes in interest rates (IMF 2018:42-43). In addition, although China has a big stock of Foreign Exchange reserves at its disposal, the absence of a direct Foreign Exchange swap line with the Fed could lead to China heavily influencing the Foreign Exchange swap markets in Hong Kong, London, and New York in times of Foreign Exchange market strains (Pozsar and Sweeney 2020:9). Finally, the growing internationalization of the Renminbi (RMB) has led to a handful of foreign institutions to receive access to Chinese repo markets, which are a core funding market for shadow banks and therefore prone to risks deriving from securitization and rehypothecation of collateral (Gabor 2018:405-406).

With the aim of presenting these developments as accurate and up to date as possible, the data used in this paper ranges from 2010 – when the US signed the monumental Dodd-Frank Act into law (Goodhart 2011:1) – to 2020.

1.3 Relevance

Answering the research question can be of use for a number of individuals and institutions alike – both retail and wholesale investors can use the framework presented in chapter 3 to spot certain telltale signs that indicate stress in shadow banking funding markets and adjust their operations accordingly. Furthermore, the chosen country cases can also shed light on the differing challenges of financial systems with a varying degree of sophistication. These findings are also relevant for policymakers and regulators, as (unintended) side-effects of the regulation of regular banks may lead to the build-up of leverage in the shadow banking sector respectively a higher appetite for risk-taking overall.

By contrasting the similarities and differences of the respective countries' shadow banking sector, this thesis aims to demonstrate which products and players contribute to systemic risk. The understanding of the way specific financial products are structured is imperative to assess the degree of risk these assets carry, respectively how these risks can be amplified by the (funding) structure of the entity that is holding them. This is especially relevant for international planning and regulation bodies such as the Financial Stability Board (FSB) because the current guidelines often reflect the financial systems of developed countries. The comparison of China, South Korea, and the United States can be beneficial for the development of future guidelines, as it offers insights into shadow banking systems of an emerging market economy, an economy that transitioned from emerging market to developed economy during the last decade, and the world's leading developed economy.

With respect to the thesis' focus on shadow banking in the real estate sector, the relevance lies within real estate being the most important center of systemic risk (Allen and Carletti 2013:30, Cho et al. 2012:6-7, ESRB 2016:12, Li et al. 2016:1). However, as key agents – such as households construction companies as well as banks and other lenders – tend to take (sometimes excessive) risks because they do not bear the full economic consequences of their behavior, they tend to ignore possible spillover effects to the rest of the economy. Real estate is prone to boom-bust cycles, where leverage is accumulated in the boom phase. In the bust phase, however, price drops result in lowered collateral value, which is detrimental to shadow banking products like mortgage-backed securities (ESRB 2016:12-15). The thesis aims to shed light on the connection between the resurgence of shadow banking after the GFC, especially in the real estate sector, and circumstances that beneficiated this development (i.e. relaxation of lending standards coupled with a low-yield environment, and the expansion of credit through stimulus packages). This is important for regulators and policymakers, as it points to areas where reform is still needed in order to identify risk potentials stemming from the shadow banking sector.

2. State of the Art

2.1 Definitions and overview

Shadow banking

Before entering the discussion of the literature on shadow banking and its associated characteristics it is first necessary to establish key concepts that are relevant for the research interest of this thesis.

The definition of shadow banking that is employed in this thesis is adopted from Mehrling et al. (2013), who view shadow banking as being "[…] simply **money market funding of capital market lending**, sometimes on the balance sheet of entities called banks and sometimes on other balance sheets" (Mehrling et al. 2013:2, emphasis added by author). The reason this definition was given precedence over others[3] is the fact that it sets focuses on a distinct economic function instead of institutions. This insofar relevant, as regular banks are often participating in the process of shadow credit intermediation (Adrian and Ashcraft 2012:16-18, Pozsar et al.

[3] Earlier definitions of shadow banking focused on credit intermediation by nonbank financial institutions outside the regular banking system and are therefore not (or only partially) subject to supervision and regulations (Ghosh 2012:1-2, Moenjak 2014:271, Pozsar et al. 2010:1-2). However, in recent years scholars have pointed out that this definition could lead to an incomplete picture of the SBS, as regular banks are also operating within the shadow banking system (SBS) – be it through (part)ownership, investing in assets associated with shadow banking, or committed lines of credit. A distortion of the true size of shadow banking activities could lead to an underestimation of the system's susceptibility to runs and the ensuing risks to the global financial system (Harutyunyan et al. 2015:4-5, Mehrling et al. 2013:2, Moe 2015:3).

2010:18-19).

The shadow banking system (SBS) can be divided into four different subdivisions: internal, external, independent, and government sponsored shadow banking. Internal shadow banking refers to institutions that are part of a bank holding company, while external shadow banking is conducted under the sponsorship of a major nonbank financial institution (e.g. insurance companies). Independent shadow banking institutions operate outside the influence of major financial institutions and often come in the form of special purpose vehicles (SPVs). Finally, government sponsored shadow banking refers to institutions that provide credit intermediation with implicit government guarantees (Adrian and Ashcraft 2012:18-20).

Since shadow banks do not issue deposits like regular banks, they need to tap different sources to fund their operations. The most important funding market for shadow banks is the market for repurchase agreements (repos). According to Cullen (2017) the increasing volumes of repos are a symptom of the emergence of shadow banking. In this respect, Zhang (2014) links illiquidity in repo markets with spreading contagion to other parts of the financial system and triggering massive initial default as well as persistently depressed investment and output. For these reasons, it is important to understand how the repo market works respectively how and why financial intermediaries engage in it.

As a result, this thesis puts emphasis on the importance of the repo market as core funding market for the shadow banking system.

Shadow money

While central banks issue money in the form of currency and regular banks in demand deposits, shadow banks issue money (or money-like claims) by using highly rated, long-term securities (e.g. mortgage loans) as collateral to back the issuance of short-term debt (e.g. RMBS) (Sunderam 2015:3). Against this backdrop, Sunderam (2015:5-6) finds that shadow banking growth was spurred by increased demand for shadow money, and the surge of asset-backed securities respectively commercial paper (CP) is representative for a broader shift from commercial banks to securities markets.

This thesis follows the definition of shadow money by Gabor and Vestergaard (2016:32), who define shadow money as “repo liabilities backed by tradeable collateral” (Gabor and Vestergaard 2016:2) and assign it four distinct features:

1. It is issued to delay settlement in money proper,
2. Growing acceptance of shadow money (as means of deferred settlements) is dependent on the value of the underlying collateral and its preservations of par convertibility,

3. Shadow money convertibility is inextricably connected with issues of creditworthiness and sovereign authority, and
4. Shadow money cyclically shapes moneyness lower in the hierarchy of money, including tradeable debt of the state.

More importantly, Gabor and Vestergaard (2016:32-33) stress the need for re-thinking many well established and powerful ideas in monetary economics as well as central bank practices[4]. In the latter's case, the convertibility of shadow money implies that central banks do not just need to backstop institutions, but whole markets (a view that is shared by Mehrling (2011:114-116). Furthermore, the Treasury can no longer be guided by ideas of balanced budgets and market-neutral sovereign debt management in the era of shadow finance. Coordination between Treasury and central bank becomes essential if the fragilities inherent to shadow money creation are to be contained (Gabor and Vestergaard 2016:32-33).

To sum up, shadow money has an important role as "grease" in the machinery that is the global economy but inhibits some potential for volatility. In this regard, the possibility of a collapse in value of the underlying securities that shadow banks use to issue money makes this type of money highly fragile in nature.

Shadow credit intermediation

Similar to traditional banks, shadow banks engage in credit intermediation by converting long-term assets (e.g. loans, leases, mortgages) into short-term, tradeable instruments. However, there is a critical difference with respect to the process of intermediation itself – while traditional banks perform credit intermediation "all under one roof", the shadow banking system has divided this into a multi-step process (Pozsar et al. 2010:10). Compared to traditional credit intermediation, this process looks more like a vertical slicing of credit intermediation into seven steps, them being:

1. Loan origination (Adrian and Ashcraft 2012:15)
2. Loan warehousing
3. Pooling and structuring of loans into asset-backed securities (ABS) (Adrian and Ashcraft 2012:15)
4. ABS warehousing
5. Pooling and structuring of ABS into Collateralized Debt Obligations (CDOs) (Adrian and Ashcraft 2012:15)

[4] In this case, Hahm et al. (2012:28) point out that the traditional hierarchy of monetary aggregates is not addressing the factor of **who holds the claims** in question. This important because the same claim can have very different implications for financial stability depending on the entity that holds it.

6. ABS intermediation
7. Funding of all the above activities and entities (Adrian and Ashcraft 2012:16)

Not every intermediation chain involves all of these seven steps, however the chain always starts with loan origination and ends with wholesale funding. As a rule of thumb, the shorter the intermediation chain, the better the quality of the underlying collateral. For example, low-quality long-term assets like sub-prime mortgage loans would require all seven steps to bring them up to acceptable standards for MMMFs and similar funds. In contrast, higher-quality medium- to short-term debt such as credit card debt or car loans usually only require three steps (Adrian and Ashcraft 2012:15-16).

The set of definitions presented above established basic knowledge on shadow banking and should make it easier to follow the rest of the literature review. To most efficiently explore the issue of how shadow banking contributes to systemic risk to the financial system, a subset of literature has been selected based on its relevance to answer the following questions:

1. Which forms of shadow banking exist and how do they impact financial stability? How large is the sector and why does it matter?
2. What kind of entities make up the shadow banking system (in the real estate sector) and what risks are associated with these entities respectively the assets they usually hold?
3. How are shadow banks regulated, especially with respect to regular banks?
4. How do shadow banks fund their operations, and which concerns have been raised over the risks that these operations pose to the financial system?

2.2 Developments in shadows and securities

2.2.1 Associated risks and benefits of shadow banking

2.2.2.1 Advantages of credit intermediation through nonbank channels

While shadow banking carries the possibilities of severe risks to the stability of the global financial system, it also can contribute significantly to economic growth by making credit more widely available to customers and regions that regular either cannot or will not cater to. Furthermore, shadow banks can offer loans and other credit services at a cheaper cost (Elliott et al. 2015:4). While this advantage in flexibility and price competitiveness is usually attributed to be a result of reduced safety margins of shadow banking (Elliott et al. 2015:4-5), this is not necessarily the case for all types of shadow banking. In this regard, Seru (2019:9-10) argues that FinTech shadow banks (which will be more closely described in chapter 2.3.2) in the US mortgage sector not only outperform regular banks in terms of speed but can also evaluate borrowers' likelihood of

default more precisely through the use of big-data, AI and targeting of specific customer groups.

Especially in the area of inclusive finance, entities that operate outside of the regular banking system can deliver valuable services to the financially excluded and underserved, e.g. through microcredit and microfinance institutions, issuers and distributers of e-money in digital finance models, or financial cooperatives (Lyman et al. 2015:2).

In this regard, Chinese small and medium-sized enterprises (SMEs) in the private sector have been reported to be underserved in terms of receiving bank loans - although SMEs have contributed 60% of China's GDP in 2012, they only received (depending on the definition of SME) 20%-36% of total business loans. While most nations find it difficult to channel sufficient credit to SMEs, it is especially difficult for Chinese SMEs to access funding through bank loans because a) the majority of banks in China is still state-owned, and these banks favor state-owned enterprises (SOEs) over SMEs, b) SMEs often lack high-quality collateral and/or documented credit histories and are therefore associated with higher risk of default, and c) under the current commercial bank credit manager responsibility system the punishments for defaulted SME-loans are much severe than for defaulted SOE-loans. For these reasons, shadow banking is an important way for SMEs to finance their investments (Elliott et al. 2015:6-7).

2.2.2.2 Associated risks of shadow banking

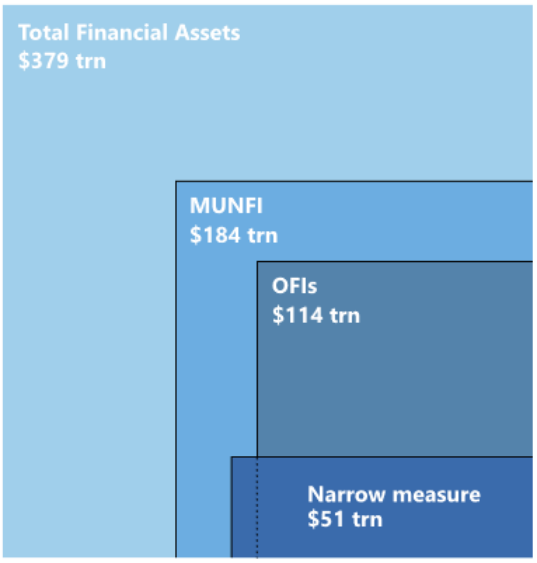
Despite the positive effects it can emit regarding the provision of credit, shadow banking can be an important source of systemic risk. Although commercial banks carry similar financial risks as shadow banks, the SBS is lacking regulation and oversight that regular banks are subjected to. The literature on risks associated with shadow banking has identified the following risks to be the most prevalent in the sector as of writing:

- **Instability of wholesale funding coupled with maturity transformation and liquidity transformation:** Shadow banks are undertaking significant maturity and liquidity transformations, i.e. they transfer short-term liabilities into long term-liabilities and illiquid into liquid assets. These processes are funded through short-term or callable deposit-like liabilities e.g. repos, money fund investments and various types of asset-backed securities – while this model of financing is not constituting a problem (and can even function as "lubricant" for spreading credit) in an economic boom phase, it can lead to a run on specific assets market in a bust and thus undermine the wider financial system (Ghosh et al. 2012:3). In this regard, Ban and Gabor (2016:904) argue that both the Lehman crisis as well as the European sovereign debt crisis are best understood as crises of the respective repo markets.

- **Leveraged credit cycles/Amplification of procyclicality:** Shadow banks engage in activities that can be highly leveraged, e.g. when non-deposit sources of collateralized funding are used to buy assets, which in turn are used as collateral to raise more funds. This can prove to be a source of procyclicality (i.e. mutual reinforcing interactions between the financial and real economy), or simply put: Rising assets prices set an incentive to further increase the amount that can be borrowed against this collateral (e.g. mortgage-backed securities in the case of the US subprime crisis). As this affects the business cycle positively, credit availability is expanding during economic expansions (Ghosh et al. 2012:2).
- **Regulatory arbitrage:** Shadow banking activities or agents of the SBS could be used to circumvent the tighter regulations imposed on the banking sector in the aftermath of the GFC. This could undermine the effectiveness of financial regulation and could lead to heightened systemic risk and leverage, which in turn could spread to the regular banking system through ownership or financial linkages (Ghosh et al. 2012:3, Lyman et al. 2015:2).
- **Tax evasion:** New strands of literature are studying the possibilities of shadow banking for reducing the tax footprint of globalization winners and the production of opportunities for tax arbitrage. Furthermore, the nexus between shadow banking, tax havens and growing inequality points to the possibility of shadow banks either register entities in tax havens (or are registered there themselves), which in turn could alter corporate and individual tax exposure to state power by changing what/where/if tax is levied (Ban and Gabor 2016:905-906).

2.2.2 Shadow banking in numbers

The global SBS grew rapidly until 2007, when it reached about USD 60 trillion (FSB estimate) compared to an estimated USD 27 trillion in 2002. Although many parts of the SBS collapsed during 2008, the system sprung back to its 2007 numbers as early as 2010. According to a flow of funds analysis as a proxy measure the FSB estimated the SBS to represent around 25-30 percent of the total financial system (Ghosh et al. 2012:2). Starting 2011 the FSB conducted to monitor the growth of the SBS more closely through their yearly *Global Monitoring Report on Non-Bank Financial Intermediation*. As of writing, the SBS has grown to a reported sum of USD 50.9 trillion, which translates to roughly 60 percent of global GDP (see Figure 4).



Economic Functions	Size (USD trillion)	Share (%)	Change in 2018 (%)
EF1 (*collective investment vehicles with features that make them susceptible to runs*)	36.6	72.0	0.4
EF2 (*lending dependent on short-term funding*)	3.6	7.0	6.9
EF3 (*market intermediation dependent on short-term funding*)	4.5	8.8	8.7
EF4 (*facilitation of credit intermediation*)	0.3	0.6	5.0
EF5 (*securitisation-based credit intermediation*)	4.7	9.3	0.0
Unallocated	1.1	2.3	9.5
Total	**50.9**	**100**	**1.7**

[1] Total financial assets, MUNFI and OFIs are based on 21+EA Group; Narrow measure is based on the *29-Group*. [2] Net of prudential consolidation into banking groups. For additional details on these categories, see Section 4.
Source: Jurisdictions' 2019 submissions (national sector balance sheet and other data); FSB calculations.

Figure 2: Size of monitoring aggregates and composition of FSB narrow measure.

Source: FSB 2020:5.

MUNFI: non-bank financial intermediation, OFI: other financial institutions, Narrow measure: credit intermediation by non-bank financial entities that may pose financial stability risks.

The growth of the SBS has overall slowed down to 1.7 percent, which is signicifantly less than the 2012-17 average annual growth rate of 8.5 percent (FSB 2020). This was attributed to the first slight decline in shadow banking assets since 2008 due to stock market declines towards the end of 2018 – however this trend was reversed when the market rebounded again.

While the international community has made progress in measuring the size and growth of the shadow banking sector and its associated risks, these risks have risen rapidly in emerging markets (IMF 2018:69). Although shadow banking has gained importance in EMDEs, many EMDE's financial system are still dominated by traditional banking (Ghosh 2012:3). In order to account for this institutional differences subchapter 2.3 will look closer at the nature of shadow banking in EMDEs, while the following section will introduce entities that are typically involved in shadow credit intermediation. The FSB-framework employed in the classification is based on economic functions and was extended to incorporate commercial banks as an entity by the author.

2.2.3 Entities involved in shadow credit intermediation

2.2.3.1 Money market funds (MMFs), fixed income funds, mixed income funds, credit hedge funds, and real estate funds (EF1)

Classification by Economic Functions (EFs) Exhibit 4-1

EF	Definition	Typical entity types[79]
EF1	Management of collective investment vehicles with features that make them susceptible to runs	MMFs, fixed income funds, mixed funds, credit hedge funds,[80] real estate funds
EF2	Loan provision that is dependent on short-term funding	Finance companies, leasing/factoring companies, consumer credit companies
EF3	Intermediation of market activities that is dependent on short-term funding or on secured funding of client assets	Broker-dealers, securities finance companies
EF4	Facilitation of credit creation	Credit insurance companies, financial guarantors, monolines
EF5	Securitisation-based credit intermediation and funding of financial entities	Securitisation vehicles, structured finance vehicles, asset-backed securities

Figure 3: Classification of non-bank financial intermediation by Economic Functions (EFs)

Source: FSB 2018:45

"Two of the largest EF1 entity types, Money Market Funds (MMFs) and fixed income funds, invest primarily in credit assets (reflecting their business models) and engage in liquidity and maturity transformation" (FSB 2020:4).

MMFs *raison d'être* can be summed up in two points: 1) when MMFs first appeared in 1974, they represented a lucrative alternative to a demand-deposit at a commercial bank because the limited interest rates depository institutions were allowed to pay on deposits did not apply to them, and 2) MMFs were initially designed to benefit the small investor by offering low transaction costs in both money and time spent as well as reducing credit risk by investing in a wide range of securities (Stigum and Crescenzi 2007:1099-1101). However, although the risk associated with MMFs was generally assumed to be low, Stigum and Crescenzi (2007:1105-1107) compared a small group of MMFs to a Ponzi-scheme and, without them knowing, spelled out word by word how the GFC would unfold in the realm of MMFs[5]. MMFs mostly invest in following debt-based financial instruments: Bankers' Acceptance (BA), Certificates of deposit (CD), ABCP, CP, repo, and US Treasuries. They do not offer accounts, but instead give out shares that usually are priced around a fixed share value, the so-called constant net asset value (C-NAV) of 1 USD (Segal 2021). However, the consequences of the GFC prompted regulators

[5] "Suppose short-term interest rates were to rise sharply; then the market value of the securities in the fund's portfolio would be temporarily depressed. Suppose also that a large number of investors simultaneously redeemed their fund shares for cash. Conceivably such a fund might be forced to sell off some of its securities at a loss and the actual *market* value of the securities backing its remaining outstanding shares would fall below its fixed share value. In that case, if redemptions continued, the fund would run out of money before all shares were redeemed" (Stigum and Crescenzi 2007:1105-1106).

to introduce restrictions to MMFs ability to promise payment at demand, e.g. through the introduction of a floating NAV instead of a C-NAV (Gabor and Vestergaard 2016:14).

Fixed income funds, exchange-traded funds (ETFs), and mixed income funds are collective investment vehicles (CIVs) that are engaged in varying forms of maturity/liquidity transformation respectively leverage. According to BlackRock (curently the world's largest asset management firm with 7.32 trillion USD of assets under management) all three variants offer fixed income streams and typically invest in government and corporate bonds, CDs, and money market funds (BlackRock 2020). However, these supposedly safe ("less risk than stocks" (BlackRock 2020)) investement streams can carry underlying risks – e.g. synthetic ETFs, who in effect transform (benchmark/index) tracking error with counterparty risk for its investors by holding derivatives instead of outright owning the underlying security itself. This growing complexity in ETFs could undermine the capacity of risk monitoring (Ramaswamy 2011:10-11).

Credit hedge funds are included as EF1 entity because both their funding structure (short-term) as well as their naturally high leverage as risk-seeking agent make them susecptible to runs should lenders suddenly pull their funding because of changes in the risk exposure of the fund (FSB 2015:20). Real Estate Investment Trusts and Funds (REITs) receive special tax considerations and are therefore able to offer a high yielding investment opportunity in real estate. They ususally invest in physical real estate (building) projects, but also in mortgage derivatives, liens and MBS (FSB 2014:15-16).

2.2.3.2 Finance Companies, leasing/factoring companies, consumer credit companies (EF2)

Finance companies, the entity type most commonly classified into EF2, displayed a somewhat elevated degree of leverage, but have moderate maturity transformation in most jurisdictions (FSB 2020:4).

Loans, leases, mortgages and other (risky) long-term assets are transformed by the shadow banking system into seemingly risk-free, short-term and tradeable money-like instruments. In the chain of shadow credit intermediation EF2-type entities are responsible for the origination of loans (sometimes with explicit or implicit support from commercial banks or insurance companies), which are funded through Commercial Paper (CP) and medium-term notes (MTNs) (Bouveret 2011:6-7, Pozsar et al. 2010:10-11).

2.2.3.3 Broker-dealers, securities finance companies (EF3)

"Broker-dealers that are not prudentially consolidated into banking groups constitute the largest EF3 entity type; they employ significant leverage (reflecting their business models), particularly

when accounting for off-balance sheet exposures. The leverage of these broker-dealers increased modestly in 2018 in most jurisdictions, but in aggregate remains lower than the levels seen in the lead up to the financial crisis" (FSB 2020:4).

Broker-dealers have large balance sheet including long-term and risky assets, while their major source of funding is done through repos with MMFs. This can lead to significant funding problems during times in which short-term funding is hampered due to high repo rates, as has been the case in during the GFC. Furthermore, once the short-term funding evaporates and broker-dealers may have a hard time finding a counterparty that is willing to buy the collateral that was used beforehand as the underlying in the repo (Rosengreen 2014:4-7).

Securities finance companies offer credit in different segment, ranging from auto-loans to credit cards, student loans, or equipment leases. The demand of this kind of credit is depending on both credit risk and yield offered, as these credit type tend to be securitized. Risk factors that are usually associated with included rollover risk in the form of early amortization triggers (IMF 2014:94).

2.2.3.4 Credit insurance companies, financial guarantors, monolines (EF4)

This grouping of economic functions is comprised of entities that insure structured securities and enable low cost financing for certain segments of financial markets, whereby insurance corporations, financial guarantors and mortgage insurers together accounted for 35% of total EF4 assets in 2019 (FSB 2020:63). Monolines and bond insurers traditionally hold high credit ratings, which they in effect "lent out" to lesser rated issuers for a fee or premium. The fee for this insurance should ideally reflect the amount of risk the monoline takes on by guaranteeing it (Jayasuriya 2019:2).

Five key factors in the insurance failures of monolines during the GFC included 1) increased proportion of structured finance products (e.g. super-senior tranches of CDOs, usually in the form of RMBS) relative to low capital, 2) limited re-insurance, especially in the case were monolines were the counterparty to credit default swaps (CDS), 3) Investing in self-guaranteed securities, 4) Limited diversity among insured securites portfolio, and 5) Pricing of fees and premiums did not adequatly mirror risk (Jayasuriya 2019:3-4)

EF4 entities may encourage excessive risk-taking if credit, liquidity, or counterparty risk are not calculated correctly, thereby potentially contributing to boom-bust cycles. The difficulty of capturing off-balance sheet exposure adequatly (e.g. in the case of CDS) may lead to the impact and importance of EF4 kind entities to be understated (FSB 2020:62-63).

2.2.3.5 Securitization vehicles, structured finance vehicles, asset-backed securities (EF5)

This grouping includes assets of structured finance vehicles (SFVs), which include collateralized loan obligations (CLOs) (FSB 2020:5).

SFVs (sometimes also referred to as "Special Purpose Vehicles" (SPVs)) played an important role during the GFC with respect to their connections to the originators of the securitization process. The SPV is a separate legal entity from the originator with an own balance sheet and serves three functions: 1) as pass-through entity that transforms the originator's assets into liquid, sellable securities, 2) protection of investors of securitized asset from going bankrupt, and 3) protection of the securitized assets from the originator's creditors. To this end, the SPV can take the form of different legal entities, ranging from trust to corporations, partnerships, or limited liability company (Klee and Butler 2002:26-27).

During the US subprime crisis, a special type of SPV, so-called Structured Investment Vehicles (SIVs), emerged. SIVs business model was to profit from the spread between income in the form of principal and interest payments of long-term assets (ranging from MBS to ABS and secure tranches of collateralized debt obligations (CDOs)) and high-rated CP that it issued. Funding was generated through MMFs, while maturing debt was simply payed of by issuing more CP. This generated excess amount of leverage (18 SIVs managed 395 billion USD by 2008) which their originators never would have been able to engage in due to regulation and capital requirements (Chen 2019).

Asset-backed securities (ABS) can come in the different forms of 1) debt (of varying classes), 2) certificates of beneficial interest, and 3) preferred stock (Klee and Butler 2002:29). In effect, they can be described as collateralized claims on pools of various credit types such as loans, mortgages, or receivables. Both cash flow and income from ABS are structured in tranches with varying levels of credit ratings, e.g. AAA for the super-senior tranche and BBB in the case of the mezzanine tranche. Legally, ABS is structured as bankruptcy-remote SPV and performs credit transformation (through different credit ratings of assets vs. liabilities) and liquidity transformation (transforming illiquid loans such as mortgages into liquid assets), but (typically) no maturity transformation (Adrian and Ashcraft 2012:7).

2.2.3.6 Commercial banks' role in (shadow) money creation (EF6)

Most definitions of shadow banking (i.e. "credit intermediation outside the regular banking system") rule out commercial banks as shadow banking entity because they have access to central bank liquidity and deposit insurance. However, there are several ways in which commercial banks can be involved in shadow banking:

- Providing credit and liquidity lines to shadow banking entities such as SPVs, ABS issuers, or conduits
- Commercial banks are usually owned by bank holding companies (BHC), which might own a wealth management unit with a MMF, or employ a broker-dealer subsidiary which engages in funding of tri-party repos
- BHCs tend to have hundreds or thousands of subsidiaries (the largest five BHCs in the USA in 2012 had each at least 1,500 subsidiaries), most of them being funds, trusts, or financial vehicles that are engaging in shadow banking (related) activities (Adrian and Ashcraft 2012:16-18).

While section 23A in the USA restricts the interactions between the broker-dealer (securities trading) and the commercial bank (depository) arm of a BHC in order to prevent the extension of the public safety net to shadow banking entities. However, both the European and the Chinese repo market are dominated by commercial banks which issue short-term repos - thus, they are not only involved in the creation of ("regular") money, but also shadow money (Gabor and Vestergaard 2016:14-16).

2.3 Shadow banking in EMDEs

2.3.1 General overview of shadow credit intermediation in EMDEs

In contrast to advanced economies, where financial markets and instruments exhibit a high level of sophistication as well as long, complex chains of intermediation, EMDEs' financial systems are mostly bank-dominated. When looking at these important differences in financial systems of AEs and EMDEs the question of how much a threat shadow banking may pose in the latter's case – in this regard, Ghosh et al. (2012:3) identified four main factors which determine whether or not the SBS constitutes significant risks for EMDEs financial systems:

1. Size and systemic importance of SBS in total financial system
2. Types of shadow banking activities and their associated risks
3. Grade of interconnectedness with regular banking sector
4. Degree to which shadow banks are subject to regulation and supervision

While the first FSB global monitoring exercise in 2011 only included one EMDE, namely South Korea, the importance of shadow banking in EMDEs quickly changed two years later when FSB Chairman named shadow banking excesses in EMDEs as posing serious risk to global financial system (Gabor 2018:395). However, there has been criticism towards the criteria for destabilizing shadow banking employed by the FSB may leave out important sectors or innovations (e.g.

the rise of peer-to-peer online lending platforms) reaching significant proportions (Lyman et al. 2015:3). Borst (2014:12-13) refines this criticism insofar, as he points out the ineffectiveness of applying a methodology designed for the Anglo-American financial systems of AEs to the SBS of EMDEs – this would lead to an underestimation of the actual size of a given SBS in an EMDE, as happened with the Chinese SBS in 2012[6]. Furthermore, Borst criticizes the FSB measure to be decidedly focused on entities, while it claims to be focused both on entities and activities (Borst 2014:13). Harutyunyan et al. (2015:27) insofar support Borst's criticism, as they find that their activity-based approach centered on noncore liabilities showed the procyclicality of these liabilities and therefore gave a more comprehensive picture of the jurisdictions considered in their work. Concerning criticism towards the FSB, Gabor (2018:396-397) argues that the FSB agenda has changed from a focus on regulatory intervention to a deeply normative project of transforming shadow banking into market-based finance through organizing financial systems around securities markets.

In EMDEs, "rapid increases in the banking system's noncore liabilities show up as capital inflows through increased foreign exchange-denominated liabilities of the banking system" (Hahm et al. 2012:25). As banks dominate the financial systems of EMDEs, they are the most important kind of financial intermediary and often play active roles in propagating the financial cycle (Hahm et al. 2012: 27). As can be seen in Figure 8, a substantial variation of noncore liabilities took place in South Korea around the Lehman crisis, when noncore liabilities (i.e. Short-term FX[7] bank debt as part of FX borrowing, debt securities, and repos) peaked from 15 percent share of M2[8] aggregate to 50 percent. The rapid move towards market-based finance, as described earlier, has led to a greater reliance on non-traditional, non-deposit-based funding (e.g. commercial paper or asset-backed securities). In order to curb the dangers from short-term FX funding, South Korea implemented a levy on noncore FX liabilities in August 2011 (IMF 2014:47). However, this has not stopped the South Korean shadow banking sector from growing, as it nearly doubled from USD 907.25 billion in 2011 to USD 1.78 trillion in 2018 (Yoon 2018).

[6] Shadow banking assets (as defined by Chinese authorities) accounted for 2.4 percent of total financial assets in 2012. However, if a more activity-based approach would have been utilized, the picture would alter substantially: Alternative financing channels (including trust loans, company-to-company entrusted loans, corporate bonds, and bankers' acceptances) amounted to 42 percent of the USD 2.5 trillion in new credit that was extended by Chinese financial institutions (Borst 2014:13).

[7] Foreign Exchange (FX) means trading of two international currency and/or currency derivatives

[8] M2 is a monetary aggregate that is comprised of bank deposits, cash, and easily convertible assets (e.g. MMF shares) or certificates of deposits (CDs)

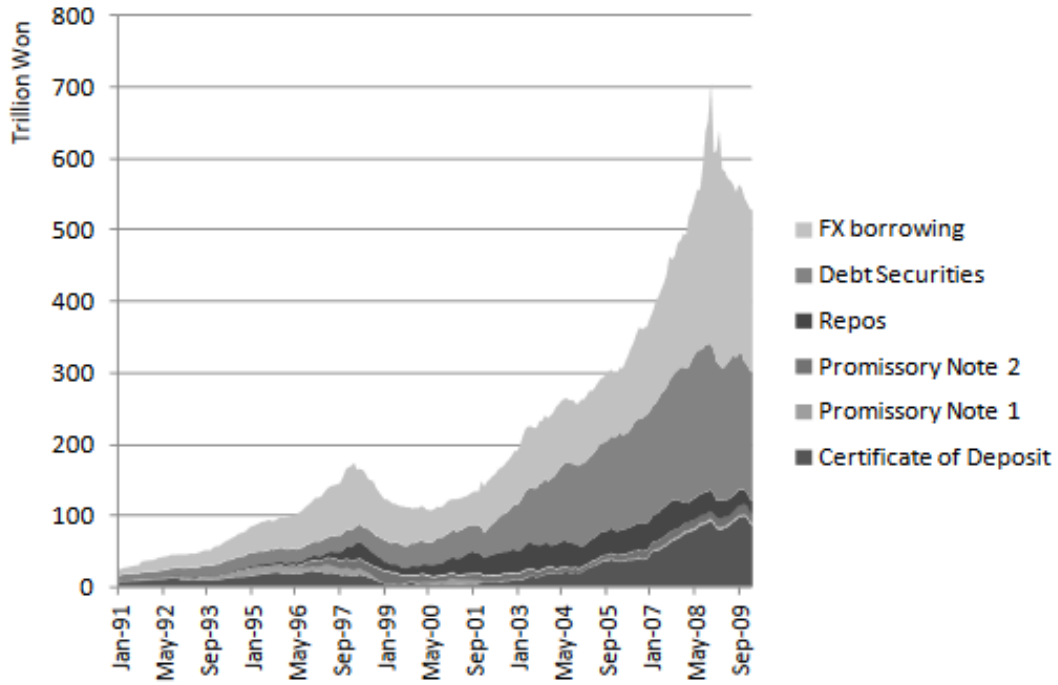


Figure 4: Noncore liabilities of Korean Banking Sector.

Source: Hahm et al. 2012:26.

2.3.2 Recent innovations in non-bank financial intermediation

The FSB collects data on recent innovations in non-bank financial intermediation as a part of its forward-looking approach, which it publishes in its annual global monitoring report on non-bank financial intermediation (FSB 2020:7-8, FSB 2018:9-10). According to the FSB, out of all recent innovations the most reported non-bank business model across all jurisdictions were matching platform, perhaps better known under one of its subcategories: **peer-to-peer (P2P) lending**[9]. The way P2P lending works is the following: Similar to banks, a P2P lending platform assesses the creditworthiness of the borrower and monitors the borrower after the lending has happened. The crucial difference, however, is that the P2P lending platform does not conduct business via their balance sheet because here, the lender is making the decision if he wants to extend loans and thereby take on the risk of the borrower defaulting. This allows P2P lending platforms to operate outside of banking regulations, which in turn leads to P2P lending platforms being able to offer lower borrowing rates while performing the service at a faster pace than regular banks. Some argue that this sector does not seem to pose systemic risk to the financial system, factors such as size of the market, cross-border activities, interconnectedness with other parts of the financial system (e.g. involvement of institutional lenders or securitization), or slippage in underwriting standards should be kept in mind (Atz and Bohlat 2016, FSB 2016:84-86, Samitsu 2017).

[9] There are two main arms of matching platforms, namely 1) Community crowdfunding, consisting of Social Lending/Donation Crowdfunding (e.g. for healthcare reasons) and Reward Crowdfunding, and 2) Financial Return Crowdfunding, which includes P2P lending and Equity-Crowdfunding (Kirby and Worner 2014:8).

In this regard, Kirby and Worner (2014:23-28) are laying out a detailed list of possible areas of risk, one of the most important ones being liquidity risk, especially when the sector grows to a sizeable level. The last-minute blocking of the initial public offering of Chinese FinTech company Ant Group (with Alibaba founder Jack Ma as its controlling shareholder), which was estimated to be at a record number of USD 37 billion, could be seen as a successful lobbying effort of regulators and rivals against a P2P lending group that had become too dominant for some time (Jenkins 2020, Sender 2020).

Similar to P2P lending and crowdfunding, "**Buy Now, Pay Later" (BNPL)** solutions stem from the (seemingly) ever growing realm of financial products that is FinTech. BNPL products, e.g. "Simpl" in India, offer loans for goods and service from participating retailers to consumers. In contrast to credit cards, however, they do not charge interest on their customers' balance and often also do not demand an establishment fee. Furthermore, they do not require a credit score (Lewis 2020). BNPL providers make money through 1) late fees charged to borrows that fail to meet scheduled payments, and 2) commissions that they receive from the seller of the goods and services (FSB 2020:8). In terms of risk, BNPL providers are also susceptible to liquidity risk, as they operate on razor-thin margins, as the example of Simpl shows (Lewis 2020).

The last recent innovation has two distinct features – it is neither recent, nor is it an innovation. However, after dropping almost entirely from financial lexicon, **Special Purpose Acquisition Companies (SPACs)** have made a big comeback. A SPAC makes money through something that is called a reverse merger – first, the SPAC raises money through a stock listing with the intention of buying a private company (that the SPAC deems to be undervalued) and takes it public. Recent prominent examples of this kind of investment practice include *inter alia* the sports-betting site DraftKings and the electric truck start-up Nikola, both of which are currently valued at more than USD 10 billion each. However, a glance back in the not-so-distant past reveals why SPACs should be monitored: The term SPAC had almost become a dirty word in the early 2000s, when several of these blank cheque companies were raised but virtually all flopped, either due to poor acquisitions, subpar management, or both. While improvements have been made by regulators in 2011 regarding the easing of the approvement process of acquisitions by investors, the fact that big banks are eager to get in on the "new" trend **although** the majority of all SPACs between 2015 and 2019 lie below USD 10 per share (which is the standard price when they are first sold to the public) should give rise to at least some concern (Aliaj et al. 2020, Financial Times 2020).

2.4 Shadow banking and real estate in East Asia

2.4.1 Country-specific shadow banking systems and implications for systemic risk

China

While Chinese authorities held a neutral attitude towards shadow banking following the GFC, the boom in China's own shadow banking system after 2010 shifted its stance on the industry to positive and constructive. This change of attitudes was not only reflected in the expansion of non-bank credit intermediation but also in a research boom in the field of shadow banking. According to statistics of the China National Knowledge Infrastructure (CNKI), research articles on shadow banking in China expanded heavily from 114 in 2008 to 3,015 in 2013 (Liangsheng 2015:4-5). Elliott et al. (2015), Lasak (2015), Yao and Hu (2015), Gabor (2018), Ehlers et al. (2018), and Sun (2019) addressed the emergence, contribution to systemic risk, regulatory reform and the role of commercial banks in the Chinese shadow banking sector. Elliott et al. (2015) compare the Chinese credit system *ex-ante* and *ex-post* shadow banking and the emergence of distinctively Chinese shadow banking products, *inter alia* trust loans or wealth management products (WMPs), emphasizing the difficulty to accurately estimate the size of the Chinese shadow banking system (Elliott et al. 2015:5-8). Gabor (2018) claims that scholars are underestimating the possible negative externalities of Chinese shadow banking and points to the sector's structure and complexity becoming increasingly similar to the pre-crisis US shadow banking (Gabor 2018:401). In this regard, Yao and Hu (2015) point to the possibility of domestic defaults spilling over to foreign banks and investors, as China is becoming increasingly integrated with the global financial system (Yao and Hu 2015:116). Ehlers et al. (2018) capture the structure and dynamics of Chinese shadow banking activities from 2013 to 2016 in a stylized map, highlighting the dominant role of commercial banks within the sector – in contrast to developed countries, securitization and market-based instrument do not play an important role yet (Ehlers et al. 2018:31). Lasak (2015) discusses several proposals on how to regulate Chinese shadow banking. He highlights the importance of shadow banking as a source of funds for small and medium enterprises (SMEs), and the need for regulations to be highly sensitive to these circumstances (Lasak 2015:314-315). Similarly, Sun (2019) emphasizes the money creation role of shadow banks in China, focusing on what he calls "bank's shadow" (i.e. loans that take the form of other types of assets, thereby committing regulatory arbitrage). He also proposes policy implications for both traditional and shadow banks, where overly strict regulations on traditional banks should be avoided (Sun 2019:2-3).

South Korea

In contrast to other developed nations, South Korea's shadow banking regulation appears to be more stringent – this stance is *inter alia* visible in MMFs being subject to strict asset management regulation, and the prohibition of reusing collateral in repos (Lee 2015:3-4). Lee et al. (2020) use a novel dataset of matched firm-lender credit accounts from South Korea to document that the implementations of Basel III policies coincided with a reduction in traditional bank lending of 25%, and an increase of the same size in shadow lending (Lee et al. 2020:2). The authors find that there are three broad types of credit involved: loans (short-term and long-term loans, repos, financial/capital leasing), securities (CP, bonds, and securities lent), and off-balance sheet items (acceptances and guarantees). While loans make up the biggest credit type for traditional banks and securities the smallest, the situation is reversed in the case of shadow lenders (Lee et al. 2020:55). Similar to research on Chinese shadow banking, shadow banking in Korea is viewed as displaying not only possible danger but also merits. In this regard, Lee (2015) names risk capital providers such as private equity funds (PEFs), private debt funds, and real estate investment trusts (REITs) as a stabilizing factor for the financial system in lieu of traditional banks (Lee 2015:1-2). Lee (2015) makes an effort to distinguish between what he calls "the non-banking system" and "shadow banking", resembling Sun's (2019) distinction between "bank's shadow" and "traditional shadow banking" (Sun 2019:2-3). Lee (2015) sees the global banking system on a shift from banking-oriented to non-banking oriented, where shadow banking is replacing traditional banking by providing wealth management tools and risk capital (Lee 2015:5-6).

United States

The shadow banking sector in the US is perhaps the best researched one, *inter alia* because the GFC originated within it and the leading role the United States play within the global financial system. Influential research on this topic was done by Adrian and Shin (2008), Pozsar et al. (2010), Mehrling (2011), Adrian and Ashcraft (2012), Mehrling et al. (2013), and Pozsar (2014). Adrian and Shin (2008) were one of the first to point to key differences between traditional banking and market-based banking – while the GFC was still in full swing, nonetheless. Furthermore, they elaborate on the elevated role that the assets of broker-dealers play in the modern financial system of the US (Adrian and Shin 2008:29-30). Similarly, Mehrling (2011) and Mehrling et al. (2013) elaborate on the function of dealers and argue, that the modern financial system bears great resemblance to the 19th century – however, the latter was built on **promises to pay**, while the former rests on **promises to buy** (Mehrling et al. 2013:7-9). According to Mehrling (2011), the Fed's outright purchases of ABS and MBS during and after the GFC can be under-

stood as the central bank posting a wide bid-ask spread in the money market and, through this, create incentives for lenders and borrowers to find each other again once the crisis has weathered down (Mehrling 2011:26-28). Pozsar et al. (2010) and Pozsar (2014) both engage in mapping the shadow banking system. In addition, Pozsar et al. (2010) present the different steps in which assets are intermediated between the various actors of the shadow banking system and form new products (Pozsar et al. 2010:5-7). Pozsar (2014) then builds on this foundation to develop a new compartmentalization for shadow banking (i.e. public, private, independent, and government-sponsored shadow banking) (Pozsar 2014:8-9). Finally, Adrian and Ashcraft (2012) produced one of the most comprehensive reviews of the literature on shadow banking available. They provide a topology for understanding the different parts of the shadow intermediation process as well as an overview of regulation (Adrian and Ashcraft 2012:31-32).

Similarities and differences in cross-country comparisons

The annual monitoring report on global shadow banking (respectively non-bank financial intermediation) that is administered by the FSB since 2011 compares the size and trends of financial sectors both on aggregate and cross-country level by using the monitoring aggregates MUNFI (monitoring universe of non-bank financial intermediation), OFIs (other financial intermediaries), and the narrowest measure of non-bank financial intermediation (FSB 2020:3). While the FSB does this monitoring exercise for as much as 29 different countries, the FSB's regional consultative group for Asia (RCGA) conducted a study on the proliferation of shadow banking in Asia. The latter report found, that ten out of 16 RCGA members belonged to EMDEs[10], whose banking systems were bank-centric and therefore would need a balanced approach in the policy approach to shadow banking. This is especially important as RCGA members have generally adopted the FSB's definition of shadow banking practices, yet the survey showed that none of the members had formally defined shadow banking within their own jurisdiction (FSB RCGA 2014:6-10). This circumstance is widely criticized in the work of Godwin et al. (2016), who argue that there is a pressing need for more detailed regional support to assist Asian countries in effective representation in global fora. Furthermore, they find that systemic risk arising from shadow banking can readily spread between and among financial and economic systems (Godwin et al. 2016:17-19). Allen and Gu (2020) compare China's shadow banking system with shadow banking in the Euro Area, the United Kingdom, and the US. From 2010 to 2018, the largest component across all four countries were collective investment vehicles (MMFs, fixed-income funds, credit hedge funds, and all types of mixed funds). One main difference between

[10] Out of the 29 jurisdictions featured in the FSB's shadow banking monitoring report, only eleven were classified as EMDE, while the other 18 were all advanced economies (FSB 2020:9).

China and the US is that off-balance-sheet vehicles were issued mostly by smaller banks in China because they are constrained by liquidity requirements, while larger banks in the US were more engaged in off-balance-sheet operations because they are more constrained by capital requirements (Allen and Gu 2020:11-12). Tsai (2015) compares the role of non-bank financial intermediaries (NBFIs) played in financial development in China, early industrializers (US, United Kingdom, and European countries such as France) and Asia. The author highlights the intrusiveness of Korea's experience with NBFIs – while *chaebols* gained controlling stakes over NBFIs after the deregulation of the NBFI sector in the 1980s, NBFIs were closely regulated following the Asian Financial Crisis and now primarily serve SMEs instead of *chaebol*. (Tsai 2015:29-32). Finally, Dang et al. (2019) compare the Chinese and US shadow banking systems and find, that they are driven by different mechanisms and operate on different platforms. While the US shadow banking system is market-based and relies on financial engineering to reduce funding costs for firms and create safe assets for investors, the Chinese shadow banking system is bank-centric and relies on implicit guarantees by both banks and the government. Therefore, policy and reforms proposals tailored to the US shadow banking system might not be necessarily applicable to the Chinese counterpart (Dang et al. 2019:27-28).

2.4.2 The role of shadow credit intermediation in real estate volatility

China

As mentioned in the introduction of this thesis, real estate does not only make up an important part of households' wealth but is also the most important center of systemic risk (Allen and Carletti 2013:30, Cho et al. 2012:6-7, ESRB 2016:12, Li et al. 2016:1). With respect to shadow banking, the credit enhancing properties of the sector are contributing to volatility in the Chinese real estate sector because the high interest rates of the shadow banking sector (e.g. 18-36 percent in the case of 2014 defaulted local developer Xingrun Real Estate) can become higher than the returns generated from an underlying real estate asset (CBRE 2014:10-11).

Tsai (2015), Yao and Hu (2015), Lai and Van Order (2019), and Gabrieli et al. (2018) made contributions to the research on the size, origin, buildup of leverage, and various risk implications of shadow banking to real estate volatility. Yao and Hu (2015) trace the growth of China's major shadow banking categories from RMB 3,9 trillion in 2008 to RMB 22,5 trillion in 2014. The authors also emphasize the important role of real estate in the Chinese economy and discuss the sector's interconnectedness as well as the vulnerability of Local Government Financing Platforms (LGFPs) and possible impact of shadow banks' non-performing loans (NPLs) on the regulated banking sector (Yao and Hu 2015:127,130,138,141-144). Tsai (2015) argues, that

small- and medium businesses (SMEs) face a financing gap that is structural in nature and likely to persist even after a possible interest-rate liberalization. Therefore, NBFIs will remain the primary source of funding for SMEs. With regard to real estate, the author views speculative WMPS that invest primarily in real estate as holding a greater potential to trigger a crisis (Tsai 2015:18-19). Lai and Van Order (2019) find that shadow banking appears to be an important factor in property price dynamics in China, their data further suggests a strong link suggesting worrying implications of a collapse in shadow banking (Lai and Van Order 2019:19-20). Gabrieli et al. (2018) estimate the Chinese real estate market's bubble dynamics by adopting a State Space Model (SSM) in order to analyze real estate demand, real estate supply and the unobservable overvaluation component. The authors find strong evidence of a housing bubble after 2010, which were positively affected by stimulating monetary policies after the GFC. Furthermore, the inefficacy of interest rate policies is attributed to the role played by shadow banking (Gabrieli et al. 2018:497-498).

South Korea

The literature on shadow banking in the Korean real estate sector seems to be more extensive than on the Korean shadow banking system as a whole. Jin and Kim (2017), Kim and Song (2018), Shyn (2019), and Al-Yahyaee et al. (2020) looked at the growth of shadow banking in real estate post-2010, the management of bubbles, origin and development of Korean Real Estate investment Trusts (REITs), and associated spillover effects in Korean housing markets.

Jin and Kim (2017) trace the origin of REITs in Korea to the aftermath of the Asian Financial Crisis in the late 1990s, where REITs functioned as a bridge between corporate property owners who suffered from financial distress and investors who required a stable return source. They give a detailed overview of the growth of Korean REITs' market capitalization, assets under management in the REIT market, and the organizational structure of these kind of entities (Jin and Kim 2017:355-357). With regard to volatility in the Korean real estate market, the IMF pointed out the so-called *jeonse* (leasehold deposit) market as a potential vulnerability for the Korean real estate market (IMF 2020a:22). The paper put forward by Kim and Song (2018) focuses on how to measure and manage bubbles in the Korean real estate market. To this end, the authors employ a framework that utilizes the aforementioned *jeonse* system as leasing mechanism to represent the value of residence. Based on a real options framework, the authors find that the Korean real estate market shows characteristics of an American option, the *jeonse* system can be utilized to assess the size of bubbles in the real estate market, and traders are able to hedge their positions when information regarding the real estate bubble is provided (Kim and Song 2018:21-22). Shyn (2019) analyzed the scope of real estate related shadow banking "by dividing

the relevant actors into alternative investment funds (real estate funds and special assets funds) managed as collective investment vehicles, real estate trusts, non-banking real estate provident fund (PF), real estate securitized assets and loan guarantees, and P2P real estate financing" (Shyn 2019:62). Al-Yahyaee et al. (2020) examine spillover effects and connectedness in regional Korean housing markets using the spillover index of DY. They find "that Gangnam is the most influential regional housing market, followed by Gangbuk" (Al-Yahyaee et al. 2020:25). Furthermore, the authors argue that their results show that recent financial crises intensify spillover effects across Korean regional housing markets, and that expansion of credit reduces the yield of real estate related assets such as bonds (Al-Yahyaee et al. 2020:25-27).

United States

Schwarcz (2012), Wray (2012), Duca et al. (2017), Seru (2019), Fabozzi et al. (2020), and Jiang et al. (2020) cover shadow banking in the US real estate sector from the leadup to the GFC, the influence of private government-sponsored enterprises (GSEs), the components underpinning bubbles in the US real estate market, and the composition of shadow banks' lending and assets compositions vis-à-vis regular banks.

Schwarcz (2012) names securitization, hedge funds, and REITs as especially relevant parts of shadow banking in the real estate sector. With regard to securitization, Schwarcz emphasizes that securitization by GSEs is the primary domestic source of mortgage funding regeneration, which is at least partly driven by regulation such as the Dodd-Frank Act. This stipulates that non-GSE mortgage loan securitizations require a 5 percent minimum unhedged risk-retention in order for investors to have some "skin in the game" (Schwarcz 2012:187). Wray (2012) depicts the GFC as being induced by the biggest speculative boom in recorded US history. In this regard, he emphasizes the role that fraud has played in the development of the sub-prime bubble in the US mortgage market. The author points out the creation of collateralized debt obligations (CDOs) and their creators (*inter alia* Goldman Sachs) allowing hedge funds to bet against hand-picked ultra-risky mortgages (Wray 2012:8-9). Duca et al. (2017) note that real estate busts contribute to deep downturns followed by a sluggish recovery and can cause long-lasting economic damage. Their analysis indicates that changes in regulation amplified financial innovation in the form of structured financial products that are part of shadow banking (Duca et al. 2017:133-134). Seru (2019) finds that the US mortgage market is the world's largest consumer finance market. Its structure is unique due to the role of the GSEs Fanny Mae and Freddie Mac, which are buying up home loans from lenders in order to make mortgages more widely available. Shadow banks profit extremely from this setup because they always have a market that they can sell into. The author further traces the growth of shadow banking to the increased regulatory burden on regular

banks and advanced financial technology solutions employed by shadow banks (Seru 2019:18-19). Fabozzi et al. (2020) analyze real estate indices of commercial, residential, and equity real estate sector and find evidence of significant periods of **overevaluation** in residential real estate as well as economically significant periods of **undervaluation** in the equity real estate market (Fabozzi et al. 2020:504). Finally, Jiang et al. (2020) compare lending and asset compositions of regular banks and shadow banks in the US mortgage market. Using call report data, they find that shadow banks' (which specialize in mortgage lending) balance sheet contains, on average, close to 100 percent real estate loans, while traditional banks' balance sheet are made up by real estate loans by about 80 percent (Jiang et al. 2020:8-9).

Similarities and differences in cross-country comparisons

Cho et al. (2012) have produced an extensive research monograph that focuses on the nexus between real estate volatility and economic stability in the East Asia region, covering the jurisdictions of Japan, South Korea, China, Hong Kong, Taiwan, and Singapore. The authors point to the influence of changes in lending restrictions in 1998 which allowed financial institutions in Korea to make loans for purchasing land and specified housing units. Furthermore, with the Korea Housing Foundation (formerly known as Korea Mortgage Market Corporation from 1999 until 2003), a government-owned entity was commissioned with the issuance of MBS in order to fund mortgage lenders in Korea (Cho et al. 2012:25). This bears a striking resemblance to the US case, where Fanny Mac and Freddie Mae serve a similar purpose. In China's case, the authors see the impact of credit expansion via the 2009 stimulus program and imbalances caused by investment-led growth policies as two of the major sources of risk for the Chinese financial system (Cho et al. 2012:140-141). With regard to the application of policy concepts and formal quantitative economic models developed for western countries – especially the US – is "either premature or entirely inappropriate for China" (Cho et al. 2012:159). Yao and Hu (2015) benchmark shadow banking exposures to non-performing loans (NPLs) to those of other Asian countries and find that South Korea actually has the most similarities with China because the interest rates differences between formal and informal banking sector appear to be mostly the same (Yao and Hu 2015:142). Cumming et al. (2018) compare the provision of finance to SME real estate developers in emerging and developed Asian markets by two important participants of the shadow banking system, namely specialist domestic and international private credit funds. The authors find a financing gap in the SME sector that may be filled by private credit funds and other non-bank lenders. Differences between emerging and developed Asian economies appear to stem from differing effects of regulations – while China and India see a lag of supply of finance for real estate developments because either SMEs do not have access to capital markets or regular banks

are face regulatory restrictions towards SMEs, developed economies (e.g. Australia, Hong Kong, Korea, Singapore) banks tend to favor larger projects because regulations ensure that they have to stay within certain prudential limits (Cumming et al. 2018:1-2). Finally, Jang et al. (2020) examine the REIT markets of 23 different countries through empirical analysis and find that the age of a given REIT industry does not seem to have a significant effect on the respective market's volume. While the US and Australia saw high growth in their REIT industries as their REIT markets aged, the same could not be observed in other comparable jurisdictions (Jang et al. 2020:6-7).

2.5 Rules and Regulations in an era of shadow banking innovations

2.5.1 Technical Development – the emergence of FinTech shadow banks

In the last decade, the US consumer finance market has changed remarkably, with intermediation being shifted from traditional banks to shadow banks. This shift also coincided with an increasing change away from "analog" originators towards "digital" or online intermediaries – Buchak et al. (2018) argue that two main driving factors were responsible for this development: 1) increased regulatory burden on traditional banks, and 2) improving lending technology (especially among Fintech shadow banks, which accounted for roughly 25 percent of shadow bank loan originations in 2015 (Buchak et al. 2018:4).

Concerning regulation of these new types of financial intermediation, Seru (2019:18) concludes that lessons from the US mortgage market might be of general use. Furthermore, the assessment of financial stability in this new era makes it necessary to analyze to impact of regulations on banks and shadow banks side by side as well as understanding similarities and differences in the business models of (different types of) shadow banks and traditional banks. An integrated view of financial intermediation is especially needed when the case of Chinese shadow banks is considered, where a further tightening of monetary policy could lead to increased capital flows into Wealth Management Products (WMPs[11]) and internet finance products (Seru 2019:18-19).

2.5.2 Shadow bank regulation and policy challenges for central banks

As an alternative to theoretical models, Goodhart (2011) follows a more praxis-oriented approach of (shadow) banking regulation. He argues that most of the proposed reforms for financial regulation following the GFC were aimed "just at banks and bankers" (Goodhart 2011:4), whereas non-bank financial entities – such as Money Market Mutual Funds (MMMF), Hedge

[11] Off-balance sheet funding instruments (Gabor 2018:400), which bear a resemblance to the US SIVs in times of the GFC.

Funds (HF), or Insurance Companies, and other types of shadow banking entities – were left with too much leeway, while simultaneously hindering central banks' lender-of-last-resort (LOLR) capabilities to expand to these nonbanks in a fear of over-extending the safety net (a stance visible in the Dodd-Frank Act).

The question at hand is, whether the extension of LOLR assistance to the SBS should be seen as something "natural", or if the shadow financial system has to be reined in via stricter regulation (Moe 2015:2). In this regard, Goodhart (2011:25-26) suggested the formation of Special Resolution Regimes (SRR) for the handling of (shadow) banking insolvencies. The reason for this proposal is that, in his view, banks and other systemically important financial intermediaries (SIFIs) cannot be wound down with standard insolvency procedures, as this can lead to severe externalities (e.g. severe and widespread economic and social effects) (Goodhart 2011:21-22). As crises are likely to keep occurring in the future, pre-planning for the potential failure of any SIFI is imperative in the prevention of externalities. A key idea in this regard is the creation of so-called "living-wills", which are comprised of two elements: a recovery plan for the redemption of the institute on the one hand, and a plan of how to wind it down, should it become unsalvageable (Goodhart 2011:26-27).

2.5.3 International (shadow) banking regulations and missed opportunities

Prior to the GFC, the Basel Committee on Banking Supervision (BCBS) published new guidelines for banks' capital requirements known as Basel II, which was an attempt to improve its predecessor Basel I through the use of the so-called three pillars approach[12]. However, the crisis uncovered the need to revise Basel II in many areas - these considerable adjustments culminated in a new set of regulatory guidelines that was issued in late 2010, known as Basel III. The BCBS improved the three pillars and laid out minimum global standard, the liquidity coverage ratio (LCR), which requires banks to have sufficient liquidity to withstand a 30-days stress scenario as well as the requirement for additional capital buffers for SIFIs (Moenjak 2014:240-243).

While Goodhart (2011) argues that Basel III reforms were incomplete and/or partially misdirected in several aspects (as discussed in the previous subchapter) the IMF stated in its 2014 Global Financial Stability Report that regulatory reforms have helped to strengthen the global banking system by reducing risk associated with wholesale funding and proprietary trading (IMF 2014:21-22). The FSB has also produced a comprehensive regulatory regime - although its members are not legally bound to follow these rules, a "combination of moral suasion

[12] Pillar 1: capital requirements were made more comprehensive and responsive to risk, including operational, market, and credit risk (all three require to be quantified), Pillar 2: Need for examination of banks by regulatory authorities with regard to risk-weight and adjustment of said risk weight to truly reflect underlying risk if deemed necessary, Pillar 3: focused on having private investors validating banks' risk management practices (Moenjak 2014:240-241).

and peer pressure has thus far proved effective" (Gabor 2018:411). Nevertheless, Gabor (2018) sees mounting evidence that the amount of optimism expressed over both Basel III and FSB recommendations might have been well overstated. In this regard, she highlights the significant watering down of some proposals (e.g. repo collateral rules) while others (e.g. treating large asset managers as "too-big-too-fail") were abandoned altogether. Another important point raised is the danger for EMDEs that are pushed by financial globalization goals of the G20 to adopt western-style repo markets and opening them up for foreign investors - which would potentially lead to these repo markets becoming a source of systemic risk because the re-engineering of EMDEs' shadow banking systems imposes a structure for generating liquidity that is known to be highly fragile (Gabor 2018:411-413).

With respect to the Basel regulations, Jones and Knaack (2019:196-197) point out five implementation challenges that low- and middle-income countries (LMICs) face when they seek to implement Basel II and III:

1) Even simpler components of Basel II and III require a degree that is not in place in many LMICs, e.g. credit rating agencies do not cover wide segments of developing country markets which undermines the standardized approach to credit risk because it relies on credit rating agencies. Furthermore, “the supply of high-quality liquid assets in many LMICs may not be sufficient for banks to meet the liquidity requirements of Basel III” (Jones and Knaack 2019:196).
2) “Basel II and III address financial risks that may be of little or no relevance to simpler financial system, e.g. counterparty risk with respect to derivatives trading or liquidity mismatches arising from wholesale funding” (Jones and Knaack 2019:196).
3) Resource constraints arising from (human) resource scarcity due to the complexity of internal ratings-based approaches of Basel II respectively the macroprudential elements of Basel III. Information asymmetries between regulator and regulatee are even more salient in developed nations because of this resource scarcity, as remuneration differences between the private sector and the regulator authorities pose significant challenges.
4) Implementation of Basel II and III takes away scarce resources from other important regulatory priorities and also do not necessarily address underlying systemic weaknesses or vested interests in politics.
5) Lastly, implementation may lead to a deterioration of credit composition, e.g. in the case of Basel III the required liquidity rations could raise the cost of infrastructure lending because banks would need to match such exposures with long-term liabilities that are not abundant in developing countries (Jones and Knaack 2019:196-197).

2.6 Money market derivatives, Foreign Exchange (FX), and global liquidity

2.6.1 Money market derivatives

2.6.1.1 Forwards and Futures

According to Simon and Thalassinos (2020), "derivatives are any financial instrument that **derive** their value from the value(s) of other, more basic, underlying variables. The underlying can be anything, for example, a financial asset or a rate, with payments that are linked to an index, the weather in a specific region or the profitability of selected companies" (Simon and Thalassinos 2020:8, emphasis added). A mix of stronger network and communication infrastructure as well as the need to hedge relative risks more efficiently (due to sharp rises in interest rates and currency exchange rates) changed derivatives trading drastically (Simon and Thalassinos 2020:9). In the second half of 2019 the market for derivatives stood at a notional amount of outstanding of all over-the-counter (OTC, i.e. traded over a decentralized network of banks or financial institutions) derivatives contracts of USD 558.5 trillion at the end of December 2019 (BIS 2020). In contrast to OTC-derivatives (e.g. forwards, swaps, and some options), which usually are custom-tailored contracts, exchange-traded derivatives (e.g. all futures and many options) have been standardized in order to be tradeable on exchanges. While there are many different variants of derivatives, the purest form of derivatives (so-called "vanilla types") can be categorized in forwards, futures, options, and swaps (Simon and Thalassinos 2020:23-24).

According to Stigum and Crescenzi (2007), "**forward** transactions are common in many areas of economic activity including the markets for commodities. *In a forward transaction* a seller agrees to deliver an asset to a buyer at some future date at some fixed price" (Stigum and Crescenzi 2007:693, emphasis (bold) added). A possible use-case for a forward contract would be an international exporter (e.g. form the US to Malta) who has agreed to payment in euro for shipment of goods in one year. In this case, the exporter can use a forward agreement as a hedge against currency risk in case the dollar value of euro should fall (Simon and Thalassinos 2020:24).

A **futures** contract is similar to a forward contract in some ways, however there are some important distinctions between the two concepts:

- While forwards are custom-tailored contracts, futures are standardized contracts that are traded on exchanges, which serve as trading arenas for specific types of futures contracts.
- Whereas forward contracts are usually made with the intent to deliver either cash or goods at the expiration of the contract, only a small number of outstanding futures contracts (around 2%) are eventually settled by delivery. Instead of fulfilling delivery provi-

sions, a buyer will typically close out his position with an offsetting sale of the same contract, while a seller would make an offsetting purchase.

The reason for the second difference is that, rather than buying or selling an item, people who enter into futures contracts use them either to 1) offset risk on a long or short position by taking an equal and offsetting position in the form of a future, or 2) to speculate on the price of a specific item respectively the spread in which it trades (in relation to another item) (Stigum and Crescenzi 2007:693-695).

2.6.1.2 Options

Options grant the buyer the possibility – but not the obligation – to either buy (**call** option) or sell (**put** option) a certain asset or commodity for a pre-defined price (strike price) until a certain date (maturity date) in the future. Compared to other derivatives the losses to option buyers are very lenient because there is no obligation to go through with the option at the maturity date, hence the only loss that can be incurred via an option is the cost for the premium due to the seller of the option (who, in turn, is forced to make the trade if the option holder decides to go through with it).

Options can have different underlying such as stocks, bonds, an index, a currency, or a commodity. They can be traded both OTC and on exchange (Simon and Thalassinos 2020:24). Options contracts come in a variety of different flavors, the most common ones being:

- **European option:** The holder can only exercise his option on the maturity date, which limits his ability to react to sudden value changes in the underlying.
- **American option:** Contrary to the European option, the holder of an American option can exercise an option at any time until the maturity date. This makes the option especially appealing for buyers because they can choose to make use of it at the best possible time.
- **Asian option:** An Asian option can be exercised anytime, however the important distinction is in the underlying – rather than a single price, the value of the underlying is determined by an average of different price (indexes). This limits the fluctuation of prices and therefore costs, especially if prices were to rise sharply just before the maturity date.
- **Bermudan option:** This type of option is a mix of the American and European variant, i.e. the option can be exercised on a number of set days (instead of just the maturity date) but not at any given date. This option gives the holder more freedom than a European option to exercise it on a favorable spot in time (Agiboo 2020, Stigum and Crescenzi 2007:793-796).

2.6.1.3 Swaps

2.6.1.3.1 Interest Rate Swap (IRS)

Swaps are OTC agreements between two parties during which cashflows or liabilities exchanged over a pre-specified timeframe. Swaps are normally used by financial institutions and businesses rather than retail investors because they are often used as a hedge against interest rate fluctuations, default risk, or mismatches in asset and liability timeframes (Chen 2020, Simon and Thalassinos 2020:25).

Interest rate swaps (IRS) were first used in the 1980s and are among the most popular types of derivative contracts. Two parties exchange two different kinds of interest rates, fixed and floating, usually as a measure to manage interest risk or to gain a more favorable rate than they would be able to secure directly (Jermann and Yue 2018:104). Stigum and Crescenzi (2007) give an example of how a rather straight-forward version of an IRS could work: Imagine a BBB rated company and a AA rated investment bank – while BBB can borrow at a floating rate that is close to the one of AA (6-month LIBOR[13] + ¼ vs. 6-month LIBOR + 1/8), the difference in the long-term fixed-rate is more significant (interest rate of 5.85 vs. 5.375). This margin of 47.5 basis points (bp) is the reason for both parties to enter into a swap agreement: BBB borrows at LIBOR + ¼ and sells the debt to AA at LIBOR flat. While it loses 25 bp by doing this, AA lends 5-year, fixed-rate money to BBB at 5.50. Therefore, BBB earns a total saving of 10 bp through the swap, while AA gains 25 bp (Stigum and Crescenzi 2007:874-875).

2.6.1.3.2 Credit Default Swap (CDS)

Stigum and Crescenzi (2007) define a **credit default swap** (CDS) as "A credit derivative that enables parties to exchange the credit risk of fixed-income securities. CDS buyers purchase protection against a bond's default, paying a fee to protection sellers" (Stigum and Crescenzi 2007:1128).

One of the best examples for this kind of swap is probably the case of AIG, which insured a large number of counterparties, including large banks, against credit risk. AIG also expanded its insurance (which a CDS technically is, although it is not classified as such) to complex financial assets such as MBS, especially in the subprime mortgage category. The way a CDS works, the insurer – while regularly receiving a premium by the CDS buyer – only has to post cash collateral to the CDS buyer if the insured collateral gets downgraded. Furthermore, in case of default of the collateral issuer, the insurer has to pay the CDS buyer to cover its loss on the collateral holdings. After the onset of the GFC AIG started to incur heavy losses through the

[13] London Inter-Bank Offered Rate

CDS it had issued as banks, firms, and MBS were downgraded. When Lehman collapsed in September 2008 AIG was also in dire straits, as 1) its own credit rating was downgraded, and 2) demands of large amounts of cash collateral came in from various CDS buyers. The Fed's decision to rescue AIG was made because of the large losses AIG's counterparties (including many large banks) would have otherwise incurred (Moenjak 2014:261-262).

2.6.2 Eurodollars, FRAs, and FX swaps

In essence, "Eurodollars are simply dollars held on deposit in a bank or bank branch located outside the United States or in an international banking facility (IBF)" (Stigum and Crescenzi 2007:209-210). Eurodollars got their name because the praxis of accepting dollar-denominated deposits originated in Europe – however, through the spread of these kinds of deposits to other financial centers around the globe the term Eurodollar has *de facto* become a misnomer (Stigum and Crescenzi 2007:49-50). Apparently, the Eurodollar market came into existence for two major reasons:

1) The importance of the US dollar as (leading) world reserve currency – as many people wish to make and receive payments in US dollars, an interbank lending market to link deficit and surplus agents (analogous to the Fed Funds market) is needed. As foreign banks have no access to either Fed Funds or Fed Wire, Eurodollars settle on the private CHIPS (Clearinghouse Interbank Payments System, Stigum and Crescenzi 2007:217) network.
2) In a way similar to the emergence of MMFs, Eurodollars developed in order to circumvent capital respectively regulatory requirements (e.g. reserve requirements or premiums for deposit insurance). Although most of these barriers have been lifted since, the market survived as a separate entity. In addition, the Eurodollar market does not only serve as an (interbank) dollar payment system, but also as the world funding market. In these funding operations, foreign banks act as a sort of money dealer by taking deposits and granting loans in the global dollar market (Mehrling 2019b:1-3).

Customer-led demand of US dollar holdings at international banks causes natural surplus and deficit positions of these banks. Although these imbalances could also be resolved by doing business with US banks directly, the preferred method seems to be that surplus banks lend to deficit banks in the Eurodollar market. The rate of interest charged in this market is the London Interbank Offered Rate, LIBOR for short. The nature of the Eurodollar market, as an unsecured lending market with special vulnerability to liquidity problems, led Eurodollar banks to line up the time pattern of their cash inflows and outflows, i.e. the banks want to know when exactly a

cash outflow will happen and be prepared to meet it (Mehrling 2019b:3).

However, sometimes dates of cash inflows and outflows do not line up – this mismatch in international banks' Eurodollar books has led to the development of so-called **Forward Rate Agreements (FRAs)**. FRAs are off-balance sheet instruments that is used by banks to help each other in lining up their cash flows by swapping their promises to pay and locking in an interest rate of X%. The way this works is the following: Imagine one bank that is expecting to **lend out** a 3-month USD loan (Bank A), while another bank is expecting to **receive** a 3-month USD deposit in two months (Bank B). The two banks can both hedge their natural position (deficit respectively surplus) while simultaneously economizing their balance sheet space, which is possible because the only payment necessary is the difference between LIBOR and the previously locked in interest rate of X%. The motivation of Bank A, as the buyer of the FRA, is protection against a rise in interest rates in the future – whereas Bank B, as the seller of the FRA seeks protection against a fall in interest rates. FRAs are usually traded in 3, 6, 9, and 12-month maturity ranges, although non-standard periods (so-called broken dates) are also possible. FRAs offer some advantages over futures, e.g. flexibility because they are OTC traded, do not require any initial margin, exhibit reduced exposure to base risk since the only amount at risk is the settlement sum (never the principal amount), and can be traded in any currency (Stigum and Crescenzi 2007:831-836).

Besides the Eurodollar market, which trades at USD-LIBOR, there is also the "Eurocurrency market" (Stigum and Crescenzi 2007:855), which represents deposits of various non-dollar deposits. Banks use **FX swaps** in these markets to match their cash flows in the currencies that their customers desire. The effect of FX swaps is that banks can shield themselves from fluctuations in the exchange rate of a given currency (Mehrling 2019b:7-8). Private FX dealers (see Figure 10) can facilitate a USD-denominated loan to a deficit country, for which the latter pays in its local currency. In order to hedge against price risk, the dealer enters into an offsetting contract by borrowing term FX and lending term dollars. This way, the dealer can achieve matched book – although he still faces liquidity risk since the spot-USD liability requires rerolling until the term-USD asset matures. The last row in the graph represents a speculative dealer, who would take the opposite side in the matched book-dealer's offsetting FX swap. While this is how the system works in normal times, the stress caused by the GFC made is collapse and required the Fed to engage in a USD 600 billion central bank liquidity swap with various central banks around the globe. One specific symptom of the private FX dealer market was a large and persistent spread in Eurodollar interest rates and domestic US dollar interest rates, also known as LIBOR-OIS (Overnight Index Swap) spreads (Mehrling 2015:11-14).

Surplus Country		FX Dealers		Deficit Country	
Assets	**Liabilities**	**Assets**	**Liabilities**	**Assets**	**Liabilities**
$10 due from					$10 due to
-$10 due from +$10 spot		+$10/s FX spot	+$10 spot	-$10/s FX spot	-$10 due to
		+$10 term	+$10/s FX term		
		+$10/s FX term	+$10 term		

Figure 5: Settlement in a private FX dealing system

Source: Mehrling 2015:12

2.7 The inherent instability of credit – the case of repurchasing agreements (repos)

2.7.1 The way the repo goes

"We have traced the inherent instability of credit to its source […]. We found that the initiative in production rests with the merchant and the promoter, the dealer in commodities, and the dealer in capital issues. It is they who give the order to produce. The process of production which follows, gives rise to a chain of debts" (Hawtrey 1919:376).

This quoting of Hawtrey's famous "inherent instability of credit" is of special relevance to the repo market, notably so in his observation that an expansion of credit inevitably entails a contraction that is maintained through the downward tendency of prices (Hawtrey 1919:124). This phenomenon was visible during the GFC when collateral values kept falling and market participants increasingly withdrew their funding, which culminated in a run on repo markets that proved to be a key driver of the crisis. The repo market is a major source of short-term funding for shadow banking, and according to Cullen (2017:2) the increasing repo volumes were (respectively, are) a symptom of the emergence of shadow banking. In this respect, Zhang (2014) links illiquidity in repo markets with spreading contagion to other parts of the financial system and triggering massive initial default as well as persistently depressed investment and output. For these reasons, it is important to understand how the repo market works respectively how and why financial intermediaries engage it in, which is the purpose of this subchapter.

The basics of a standard repo transaction was already introduced in the beginning of this thesis – however, this thesis will expand on the process and go more into detail in this subsection. First, it is important to note that repurchasing agreements come in **two different types**, namely **repo** and **reverse-repo**. While the former lends out collateral to obtain cash (either to finance securities holdings or to buy more securities), the latter lends out cash to earn interest on his money balances. The trade is constructed in two separate security transaction (usually re-

ferred to as “legs”), often overnight (O/N) repos. After a deal has been struck between dealer and customer, the dealer sends the customer a confirmation (also called “confirm”, see Figure 6) detailing all relevant information involved in the deal. The example of Stigum and Crescenzi (2007) uses a 10-year treasury bond with a 2% haircut and a repo (interest) rate of 4.92% overnight, which amounts to 135.61 USD on loan with an amount of nearly one million USD (Stigum and Crescenzi 2007:533-534). Standardized repo forms are called “master repo agreements”, the two most prevalently used are the Bond Market Association’s master repurchase agreement (MRA, governed by New York laws) and the global master repurchase agreement (GMRA, governed by laws of England) published by the Bond Market Association and the International Securities Market Association (ISMA) (Stigum and Crescenzi 2007:532).

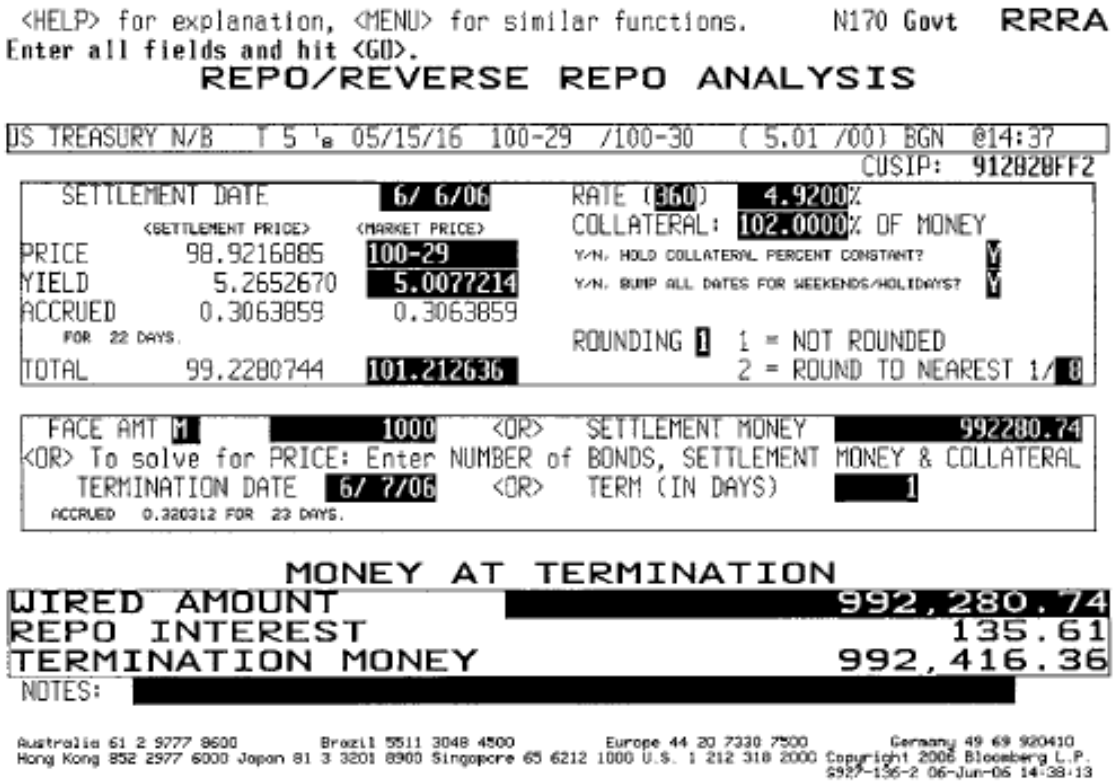


Figure 6: Details of a repo transaction

Source: Stigum and Crescenzi 2007:533

There are different repo markets, differentiated by market participant type, *inter alia* customer repo markets for trades between companies and customers (B2C), institutional repo markets for trades between companies (B2B), or OTC/interbank repo markets. The repo market in the US is largely a dealer market, the most important ones being the so-called primary dealers, which are monitored by the Fed. Primary dealers gain their elevated status by serving as counterparty to most repo transactions and, by contributing to a unified and relatively homogenous market, can be thought of as market makers (Mehrling 2019a:1-2). It is exactly this important trait that is the reason why the Fed conducts repos only with primary dealers – reverse repos,

however, are conducted with "both primary dealers and an expanded set of reverse repo counterparties that includes banks, government-sponsored enterprises, and money market funds" (FRB-NY 2020). As mentioned in the introduction, other central banks have also increasingly engaged in **reverse repo** transactions, the objectives of which were the easing of money marketing conditions. Accordingly, **repo** transactions by a central bank would serve the purpose of temporarily tighten money market conditions (Moenjak 2014:124-126).

The literature has identified two different types of repo trades, depending upon whether the borrower and the investor are dealing directly with each other, or an intermediary between them is involved – **bilateral** and **tri-party** repos. The upper half of Figure 7 depicts a bilateral repo transaction, wherein both payment and securities delivery are executed between the personal infrastructures of borrower and investor, respectively through e.g. collateral management provided by their respective custodian banks. A tri-party repo transaction, as shown in the lower half, involves a third-party service provider that facilitates settlement, custody, and collateral management on behalf of borrower and investor. This third-party agent can take the form of a central securities depository (CSD) or clearing bank (Yun and Heijmans 2013:2-4). While tri-party repos account for two thirds of overall repo transactions in the US, they only amount to about 10 percent in Europe. Similar to China, Europe's bilateral repo market is dominated by banks, and exhibits strong tendencies towards the use of CCP (central counterparty clearing) institutions (Gabor and Vestergaard 2016:12-13).

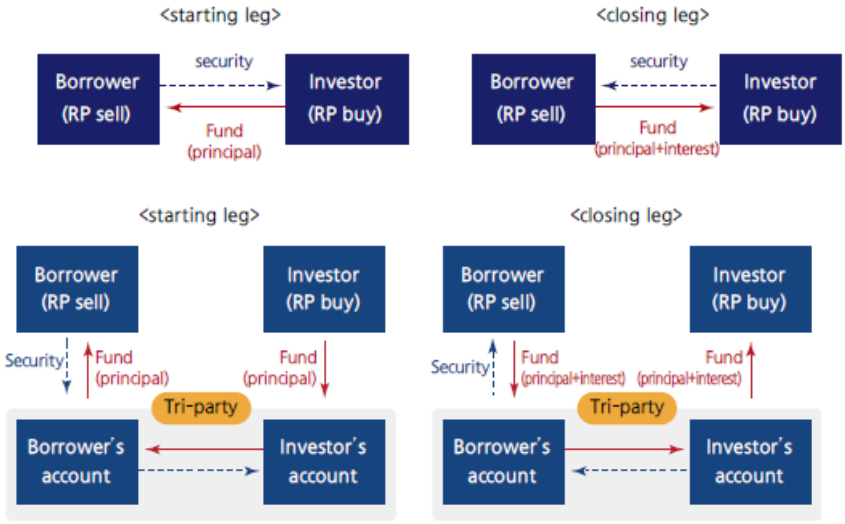


Figure 7: Bilateral and tri-party repo trades

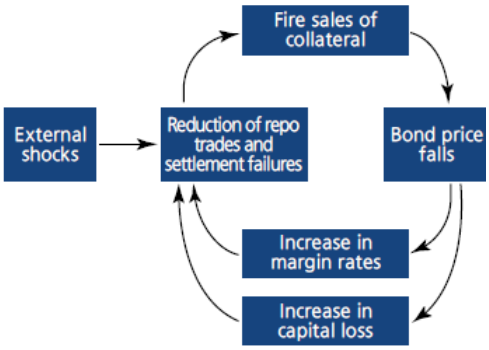
Source: Yun and Heijmans 2013:3

2.7.2 Sources of risk and volatility within repo markets

As mentioned several times before, the repo markets play an important role in facilitating the flow of cash and securities throughout the financial system, with both banks and non-bank financial intermediaries as participants. While well-functioning repo markets is beneficiary to reduc-

ing funding costs of companies in the real economy as well as improving the effective allocation of capital, excessive use of repos can lead to an overreliance on short-term funding, thereby contributing to the build-up of leverage (CGFS 2017). In general, repo markets are seen as relatively stable because repo transactions are collateralized with high-quality securities. This is also the reason why the repo rate is usually a bit below the central bank's policy rate (e.g. Fed Funds in the Fed's case), as a repo constitutes a **secured** loan (while an interbank loan is **unsecured**), and many investors who can invest in repo cannot sell at Fed Funds (because they do not have access to the interbank market) (Stigum and Crescenzi 2007:540).

However, the GFC turned this (supposedly) stable relationship upside down – nowhere was this more visible than in the spread between the General Collateral (GC)[14] repo rate and the Overnight Index Swap (OIS)[15] rate. Normally, the two rates are only a few basis points apart, but increasing financial instability led the GC-OIS spread to grow as high as 80bp[16] (Yun and Heijmans 2013:11-12). Furthermore, the sharp decline in housing prices caused haircuts and repo rate to increase drastically because financial intermediaries were increasingly concerned about the value of the underlying collateral. This forms an amplification mechanism as depicted in Figure 8 (Zhang 2014:2-4).



	US	Europe
Pre-crisis period	2.86	0.47
Initial crisis period	21.99	1.55
March 2008 to Lehman Collapse	18.45	2.13
Post-Lehman Collapse	12.82	2.81

Note: 1) Standard deviation of GC RP-OIS spread.
Sources: Bloomberg, European Banking Federation.

Figure 8: Shock amplification mechanism in repo markets and repo rate volatility in the US and Europe

Source: Yun and Heijmans 2013:14

In this regard, Smith (2012) studied the term structure and collateral type of short-term repo markets from 1997-2012 and found, that the spreads between MBS, agency, and US Treasury repo rates capture the relative risk of the underlying collateral. Furthermore, the literature on credit risk in repos finds that bilateral repo markets in the US were nearly completely shut down, whereas tri-party repo markets were not affected in a similar way (Smith 2012:7-8). Another

[14] GC repos were introduced in 1998, designed to enhance the ability of repo participants to trade general collateral repos by removing constraints on collateral notification and allocation. Through this, GC repos reduced transaction costs and improved liquidity in the interdealer repo market (Stigum and Crescenzi 2007:545).
[15] The OIS is an interest rate swap in which a floating and a fixed interest rate are exchanged within a specific period and reflects the expected average interest rate of its underlying asset (a given country's central bank rate) (Yun and Heijmans 2013:10).
[16] If we look back to the margins of derivatives dealing in the example of IRS, we can clearly see why these kinds of spreads constituted a major problem for the global dealer system.

possible method to mutualize repo risk is to put a Central Clearing Counterparty (CCP) directly between counterparties. However, while mandatory centralized clearance of repo transactions via CCPs benefits financial stability in some ways, there are legitimate concerns that a market controlled by a few (large) CCPs might rather concentrate risk instead of eliminating it (Cullen 2017:19-21). Against this backdrop, Boissel et al. (2016) found three main elements that affect Central Clearing Counterparties (CCPs) in a crisis, namely 1) the effectiveness of the haircut policy, 2) CCP member default risk, and 3) CCP default risk. The model of the authors shows that repo investors during the 2011 sovereign debt crisis behaved as if the conditional probability of CCP default was very large and was accordingly priced in repo rates (Boissel et al. 2016:39-40). Another potential source of risk within repos is the use of rehypothecation, or reuse, of collateral which is common in both bilateral and tri-party repo markets. This practice allows a prime broker to use an asset (let us say a AAA-rated tranche of MBS) posted by e.g. a hedge fund to use this asset for the broker's **own** funding purposes. This is also beneficial to the hedge fund in this example because the broker then charges less for his services if the collateral is allowed to be reused (Cullen 2017:13-14, Singh and Aitken 2010:3-4). The build-up of these kind of collateral chains is problematic because they make assets that were already complex (e.g. MBS, ABS, ABCP, CLOs/CMOs) even more opaque. Furthermore, if haircuts **do** rise, the money multiplication mechanism that allowed the asset in question to be passed around also distributes the increased cost. The cumulative cost of these haircuts can be sizeable, as Singh and Aitken (2010) show through their model that the global shadow banking system was at least 50 percent bigger than estimated at first.

To summarize, repo markets exhibit the following risk factors that all can have an effect on the height of a given repo (market) rate:

1) Collateral value risk
2) Counterparty risk
3) Rehypothecation

As mentioned in the introduction, the end of 2019 saw repo rates in the US soaring as high as 10 percent before Fed intervention in the repo market calmed the distress. Many experts (Kaminska 2019, Long 2019, McDermid 2019, Snider 2019) have concluded that repo rate surges at the end of a quarter are no anomaly *per se* and do not necessarily mean that (another) financial meltdown is imminent – however, a reduction in excess bank reserves was also cited as a large contributor to September's repo rate surge. With regard to reducing the risk of further disruptions, some market participants expect the Fed to set up a permanent repo market backstop, also known as a standing repo facility (McDermid 2019).

3. Methodology

3.1 Genesis and structure

Past research has created a variety of different approaches that can be employed to measure fragility in financial assets respectively to identify systemic risks to the entire financial system. The literature has identified three main concepts of measuring the size of shadow banking, them being 1) the flow of funds measure (also known as Financial Accounts of the United States), 2) the FSB measure (narrow and broad), and 3) the size of non-core liabilities (IMF 2014:68-72). However, there are substantial shortcomings to these approaches, which in turn could lead to a distorted picture of the degree of systemic risk present in the respective financial system(s). These limitations will be addressed in the following paragraphs in the order presented above:

- **Flow of Funds (FoF)**: FoF is used to track who borrows and who lends in the real economy, which is useful when you want to look at inflation or growth dynamics, but it is less useful when the object of interest is to monitor risks to the financial systems. This stems from the nature of derivative products as well as funding sources of shadow banking – derivatives separate the flow of risks away from the flow of funds (through CDS, IRS, or FXS), and funding in the form or repos can use the same collateral and therefore lead to the build-up of leverage that would be invisible to the FoF measure. In addition, funding in the form of Eurodollars is also not encompassed in the FoF, which contributes to an incomplete picture of an investors' exposure to bonds and other credit (Pozsar 2014:4-5).
- **FSB measure**: The main issue with the way the FSB measures the shadow banking system and the parts of it that "[…] have increased potential for posing risks to financial stability […]" (FSB 2020:36). While I do not agree with Borst's (2014) comment that the FSB measure focuses decidedly more on entities than activities, this thesis shares his criticism that the framework for this so-called narrow measure is primarily drawn from an Anglo-American structure of finance, i.e. financial systems with significant direct financing channels. EMDEs such as China, on the other hand, have a more bank-centric financial system, where the share of financial assets held outside of the banking system is much smaller in comparison (Borst 2014:13).
- **Size of non-core liabilities**: Compared to FoF and the FSB measure, the size of non-core liabilities has an advantage in the measurement of shadow banking, especially in EMDEs because they include both banks and non-banks while also accounting for the procyclicality of shadow bank funding through e.g. repos (Harutyunan et al. 2015, Shin and Shin 2011). However, the non-core liabilities approach excludes non-MMFs (as does FoF), which is problematic because recent studies have discovered that these funds can expose

bank-like risks (e.g. vulnerability to runs in case of an investor confidence crisis, also non-MMFs are often subject to easy redemption) (IMF 2014:72). This is of special importance in light of the growing number of ETFs respectively the argument that asset managers pose a potential threat to financial stability in EMDEs as they are increasingly taking on leveraged investment in these markets (Gabor 2018:396).

For the reasons presented above this thesis will employ an eclectic framework in order to measure the development of the shadow banking sector in the specified countries as well as possible indicators for systemic risks that (some parts of) shadow banking poses. To this end, the chosen framework puts special emphasis on the funding side of shadow banking in the form of repos because they are debt relationships that are organized via tradeable, highly liquid securities. This is insofar important, as the GFC also had its roots in these markets, especially the repo markets. In this regard, Gabor and Vestergaard (2016) provide a comparative lens that is also employable in bank-based financial systems – this makes it particularly useful for research of EMDEs' shadow banking system, given the bank-centric structure of most EMDEs' financial and shadow banking systems.

As mentioned in subchapter 2.4.3, decisions on international regulations and guidelines are almost always formulated (or at least heavily influenced) by developed countries, which leads to frameworks presented by international bodies such as the FSB or the IMF, *inter alia*, to presume a financial system that is at least similar to those of developed economies. Therefore, it is necessary to develop a framework that incorporates the institutions that engage in shadow banking (= money market funding of capital market lending) regardless if they are banks of NBFIs, as well as the assets that these entities hold respectively how they are regulated. Another important factor is to watch financial trends that are growing at a fast pace and carry potential risks to the wider financial system with them, e.g. P2P lending. Finally, the framework should also reflect the differences and similarities in the countries' respective repo markets, as they are the primary source of shadow bank's funding. In order to link the information gathered by these categories to potential systemic risk, it is necessary to look at spreads in credit rates that are known to be an indicator for stress in money and funding markets, e.g. LIBOR-OIS spreads.

Accordingly, the chosen framework consists of the following components: 1) Key agents and assets, 2) Recent innovations, 3) Regulations and oversight, 4) Repo market, and 5) Credit rate spreads (see Table 4 at the end of this chapter).

3.2 Key agents and assets

The question which financial institutions are part of the shadow banking system, and which are not can still not be answered definitively given the differences in how financial systems are set up in different jurisdictions. Therefore, the FSB's approach to employ a framework based on economic functions (EFs) for parts of the shadow banking that are potentially detrimental to financial stability is a good starting point for developing a more flexible measurement. To account for the role regular banks, both in developed economies and EMDEs, banks were included as a sixth group to this framework. The aim of this approach is to be able to depict the distinct shadow banking system of each of the respective country cases chosen for this thesis, rather than apply a one-size-fits-all method.

In order to get an idea about the financial soundness of the EFs 1 to 6 it is vital to know which kind of assets the institutions attributed to the different groupings hold as well as the quantity of them. The latter part will be measured in USD to allow for better comparison, while the qualitative measurement makes it possible to account for country-specific shadow credit products, e.g. WMPs or entrusted loans in China (Ehlers et al. 2018:13-17).

3.3 Recent innovations

In the aftermath of the GFC a great deal of emphasis was put on the relatively new respectively unknown character of shadow banking and its products, especially derivatives and SPVs. However, as was shown on multiple occasions in the literature review of this thesis, this claim does not really hold up when we look at how early e.g. swaps and other complex options and their "virtual explosion in volume" (Allen and Santomero 1997:1464) were reported in the literature.

In light of these insights it makes sense to keep track of the introduction of new and innovative financial products and trends which grow at a fast pace and exhibit potentially risky features. In this regard, the FSB has highlighted the emergence of notarized and non-notarized matching platforms, i.e. P2P lending or other crowd-lending services as well as blockchain-based bond issuance (driven by FinTech) (FSB 2020:7-8), and a resurgence of SPACs (Financial Times 2020). The latter one is especially worrisome, as SPACs used to be known for their fragility (or even fraudulent character in some chases) - a fact that seems to be almost gladly overlooked by investors who are emphasizing that "[…] the Spac is not a gimmick, it’s a financial tool" (Aliaj et al. 2020).

3.4 Regulations and oversight

The dimension of regulation and oversight refers to the varying degree of financial regulation in a specific jurisdiction, both on a regional as well as an international level. In this regard, the BSBC's regulations (Basel II and III) respectively the FSB's recommendations for prudential banking regulations are of interest because they are the most comprehensive international guidelines on how to increase financial stability respectively identify risks in specific credit markets (Jones and Knaack 2019). The second tier of this category is aimed at the regional, or country, level and how financial institutions are (de)regulated there. In this regard, it is also important to look not only on rules and regulations that were announced and implemented, but also on the ones that were either rolled back at a later time or only a temporary measure anyways.

Category: Regulation and oversight	
International Regulations	Aimed at banks
	Aimed at non-bank financial intermediaries
Regulations on national level	Aimed at banks
	Aimed at non-bank financial intermediaries

Table 1: Criteria for regulation and oversight

Source: Author

3.5 Repo market

The repo market is of special importance for shadow banking because it is the main funding source for most of the sector's undertakings (Gabor and Vestergaard 2016, Mehrling 2019a). There are, however, many important differences that need to be taken into account when comparing the repo markets of the respective country cases - the size, structure, and sophistication of the market in itself as well as the major participants and the different types of repo contracts (especially in the chase of China) are important factors in determining the susceptibility to risk and runs that these markets face.

The information by J.P. Morgan Asset Management on the Chinese repo market (J.P. Morgan Asset Management 2015, 2018) respectively Yun and Heijman's (2013) comparison of the Korean repo market with its US and European counterparts were important steppingstones in the formation of the framework for this subcategory. Furthermore, Smith (2012) and Zhang (2014) highlighted the importance of the kind of assets that are used as collateral in repo trades brought about the inclusion of this factor into the framework (see Table 3).

Category: Repo market	
Size of repo market in USD	
Major type of trade	Bilateral
	Tri-party
Types of repo markets and participants	Country-specific types of repo markets
	Major participants
Infrastructure	Trade platform
	Central Clearing Counterparty (CCP)
	Settlement system
Type of repo contracts	

Table 2: Criteria for repo market classification

Source: Based on J.P. Morgan Asset Management (2015, 2018) and Yun and Heijmans (2013)

3.6 Credit rate spreads

With respect to possible indicators of stress in the financial system the literature has identified several important credit rates that can be a hint of a liquidity crunch somewhere in the system. Pozsar and Sweeney (2020) separate funding markets into (a varying degree of) core and periphery. According to the authors, funding pressure can appear in peripheral funding markets in the form of spreads in peripheral and cross-currency bases (e.g. USD and KRW, Korean Won).

Should a liquidity shortage persist, e.g. through banks not being willing to lend extensively due to LCR and/or other regulatory constraints. Finally, a liquidity crunch can also emerge in core funding markets, i.e. the repo market - this can be caused through either an unexpected rise in collateral value risk (Smith 2012) and/or increased counterparty/clearing risk (Boissel et al. 2016, Cullen 2017).

Category: Credit rate spreads		
Type of funding market	**Indicator**	**Underlying causes**
	• Spreads in peripheral cross-currency bases	• Growth of missed payments • Rising number of deficit agents
	• USD – LIBOR spreads	• Banks start fixing their LCRs • Outflows of deposits and corporate credit lines
	• GC repo – OIS spread	• Collateral value risk increases unexpectedly • Increased counterparty/clearing risk

Table 3: Criteria for determining stress in funding markets

Source: Based on Boissel et al. (2016), Cullen (2017), Pozsar and Sweeney (2020), and Smith (2012).

	Key blocks	Criteria	Sub-criteria
PROFILE OF COUNTRY-SPECIFIC SHADOW BANKING SECTOR	**Key agents and assets**	Money market funds (MMFs), credit hedge funds, real estate funds (EF1) Finance Companies, leasing/factoring companies, consumer credit companies (EF2) Broker-dealers (EF3) Credit insurance companies (EF4) Securitization vehicles, structured finance vehicles, asset-backed securities (EF5)	• Number of institutions • Assets (in USD trillion) • Share of total assets (in %) • Assets (in % of nominal GDP)
		Systemic importance of SBS to total financial system	• Grade of interconnectedness with regular banking sector • Share of total financial assets
		Assets per type/in USD	• Treasury bills, bonds, ABCP, RMBS, ABS
	Recent innovations	Notarized and non-notarized matching platforms	• Number of institutions • Investment volume (in USD million) • Number of deals • Outstanding balance of lending platforms
		Investment vehicles susceptible to runs	
		Balance sheet lenders	
EFFECT OF REGULATION	**Regulations and oversight**	International Regulations	• Aimed at banks • Aimed at NBFIs
		Regulations on national level	• Aimed at banks • Aimed at NBFIs
FUNDING MARKETS AND STRESS INDICATORS	**Repo market**	Size of repo market	• Size in USD • Size in % of nominal GDP
		Major type of repo trade	• Bilateral repo • Tri-party repo
		Types of repo markets and participants	• GC repo market, SC repo market, interbank repo market • MMFs, securities lenders, pension funds, insurance companies, hedge funds
		Infrastructure	• Trade execution, CCP clearing, delivery and settlement of securities and funds
		Type of repo contracts	• Pledged repo, outright repo, x-repo, d-repo, agreed repo
	Credit rate spreads	Repo rate volatility	• O/N repo vs. interbank offered rate spread
		Peripheral cross-currency bases	• KRW/USD or RMB/USD spread
		FX volatility Balance sheet lenders	• USD Libor-OIS spread

Table 4: Analytical Framework.

Source: Author.

4. Empirical Part

4.1 Development of shadow banking in China

4.1.1 Key agents and products

China's financial system has undergone tremendous changes in the last four decades. While at the start of the people's republic's market-oriented reforms in the late 1970s the sector consisted of a few institutions with limited capabilities, in 2019 Chinese banks took four places among the top banks worldwide rated by tier-one capital. The total assets of the Chinese financial system are enormous, with most of them being concentrated in the banking system (Sun 2020:9-10).

As banks (be they state-owned, commercial, or rural) are central to China's shadow banking sector, it is necessary to give a short overview of the banking sector as well. Generally speaking, there are four different types of domestic commercial banks in China – state-owned banks, national joint-equity banks, urban banks, and rural banks. As per 2017, there were 5 large commercial banks ("big 5")[17], 3 policy banks, 12 joint-commercial banks, 134 city commercial banks, 965 rural credit cooperatives, 1,262 rural commercial banks, 33 rural enterprise banks, and 17 private banks registered in China (Huang et al. 2018:4-5, Sun 2020:17).

With regards to shadow banking actors outside the banking sector, according to the 2020 annual report of the China Trustee Association, the number of trust companies stood at 68 at the end of the fourth quarter in 2019, with total assets under management standing at 3,1 USD trillion. Since mid-November 2020, there are no more P2P lending platforms left in existence[18], after regulators forced existing platforms to either close down or restructure as a micro-lending company (Ding et al. 2020:8-9). At the end of the first quarter of 2020 there were 7,458 micro-loan companies operating in China (China Banking News 2020), while there are roughly 8,500 pawn shops who dealt out 14.3 USD billion in credit in 2019, primarily to SMEs and at steep interest rates (CBIRC 2020:16-17). Another interesting actor in the wider shadow banking nexus is the so-called factoring sector. While the China Banking and Insurance Regulatory Commission (CBIRC) has included commercial factoring companies with a factoring balance of roughly 14 USD billion (CBIRC 2020:16-17), the industry itself is much larger and was estimated to grow to 3 USD trillion in size in 2018 (AuYeung 2018). Given the current tumult surrounding one of the biggest providers of supply-chain finance, Greensill capital, regulators, rating agencies and accountants may well need to readjust the risks (and its volume) that this sector emits (Smith 2021).

[17] These consist of the Agricultural Bank of China (ABC), the Bank of China (BOC), the China Construction Bank (CCB), the Industrial and Commercial Bank of China (ICBC), and the Bank of Communications (BCM) (Sun 2020:9).
[18] More detailed information on this sector will be given in the following sub-chapter 4.1.2.

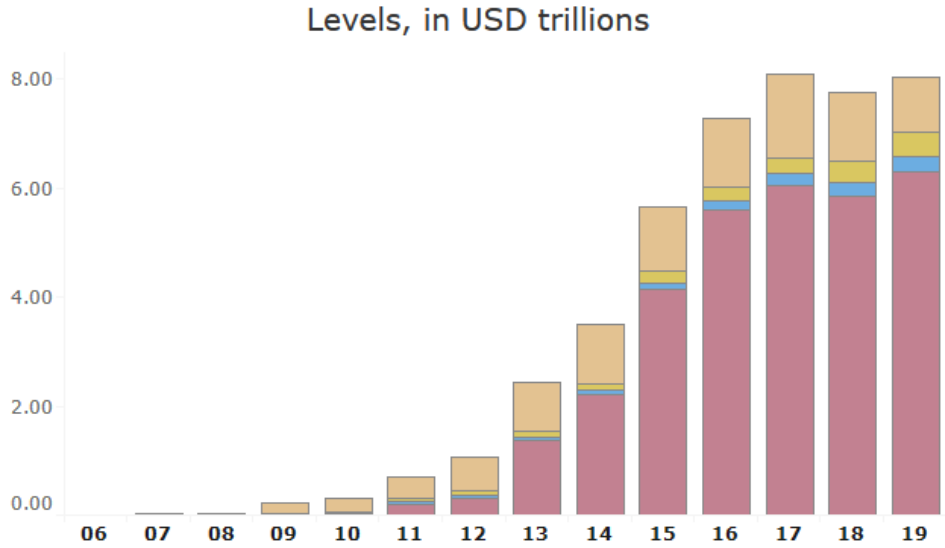


Figure 9: Shadow banking in China, in USD trillions

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

As depicted in Figure 9, the levels of shadow banking (as the FSB defines it narrowly) rose from modest 300 USD billion in 2010 to 8.04 USD trillion at the end of 2019. This means that shadow banking makes up the lion's share of China's NBFI measure (14.79 USD trillion) and amounts to roughly 13.5 percent of total financial assets as of end-2019.

Following the narrow measure of the CBIRC, however, the narrow measure of Chinese shadow banking[19] only amounts to 5.6 USD trillion. This is insofar worth mentioning as the broad measure of the FSB and CBIRC are relatively close together, with 11.71 USD trillion and 12.18 USD trillion, respectively.

[19] Consisting of 1) Interbank special purpose vehicle investment and interbank wealth management, 2) Certain bank wealth management operations such as non-standard debt, 3) Entrusted loans, 4) Trust loans, 5) Non-equity privately raised funds, 6) Online lending and P2P loans (CBIRC 2020:17).

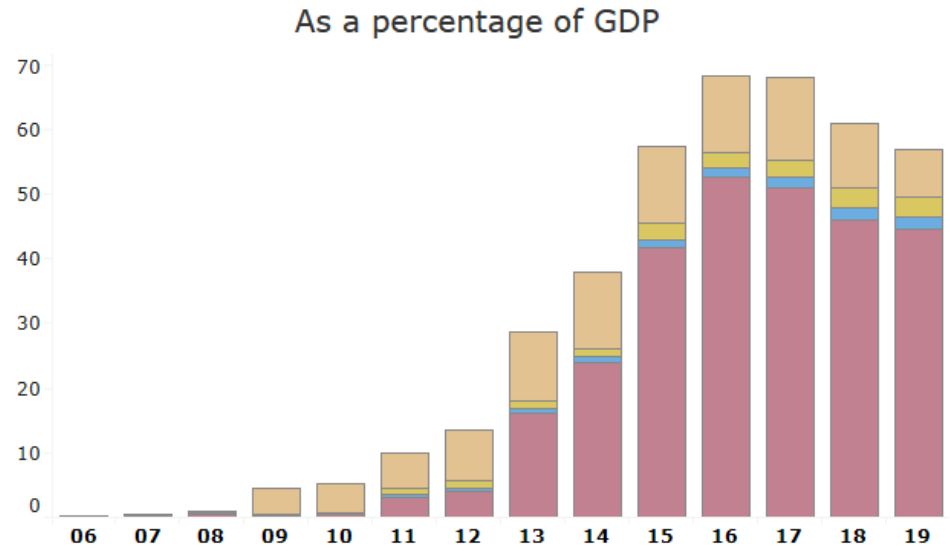


Figure 10: Shadow banking in China, as a percentage of GDP

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

While size of shadow banking in US dollars has leveled between 2017 and 2019, Figure 10 shows that the sector has shrunken down sizably in this timeframe, from 69 percent GDP in 2016 to 56.8 percent in 2019. In addition, the Year-Over-Year (YOY) growth in levels from 2018 to 2019 with 3.7 percent was very modest when compared with the median growth of 26 percent growth rate between 2013 and 2018 (FSB 2021).

Shadow banking exhibits a very high degree of interconnection with the regular banking sector in China, especially with regards to small and medium commercial banks, as a large number of these kind of institutions take part in the origination of shadow banking assets such as WMPs, trust products or entrusted loans. With regards to the real estate sector, there are two main asset groups that are connected to shadow banking, either as a funding source or through loan origination, namely 1) asset-backed securities (ABS) in the form of residential mortgage-backed securities (RMBS) and commercial mortgage-backed securities (CMBS), and 2) debt issued by local government funding vehicles (LGFVs) in the form of bank loans, Municial Corporate Bonds (MCBs), Municial Bond (Munibonds), and trusts (Chen et al. 2018b:2).

Against this backdrop, tables 5 and 6 give an overview of the development in the amount and proportion of LGFV debt, respectively real estate related ABS. Outstanding local government debt has ballooned from only 60 bonds with a balance of 57.46 USD billion and a share of 1.94 percent in the overall outstanding balance in 2010 to a colossal 6,230 number of bonds with a balance of 3.66 USD trillion, amounting to a share of 22.30 percent in the overall balance of outstanding bonds by the end of 2020. This surge in shadow banking-related real estate assets is rooted in the so-called “four-trillion-yuan stimulus” (Chen et al. 2018b:4) of

2009, which translates to 574.60 USD billion or 11.7 percent of China's 2009 GDP, which stood at a total of 4.91 USD trillion (Xin and Zhang 2010).

Year	No. of Bonds	Proportion of total NO. Bonds (%)	Balance (USD, bn)	Balance %
2010	60	2.37	**57.46**	**1.94**
2011	76	2.18	**86.19**	**2.69**
2012	44	0.82	**93.37**	**2.47**
2013	62	0.85	**123.77**	**2.87**
2014	97	0.86	**166.97**	**3.23**
2015	1,123	5.89	**693.25**	**9.95**
2016	2,266	7.70	**1,526.72**	**16.55**
2017	3,377	9.09	**2,118.07**	**19.72**
2018	4,062	9.52	**2,595.71**	**21.08**
2019	4,874	9.85	**3,033.60**	**21.75**
2020	6,230	10.92	**3,661.07**	**22.30**

Table 5: Outstanding Local Government Debt 2010-2020

Source: WIND

As for the ABS component of real estate related shadow banking, it is not feasible to comply everything into one encompassing table because 1) of all selected real estate related ABS only RMBS was around in 2010, and 2) the sector changed and grew dramatically over the last decade. While there were only six different types of underlying assets in the Chinese ABS market in 2010 (BT project repo, Non-performing loan, Auto loan, RMBS, Return on Infrastructure charges, and Business loan) with combined outstanding balance of 1.60 USD billion, there were 53 different types of underlying assets with an outstanding balance of 656.03 USD billion at the end of 2020.

Table 6 shows that the balance of RMBS in 2020 rose to 169,875.23 USD million (from 317.18 USD million), which translated to a share of 25.89 percent of the total outstanding balance of all types of ABS. Real Estate Investment Trusts (REITs) are listed in two different categories because there are differences in their registration (on-shore vs. off-shore), as are CMBS. While REITs have a combined total of 18,192.17 USD million and make up a share of 2.66 percent of the total ABS outstanding balance, CMBS accounts for 50,767.68 USD million and 7.74

percent of total ABS outstanding by end of 2020 (up from 215.47 USD million and 0.48 percent when first launched in 2014).

Year	Type of Underlying Assets	Project Amount	Proportions of Project Amount (%)	Total Issue (USD mn)	Proportions of Total Amounts (%)	Current Balance (USD mn)	Balance %
2020	Residential mortgage-backed securities	220	6.37	26,193.66	28.07	**169,875.23**	**25.89**
2020	Similar REITs	1	0.03	7.90	0.01	**68.95**	**0.01**
2020	Similar real estate investment trusts	73	2.11	1,824.62	1.96	**17,404.98**	**2.65**
2020	CMBS	145	4.20	4,707.35	5.04	**45,902.61**	**7.00**
2020	Commercial mortgage backed security	22	0.64	533.80	0.57	**4,865.10**	**0.74**

Table 6: Total amount of selected ABS Outstanding per 31.12.2020

Source: WIND

4.1.2 Recent innovations

Mobile payments

While Western countries rely mostly on banks and credit cards for payments, the chronically underserved consumers and SME businesses in China have turned directly from cash to digital payments via e-wallets and apps. As shown in Figure 11, total mobile payment transaction volume hit 39.85 USD trillion in 2018, which meant an increase of 36.7 percent from the previous year and more than 12 times the total value recorded 2014 (McSheaffrey et al. 2019:1-2).

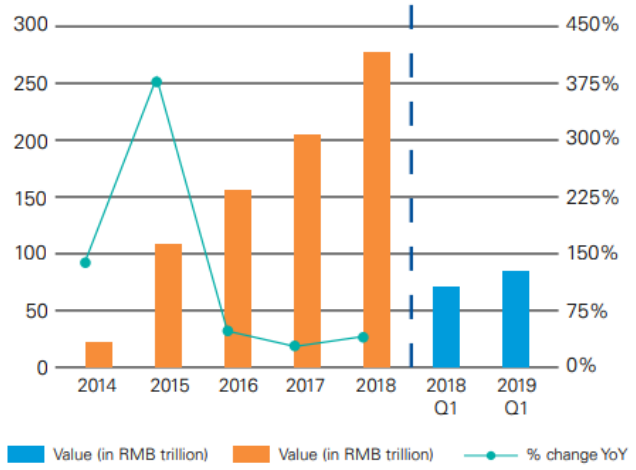


Figure 11: China's mobile payment market (by value) 2014-2019Q1

Source: McSheaffrey et al. 2019:2

There are 11 main players in China's mobile payment market, although Alibaba's "Alipay" and Tencent's "Tenpay" dominate with 54.3 percent and 39.2 percent market share in 2018. While other mobile payment providers such as Didi Chuxing, Meituan Dianping, JD, or Baidu all had hundreds of millions of active users in 2019, Alibaba and Tencent both scored well above 1 billion customers. This can be attributed to the seamless integration and immersing of their platforms, which gives them a special advantage over banks. In this regard, Alipay and Tenpay/WeChat Pay profit from their ability to easily tap into consumers in second or third-tier cities and get them connected to their apps and platforms, especially in the retail payments space (McSheaffrey et al. 2019:3-4).

P2P lending

The first P2P lending platform in China was registered as early as 2007, however it took until 2012 for the sector to really gain traction. While there were 50 platforms operating in 2011, their number grew to 200 in 2012 and 800 in 2013, peaking at 2,595 in 2015. This rapid growth of P2P lending is commonly attributed to two key factors: 1) China's inefficient financial system and the resulting large number of underserved consumers and SME businesses, and 2) the *lais-*

sez-faire approach of Chinese regulators. Especially the last point is of heightened interest here because it seems to have been caused by the need to ease financial stress on SMEs, which heavily rely on informal lending and were put in a tight spot by the collapse of the informal lending market in the so-called Wenzhou financial crisis. Furthermore, the (compared with overall borrowing) miniscule amount of P2P lending was apparently not thought to be of substantial risk to more than the industry itself (Ding et al. 2020:2-4, Chen et al. 2018a). However, the scale of risk ramped up by FinTech-enabled financial services should not be taken lightly, as is shown in the number of troubled P2P platforms and involved investors/outstanding loans (see Figure 13).

Key indicators	Numbers of platforms that went bust or found to be problematic (cumulative)	Number of investors involved (1000)	Outstanding P2P loans involved (RMBbn)
2014	395	63	6.84 ($1.1bn)
2015	1686	272	16.79 ($2.7bn)
2016	3407	454	26.59 ($4.2bn)
2017	4129	576	33.24 ($5.2bn)
2018	5417	2154	176.65 ($26.8bn)
2019	5433	2162	177.21 ($26.9bn)

Figure 12: Key indicators of trouble in the P2P sector

Source: Ding et al. 2020:4

While there was still a faint hope that the P2P industry would not be "killed off" completely in 2019 due to the fourth largest Internet tech company in China Jing Dong (also known as "JD") acquiring Xiamen-based P2P lending platform Yilidai in April 2019 and Ant Financial still operating its P2P lending facility Zhao Cai Bao (which launched in 2014), the issuance of the 'Guidelines on Transforming Online-lending Information Intermediaries into Micro-loan Companies' (No.83 Notice) quickly smothered the last rests of confidence. After the biggest P2P platform Lufax, subsidiary of insurance juggernaut PingAn announced its market exit from P2P lending in July 2019, the rest of the industry quickly followed. In November 2020 CBIRC chairman Guo Shuqing delivered the death certificate by stipulating that "By mid-November, all the operating P2P platforms have been closed down" (Shuqing 2020).

Insurtech

Insurtech, a mixture of insurance and (financial) technology, provides greater efficiency and improved customer experience by linking, for example, customer databases with and core claim management platforms with an AI (artificial intelligence) risk management system, thereby creating an intelligent, automatic insurance-claim handling system. In the case of PingAn, its claims system can allegedly handle claims online in under three minutes, while its chatbots are suppos-

edly able to handle 97 percent of customer inquiries (SCMP 2020:31-32).

However, PingAn is not the only provider of Insurtech solutions – in fact, the company partnered with Alibaba and Tencent to launch China's first online-only insurer, ZhongAn, in 2013. When ZhongAn listed on Hong Kong's stock exchange in 2017, it marked the city's largest IPO for that year. However, having served 486 million users and underwritten 8 billion policies in 2019 the company has yet to report a profit, despite offering innovative products not available on other platforms (SCMP 2020:31).

Furthermore, there is bound to be increased competition in the sector, with a number of China's tech giants now offering affordable health care plans via their smartphone apps. Against this backdrop, Ant Financial has revealed that it has recently become the country's largest online insurance services platform, covering life, health, and property and casualty insurance. Ant offers these services through 90 partner insurance institutions, from which they receive commissions on premiums sold over their platform. According to the South China Morning Post, the insurtech sector accounts for less than 8 percent of the 4.3 RMB trillion Chinese insurance premium market and is poised to grow at an annual compound rate of 38 percent to an estimated 1.9 RMB trillion in 2025 (SCMP 2020:32).

Case study: Ant Group

As mentioned previously, there are several big tech corporations engaged in the Chinese fintech market. However, two of them stand out because of their large and deeply engaged customer base as well as the development of a wider fintech ecosystem with cross-selling of complex (financial) services: Ant Group (formerly known as Ant Financial Services) and Tencent (owner of WeChat and affiliated platforms (Zhang and Le Moal 2020:6-7), whose fintech ecosystem are depicted in Figure 13.

Figure 13: Tencent and Ant Group's fintech ecosystems

Source: SCMP 2020:19

This subchapter, however, will deal with Ant Group exclusively. The reasons for this do not only lie within the vast ecosystem of companies surrounding Ant, but also the tremendous speed the company has grown – being launched in 2014, Ant has already the following hallmarks under its belt:

- Most highly valued fintech company worldwide
- Owning the world's largest MMF (Yu'ebao)
- Largest mobile and only financial payment company in the world
- Processed more payment transactions than MasterCard and Visa put together
- More valuable than any other bank in the world…

… or at least it was going in this direction, **before** Ant's planned IPO (Initial Public Offering), which would have even toppled the previous IPO record set by Saudi Aramco with an estimated 37 USD billion, was summarily canceled by Chinese regulators. The following disappearance of company leader and allegedly richest man of China, Jack Ma, only added to the confusion surrounding this decision (Calhoun 2020).

According to a *Forbes* article by George Calhoun, there were three main reasons behind these developments:

1. The market dynamics surrounding the offering itself
2. The business model of Ant Group, which created enormous risk both for the Chinese financial system and the company itself
3. The impact on the valuation of Ant's shares after the IPO, which would have probably seen a collapse in value in the days following the offering

Point 1 is referencing the magnitude of interest in investing in Ant Group, which attracted roughly 3 USD trillion in pre-orders for the dual-listing in Hong Kong and Shanghai ahead of the IPO. These pre-orders can be placed on an OTC-basis in the so-called "grey market", where investors can bid on stock before it is actually trading on a stock exchange (Fioretti et al. 2020). Even optimistic voices were almost certain that there would be an enormous burst in value after the offering, as the oversubscription was 870 times the original value, or more than all of the stocks listed on the exchange in Germany. Even worse, millions of small investors who wanted in on the deal took out loans for this purpose, paying the highest price pre-IPO with leveraged debt (up to 95%). Against this backdrop, Calhoun (2020) points out the case of China's leading chip maker (SMIC), which tripled in value on the first day of trading, only to see a 60 percent decline only two months after the IPO. Retail investors were among the big losers of this story as

well.

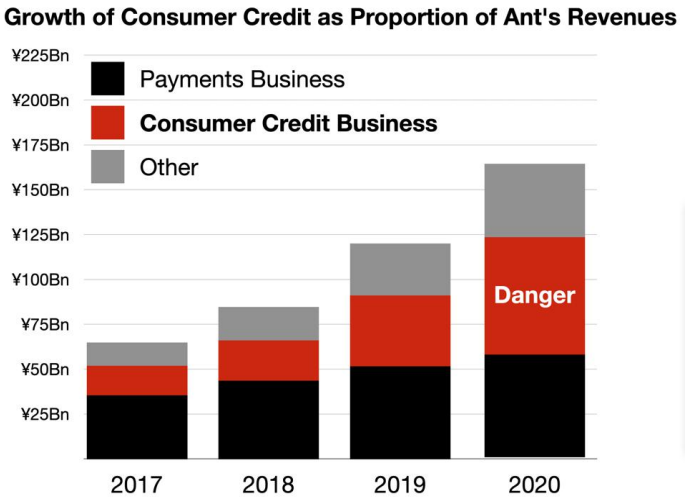


Figure 14: Growth of Consumer Credit as Proportion of Ant's Revenues

Source: Calhoun 2020

Figure 14 illustrates the growing share of consumer credit as a part of Ant's revenues. The reason why Calhoun (2020) has flagged it so boldly is the system that is behind it. Ant's consumer credit business is based on an originate-to-distribute model, meaning that after securing a loan and performing credit valuations the loan and its payment stream are passed on to someone else. In Ant's case, "someone else" are roughly "100 different banks, including all policy banks, large national state-owned banks, leading city and rural commercial banks, international banks that operate in China, as well as trust companies" (Calhoun 2020). The loans are unsecured and according to the head of consumer protection at the CBIRC targeted at 'low-income and young people'. Ant's platform processes a loan within 3 minutes and 1 second to disburse it – all with zero human interaction. As Ant contributes only 2 percent of every loans capital, which is offset by a 2.08 percent service rate the company charges, banks essentially end up carrying all of the risk. This would translate to a pathway (if not highway) to contagion, should Ant's AI-powered due diligence prove to be flawed (Calhoun 2020).

For this reason, regulators slapped a new rule on originators in September 2020 – they required them to fund and retain 30 percent of the loans they originate. This would turn Ant from a fintech into a (very well capitalized) bank – who are worth far less than tech companies, which in turn would have caused an enormous collapse of the aforementioned (leveraged) retail investors. Apparently, regulators were overestimating the ability of retail investors to understand this part of value adjustment as an effect of the new regulations, which could cost Ant up to half of its market valuation. Therefore, they "pulled the plug" before the foundations of the Chinese financial system could be shaken by the losses of millions of small retail investors (Calhoun 2020).

4.1.3 Regulation and oversight

International regulations

As mentioned in sub-chapter 2.5.3, the guidelines for banks' capital requirements published by the BCBS, known as Basel III, constitute the most comprehensive international regulations for the banking sector. To recapitulate, Basel III consists of three main pillars centered on capital[20], which are complemented by global liquidity standards (i.e. liquidity coverage ratio (LCR) and Net Stable Funding Ratio (NSFR)), a large exposures regime dealing with risks arising from interlinkages across financial institutions, and higher loss absorbency capacity requirements for Systemically Important Banks (SIBs), both on a global (G-SIB) and a domestic level (D-SIB).

With respect to China, implementation for Pillar 1 (capital) Basel standards is mostly overdue – out of seven standards that are past the BCBS deadline, only the Standardized Approach to Counterparty Credit Risk (SA-CCR) final rules have been published and are in effect. High-level principles concerning Countercyclical capital buffer (CCyB) were published in 2012 and enforced in 2013, however a detailed policy framework is still under development. "Although requirements for non-centrally cleared derivatives, capital requirements for CCPs and capital requirements for equity investment in funds are past due over four years each, the draft rules are still under development" (BIS 2019:17). In contrast, the draft regulation on a securitization framework (due since January 2018) is about to be published for consultation, while there is a policy framework under development for total loss-absorbency capital (TLAC) holdings (due since January 2019). Concerning liquidity, the NSFR came into effect in July 2018. "For liquidity disclosure requirement, the former CBRC implemented rules on liquidity coverage ration disclosure in December 2015 and the CBIRC promulgated rules on NSFR disclosure in March 2019" (BIS 2019:18). However policy for monitoring tools for intraday liquidity management are still under development (due since January 2015). The supervisory framework for measuring and controlling large exposures has also been enforced since July 2018.

Revised Pillar 3 requirements (due since December 2016) are under development, with the CBIRC planning to formulate a comprehensive Pillar 3 framework covering all disclosure requirements of phases 1, 2, and 3.

Overall, the progress report on adoption of Basel III published by the BIS shows that China's financial system is still in transition and still has a ways to go. This becomes especially clear when China's assessment is compared to Hong Kong's, which completed the adoption of all but one standard (where the adoption is already in progress).

[20] Pillar 1 consists of regulations regarding capital, risk coverage and containing leverage. Pillar 2 deals with risk management and supervision, while Pillar 3 is concerned with market discipline (Figure 16, Appendix).

With regards to further international regulation and oversight the IMF and FSB are also worth mentioning, although the respective reports (IMF Financial Sector Assessment Program (FSAP) respectively FSB peer review) are mere non-binding recommendations. However, FSB jurisdictions (including China) have committed to undergoing an FSAP every five years, which is then followed up by a peer review two or three years later (FSB 2015, Appendix A). As Basel III does not address non-banks directly (but rather activities/processes that surround them) the gathered recommendations provide at least some insight into the current status of NBFI regulations. In this regard the IOSCO peer reviews are also of interest because they address inter alia reform on MMFs, which are a central shadow banking actor. According to the latest available report (IOSCO 2019) China has advised two additional major regulatory reforms on MMFs which seem to strengthen the existing regime:

- "On 1 September 2017, the CSRC issued Provisions on Liquidity Risk Management of Publicly Offered Open-End Securities Investment Funds which further improved regulations in valuation and liquidity management of MMFs" (IOSCO 2019:19-20).
- "On 1 June 2018, the CSRC issued Guiding Opinions on Further Regulating Internet Sales and Redemption Related Services of MMFs, which further standardized MMFs' sales behaviors on the internet and strengthens risk disclosure and reduce investors' expectations for unlimited liquidity" (IOSCO 2019:20).

National regulations

The main regulators of China's banking industry are the People's Bank of China (PBoC), the China Banking and Insurance Regulatory Commission (CBIRC), the Ministry of Finance (MOF), the China Securities Regulatory Commission (CSRC), and the State Administration of Foreign Exchange (SAFE) (Sun 2020:10).

The GFC prompted China to reevaluate its regulation policy framework and shift from a micro-prudential policy to prudential policies that balance both micro and macro regulations in order to detect and prevent possible outbreaks of systemic risk and relieve spillover effects of financial crises (Sun 2020:26). Throughout China's restructuring process, the following milestones were achieved:

- 2010: PBoC implemented macro-prudential regulation strategy
- 2011: Mechanism for dynamic adjustment of differential reserves and consensus loan management was established to reduce systematic financial risk
- 2016: Mechanism was upgraded to Macro-Prudential Assessment (MPA), which assess seven aspects of banks and NBFIs: capital and leverage, balance, liquidity, price fixing, quality of assets, risk of cross-border finance, and implementation of credit policy

- 2017: PBoC included underlying assets of WMPs within MPA to control shadow banking activities of commercial banks
- 2018: MPA includes interbank Certificates of Deposit (CD) in interbank liability evaluations to enhance liquidity management of financial institutions and more use of stable funding sources (Sun 2020:26-27)

With regards to regulation of shadow banking, "Chinese regulators have announced a series of policies since 2010 to mitigate the risks posed by rapidly expanding shadow banking activities" (Bowman et al. 2018:15). However, NBFIs and regular bank have thus far been successful in their efforts to find workarounds to new regulations. "In particular, regulations were circumvented by operating through different entities or creating new ones" (Bowman et al. 2018:15) (e.g. WMPs for banks or trust companies). However, the PBoC and other regulators ramped up their efforts and issued sweeping regulations[21]. Starting 2017, financial regulations were tightened on an array of institutions, *inter alia* NBFI Asset Management Plans (AMPs), P2P lending platforms, and trust companies. The regulation efforts culminated recently in the previously discussed last-minute pull of Ant Group's IPO in November 2020 and the preceding regulation of September 2020 that imposed a new requirement forcing originators of credit — such as Ant Group — to keep at least 30 percent of the loans on their own books in order to enhance lending standards (Bowman et al. 2018:15-17, Calhoun 2020, Sun 2019:16-17).

4.1.4 Repo market

The Chinese repo market is an important source of short-term funding for financial institutions as well as a means for the PBoC to inject liquidity into the system via open market operations (usually via 7 day reverse repos), therefore constituting a vital channel for the transmission of monetary policy for China's central bank ((J.P. Morgan Asset Management 2015:7). China's repo market is segmented into the interbank repo market, where repos are conducted over-the-counter (OTC), and the stock exchange repo market at the Shanghai and Shenzhen stock exchanges. For reasons of data availability as well as importance the data on stock exchange repos concentrates on the Shanghai stock exchange (SSE) repo market, for which the annual published Fact Books of the SSE were utilized.

In terms of size, the transaction volumes of selected years were as follows:

[21] A list of selected regulatory changes (adopted from Bowman et al. 2018:19-20 and enhanced/prolonged with data to cover 2010 until 2020 is attached in Appendix A.

Year	Type of repo market	Cumulative trading volume (in USD trillion)
2010	Interbank	12.58
	Stock Exchanged	1.00
2012	Interbank	20.35
	Stock Exchanged	5.33
2016	Interbank	86.38
	Stock Exchanged	31.65
2020	Interbank	137.86
	Stock Exchanged	30.94

Table 7: Size of Chinese repo markets

Sources: PBoC, Shanghai Stock Exchange (SSE), J.P. Morgan Asset Management 2015, J.P. Morgan Asset Management 2018, Kendall and Lees 2017

As shown in Table 7, the interbank repo market is by far the bigger market, although exchange traded repos have also grown quite sizably between 2012 and 2016 and stagnating between 2016 and 2020. The fact that the interbank repo market is by far the biggest repo market in China means that the major type of repo trading is done on a bilateral basis, similar to bilateral repo in Western markets (J.P. Morgan Asset Management 2015:7).

Interbank repo market

The interbank repo market was established in 1990 by the PBoC as a one-to-one OTC platform. The scope of participants used to be limited to mainly banks (domestic, rural, commercial, and foreign) as well as finance and securities companies in 2010. Since then, the field of participants has become more diverse and now includes trust companies, insurance companies, asset management companies, financial leasing companies, auto finance companies, security brokers, and government entities (although almost exclusively with reverse repos).

The available tenors include o/n (overnight), 7 days, 14 days, 21 days, 1 month, 2 month, 3 months, 4 month, 6 months, 9 months, and 1 year (CFETS 2021). However, repos of maturities between o/n and 7 days continue to make up the bulk of the market with around 95 percent throughout the observation period. As is customary in a bilateral repo trade, the factors interest rate/yield, eligible collateral[22], and appropriate haircut are negotiated between the counterparties – only the collateral registration involves either the China Central Depository & Clearing Co.,

[22] The main types of collateral used are Policy bank bonds, Chinese government bonds, PBoC bills (Kendall and Lees 2017:345). However, due to growing presence of shadow banking entities and their counterparties, Certificates of Deposit (CDs), ABS, enterprise bonds, Commercial Paper (CP), Medium Term Notes (MTNs), and Local government debt are also sparingly used (J.P. Morgan Asset Management 2015:8).

Ltd. (CCDC) as a general collateral holder for the interbank repo market, or the Shanghai Clearing House (SCH) as collateral holder for interbank repo involving commercial paper or private placement bonds. (J.P. Morgan Asset Management 2015:16).

According to the China Foreign Exchange Trade System & National Interbank Funding Center, the method of clearing and settlement in the interbank market is as follows:

"The two trading parties, at the specified date, shall handle gross settlement of funds at their own risk in accordance with deal sheet. Depository bond settlement is carried out through the China Central Depository & Clearing Co., Ltd, while funds settlement is conducted through the China National Automatic Payment System of PBC. Three types of settlement, namely "payment after delivery ", " delivery after payment " and "delivery versus payment", are available" (CFETS 2021).

There are four different kinds of repo contracts that exist in the interbank repo market: 1) pledged repo, 2) outright repo, 3) X-repo, and 4) D-repo. Pledged repo is the dominant repo type by transaction volume. The repo buyer has possession of the collateral but not ownership unless default occurs. The pledged collateral is returned to the repo seller when all conditions of the repo agreement have been satisfied. Under an outright repo contract the ownership of collateral is transferred from the repo seller to the repo buyer. The collateral can then be used for other purposes but has to be returned on the agreed time. Outright repo is not exactly popular, with a 20 times lower volume than interbank pledged repo. X-repo offers a standardized pledged repo contract with anonymous counterparties, which has proven useful for the PBoC when it needs to facilitate anonymous liquidity injections. Finally, D-repo is a form of pledged repo exclusively for deposit taking financial institutions. D-repo is an important indicator of liquidity conditions as the PBoC conducts its OMOs via this type of repo contract. Due to better access to funding the interest rates on D-repos are generally lower than standard interbank pledged repo (JP Morgan Asset Management 2018:3).

Stock exchange repo market

Initiated in 1991 by the SSE, in contrast to the interbank repo market, the stock exchange repo market is significantly smaller, however it offers a more diversified investor base, standardized rates and products (as is customary for exchange traded markets) and lower credit risk. Participants in the stock exchange repo market include non-bank financial institutions, security firms, insurance companies, mutual funds, institutional investors and retail investors (provided they have a stock exchange account). However, retail investors cannot trade directly with the exchange but are restricted to reverse repo and a limited subset of bonds, which they trade via security brokers (J.P. Morgan Asset Management 2015:9-10). The absence of commercial banks in

the stock exchange repo market is deliberate, as the China Securities Regulatory Commission (CSRC) disallowed commercial banks from trading at the stock exchange repo market in 1997. This was done to separate commercial bank repo trading from repo trading by other market participants (Fang et al. 2018b:9).

Available tenors include 1 day, 2 days, 3 days, 4 days, 7 days, 14 days, 28 days, 91 days, and 182 days. While the exchange does not only facilitate the transaction but also acts as counterparty to both repo sellers and buyers, the China Securities Depository & Clearing Corporation (CSDC) establishes rules and procedure for trading and settlement as well as eligible collateral and volume of haircuts. The method of settlement is "delivery versus payment". "In the exchange market, all bids from investors are aggregated in electronic order books, with the exchange acting as the central clearing house, and all matched trades settled via CSDC" (J.P. Morgan Asset Management 2015:16). The CSDC also acts as clearing agent for all stock exchange transactions and collateral holder for stock exchange repo (J.P. Morgan Asset Management 2018:2-3).

There are two different types of repo contracts available in the stock exchange repo market, them being 1) pledged repo, and 2) agreed repo. "As for the pledged repo, the stock exchange facilitates transactions and acts as counterparty to all repo buyers and sellers" (J.P. Morgan Asset Management 2018:3). Terms and conditions are standardized, and individual counterparties are anonymous. Agreed repos represented only 3 percent of total stock exchange repo in 2018. Similar to the pledged repo the stock exchange facilitates transactions – however, under this type of stock exchange repo contract the counterparties negotiate terms and conditions directly (JP Morgan Asset Management 2018:3).

(Dai Chi Market)

Besides the interbank and stock exchange repo market there is also on additional, informal sort of repo market called *dai chi* market (spelled 代持, meaning 'holding something on someone's behalf). While the informal nature of the *dai chi* market means that some transaction within this market may not be legally enforceable, there are at least two compelling reasons why one might choose the *dai chi* market over the interbank market: 1) circumvention of regulatory policies by removing certain assets from a given balance sheet for the duration of the loan, and 2) the *dai chi* market allows for rehypothecation of collateral, allowing for greater flexibility than e.g. pledged repo. However, the leverage is also noticeable higher (Kendall and Lees 2017:357).

Unfortunately, there is very little data (or even information) available on the *dai chi* market. The president of the CCDC estimated the value of outstanding *dai chi* repo in 2016 to be as high as 1.72 USD trillion – this would have made the *dai chi* market almost twice as large as the

interbank repo market in 2016 (by amount outstanding). There is no information on the type of collateral used, type of contract, or creditworthiness (and type) of institutions involved, which makes an assessment of risk difficult. However, the case of Sealand Securities resulted in volatility in the interest rate, formal repo, and bond market. The dislocation was resolved through the CSRC stepping in to force a resolution and large commercial banks increasing their lending in the repo market via so-called "X-repo". This episode shows that the potential for volatility and contagion spreading is present within the *dai chi* market (Kendall and Lees 2017:357-358).

4.1.5 Credit rate spreads

Repo rate volatility

Liquidity crunches in the repo market can, as explained in the paragraph above, be caused by an unwillingness to lend because of e.g. perceived risk in lending to certain counterparties, as Sealand Securities case of fraudulent behavior in the informal *dai chi* market caused banks and other repo market participants to reevaluate their risk exposure to NBFI borrowers in general.

With respect to the cost of providing liquidity in the repo market one way to summarize this cost is to look at the spread between the repo rate and the interbank lending rate. The interbank pledged repo rate reflects the willingness to accept collateral that is eligible for this kind of repo market, whereas lending in the interbank market at SHIBOR (Shanghai Interbank Offered Rate) uncollateralized. Therefore, differences in the interbank pledged repo rate and SHIBOR will partly reflect balance sheet constraints that make accepting repo collateral more or less costly (Barth and Kahn 2020:5-6).

Figure 16 depicts the development of the pledged repo overnight rate (green) and 1 week SHIBOR (orange) between 31.12.2009 and 31.12.2020. The blue graph on the upper part of the figure represents the spread between these rates – the bigger the spread, the more pronounced the liquidity crunch within the money market. The biggest of these spreads occurred in mid-2013, which coincides with a sharp reduction of interbank loans by 60 percent between May and June 2013. The fact that the PBoC did not initially meet the surging demand in the money market with OMOs via reverse repo was interpreted as the central bank's intent to rein in the shadow banking industry by monetary tightening and therefore contributed to the buildup and duration of the liquidity squeeze. After the PBoC subsequently provided more liquidity and foreshadowed its commitment to do so until the market had stabilized again ended the squeeze (Ma and Shu 2013:10-11).

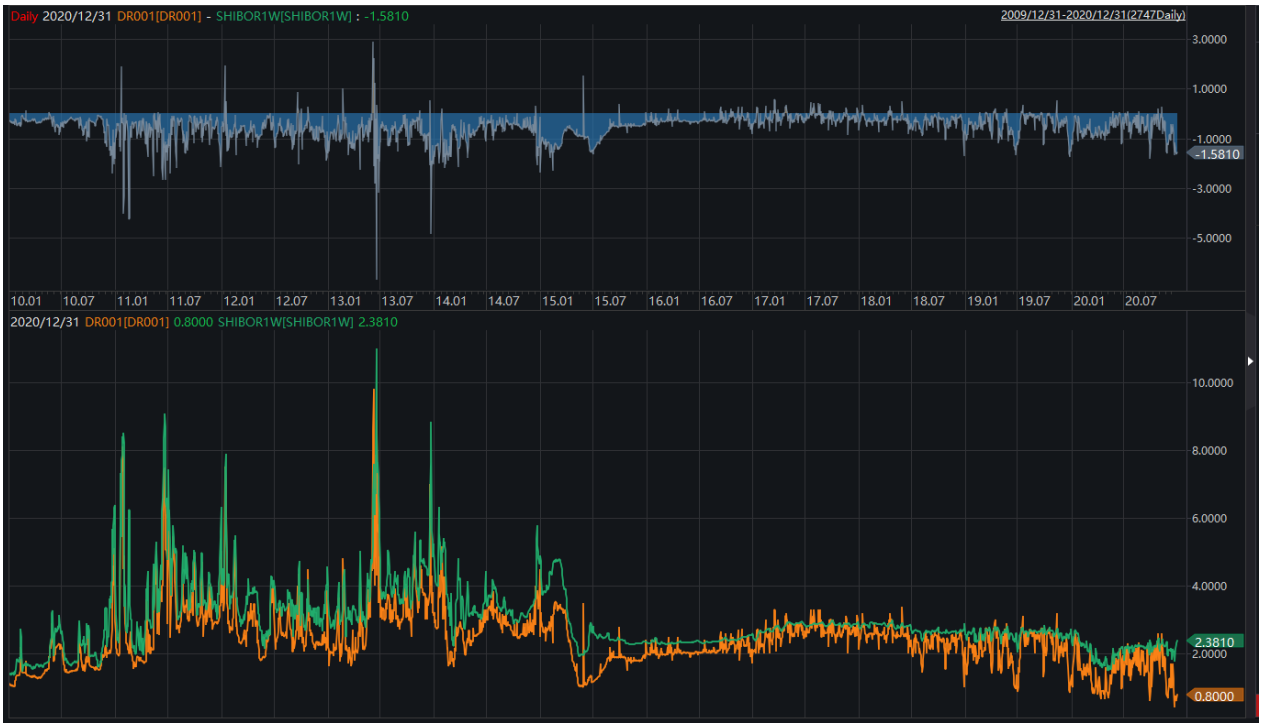


Figure 15: Spread between o/n interbank pledged repo vs. 3 months SHIBOR 2010-2020

Source: WIND

A series of more pronounced spreads is located in mid-2011 can be attributed to monetary tightening by the PBoC by raising its reserve requirement ratio (RRR), exceeding 21 percent for large banks. This has led to a draining of liquidity out of the system to reduce bank reserves available for new lending (Ma et al. 2011:2-7). The spike in the spread at the start of 2011 be attributed to the same combination of factors – hikes in the RRR, heightened expectations for tighter liquidity conditions, and the examination of banks' loan/deposit ratio by regulators (PBoC 2010:47).

However, not all major spikes in the spread are necessarily caused by central bank policies or (in)action, but also by e.g. seasonal factors such as the three golden week holiday (i.e. Chinese Lunar New Year, Labor Day in May, and National Day Holiday) when markets close for several and liquidity conditions therefore tighten. Repo volatility is higher ahead of these holidays, and at quarter-end because of tax and dividend payments, as banks struggle to estimate their funding needs due to strong retail and institutional demand for cash at these times (J.P. Morgan Asset Management 2015:12).

There are two last trends that need to be addressed in this figure: 1) the dip of both reference rates by more than 200 bps in 2015, and 2) the noticeable absence of big spreads after 2015. These events are actually connected, as point number one was caused by heightened market volatility in summer of 2015, where on some days trading on over half the stocks in the capital

market were suspended (ASIFMA 2019:29). As a consequence, the PBoC became more to manage liquidity more actively and changed from bi-weekly OMOs to daily OMOs, while also increasing the size of injections and withdrawals (Kendall and Lees 2017:353).

Peripheral cross-currency bases

Global financial markets have (again) been under great pressure by the ongoing Covid-19 pandemic, as global demand for US dollar funding soared amid a flight to safety. These developments have put the currencies of emerging Asian economies under severe strain, as they remain heavily exposed to US dollar funding risks.

While the cross-currency basis swap of CNY[23]/USD has widened to a greater degree than it did for the Japanese yen, the euro, or the British pound, the difference was not as pronounced as it was in the aftermath of the GFC (first major spike in the spread, at -600 bps) or when the Fed caused the so-called "taper tantrum" in 2013 (second major spike at -500 bps) (see Figure 16).

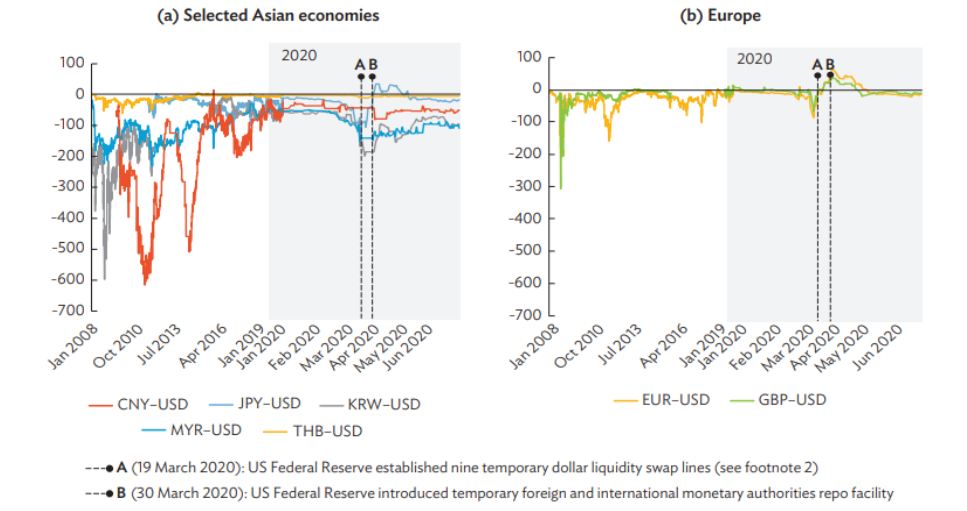


Figure 16: Cross-Currency Basis Swap (basis points)

Source: Park et al. 2020:2

The incision points A and B mark the establishment of nine additional temporary US dollar swap lines respectively the introduction of a temporary foreign and international monetary authorities repo facility by the Fed. While these to have staved off the worst liquidity strains for some Asian countries it should be remembered that the PBoC did not (and to the best knowledge

[23] Chinese Yuan Renminbi

of the author in the time of writing) and does not have access to either of these sources of US dollar liquidity. Then how did China keep the CNY/USD cross-currency bases from widening? One piece of the answer to this question might be the reductions of the reserve requirement ratio the PBoC has made since 2020, which amount to roughly 1 percent point, or 251.38 USD billion worth of freed up liquidity (Gang 2020). The handling of the Covid-19 pandemic coupled with the almost normalized economy were possibly another factor that kept foreign (USD denominated) capital from flowing out of the country and, therefore, the cross-currency bases narrow.

FX volatility Balance sheet lenders

Another sign of stress in money markets can be spikes in the so-called LIBOR-OIS[24] spread. This indicator is useful because in modern money markets the prices of debt securities are usually quoted in interest rather than prices. Therefore, it follows that the deviation in debt securities are measured in interest rates. The LIBOR-OIS measure is exactly that – namely the difference between the interest rate of unsecured interbank lending of Eurodollars versus the fixed rate for an overnight index swap (for US purposes this index tracks the Fed Funds rate). In short, it represents a premium a bank pays for borrowing in the money market over a baseline rate that carries little risk and liquidity concerns due to counterparties swapping only the rate of interest (see sub-chapter 2.6.1.3.1). Taking into account the work of Lu et al. (2018:114) this thesis also employs a Chinese equivalent to the LIBOR-OIS spread, which translates to a spread between SHIBOR and the yield of a Treasury Bond (TB). According to the authors, the TB should be chosen because the availability of China's interest rate swap data, due to the infrequent IRS transactions, makes a SHIBOR-OIS spread impractical (Lu et al. 2018:114).

Figure 18 shows that there were three phases where the rates diverge from each other for more than 100 bps: 2011, 2014, and (less pronounced) between 2016 and 2018. These seem to match the widened cross-curency bases from before quite well – however, to doublecheck I also looked at the spread between 3 month USD LIBOR and an IRS that tracks SHIBOR respectively the LIBOR-HK HIBOR spread (Appendix A: Figure 33). While the former confirms the findings of Figure 18, the latter shows hardly any spreads until 2018 and 2019. Here, the hike in the spread during 2017/18 can be attributed partly to a combination of factors such as the ongoing trade war between China and the United States as well as a rise in political uncertainty in Hong Kong. Furthermore, there have been massive capital inflows from (mainly) China since the GFC, which created abundant liquidity and therefore diminished HIBOR relative to LIBOR (ActionForex 2019). In 2019, the imminent IPO of Alibaba was creating tensions in interbank

[24] LIBOR = London Inter-Bank Offered Rate, OIS = Overnight Index Swap

liquidity because banks and brokers alike had to prepare enough cash for margin financing of this IPO (Pang and Carnell 2019).

The Covid-19 pandemic, however, did not produce any strains in interbank or US dollar liquidty. This outcome was to be expected because central banks and governments around the world have been injecting liquidity in the form of stimulus packages, forbearances, and other measures into the (global) financial system.

Figure 17: 6 month SHIBOR against 6 month Treasury Bond Yield to Maturity Rate

Source: WIND

4.2 Development of shadow banking in South Korea

4.2.1 Key agents and products

Since 2013, South Korea's financial system has grown by 40 percent of GDP and developed deeper, more resilient financial markets. With respect to the types of institutions that populate the financial system, they can be broadly classified into the seven classes of 1) financial holding companies (7 bank and 2 non-bank holding companies), 2) banks (57, including two internet-only banks), 3) non-bank depository institutions (3,652), 4) financial investment business entities (510), 5) insurance companies, 6) other financial institutions (260), and 7) financial auxiliary institutions (54) (BOK 2021, FSS 2020:7).

Unfortunately, there is no recent report by the Bank of Korea or other reliable sources that measure the size and composition of the Korean shadow banking system in detail. Therefore, this paper is utilizing the most recent report on the state of non-bank financial intermedia-

tion in Korea available, which is (to the best knowledge of this author) the report by Kim Kyung-Seop from November 2018. In this report, the broad definition of shadow banking as employed by the FSB amounted to 1.69 USD trillion at the end of 2017, which translated to 113 percent of GDP. Of this sum, collective investment institutions accounted for 29.5 percent, securities institutions for 20.9 percent, trust accounts for 19.9 percent, securitization institutions for 15.6 percent, and finally credit financial institutions for 12 percent. In particular, financial investment activities of securities companies, short-term financial collective investment institutions (MMF), and short-term asset securitization institutions (ABCP, ABSTB, etc.) are increasing in the size of credit brokerage in Korea (Kim 2018:21). As for the composition of the respective EF criteria specified by the FSB, Kim gives the following compositions (units in USD billions):

- **EF1**: MMFs (85.01), bond-type funds (106.34), hybrid funds (20.36), and real estate funds (19.5) – Total: **230.87 USD billion, 30.2 percent**
- **EF2**: Credit card companies (56.14), and installment leasing companies (63.70) – Total: **128.26 USD billion, 16.8 percent**
- **EF3**: Securities companies (226.89) – Total: **226.89 USD billion, 29.7 percent**
- **EF4**: Securities companies' debt guarantees[25] (14.56) – Total: **14.56 USD billion, 1.9 percent**
- **EF5**: Securitization of term deposits (68.11), ABS, ABCP and ABSTB (84.93), and Other Securitizations (est. 8.66) – Total: **164.57 USD billion, 21.5 percent**

In summary, the growth of securities companies and asset securitization institutions, which were the main causes of the GFC, was remarkable in Korea. Furthermore, the size of MMFs, bond-type funds and trusts has increased, as has the proportion of corporate investors with strong redemption tendencies and the incorporation of low-liquidity[26].

[25] i.e. purchase guarantees of securitized securities e.g. ABCP and ABSTB (which are guarantors related to real estate project finance (PF)), loans to be acquired, and unsold mortgage loans (Kim 2018:29).

[26] Against this backdrop, Mehrling's observation of liquidity risk that has not yet been priced in should be recalled – and actually, Kim is alluding to the same danger, although he terms it "liquidity illusion" (Kim 2018:42).

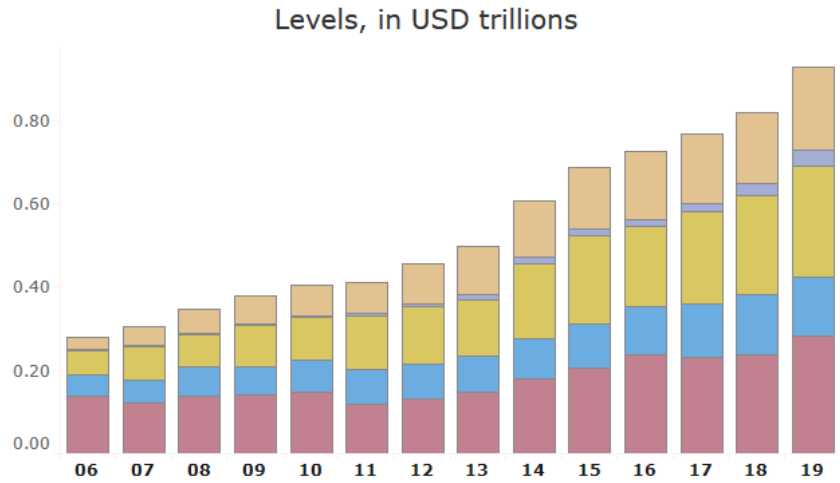


Figure 18: Shadow banking in South Korea, in USD trillions

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

As depicted in Figure 18, the dollar levels of shadow banking's narrow measure increased remarkably starting 2014, which reflects the aforementioned expansion of the financial system. The compound annual growth between 2013 and 2018 was 10.5 percent, while the year-on-year growth from 2018 to 2019 constituted 13.0 percent. EF 1 and EF 3 constituted the largest sub-sectors of shadw banking, while EF 4 sported the highest growth-range with 22.7 percent compund growth (2013 to 2018) respectively 23.6 percent Year-Over-Year growth (2018 to 2019).

With regards to the total amount of financial assets, the narrow shadow banking measure of South Korea amounts to 56.5 percent of the reported 7.56 USD trillion. However, the broad measure of all non-bank financial intermediation (including insurance corporations, pension funds, OFIs, and financial auxiliaries) together has risen to a share of 51.3 percent of total assets respectively 236.5 percent GDP, amounting to 3.88 USD trillion.

This also reflects the increase of shadow banking's narrow measure, which increased from 36 percent GDP to the aforementioned 56.5 percent GDP (see Figure 19).

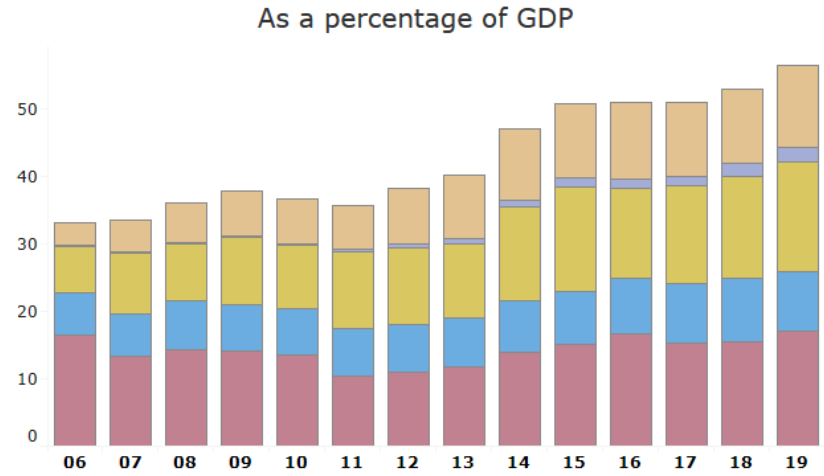


Figure 19: Shadow banking in South Korea, as a percentage of GDP

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

Regarding the grade of interconnectedness of NBFIs with the regular banking sector, the figures of the Bank of Korea's June 2020 Financial Stability Report show that between 2015 and 2020 the mutual transactions (on an end-to-end basis) that took place within the banking sector ranged from 4.0 percent of all transactions between financial instutions and sectors as the lowest to 4.7 percent as the highest. On the other hand, transactions between banks and NBFIs fluctuated between 36.0 and 38.5 percent. As for transactions among NBFIs, they constituted the lion's share of transactions and ranged from 57.4 to 59.3 percent between 2015 and 2020. Accordingly, investment funds, domestic banks, trusts, and securities corporations were indicated as the four highest-ranked financial sectors in terms of their mutual transaction volumes (BOK 2020:73).

With regards to real estate related shadow banking, the sector has grown to a record-high size in Korea after a real estate market boom that started in the early 2010s coupled with a heavy flow of funds into real estates and related investments (Shyn 2019:60). Table 8 shows some of the most important real estate related debt instruments and their evolution through the observation period. The two mortgage-based debt instruments, MBS and MBB, have grown many times over their 2010 balance, although MBBs have fluctuated a bit in between and are generally far smaller than MBS. There was an especially pronounced uptick in the MBS balance in 2015, which can be attributed to an effort of the KHFC to facilitate MBS as an investment product in the secondary market (Baek 2020:49-50) as well as the 39 USD billion stimulus package in 2014 dubbed "Choinomics" after finance minister Choi Kyung-Hwan, which represented nearly 3 percent of Korea's GDP. Although there were some concerns about on the stimulus increasing the already high Korean household debt, it was seen as a necessary boost to the country's then (2014) weak real estate market (Chandran 2014). In contrast to Shyn, this

thesis includes MBS and MBB as shadow banking related debt instruments, because the fact that the KHFC as a government-sponsored enterprise (GSE) is backing these securities does not alleviate the fact that a) another entity than KHFC serves as the loan originator, and b) the security is tradeable and useable as collateral, *inter alia* in repo trades,

Project Finance (PF) ABCP (asset-backed commercial paper) or ABSTB (asset-backed short-term bond) are securitizations that use a project finance loan on cash-flow generating illiquid assets like real estate or infrastructre as the underlying, e.g. power plants, transportation infrastructure, or telecommunications infrastructure (Baek 2020:19-20). PF has decreased since the GFC, when many PF loans defaulted due to projects being suspended or turning out not profitable enough to pay the debt. The unresolved problemativ market conditions led to another PF loan crisis in 2011, when second-tier banks lent to ever riskier projects in the search for yield. This led to insolvencies of seven banks and stricter policies on ABS issuance in 2011, which also led to new participants in the PF loan market, e.g. securities companies and insurance companies. In Korea, ABCP is sometimes preferred as an alternative to ABS, in the case when a company is unable to satisfy the prerequisites for issuing ABS. The reason for this is, that PF ABCP can be issued by any SPE established under the Commercial Law (Baek 2020:30-34).

Year	Mortgage-backes securities (balance, in USD billion)	Mortgage-backed bonds (balance, in USD billion)	PF ABCP	PF ABSTB (
2010	**18.80**	**0.53**	**N/A**	**N/A**
2011	**20.45**	**1.86**	**N/A**	**N/A**
2012	**31.36**	**2.08**	**N/A**	**N/A**
2013	**41.68**	**2.39**	**6.98**	**7.50**
2014	**43.54**	**1.76**	**8.17**	**10.72**
2015	**72.66**	**1.56**	**11.36**	**8.59**
2016	**85.18**	**1.58**	**11.45**	**10.11**
2017	**97.96**	**2.07**	**10.48**	**9.75**
2018	**100.62**	**2.03**	**7.98**	**7.45**
2019	**105.28**	**2.61**	**N/A**	**N/A**
2020	**123.47**	**4.32**	**N/A**	**N/A**

Table 8: Mortgage-backed debt instruments in South Korea

Source: Korea Housing Finance Corporation (KHFC) 2021, Shyn 2019:65-66

Economic Function	Corresponding agency		Size (Unit: USD billion)	
Collective Investment (EF1)	Real estate/special asset fund		120.46	
	Real estate trust (leveraged / construction confirmation-based)		201.16 (6.67 and 2.08, respectively)	
Loan for short-term funding (EF2)	P2P real estate mortgage		0.95	
PF (Project Finance) loans (EF3)	Securities		16.81	35.62
	Insurer		18.81	
Debt guarantee (EF4)	Credit offering	Securities	10.75	19.24
		Constructor	8.49	
Securitization of equity (EF5)	ABCP		8.84	20.63
	ABSTB		11.79	
Total	-		407.06	

Table 9: Size of real estate related shadow banking in South Korea

Source: Shyn 2019:62

Table 9 shows an overarching summary of all real estate related shadow banking (excluding KHFC-issued MBS) by Shyn (2019). Although it excludes MBS and MBB, this table combines a high-profile overview of South Korea's real estate related shadow banking, as it also includes relevant assets of real estate trusts, alternative investment funds, real estate funds, real estate PF lending (both by securities firms and insurers), real estate-backed securities (ABCP and ABSTB) as well as PF loan guarantees, credit enhancements, and real estate P2P lending.

With respect to securities firms' PF lending, significant leverage and maturity transformation are involved. Furthermore, the aforementioned boom in the housing market since 2010 has driven growth again in the PF ABCP and ABSTB market, where related loan guarantees have magnified pro-cyclical movements as construction and securities firms have constantly expanded credit supply Shyn 2019:64-65). A further cause for concern are the developments in the P2P lending sector, where delinquency rates of PF and mortgage lending constituted a tremendous 18.7 percent, respectively 6.7 percent in May 2018 (Shyn 2019:66). However, this trend in

increasing delinquency rates is not exclusive real estate related P2P loans, as will be shown in the following sub-chapter.

4.2.2 Recent innovations

Mobile payments

Mobile (or digital) payments constitute the biggest sector of Korea's fintech industry and continues to grow rapidly. The sector's daily total transaction value was 101.76 USD million in the second quarter of 2018, which translated to a whopping 208 percent increase from Q2 2017, and even 568 percent compared to Q2 2016. The average number of daily mobile transactions in Q2 2018 was 3.63 million, compared to 2.14 million in 2017 and 859,000 in 2016 (Interlink 2020:7).

There are around 15 relevant mobile payment providers, however the market is really dominated by five major players, which consist of established online service giants as well as a startup from Korea's first fintech unicorn Viva Republica:

- Kakao Pay: 13.4 GBP billion transmitted, 26 million users, launched 2014 by LG CNS and Kakao Corp, operator of Korea's most popular social messenger with more than 43 million users (out of a population of around 51 million people).
- Toss (Viva Republica): 18.72 GBP billion transmitted, 11.1 million users, launched in 2015 as a startup by fintech unicorn Viva Republia, which has transformed its P2P payment app into a platform with 25 different financial services (including credit score, customized loans, insurance, and stock services).
- Naver Pay: 7.63 GBP million transmitted, 26 million users, launched in 2015 by largest search engine in Korea, Naver Corp. Naver aims to use Naver Pay as a means to complete the path from searching for a product via their engine until purchase through a partnering store using Naver login. Within the app, users can check their loyalty points, status, and return or exchange products.
- Payco: 4.02 GBP million transmitted, 9 million users, launched in 2015 as NHN Entertainment's mobile payment system, which can be used in Google Play and for in-game purchases. Payco is a straight-forward platform that was added into NHN Entertainment's app via a simple "finance" tab, but also offers recommendations and ecommerce funcionalitites.
- Samsung Pay: 11.96 GBP billion transmitted, 13 million users, launched in July 2015 in Korea. Samsung pay utilizes an already existing payment/credit card that can be simply added into the service (multiple cards can be added). Payments are made by holding the smartphone near a card reader, the solution comes built-in into Samsung devices and is

also available on some Android devices. Samsung pay is the number one mobile payment option in the offline market and present in more than 24 countries worldwide (Interlink 2020:7-9, Samsung Newsroom 2015).

Despite the positive developments in digital payments, coupled with one of the world's fastest internet speeds, credit cards are still considered more convenient than digital payments like e.g. QR codes. However, some platforms like Kakao Pay or Toss have started to combine their digital offer with physical payment cards (connected with users' commercial bank accounts) and introduced cashback services or loyalty point collections to boost acceptance of their service (Intralink 2020:7).

P2P lending

The first P2P lending platform in Korea was established in August 2006 with Money Auction, which was followed by Pop Funding in 2007. However, the sector did not really take off until 2016, and even before that in 2015 was on the verge of collapsing after the FSC deemed that P2P loans were unlawful because lending platforms brokered loans without previously registering as qualified lenders with the FSC. However, after initially requesting the Korea Communications Commission to block the website of P2P lender 8Percent due to illegal business operations, the FSC restarted the sector in an effort to promote fintech in Korea as a means of economic growth (Bloter 2015, FSC 2021).

Since then, P2P lending has seen astounding growth from 32.3 USD million at the end of 2015 to 2.03 USD billion in 2017 and 5.37 USD billion in June 2019 (FSC 2021). According to data obtained from the Korea P2P Finance Association, the accumulated loan amount from its 44 member companies at the end of 2020 amounted to 6.92 USD billion. Of this sum, 62.37 percent are real estate related, namely: 1) private real estate mortgages (1,314.05 USD million) and corporate real estate mortgages (647.92 USD million), 2) real estate PF (1,866.32 USD million), and 3) other property collateral (490.45 USD million).

While the average rate of return for P2P loans reported to be around 15.71 percent by the end of 2017, respectively 15.34 percent in February 2018, P2P loan default rates hovered around 2 percent, which constituted an increase from the 0.42 percent recorded in 2016. However, this trend should prove to continue, as delinquency rates shot up dramatically to 8.43 percent at the end of 2019, and even further to 10.35 percent at the end of November 2020 (Fintech News Hong Kong 2020). Against this backdrop, it is vital to point out that these figures only cover the 44 member companies of the Korea P2P Finance Association (KP2PFA) – but there was a total of 239 P2P lenders active in Korea (up from 27 in 2015), which means that the biggest part of them do not report to the KP2PFA (Kapronasia 2020). To make matters more worrisome, the 44

companies that do report to the KP2PFA differ widely in their delinquency rates, ranging from 0 percent (20 companies) to as high 89.0 percent in the case of Sunfunding Co., Ltd.

To address these developments, the FSC implemented the Act on Online Investment-Linked Financing (P2P Act) in November 2019, which imposed a minimum capital requirement ranging between 433,316.88 USD and 2.6 USD million at the compulsory registration with the FSC. Furthermore, different lending caps were applied to retail investors (43,331.69 USD) and accredited investors (up to 86,663.38 USD). The P2P Act went into effect on August 27, 2020 (FSC 2021). However, the somewhat reluctant position the FSC took on imposing regulation measures on the P2P lending sector[27] underscores the importance of deregulating the fintech sector in order to stimulate the economy. More information on this will be given in the case study at the end of this sub-chapter.

Insurtech

Compared to first-mover countries in fintech, the Korean insurance market is still rather conservative, although the sector started to adopt new technologies and creating new business models to address the needs of modern customers. This trend is expected to gain further traction as Korea's rapidly ageing society is bound to offer a shrinking customer base to insurance providers.

The launch of Korea's first online-only insurer Kyobo LifePlanet in 2013, a subsidiary of Kyobo life, may well present the starting point for a (fin)tech powered insurance sector. In an effort to further develop its insurance offerings, Kyobo LifePlanet announced its partnership with Samsung Fire & Marine (one of the major insurers of the country) as well as the aforementioned Toss. Another major insurer, Hanwha Life (which also sports a general insurance and asset management company), launched its first online-only non-life insurance in 2019 (Intralink 2020:15). The launch of "Carrot General Insurance" by Hanwha General Insurance's constituted Korea's first all-digital platform for non-life insurance products. Hanwha Life, meanwhile, rolled out an AI-driven assessment system that automatically analyzes customer claims and approves or denies payouts almost instantaneously without needing human input (Hanwha 2021).

Two other Korean tech giants, Kakao Pay and Naver, voiced intentions to move into the insurtech domain. Kakao Pay intends to integrate IT-based insurance products into its service as part of its current platform expansion plan. After acquiring online insurance startup and purchase platform Inbyu (for overseas travel insurance packages) in 2019, Kakao Pay applied in February

[27] FSC chairman Eun Sung-Soo said in a press conference on 19 February 2020, that "There exists criticism that the delinquency rate of P2P lending firms is rising, and we are facing a dilemma over the intensity of regulation […]. However, we should continue financial innovation and integration" (Park 2020b).

2021 for a digital non-life insurance license. Naver, on the other hand, established a subsidiary that specializes in offering finance services ranging from mobile payments to loans and insurance (Kim and Cho 2019). Furthermore, Viva Republica's Toss started offering customized insurance plans and also voiced intentions to acquire an insurtech platform under the FSC's announced regulatory sandbox program to help broaden its user base (Intralink 2020:15).

The FSC is currently drafting a policy framework in February 2021 to ease current regulations to enable internet companies to develop and sell micro insurance products in accordance with its regulatory sandbox program. This policy is another effort in the broader push for deregulation in the finance and fintech sector by the FSC and the Korean government. This agenda will be more closely examined in the following sub-chapter.

Case study: Fintech deregulation as a means of economic growth

The Korean government has singled out fintech as one of the key areas it wants to actively promote under the digital arm of its so-called "Korean New Deal", which was announced on May 7, 2020 (Kim 2020). Although the country has been "a latecomer and a fast follower" (Kim 2019) to the global fintech landscape, the 2019 EY fintech adoption index showed Korea with an above average fintech adoption rate of 67 percent, putting Seoul on par with other Asian jurisdictions such as Hong Kong and Singapore (EY 2019:7). This development can be attributed to the expanding period of Korean fintech policy (2017-2019) during which major breakthroughs in fintech legislation where made, e.g. the Special Act on Internet-only Banks (2018), the Fintech Innovation Support Act (2018) and the Act on Peer-to-Peer (P2P) Lending (2019) (FSC 2021).

With regard to key milestones in Korea's fintech policy, the so-called "regulatory sandbox scheme" warrants mentioning as well. Under this scheme, fintech companies and financial service providers can apply for the designation as an "innovative financial service" by the FSC – if successful, the newly designated financial service enjoys regulatory exemptions for a 2-year period which can be renewed once thereafter. As of April 2020, the FSC has designated a total of 102 innovative financial services to the regulatory sandbox program within the program's first year in existence (FSC 2021).

According to the FSC's director-general Kwon Dae-Young, deregulation is a critical part of invigorating the country's fintech industry. In the strive to eliminating regulatory obstacles to fintech innovation, the FSC has announced the shift to a negative list system, where everything not explicitly forbidden is allowed. Furthermore, the regulator also introduced its so-called "open banking system" in December 2019, which allows fintech firms to access banks' payment network and paying lower transaction fees through open API initiatives (FSC 2021, Kim 2019). Fintech companies also profit from lowered usage fees, which used to be as high as 0.26 USD to

0.43 USD per transaction. Through the open banking initiative, fintech firms' fees were lowered to 0.03 USD per transaction (Intralink 2020:21).

Besides the open banking system, the FSC also launched three other major initiatives that are supposed to contribute to fintech as a driver for economic growth, including a user data utilization platform (MyData), introducing and revising legislature for P2P lending, and the introduction of a common regtech (regulation technology) platform:

- MyData: The revision bill to the Credit Information Use and Protection Act provides a legal basis for the commercialization of MyData businesses through which individuals can access their integrated personal information and receive financial advising and asset management services (FSC 2021).
- P2P lending: New legislation in the form of the Act on Online Investment-linked Financing – active since August 27, 2020 – established the regulations on P2P lending firms' entry requirements, guidelines for their business operation and rules on investor protection. The P2P lending firms must be registered with the FSC and meet capital requirements (between KRW500 million and KRW3 billion) at registration (FSC 2021).
- Regtech platform: The programme's main goals are supporting: 1) automation of compliance management, 2) automatic financial security reporting, 3) intelligence regulation search, 4) notification, as well as 5) financial security business support (Intralink 2020:21).

4.2.3 Regulation and oversight

International regulations

With respect to pillar 1 capital requirements, Korea is largely compliant with six out of seven different standards already having the final rule in force and adoption completed. The total loss-absorbency capital (TLAC) holdings (due since January 2019) are the only standard out of the three pillars were adoption has not started and the draft rule is not yet published (although it is under development). As for pillar 2 and 3 requirements, Korea is either fully compliant or has even published the respective finals rules that are due in January 2023.

In terms of liquidity requirements, the Net Stable Funding Ratio (NSFR) is already in force for Korean banks since January 2018. However, adoption of monitoring tools for intraday liquidity management (due since January 2015) has not started with the draft rule still being in process. The draft rule concerning the supervisory framework for measuring and controlling large exposures was published in the form of an administrative guideline in March 2019 and the adoption process already in motion (BIS 2020:29-30).

To sum up, the progress that South Korea has made in implementing Basel III requirements puts the country in the top bracket of implementers like Singapore, Switzerland, Argentina or Brazil. In addition, Korea's willingness to bring legislature for standards not yet due on the way to adoption makes Seoul one of the few first-mover jurisdictions together with Australia, Indonesia, and Russia. Against this backdrop, South Korea is yet the only jurisdiction to prepare the disclosure standard of market risk for adoption and planning implementation before its due-date on January 2023 (BIS 2020:30).

Further recommendations of international bodies on regulation and oversight were given *inter alia* in Korea's latest Financial System Stability Assessment by the IMF in April 2020. Among other things, this report found that Korea's financial system, which is among the most developed and internationally connected in Asia, appeared resilient but also exhibited signs of growing vulnerabilities. The growing household debt remains a key vulnerability to financial stability, while the *Jeonse* leasehold deposit market presents a potential vulnerability for the real estate market (IMF 2020a:1). Against this backdrop, it should be pointed out that the increase in jeonse loans and mortgage loans are directly responsible for the abrupt surge in Korean household debt, which in turn has been singled out as the single largest risk factor for the Korean economy (Hyun 2017:1). The IMF's key recommendations addressing these issues include 1) assessing the potential rollover risk implied by the *Jeonse* leasehold system and its connected securities companies, 2) implementing a sectoral countercyclical buffer (CCyB) framework for secured and unsecured household exposures of the banking sector, and (with regards to the non-banking sector) 3) focusing the role of the FSC towards strategy, addressing nonbank data gaps, market development policies, and crisis preparedness (IMF 2020a:7-9).

Similar to the IMF, the FSB also addressed, among others, the topic of household debt growth and the increasing role that non-bank credit plays in this development (FSB 2017b:40). The IMF also referenced the 2011 Mutual Savings Bank (MSB) crisis in Korea and pointed out that only seven of the 79 MSBs in operation in 2016 were owned by banks, while the others were run by securities companies, fund managers and other financial entities (16), non-financial business entities (22), and individual owners (34). MSBs faced large exposures to the real estate and construction sector in the form of real estate PF loans (FSB 2017b:25-27). The catering of NBFIs to less creditworthy borrowers also involves elevated risks. This assumption is supported by the strong growth in non-bank depository institutions (NBDIs) loans compared to banks and OFIs despite the higher interest that NBDIs normally charge. In this respect, NBDIs lending to vulnerable households coupled with a growth in mortgage loans (especially bullet-payment loans) presents a particular volatile risk mix that is susceptible to e.g. asset quality deterioration should the real estate market slow down or interest rates increase (FSB 2017b:40). Overall, the FSB peer

review of South Korea made five recommendations in order to develop and promote the implementation of effective regulatory, supervisory and other financial sector policies:

1. "The authorities should implement, on a timely basis, planned reforms on RRP requirements as well as bail-in and temporary stay powers" (FSB 2017b:23).
2. "Regulation entities should consider the establishment of a dedicated forum on crisis preparedness and jointly run a hypothetical simulation of the resolution of a systemic bank on a periodic basis" (FSB 2017b:24).
3. The role of the FSC and FSS in mutual credit cooperatives (MCCs) should be strengthened through assigning regulatory and supervisory responsibilities for community credit cooperatives to both FSC and FSS as well as expanding FSS resources to MCC examinations and adopting a risk-based supervisory approach for MCCs (FSB 2017b:44).
4. Prudential requirements for mutual savings banks (MSBs) and MCCs should be enhanced by the FSC in line with international standards to reflect the risks to which these entities are exposed (FSB 2017b:46).
5. Supervisory and regulating institutions should increase their focus on MCC federations by conducting a stockpile of supervisory and examination practices of the federations, reviewing corporate governance rules to ensure potential conflicts within a federation are managed, and including the financial activities of federations in systemic risk analyses (FSB 2017b:48).

National regulations

They major regulating and supervisory bodies of South Korea's financial system are the Ministry of Strategy and Finance, the Financial Services Commission (FSC), the Bank of Korea (BOK), the Financial Supervisory Service (FSS), and the Korea Deposit Insurance Corporation (KDIC) (BOK 2018:73, Appendix B).

Akin to other countries, South Korea too was forced to amend its regulatory framework following the GFC to meet the challenges unearthed by the events following the US subprime-crisis. With respect to regular banks, the following regulation (changes) represented a selection of key developments in the chosen timeframe of this thesis:

- "The Bank of Korea Act was revised once again on August 31, 2011, in an effort to heighten the Bank's role in financial stability. Details of this revision include: 1) the Bank's responsibility for financial stability in formulating and implementing monetary and credit policy is specified in the object clause to focus on financial stability; 2) the Bank being tasked with producing a Macro-financial Stability Report at least two times per year for submission to the National Assembly" (BOK 2018:33); "3) the Bank's ac-

cess to information was improved by it being granted the right to order non-bank financial institutions to submit needed materials and by stipulating a mandatory period for joint BOK-FSS examinations of financial institutions by Presidential Decree; and 4) the Bank was better empowered to take vigorous action against factors causing financial instability by providing effective emergency liquidity assistance and expanding the debts subject to reserve requirements beyond deposits" (BOK 2018: 34)

- The Banking Act and Financial Holding Companies Act were amended in 2013 to strengthen the restriction on the holding of shares of non-banking entities (industrial capital) for banks and financial holding companies from 9% to 4% of outstanding shares issued with decision-making rights.
- The Act on Corporate Governance of Financial Companies was enacted in July 2015 to induce the sound management of financial companies (BOK 2018:15-17)
- The Act on Special Cases Concerning the Establishment, Operation, etc. of Internet-Only Banks (the "Act") was enacted on January 17, 2019. This prompted the emergence of Korea's first two internet-only banks: Kakao Bank, operated by mobile messaging giant Kakao; K bank, run by telecommunications firm KT.

With respect to the regulation of shadow banks, or NBFIs, as they are referred to in Korea (mimicking the FSB's change in addressing shadow banks), there were some major regulations as well as deregulation that occurred between 2010 and 2020. One of these regulatory highlights was the money market reform of 2011. "In June 2011 the BOK, the Ministry of Strategy and Finance, and the Financial Services Commission agreed to gradually limit the amount of call money borrowing by securities companies" (Yun and Heijmans 2013:16) to below 25% of their capital by July 2012 (Suh 2016:1988), "in a measure to minimize the possible emergence of systemic risk" (Yun and Heijmans 2013:16). These measures were further strengthened by the enactment of the "Issuance and Distribution of Electronic Short-term Debentures Act" (IDESDA) in July 2011. The IDESDA, together with the restrictions on securities companies` call money borrowing brought about major changes to the money markets. Before the act, commercial paper (CP) had long provided an important short-term financing vehicle for financial and non-financial firms. However, the IDESDA will replace CP with electronic short-term debentures, which are likely to enhance market transparency and convenience in issuance. In addition, non-banking financial companies will not be able to participate in the call market from 2014. Under the circumstances, securities companies, which rely heavily on call borrowing for short-term financing, will have to use more diversified financing tools, such as electronic short-term debentures, repurchase agreements (RP), and corporate bonds.

A new development in the deregulation department was the enactment of the Financial Investment Services & Capital Market Act, which enabled Korean hedge funds start to operations under new regulations in December 2011 (KSD 2011).

In November 2013 it was announced that Securities companies will effectively be banned from participating in the call market by 2015. The exceptions will be primary dealers and open market operation participants. MMFs must decrease their call loan to below 1.5% of their assets under management. In principle, MMFs too will be run out of the call market in the long run.

2019 was an important year in terms of non-bank (de)regulation for three major reasons: 1) the introduction of a debt service ratio (DSR) requirement for non-bank lenders was introduced on May 30, and 2) the fintech deregulation push mentioned in sub-chapter 4.2.2 saw a total of 27 fintech companies had been selected as designated agents. The most important regulatory easing, however, would be the amendment to the ABS Act, which only allows those specified in the ABS Act to become an originator of the ABS, so that companies with credit ratings less than BB (e.g. local governments, mutual savings bank, community credit cooperatives, credit unions) can also qualify as an originator of the ABS. Further changes concerned the amendment of relevant regulations so as to extend the scope of the ABS enable other assets such as intellectual properties to become an underlying asset for ABS, explicitly allowing an ABS special purpose company (SPC) to securitize assets which have been directly transferred by unspecified, large numbers of originators. Furthermore, "the FSC intends to lower the standards as to who could become a servicer under the ABS Act so that more companies can act as a servicer for ABS, simplify the ABS registration procedures, and abolish regulations which have been conformed and in place without explicit legal grounds" (Sohn et al. 2020).

However, 2020 saw some major re-regulation moves that were forced by a) a record outflow of foreign investment triggered by the coronavirus outbreak in March 2020, and b) billions of dollars in losses after two South Korean hedge funds were investigated for alleged financial fraud, which strained South Korea's 386 USD billion private investment fund industry, which the government has tried to nurture via rapid deregulation (Song 2020a). With regard to the first point, Korean regulators suspended short-selling for six months as a response in March and extended the ban (against heavy criticism from the hedge fund industry) in August 2020 for another six months. These measures were beefed up again in December 2020, when the FSC announced "plans to jail and levy hefty fines on traders that illegally bet against the country's stocks as part of a broader campaign against short selling that has annoyed hedge funds. Investors who break rules that outlaw so-called 'naked short selling' could be imprisoned for at least a year or have to pay financial penalties of up to five times any profit they make on a trade" (Song 2020b).

4.2.4 Repo market

There is a total of three repo markets in South Korea that differ by the types of market participants: 1) the customer repo market, where trades between customers and financial companies are facilitated, e.g. investment from households and corporations in short-term instruments, 2) the institutional repo market, where firms which use repos to balance out any shortages or excesses in their short-term funding, and 3) the Bank of Korea (BOK) market for trades between the BOK and financial companies (BOK 2017:19, Yun and Heijmans 2013:4). Similar to Yun and Heijmans (2013), this theses excludes the BOK repo market because it is used for the purpose of open market operations (OMOs) by the BOK to smooth out temporary excesses or shortages of market liquidity (BOK 2017:28).

Year	Type of repo market	Repo transactions in Total Amount Outstanding (in USD million)
2010	Customer repo market	57.62
	Institutional repo market	10.03
2012	Customer repo market	57.67
	Institutional repo market	19.82
2016	Customer repo market	68.87
	Institutional repo market	47.67
2020	Customer repo market	74.33
	Institutional repo market	110.96

Table 10: Size of Korean repo markets

Source: Korea Securities Depository (KSD)

While the customer repo market used to be the bigger market for most of the observation period, the institutional repo market – which also incorporates a small part of repos that are exchange traded via the Korea Exchange (KRX) – transitioned to be the major repo market in Korea between December 2017 and September 2018 (Table 10, KSD). During the last three decades, repo markets have increased their share in the Korean money market from 7.6 percent in 1990 to 33.8 percent in 2016, making them the biggest sub-category. This remarkable expansion was led by deregulation, infrastructure improvement and reorganization of the (unsecured) call market (BOK 2017:9-10).

The majority of Korea's repo markets are OTC and are serviced by the Korea Securities Depository (KSD) repo service. As this service offered by KSD constitutes a Tri-party repo ser-

vice, it follows that the lion's share of repo transactions in Korea (including the BOK repo market) are facilitated on a tri-party base. The applicable regulatory provisions are the agreement of the Korea Securities Dealer Association (KSDA) and the provisions of the Global Master Repurchase Agreement (GMRA).

Customer repo market

Participants in the customer repo market include securities companies, the Korea Security Finance Corporation, banks, merchant banks, and the communications agency as eligible parties for repo transactions, while corporations, trust, and individuals may engage in reverse repos (i.e. investing their money in a short-term debt instrument). The amount of customer repos steadily increased as investors came to consider them as an alternative to (bank) deposits or MMFs. This development was also aided by the improvement of investor protection and other related systems. Securities companies constitute the main sellers of customer repos (92.4 percent), while buyers are mainly non-financial corporations and individuals who invest their short-term surpluses in funds (BOK 2017:20-21).

The securities most utilized as collateral in the customer repo market are financial bonds (31.2 percent), monetary stabilization bonds (MSBs, 22.3 percent), corporate bonds (18.5 percent), Korean Treasury Bonds (KTBs, 17.9 percent), and special and municipal bonds (10.1 percent). Tenors in the customer repo market mostly range from overnight to six days (95.3 percent), however there are also tenors for seven to 15 days (1.2 percent), 16 to 30 days (2.1 percent), and 31 days or longer (1.4 percent) available (BOK 2017:22).

In contrast to the institutional repo market, there are quite some restrictions with respect to eligible collateral: The securities eligible for the customer repo trade are restricted to government bonds (KTBs), municipal bonds, special bonds, guaranteed bonds, corporate bonds issued publicly by listed companies, and ABS or MBS issued publicly with ratings of BBB or higher (and ratings of A or higher for CMA with repo features) (BOK 2017:21-22).

Institutional repo market

Transactions in the institutional repo market (hereafter referring to the OTC portion) were rather sluggish until 2010, when the restructuring of short-term money-markets led to a dramatic increase probably best exemplified by the aforementioned IDESDA, which ultimately led to the exclusion of NBFIs from the call market starting 2014 (2015 by the latest). Since then, the institutional repo market has evolved into the largest market of this type in South Korea.

Participants in the institutional repo market are asset management companies (AMCs), securities companies, banks, insurance companies, and public financial companies such as the

Korea Securities Finance Corporation, or the Korea Housing Finance Corporation. Securities companies and asset managers are major repo sellers, which they use for (leveraged) bond investment. AMCs, MMFs, and trust accounts held by banks and securities corporations are major repo buyers, which use repos as a means of short-term asset management. As fixed income hedge funds started becoming active in Korea in 2017, hedge funds accounted for an increasing portion of the institutional repo market (KCMI 2017:85).

Korea Treasury Bonds (KTBs) constitute the most utilized collateral type (48.2 percent), followed by Monetary Stabilization Bonds (MSBs, 20.8 percent), financial bonds (17.4 percent), municipal and other special bonds (11.3 percent), and corporate bonds (2.4 percent). The available tenors in the institutional repo market roughly fit in three categories: 1) overnight repos, 2) term repos: two to seven days, or eight days or longer, and 3) open repos (without fixed end-date, recallable anytime). The vast majority of repos are overnight (91.9 percent in 2016), while term repos (3.8 percent) and open repos (4.3 percent) are about the same proportion. This concentration of overnight repos is attributed to lacking systems respectively infrastructure for trade facilitation, e.g. the restricted use of secured bonds after selling repos (BOK 2017:24-26).

"Haircut-setting practice: In the institutional repo market, a uniform haircut of 5% (margin requirement) is applied, regardless of the type of borrower or collateral. Haircuts do not vary, depending on the characteristics of collateral securities and the credit risk of borrowers. Borrower or collateral risk is reflected in the repo rate, not the haircut" (KCMI 2017:86).

Trading, clearing, and settlement of repos in Korea

As both the customer and the institutional repo market operate using the KSD's tri-party repo market service, the trading platform as well as the clearing and settlement process are jointly presented in this sub-section.

Concerning the trading platform, the KSD system is linked with the Bank of Korea's payment system BOK-wire+, which constitutes a fund settlement system among financial institutions. BOK-Wire+ is operated as a hybrid settlement method where an algorithm for simultaneously processing bilateral or multilateral payment instructions is applied. As tri-party agent, the KSD also handles the safekeeping and management of the traded securities. As for brokering services, OTC transactions in Korea are brokered by Korea Money Brokerage Corp., Seoul Money Brokerage Services, KIDB Money Brokerage Corp., Korea Securities Finance Corp., and securities companies (BOK 2017:20).

When settling repo transactions, the KSD settles cash and securities on a Delivery Versus Payment (DVP) basis using its own system linked with the national payment system by the Bank of Korea (BOK-wire+). In case that both of the trade parties agree, they can choose Free Of

Payment (FOP) settlement whereby securities and cash are settled separately. However, most trades are done on DVP base (BIS Statistics 2021). In the case of collateral value falling below the agreed requirement, the KSD also facilitates margin calls for mark-to-market transactions.

4.2.5 Credit rate spreads

Repo rate volatility

At the outset of this sub-chapter it has to be pointed out that the data availability regarding the relevant data for (market) interest rates necessary for the framework employed in this thesis was insufficient at best. Without access to a relevant financial information terminal specialized in Korean financial data (e.g. Yonhap Infomax) it is very difficult to find conclusive information, if any at all[28]. For this reason, this thesis extracted data through the Economic Statistics System (ECOS) of the Bank of Korea (BOK) or, if applicable, data and graphs published in journal articles with a (to a certain degree) congruent research interest.

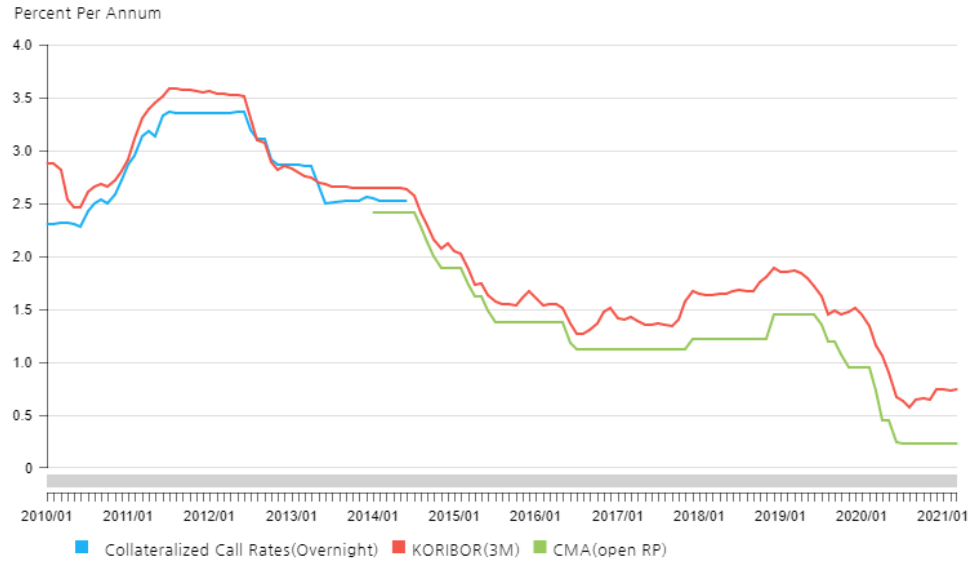


Figure 20: Overnight collateralized Call Rate / CMA (open RP) vs. 3 month KORIBOR

Source: Bank of Korea ECOS (Economic Statistics System)

With regard to the repo rate, there is neither information on the current state nor the development of a general collateral repo rate in either the constitutional or customer repo market. As neither the KSD as the tri-party repo agent servicer nor the BOK publish conclusive data this thesis had to resort to the rate for Cash Management Accounts (CMAs) open repos, which follows the BOK Base Rate applied in transactions between the BOK and financial institutions.

Figure 20 depicts the development of the overnight uncollateralized call rate, respectively starting 2014 the CMA open repo rate versus 3 month Korea Inter-Bank Offered Rate (KORI-

[28] Requests for information on repo data to the KSD as well as Yonhap News Agency for usage of the Infomax portal made by the author of this paper were left unanswered.

BOR, benchmarks the UK's LIBOR), which shows some spreads between 2010 and 2020, however they do not divert farther from each other than 20 to 50 bps. The first longer spread in 2011 can be attributed to the Mutual Savings Bank (MSB) crisis, which involved an increase in insurance premiums by the Korean Insurance Deposit Corporation (KDIC) to recover losses incurred by the bankruptcies respectively reconstructions of a number of MSBs (FSB 2017:4). Overall, the uncollateralized call rate increased from 1.98 percent in 2009 to 3.25 percent in the first of half of 2012, a development that mirrored the raising of the Base Rate by the BOK (BOK 2013:19).

After 2015, the CMA open repo rate diverges more pronounced and for longer time periods from the 3 month KORIBOR rate. This can be attributed to the increase in collateral types that are eligible in the Korean repo markets, especially with respect to asset-backed securities such as ABCP or MBS. Unfortunately, there is no further information on repo rate spikes available for the time after 2012 (BOK 2013:33), which is why the only development that can be genuinely discussed is the general direction of Korean money market interest rates. Similar to other developed nations, Korea also engaged in lowering of its policy rate (i.e. BOK Base Rate) in order to boost economic recovery from the GFC by making liquidity available in abundance to investors and businesses alike.

Peripheral cross-currency bases

With respect to the widening of cross-currency bases, South Korea has been prone to be largely impacted by FX liquidity mismatches both at the Asian Financial Crisis (AFC) and the GFC. However, the underlying source of this over-reliance in non-core funding differed in the respective crises – while Korean banks borrowed heavily abroad and were heavily exposed to rollover risk, the GFC exposed the FX hedging by South Korea's export-oriented economy as well as the large-scale and short-term US dollar borrowing by branches of foreign banks in Korea undertaking KRW-USD carry trades as sources of systemic risk (IMF 2020x:43).

When revisiting Figure 16, the failure of Bear Stearns spurred widening in KRW-USD cross-currency spreads of over 600 bps. The sizable outflows of foreign exchange from domestic banks and foreign branches alike could only be quelled after massive intervention by the BOK, the Korean government, and a swap line arrangement with the Federal Reserve that was in place until 2010 (IMF 2020x:43-44). Since the GFC, Korea has managed to control its FX exposures fairly well with small-scale widenings of its cross-currency base caused by the high openness of Korea's deep and liquid capital markets, which exposes the country to volatile swings in capital flows. However, the advent of the still ongoing Covid-19 pandemic caused KRW-USD cross-currency bases to widen to spreads not seen since the GFC, which triggered a short-term liquidi-

ty squeeze and an abrupt climb in the won-dollar exchange rate (Lee 2021:1-2). Contrary to the events of September 2008, the Fed reacted quickly by creating a) temporary dollar liquidity swap lines on 19 March 2020, and b) a temporary foreign and international monetary authorities repo facility on 30 March 2020 (see Figure 16).

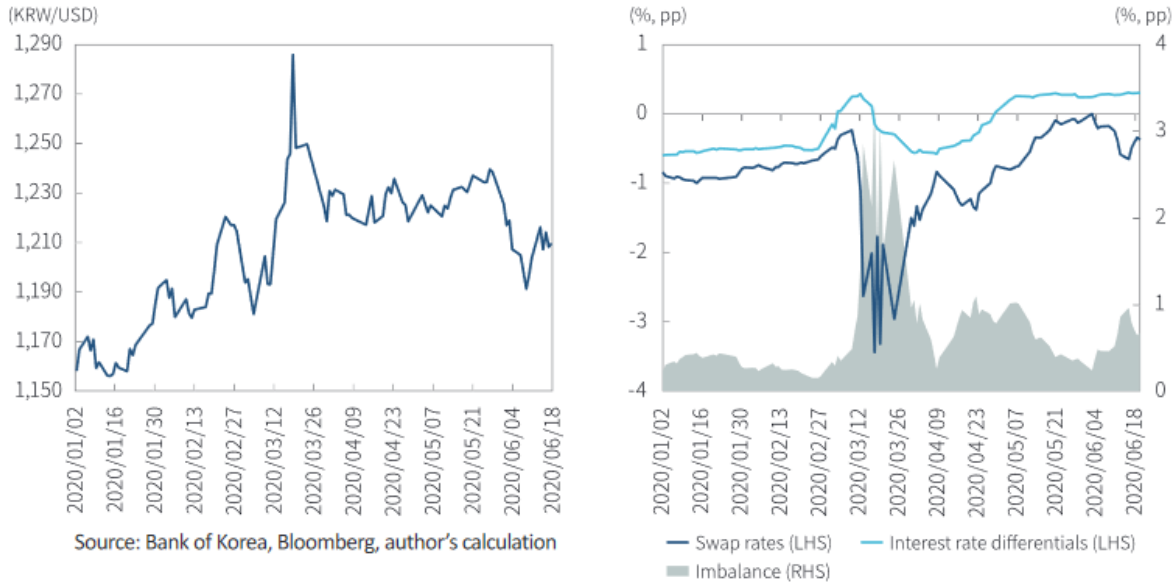


Figure 21: Changes in won-dollar and swap rates in 2020

Source: Lee 2021:3

A direct cause behind the liquidity squeeze of March 2020 was that securities firms faced margin calls on their positions related to equity-linked securities (ELS). The demand for FX liquidity of these firms could spread to the overall FX market, the probability of which is rising through the increase in ELS issuance. As Korean securities firms tried to secure dollar liquidity via call money, CP, or the BOK's auction for repos in both FX swap and spot markets, this short-term rise in FX demand led to a spike in the KRW-USD exchange rate to KRW 1,285 on 19 March 2020 (see Figure 21, left). The right frame of Figure 21 shows the imbalance in the FX swap market (grey) rose to roughly 300 bps, exhibiting high market volatility.

FX volatility Balance sheet lenders

Based on Baba and Shim (2011:17) the Korean version of the Treasury-EuroDollar (TED) rate used for measuring credit risk translates to the spread between KORIBOR as an unsecured rate on the one side, and the yield of a Monetary Stabilisation Bond (MSB) rate, both with a one year maturity.

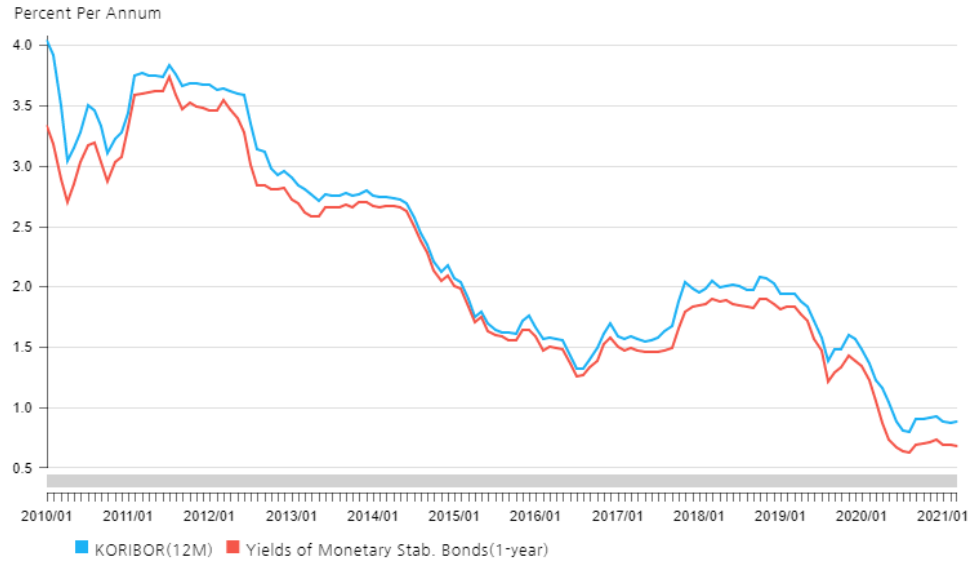


Figure 22: 12 month KORIBOR vs. 1-year Monetary Stabilisation Bond (MSB)

Source: Bank of Korea ECOS (Economic Statistics System)

Figure 22 depicts the development of the aforementioned Korean TED spread variables between 2010 and 2020/2021. The most pronounced deviations of these interest rates happened in 2010, 2011 and between 2020 und 2021. One of the reasons for the relative stability of credit risk in the Korean money markets can be attributed to the regulatory tightening of Korean authorities following the GFC – between January to July 2010 mandatory minimum holdings of safe foreign currency assets were introduced, and the ration of mid- to long-term borrowing was raised to mid- to long-term lending. Furthermore, financial authorities in Korea introduced limits on net aggregate FX forward positions that both domestic banks and foreign bank branches were subjected to (Baba and Shim 2011:30).

The KORIBOR-MSB spread of around 70 bps recorded in January 2010 was never again reached in the entire assessment period between 2010 and 2020, not even the onset of the Covid-19 pandemic came close. However, while the aforementioned regulatory measures post-GFC surely were beneficial, the most vital reasons why the Korean TED spread did thus far not exceed 20-25 bps is probably the quick provision of bilateral currency swap line by FX authorities in Korea with the US to bank via several auctions (Lee 2021:4).

4.3 Development of shadow banking in the USA

4.3.1 Key agents and products

A key characteristic of the US financial system is the high grade of fragmentation, illustrated by the structure of the country's banking industry, which consists of 10,413 independently chartered commercial banks with varying size and diversification. This number encompasses 753 state member banks, 1,086 national banks, 3,338 state non-member banks, and 5,236 credit unions (SF Fed 2021).

Financial intermediation outside the banking system is highly diversified as well – according to the IMF's recent Financial System Stability Assessment of the US, the composition of the financial intermediation sector is as follows: Private Depository Institutions (19 percent), Insurance (11 percent), Private and Public Pension Funds (24 percent), MMFs (4 percent), Mutual Funds (17 percent), Government-Sponsored Enterprises (GSEs)[29] (7 percent), Exchange-traded Funds (4 percent), Security Brokers & Dealers (3 percent), and Other (11 percent) (IMF 2020c:24).

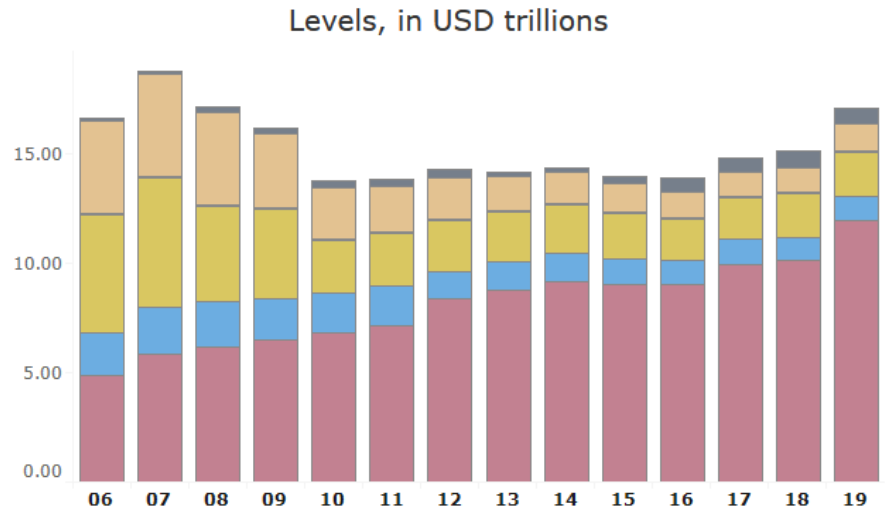


Figure 23: Shadow banking in the US, in USD trillions

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

As depicted in Figure 23, the levels of shadow banking (as the FSB defines it narrowly) have begun to grow back to pre-GFC levels in recent years, after being stagnant between 2010 and 2016. While the compound annual growth between 2013 and 2018 was 2.9 percent, the Year-Over-Year growth from to 2018 to 2019 was 12.8 percent, mainly driven by the strong growth from EF1 entities such as fixed income funds and MMFs. The total levels in 2019 reached 17.10

[29] The three main GSEs, namely 1) the Federal Home Loan Mortgage corporation (Freddie Mac), 2) the Federal National Mortgage Association (Fannie Mae), and 3) the Government National Mortgage Association (Ginnie Mae) are all entities that were created to reduce the cost of housing- and mortgage-related credit, respectively to improve the flow of credit in these markets (Segal 2020).

USD trillions, which is the second highest measure tied with 2009. Only 2008 was shadow banking bigger, with a total of 18.72 USD trillion.

With regards to the amount of total financial assets, the narrow shadow banking measure amounts to 15,74 percent of the 108,61 USD trillions reported in 2019. **However**, NBFI share of total financial assets is a 70.64 percent, compared with banks' share of 24.05. This translates to a share of 329.70 percent of GDP for NBFIs, and 112.30 percent for banks.

As for the narrow shadow banking measure, Figure 24 shows that the share of GDP in 2019 of 79.80 percent is a remarkable descent from the 130 percent the sector measured at in 2007.

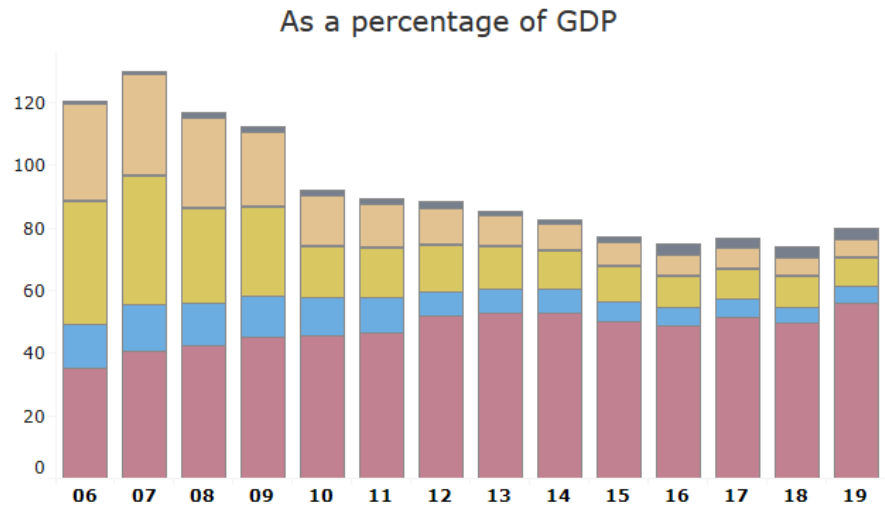


Figure 24: Shadow banking in the United States, as a percentage of GDP

Source: FSB 2021; Red: EF1, Blue: EF2, Yellow: EF3, Purple: EF4, Orange: EF5, Grey: Unallocated

The US financial system is not only very diverse, but also exhibits a high degree of inter-connectedness. This translates to a considerable potential for shocks to reverberate through the whole system, as both NBFIs and banks have considerable direct exposures to corporates and households alike. While NBFIs intermediate twice the amount of credit to the real economy than depository institutions do, the two sectors also share significant interlinkages, amounting to over 30 percent of their assets. Furthermore, there is further interconnectedness through unused credit lines as well as warehousing of NFBI asset-backed securities by banks (IMF 2020c:50-51).

The US post-GFC stimulus which was administered under the American Recovery and Reinvestment Act (ARRA) amounted to an estimate of 831 USD billion between 2009 and 2019 (CBO 2012:1), which translated to 10 percent of GDP (Izvorski 2018).

Year	Agency (FHLMC, FNMA, GNMA)		Non-agency		Total	
	MBS	CMO	CMBS	RMBS	Agency	Non-agency
2010	5,481.4	1,114.3	747.0	1,676.7	6,834.7	2,423.7
2011	5,546.4	1,253.3	690.3	1,437.5	6,947.7	2,127.7
2012	5,656.7	1,341.1	638.4	1,239.3	6,960.4	1,877.7
2013	5,905.6	1,322.6	627.1	1,075.9	7,039.6	1,703.0
2014	6,008.4	1,264.2	628.9	994.3	7,218.8	1,623.2
2015	6,217.1	1,353.3	603.2	924.7	7,366.9	1,527.9
2016	6,529.9	1,401.3	531.5	853.4	7,638.4	1,384.8
2017	6,924.3	1,303.7	508.7	790.8	8,005.1	1,299.4
2018	7,268.7	1,134.0	543.1	817.3	8,371.9	1,360.4
2019	7,710.5	1,210.4	596.3	805.3	8,827.9	1,399.7
2020 (Q3)	8,181.4	1,378.2	595.8	751.0	9,559.6	1,347.3

Table 11: Total amount of real estate securities Outstanding in the US (in USD billion) 2010-2020

Source: SIFMA

As the US mortgage (sub-prime) market was at the center of the GFC, it warrants our attention. Table 11 shows, that the total amount of real estate securities Outstanding has increased substantially by 1.5 USD trillion since 2010, and since 2018 to 2020 consecutively surpassed the levels reached during the GFC. However, the growth was largely carried by rising Agency MBS, who became the main buyer of NFBI-issued MBS[30]. There is another recent trend that is worth mentioning – while Agency MBS continue to gradually increase and non-Agency RMBS to gradually decrease, Collateralized Loan Obligations (CLOs) started to increase substantially in 2020 with 21 percent YoY change in Q2 and 24 percent increase in Q3. This is worrisome because the growth rates are similar to the buildup to the GFC in this type of collateralized product.

[30] More detailed information on NBFIs role in the mortgage sector is given in a case study in the following subchapter

4.3.2 Recent innovations

Mobile payments

In terms of market size, the US mobile payment sector ranks sixth worldwide with 98.8 USD billion in 2019. This means a growth of 41 percent from 69.8 USD billion in 2018 and a near-eightfold increase of the 12.8 USD billion registered in 2012. The growth in volume is also mirrored by an increasing diversity of the mobile payment landscape with providers such as PayPal, Venmo, Zelle (formerly ClearXchange), Google Pay, and Apple Pay (Kohan 2020).

However, despite this remarkable growth in recent years mobile payments are still lacking in merchant acceptance, with PayPal being the most popular nonbank option with 44 percent adoption rate. The second most accepted nonbank option is Apple Pay, with only 9 percent adoption rate (see Figure 25).

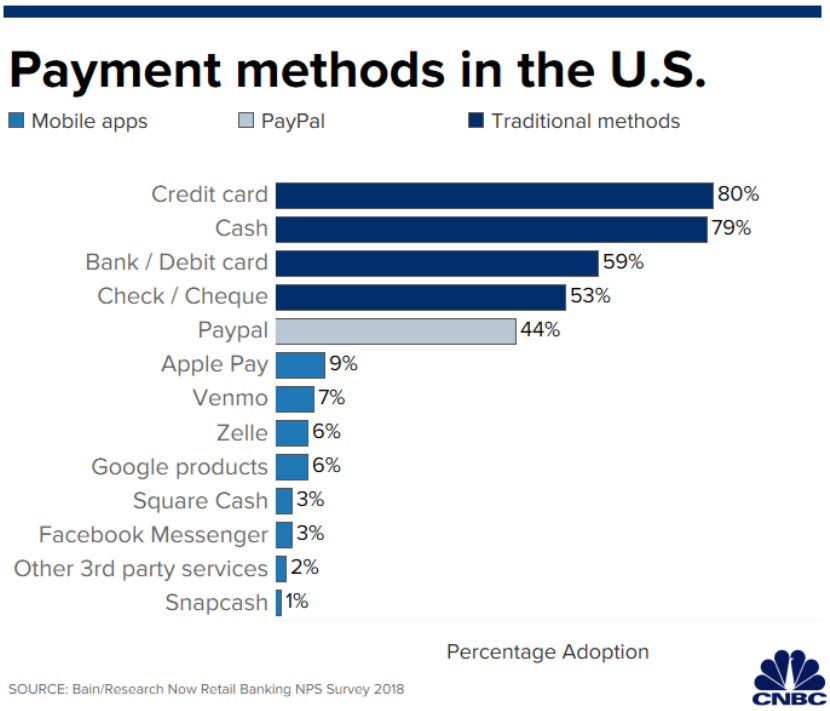


Figure 25: Payment methods in the US in percent adoption rate

Source: Rooney 2019

Credit and debit cards are well-established in the United States and already fulfill the role of alternative to cash payment that mobile payments usually try to fill. To put things in perspective, in 2018 credit card payments alone totaled 44.7 billion (by number of transactions) with a value of 3.98 USD trillion (FRB 2019:13). Against this backdrop, the announcement of a real-time payments system by the Fed (called the "FedNow Service"), which is set to begin service in 2024, could allow mobile payment providers to leverage the direct, real-time connection to customers' account this service promises to offer (Rooney 2019).

Marketplace lending

The term marketplace lending includes certain online lending practices that rely on fintech solutions. As such, marketplace lending encompasses *inter alia* P2P lending. P2P lending used to be the initial *modus operandi* in the marketplace lending sector, which involved the selling of loans to individual people. However, as institutional investors such as hedge funds continue to play an increasingly important role in the funding of these loans, the term peer in P2P lending became misleading. Marketplace is characterized by their customer base (individuals and small businesses), the complete digitalization of their operations without a brick and mortar presence, fully automated and algorithmic underwriting, and funding by issuance of equities or the sale of loans to investors (Perkins 2018:1).

There are two different business models that marketplace lenders can be distinguished as: 1) Direct-lenders, or **balance-sheet lenders**, and 2) Indirect lenders, or **platform lenders**. Direct lenders are also called balance-sheet lenders because they hold most of the loans they originated on their own balance sheet and earn interest on the loans – however, they also face the credit risk of a borrower defaulting on his loan. Balance-sheet lenders typically issue equity to large investors like hedge funds and venture capitalists to raise funds. The indirect lender, on the other hand, rarely holds loans himself but matches individual investors such as individuals, investment funds, or financial institutions, that want to purchase a specific loan (based on interest rates and risk profiles) to an individual loan. Once the prospective buyer has committed to funding said loan, the platform lender originates the loan via a partner bank by using an instrument known as payment dependent note, which directs the payment streams of the loan to the respective investor. Typically, the platform lender earns fees for origination and servicing of the loan, however he does not face losses in the event of a default (Perkins 2018:2-3).

The marketplace lending sector in the US was estimated to encompass about 111 operating institutions in 2016, however not even the Marketplace Lending Association has published a more conclusive/exhaustive list as of writing. Therefore, the best possible point of departure seems to be Standard & Poor's 2018 US Fintech Market Report, which identifies 16 major digital lenders that drove loan origination between 2013 and 2018 (see Figure 35, Appendix C). As for market size, marketplace lenders originated roughly 26 USD billion of loans in 2017. While this is of course small compared to total consumer credit outstanding of 3.8 USD trillion in the same year. However, the growth of marketplace lending has been astounding, with a compounded annual growth rate of 163 percent between 2011 and 2015. Loan origination continued to grow to 58.4 USD billion in 2019 but was severely dampened by the Covid-19 pandemic (Dixit 2020).

In order to continue growth, certain marketplace lenders have expanded the scope of their

lending activities (funding as well as product offerings), e.g. LendingClub, who now also offers business loans as an addition to its personal loan-focused portfolio. Other examples, such as Square or PayPal, entered the marketplace lending market from adjacent fintech segments, while original marketplace lenders started offering non-lending services such as wealth management or payment. One of the most aggressive moving companies in this respect is SoFi Lending Corp., which started out as a student loan refinancing company and now also offers personal loans, wealth management, high-yield deposit account products, and mortgages (S&P 2018:5-6).

Case study: non-bank mortgage lending in the US

As alluded to in the previous subchapter, this part will shed light on the role of non-banks in the US mortgage market. With a size of roughly 11 USD trillion (FDIC 2019:34), the US residential mortgage market represents the largest consumer finance market in the world. This market can be divided into two sides: 1) traditional banks that are highly regulated and handle the three main mortgage functions – originate, funding, and servicing – themselves, whilst holding the loans either themselves or securitizing them in pools guaranteed by the three big GSEs, and 2) non-bank originators and servicers, which are only lightly regulated and generally do not have the balance sheet capacity to keep the loans they originate. Instead, they sell almost all of them directly to GSEs, especially Ginnie Mae, and collect fees for originating the loans respectively servicing them.

Non-bank mortgage lenders operate on an "originate-to-distribute" model, which relies on the readiness of GSEs to buy the mortgage loans originated by non-banks (Seru 2019:12-13). For loan origination non-bank lenders rely on short-term credit lines by warehouse lenders, usually via repo, to extend the mortgages. A key feature in this funding method is that many of these repos underlie daily mark-to-market valuations of the respective mortgage loan, with the ability of these warehouse lenders (almost always banks) to issue margin calls should the value drop below the purchasing price (Kiriakos et al. 2020). As for the distribution side, non-bank lenders are completely dependent on GSEs, whose standards the underlying securities have to meet, as the private-label RMBS market has completely dried up after the GFC. With respect to servicing, non-bank lenders collect the payments and forward them to investors, insurers, and tax authorities. The important point is, that these payment have to be made by the loan servicer even if the loans are delinquent (IMF 2020c:27). As part of the Trump administration's 2 USD trillion relief bill of March 2020 mortgage borrowers are able to defer mortgage payments for up to a year – this constituted a monthly gap that mortgage servicing companies now had to fill, which were estimated at 12 USD billion per month by the Mortgage Banking Association. In response to non-bank mortgage servicers coming under increasing liquidity concerns, Ginnie Mae – which

backs loans that usually cater to sub-prime borrowers – has announced a temporary last resort measure that the agency would cover the difference between what servicers owed and what funds they had on hand (Naumann 2020).

Non-bank mortgage lending saw tremendous increases in market share in the 2000s – while non-banks mortgage loans accounted for only 20 percent in 2007, non-banks are now the major source for mortgage originations with a rough market share of 61.6 percent (CSBS 2019:3). They also represent 60 percent of all mortgage originations sold to Fannie Mae respectively 53 percent to Freddie Mac, as well as 85 percent sold to Ginnie Mae in June 2019 (CSBS 2019:11). This increase in loans for sales to GSE was also accompanied by a loosening of underwriting criteria in recent years as well as mortgage servicing also shifting from banks to non-banks, with non-banks holding 47.5 percent of mortgage servicing rights (MCRs) compared to 4 percent in 2008 and 38 percent in 2000 (CSBS 2019:34, FDIC 2019:34). Of the 25 top institutions non-banks were accounting for 15, with Quicken Loans and United Shore Financial Services taking the two top spots, well before Wells Fargo and J.P. Morgan Chase, the two top members of the regular banking sector (CFPB 2019:62-66).

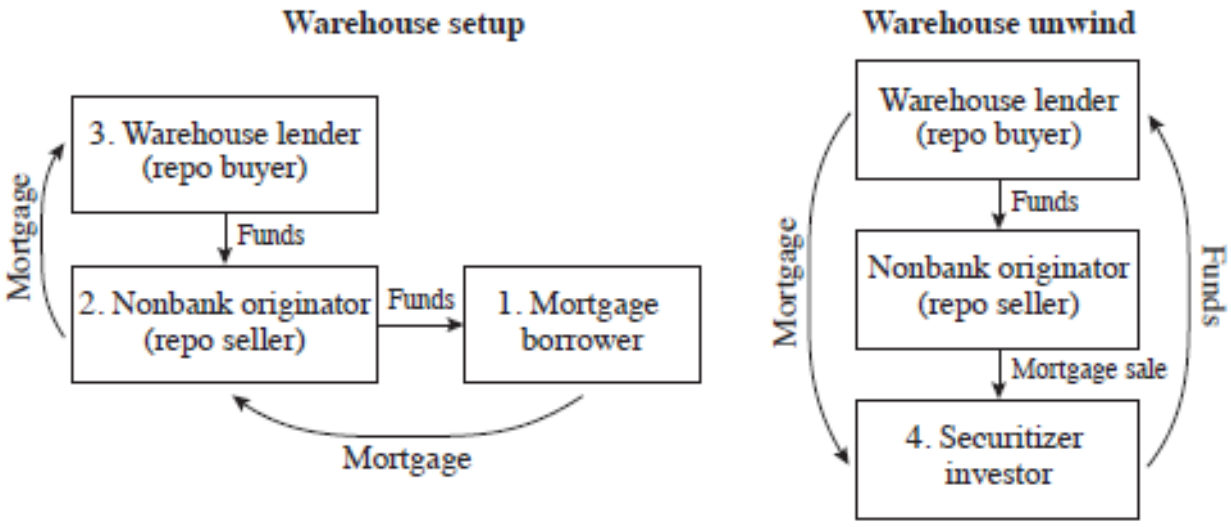


Figure 26: Schematic for Collateralized Warehouse-Lending Process for Mortgage Originations

Source: Kim et al. 2018:362

4.3.3 Regulation and oversight

International regulations

With regard to the implementation of Basel III standards, the United States are mostly on track with respect to Pillar 1 (capital) regulations. Countercyclical capital buffers (CCyB) and margin requirements for non-centrally derivatives are fully effective since January 2019, respectively September 2020. The adoption of capital requirements for CCPs and Standardized Approach to

Counterparty Credit Risk (SA-CCR) has already begun in April 2020, however banks can make use of a grace period until January 2022, when adoption becomes compulsory. With respect to total loss-absorbency capital (TLAC) holdings, proposals were issued as early as April 2019, but the adoption is still in process with no initial target date announced. However, there seems to be little progress (if none at all) in the areas of capital requirements for equity investment in funds (due since January 2017) and a framework for securitization (due since January 2018).

As for liquidity, monitoring tools for intraday liquidity management are in full effect and were confirmed with the 2017 Comprehensive Liquidity Assessment and Review (CLAR), which proofed the ability of US G-SIBs to meet their respective liquidity and capital requirements. Nonetheless, the adoption of the Net Stable Funding Ratio (NSFR) proposal of May 2016, through which the Federal Reserve would require public disclosure of a firm's NSFR and certain of its components, is still underway and has yet to be implemented. Concerning the large exposures category, the Federal Reserve Board has issued a final rule to apply single-counterparty credit limits to bank holding companies with total assets of USD 50 billion or more in August 2018.

With regard to the revised Pillar 3 requirements (due since December 2016), there was no policy announced or in progress as of the latest available, eighteenth progress report on the adoption of the Basel regulatory framework (BIS 2020).

Overall, the United States have implemented a fair amount of Basel III requirements. However, while the US have imposed some stricter standards for their G-SIBs[31], there are some also some short-comings in the form of reduced or non-existing requirements and/or charges for firms with up to 250 USD billion in assets or 75 USD billion in non-bank assets, short-term funding, or off-balance sheet exposure. The possibility for these firms to exclude gains and losses from regulatory capital (i.e. unrealized losses are not deducted from capital) is of concern because firms are likely to accumulate underlying losses when under stressful conditions (IMF 2020c:112).

Additional input with regards to regulation and oversight from international bodies for the United States was given by the IMF as well as the FSB. The key recommendations of the IMF in their recent (August 2020) Financial System Stability Assessment cover the areas of 1) Systemic Risk Oversight and Macroprudential Framework, 2) Banking Regulation and Supervision, 3) Insurance Regulation and Supervision, 4) Regulation, Supervision, and Oversight of FMIs, 5) Securities Regulation and Supervision, 6) AML/CFT, 7) Systemic Liquidity, and 8)

[31] G-SIB surcharge ranging from 1 to 5 percent (Basel: 1 to 3.5 percent), leverage buffer within 0.5 to 2.75 percent range (Basel: 0.5 to 2.75 percent), and a 100 percent prudent permanent capital floor on banks based on the standardized risk-based capital rules was implemented (Basel: 72.50 percent) – however, the US standardized approach excludes capital charges for operational risk and Credit Value Adjustment (CVA) risk (IMF 2020c:112).

Crisis Preparedness and Management. Out of 27 total recommendations, the event horizon of four was judged to be "immediate": 1) Intensifying efforts to close data gaps, including reporting disclosures of holdings of collateralized loan obligations (CLOs) and repo markets to reinforce market discipline, 2) Assessing financial stability risks related to mutual funds and stable net asset value (NAV) money market funds (MMFs), including through SEC-led liquidity stress testing, 3) Increasing scrutiny of new registrants and reduce reliance on self-attestations where applicable, and 4) Continuing to operate regular fine-tuning OMOs (IMF 2020c:11-12).

With respect to the FSB's contribution to non-bank regulation, the 2013 identification of nine "global systemically important insurers" (G-SIIs) by the FSB and the International Association of Insurance Supervisors (IAIS) has to be mentioned. The definition goes as follows: A G-SII "is an insurer whose distress or disorderly failure, because of their size, complexity, and interconnectedness, would cause significant disruption to the global financial system and economic activity" (FSB 2013). Three G-SIIs were identified in the US, namely: American International Group, MetLife, and Prudential Insurance. However, in 2017 and 2018 the FSB decided to not publish new lists of G-SIIs and decided to suspend G-SII identification completely as of the beginning of 2020 because the IAIS's holistic framework, which constitutes an activities-based approach to systemic risk. The FSB has also announced to review the need to re-establish or discontinue an annual identification of G-SIIs depending on an assessment of the initial years of implementation of the IAIS holistic framework (NAIC 2020).

National regulations

As mentioned at the start of chapter 4.3, the financial system of the United States is highly fragmented. In order to address the system's fragmented nature, the Financial Stability Oversight Council (FSOC) was created as a council of regulators and experts chaired by the Treasury Secretary. The regulatory architecture at the federal level can be grouped in the following areas:

- **Depository regulators** – Office of the Comptroller of the Currency (OCC), Federal Deposit Insurance Corporation (FDIC), and Federal Reserve for banks; and National Credit Union Administration (NCUA) for credit unions.
- **Securities markets regulators** – Securities and Exchange Commission (SEC) and Commodity Futures Trading Commission (CFTC).
- **"Government-sponsored enterprise (GSE) regulators** – Federal Housing Finance Agency (FHFA), created by HERA, and Farm Credit Administration (FCA), and
- **Consumer protection regulator** – Consumer Financial Protection Bureau (CFPB), created by the Dodd-Frank Act" (Labonte 2020).

In the aftermath of the GFC, the United States passed the Dodd-Frank Wall Street reform and consumer protection Act (Dodd-Frank Act for short), which arguably represents the most comprehensive financial regulatory reform since the Glass-Steagall Act which followed the Great Depression. The Act was signed into law by the Obama administration in July 2010 and stated the following main goals: 1) Provide financial regulatory reform, 2) protect consumers and investors, 3) put an end to the too-big-to-fail (TBTF) problem, 4) regulate the over-the-counter (OTC) derivatives markets, and 5) prevent future financial crises. As the Dodd-Frank Act consists of 16 different titles, spanning 848 pages, and the implementation of roughly 398 regulatory measures (as well as various mandated studies) (Evanoff and Moeller 2014:3) this thesis does not aim to give a comprehensive summary or discussion but rather a presentation of highlights within the Act.

A first noteworthy mention is the introduction of various reforms for mortgage lending practices, conflict resolution at rating agencies, hedge fund disclosure, risk taking by MMFs, origination and securitization of assets, and shareholder say on pay and governance. With respect to some predatory mortgage lending in the sub-prime crisis, the newly established CFPB has the ability to write rules governing products and services that banks and non-banks offer to consumers. With respect to the identification and regulation of systemic risk, Dodd-Frank set up the FSOC to regulate NBFIs and deem them systemically important (G-SIFI or SIFI), with the option to break them up as a last resort measure. In order to put an end to the TBTF problematic, systemically important institutions (banks as well as nonbanks) are required to formulate "living wills" (or "funeral plans") to ensure orderly liquidation and rule out taxpayer funding of wind downs of these kind of institutions. The Fed's authority was expanded on the one hand, over all systemic institutions as well as the responsibility for preserving financial stability – on the other hand, emergency federal assistance to individual non-bank institutions was limited respectively prevented. With respect to the regulation and transparency of derivatives, central clearing of standardized derivatives, regulation of complex derivatives that can remain outside of central clearing platforms, and separation of "non-vanilla" position into well-capitalized subsidiaries (derivates used for hedging purposes excluded) were provided (Acharya 2012:5).

As a last point, I want to highlight the so-called "Volcker Rule"[32], which was included as a part of Title VI in the Dodd-Frank Act. The two most important components of the Volcker Rule are probably the prohibition on proprietary trading (for both banks and non-bank SIFIs, although the Volcker Rule does not apply to companies that were designated as SIFI by the

[32] Named after former Fed Chairman Paul Volcker, who proposed a piece of regulation to reinstate a division between investment and commercial banking, which once existed under the Glass-Steagall Act but was repealed in 1999 by the Graham-Leach-Bliley Act.

FSOC) and the so-called *De Minimis* Investment requirement. With respect to the former, there are important distinctions between banks and non-banks, namely:

- A banking entity cannot 1) engage in proprietary trading, or 2) acquire or retain any equity, partnership or other ownership interest in or sponsor a hedge fund or private equity fund (with the exception of certain permitted activities, e.g. forward exchange and swap transactions are allowed only for some purposes, such as for the purpose of creating a market).
- Non-bank SIFIs that engage in proprietary trading in any permitted activities (i.e. any activities regular banks are allowed to engage in) are subject to the same capital requirements and quantitative limits as banks. In cases other than these exceptions, proprietary trading or fund activities will be subject to additional capital requirements and quantitative limits that are to be established by a rule (Douglas and Evanoff 2014:15-17, Morrison & Foerster 2010:19-21).

De Minimis Investment means that a banking entity "may make and retain an investment in a fund that the banking entity organizes and offers; provided, that, it seeks unaffiliated investors for the fund; within one year of a fund's start date, the banking entity's investments shall not exceed more than 3% of the total ownership interests in such fund; and the aggregate of investments in all such funds does not exceed 3% of the banking entity's Tier 1 capital." (Morrison & Foerster 2010:19).

With regard to the designation of non-bank SIFIs, the FSOC developed a three-stage process in 2012. Stage one was based on quantitative thresholds, e.g. at least 50 USD billion in assets and matching one of five additional metrics, stage two involves the analysis of publicly available data and information as well as consultation of the firm's primary regulator to assess the potential risk posed by the company. If the firm is advanced to stage three for in-depth analysis, it is notified and may submit materials it believes should be considered – the Council can make the designation final by a two-thirds vote and (with the affirmative vote of the FSOC chair) can finalize the designation. Under the Obama administration, a total of three insurance companies (AIG, MetLife, and Prudential) and once finance company (GE capital, successor to General Electric's financial arm GECC) were designated as SIFIs. However, the designation status is reviewed annually by the FSOC and can be revoked, given the designated entities have sufficiently de-risked. This was successfully undertaken by GE capital in 2016, after reducing its risk profile by undertaking concrete steps to break up the company (Gelzinis 2019:17-18).

The advent of the Trump administration brought with it a countermovement to the rules and regulation efforts of the Obama era. With regards to SIFIs, the FSOC under the aegis of Steven Mnuchin started rescinding the designations of the remaining three non-bank SIFIs – AIG in

September 2017, and MetLife – after dropping the government's appeal, despite substantial evidence of the federal district court's decision being flawed – in January 2018. Prudential's SIFI status was rescinded at the annual re-evaluation in October 2018, which means that in effect there are no more designated non-bank SIFIs in existence. While the de-designations of AIG and maybe even MetLife can be argued in favor for, this is not the case for Prudential's de-designation. Prudential has not only gained in overall assets since its designation in 2013 (100 USD billion growth until 2018), its risk exposure and increasing complexity of operations also increased substantially. When comparing the point of designation (2013) with the decision of de-designation (2018), Prudential's derivatives exposure grew by 30 percent, its repos by 45 percent, and securities lending by 13 percent. In addition, the process for designating SIFIs was aggravated by the need to factor in a firm's likelihood of distress in the designation process. This is problematic for at least two reasons: 1) It is extremely difficult, if not impossible, to predict the likelihood of a firm experiencing material financial distress many years in advance[33], and 2) non-bank SIFI designation would then become a potentially dangerous label and be afflicted with stigma (much like if a bank's need for lender of last resort assistance would be publicly announced) (Gelzinis 2019:24-27).

The deregulation efforts of the Trump administration did, however, not stop at non-bank SIFIs – the Economic Growth, Regulatory Relief, and Consumer Protection Act (EGRRCPA) passed in 2018 eased regulations on small and midsize banks – banks within 100 USD billion and 250 USD billion in assets were no longer classified as "TBTF", and therefore faced lower levels of scrutiny over their stability. Additionally, small banks (i.e. banks with assets below 10 USD billion) no longer have to comply with the Volcker rule and can again use depositors' funds for risky investments (Sahni et al. 2021).

4.3.4 Repo market

After undergoing major legal and structural changes in the 1980s, *inter alia* the exemption of Treasury (and other selected securities) repos from the bankruptcy code's automatic stay provision, the US repo market evolved to largest short-term wholesale funding market in the United States. As such, the stability and functioning of the repo market is critical to the US economy and financial markets – therefore, it is also incremental to financial stability. The two most important *raisons d'être* for the repo market are 1) the option for financial institution that are holding a lot of securities (e.g. hedge funds, broker-dealers, banks) to borrow cheaply, while simultaneously allowing institutions that are holding a lot of cash (e.g. pension funds, MMFs) to earn an

[33] E.g. Bear Stearns reported its first ever quarterly loss only three months before it defaulted in the run-up to the GFC (Gelzinis 2019:27).

interest on their cash holdings without taking on a lot of risk, and 2) the Fed can use reverse repos as an additional monetary policy tool to increase or decrease the amount of liquidity in the system as needed. There are two main markets for repo transaction in the US, which can be distinguished by the way they are settled – either bilateral, on a delivery-versus-payment (DVP) basis, or on the books of tri-party custodian banks.

In terms of size, the average daily outstanding volume of repos in the United States in selected years were as follows:

Year	Type of repo market	Average Daily Outstanding (in USD billion)
2010	Bilateral repo market	2,700.00*
	Tri-party/GCF repo market	1,716.71
2012	Bilateral repo market	2,200.00*
	Tri-party/GCF repo market	2,064.20
2016	Bilateral repo market	2,200.00*
	Tri-party/GCF repo market	1.788.38
2020	Bilateral repo market	2,600.00*
	Tri-party/GCF repo market	2,566.12

Table 12: Size of US repo markets

Sources: Federal Reserve Bank of New York, Securities Industry and Financial Markets Association (SIFMA)

** Note: The figures for bilateral repos were taken from the SIFMA US Repo Factsheet 2021 because they provide data for the complete timeframe chosen. However, these numbers should be taken with a grain of salt, as SIFMA does neither represent the entire US broker-dealer sector (75 percent by revenue) nor asset management sector (50 percent by assets under management). Furthermore, a data collection pilot project by the Office of Financial Research (OFR), using data from nine bank holding companies (BHCs) and their affiliated securities dealers, found that the average daily outstanding sum of bilateral repos in the US was around 1.6 USD trillions in Q1 of 2015 (vs. 2.7 USD trillion reported by SIFMA). While the study admits to the limited scope of this pilot project due to a limited number of broker-dealers, the difference in reported amounts is striking and underscores the existing data gaps caused by separation of data from trading platforms and separate back office systems (Baklanova 2016).*

As explained in the note to Table 12, there are significant data gaps that make it difficult to estimate the exact size of the bilateral repo market. These shortcomings will be addressed in the following paragraph – for now it suffices to say that the tri-party repo market can probably be ascribed a more important role as it ultimately accounted for the majority of repo market activity of large government securities dealers, which are known to be important market makers. There are four main differences between the two repo markets, namely 1) timing of settlement, 2) cost of clearing and settlement, 3) settlement risk protections, and 4) the ability to specify that any security with a general asset class can serve as collateral (Baklanova et al. 2015:4).

Bilateral repo market

Trading in the bilateral repo market involves two parties exchanging money and securities directly without a second counterparty. The US bilateral repo market consists of two segments that are both settled on a DVP basis, namely centrally cleared DVP transactions and uncleared DVP repos. Bilateral repo is preferred when specific collateral (outside of the general collateral basket) is requested or when market participants want to interact directly with each other. The two parties then agree on contract details such as type of securities to be delivered, haircut applied for the pledged collateral, and the maturity date. Securities dealers are at the heart of repo trading, operating in both the bilateral and the tri-party repo market. Other participants include pension funds, sovereign wealth funds, mutual funds, insurance companies, and exchange-traded funds (ETFs) on the securities lender side, and hedge funds, broker-dealers, and mortgage REITs as cash borrowers (Baklanova 2016:2).

Bilateral repos that utilize centrally cleared DVP transactions are cleared and settled via the DVP repo service offered by the Fixed Income Clearing Corporation (FICC). “In a same-day settling FICC DVP repo transaction, participants negotiate bilateral repos directly or through a broker, submit details of the trade to FICC, and settle transactions outside of FICC via Fedwire or on the books of the participants' designated clearing banks” (Bowman et al. 2017). FICC is only involved in the exchange of securities and cash when the trade is unwound, when each participant settles their respective net obligations directly with FICC. Bilateral repos that are not centrally cleared are conducted entirely outside of the services offered by tri-party clearing banks or FICC, which leads to data gaps for these kinds of trades (Bowman et al. 2017, SIFMA 2021:3-4).

As for the types of assets used in bilateral repo trading, US Treasuries made up the lion’s share of assets, followed with a respectable distance by MBS. Other important asset classes are private-label structured products (i.e. CMO, ABS) and corporate debt. With respect to tenors, most contracts have very short maturities, 71.5 percent being overnight or open (i.e. they can be recalled at any time) and 28.5 percent term durations, ranging from seven days to a month, respectively from one month to one year. Maturities of more than one year do exist, but they are seldom used (Baklanova 2016:3-4, SIFMA 2021:6).

With respect to the type of repo contract, bilateral repos can be classified as outright or “classic” repos, i.e. ownership is transferred from repo seller to repo buyer. The bilateral repo market also allows for rehypothecation, which can be an important source of profit for dealers, as they can set different contracting terms in their various transactions and thereby exploiting their market maker role (Kotidis and van Horen 2018:3-4)

Tri-party and GCF (General Collateral Financing) repo market

The tri-party repo market, which had been pioneered by Salomon Brothers in the late 1970s, can also be separated into two segments: on the one side, there is the non-centrally cleared segment funded by non-dealers, usually referred to as "tri-party repo", where collateral is earmarked and held in custody by an agent bank. On the other side, there is the "GCF repo" segment, which is a blind-brokered interdealer market. Introduced in 1998 by FICC, GCF repos are centrally cleared through FICC's GCF repo service, which provides trade matching and netting services for these kind of repos. The settlement of GCF repos happens on the tri-party platform (Baklanova 2015:8-9, Bittner and McCormick 2018:31898-31899).

In the case of tri-party repos ex-GCF, the clearing and settlement infrastructure are provided by the Bank of New York Mellon (BNYM) and J.P. Morgan Chase (JPM). "These two clearing banks provide collateral valuation, margining, and management services to facilitate tri-party trading" (Bowman et al. 2017). Through this mechanism, repo lenders are protected from a repo borrowers default because they can access and sell the respective collateral in the event of the borrower's default. In turn, repo borrowers are protected because they can secure access to their pledged collateral once they have repaid their repo loan (Bowman et al. 2017, Mullin 2020). The participants of the tri-party repo market ex-GCF are mostly institutional investors such as MMFs and securities lenders, which together account for over half of tri-party repo lending, but also other mutual funds as well as corporate, state, and local government treasurers (Copeland et al. 2012:7).

The GCF market allows its members to trade repo contracts anonymously through interdealer brokers, with FICC serving as the central counterparty. Only securities that settle on the Fedwire Securities service (e.g. US Treasuries, Agency MBS, Agency other than MBS) can serve as collateral for a GCF repo transaction.

Both tri-party and GCF repos offer three main tenors, 1) overnight or open-ended, 2) up to 30 days, and 3) over 30 days. While tri-party repos tend to be overwhelmingly overnight or open-ended (23.9 USD trillion transaction volume in December 2020 vs. 2.19 USD trillion under 30 days and 1.43 USD trillion over 30 days), GCF repos meander between the three classes, with no clear, constant majority discernable. This is probably attributable to the nature of the GCF as an interdealer market, and dealers have to take also different positions than just spot to be able to get a matched book (OFR 2021).

GCF repos as well as tri-party repos are settled using the triparty settlement platform of BNYM and JPM, and both types of trades are settled on the respective transaction day – however, GCF repos are settled before tri-party repos. This is important because this enables dealers to

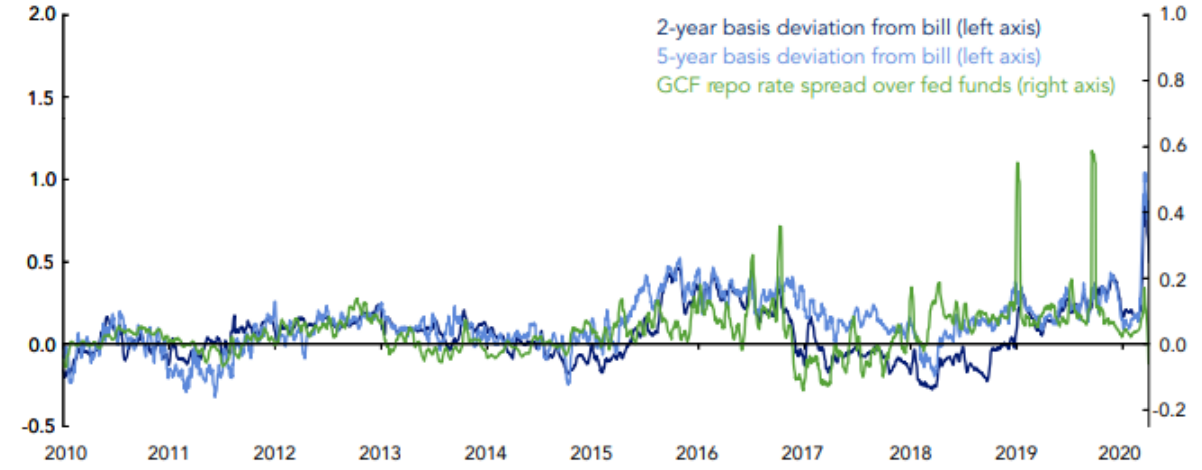
rehypothecate securities obtained as collateral via GCF repo into tri-party repo (Baklanova 2015:9). In contrast, securities posted as collateral in tri-party repos cannot be re-used outside the tri-party platform (Baklanova 2015:6).

4.3.5 Credit rate spreads

Repo rate volatility

Prior to the GFC, the Fed had seldom engaged in the borrowing of funds via reverse repos. In 2014, however, the Fed was forced to create the Overnight Reverse Repurchasing Agreement Facility to stand ready to borrow funds at a set rate from firms, including MMFs, in order to reestablish a floor for market rates. This was necessary because the Fed's Quantitative Easing (QE) policy had caused short-term interest rates to decline below the Fed's Fund Rate (FFR). This established a new kind of interest rate targeting regime at the Fed, which was a combination of paying interest on bank reserves and the aforementioned reverse repo facility (Mullin 2020).

Concerning the cost of liquidity provisioning in the US repo markets the Treasury repo market is a good starting point because of the critical role repo markets play in the liquidity of markets for government bonds. The symbiotic relationship of the Treasuries and repo markets in the United States goes back until 1951, when control over monetary policy shifted from the Treasury to the Fed, which emphasized the need for low interest rates to control inflation (Gabor 2016:974-976). Around 2000, the Fed turned to repo as a future policy measure to implement interest rate decisions in the face of falling levels of government debt. To account for this falling level of debt that could be used in repo transfers, the Fed first expanded the range of acceptable collateral for repo operations by one distinct shadow banking asset in 1999 – mortgage-backed securities (MBS). In 2005, Fed and US Treasury succeeded in extending the exemption from bankruptcy rules such as the automatic stay rule to MBS and ABS collateral, thereby essentially granting debt obligations issued by shadow banks the same rank as debt issued by the state (Gabor 2016:981-983).



Note: Data are 14-day moving averages of the spread of the implied repo rate for futures contract with the second-to-nearest delivery date over the yield for an equivalent maturity Treasury bill for two-year and five-year Treasury futures and the spread of the GCF Treasury repo index over the effective federal funds rate.

Sources: Federal Reserve Bank of New York Effective Federal Funds Rate, DTCC GCF Repo Index, Bloomberg Finance L.P., Center for Research in Security Prices/University of Chicago Booth School of Business, Office of Financial Research

Figure 27: GCF repo spread over Fed Funds Rate

Source: Barth and Kahn 2020:5

Figure 27 shows the deviation of the basis trade return for two-year (dark blue) and five-year (light blue) Treasury futures. These deviations constitute a liquidity premium that basis traders charge as compensation for the risk they incur by financing their Treasury holdings until the maturity date. As the spread between the GCF repo rate and the Fed Funds Rate (FFR) represents the cost of financing the Treasury note, it is closely followed by the two Treasury rates.

Between 2010 and 2015 there are only small and unpronounced spreads visible between GCF repo and Fed Funds Rate, which points to stable liquidity conditions in the money markets. However, since the Fed has started its reverse repo facility at the end of 2013, there has been an evolving trend of spikes in take-up of Fed reverse repos, which is largely reflected by so-called "window dressing" by financial institutions, i.e. that institutions like banking organizations reduce the size of their balance sheet by cutting down borrowing at quarter end because their capital regulations are based on the amount of asset measured at quarter-end. In turn, this reduces the investment opportunities for MMFs and other cash investors, who then shift their money into the reverse repos offered by the Fed (Frost et al. 2015:10).

The bigger spikes in the GCF-FFR spreads in 2016 correlate with the enacted reform for MMFs, which resulted in an outflow of over 1 USD trillion from prime and tax-exempt funds (which mostly ended up at government funds) and the bulk of prime funds reclassifying themselves to become government funds. In addition, the Fed announced the gradual unwinding of its balance-sheet coupled with the raising of the FFR, which sparked investors' fears of negative impacts on credit spreads and equities (Rennsion 2018, Rennison 2016).

The two most pronounced spikes in the GCF-FFR spread, however, happened at the be-

ginning and the end of 2019. The first spread, which happened on December 31, 2018, saw the GCF overnight rate shoot up from 2.56 percent to 6.125, its highest level since 2001. This spike was attributed to have been caused by window-dressing by big banks, which have been more wary than usual to lend into the repo market towards the end of the year. A further influence were the tax cuts administered by the Trump administration, which caused budget deficits that had to be financed via the selling of US Treasuries – since cash was needed to buy Treasuries, there was less available for the repo market (Wigglesworth 2019). The largest spike in the entire assessment period took place on September 16 and 17, 2019, when the repo rate shot up to almost 10 percent, taking traders and policymakers alike by surprise – mostly because held a cumulative amount of USD 1.2 trillion of cash reserves at the Fed at the moment. Some reasons cited for the cash crunch were the upcoming due dates for US corporate taxes, a large settlement of US Treasuries as well as regulatory requirements such as Liquidity Coverage Ratio or Net Stable Funding Ratio. However, is seems more plausible that two other reasons had more of an impact in the developments: 1) the four largest US banks were turned into key players in the repo market by Fed balance sheet expansion, however they held only 25 percent reserves that could be supplied at short notice to the repo market, and 2) since 2017, MMFs have started to lend to hedge funds via so-called "sponsored repos" through the FICC, however during September 2019 quantities dropped due to MMF concerns over large possible redemptions given strong prior inflows (Alavos et al. 2019). While the liquidity shortage of December 2018/January 2019 was cleared by banks' lending, the Fed had to step in via 500 USD billion in reverse repo operations to alleviate tensions in the market in September 2019.

Peripheral cross-currency bases

While the US dollar, or its credit-variant Eurodollar, is the first port of call for virtually all financial institutions outside of the United States amid capital's flight to safety, the best possible option for financial institutions within the US are US Treasuries as they represent the most stable option. For this reason, the present thesis will take a look at selected volatility indexes of US Treasuries to offer a suitable counterpart to the cross-currency bases of the other two country cases.

Figure 28 offers a broad timeline from March 2006 to March 2020. So, although not relevant for the chosen timeframe of this thesis, we can see that during the time of the GFC the volatility index for 10-year Treasuries (commonly referred to as the "fear index") as well as the Merrill Lynch MOVE index rose sharply. While spikes in 2010 were most likely caused by post-GFC uncertainty and the Fed's second round of QE, the announcement of "Operation Twist 2" by the Fed in September 2011 seemed to have successfully calmed the Treasury market. Howev-

er, the contrary was reached via the much-cited "taper tantrum" of October 2013.

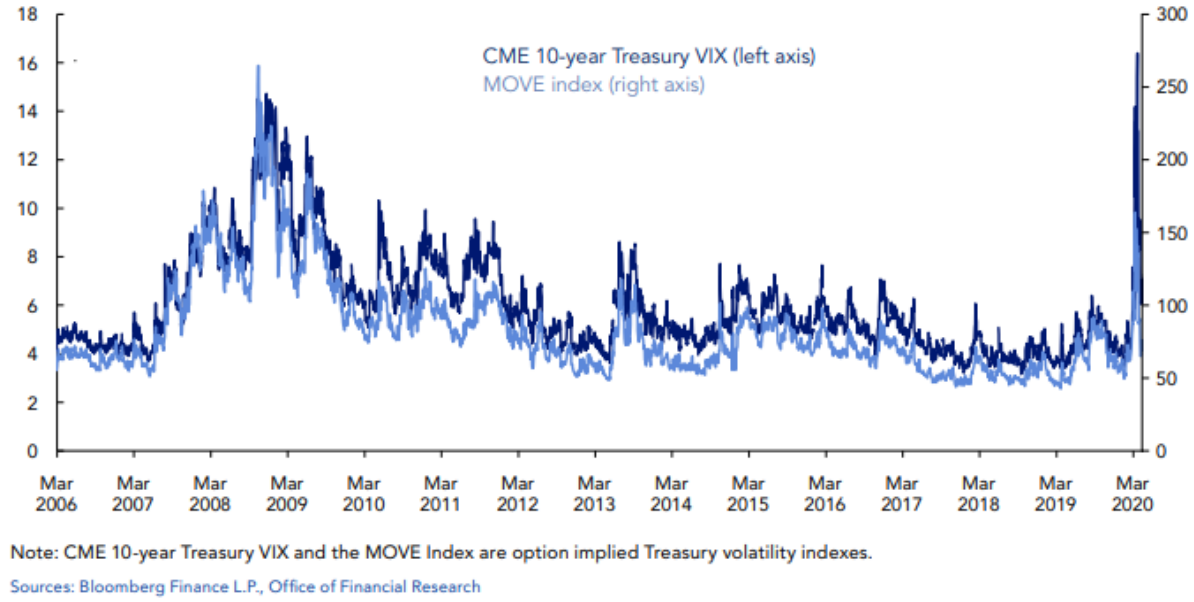


Figure 28: US Treasury volatility indexes

Source: Barth and Kahn 2020:11

The most pronounced spike, especially in the VIX, occurred in March 2020 with the onset of the Covid-19 pandemic. All indicators were consistent with a general flight to liquidity, with investors selling off-the-run Treasuries to either hold the proceeds as cash (in US dollar) or directly reinvest them in more-liquid on-the-run Treasuries. Treasury market liquidity continued to decline due to selling pressure from multiple sources, most notably from foreign accounts. This in turn made prime dealers hesitant to create markets for off-the-run Treasuries because they had no immediate buyers for them. In addition, the illiquidity in the Treasury market put severe strain on hedge funds associated with the basis trade. Rapid action of the Fed to expand its purchases of Treasury securities and its reverse repo facilities to cheapest-to-deliver Treasuries may have been substantial for these hedge funds surviving the margin calls during this period of market illiquidity (Barth and Kahn 2020:15-17).

FX volatility Balance sheet lenders

Figure 29 shows the spread between 3 month LIBOR based on US dollars and a 3 month US Treasury bill. This measure was chosen because of the importance of Treasury securities as collateral in core money market such as repo markets. In this case, LIBOR is dollar-denominated gauge that reflects either the credit risk of large international banks when they lend to each other, or the credit ratings of corporate borrowers. As US Treasury bills are usually seen as virtually risk-free assets, their rate represents a risk-free rate. Therefore, the TED spread is used as

an indicator for credit risk and a way to manage liquidity in the United States.

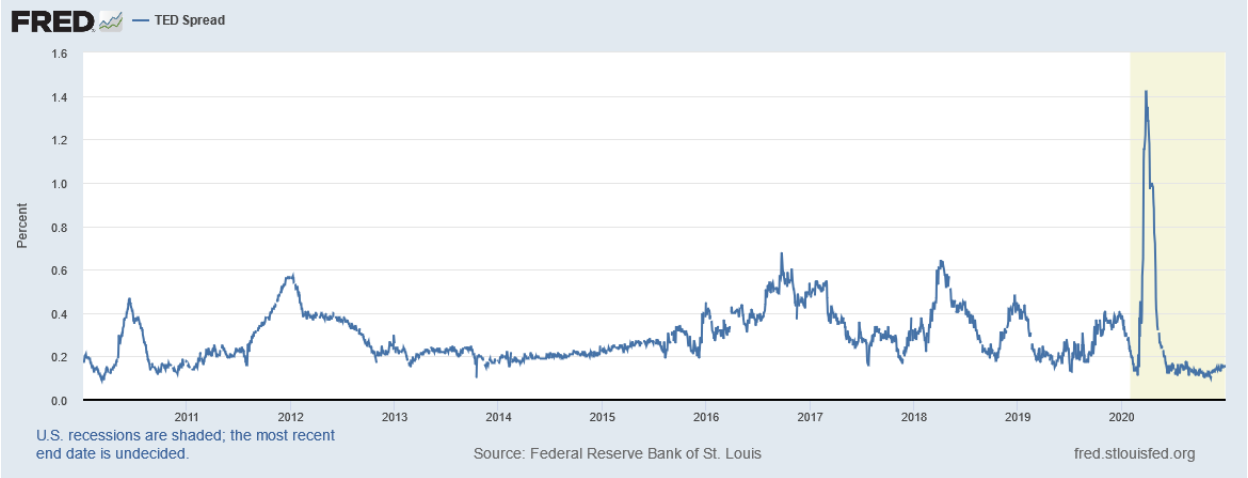


Figure 29: TED spread - 3 month USD LIBOR vs. 3 month US Treasury Bill

Source: Federal Reserve Bank of St. Louis

In 2011 the TED spread heralded the escalation of the European sovereign debt crisis, while the spike in 2018 is attributed to the aforementioned financing of the deficit that the Trump administration had caused by issuing a tax cut. As a kind of general rule of thumb a TED spread below 0.50 is generally considered to be rather low and risk to financial markets minimal. However, a spread above 1.0 indicates greater uncertainty and at least some risk to the global financial system. Figure 29 shows, that the TED spread spiked at the end of March 2020 at 1.42 percent. While this constituted the biggest spike by far in the last ten years, it was still some distance away from the 4.58 percent recorded at the height of the GFC in October 2008. While the Fed was able to intervene successfully to stem the devastating economic repercussion caused by the pandemic, this was achieved at no small cost. In absolute terms, the Fed injected an unprecedented amount of almost 3 USD trillion into the system, with 1.64 USD trillion of US Treasuries making up the lion's share of the Fed's recent QE program. MBS purchases were also noteworthy with an amount of 463 USD billion (Minenna 2020).

5. Analysis

5.1 Research question revisited

The aim of this thesis was to discover possible similarities and differences in the development of the shadow banking sector in the real estate sector of China, South Korea, and the United States. In this endeavor, the following research question was formulated:

"What are the similarities and differences in the development of shadow banking in the real estate sectors of China, South Korea and the United States since the Global Financial Crisis in 2007/8 and their implications for systemic risk?"

In order to provide an answer to this research interest, an eclectic framework was constructed based on the key elements of shadow banking and risk transfer that were discussed in the literature review. This chapter will sum up and contrast the similarities and differences of the three countries' shadow banking sector development, while chapter 6 discusses the implications for systemic risk stemming from the actions of NBFIs.

5.2 Similarities and differences in the development of China's, South Korea's, and the USA's shadow banking sectors

5.2.1 Key agents and products

When looking at the dimension of actors and assets involved in the shadow banking systems of China, Korea, and the US, the heterogeneity of these systems is apparent. While this is caused by the nature respectively maturity of the respective financial systems, there are also factors that unite the three countries, especially with respect to (some) developments in the real estate sectors.

First, all three jurisdictions have issued stimulus packages after the GFC, with real estate related positions such as housing and infrastructure as one of the key points, although the size of the stimuli varied both in the total amount (which is to be expected) and in percent of GDP. In this regard, China and the US spending over 10 percent while Korea's two stimulus packages in 2009 and 2014 make up a combined total of around 5 percent of GDP.

Second, entities that fall under the Economic Function (EF) 1 category as specified by the FSB make up the biggest share of shadow banking in all three countries, although Korea's EF3 is a close second with 28.8 percent compared to the country's EF1 share of 30.4 percent. With re-

gard to the size in GDP, the shadow banking systems of all three jurisdictions make up more than 50 percent of GDP, although the US (79.8 percent) is still a ways ahead of China (56.8 percent) and Korea (56.5 percent). With regard to real estate specific shadow banking institutions, we can see that institutions like REITs have appeared in the jurisdictions according to the maturity and depth of the respective financial system that they operate in, i.e. they are very common in the United States and, with some limitations, in Korea. With respect to China, REITs are still a fledgling industry, although the country has only recently taken steps towards opening up the onshore-REIT market to be publicly traded by publishing rules for a pilot program, which was met with a high degree of interest (Feng 2020).

Third, the systemic importance of the shadow banking system can be rated as (very) high as the grade of interconnectedness between banks and non-bank financial intermediaries (NBFIs) is high in all three cases. Of course, China is somewhat of a special case in this regard, as its regular banking system is not just in the periphery, but at the very center of shadow banking through wealth management products (WMPs) and other cooperation with trust companies and trust funds. However, regular banks in Korea and the United States are not exactly austere when it comes to cooperation with NBFIs, exemplified by the high rate of transactions between banks and NBFIs in Korea between 2015 and 2020 (36.0 to 38.5 percent of all transactions). Similarly, regular banks in the United States share significant interlinkages with NBFIs of roughly over 30 percent of their assets.

Lastly, the type of assets that are mostly used by shadow banking entities to (re)finance their operations is a similarity across jurisdictions, with government bonds, asset-backed securities (ABS), asset-backed commercial paper (ABCP) and mortgage-backed securities (MBS), both residential and commercial, making up the majority of assets in circulation. Especially MBS have become a vital part of all jurisdictions' capital markets. However, there are some differences in the way origination and issuance of MBS is set up in the respective countries. On the one hand, China has set up three main schemes for MBS issuance, namely 1) the credit asset securitization (CAS) scheme managed by the CBIRC and the PBoC, 2) the securitization scheme managed by the CSRC, and 3) the asset-backed notes (ABN) scheme managed by China's National Association of Financial Market Institutional Investors (NAFMII) (Kothari 2021). On the other hand, Korea and the United States have opted for a model were one (the Korea Housing Finance Corporation in Korea's case) or many (Fannie Mae, Ginnie Mae, and Freddy Mac in case of the US) government-sponsored enterprises are buying residential or commercial mortgages from bank and non-bank originators to encourage home-ownership while simultaneously providing money to lenders and financial institutions.

The nature of real estate related financial assets in particular is another point where the

respective countries diverge from each other. The case of local government financing vehicles (LGFVs) in China poses as a key differentiator in the underlying source of real estate related debt instruments vis-à-vis Korea and the US. The ballooning of LGFV debt in China is rooted in the way the 2009 stimulus was set up – while it was advertised as "4-trillion-yuan stimulus" the reality was that the central government could only finance 143.65 USD billion of the total 574.60 USD billion stimulus package. This meant that there was a not miniscule financing gap of around 430.94 USD billion to fill, which Beijing intended to achieve by local governments borrowing from banks via their LGFVs (Chen et al. 2018b:7-8).

A further point where the three jurisdictions differ from each other is the growth of shadow banking between 2010 and 2020. China's shadow banking sector saw explosive growth post-GFC, especially between 2012 and 2017, fueled by the vast expansion of credit in the form of the 2009 stimulus and the resulting LGFV-NBFI nexus as well as the rapid expansion of the P2P loan market. In past years, however, the shadow banking sector has stagnated on a total sum basis, respectively decreased after regulatory crackdowns that are still ongoing as of writing. In the case of Korea, shadow banking saw a slow but steady growth between 2010 and 2020, both in total (USD) levels and in percent of GDP. As for the United States, shadow banking decreased both on a total level as well as in percent of GDP post-GFC, which is a result of the sweeping regulations laid out in the Dodd-Frank Act of 2010. However, deregulation of parts of Dodd-Frank during the Trump administration saw an increase in total shadow banking levels, which has as of writing not been mirrored yet by shadow banking as measured in percent of GDP.

Summary

Shadow banking growth in China increased tremendously within most of the chosen timeframe but started leveling off since 2017, while Korea's NFBI sector saw moderate but steady growth that is still continuing as of writing. The United States were able to reduce shadow banking in their jurisdiction considerably since the GFC, although deregulation in recent years has allowed NBFIs (mostly of the EF1 category) to start growing again.

All three jurisdiction share a high systemic importance of shadow banking for the total financial system due to the high grade of interconnectedness between regular banks and NFBIs as well as the large size of shadow banking assets in percent of GDP, ranging from 56.5 to 79.8 percent. While the size of US shadow banking is distinctively larger than the two East Asian countries, China's unique shadow banking structure with regular banks not only at the periphery but in the center stands out. However, regular banks in all three jurisdictions play an important part in shadow banking, be it through the provisioning of funding, trading with off-balance sheet debt instruments, or operating shadow banks themselves e.g. as part of a bank holding company.

The major debt instruments that are utilized by various shadow banking entities in all three countries are mostly the same, with government/treasury bills, ABS, ABCP, and MBS as the main assets. There are, however, local peculiarities – in China there are the aforementioned local government bonds which have exploded from only 60 bonds and an outstanding balance of 57.46 USD billions to 6,230 bonds respectively 3.66 USD trillion in amount outstanding in 2020. Korea has non-bank depository institutions in the form of inter alia MSBs, which were entangled in a small-scale financial crisis in 2011 that was connected with project finance (PF) loans, another real estate debt instrument. The similarity in both Chinese local government bonds and Korean PF loans is that both inhibit a serious maturity mismatch, i.e. the loaned funds are used for financing infrastructure projects whose economic benefits or revenue streams (if they materialize) materialize over two or three decades, while the initial debt has to be rolled over much earlier (Chen et al. 2018b:15).

5.2.2 Recent innovations

With respect to the factor of recent innovations, there is one dominating trend that can be found in the fintech industries of China, Korea, and the United States. This development involves a handful of tech or e-commerce giants that are working on spreading their service offerings over various sector, ranging from *inter alia* finance to e-commerce, insurance, wealth management, and student loans.

In China, the two dominating players are Ant Group and Tencent. While the latter is mostly known for its popular messaging app "WeChat", the former acts as a parent company for e-commerce giant Alibaba, not dissimilar to the way Alphabet Inc. acts as a holding for Google. Ant and Tencent dominate not only the mobile payment market but also embarked in the insurance sector by jointly creating China's first insurtech company ZhongAn, together with industry leader PingAn. Prior to the downfall of P2P platforms in China, PingAn was heavily involved in the sector through its subsidiary Lufax. Similarly, Ant was active in P2P lending via its facility Zhao Cai Bao, while Tencent was involved in the sector via online lending platform Zhongdoubao. With regard to Korea, there are also two major companies that are involved in the evolution of fintech, namely Kakao Corp. and Naver Corp. Both firms operate hugely popular mobile payment apps (Kakao Pay and Naver Pay) and have recently ventured into the domains of insurtech as well as offering a broader range of financial services. Another similarity with Chinese fintech companies is the integration of further (fintech) service offerings in the respective existing core application. The resemblance stops, however, at the P2P lending sector. While Kakao Pay invested in one of the four leading P2P lenders PeopleFund (also backed by Alibaba), Naver

offers cloud infrastructure consulting for P2P companies. However, none of the two companies is as directly involved in P2P lending as its Chinese counterparts.

In the United States, with the exception of PayPal, mobile payments are still lagging far behind conventional payment option when measured in percent adoption rate. This comes at no surprise, as credit and debit cards already constitute an alternative to cash payments, which mobile payments usually aim to position as. However, similar to China and Korea there is a messaging/social media company (Facebook), tech-company (Apple), and search engine provider (Google) engaged in the mobile payments sector. While insurtech startups are seen as an interesting investment option in the United States, it is attributed with the potential to disrupt the US insurance industry because a) many traditional insurers already started cooperating with insurtech startups, and b) as of writing there are no business models or corporations that would drastically alter the current distribution model, with online sales of policies already being a well-entrenched concept (S&P Global 2018:2-3). The US also differ from the two East Asian countries in the area of P2P lending – first, the US equivalent is called marketplace lending (or digital lending) and encompasses parts of P2P lending but also crowdfunding and (in)direct lending via platform or balance sheet. Second, the leading companies in this sector are neither operated by nor (to the best knowledge of this author) sponsored significantly by one of the key actors of the mobile payment or insurance/insurtech sector. The trend to spread out services over different business areas, however, is also visible with key marketplace lenders like Social Finance Inc. (SoFi) or LendingClub.

Summary

With regard to the type of institutions that engage in the fintech realm of shadow banking as well as the degree of risk that those institutions can possibly transmit, there are again certain differences that are rooted in the maturity respectively openness of the respective financial system.

In the case of China, mobile payments emerged as an important alternative to cash payments due to the chronic underserving of consumers and SMEs by banks. Ant and Tencent have established themselves as the major players in this and other fields, with Ant operating the biggest MMF Y'uebao. However, both Ant and Tencent have come under increasing scrutiny of regulators prior to planned IPOs because parts of their business models (especially concerning consumer credit loans) were deemed to create potentially enormous risk for the Chinese financial system. The same reasoning was behind the closing down of the whole P2P industry in China, which was growing at record speed until 2015. This factor is of high importance when addressing the situation surrounding P2P in Korea – here, the P2P industry is only lightly regulated. Similar to China, the sector witnessed astounding growth rates in recent years. Another similari-

ty, however, are the rising default rates of P2P lending as well as cases of fraud popping up. This is especially relevant for the research interest of this thesis, as most Korean P2P loans are linked to real estate assets such as risky PF loans. With respect to mobile payments, Korean providers such as Naver and Kakao are becoming increasingly popular, which can be attributed to partly underserved parts of the society.

In contrast, mobile payments in the US have (with the exception of PayPal) not caught on to an extent as seen in China and Korea. This is due to the fact that credit cards are widely available (even people with bad credit scores often being "pre-approved" for credit cards) in the United States, therefore already occupying the main role as cash alternative. With respect to the P2P sector, the US has a highly competitive landscape of marketplace lenders. Concerning risk to the financial system, non-bank mortgage lenders and servicers deserve a special mention as their business model is prone to liquidity risks in the case of either margin calls on the underlying or compulsory payments on loans that are delinquent. It is important to reiterate that this originate-to-distribute model is the same one that Ant Group uses for its consumer credit business.

5.2.3 Regulation and oversight

The regulation and oversight dimension exhibits a high degree of similarity across all three jurisdictions with regard to international regulations on regular banks. In this respect China, South Korea, and the United States all either adopted the Basel III standards or are working on the implementation. Again, the difference in the maturity of the respective financial and banking comes to light, especially when looking at the different pace of Basel III implementation of China vis-à-vis Korea and the US. One particularly important part of the Basel III standards constitutes the special requirements for G-SIBs and D-SIBs, which are subject to higher capital buffers, total loss-absorbing capacity (TLAC), resolvability assessment processes, and higher supervisory expectations. Out of the 30 currently (November 2020) designated G-SIBs, Korea has zero, while China has four (Bank of China Ltd., China Construction Bank Corp., Industrial and Commercial Bank of China Ltd., and Agricultural Bank of China Ltd.), and the US have eight (Citigroup Inc., JPMorgan Chase & Co., Bank of America Corp., Bank of New York Mellon Corp., Goldman Sachs Group Inc., Morgan Stanley, State Street Corp., and Wells Fargo & Co.) (Jafri and Taqi 2021).

With respect to non-banks, there were few (if any) binding international regulations. This is exemplified by peer reviews and studies by the FSB, IMF, and IOSCO, which all bear a recommendation character only. However, some significant regulatory reforms have been the outcome of these recommendations, e.g. the improvement in regulations in valuation and liquidity

management of Chinese MMFs. Key areas for improvement of regulation and supervision of NBFIs issued by the IMF differed with the respective jurisdiction, which focused on continued advances in the financial stability framework (China), elevated household debt and potential vulnerabilities of the real estate market (Korea), and multi-faceted exposure of banks to the leveraged loan market in the form of e.g. Collateralized Loan Obligations (CLOs). A noteworthy contribution of the FSB, together with the IAIS, constituted the identification of G-SIIs. However, this promising approach was suspended in lieu of the IAIS holistic framework, whose benefits have to be assessed in the years to come.

As for national rules and regulations of banks and non-banks, there are again significant differences in how the respective countries drafted their legislation. Overall, regular banks were much more subject to scrutiny and prudential regulation efforts post-GFC, while similar approaches in the NFBI area were either watered down or not far-reaching enough (Goodhart 2011:4). In this regard, the different strategies of shadow banking regulation deserve special attention – China initially tried to let the shadow banking system run from a long leash as a means to help finance the massive post-GFC stimulus. However, this stance had to be readjusted after the P2P-loan industry became increasingly unstable and was effectively shut down in recent years. This sparked a wave of sweeping reforms around 2016 that are still ongoing, as was visible in the case of Ant Group's re-regulation. South Korea, on the other hand, went exactly the opposite way from China and initially regulated NBFIs more strictly post-GFC. In this regard, the Issuance and Distribution of Electronic Short-term Debentures Act of 2011 was integral in reorganizing the funding structure of Korean NBFIs from the call market to the short-term debentures, repos, and corporate bonds. However, after the growth of the economy slumped more and more, the financial sector was singled out as one of the key areas for economic growth in the future. This resulted in a wave of deregulations in the financial market, which Seoul is trying to uphold even when warning signs appear in the form of increasing delinquency rates (P2P loans) or cases of misappropriation and embezzlement (hedge fund industry). The United States imposed strong regulations on regular banks and (with some exceptions) shadow banks in the form of the Dodd-Frank Act. After decades of deregulation and expansion of credit, the pendulum swung back into the direction of discipline *vis-à-vis* elasticity. While the critics were rightly pointing out several flaws of NBFI-specific regulation, there were extremely important additions to financial stability e.g. the Volcker Rule, the strengthening of consumer protection, and the designation of shadow banking entities as non-bank SIFIs. However, some of these important additions have been, at least partly, by the 2018 Economic Growth, Regulatory Relief, and Consumer Protection Act and the de-designation of all previously existing non-bank SIFIs.

Summary

The most effective and far-reaching international regulations on the regular banking industry was introduced in the form of the Basel III requirements, which all three countries implemented (albeit with some differences). Recommendations for regulation and supervision of NBFIs of further international bodies – e.g. FSB, IMF, IOSCO, IAIS – contributed to some extent to the formulation of new legislation. However, the non-binding nature of these recommendations was also one of the reasons why not more decisive actions was taken towards shadow banking regulation.

As for national regulation, the stance of China changed from a *laissez-faire* attitude directly after the GFC towards engagement in massive regulations starting 2016/17. While this sudden reorientation (intentionally or unintentionally) wiped the Chinese P2P-lending industry off the financial landscape, the same fate was avoided by Fintech giant Ant Group after it was *de facto* re-classified from a fintech into a bank by the CBIRC in September 2020. However, the final jury is still out on this matter. As of writing, Chinese regulators seem to be determined to continue this path of stricter regulations for both regular and shadow banks.

In the aftermath of the GFC, Korea seemed determined to push for stricter regulation of its financial sector, exemplified by *inter alia* changing the main funding source of NBFIs to secured short-term funding by banning them from the call market. Together with the installation of a levy on FX borrowing by banks, this constituted an effort by Korea to not repeat the mistakes made in the AFC, where call and FX market contributed on a large scale to the build-up in vulnerabilities. However, in an effort to reignite the stagnating economic growth, Seoul started to deregulate potentially volatile parts of (fintech) shadow banking as well as asset securitization. This reduction in lending standards found its succession in the *jeonse* leasehold market, which in turn influenced the record-high in Korean consumer respectively household debt (IMF 2020d:22-23).

The United States took a decisive step in the direction of more discipline with the passing of the monumental Dodd-Frank Act in 2010. While the Act introduced the most sweeping reforms to the financial sector since the Glass-Steagall Act of 1933, its regulations focused mostly on banks as institutions and activities that attributed to GFC, however NBFIs were – compared to regular banks – left mostly undisturbed. The possibility to designate a shadow bank as a non-bank SIFI was a noteworthy exemption to this but was rescinded by Trump administration. By 2018, all four previous SIFIs (AIG, GE capital, MetLife, and Prudential) were de-designated, regardless of whether they reduced their risk exposure and complexity of operations (AIG, GE capital, MetLife with some limitations) or not (Prudential).

Finally, one similarity between the US and China deserves further attention: The low

deposit rate ceiling in China fueled shadow banking growth, even after full liberalization of bank deposit rates shadow savings instrument continue to pay noticeable premium over bank deposits (Wang et al. 2019). This development bears striking similarity to the advent of MMFs in the US as a response to regulation Q, which restricted banks' payment of interest on deposit accounts.

5.2.4 Repo market

The repo markets in all three countries have developed to be the main source of funding for their respective shadow banking systems, with the Chinese and Korean repo markets rapid growth signifying the growing importance for these funding markets. Generally speaking, each jurisdiction has two (main) repo markets, with the special cases of the *dai chi* market in China respectively the GCF-repo market in the United States. A further similarity is the tenure of repos, which tends to be between one day and one week in over 90 percent of the cases. Furthermore, all three central banks (PBoC, BOK, and Fed) use the repo markets as a means of conducting monetary policy via reverse-repo operations. With regards to settlement of repo trades, the respective markets offer various option, ranging from delivery-versus-payment (DVP) to free-of-payment (FOP), with the former being the most popular choice. From a trading platform point of view, the biggest part of repo transactions use the trading system of the respective central bank (China National Automatic Payment System, BOK-wire+, and Fedwire), with only a miniscule part being transferred via stock exchanges.

It is rather difficult to compare the sizes of the respective repo markets because of the difference in which the numbers are reported (cumulative trading volume in China, total amount outstanding in Korea, and average daily outstanding in the US) as well as some pronounced gaps in data availability, especially concerning the *dai chi* market in China and the bilateral repo market in the US). The main type of trading is also different in each country – in China, the lion's share of repo dealing is done bilateral, while in Korea's case tri-party repo is the dominant variant. In the US, the tri-party repo market can be stated to be the more important market because of its function as a tool for monetary policy for the Fed – however, the bilateral repo market seems to be at least as big (if not larger). Due to pilot programs on data collecting/reporting in the bilateral market being still at the very beginning, no definite statement can yet be made on this matter.

The type of repo contract is another factor that differs across all three nations. China has the most variety of different repo contract, ranging from pledged repo, X-repo, and D-repo to outright repo, the equivalent to a "classic" repo in the US that transfers the right of ownership to

the repo buyer. While this rehypothecation is common in Korea[34] and the United States, pledged repo is the dominant type of repo contract in China. Considering the fact that rehypothecation has often been cited as a contributor of build-up of collateral chains (Cullen 2017:13-14, Singh and Aitken 2010:3-4), this might actually contribute to financial stability in China (although others might point out the missed opportunities of a developed financial market).

Summary

To summarize, repo markets have become the most important sources of short-term money market funding for capital market lending operations – in other words, shadow banking (as per this thesis' definition of the term). The importance of repo is also underscored by it being utilized as a means for monetary policy by all three central banks. There are again some differences that can be attributed to the differing stage of maturity of the respective financial systems, best exemplified in the type of repo contract (pledged vs. outright/classic). However, there are also two (semi-)blind spots with *dai chi* market in China and the bilateral repo market in the US. There is little to no data available on the actual size, participants, committed collateral, or creditworthiness of participants, which makes a risk assessment difficult or impossible.

5.2.5 Credit rate spreads

The credit rate spread dimension can be divided into core (repo rate volatility) and periphery (spreads in cross-currency bases), with the USD-LIBOR spread as a sign of a persisting global liquidity crunch.

With respect to repo rate volatilities between 2010 and 2020, there are some interesting similarities between China and the United States with regards to seasonal factors as source of spikes in repo volatility. In China's case, these seasonal factors that contribute to tightened liquidity conditions in the repo markets are rooted in national holidays because markets are closed for several days. Quarter-ends are a further seasonal factor because of tax and dividend payments. Similarly, quarter-ends tend to create liquidity shortages in the US repo markets as well, although the reason behind this is not tax-season but so-called window dressing by financial institutions that cut down borrowing at quarter-end to positively influence their capital requirements. Monetary policy was also factor that frequently led to liquidity shortages in both China and the US – while hikes in the reserve requirements and examinations of banks' loan/deposit ration by regulators were factors in China, newly enacted reform on MMFs in the US in 2016 as well as tax cuts by the Trump administration. With regards to Korea, the availability of data on

[34] Before the regulatory reform change by the FSC in 2016, pledged repo was the common way to provide securities as collateral, with neither transfer of ownership nor possibility of usage for rehypothecation (Song et al. 2016).

repo rate (spikes) is unfortunately rather scarce. From the accessible data, the occasionally arising divergences between repo and KORIBOR rate are attributable to the 2011 MSB crisis as well as increased eligibility of different collateral types in Korean repo markets.

In the case of spreads in cross-currency bases, China and Korea both were subject to effects of the United States' unconventional monetary policy. In contrast to Korea, however, China was far more affected by the 2013 "taper tantrum" because it didn't have direct access to US dollar liquidity in the form of a swap line with the Fed. Although global demand for US dollar funding soared again due to the Covid-19 pandemic, China kept the CNY-USD cross-currency bases from widening by reducing reserve requirement ratios and the effective handling of the pandemic. South Korea keep its FX exposures under control since 2010, both through domestic measures as the levy on FX borrowing as well as international ones in the form of a swap line with the Fed. Still, KRW-USD cross-currency bases widened close to GFC-like levels in March 2020 because of the high openness of Korea's deep and liquid capital markets to FX investments. In the US, pandemic-induced liquidity shortages in the Treasury markets made prime dealers hesitant to create markets for off-the-run Treasuries because they had no immediate buyers for them. The illiquidity in this market put severe strain on hedge funds associated with basis trading.

With regards to FX volatility of balance sheet lenders, the country-specific equivalents to the LIBOR-OIS spread had the reactions to overarching global events such as the China-US trade war or the pro-democracy movement in Hong Kong. In the case of China, the IPO of Alibaba in 2019 created an interbank liquidity crunch which would have undoubtedly been repeated by Ant's cancelled IPO in September of 2020. Interestingly enough, the Covid-19 pandemic did not put larger strains on interbank or US dollar liquidity, which can be attributed to the prospect of adequate liquidity conditions due to announced stimulus packages of various nations and central banks around the globe. Korea's post-GFC regulatory tightening coupled with direct access to US dollar funding and limits on net aggregate FX forward positions were the reason for the relative stability of the Korean TED spread. Similarly, the United States' TED spread remained rather low throughout the last decade, with the most pronounced spike at the end of March 2020 at 1.42 percent still being far away from the 4.58 percent recorded at the height of the GFC. However, this quick repelling of pandemic-related economic hardships came at no small cost, with the Fed injecting an unprecedented amount of almost 3 USD trillion into the system.

Summary

Liquidity shortages in the repo markets were mostly caused by seasonal effects e.g. quarter-ends or important public holidays or monetary policy and regulation efforts. Interestingly enough, even tax cuts seemed to have a certain effect on repo liquidity in the US, as cash had to be used for the financing of the 2018 tax reduction in the form of increased Treasury divestments.

(US) monetary policy also played an important role in global liquidity shortage. In this regard, the United States' experiments with unconventional monetary policy had a profound impact on emerging Asian economies, which have been (and remain) heavily exposed to US dollar funding risk. A main advantage of Korea *vis-à-vis* China in mitigating these monetary policy "fallouts" is the direct access to US dollar funding via (temporary) bilateral currency swap lines.

6. Discussion

6.1 Factors accounting for systemic risk by shadow banks in the real estate sector

When assessing the factors that shadow banks can potentially influence systemic risk in the real estate sector, all three country cases exhibited possible transmission channels for systemic risk through shadow banking entities. While the respective type of entity differed from jurisdiction to jurisdiction, certain patterns have been uncovered – *inter alia* the size of the public sector's footprint in real estate (especially the housing market), the existence of absence of regulation, and the impact of post-GFC stimulus packages.

In China's case, there is a broad consensus that local governments and their affiliated financing vehicles (LGFVs) are the nexus of the post-GFC housing boom and its accompanying key structural distortions (Cho et al. 2012:122-126, Chen et al. 2018b, Gabor 2018:402-403, Wang et al. 2019:11-13). There are two main reasons for this assessment: 1) the gaping financing hole in the 2009 stimulus package, which had to be filled by local governments, whose financial situation was already impaired by 2) the 1994 budget law, which reduced local governments' tax shares from 80 percent to 40 and 50 percent. While LGFVs were severely restricted in their financing activities and local governments forbidden to run budget deficits by the 1994 budget law, the financing needs of the post-GFC stimulus led to a circumvention of this law and a sudden rise in bank borrowing and local government debt (Chen et al. 2018b:7-9). Subsequently, the government issued regulations for LGFVs in June 2010 to curb exploding soaring local government debt. As a first outcome LGFVs turned increasingly to non-banks as a source of credit, which was reflected in a decrease of bank loans while non-bank finance increased. However, this did not solve the problem but merely pushed the day of reckoning further in the future, where LGFVs where faced with mounting rollover problems in 2013 and 2014 (Chen et al. 2018b:39-41). This can be explained by the maturity mismatch that is inherent to Chinese local government debt – localities borrow from banks to finance (in accordance with the stimulus plan) infrastructure projects.

This maturity mismatch between loans that have to be repaid sooner than they can generate cash-flows (if any) is also deep-rooted in Korean Project Finance (PF), which issues ABCP or ABS/ABSTP. PF was at the heart of the post-GFC housing market boom in Korea as well as the 2011 Mutual Savings Bank (MSB) crisis in Korea, with 72 out of 79 MSBs being operated by NBFIs usually associated with the shadow banking system e.g. securities companies, fund managers, and other NBFIs. The existence of a non-bank depository institution (NBDI) as part of

the shadow banking system was a finding about Korean shadow banking that did not match the expectations that were present ahead of writing. However, the existence of MSBs in Korea and their role in extending credit to underserved parts of the populace confirms that this thesis was correct in choosing the definition of shadow banking as "money market funding of capital market lending" over other existing definitions that *inter alia* excluded deposit taking institutions. A further unexpected discovery was the deregulation campaign of the fintech sector in Korea. This is insofar astounding, as regulators such as the FSC and FSS **must have** witnessed the rise and demise of the Chinese P2P sector. However, although first signs of a potential repetition of the Chinese P2P experience have already appeared with rising delinquency rates, cases of fraudulent platforms and embezzlement (mixed with a less than ideal data conditions on the entire P2P industry), Seoul clings to fintech deregulation as a means to kickstart the stagnating economic growth of the last years. This is insofar problematic, as the part of the market where data is reported shows that roughly two thirds of accumulated P2P loans are real estate related, with private real estate mortgages and real estate PF as biggest contributors. Similar to MSBs, P2P lenders charge much higher premiums for loans and cater to less creditworthy borrowers than regular banks (IMF 2017:40). This deterioration in lending standards is adding to vulnerabilities already present in the *jeonse* leasehold system, where tenants and landlords alike could face serious difficulties if the overheated housing market were to slow down abruptly causing a deterioration in asset quality. The pronounced uptick in other real estate related securities such as MBS or MBB coincided with the 39 USD billion stimulus package of 2014, which aimed to boost the real estate market. Similar to China, post-GFC stimulus had a distinct influence on number and prevalence of securitized finance products.

With regard to the United States, the Dodd-Frank Act actually did succeed in pulling banks away from the riskier parts of real estate, especially the mortgage sector. However, this void was quickly filled by shadow banking entities that do not underlie the same regulations and supervision as regular banks do. Shadow banking entities do not only account for two thirds of all mortgage originations, they also now hold 47.5 percent of mortgage servicing rights (MCRs), which is a tremendous growth from the eight percent they held in 2008. While the originated loans are almost always immediately sold off to one of the three big GSEs (Ginnie Mae, Fannie Mae, or Freddie Mac), the MCRs stay with the non-bank mortgage lenders. However, the Covid-19 pandemic uncovered a serious vulnerabilities of shadow banks acting as mortgage servicing company – they still have to forward payments to investors, insurers, and tax authorities even if the loans are delinquent. Due to their thin balance sheets, this led to increasing liquidity concerns among non-bank mortgage lenders. As a kind of last resort measure, Ginnie Mae (as their biggest buyer of mortgages) has covered the difference between the sum that NBFIs owed and what

funds they had on hand. However, there are additional vulnerabilities that are looming on the US real estate horizon in the form of the mounting numbers of mortgage and housing delinquencies on the one hand, and the state of US housing inventory on the other.

The US National Association of Realtors (NAR) has stated that, historically, six months of housing supply is associated with moderate price appreciation, i.e. a six month supply equals a balanced housing market. A lower level of months' supply usually tends to push up prices, which is visible in the pronounced uptake of housing prices between April 2020 and April 2021, when housing inventory was at historical lows of 1,070,000 houses respectively 1.9 months of inventory in December 2020 (Dunn 2021). A further important incident were delinquency rates on first lien mortgages, which shot up from the lowest number on record of 3.2 percent in January 2020 (well below the 2000-2005 average of 4.93 percent) to 7.8 percent in June 2020. However, the number of foreclosures staid on record lows due to government support and (extended) forbearances, which was scheduled to expire in June 2021 but was extended by the Biden administration to the "final" month of July 2021 (Egan 2021). Now, how and why is this relevant for the systemic risks posed by shadow banks in the United States? At the end of 2020, the number of borrowers that were seriously delinquent (i.e. more than 90 days past due) has shot up to 2.15 million, an increase of 400 percent compared with end 2019. Further pressure on the market is added by the 10 million renters that were behind their rent payments and risking eviction. To put things into perspective, during the GFC roughly seven million households faced the same fate between 2008 and 2012 (Parrott and Zandl 2021). Due to the structure of securitized real estate assets such as RMBS or CMBS, a sudden drop in housing prices, and therefore the underlying of these assets, could likely put shadow banks under serious liquidity strains as margin calls start to come in. The case of non-bank mortgage lenders' liquidity crunch as a result of their contractual obligations exemplifies that these institutions do not have balance sheets of a size that can accommodate effects of a crisis. Considering the create-to-distribute model of non-bank mortgage lenders, they fully rely on regular banks who act as warehouse lenders. Should asset quality deteriorate as theorized above, contagion could spread once more from the shadow banking realm into the domain of regular banks.

6.2 Implications of results for Fintech in Consumer and Small-Business Lending

The originate-to-distribute model is not exclusive to US fintech shadow banking entities, but also commonplace in China and Korea. This is best exemplified by the case of Ant Group, which was denied (among other reasons) its IPO in September 2020 because of the business model that it operates with. Similar to Quicken Loans and United Shore Financial Services, Ant used to immediately sell most of its originated loans to regular banks. However, the business model was not the major stumbling block for Ant, but more so the increasing share of consumer credit business, which pointed to a relaxation in lending standards as they were primarily targeted at low-income and younger people. In this regard, Chinese household debt continued to increase to 62 percent of GDP by end-2020, which meant an upturn of 8 percent since end-2018 and an even larger expansion compared to the 18 percent of GDP in 2008 (Shen et al. 2020). As rapid growth in household leverage is deemed a risk posed to financial system stability, Chinese authorities are continuing regulatory tightening in order to increase lending and underwriting standards (Fitch Ratings 2021).

Against this backdrop, the role of regulation in (fintech) shadow banking has to be discussed again – this time in the context of credit extension to households. This is insofar important for the research interest of this thesis, as housing related debt usually makes up a major part of household debt. However, consumer debt has been developing a larger footprint within household debt. While this materialized with varying markedness in the respective country cases, the overall trend is visible in all three jurisdictions.

There appears to be some striking similarities between the development of consumer debt between China and Korea. In the last five years, Chinese consumer debt (partly fueled by increased issuance of credit cards by banks) doubled to 2.5 USD trillion. The case of credit companies playing a major role in ballooning consumer debt, as well as the potential negative externalities, is no stranger to Korea. The country has witnessed the ignition of a credit time bomb in 2003, when account fraud by credit card company SK Global was revealed in March 2003 (Park 2007:44-46). With regards to fintech shadow banking, the roles are reversed – China has already laid its P2P-lending industry to rest, while the jury is still out for its Korean counterpart. It is, however, worth to point out that South Korea is in a remarkably similar situation as in the build-up to the 2003 credit card crisis. Then as now, the economy remained sluggish and the deregulation of (parts of) the financial sector was being vigorously pursued by financial regulators (Park 2007:22-23). As of end-2020, Korean household debt-to-nominal GDP ratio swelled from 91.8 percent in 2018 to 103.8 percent, the sixth-highest of all OECD countries (Jung 2021).

In the United States, the household debt to GDP ratio kept tapering off from its peak in 2008 (99.8 percent) to 75.4 percent at end-2019. There was a sharp spike in Q2 of 2020 to 84.5 percent due to the COVID-pandemic, however the overall trend of rising household debt was not affected by either the tapering off or the sudden spike (see Figure 38). While housing debt has risen from 9.99 USD trillion at the height of the GFC to 10.39 USD trillion at end-2020, the major driver of US household debt was non-housing debt such as student loan, credit card, or auto loan debt. This sector saw an increase of 155 percent since the GFC, from 2.69 USD trillion to 4.17 USD trillion at end-2020 (see Figure 37). Fintech shadow banks are not only strongly represented in the mortgage market, but also in the student loan industry (Seru 2019:39), the personal loan market (Seru 2019:22), and SME-focused lending (S&P Global 2018:5-7).

The overarching similarities in the way that fintech shadow banks in all three jurisdictions operate are

1) differences in regulation of shadow banks versus regular banks, and
2) the tending to borrower classes and market segments that are either underserved or deemed (too) risky for regular banks (or both).

With regards to point 1, the question has to be raised whether fintech shadow banks are actually delivering what they promise – namely profitability through their advanced technology. In this case the study of Buchak et al. (2018) points to the conclusion that the vast majority of shadow banking growth (roughly 60 percent) can be attributed to regulatory arbitrage respectively business segments that banks had to pull back from because regulators deemed them too risky to engage with. According to the authors' model, only 30 percent of fintech shadow banking growth is due to the disruption of the origination process by fintech technology.

In the previously mentioned case of Ant Financial in China, consumer credit business made up over a third of the company's revenues. When regulations where changed so that Ant had to keep a significant number of the loans they originate, their value dropped significantly. This shows that Ant profited immensely from regulatory arbitrage, which allowed them to operate much freer than regular banks who had to adhere to rules such as reserve requirement ratios, countercyclical capital buffers, or liquidity coverage ratios.

As for point 2, the extension of credit to risky or leveraged borrowers has potentially disastrous effects, as has been exemplified by the P2P-lending industry in China (and increasingly in Korea). Should the algorithms that fintech companies use to grant (micro) loans to consumers be revealed to be flawed or a domino effect in defaults start similar to the US subprime-crisis in the runup to the GFC, the interconnectedness of fintech shadow banks with regular banks could spread the contagion throughout the entire financial system. This is possible because banks are connected to fintech shadow banks by funding their operations (via warehousing their loans) or

are engaged in partnerships or joint ventures with them. Another important factor in the possible spreading of contagion is the diversification of services that fintech lenders underwent – they built a foothold in asset management, student loans, non-life and life insurance, as well as payment systems. This behavior is visible in the digital marketplace lenders in the US as well as in the cases of China and Korea, where a few big players (Ant Financial, Tencent, Kakao, or Naver) have spread out far beyond their initial offering and now combine a vast array of services and industries they tend to.

6.3 Potential for future research

Through their research, numerous scholars have proofed that shadow banking has become the dominant form of banking in the last decades. Furthermore, the sector does not only bear high significance for developed countries (where its growth has slowed down), but also for emerging markets that have been, spearheaded by China, the engine for global shadow banking growth. This thesis contributes in some ways to existing literature on shadow banking in East Asia region, more specifically to studies that focus on shadow banking in China (Liangsheng 2015, Elliott et al. 2015, Lasak 2015, Yao and Hu 2015, Gabor 2018, Ehlers et al. 2018, Sun 2019) and South Korea (Lee 2015, Kim 2018, Shyn 2019, Baek 2020, Lee et al. 2020). In other ways, the present study adds to existing research of shadow banking and its peculiarities in the United States (Adrian and Shin 2008, Pozsar et al. 2010, Mehrling 2011, Adrian and Ashcraft 2012, Mehrling et al. 2013, and Pozsar 2014). There is enormous potential for the study of the various forms, products, and participants of shadow banking in other (Asian) countries. Against this backdrop, India comes to mind with its vibrant shadow banking entities (or non-banking financial companies (NBFCs), as they are referred to), especially in the areas of digital lending and Buy-Now-Pay-Later (BNPL) services (Sivramkrishna et al. 2019).

The obstacles that the present thesis encountered – in the form of data gaps, language barriers, and others – did indeed proved to add to its limitations, however they can also be looked at as opportunities for future research.

With reference to the Korean case, the absence of access to tools that make it possible to analyze major credit rates and their spreads (e.g. Yonhap Infomax Terminal) or limited availability of in-depth research of recent studies by the Bank of Korea (BOK) or the Korea Capital Market Institute (KCMI) in English have been to of the major setbacks towards compiling dependable data on the Korean shadow banking system and the implications of the sector's vulnerabilities for the financial system in general respectively the real estate industry in particular. To complicate matters further, requests for information sent in English were altogether left without a

reply. For this reason, this study advises to form a research team with researchers that provide adequate proficiency in the languages of the selected country cases.

For the Chinese case, more reliable data on the obscure *dai chi* market is needed, both because of its estimated size and because *dai chi* transactions allow the rehypothecation of collateral and has therefore more potential for systemic risk through the build-up of collateral chains. Kendall and Lees (2017) have formulated a fitting list of information needed to assess the risks involved with dealing in this type of market – a) the types of collateral used, b) the enforceability of contracts, and c) the creditworthiness of the institutions involved. Further studies should therefore focus on these criteria, and likely will need to be undertaken by independent researchers, private research institutions, or small teams of researchers due to the informal nature of the *dai chi* market.

Finally, this study uncovered serious vulnerabilities in all three jurisdictions that are linked to (fintech) shadow banks and consumer credit business. Against this backdrop, Buchak et al. (2018:453) have shown that roughly two-thirds of (fintech) shadow banking growth is not attributable to superior technology or a better business model, but regulation that does not apply to them. The originate-to-distribute model that many shadow banking entities employ in all three countries may subject them to serious liquidity risk in the case of e.g. regulatory tightening or changes in the monetary policy of a given central bank. In the latter case, the interest rate policy of the Federal Reserve as well as the asset purchasing program via Open Market Operations (OMOs) could prove to be influential for Korea, which is vulnerable to changes in the US dollar FX markets. Against this backdrop, this study has identified the contributions of Shyn (2019) and Kim (2018), where the former has created a detailed register of real estate related shadow banking assets in Korea, while the latter has produced the most recent overview of overall shadow banking activity in Korea. While both studies produced highly important results, they are the exception to the otherwise significant gap in quantitative research. However, even though there is still a profound shortage on dependable data about some aspects of the Korean shadow banking system, key developments and their consequences such as the change in the funding structure from call to repo market, young and lower-income people as the target group of loan advancements, or the rapid extension of credit in both housing and consumer debt are clearly visible. With respect to the Chinese case, Chen et al. (2018b) pointed out the connection between shadow banking and the financing of local governments via key shadow banking products such as Wealth Management Products (WMPs) and entrusted loans. Kemp et al. (2020) showed that a further source of non-bank financing in real estate, trust company investment, grew strongly between 2017 and 2018, which prompted regulators to focus their efforts more on this sector leading to a subsequent decline. Fang et al. (2020a:8-9) also pointed out the effects of regulation on

the possibility of arbitrage between Chinese repo markets, inter alia short-selling being very limited because a) regulation makes it very expensive to borrow for this purpose, and b) different collateral requirements can result in the prices of the same bond being very different in the interbank and exchange traded repo market, if dual listed. The advent of stricter regulation in 2017 and the far-reaching effect of these developments is of particular interest for this study. Especially when looking at the possible way ahead for fintech shadow banking in China, the future path that regulators will pursue is vital to the further development of the sector.

7. Conclusion

The aim of this thesis was to give a comprehensive overview of the landscape of non-bank financial intermediaries in China, South Korea, and the United States with a focus on real estate. The research interest of the study was to uncover the effect that these entities had (and have) on systemic risk for the respective regional as well as the global financial system. In order to satisfy this interest, an eclectic framework that focused on institutions as well as activities based on the previously conducted literature review was created.

China, Korea, and the United States all proved to be insightful case studies for the study of shadow banking in financial systems with differing level of maturity and depth. While the latest FSB monitoring exercise on non-bank financial intermediation reported the stagnation respectively decline of shadow banking in developed nations, emerging markets and developing economies with China at their helm became the driving force behind global shadow banking growth (FSB 2020). While China often took the spotlight of attention with regards to shadow banking in Asia in the last decade, the comparison with Korea was an especially fruitful one. On the one hand, Korea's financial system, as one of the most developed ones in Asia can serve as a kind of roadmap what is yet to come for China's financial sector (Kim 2004). On the other hand, China's experiences with fintech and new forms of lending could (and should) be a lesson to Korea. In particular, the rise and fall of China's P2P-lending industry is of relevance here. When looking at the continuously increasing rate of delinquencies at Korean P2P platforms, coupled with the ongoing deregulation of the fintech sector, this surely brings back memories of the surge in failing Chinese P2P-lenders in 2015 as well as the Korean credit card crisis in 2003. Given the fact that most of Korea's P2P loans are real estate related (roughly 62 percent), a similar meltdown of the sector as it happened in China could possibly increase rollover risk for *jeonse* contracts, which in turn could amplify negative shocks to house prices and linked financial assets (IMF 2020d:22).

One of the most interesting aspects that the present thesis has uncovered is that, although China, South Korea, and the US are all on a differing level of financial maturity, there are overarching principles in how shadow banking entities behave that are valid in all three country cases respectively degree of maturity:

1) Shadow banks will occupy market segments that banks are retreating from – either because they do not underlie the same regulatory principles or banks view the segments as too risky or not profitable enough.
2) The target audience is usually the underserved fraction of society, which is comprised of young people, people without a (good) credit history, low-income households, and SMEs.

While the extension of credit to these groups can be beneficial in and of itself, an accompanying deterioration in lending standards can have potentially devastating effects, especially when shadow banks are taking on increasingly more leverage.

3) Repo markets are the prime funding source of shadow banks and thereby, by extension, the modern banking system. This became visible by various reverse repo facilities by central banks, some of them even announced as "open-ended".
4) Regular banks are often involved somehow in shadow banking activities – either through supplying credit lines for the warehousing of loans that shadow banks originate, or the direct cooperation through off-balance sheet vehicles like WMPs or SIVs.
5) The government has a very large footprint within the respective real estate sectors, first and foremost in the pooling and subsequent selling of mortgage backed securities (MBS) like the three big GSEs in the US or the Korea Housing Finance Corporation (KHFC) in Korea. In China, local governments have amassed a tremendous amount of debt, stemming from investments in real estate related projects as outcome of the 2009 stimulus.

Most crucial, however, has been the effect of regulation being either present or absent, which was expected at the onset of this research. While it could have further been suspected that the strictness of regulation goes hand in hand with the level of maturity of the respective financial system, this assumption did not hold true (for every aspect) of shadow banking in the three corresponding jurisdictions. If regulations were known to be a vital factor in shadow banking's influence on systemic risk, what is so peculiar about the cases of China, South Korea, and the United States that the present thesis has identified?

Chinese regulators have applied a laissez-faire attitude towards the growth of shadow credit, as it was considered beneficial in aiding local governments to roll over the huge amount of debt they had amassed in filling the funding gap in the 2009 stimulus. However, after cases of fraudulent and delinquent shadow entities (especially P2P-lending platforms) began to pile up, the financial watchdogs changed gears around 2016/17 and started to vigorously regulate the sector. In what can be seen as a kind of "second wave" of reigning in shadow banking, the regulatory expansion towards fintech companies – especially heavyweights such as Ant Financial or Tencent – the CBIRC and PBoC have embarked on further regulatory tightening. The Korean case is somewhat the exact opposite – Seoul issued several reforms after the GFC, aimed at both banks and non-banks e.g. the revision of the Bank of Korea Act and the passing of the money market reform in 2011 as well as the levy on FX investment of domestic and foreign banks. However, as economic growth remained sluggish, the financial sector was selected as a means to accelerate this development again. Despite mounting evidence of deregulation-induced instability in the form of e.g. cases of fraud and embezzlement at hedge funds and P2P-lenders, which

also show rapidly increasing delinquency rates, Korean regulators seem relentless in their efforts to further deregulate the financial sector. The United States, on the other hand, have delivered the most stringent and comprehensive piece of financial regulation since the Glass-Steagall Act of 1933 that superseded the Great Depression in the form of the Dodd-Frank Act in 2010. This vital piece of financial regulation saw not only the establishment of a consumer protection agency, but also tremendously increased financial oversight and the classification of some of the biggest shadow banks as Systemically Important Financial Intermediaries (SIFIs), which for the first time obliged shadow banks to have some regulations similar to banks. However, these efforts were either (partly) rolled back by the Trump administration or watered down significantly until the end of its term in 2020. Both regular banks and shadow banks do now have more leeway than they did ten years ago, with potentially negative externalities to the wider financial system.

The comparative analysis of the influence of shadow banking on systemic risk, especially with respect to housing and consumer debt, provides some distinct implications for regulators and policymakers. Based on the findings of the three chosen country cases, regulators should consider more stringent regulation of shadow banks, especially entities that offer a return rate far above the interest rate in the regular banking sector such as P2P-lenders, non-bank depository institutions, or other marketplace lenders. While this concerns the factor of leverage, another important implication is the vulnerability of shadow banks to a liquidity crunch in the repo markets. Even with record amounts of money gushing through the global financial system, now further enhanced with pandemic-related stimulus packages around the globe, liquidity shortages are all but a thing of the past in the repo markets of China, Korea, and the US. Maturity-mismatches are the third major vulnerability that shadow banking is exposed to, most notably in the real estate markets, where the asset that is invested in usually takes far longer to become profitable (if ever). In order to mitigate some of these risks, state measures such as subsidies for SMEs, small loans with a low interest rate, and public housing programs for low-income households could prove to be reducing the amount of credit extended by the shadow banking system.

The results of the present thesis have brought several data gaps to light as well as pointed to some possible options future research could embark on. More reliable data is needed in several aspects of Korean shadow banking, especially with respect to the number of NBFIs that originate MBS via the KHFC as well as the factor that shadow banks play in the rapid growth of Korean household and consumer debt. Furthermore, more quantitative studies are needed for both the *dai chi* market in China and the bilateral repo market in the United States. While for the latter there was at least a pilot program started with the intention of creating a better understanding of the actors, securities, and sums involved, there is no knowledge about a similar effort with respect to the former. This research can be highly important not only for policymakers in the three

jurisdictions selected for this study but also for regulators in other countries, especially developing countries and emerging economies that have embarked on the internationalization of their financial markets. The efforts to continuously monitor and regulate the shadow banking sector are not only necessary for the reason of financial stability and sustainable economic growth but also to be able to mitigate the build-up of leverage and bubbles.

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Figure 30: Basel III reforms overview

Source: Bank for International Settlements

Basel Committee on Banking Supervision reforms – Basel III

Strengthens microprudential regulation and supervision, and adds a macroprudential overlay that includes capital buffers

Capital

Pillar 1

Capital

All Banks

Quality and level of capital

- **Raising minimum common equity** to 4.5% of risk-weighted assets, after deductions.
- **A capital conservation buffer** comprising common equity of 2.5% of risk-weighted assets brings the total common equity standard to 7%. Constraints on a bank's discretionary distributions will be imposed when it falls into the buffer range.
- **A countercyclical buffer** within a range of 0–2.5% comprising common equity will apply when credit growth is judged to result in an unacceptable build-up of systematic risk.

Capital loss absorption at the point of non-viability
Allowing capital instruments to be written off or converted to common shares if the bank is judged to be non-viable. This will reduce moral hazard by increasing the private sector's contribution to resolving future banking crises.

Risk coverage

Revisions to the standardised approaches for calculating

- **credit risk;**
- **market risk;**
- **credit valuation adjustment risk;** and
- **operational risk**

mean greater risk-sensitivity and comparability.

Constraints on using internal models aim to reduce unwarranted variability in banks' calculations of risk-weighted assets.

Counterparty credit risk
More stringent requirements for measuring exposure; capital incentives to use central counterparties for derivatives; a new standardised approach; and higher capital for inter-financial sector exposures.

Securitisations
Reducing reliance on external ratings, simplifying and limiting the number of approaches for calculating capital charges and increasing requirements for riskier exposures.

Capital requirements for exposures to central counterparties (CCPs) and equity investments in funds to ensure adequate capitalisation and support a resilient financial system.

A **revised output floor**, based on Basel III standardised approaches, limits the regulatory capital benefits that a bank using internal models can derive relative to the standardised approaches.

Containing leverage

A non-risk-based **leverage ratio** including off-balance sheet exposures is meant to serve as a backstop to the risk-based capital requirement. It also helps contain system-wide build-up of leverage.

Pillar 2

Risk management and supervision

Supplemental Pillar 2 requirements address firm-wide governance and risk management, including the risk of off-balance sheet exposures and securitisation activities, sound compensation practices, valuation practices, stress testing, corporate governance and supervisory colleges.

Interest rate risk in the banking book (IRRBB)
Extensive guidance on expectations for a bank's IRRBB management process: enhanced disclosure requirements; stricter threshold for identifying outlier banks; updated standardised approach.

Pillar 3

Market discipline

Revised Pillar 3 disclosure requirements

Consolidated and enhanced framework, covering all the reforms to the Basel framework. Introduces a dashboard of banks' key prudential metrics.

SIBs

The Committee identifies global systemically important banks (G-SIBs) using a methodology that includes both quantitative indicators and qualitative elements. In addition to meeting the Basel III risk-based capital and leverage ratio requirements, G-SIBs must have higher loss absorbency capacity to reflect the greater risks that they pose to the financial system. The Committee also developed principles on the assessment methodology and the higher loss absorbency requirement for domestic systemically important banks (D-SIBs).

Liquidity

Global liquidity standards and supervisory monitoring

The **Liquidity Coverage Ratio** (LCR) requires banks to have sufficient high-quality liquid assets to withstand a 30-day stressed funding scenario that is specified by supervisors.

The longer-term, structural **Net Stable Funding Ratio** (NSFR) is designed to address liquidity mismatches. It covers the entire balance sheet and provides incentives for banks to use stable sources of funding.

The Committee's 2008 guidance ***Principles for Sound Liquidity Risk Management and Supervision*** takes account of lessons learned during the crisis. It is based on a fundamental review of sound practices for managing liquidity risk in banking organisations.

Supervisory monitoring
The liquidity framework includes a common set of intraday and longer-term monitoring metrics to assist supervisors in identifying and analysing liquidity risk trends at both the bank and system-wide level.

Large exposures

Large exposures regime established to mitigate systemic risks arising from interlinkages across financial institutions and concentrated exposures.

Table 1. China: Recommendations		
	Timing[1]	Authorities
Recommendations for the oversight of FMIs		
Strengthen legal framework for the regulation and supervision of FMIs, through the development of a dedicated law on the supervision of FMIs, the adoption of the Futures Market Law, changes to the Securities Market Law, and the drafting of a NPS Law.	ST-MT	PBC, CSRC
Ensure a sufficient number of staff with relevant expertise.	ST	PBC, CSRC
Strive for full and consistent implementation of the PFMI, in particular: • Update supervisory regulations and FMI rules to reflect the PFMI; • Improve DVP arrangements within the CSDC; • Implement a risk governance structure within the four futures exchanges.	ST-MT	PBC, CSRC
Explicitly evaluate risks related to links of the CSDC with other central securities depositories (CSDs).	MT	CSRC
Recommendations to manage system wide risks		
Adopt finality and netting at a statutory level in line with international standards.	ST-MT	PBC, CSRC
Supervise cyber resilience of FMIs as part of the PFMI office.	ST	PBC, CSRC
Develop recovery and resolution planning in line with international guidance.	MT	PBC, CSRC
Adopt policy to provide central bank services to FMIs.	MT	PBC
Recommendations for the risk management of high-value payment system (HVPS) and SHCH		
HVPS: review fees and the timings of the intraday repo window.	ST	PBC
HVPS: review use of open market operations (OMO) for intraday liquidity requirements.	MT	PBC
HVPS: review collateral haircut methodology and ensure independent validation.	ST	PBC
HVPS: operationalize mark-to-market module.	ST	PBC
HVPS: revise priority levels of instant transfer transactions.	ST	PBC
HVPS: prescribe a cut-off time for withdrawal of transactions in queue.	MT	PBC
HVPS: examine introduction of time varying fees for payment instructions.	MT	PBC
HVPS: complete and disclose publicly CPSS-IOSCO Disclosure framework.	ST	PBC
SHCH: appoint independent chair at the Risk Management Committee (RMC).	ST-MT	PBC, SHCH
SHCH: ensure regular reporting of operational and IT risks to chief risk officer (CRO).	ST	PBC, SHCH
SHCH: dispose of exposure thresholds per clearing member.	ST	PBC, SHCH
SHCH: apply haircuts to cash collateral.	MT	PBC, SHCH
SHCH: ensure independent validation of credit models at least annually.	ST	PBC, SHCH
SHCH: conduct liquidity stress tests on a daily basis.	ST	PBC, SHCH
SHCH: further develop business continuity plans by introducing a hot site.	MT	PBC, SHCH
SHCH: increase the number of liquidity providers and settlement banks.	MT	PBC, SHCH
[1] MT: Medium-term; ST: Short-term.		

Figure 31: Recommendations of IMF FSAP

Source: IMF 2018

Date	Regulator(s)	Main target of regulation	Key contents
August 2010	CBRC (Document 72)	Direct bank-trust cooperation	"Banks required to make capital and loss provisions for off-balance sheet business with trust companies; trust companies prohibited from engaging in channel business" (Bowman et al. 2018:19).
December 2010	CBRC (Document 102)	Channel investments	"Credit asset transfers must be authentic – including being clear from any repos, whether explicit or implicit – and cover all outstanding principal and interest payments" (Bowman et al. 2018:19).
September 2011	CBRC (Document 91)	Bank WMPs	"Banks required to boost WMP information disclosures, ensure standalone risk and return calculation for each WMP and minimize regulatory arbitrage" (Bowman et al. 2018:19).
March 2013	CBRC (Document 8)	Bank WMPs	"Cap on NSDA investments at the lesser of 35 per cent of total WMPs and 4 per cent of the bank's balance sheet assets; WMPs cannot be managed using asset pools; full disclosure of investments in NSDAs to investors, including the underlying borrower, maturity and structure of the transaction (e.g. counterparties); banks prohibited from providing any explicit or implicit guarantees or repurchase commitments for NSDAs" (Bowman et al. 2018:19).
January 2014	CBRC	Banks, trust companies, microfinance companies and credit guarantee companies	"The China Banking Regulatory Commission (CBRC) tightens regulations on shadow banking activities for banks, trust companies, microfinance companies and credit guarantee companies" (Moody's 2014b:31). For Details see Moody's 2014a.
April 2014	CBRC (Document 99)	Trust companies	"Trust companies prohibited from managing new AMPs using asset pools and investing in NSDAs; new AMPs must be reported to regulators at least 10 days before issuance" (Bowman et al. 2018:19).
„May 2014" (Bowman et al. 2018:19)	"CBRC, PBC, CSRC, CIRC, SAFE (Circular 127)" (Bowman et al. 2018:19)	"Interbank activities (incl. borrowing, lending and repos)" (Bowman et al. 2018:19)	"Banks' interbank borrowings must not exceed one-third of total liabilities; standardized accounting and capital requirements for interbank business; stronger oversight of interbank activities" (Bowman et al. 2018:19).
July 2014	CBRC (Document 35)	Bank WMPs	"More stringent requirements for banks' wealth management operations, including: separate accounting, risk isolation and centralized management of WMP business by a specialized department" (Bowman et al. 2018:19).
March 2016	CBRC (Document 82)	Investment receivables	"Tighter supervision of credit assets transferred off-balance sheet, including restricting retail WMP fund investments into NSDAs and requiring banks to treat loan-like assets as loans for capital and provisioning; banks encouraged to register transferred credit assets on a centralised platform" (Bowman et al. 2018:19).
August 2016	CBRC	P2P lending platforms	"CBRC formally releases detailed measures on regulating the 'P2P' lending industry based on draft rules distributed last December. These first-ever P2P regulatory measures also cap the aggregate borrowing amount for individu-

			als (RMB 1 million) and companies (RMB 5 million) through all the P2P lending platforms" (Moody's 2017:45).
December 2016	PBC	Bank WMPs	"Banks' off-balance sheet WMPs to be included in the PBC's macro-prudential assessments (starting from March 2017). Penalties to be issued for non-compliance" (Bowman et al. 2018:19).
Early-mid 2017	CBRC (Document 45, 46)	Regulatory arbitrage	"Banks required to review and monitor their existing channel investments and to correct any under-reporting or misreporting of capital, provisioning and non-performing loans; stricter enforcement of existing regulations and penalties for violations" (Bowman et al. 2018:19-20).
November 2017	CBRC, PBC, CSRC, CIRC & SAFE (Draft)	All AMPs (including WMPs)	"Unified rules covering all asset management products: asset manager sponsors prohibited from promising guaranteed returns and required to set aside 10 per cent of management fees for provisioning (up to 1 per cent of AUM); NAV should be regularly reported to investors; limits on leverage; restrictions on investing in other AMPs; explicit guarantees banned" (Bowman et al. 2018:20).
January 2018	CBRC (Draft)	Entrusted loans	"Clarification that entrusted loans can only be facilitated by banks and that banks cannot assume any credit risk; ban on entrusted loans extended by asset management plans (such as NBFI AMPs); restrictions on use of entrusted fund proceeds; banks required to strengthen entrusted loan risk management" (Bowman et al. 2018:20).
August 2018	CBIRC	P2P lending platforms	Announcement of ten measures to consolidate the industry, *inter alia* mitigating liquidity risks through various market-based measures such as mergers and acquisitions, consolidating the responsibilities of online lending institutions and their shareholders, or severe crack downs on online lending platforms that maliciously withdraw funds in accordance (Xinhuanet 2018).
November 2019	PBoC, CBIRC	Banks	"PBOC and CBIRC publish draft regulation to define domestic systemically important banks (D-SIBs) subject to increased supervision. Tightened supervision of China's larger banks helps reduce systemic risk and maintain financial system stability" (Moody's 2020:36).
	Internet Financial Risk Special Rectification Work Leadership Team, Online Risk Special Rectification Work LeadershipTeam	P2P lending platforms	Guidance on transformation of qualified P2P lending platforms into micro-credit companies. "This will facilitate transformation of the industry and liquidation of weaker platforms" (Moody's 2020:36).
December 2019	CBIRC	Commercial Bank WMPs	"Pilot regulations on commercial banks' wealth management subsidiary companies, effective 1 March 2020. The regulations require these subsidiaries to maintain net capital (1) not below RMB500 million and not less

			than 40% of net assets, and (2) not lower than capital at risk. Regular regulatory reporting of net capital conditions is also required" (Moody's 2020:36).
	PBoC	P2P loans	"PBOC releases a draft regulation on forbidding agency services in receiving payments through certain channels, including P2P loans. The new regulation aims to mitigate third-party risks" (Moody's 2020:36).
	CBIRC, PBoC	Bank WMPs	"CBIRC and PBOC published a draft regulation to step up supervision on banks' cash management type WMPs. The regulation focusses on specifying the investment scope and strengthening liquidity and leverage requirements. This will impose such type WMPs to roughly the same thresholds for investment scope as for Money Market Funds (MMFs)" (Moody's 2020:36).
January 2020	CBIRC	Commercial leasing companies	"Strengthening regulations for commercial leasing companies. "The regulations focus on specifying business scope of commercial leasing companies and tightening requirements on capital adequacy" (Moody's 2020:36).
March 2020	PBoC	Structured products/deposits	"PBOC announces regulations to supervise structured deposits' offered returns, in particular their guaranteed yields. The new regulations target to ensure that the structured products' rates truly reflect their underlying risks. This will prevent banks from offering some non-structured products with high guaranteed yields to attract funding" (Moody's 2020:36).
May 2020	CBIRC	Trust companies	CBIRC releases a draft regulation for strengthening regulations regarding trust companies' management of their trust funds. "The strengthening would focus on limiting funds trusts' investment scale on non-standardized debt assets, promoting transformation of trust companies" (Moody's 2020:36).
	CBIRC	Pawn shops	"CBIRC issues regulations to further supervise pawn shop business. The new regulations guide pawn shops to focus on short-term lending to MSEs and households and prevent inter-lending among pawn shops or any fund raising activities" (Moody's 2020:36).
July 2020	PBoC	Bank WMPs	Announcement "that implementation of new asset management rules would be delayed by one year until the end of 2021, from the end of 2020. Announced in April 2018, the new rules aim to eliminate banks' explicit and implicit guarantees to investors on the WMPs they issue. The delay will slow down the elimination process" (Moody's 2021:38).
August 2020	Supreme Court	Financing leasing, micro-credit, pawnshop loans and online P2P lending	Revision of ceiling "for interest rates on private loan agreements between individuals and small businesses to four times the one-year benchmark Loan Prime Rate (LPR). Based on the LPR (3.85%) in August 2020, the ceiling would be lowered to 15.4% from a range of 24% to 36% under previous judicial interpretation in 2015. This will help crack down on private lending, which includes financing

			leasing, micro-credit, pawnshop loans and online P2P lending" (Moody's 2021:38).
September 2020	State Council, PBoC	Financial Holding Companies (FHCs)	Announcement of "new regulatory requirements on financial holding companies. Under the new rules, all FHCs will need approval by the central bank and meet a RMB 5 billion minimum requirement in paid-in registered capital for financial institutions. The regulations aim to standardize management of financial holding companies and contain spillover risks in the financial system" (Moody's 2021:38).
	PBoC, CBIRC	G-SIBs	"Draft regulation on the implementation of total loss-absorbing capacity (TLAC) for Chinese banks that the FSB has designated as global systematically important banks (G-SIBs). The TLAC implementation will provide a larger buffer for loss absorption and recapitalization in the event of bank failure" (Moody's 2021:38).
November 2020	PBoC, CBIRC	Microloan companies	Draft regulation of online lending businesses for microloan companies. "Under the draft regulation, the microloan lenders are required to provide at least 30% of any loans they fund jointly with banks. A threshold of 5 billion yuan registered capital is set for the lenders that offer loans online across different regions. Additionally, the microloan companies will have to obtain an additional license for an online microloan business to lend to borrowers online. The regulation also places limits on online microloan companies' leverage, business scope and funding sources" (Moody's 2021:38).
December 2020	PBoC, CBIRC	D-SIBs	"PBOC and CBIRC published their final assessment methodology to define domestic systematically important banks (D-SIBs). The major change in the final regulation versus the draft is an increased likelihood that more candidate banks will be designated as D-SIBs since a candidate bank will now be placed on the initial list of D-SIBs if its assessment score exceeds 100, instead of 300 as the draft regulation proposed. Under the final regulation, designated D-SIBs will be required to disclose constituent indicators of their scores to improve transparency and investors' assessment of creditworthiness" (Moody's 2021:38).

Table 13: Selected Chinese Financial Regulations 2010-2020

Sources: Bowman et al. 2018:19-20; Moody's 2014b:31-32; Moody's 2017:45-46; Moody's 2020:36-37; Moody's 2021:38-39; Xinhuanet 2018.

Figure 32: 3 month LIBOR-SHIBOR based IRS 2010-2020

Source: 2010-2020

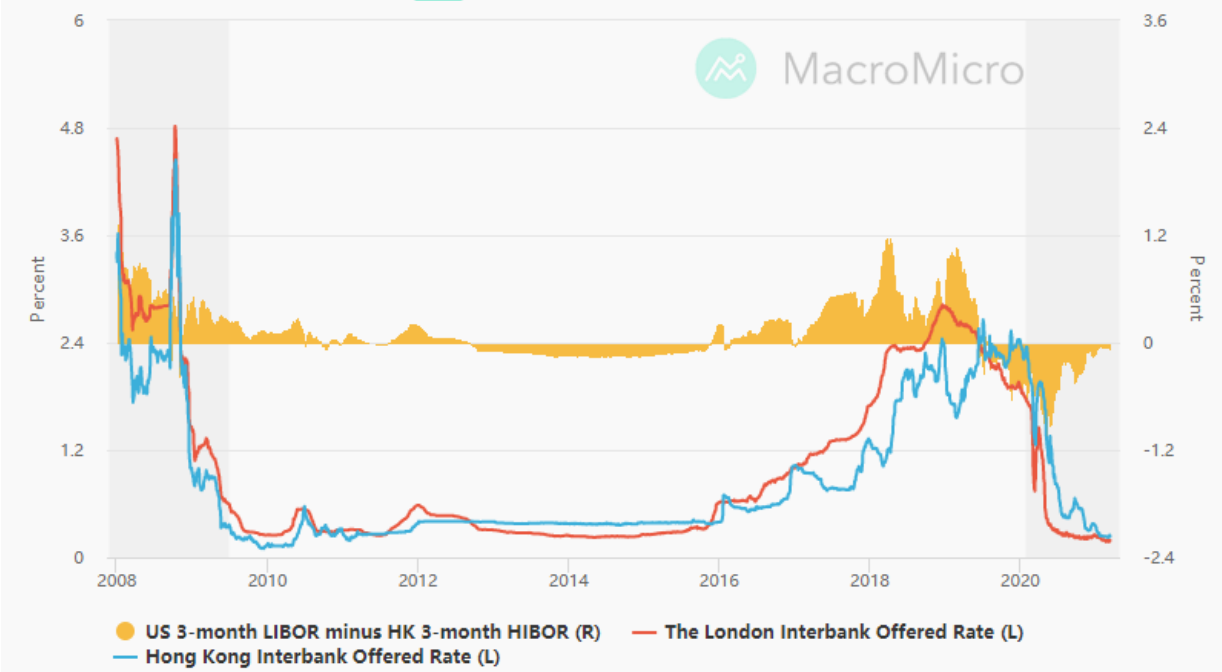

Figure 33: US LIBOR- HK HIBOR spread 2008-2020

Source: MacroMicro

Appendix B

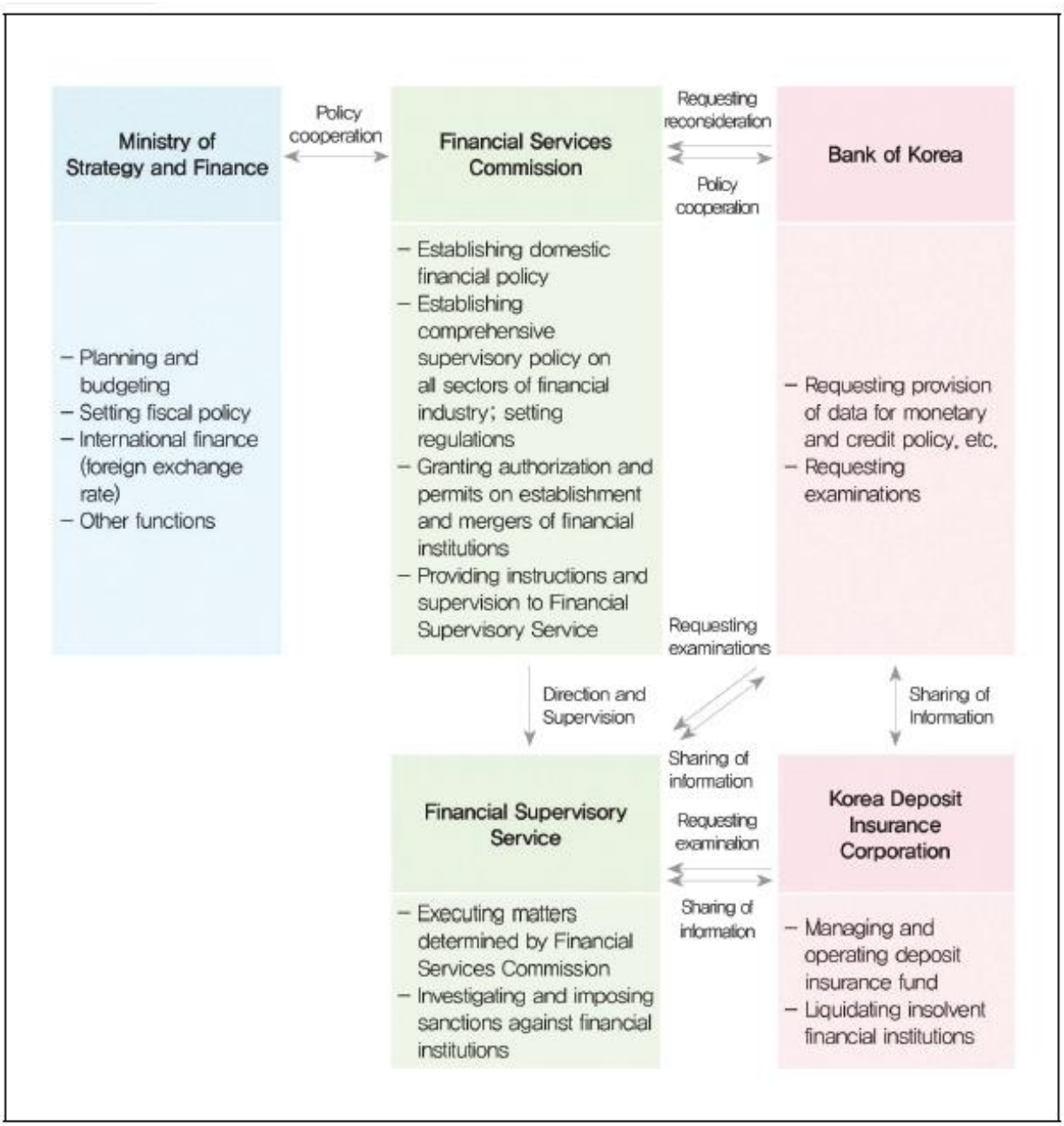

Figure 34: Financial supervisory system in Korea

Source: BOK 2018:73

Appendix C

Wallet	Bank-centric	Fees	Stored value
PayPal	No. Publicly held company; NASDAQ: PYPL. $9.2 billion revenue reported for full year 2015.	Send P2P using debit/credit card: 2.9% plus $0.30 USD. Free if using bank account (ACH).	Yes
Venmo	No. Acquired by PayPal in 2014.	Send P2P using credit card: 3%. Free if using debit/prepaid/ bank account (ACH).	Yes
ClearXchange (Zelle)	Yes. ClearXChange (an Early Warning company) is owned by Bank of America, BB&T, Capital One, Chase, PNC, U.S. Bank, and Wells Fargo.	None for P2P.	Yes
Popmoney	Yes. Service provided by Fiserv, integrated into over 1,000 FIs.	Send P2P using debit/ bank account (ACH): $0.95. Credit cards not accepted.	No
Snapcash	No. Built on top of Square Cash.	None. Debit cards only.	No
Facebook Messenger	No	None. Debit cards only.	No
Google Pay	No	Send P2P using debit/credit cards: 2.9% plus $0.30 USD. Free if using bank account (ACH).	Yes
Square Cash	No	Send P2P using credit cards: 3%. Free if using debit/prepaid/ bank accepted (ACH).	No. Funds come directly from bank account, sent direclty to bank account tied to debit card.
Apple Pay Cash	No. Only works between iPhone/iPad/Apple Watch owners.	Send P2P using credit cards: 3%. Free if using debit.	Yes. Payments sent to/stored on virtual debit card. Stored funds can be used in Apple Pay transactions.

SOURCE: Grilli, L. "P2P—A Comprehensive Look at Person-to-Person Payments." *Payments Review*, January 12, 2017; http://www.thepaymentsreview.com/a-look-at-p2p-payments.

Table 14: Mobile payment providers in the United States

Source: Federal Reserve Bank of St. Louis

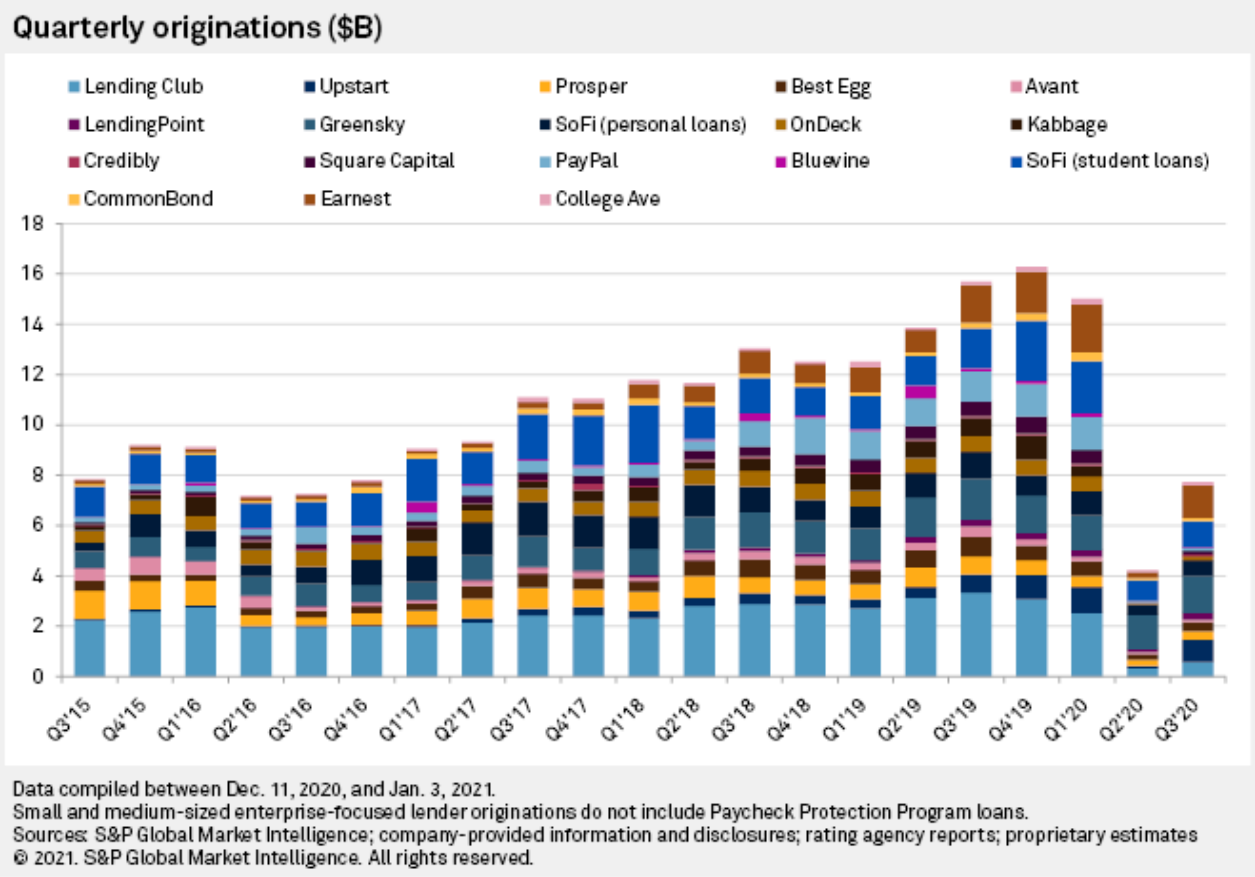

Figure 35: Quarterly loan originations by US marketplace lenders Q32015-Q32020

Source: S&P Global

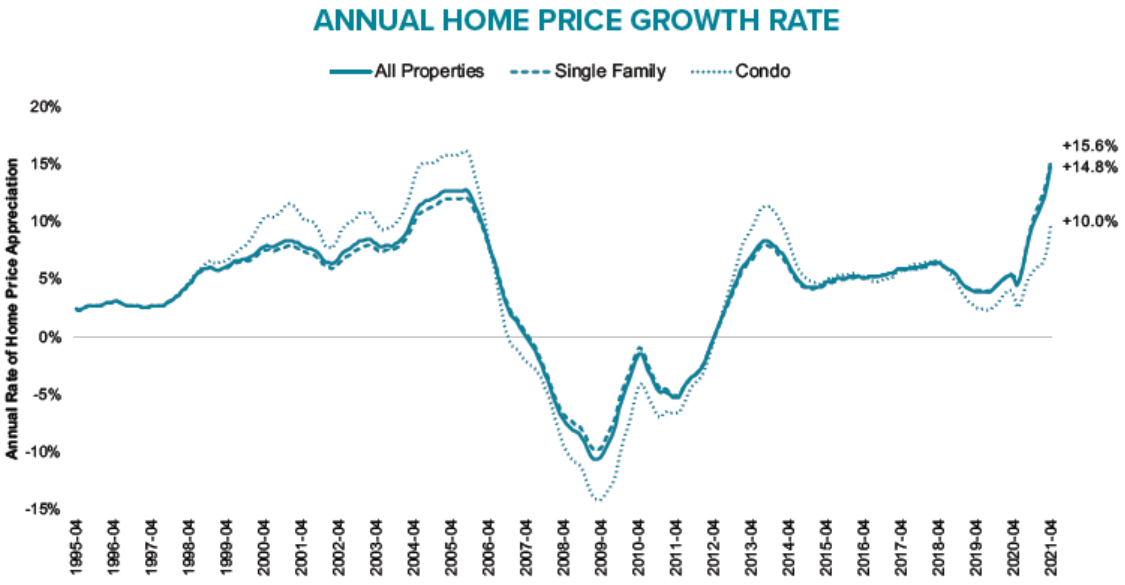

Figure 36: Annual US home price growth rate.

Source: Black Knight Home Price Index 2021

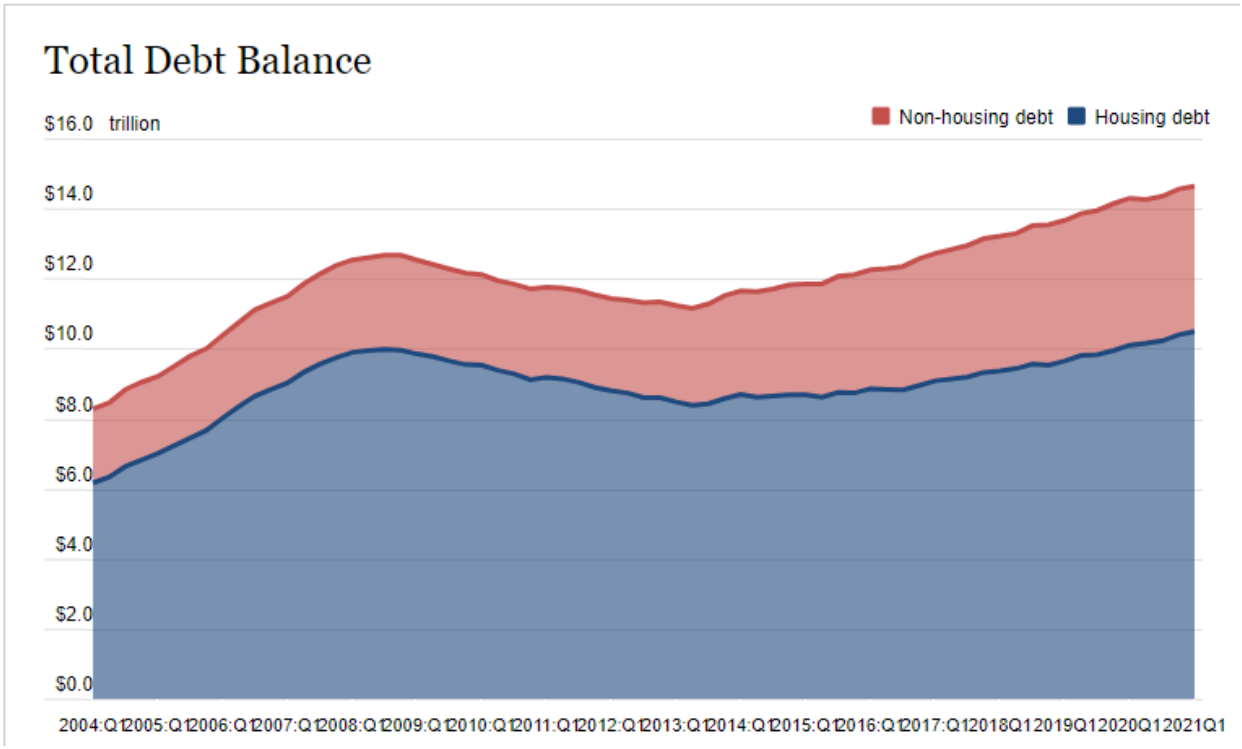

Figure 37: Household debt and credit report (Q1 2021)

Source: Federal Reserve Bank of New York

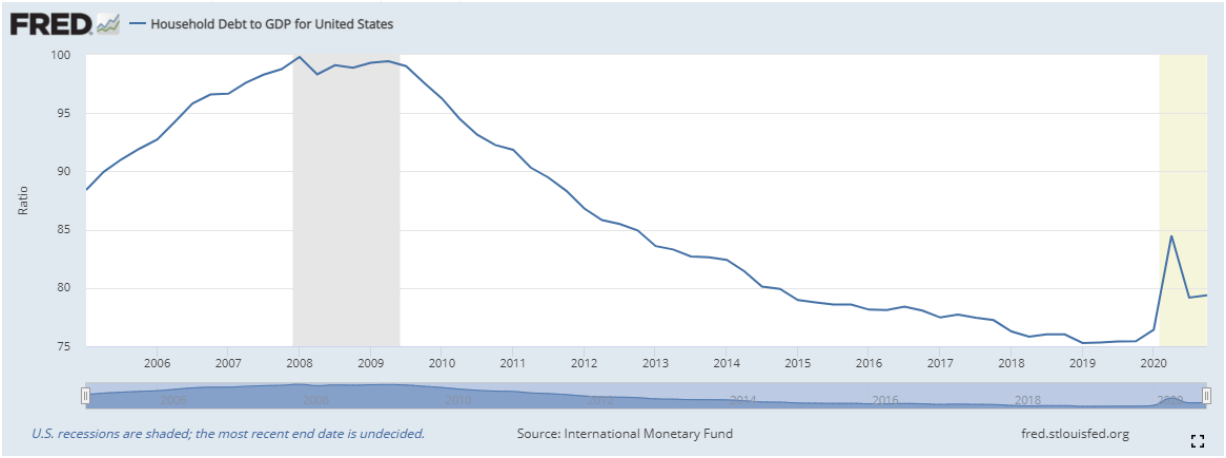

Figure 38: Household Debt to GDP for United States

Source: Federal Reserve Bank of St. Louis

Abstract

Since the aftermath of the Global Financial Crisis (GFC), scholars and practitioners alike have been monitoring the development of the shadow banking system. While the United States' shadow banking sector was the epicenter of the GFC, the development of non-bank financial intermediation in China has become the spotlight of attention due to the leading role the People's Republic has taken in the overall rise of shadow banking in emerging market and developing economies. Although Korea has been flying somewhat under the radar of international scholarly interest, it has brought forth non-banking depository institutes. While shadow banking has often been viewed in a negative light, the recently (2018) adopted "non-bank financial intermediation" moniker lends a more credible note to a wider selection of agents and their business models. Similarly, the often-cited fintech industry is widely seen as beneficial, some parts and actors are increasingly connected to issues of liquidity shortages respectively maturity mismatches. Therefore, there are increasing voices that highlight the need for more supervision and oversight.

By applying an eclectic framework that encompasses both institutional and activity-related factors, this thesis presents key metrics to assess the footprint of shadow banking in China, Korea, and the United States. It further provides a comparative analysis of the three jurisdictions' shadow banking system and discusses regional and global events that had an impact of (Eurodollar) funding structures. The results show that regulation mostly has positive effects on the level of risk assumed by shadow banks, while some rare cases of overcorrection also exist.

Keywords: shadow banking; non-bank financial intermediation; NBFI; liquidity; repo market.

Zusammenfassung

Seit der globalen Finanzkrise beobachten Forscher und Experten gleichermaßen die Entwicklung des Schattenbankensystems. Während der Schattenbankensektor der USA das Epizentrum der Krise von 2008 war, ist China in den Mittelpunkt der Aufmerksamkeit gerückt, da die Volksrepublik eine Vorreiterrolle im Wachstum des Schattenbankwesens in Schwellen- und Entwicklungsländern eingenommen hat. Korea ist im Vergleich etwas unter dem Radar des internationalen wissenschaftlichen Interesses geflogen, obwohl das dortige Schattenbankwesen sogar Nicht-Bank-Einlageninstitute hervorgebracht hat. Während das Schattenbankwesen oft in einem negativen Licht gesehen wird, verleiht die kürzlich (2018) adoptierte Bezeichnung "Nicht-Banken-Finanzintermediation" dem Sektor eine glaubwürdigere Note. Dieser positive Effekt wird damit auch einer breiteren Auswahl von Akteuren und ihren Geschäftsmodellen zuteil. In ähnlicher Weise wird die vielzitierte Fintech-Branche weithin als vorteilhaft angesehen, wobei Teilbereiche des Sektors zunehmend mit potenziellen Liquiditätsengpässen beziehungsweise Laufzeitinkongruenzen in Verbindung gebracht werden. Dies führte zu vermehrten Forderungen nach einer stärkeren Überwachung und Aufsicht ebenjener Institutionen.

Durch einen eklektischen Ansatz, der sowohl institutionelle als auch tätigkeitsbezogene Faktoren umfasst, werden in dieser Arbeit Schlüsselkennzahlen zur Bewertung des Fußabdrucks des Schattenbankwesens in China, Korea und den Vereinigten Staaten vorgestellt. Darüber hinaus wird eine vergleichende Analyse des Schattenbankensystems der drei Länder vorgenommen und der Einfluss regionaler wie globaler Ereignisse auf (Eurodollar-)Finanzierungsstrukturen erörtert. Das Ergebnis der Analyse zeigt, dass Regulierungen meist positive Auswirkungen auf von Schattenbanken ausgehendes Risiko haben, obwohl es auch seltene Fälle von Überregulierungen gibt.
Die Arbeit beleuchtet die potenzielle Entstehung von Schwachstellen im Schattenbankensystem und gibt Empfehlungen für politische Entscheidungsträger und Aufsichtsbehörden, wie potenzielle externe Effekte auf das Finanzsystem insgesamt minimiert werden können.

Schlagwörter: Schattenbanken; Nicht-Bank-Finanzintermediation; NBFI; Liquidität, Repomarkt.