

Topics in

Corporate Finance

Perspectives on Leveraged Finance and Fintech

R. DE WEIJS AND A. JONKERS

A. BOOT, P. HOFFMANN, L. LAEVEN
AND L. RATNOVSKI

in cooperation with



UNIVERSITEIT VAN AMSTERDAM
Amsterdam Center for Law & Economics

28

NUMBER

TOPICS IN CORPORATE FINANCE

PERSPECTIVES ON LEVERAGED FINANCE AND FINTECH

TOPICS IN CORPORATE FINANCE

NUMBER 28

Perspectives on Leveraged Finance and Fintech

With contributions of

Rolef de Weijts and Aart Jonkers

Arnoud Boot, Peter Hoffmann, Luc Laeven and Lev Ratnovski

ISBN 978-90-77859-71-1

© 2020, Amsterdam Center for Corporate Finance
All rights reserved

PREFACE

The 28th issue of the ACCF *Topics in Corporate Finance* series is dedicated to two key public policy issues in finance: one focuses on how to contain highly leveraged financial structures in the economy, the other on the fintech revolution in financial services, and the challenges for banks and policymakers that it may entail.

The first contribution by Rolef de Weijts (Professor of Insolvency Law at the University of Amsterdam) and Aart Jonkers (Assistant Professor at the University of Amsterdam Law School) focuses on how to contain financial leverage in Leveraged Buy Outs (LBOs), but also in firms in general. Their basic premise is that limitations on borrowing are needed not only to prevent excessive leverage with its associated (societal) costs, but also to prevent wealth transfers from uncompensated debtors to shareholders. And all this should not stand in the way of legitimate borrowing to finance investment and the operations of the firm. They discuss several approaches in detail, and come to a very interesting discussion when comparing them.

In the second contribution, the ECB economists, Peter Hoffmann, Luc Laeven and Lev Ratnovski, together with Arnoud Boot, discuss technological change in the financial sector – the emergence of fintech and bigtech (Google, etc.) – and the consequences of that for banks and the challenges that it poses for policymakers. Key distinctions are made between innovations in information (data collection and processing) and communication (relationships and distribution). The authors point to more recent innovations, such as the combination of data abundance and artificial intelligence, and the rise of digital platforms, that fundamentally change the landscape. In particular, the authors argue that the rise of new communication channels can lead to the vertical and horizontal disintegration of the traditional bank business model: specialized providers of financial services that chip away activities, and platforms that interject themselves between banks and customers. They discuss limitations to these challenges, and the resulting policy implications.

As Amsterdam Center for Corporate Finance, we hope that you enjoy reading this contribution to the *Topics in Corporate Finance* series, and that it may help foster a healthy public debate on these important issues.

Arnoud W.A. Boot
Director ACCF

December 2020

TABLE OF CONTENTS

Preface v

**1 Speed Limitations for the Financial Sector:
Three Ways to Take Leveraged Finance and its Risks Seriously** I
Rolef de Weijts and Aart Jonkers

1.1 Introduction I

1.2 Leveraged Finance and Security Rights 3

1.2.1 Distinction as to Use of Secured Finance: From Investment
to LBOs and Divided Recaps 4

1.2.2 Development of Leveraged Finance 8

1.3 Strategy 1: Re-Introduce Financial Assistance Prohibitions 10

1.4 Strategy 2: Introduce Partial Priority 15

1.5 Strategy 3: Leverage Caps 18

1.5.1 Leverage Measured in Terms of Net Debt/EBITDA 19

1.5.2 The Working of a Leverage Cap 24

1.6 Comparison of Strengths and Weaknesses of Three Strategies 26

1.7 Conclusions 29

References 31

2 Fintech: What’s Old, What’s New? 35
Arnoud Boot, Peter Hoffmann, Luc Laeven and Lev Ratnovski

2.1 Introduction 35

2.2 Financial Intermediation and Technological Progress 37

2.2.1 The Role of Information and Communication in Financial
Intermediation 37

2.2.2 Conceptual Framework 38

2.3 Information Innovation: Established Trends and New Developments 40

2.3.1 Established Trends 41

2.3.2 New Developments 42

2.4 Communication Innovation: Novel and Increasingly Pertinent 45

2.4.1 Established Trends 45

2.4.2 New Developments 47

2.5 The Future of Banks 49

2.5.1 Challenge 1: Horizontal Disintegration through Specialized
Competitors 49

2.5.2 Challenge 2: Re-Intermediation through Platforms 50

2.5.3 Limiting Factors and Banks’ Response 51

2.6	Policy Challenges	54
2.6.1	Prudential Policy: New Dimensions	54
2.6.2	Monetary Policy: A New Environment	56
2.6.3	Competition Policy: Platforms as Natural Monopolies for Communication and Data	57
2.6.4	Public Standards and Infrastructures: Focus on Data and Interconnections	57
2.7	Conclusions	59
	References	61
	Notes on the Contributors	69
	Earlier Publications in the <i>Topics in Corporate Finance</i> Series	71

1 SPEED LIMITATIONS FOR THE FINANCIAL SECTOR: THREE WAYS TO TAKE LEVERAGED FINANCE AND ITS RISKS SERIOUSLY¹

Rolef de Weijs and Aart Jonkers

1.1 INTRODUCTION

In 2019, the year prior to the global outbreak of Covid-19, the global economy was facing record high debt levels.² The IMF made strong and repeated calls for a global deleveraging of the economy.³ In most legal systems, there are however few legal boundaries in place to prevent high leverage of companies. In fact, legal concepts including limited liability for shareholders and security rights for financiers provide the basic building blocks for frequently used transactions that increase leverage, such as Dividend Recaps and Leveraged Buy Outs (LBOs). Tax deductibility of interest payments further incentivizes leveraged structures.⁴ The forces of the current ultra-low interest environment seems to push leverage to higher levels, which even seems to make Wall Street worried.⁵

-
- 1 We would like to thank J.A. de Vries, W. Peelen and N. Kuil for their feedback and comments on a draft of this paper. We also like to thank A. Tavakolnia for his research assistance. All mistakes and errors are the authors' own.
 - 2 Tappe (2020): "The world's already huge debt load smashed the record for the highest debt-to-GDP ratio before 2019 was even over. In fact, it broke that record in the first nine months of last year. Global debt, which comprises borrowings from households, governments and companies, grew by \$9 trillion to nearly \$253 trillion during that period, according to the Institute of International Finance. That puts the global debt-to-GDP ratio at 322%, narrowly surpassing 2016 as the highest level on record."
 - 3 IMF Fiscal Monitor (2016), p. 1, with its plea to deleverage the economy: "High private debt not only increases the likelihood of a financial crisis but can also hamper growth even in its absence, as highly indebted borrowers eventually decrease their consumption and investment."
 - 4 Proposals to limit this effect are being developed and implemented. See e.g. the Anti-Tax avoidance Directive (ATAD) which provides in article 3 ATAD for a maximum tax deductibility (see further section 1.5 below). As the law is now, following implementation of the Anti-Tax avoidance, there are only some limits in place to tax deductibility, thereby in no way abolishing the tax incentive for debt finance. See for the problematic nature of tax law itself providing incentives to finance with debt the Action Plan on Building a Capital Markets Union: "*Differences in the tax treatment of various financial instruments may impede efficient capital market financing. The preferential tax treatment of debt, resulting from the deductibility of interest rate payments, is at the expense of other financial instruments, in particular equity. Addressing this tax bias would encourage more equity investments and create a stronger equity base in companies. Also, there are obvious benefits in terms of financial stability, as companies with a stronger capital base would be less vulnerable to shocks.*" See Communication 2015/468 from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions of 30 September 2015, Action Plan on Building a Capital Markets Union.
 - 5 See Wigglesworth (2019).

In this paper, we present a preliminary investigation of legal options to limit highly leveraged structures. Our intuition is to look for options that tackle the incentive to design highly leveraged structures at the core with measures that work *ex ante*. Such measures should force the main parties at the table in leverage increasing transactions to internalize the increased risk involved. In as far as there are boundaries currently in place, these boundaries mostly only work *ex post*, usually as tort liability or transaction avoidance rules. The inherent problem with such measures is that they usually rely on the question whether the parties involved, such as the shareholders (under veil piercing) and banks (under lenders' liabilities or transaction avoidance), acted with a high foreseeability of the company becoming insolvent as a result of an LBO or a Dividend Recap. This will be difficult to prove and these parties themselves can all too easily argue that they would not have entered into the transaction if the threat of insolvency was that clear. Also, without clear foreseeability of financial problems, highly leveraged structures externalize risk to parties without a seat at the negotiations table and may create risk by deepening a financial crisis. That the current *ex post* rules pose few barriers is exemplified by the fact that highly leveraged structures are rife. What can be done?⁶

We consider three possible strategies:

- Reintroduce and enforce financial assistance prohibition, preventing companies to pay for their own takeover (section 1.3);
- Introduce partial priority, forcing secured lenders in part into an unsecured position, thereby internalizing the risks related to leveraged lending (section 1.4);
- Introduce general leverage caps in terms of Net Debt/EBITDA for secured lending (section 1.5).

We emphasize this is a preliminary investigation into possible measures. At this stage, we do not make the case that these measures should indeed be implemented. We hope to start a debate on implementing new measures against overleverage. We, as legal scholars, therefore phrase this as an open question towards the finance community. What could workable measures limiting excessive leverage look like?

6 In this work we build upon our previous work on the intersections of law and finance and more specifically on secured credit. Parts of the paper are repetition of R.J. de Weijs, 'Secured credit and partial priority: Corporate finance as a creation or an externalisation practice?', *European Property Law Journal*, 7(1), 63-107 and A.L. Jonkers, 'Het is tijd voor wat minder zekerheid', *Ins Updates* 2016. We also had the privilege to supervise theses on the topic of private law limitations on leverage. Here we would like to single out the work of Niels Kuil (N. Kuil, 'De Leveraged Buy Out, Over risicoafwenteling op en compensatie voor ongesecureerde crediteuren', final thesis UvA 2020), who did excellent work on developing different approaches to how a leverage related carve out rule would need to work in order to not be over- or under-encompassing. And also Wijnand Peelen (W. Peelen, 'Revising the Dutch financial assistance prohibition: a legal proposal to restrain the negative externalities of leveraged buyouts', final thesis UvA 2019), who worked out in detail possible legal rules of how a leverage cap would work. See for references to their work section 1.5 below.

The structure of this paper is as follows. First, we briefly discuss the phenomenon of leveraged finance and the role of security rights in leveraged finance (section 1.2). This is followed by a discussion of the three strategies, chiefly targeting the secured position of secured lenders (section 1.3, section 1.4 and section 1.5). Subsequently, section 1.6 compares the relative strengths and weaknesses of the strategies presented and addresses the question to which extent the different strategies could provide a sensible filter in fostering credit, leading to investments while reducing lending used primarily to lever up. Section 1.7 contains the conclusions.

For ease of reference, we will refer to secured lenders simply as banks. Furthermore, some of the analyses will be overly lengthy or simply superfluous for the finance community. For a measure to work, lawyers will need to be able to apply them. Some additional space has been included to explain the possible working of the different measures to lawyers, ourselves included.⁷

1.2 LEVERAGED FINANCE AND SECURITY RIGHTS

One of the reasons for a company taking on debt is that the shareholders can increase their return on the equity invested, i.e., Return on Equity or 'ROE'. This is referred to as leveraged finance. In the case of leveraged finance, the company is being financed with little shareholder money but significant money from creditors in the form of debt. The more debt taken on by the company, the higher the leverage of that company. Leverage amplifies the ROE when the company is profitable, but in principle makes the company less resilient in a downturn as the debts will still have to be serviced.

High leverage is only possible if someone is willing to extend credit. Security rights over the debtor's assets play a key role as they protect the lender. Security rights shift credit risk from the secured creditor to unsecured creditors. A large and inconclusive debate has evolved over the last few decades around the question whether this is fair or efficient.⁸ We will not repeat this debate here. Here we will focus instead on the conceptual different uses of secured credit and how the leverage markets have developed over the past decade.

7 Here we also use the Financial Mindmap, developed by JBR Institute and Joost de Vries. De Vries has provided the visuals for this research paper. He is not a co-author of this paper. Descriptive parts of this research paper as to company valuation, Net Debt and EBITDA(multiples) build upon and are derived from previous joint work, De Vries and De Weijts, 2020, p. 37-74.

8 See for an overview McCormack (2004). For short references to both the efficiency and fairness debates see also D'Onfro, 2018, p. 1370-1371.

1.2.1 *Distinction as to Use of Secured Finance: From Investment to LBOs and Dividend Recaps*

At their best, security rights foster the financing of investments and value-creating activities. The most straightforward type of credit, and the credit that best fits the underlying justification of security rights,⁹ is credit that allows a company to invest in assets used for production or to provide working capital finance. Much of the secured credit extended is however not used as such directly.

Large amounts of secured credit are employed to allow for distributions to shareholders and to increase leverage. In the balance sheet, equity is simply replaced by secured debt. There are two main versions of this phenomenon: Leveraged Buy Outs and Dividend Recapitalizations.

LBOs are a specific form of transfer of ownership of the company.¹⁰ The company to be acquired is usually referred to as the Target Company. A key feature of any LBO is that the acquisition of the Target Company by the new shareholder from the old shareholder is to a large extent financed by borrowing money, therefore by means of debt. The burden of repaying this debt and its related interest payments is however not borne at the level of the new shareholder, but at the level of the Target Company itself.

There are four basic steps in an LBO transaction:

- The new shareholder buys the shares in the Target Company from the old shareholder. The new shareholder is typically a Special Purpose Vehicle (SPV).
- The Target Company borrows money from a bank providing security rights on its assets. Although the SPV can also be liable for the debt, the SPV will have no assets other than the shares in the Target Company. If the Target Company cannot make the payments to the bank, there is no real recourse against the SPV either, since the shares held by the SPV will not represent any significant value. So economically, the most relevant counterparty for the banks is the Target Company.
- The money now available at the level of the Target Company flows upstream to the new shareholder, the SPV. This can be done either as a dividend payment or as an upstream loan. In the case of a loan, the loan will usually be repaid not by making actual payments, but by means of set-off with future dividends.
- The money now available at the level of the SPV as the new shareholder is used to pay the old shareholder for the purchase of the shares in the Target Company. The

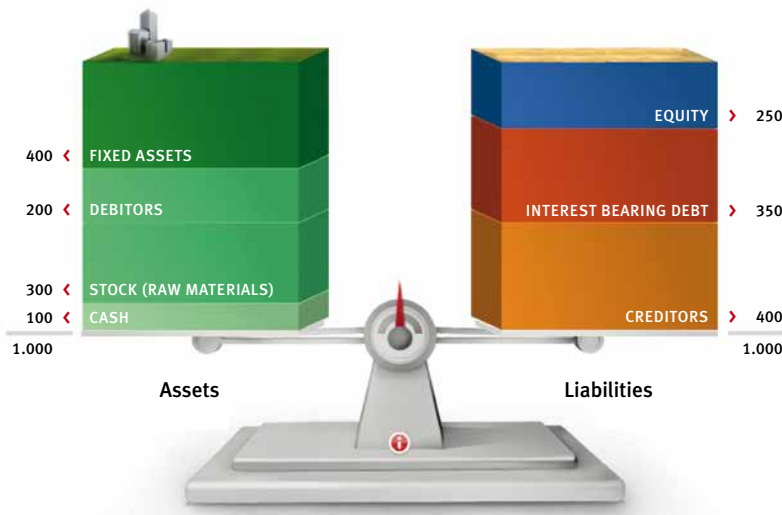
9 See UNCITRAL, Legislative Guide, 2010, p. 2: “The Guide is based on the premise that sound secured transactions laws can have significant economic benefits for States that adopt them, including attracting credit from domestic and foreign lenders and other credit providers, promoting the development and growth of domestic businesses (in particular small and medium-sized enterprises) and generally increasing trade.”

10 As for a more extensive discussion about both the structure of an LBO and the market developments going back to 1980, see Barneveld (2014).

purchase price is for the larger part formed by the upstream liquidity. Part of the purchase for the shares will, however, still be provided by the new shareholder.¹¹

The process of an LBO and how it affects the balance sheet of the Target, can be visualized by using the Financial Mindmap (see Figure 1). The Financial Mindmap depicts the different position in the capital structures by using colours and by using the relative size to show the relative positions. Equity is depicted by the blue block. Red is used to refer to interest bearing debt and is assumed to also be secured. The orange block is used to refer to non-interest bearing debt which is assumed to be unsecured. The parties making up this orange block consist among others of trade creditors. It should be noted that the Financial Mindmap adopts a corporate finance view of the balance sheet with its distinction between interest bearing debt and non-interest bearing debt, rather than the accounting view with its distinction between long-term and short-term debt. The balance sheet of the Target Company changes as follows. Prior to an LBO, the company will have a reasonably solid solvency ratio.

Figure 1: Balance of Target Prior to LBO



As part of the LBO transaction, the Target Company will borrow as much as possible, see Figure 2. Momentarily the asset side therefore increases with cash.

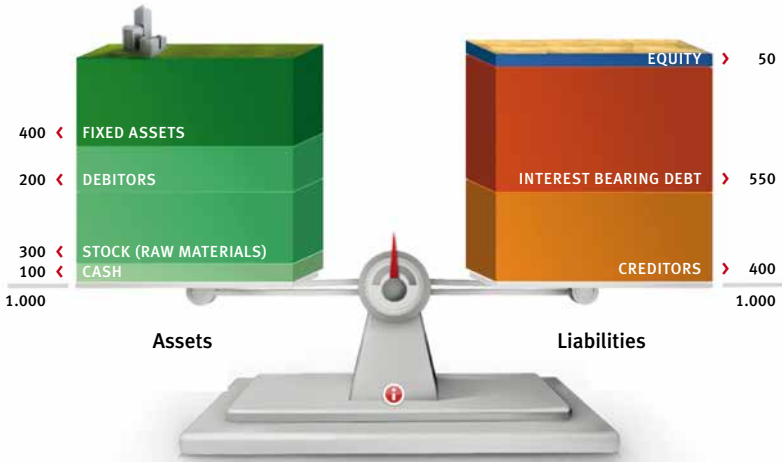
¹¹ See Ginsberg, Burgess, Czerwonka and Caldwell, 2011, footnote 15, quoting different literature that places the relative part of debt finance at 70% or stating that LBOs are typically financed with 60 to 90% debt.

Figure 2: Balance Target after Obtaining LBO Credit



The cash will, however, be used to make a dividend payment to its new shareholder, which in turn will use it to pay the old shareholder. Cash and equity are thereby reduced with the same amount (see Figure 3).

Figure 3: Balance Target after Completion LBO



During the LBO process, the bank debt has increased from €350 to €550. Upon completing the LBO, the Target Company will have taken on significantly more debt

without any matching investments on its asset side.¹² The Target Company, once taken over, is burdened with debt, and the leverage of the Target Company has gone up. Equity has gone down from €250 to €50.

Dividend recapitalizations are another method to return money to shareholders using high leverage. If the company has good assets and positive equity but no free cash, it can attract a loan to acquire cash and use the cash to make a dividend payment. When banks lend money in order to finance a dividend recapitalization, they normally do so on a secured basis.

Dividend recapitalizations are also an alternative exit strategy for private equity after a buy-out. The preferred exit strategy will usually be to sell the Target Company, either through an IPO or to another investor.¹³ However, if the company cannot readily be sold, taking out equity by means of dividend payments can be seen as an alternative and partial exit.

In case of LBOs and dividend recapitalizations, there is a clear, direct relationship between lending money and making payments to shareholders. The company borrows money for the sole purpose of paying out money to its shareholders. The effects of secured credit on facilitating leverage are not limited to such clear transactions where ‘debt-in’, matches ‘equity-out’ exactly. The process will normally be more diffuse, where the company has attracted secured debt and will later make dividend payments or conduct a share repurchase.¹⁴

12 In case the up-streaming of the cash occurred by way of an upstream loan, the asset side would increase. The loan is problematic, however, since it is a loan against the shareholder. Such loans are commonly not repaid, but instead reduced by means of set-off with future dividend payments. In case the target company would become insolvent, the company would have a claim against its parent which in case of being an SPV has no other assets than assets in the insolvent Target Company. Article 25 of the Second Company Law Directive provides that the Target Company ‘shall include, among the liabilities in the balance sheet, a reserve, unavailable for distribution, of the amount of the aggregate financial assistance.’ The Second Company Law Directive is, however, only applicable to public companies.

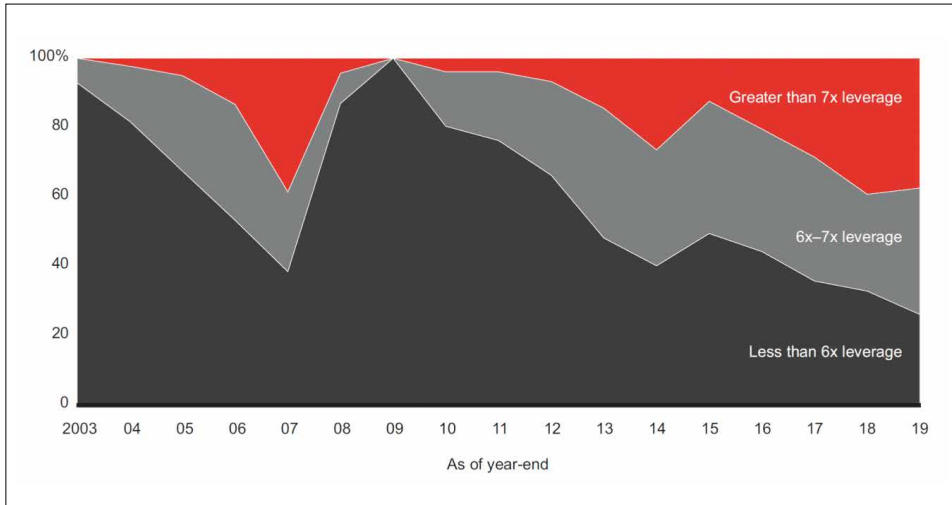
13 See on the interconnectedness of the popularity of dividend recaps and the lack of another exit strategy at the end of 2012, Philips and Hope (2012): *“Private equity firms remain focused on generating liquidity for limited partners that have seen relatively few liquidity events since the beginning of the financial crisis. Both IPO markets and M&A markets remain relatively stagnant in the current, uncertain economic environment. According to Standard & Poor’s, there have been only 14 IPOs of PE-backed companies thus far in 2012, and 29 sponsor-to-sponsor M&A transactions. On the other hand, there have been 44 dividend recap deals through which the financial sponsors have recouped approximately two-thirds of their original capital commitment to the business, on average.”*

14 See specifically on share repurchases, Lahart (2016). He writes: *“U.S. companies went on a borrowing binge in recent years. Nonfinancial corporations owed \$8 trillion in debt in last year’s third quarter, according to the Federal Reserve, up from \$6.6 trillion three years earlier. (...) The negative: Rather than investing the funds they raised back into their businesses, companies in many cases bought back stock instead.”*

1.2.2 Development of Leveraged Finance

A global multi-billion dollar market¹⁵ and industry has developed around LBOs, relying heavily on the use of security rights. See for a development of leveraged finance and the EBITDA multiples in the US, Figure 4.

Figure 4: Share of US Leveraged Buyout Market, By Leverage Level



Source: Bain & Company (2020).

Figure 4 shows the outstanding debt as a multiple of the company’s EBITDA.¹⁶ The Bain & Company Report (2020) provides the following warning:

“Leveraged debt to grow as a share of overall debt. Deals with debt multiples higher than six times earnings before interest, taxes, depreciation and amortization (EBITDA) rose to more than 75% of the total. That comes in stark contrast to the years following the global financial crisis, when their share did not exceed 25%. The true leverage of many deals may be even greater, as banks commonly allow borrowers to calculate multiples based on projected earnings instead of actual results.”¹⁷

¹⁵ The total number of private equity buy out deals in 2015 and 2016 amounted to over 3915 and 3986 deals worldwide with a total value of USD 423 billion and USD 319 billion respectively. See Ligterink e.a. (2017), with references to Preqin Quarterly Private Equity Update 2016. The data in the report as to 2016 is limited to Q1-3. From the Preqin database the numbers over the full year have been retrieved.

¹⁶ See on artificial inflation of EBITDA, Badawi and de Fontenay (2019).

¹⁷ Taken from Bain & Company (2020).

Modigliani and Miller (1988) famously argued that in a perfect world (or at least a highly stylized world) finance does not matter. Since finance obviously matters, Miller explicitly advised to use the theorem the other way around, namely to look for the imperfections and wealth transfers if it becomes clear that finance does matter. Here we already see one of the problematic aspects of leveraged finance, namely the risk externalization to other creditors. Miller wrote the following in 1988:

“Even in a no-tax world the “no gain from leverage” implication of the original MM invariance proposition might fail if the new debt was not made junior in status to the old, if the old bond covenant was “open ended,” as many still are, and if the new bonds were issued under it. Assuming no change in the underlying earning power from the recapitalization, the original creditors would then find the value of their claim diluted. The benefits of this dilution of the old bondholders accrue, of course, to the stockholders, which is why it has often been labelled ‘theft’, particularly by the adversely affected bondholders. Finance specialists prefer the less emotionally charged term “uncompensated wealth transfer.”¹⁸

It is clear that gains made within the Private Equity industry are in part attributable to externalization. Ligterink et al. (2017) find that attribution studies show that approximately 50% of the earnings need to be attributed to leverage itself and not to improvement of operations or selection.¹⁹ With such use, security rights are at risk of developing into a tool to transfer value from non-adjusting creditors to shareholders, instead of supporting investment.

One can also analyze the effects of secured lending at a macro-economic level. In an immature economy, with low debt levels, providing additional credit increases growth. At low levels, finance is not simply a by-product of the development process, but actually an engine propelling growth.²⁰ At a certain level, the opposite happens. Too much credit can have a negative impact on growth.²¹ Cecchetti and Kharroubi (2012) address this point:

“(…) as is the case with many things in life, with finance you can have too much of a good thing. That is, at low levels, a larger financial system goes hand in hand with higher productivity growth. But there comes a point – one which many advanced economies passed long ago – where more banking and more credit are associated with lower growth.”

18 Miller, 1988, p. 99-120.

19 See Ligterink, Martin & Boot, 2017, p. 238.

20 See Cecchetti en Kharroubi, 2012, p.1. See for a plea for a step away from full priority on the basis here of Jonkers (2016).

21 See Arcand, Berkes and Panizza (2012). They write: *“In particular, our results show that the marginal effect of financial depth on output growth becomes negative when credit to the private sector reaches 80-100% of GDP.”*

High debt levels, also without a financial crisis, can become counterproductive and form a break or a drain on the economic development. The IMF (2016) has also warned against the risks of high debt levels and is calling for a general deleveraging precisely for the reason that high leverage creates a drag on the economy.²²

In short, security rights play a key role in high leverage structures such as LBOs. In most cases, the new credit attracted is secured with security rights at the company level, whereas the liquidity flows to the shareholder. This practice can and has been questioned from both a microeconomic and macroeconomic perspective. Such use of security rights is difficult to reconcile with the basic justification of the law providing for the institute of security rights to foster investments and growth.²³

All criticism we direct at leveraged lending is not directed at the persons or even the institutions in the lending industry. It is directed at the legislatures creating an environment where lending will continue until the music stops and thereby making a repeated pattern of bust and boom inevitable. If deleveraging the economy is a policy goal, as the IMF calls for, an interesting and possibly most effective way to limit leverage is at the source. By back tracing the stream of money, this source is easily established as the bank loan. The incentive to provide such loans can be subdued through targeting security rights for such loans. The next three paragraphs discuss three such alternatives.

1.3 STRATEGY 1: RE-INTRODUCE FINANCIAL ASSISTANCE PROHIBITIONS

The traditional European approach to protect creditors against distribution to shareholders is through capital maintenance rules and a related ban on the company giving financial assistance to a third party for the purchase of the shares of the company. This approach originates in 19th century England. The idea was apparently that, in exchange for limited liability, shareholders bring together a certain amount of capital to which the creditors can look forward for the satisfaction of their claims.²⁴ A profit could be distributed, but the initial capital should not be distributed as that would defraud creditors.²⁵ Efforts to circumvent these rules were suspect, thus rules cracking down on financial assistance for the acquisition of the company's own shares by a third party were shaped.²⁶

From 1976 onwards, the EU adopted this model for the regulation of public com-

22 See IMF Fiscal Monitor, 2016, p. 1, with its plea to deleverage the economy: *“High private debt not only increases the likelihood of a financial crisis but can also hamper growth even in its absence, as highly indebted borrowers eventually decrease their consumption and investment.”*

23 See for a discussion of the justification of security rights from a different angle also D’Onfro (2018).

24 King, 2007, p.28.

25 King, 2007, p.28.

26 King, 2007, p. 28; Ferran and Ho, 2014, p. 234-236.

panies. Article 6 of the Second Company Law Directive²⁷ stipulates a minimum capital of €25,000 for public companies. Article 17 of the Directive forbids distributions if as a result the capital would become ‘lower than the amount of the subscribed capital plus those reserves which may not be distributed under the law or the statutes’.

Initially (until 2006) the Second Company Law Directive also featured a broad ban on public companies (in the Netherlands N.V.’s) giving financial assistance for the acquisition of its own shares by a third party. Like in the UK, the idea was that this would prevent circumvention of the capital maintenance rules. Financial assistance describes a setting in which a Target Company would take on liability or would put up security to help pay for its own take over. The most straightforward setting could be found in an LBO as discussed above. The target would offer ‘financial assistance’ if the new shareholder borrows money from the bank in order to pay the purchase price of the shares to the old shareholder with the assets of the Target as collateral for the bank. Instead of the new shareholder pledging its own assets, it is the Target that pledges its assets such as machines and inventory to the bank. The assistance provided can take on different forms, including gifts or a loan, but most straight forward would be granting a security right for a loan extended by a bank to the acquirer of the shares.

Some Member States extended the capital maintenance rules and financial assistance prohibition to private companies (in the Netherlands B.V.’s), even though the Second Company Law Directive does not command this. This was the case for the Netherlands and the UK, but they have since abolished these rules for private companies in line with a broad European trend to ease requirements for incorporation and capital maintenance and move more towards the US model of ex post creditor protection.²⁸ US law has never featured a ban on financial assistance.

In 2006, the EU Second Company Law Directive was amended. Member States are now allowed to permit financial assistance also for public companies, but only under strict conditions. These conditions are currently stipulated in art. 25 of the Directive (recast)²⁹ and include the following tests: (1) fair market conditions; (2) creditworthiness of recipient of assistance; (3) shareholder approval for assistance;

27 See Second Council Directive 77/91/EEC of 13 December 1976 on coordination of safeguards which, for the protection of the interests of members and others, are required by Member States of companies within the meaning of the second paragraph of Article 58 of the Treaty, in respect of the formation of public limited liability companies and the maintenance and alteration of their capital, with a view to making such safeguards equivalent.

28 See Hooft, 2011, p. 157-158. See on the distinction between ex ante and ex post regulation also Kuhner, 2006, p. 341-364; See also Barneveld, 2016, p. 84-85. See on the change in Dutch law Beckers, 2014, p. 117-127.

29 Directive 2012/30/EU, 25 October 2012 on Coordination of safeguards which, for the protection of the interests of members and others, are required by Member States of companies within the meaning of the second paragraph of Article 54 of the Treaty on the Functioning of the European Union, in respect of the formation of public limited liability companies and the maintenance and alteration of their capital, with a view to making such safeguards equivalent (Recast).

(4) mandatory report by directors explaining the transaction; and (5) a balance sheet test.³⁰ Some Member states have eased their national laws accordingly, others have not so far.³¹ According to some, the conditions in the Directive are still a serious constraint to financial assistance in practice as the conditions are viewed as onerous and time consuming.³²

In as far as financial assistance rules featured a broad ban on the company granting security for loans to a buyer of the shares in that company, Leveraged Buy-Out transactions were somewhat obstructed. The extent to which such transactions are indeed obstructed depends on the way the ban is formulated and enforced. For example, the Dutch Supreme Court has held that the ban did *not* extend to giving security for a bank loan to the Target company itself, even if the proceeds from the loan are directly used to make a dividend payment to the buyer of the shares.³³ In this reasoning, although securities rights granted by the Target for a bank loan granted to the shareholder would fall under the ban on financial assistance, a similar secured bank loan extended to the Target itself was not covered by the ban, even if the money would immediately leave the Target as a dividend in order to enable the new shareholder to pay the old shareholder. Since this detour was allowed, the pattern as described above in the different steps of an LBO developed. The ban thus became easy to circumvent,³⁴ which may also have been the prelude to the removal of the ban for closely held companies in the Netherlands.

Financial assistance bans have been heavily criticized as ineffective and burdensome.³⁵ Firstly, critics point to the fact that lawyers have usually been able to circumvent financial assistance rules. Enriques (2006) takes a very critical approach to the former ban on financial assistance in the Second Company Law Directive and describes it as “perhaps the most telling example of an avoidable EC company law rule”.³⁶ He points out that the sheer volume of the LBO market shows the rules are heavily circumvented.³⁷ Of course, one could question whether this is an inherent problem with a financial assistance ban or simply shows an unwillingness of courts to apply it strictly, because of a lively LBO market. Another line of criticism views financial assistance rules as too narrow in the sense that only assistance for the purchase of the shares of the company is targeted, whereas creditors can also be prejudiced by assistance in the form of for example security rights or guarantees for other

30 See also Hooft, 2011, p. 159.

31 See Hooft, 2011, p. 159.

32 See Ferran and Ho, 2014, p. 233 and the references given there.

33 Dutch Supreme Court (Muller q.q./Rabobank); see on the circumvention of financial assistance bans in the Netherlands also Beckers, 2014, p. 117-127.

34 Barneveld, 2016, p. 84-85.

35 See for example Ferran, 2004, p. 240-243.

36 Enriques, 2006, p. 39.

37 See also Ferran and Ho, 2014, p. 238.

transactions.³⁸ Yet another line of criticism is that financial assistance bans are often too broad by forbidding all kinds of transactions that do not actually prejudice creditors.³⁹ Lastly and closely related to the above, according to some commentators financial assistance rules mainly seem to lead to high costs in lawyers' and accountants' fees, without having much substantive effect. Ferran (2004) points out:

*“The law on financial assistance is notorious for being riddled with costly uncertainty, which results in the corporate sector spending a large amount each year for legal advice on its potential impact on transactions.”*⁴⁰

Enriques & Macey (2001) make the same point in relation to capital maintenance rules generally:

*“We believe that certain interest groups with more influence in Europe than in the United States benefit significantly from the legal capital rules, despite their inefficiency. (...) Two other interest groups that clearly benefit (...) are accountants (...) and lawyers (who must guide through the labyrinth of needlessly complicated legal capital rules). (...)”*⁴¹

The removal of the ban on financial assistance in the Netherlands as to private companies has shifted focus from an *ex ante* regulation of the banks as lenders to an *ex post* evaluation of the behavior of directors and shareholders under tort law. The primary focus seems to be directed at directors.⁴² It should be noted that this is an important shift in paradigm. The law no longer primarily targets the source of leveraged finance, but polices a different actor, here the directors of the Target. Although there might be some intuitive logic to policing the persons in charge of the Target, something is lost in this transition. The law is no longer targeting the parties to an LBO. The main parties are the old shareholder, the new shareholder, the Target and the Bank. Directors are only a representative of one of the parties, and the most objectified party in the process, namely the Target. Instead of actually targeting the parties designing the LBO, funding the LBO, reaping the benefits of the LBO and limiting their downside risk through the inherent structure of the LBO, rules on directors' liability are aimed at a party outside of the structure.⁴³ What's more, one should not be naïve

38 King 2007, p. 29; Hooft, 2011 p. 158.

39 King 2007, p. 29; Hooft, 2011, p. 158.

40 Ferran, 2004, p. 225.

41 Enriques and Macey, 2001, p. 1202; framing of this quote derived from Kuhner, 2006, p. 341-364.

42 See, Fluit, 2017, p. 4, 30-31; Beckers, 2014, p. 120 ff.

43 It is however common that management also participates through a tailor made compensation package awarding management a small equity stake, also to further align their interest with those of the new shareholder. The law targets management in their capacity as director and not in their capacity as minority shareholder.

in believing that management is in any way entering the negotiation with the other stakeholders in a position of equal power. If they are not willing to work along with the LBO whereas the old shareholder is, then ultimately little stands in the way of the managers being removed. It is not uncommon that management is changed prior to implementing an LBO.

Financial assistance bans are, however, not dead. The Second Company Law Directive still features constraints on financial assistance for public companies. Similar rules and notions also keep resurfacing. In the Netherlands, there has been a proposal to reintroduce a supercharged version of the financial assistance rules, but the proposal has not gone far.⁴⁴ A similar restriction against ‘asset stripping’⁴⁵ is in place in the 2011 Directive on Alternative Investment Fund Managers (AIFMD).⁴⁶ The industry’s own assessment is however that, “overall the Directive is complex and represents a significant increase in regulatory disclosures and regulatory burden, but does not materially impede any private equity fund manager from continuing their business.”⁴⁷

One could envision a reintroduction and extension of the financial assistance prohibition in order to limit highly leveraged structures. A mere reintroduction of the abolished rules on financial assistance would not provide any relief against highly leveraged structures if circumvention is as easy as it has been in most Member States over the last decades. In that sense, one could argue financial assistance bans never had a fair chance. One could consider applying a broader prohibition flanked by rules forbidding circumvention. Some of the criticism discussed above, shortly summarized as financial assistance bans being both under- and overinclusive, could however still apply. Therefore, other measures including the introduction of partial priority (section 1.4 below) and more targeted Net Debt/EBITDA caps (section 1.5 below) also deserve consideration.

44 Barneveld, 2016, p. 84-85.

45 The Directive contains a rule against what is referred to as ‘asset stripping’ in art. 30 AIFMD. Contrary to the term used, the key provision in this respect does *not* deal with selling of assets, but with dividend payments and other distributions to the shareholder. The provision is directed against the management of the fund, and not so much Target Company itself. The article provides that if a fund has taken over (acquired control) a company, during two years the manager of the fund will not realize a capital distribution reducing the subscribed capital plus statutory reserves. The article is limited to distributions within two years. So upstream loans are not covered. See Barneveld, 2014. A second rule (article 30 sub 2 under b AIFMD) provides that no distributions will be made that would exceed the amount of profits at the end of the last financial year plus any profits brought forward.

46 See on the English rules on financial assistance Ferran and Ho, 2014, p. 232-265.

47 *Private Equity Demystified. An Explanatory Guide*. Gilligan and Wright (2014), p. 94. This very much resembles the warning in 2007 from Ferran as to the limitations in art. 23 of the Second Company Law Directive. She writes (Ferran, 2007, p. 32): “*This article simply notes that no-one should be under any illusion that there already is robust protection in the form of Article 23, and that therefore there is no need for further regulatory intervention in this area.*” It should be understood that the AIFMD did not deliver such further regulatory intervention.

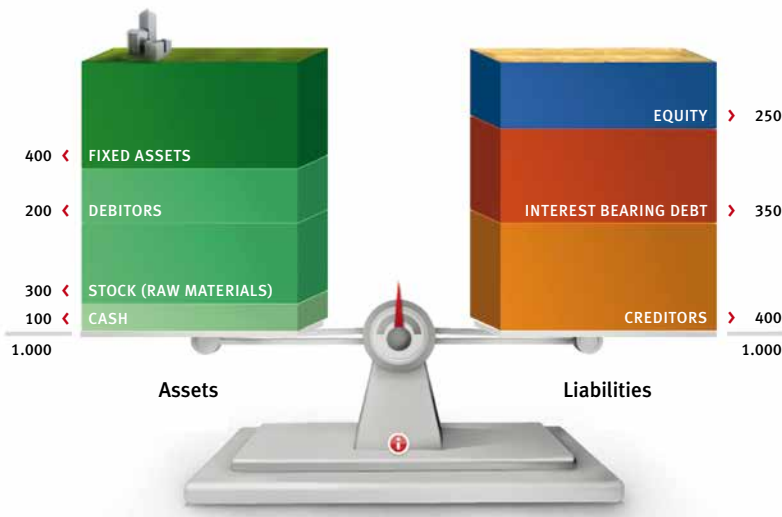
1.4 STRATEGY 2: INTRODUCE PARTIAL PRIORITY

Following up on the theorem of Modigliani and Miller, a legal debate developed as to the efficiency of secured credit in the 80's. Schwartz (1984) famously developed the puzzle of secured credit, arguing that if finance should not matter, the same applies to secured credit. In this view, security rights do not create value in themselves, whilst transaction costs are incurred by drafting and registering security rights.⁴⁸

In the 1990s US scholars Bebchuk and Fried (1997) provided a new impulse to the debate on secured credit by offering a detailed alternative to the favorable treatment of secured credit, by proposing partial priority to address perceived inefficiencies in fully secured loans.⁴⁹ Partial priority means that in case of insolvency, the secured creditor does not take full priority over unsecured creditors, but some of the value of the encumbered assets flows to the unsecured creditors, always leaving the secured creditor partly unsecured.

The working of partial priority can be shown by a balance sheet. The assumption will be that the bank has a valid security right in all assets. We take the balance sheet in Figure 5 as our starting position.

Figure 5: Balance Starting Position



⁴⁸ Schwartz, 1984, p. 1054.

⁴⁹ See Bebchuk and Fried (1997). They took inspiration from German legislative proposals to that extent. See most notably Drukarczyk (1991).

A company is 'balance sheet insolvent', if the value of the assets is less than the amount of outstanding debt. In the balance sheet, the two sides are then evened out by inferring negative equity. In the next example, with a total amount of outstanding debt of 750, the worth of the assets is assumed to no longer be 1000, but instead only 350. Equity is then 400 negative, see Figure 6.

Figure 6: Balance with Negative Equity (Insolvent Company)

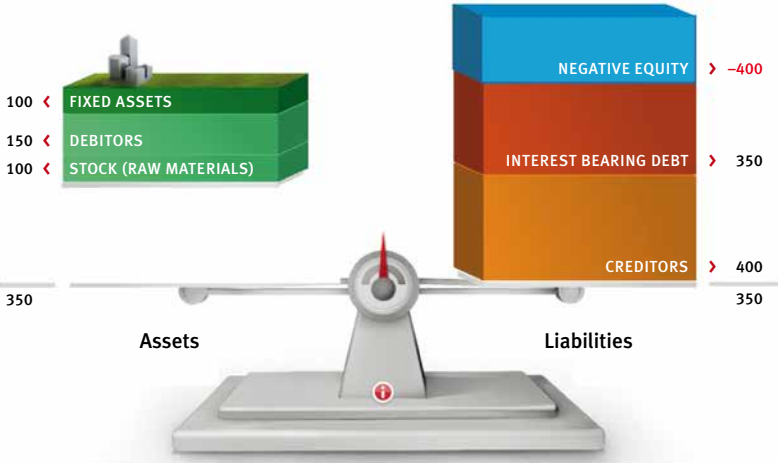
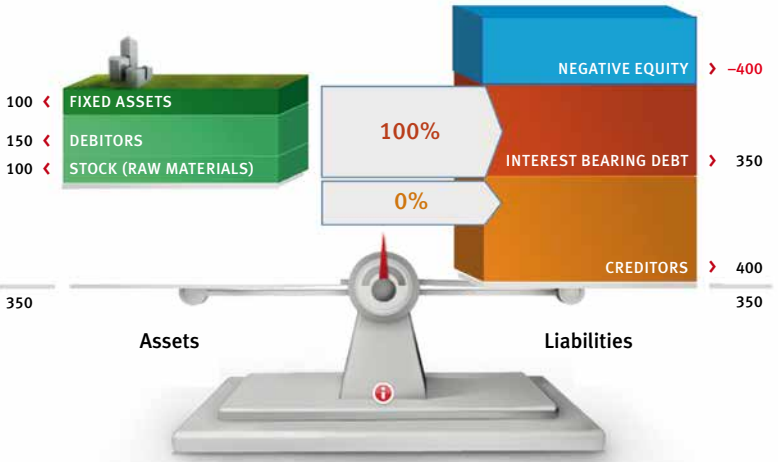


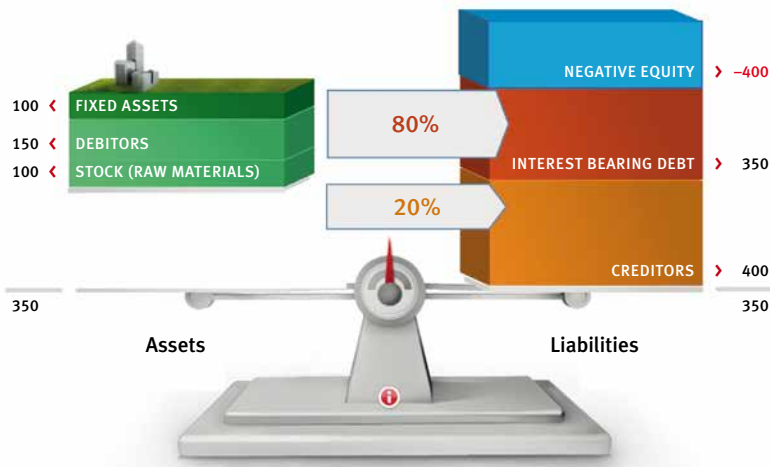
Figure 7: Payout under Full Priority



In an insolvency procedure, the value of the assets is no longer held for the shareholders, but for the creditors.⁵⁰ This change in entitlement can be visualized (see Figure 7) by placing the assets at the level of the creditors, starting at the level of secured creditors. Here the bank can be paid in full. The available amount would then be used to pay the bank in full.

Under a regime of partial priority (see Figure 8), some value would be allocated to the unsecured creditors, which would also make the bank in part an unsecured creditor.

Figure 8: Payout under Partial Priority



Different alternatives to full priority have been developed. Conceptually the easiest system is a carve out system, sometimes also referred to as a percentage rule. Under a carve out rule, a percentage, e.g. of 20%, of the value of the encumbered assets always flows to the unsecured creditors.⁵¹ This does not mean that the secured lender will necessarily become unsecured in part, since the secured creditor can limit its lending up to 80% of the value of the underlying assets. Such a simple carve out rule does not necessarily lead to partial priority. England has adopted a carve out system, but with limited scope and limited effect.⁵² The rule only applies to floating charges and it provides that the charge holder must make a certain percentage available for the satisfaction of unsecured debts, referred to as the prescribed part. The percentage is 50% of the first £10,000 and 20% of the excess above £10,000. The prescribed part is however capped at £600,000.⁵³

⁵⁰ See Armour et al., 2017, p. 109.

⁵¹ See for a proposal for a true carve out rule in the US of 20%, Warren, 1997, p. 1373-1395.

⁵² The introduction of the prescribed part formed part of a larger reordering, most notably of the abolition of fiscal preference. See Goode, 2011, p. 208-212.

⁵³ Provided by section 176A of the Insolvency Act 1986 and the Insolvency Act 1986 (Prescribed Part) Order 2003.

Bebchuk and Fried (1997) introduced three systems of partial priority, most prominently the Fixed Fraction Priority Rule.⁵⁴ The most important feature of which is that it ensures that the secured creditor is always unsecured to a certain extent by stipulating that a percentage of the loan should always be partly unsecured. For example, the secured lender, having a claim of 80 against security worth 100, would have a secured claim of only 64 and an unsecured claim for 16. Bebhuk and Fried clarify the distinction by pointing out that *a carve-out rule applies to collateral, while the partial-priority rule applies to claims*.⁵⁵

Bebchuk and Fried (1996) were concerned by inefficiencies that can result from secured credit. They argued that the fact that security interests may be used to transfer value from non-adjusting creditors under a full-priority rule means that security interests may be used even when they give rise to inefficiencies.⁵⁶

One can and should raise the question whether partial priority can be expected to form a meaningful break on excessive overall lending. Partial Priority is a longstanding concept in the literature, but developed to redress imbalances at the company level with all its stakeholders and not necessarily to limit leverage in the economy at large. Partial priority will help to limit leverage in the sense that creditors financing high leverage transactions will have to internalize more of the default risk.⁵⁷ At the same time, the current ultra-low interest rate environment has already resulted in large numbers of ‘covenant-lite’ loans,⁵⁸ showing that lenders are willing to accept large risks in search of yield. In these market dynamics, the effect of partial internalization of additional default risk may not tip the scales.

1.5 STRATEGY 3: LEVERAGE CAPS

A third strategy to limit leverage is to impose a cap. We will focus on a cap on secured lending in relation to EBITDA, and discuss how this might work.

54 See Bebhuk and Fried, 1997, p. 1323-1324. They also developed two other systems, being the Adjustable Priority Rule and the Consensual Priority Rule. See Bebhuk and Fried, 1997, p. 1325-1327.

55 See Bebhuk and Fried, 1997, p. 1347-1348.

56 They discuss at great length five inefficiencies which are likely to follow from full priority (Bebchuk and Fried 1996, p. 44-54).

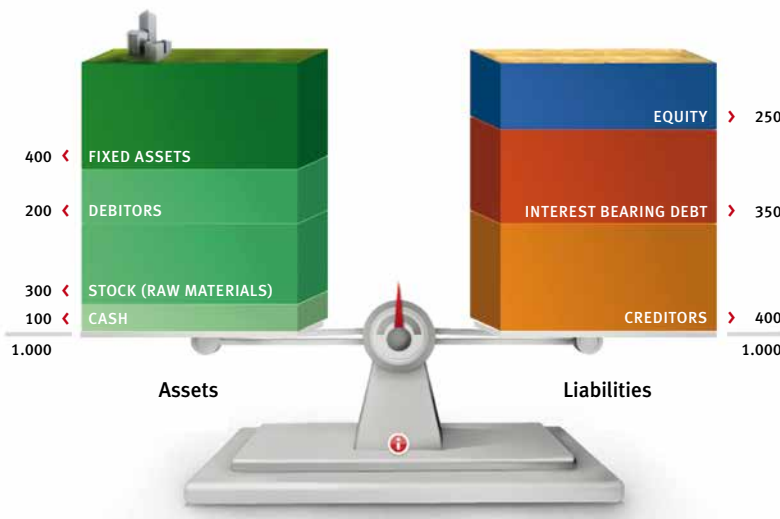
57 See for an empirical study of partial priority also Bergström, Eisenberg & Sundgren, 2004, p. 273-297.

58 See for example Wigglesworth (2019).

1.5.1 Leverage Measured in Terms of Net Debt/EBITDA

A more targeted measure to limit high leverage structures could be to cap secured lending in relation to the EBITDA of the company. Before explaining how a Net Debt/EBITDA cap would work, two other possible candidates for a leverage cap are briefly considered with reference to the visual already presented.

Figure 9: Balance Starting Position



Two other commonly used approaches of evaluating whether there is a lot of outstanding debt are less suitable to play a central role in setting such leverage caps. Those are i) a *solvency ratio* or its inverse, a leverage ratio, based on the balance sheet total, and ii) a *loan-to-value ratio*. A solvency ratio answers to what extent the company has been financed with equity or debt. In the balance sheet given in Figure 9, this is 25% (250/1000). One can also inverse this number and say that the leverage ratio is 4. Another analysis is the *loan-to-value* measure. The amount of interest bearing secured debt is compared to the encumbered assets. Assuming that all assets are encumbered in favor of the bank, one could say that the *loan-to-value* is 35%. Of course one could also develop leverage caps along these lines, as has been done for mortgage loans for natural persons in the Netherlands.⁵⁹

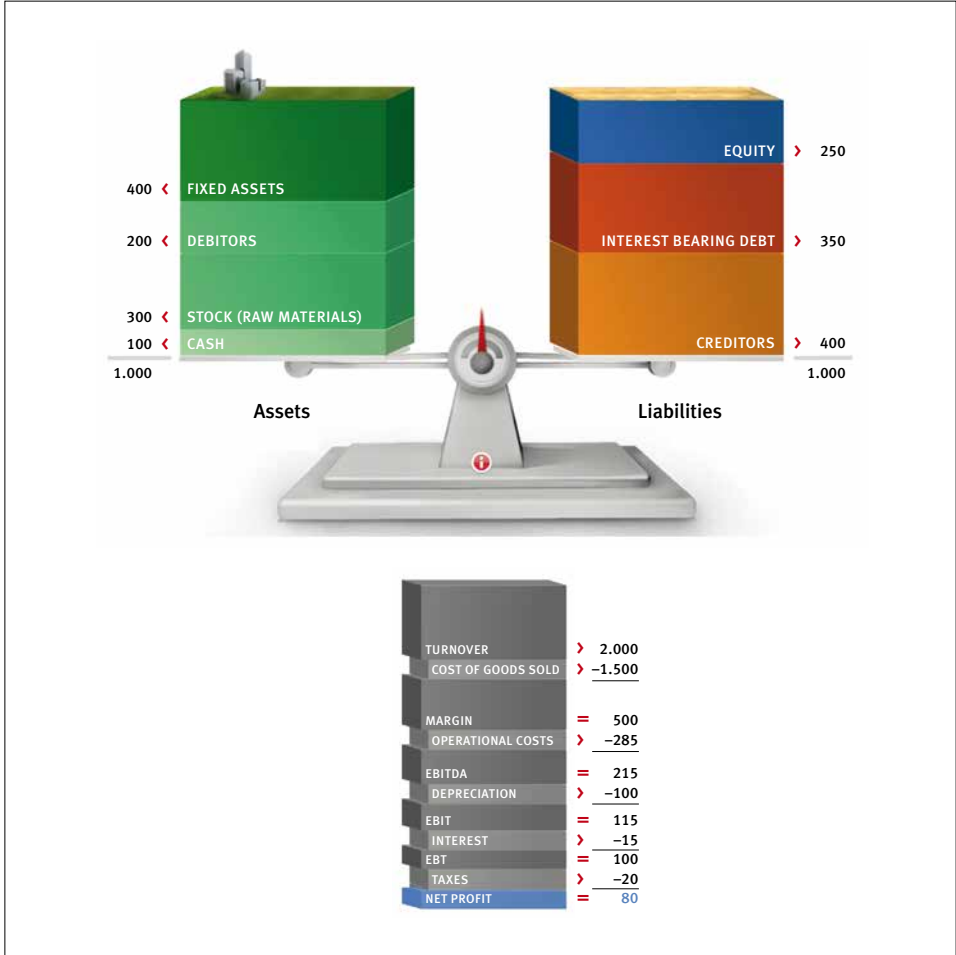
It is common to define leverage in a different way, namely in terms of Net Debt/

⁵⁹ For the leverage cap developed as a maximum loan-to-value for natural persons, see Van Bekkum, Gabarro, Irani and Peydro (2019).

EBITDA. In this measure, the size of the interest bearing debt is not assessed in relation to balance sheet total or the value of the assets, but in relation to the earning capacity of the company and therefore in relation to the profit and loss account.

The metric of Net Debt/EBITDA basically provides a measure of the earning capacity of the company to meet the obligations under the Interest Bearing Debt. It measures how much Interest Bearing Debt minus Cash a company has outstanding in relation to its EBITDA. Based on the following balance sheet and its related profit and loss account (see Figure 10), the Net Debt/EBITDA can easily be calculated.

Figure 10: Balance with Low Net Debt/EBITDA



The Net Debt is Interest Bearing Debt of 350 minus 100 in cash. EBITDA is 215. Therefore the Net Debt/EBITDA of this company is only 1.16, which is a relatively low number.

The rules of thumb as to normal Net Debt levels in the market are between 2.5-3.5 times the EBITDA.⁶⁰

The rule of thumb of 2.5-3.5 roughly translates to a number of years in which a loan can/must be paid back. With stable sales and investments equal to depreciation and a Net Debt/EBITDA ratio of 3, this financing can be repaid within approximately five years. In case a higher Net Debt/EBITDA-ratio than 3 is applied, it will become difficult for the company to repay the loans within 5 years without an increase in cash flow or without other efforts. If the excess is nevertheless financed with debt, the risk profile is generally higher.⁶¹

Two clarifying remarks as to Net Debt/EBITDA will be made (mainly for lawyers). The first relates to concept of EBITDA and why it has become so dominant within the world of Corporate Finance. The second relates to concept of Net Debt.

EBITDA stands for *Earnings Before Interest Taxes, Depreciation and Amortization*. It is also sometimes used to refer to the gross operating profit. In practice, the concept of EBITDA is often used to quantify the internally generated profits. EBITDA has developed into a central finance concept. It plays a role in financial oversight⁶² and is a basic concept of tax deductibility under tax law.⁶³ For corporate finance purposes, EBITDA can play a central role in company valuation as the basis for an EBITDA-multiple valuation to calculate the Enterprise Value. For the analyses at hand, it is however most relevant that the concept of EBITDA is used to determine how much debt the company can realistically payback, or more euphemistically how much debt a company can 'service'.⁶⁴

The concept Net Debt refers to the total amount of Interest Bearing Debt minus

60 See also the US Federal Reserve, 'Interagency Guidance on Leveraged Finance (2013)', where it seeks to delineate the scope of leveraged finance, (p 4). The US Guidance provides the following: "For example, numerous definitions of leveraged lending exist throughout the financial services industry and commonly contain some combination of the following: [...] Transactions where the borrower's Total Debt divided by EBITDA (earnings before interest, taxes, depreciation, and amortization) or Senior Debt divided by EBITDA exceed 4.0X EBITDA or 3.0X EBITDA, respectively, or other defined levels appropriate to the industry or sector." In a footnote it is added, however, that "Cash should not be netted against debt for purposes of this calculation."

61 See De Vries and De Weijs, 2020, p. 71.

62 See further below the ECB guidance on leveraged finance.

63 See the Anti-Tax Avoidance Directive, where it provides the following as to the maximum amount of interest to be deducted: "Exceeding borrowing costs shall be deductible in the tax period in which they are incurred only up to 30 percent of the taxpayer's earnings before interest, tax, depreciation and amortization (EBITDA)."

64 See for the varieties in US contracting practice as to actually defining EBITDA Badawi and De Fontenay (2019): "We use supervised learning of income definitions in thousands of credit agreements to show that there is, indeed, massive variation in the definition of EBITDA and that a substantial proportion of these agreements inflate EBITDA by adding back income."

Cash.⁶⁵ The concept of Net Debt figures most prominently within company valuation. In determining the actual purchase price for a company to be paid to the old shareholder, the Equity Value is usually calculated. In order to do so, first an assessment is made of the Enterprise Value, which is basically the value of the company under the assumption that there is no cash and there are no outstanding interest bearing debts (in short ‘cash and debt free’). In order to get from the Enterprise Value to Equity Value the Net Debt⁶⁶ is subtracted from the Enterprise Value.⁶⁷

The same two concepts of Net Debt and EBITDA, which feature prominently within company valuation, can also be related to each other in a different way in order to gauge the leverage of a company. As can be seen in the graph above as to the development of leverage in the US LBO market, leverage in market terms is commonly defined in terms of Net Debt/EBITDA.

In order to curb increasing leverage, the ECB has issued its Guidance on leveraged finance.⁶⁸ The ECB document contains instructions for significant credit institutions on implementing reporting and governance structures in their organization so as to properly assess and control risks related to leveraged finance.⁶⁹ In line with the supervisory role of the ECB, but still notable, the Guidance does not in any way seek to protect unsecured creditors against the risks of over-leveraging. It only seeks to prevent secured creditors (the financial institutions) from overstretching themselves in an era of very low interest rates, with the ensuing search for yield strategies and their expo-

65 The most interesting question is why non-interest bearing debt is not deducted from the Enterprise Value. In short, the investor calculates what the company will generate in the future for the shareholder. To this end the investor will first need to make an analysis of how much income is generated per year in total. The investor will then deduct how much interest and repayments of debts need to be made to creditors. It will be clear that as far as creditors provide non-interest bearing credit, that no interest payments will be made to these specific creditors. What is more, however, is that there will typically be a steady amount of outstanding debt, basically for the entire relevant future. Taken from De Vries and De Weijs, 2020, chapter 3.

66 See more extensively De Vries and De Weijs, chapter 3, 2020.

67 There are different valuation methods, most notably EBITDA multiples and Discounted Cash flow valuation. If an EBITDA multiple of 5 is applied, one can immediately calculate both the Enterprise and the Equity Value. If the EBITDA of €215 is multiplied by a factor of 5, then the outcome is an Enterprise Value of €1075. From the balance sheet, the Net Debt-position can be calculated. The Net Debt in the case at hand is €250. This can be calculated by taking the total amount of outstanding interest bearing debt of €350 and deducting cash being a €100 therefrom. If from the Enterprise Value of €1075 Net Debt of €250 is deducted, then the remaining is the Equity Value of €825. (Taken from De Vries and de Weijs, chapter 3, 2020).

68 See Federal Reserve System, Interagency Guidance on Leveraged Lending (2013). The 2013 Guidance in the US replaced the earlier version from 2001.

69 See ECB Guidance under 3: “*Credit institutions should have in place, as part of their internal policies, a single and overarching definition of leveraged transactions. This definition would encompass all business units and geographical areas so as to enable the institution’s senior management to have a comprehensive overview of the institution’s leveraged activities.*”

sure to leveraged finance.⁷⁰ It is a guidance issued by the ECB. Therefore, there are no clearly identified sanctions for non-compliance. The most interesting element of the Guidance for the analyses at hand, can be found in the definition of leveraged finance.⁷¹

“As part of its internal definition and subject to the exclusions detailed below, the credit institution is expected to consider as a leveraged transaction any transaction that meets at least one of the conditions below:

1. *all types of loan or credit exposure⁷², where the borrower’s post-financing level of leverage exceeds a Total Debt⁷³ to EBITDA⁷⁴ ratio of 4.0 times⁷⁵,*
 2. *all types of loan or credit exposures where the borrower is owned [...] by one or more financial sponsors.⁷⁶*
- [...]”

70 See ECB Guidance, p. 1: *“The prolonged period of very low interest rates and the ensuing search for yield strategies have warranted specific monitoring of credit quality by the European Central Bank (ECB) in general and of leveraged finance exposures in particular. In connection with this a number of credit institutions in different jurisdictions across the euro area were surveyed in 2015 to capture their involvement in leveraged finance activities. The outcome of the survey highlights that globally leveraged finance markets have experienced a strong recovery since the crisis and are characterized by fierce competition. Both the appetite to underwrite a transaction and the propensity to retain parts of the exposure have grown among the significant credit institutions supervised by the ECB. Borrower-friendly conditions have further translated into a weakening of deal structures (increased leverage levels, import of “covenant-lite” structures into European markets) and in many cases have led to greater leniency in credit institutions’ credit policies.”*

71 See Euromoney’s critical article on the ECB guidance (2017) for being over encompassing and for including CAPEX facilities.

72 Irrespective of the classification in the regulatory banking book or regulatory trading book. For the purpose of this guidance, exposure refers to all gross direct commitments to a leveraged borrower, including drawn and undrawn facilities, term loans, bridge loans or revolving credit facilities, committed exposures not yet syndicated or distributed, and exposures being warehoused for a later sale.

73 The term “Total Debt” refers to total committed debt (including drawn and undrawn debt) and any additional debt that loan agreements may permit. Committed undrawn liquidity facilities, according to the Basel Committee on Banking Supervision’s Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools (BCBS 238), are excluded. Cash should not be netted against debt. For the purpose of leverage multiple, when calculated at transaction origination, the pro forma financial statements of the resulting company after the transaction has taken place should be considered.

74 EBITDA refers to earnings before interest, tax, depreciation and amortization. Any enhancements to EBITDA should be duly justified and reviewed by a function independent of the front office function.

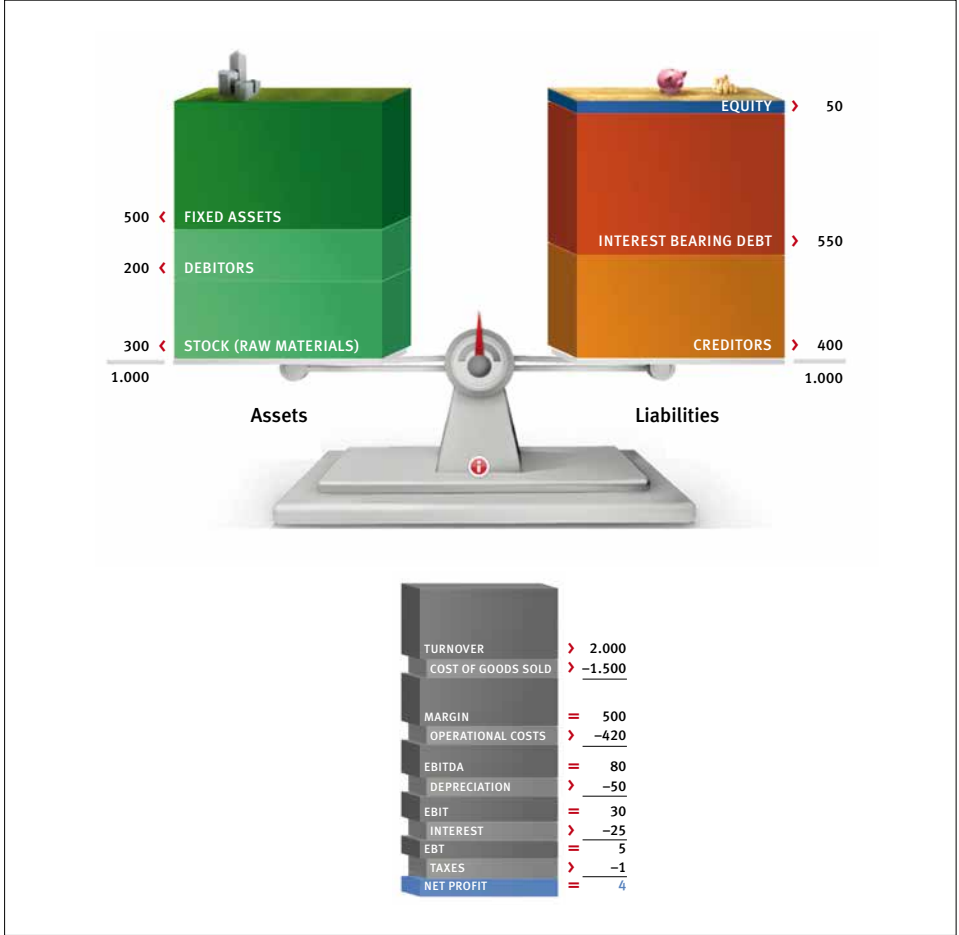
75 The designation of a financing as a “leveraged transaction” is made at loan origination, modification or refinancing. The leverage multiple should be calculated at the consolidated borrower level, unless group support cannot be assumed in case the borrowing entity is experiencing financial difficulties. Any deviation from the calculation at consolidated level should be justified and documented on a case-by-case basis.

76 The term “financial sponsor” refers to an investment firm that undertakes private equity investments in and/or leveraged buyouts of companies with the intention of exiting those investments on a medium-term basis.

1.5.2 The Working of a Leverage Cap

Following up on the ECB guidance, one can start to develop an alternative private law system to prevent overleverage. Of course there are many details to be discussed, but a basic rule could provide that a bank can only have a valid security right up to a maximum level of leverage. One could provide that a bank extending credit can only be secured up to say 5 times Net Debt/EBITDA at the time of extending credit. If the bank were to engage in excessive lending, the leverage cap would prevent the bank from being a secured creditor, assuming that the bank would finance the following capital structure in relation to the profit and loss account. In the example in Figure 11, in this case, the Net Debt/EBITDA ratio would be 6.85 (550/80), which would be above the limit the bank would be allowed to be secured.

Figure 11: Balance with High Net Debt/EBITDA



For an adequate provision of a leverage cap rule, many questions would need to be answered. Such questions would in part be strongly corporate finance oriented and in part more legal in nature. As far as the corporate finance elements are concerned, the question arises how to formulate the leverage cap. Do we allow for the deduction of Cash in order to get to Net Debt, notwithstanding its fleeting nature? Would it be a general leverage cap and include non-interest bearing debt or would it exclude non-interest bearing?⁷⁷ If we do not include non-interest bearing debt, do we include all outstanding interest bearing debt or do we only include interest bearing debt actually provided by the bank holding the security rights? And if we apply a cap formulated as a maximum in EBITDA multiple, how do we approach EBITDA? Do we allow for normalizations? Yet another possible strategy could be to look at the Net Interest/EBITDA ratio, in which case the actual interest rate paid is also taken into account.⁷⁸

The most important legal question is what the effects would be if a bank lends in excess of the prescribed Net Debt/EBITDA.⁷⁹ Take the example of a leverage cap of Net Debt/EBITDA of 5. What would be the effect if the bank would lend 6 times EBITDA? Would it lose all security rights related to this transaction, or only the excess amount of the loan exceeding the 5 times EBITDA?⁸⁰ The former may have a stronger subduing effect on leverage, but also increases uncertainty as the whole transaction can be at risk for the bank. An immediate follow up question would be what the scope of the effects would be. Would the rule only target the source, or would it also have consequences for the money flowing from that source? Are the dividend payments left untouched, or would a rule provide that basically the entire LBO should be reviewed as one transaction disqualifying not only the security rights but also the upstream payments?⁸¹ The bank would lose its security rights (at least to a certain extent), but would see the pool of available funds increase by repayments by parties that actually received the money.

Another question is whether to apply the rule generally or only to transactions that purely increase leverage without directly facilitating investments. The problem with a general Net Debt/EBITDA leverage cap would be that any form of secured finance

77 It would make sense to somehow include the amount of outstanding non-interest bearing debt (orange block) by letting it weigh in. These are also the creditors that suffer directly from externalization of risk and these are also the creditors that will be hurt the most in case of insolvency of the company. One could simply include non-interest bearing debt in the overall leverage assessment. A more sophisticated way is to analyze to what extent the orange block has been 'stretched', in the sense that the company is using long payment terms in relation to its suppliers and is engaging in aggressive working capital management.

78 See for this approach extensively Kuil (2020).

79 See for a fully developed set of rules Peelen (2019).

80 We assume here that the bank would be left with an unsecured claim to the extent that it could not invoke security rights to cover its claim.

81 Peelen, 2019, p. 35 takes inspiration from the American approach based on fraudulent transfer law and argues for voidability of the financial assistance framework in full by aggregating a large part of the total LBO transaction. This framework comprises both the loan agreement, including any security rights and guarantees, and any upstream payments made by the target company such as dividends, upstream loans and share repurchases.

for companies with a negative EBITDA becomes impossible, which could be a serious problem for example for rescue finance. Also in project finance, leverage can be high and EBITDA negative.⁸² Credit extended to facilitate the company to invest, such as project finance, and rescue finance are however not particularly problematic (at least not from the perspective discussed in this paper) and could be kept outside the scope of the rule providing for a leverage cap. The right approach might therefore be a rule providing that lending in excess of 5 times Net Debt/EBITDA cannot be secured, unless the financier can show the lending would directly lead to new investment or should be considered as finance allowing the company to continue to operate.

1.6 COMPARISON OF STRENGTHS AND WEAKNESSES OF THREE STRATEGIES

The three strategies come with their own strengths and weaknesses. Although they are not mutually exclusive and can be applied in different combinations, it merits to highlight their individual characteristics.

In the past, financial assistance bans have been designed to counter the use of security rights for leveraged finance, in an however limited context of take overs. A reintroduction and extension of financial assistance rules could be instrumental in recalibrating secured lending. As far as Dutch law is concerned, this would mean that not only security rights granted to a bank for a third party debt related to a takeover should be targeted, but also a company attracting secured credit itself followed by upstream loans or upstreaming by means of dividends.

One could argue that there are two main weaknesses to the financial assistance rule. The first is that financial rules are under-encompassing because rules on financial assistance could be circumvented also in case one would cover on-lending. An old shareholder could have the company take on secured credit to make a dividend payment prior to the take-over. This strategy is euphemistically referred to as ‘making the company light for take over’. One could also argue that the rule is over-encompassing since it targets all versions of financial assistance regardless of the actual level of leverage. A plea against financial assistance often invokes the argument that it also limits take overs within a family, with an exit of some entitled family members. There is for example no distinction under financial assistance rules between a secured LBO loan of 2.5 times EBITDA and an LBO loan of 8 times EBITDA.

The rules providing a deviation from full priority to partial priority have been primarily designed to address inefficiencies that can result from secured credit. Bebchuk and Fried (1996) argued that the fact that security interests may be used to transfer value from non-adjusting creditors under a full-priority rule means that security interests may be used even when they give rise to inefficiencies. The inefficien-

82 See on project finance extensively Pinto (2017).

cies⁸³ Bebhuk and Fried (1996) point out are at the level of individual companies (micro-economics), but do include lack of precaution and a failure by lenders to appropriately control or at least monitor the company's behavior. The measure was not designed with the problem of excessive leverage in general in mind. This does not disqualify partial priority rules from playing an important (or even central) role in also addressing overall lending trends. If the bank does appropriately incorporate default risks, one should expect a partial priority rule to have a dampening effect on excessive lending. One could also expect that banks would attribute more weight to the overall default risk of the borrower and attribute relatively less weight to the Loan-to-Value. One should, however, wonder whether a partial priority rule would provide a strong incentive in the world of highly leveraged finance, especially in the current low interest environment. If a bank is willing to lend 550 against an EBITDA of 80 (see Figure 11), it realizes that it is engaging in leveraged finance. Whether the worst case outcome is 350 or 280, the difference of a loss of 36% or 49% on its loan, might not be decisive. It is exactly the general overstretching and limited risk sensitivity that is the underlying concern, also leading to the ECB Guidance on Leveraged Finance. That large risks are taken for granted in the current market is further exemplified by the increase of covenant-lite loans.

A leverage cap on the maximum of secured debt, is a more targeted measure than both financial assistance bans and partial priority rules. It addresses excessive leverage directly and exclusively and is less dependent on the structure. It would target both LBOs and Dividend Recaps. A leverage cap could be limited to pure leverage increasing transactions and leave loans for direct investments by the company itself or rescue finance out of the scope.

Leverage caps would however suffer from the inherent weakness of a legal rule trying to strike a perfect balance from a finance perspective and therefore incorporating non legal concepts. A leverage cap as presented here relies on a rather sophisticated economic application of Net Debt/EBITDA. That makes such caps a precision instrument, but also highly complex and costly to apply and this will in practice probably vastly increase legal uncertainty. As already discussed, many difficult questions will be faced in the design of the rule (Include non-interest bearing debt? How to deal with debt and debt-like items? Exclude Cash? How to capture EBITDA?). Although depending on the exact design of the rules, circumvention may also be possible. Net Debt/EBITDA could be temporarily lowered by artificial means in order to clear a new large loan. EBITDA can be inflated, as the common practice of 'add

83 They discuss at great length five inefficiencies which are likely to follow from full priority (Bebchuk and Fried 1996, p. 44-54). They put forth the argument that the rule of providing full priority to secured claims may i) cause the use of inefficient security interests, ii) distort the choice between the use of security interests and covenants in loan contracts, iii) distort a firm's investment and precaution decisions, iv) lead to a suboptimal use of covenants and iv) reduce the incentive of secured creditors to appropriately control their borrowers' behavior.

backs' shows.⁸⁴ These questions are likely to keep surfacing in the actual application of such rules.

There is also a risk for the legal system on a different level if the law tries to achieve a perfect balance from a finance perspective. The law is a normative instrument trying to set coherent rules for society. The law has great difficulties in regulating the world of finance and to set meaningful boundaries for an increasingly financialized world also because lawyers are mostly not experts in finance. A legal framework providing for very nuanced rules using the concepts of finance, might weaken the robustness of the legal framework and undermine its normative force if lawyers would no longer be able to apply the law without outside expert input. One can debate whether it is desirable that law students can graduate without knowledge of corporate finance. One should however also be careful to design rules that have little meaning for lawyers not being fluent (or at least at a conversational level) in the language of finance. Where the world of finance has become a very complex world, one should not lose sight of the fact that it also affects persons outside of that world. The law should provide a meaningful check on externalization of risk and the law itself should remain sufficiently easy to understand, so that its working and application remain subject to democratic control itself.⁸⁵

These are inherent problems to translating sophisticated economic measures into legal rules. The rules need to factor in economic insights, but ideally their application should not rest on intricate economic analysis that judges are not in a position to make. Rules should be clear cut to provide legal certainty and lower transaction costs (less advice from lawyers and accountants needed). The idea of a leverage cap shows what the rules should aim for, but providing a clear-cut rule that can be applied with certainty is difficult. From a legal certainty and transaction cost perspective, a partial priority rule could prove to be more attractive.

At the same time, both financial assistance rules and partial priority rules suffer from weaknesses in addressing the problems related to overleverage in the economy, mainly being under- and over-encompassing in comparison to a more precise leverage cap. We therefore suggest leverage caps could be considered as a targeted measure and ask the finance community to take up the challenge of coming up with a clear, workable and understandable rule, preventing excessive leverage while still allowing for investments and working capital finance.

84 See Wigglesworth, 2019, discussing so called “add-backs” that inflate the EBITDA. According to this news source, the average EBITDA multiple in acquisitions at the time was around 5.7, but increases to around 7.4 if add-backs are excluded. See further Badawi and De Fontenay (2019).

85 See for the risk of overly complicated rules trying to get it right from a finance perspective in the setting of leverage, but then as the leverage applied to financial institutions, Myerson (2013): “*Bank regulation is obviously a complex technical matter, and we need to rely on specialists for the tasks of daily monitoring and stress tests in a crisis. But if nobody outside the elite circles of finance can recognize a failure of appropriate regulation, then such failures should be considered inevitable.*”

1.7 CONCLUSIONS

Pleas in favor of limitations to finance, are often countered by the argument that if we meddle with the levers of finance, we will disrupt the availability of finance. We are, however, living in an era where there is not a lack of finance, but an abundance. The problem is not a lack of finance, but a lack of investment opportunities for the private sector.⁸⁶ High leverage structures are rife and legal rules pose very few boundaries on such structures. The IMF (2016) has called for a global deleveraging of the economy. In this preliminary study, we have taken up the challenge to formulate rules that would subdue the incentive to create high leverage structures. Given the current mostly *ex post* regulation of high leverage structures and the fact that leverage remains high, our intuition has been to look at measures that work *ex ante* and target leverage at its source, namely the place where the money comes from: the lender, more precisely the security rights that protect the lender in case of default.

Security rights at their best allow for investments. This is also the strongest and most common justification for security rights. At the same time, secured credit is often used not make investments but to facilitate divestments by extracting money from the company in order to make payments to shareholders. Notable examples hereof are LBOs and Dividend Recaps.

In this preliminary study, three different strategies have been presented that could arguably provide a meaningful break on leverage. These three strategies are: i) reintroduce and enforce financial assistance prohibition, ii) introduce partial priority and iii) introduce general leverage caps in terms of Net Debt/EBITDA for secured lending. Implementation would limit not only uncompensated wealth transfers from non-adjusting creditors to shareholders, but would also limit excessive leverage with its related costs and risks directly. There is less of a direct trade-off to be made, if a rule could be designed that targets leveraged finance directly while allowing room for lending leading to investments and other types of lending conducive to the operation of the company, most notable working capital facilities and also distress finance.

If a very precise rule could be formulated using the language of the world of corporate finance, a trade-off presents itself at a higher level, namely to what extent

86 See on the interplay of (non)growth, credit available, prices and inflation, Perotti (2016). Seemingly at odds with the overall argument made here, he finds the following: “*In rich countries, corporate investment rates have been falling for decades, and there has been a steady drop in the external financing needed by firms. In most OECD countries, including Japan, Canada, UK, France and Germany, firms have become net lenders to the rest of the economy. Exceptions are countries in the distressed EU periphery, where the net financial position of firms has weakened.*” In reaction to Perotti. There are indeed large corporate groups with negative Net Debt levels, where the cash held is larger than outstanding interest bearing debt, also leading to a situation where the Equity Value of a company is higher than the Enterprise Value. (See for examples De Vries and De Weijs, chapter 3, 2020). Given the global debt levels, we believe the correct analysis requires a break down and would lead to the analysis that the debt problem in other sectors is much bigger than can be derived from aggregate numbers.

we want to move into the direction of formulating legal rules that require a strong background in both law and finance.

The strategies presented are not ground breaking. There is a very long tradition of private law rules limiting the use of security rights as part of pure leveraged lending in Buy Out structures. The bans on financial assistance have however largely been repealed for various reasons. The problems related to a steady increase in leverage, potentially leading to a next crisis, are however serious enough to consider ways to prevent the pattern from repeating.

REFERENCES

- Arcand, J.L., E. Berkes and U. Panizza (2012). Too much Finance, IMF Working Paper, WP/12/161.
- Armour, J., G. Hertig and H. Kanda (2017). Transactions with Creditors (Chapter 5), in *The Anatomy of Corporate Law. A Comparative and Functional Approach* (R. Kraakman et al., Eds.), Oxford: Oxford University Press, third edition.
- Badawi, A. and E. de Fontenay (2019). Contractual Complexity in Debt Agreements: The Case of EBITDA, *Duke Law School Public Law & Legal Theory Series No. 2019-67*. Available at SSRN: <https://ssrn.com/abstract=3455497> or <http://dx.doi.org/10.2139/ssrn.3455497>.
- Bain & Company (2020). Global Private Equity Report 2020.
- Barneveld, J. (2014). Financiering en vermogensonttrekking door aandeelhouders: een studie naar de grenzen aan de financieringsvrijheid van aandeelhouders in besloten verhoudingen naar Amerikaans, Duits en Nederlands recht, (Dissertation Universiteit van Amsterdam), Deventer: Kluwer.
- Barneveld, J. (2016). Strengere regels voor private equity? De initiatiefnota van Nijboer en Groot in ondernemingsrechtelijk perspectief, *Ondernemingsrecht 2016*, nr. 17.
- Bebchuk, L.A. and J. Fried (1996). The Uneasy Case for the for the Priority of Secured Claims in Bankruptcy, Harvard Law and Economics Discussion paper 166, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=417960.
- Bebchuk, L.A. and J. Fried (1997). The Uneasy Case for the Priority of Secured Claims in Bankruptcy: Further Thoughts and a Reply to Critics, *Cornell Law Review*, 82 (6), pp.1279-1348.
- Beckers, J.H.L. (2014). Art. 2:207c is vervallen - leve de steunverlening?, *Maandblad voor Vermogensrecht 2014/5*.
- Bergström, C., T. Eisenberg and S. Sundgren (2004). On the Design of Efficient Priority Rules for Secured Creditors: Empirical Evidence from A Change in Law, *European Journal of Law and Economics*, 18, pp. 273-297.
- Cecchetti, S.G. and E. Kharroubi (2012). Reassessing the Impact of Finance on Growth, BIS Working Papers, no 381.
- De Vries, J.A. and R.J. De Weijs (2020). Corporate Finance en Ondernemingswaardering, in *Grenzen aan financieringsvrijheid* (R.J. de Weijs, ed.), Deventer: Kluwer.
- De Weijs, R.J. (2018). Secured Credit and Partial Priority: Corporate Finance as a Creation or an Externalisation Practice?, *European Property Law Journal*, 7 (1), pp. 63-107.
- D'Onfro, D. (2018). Limited Liability Property, *Cardozo Law Review*, 39 (4), pp. 1365-1428.

- Drukarczyk, J. (1991). Secured Debt, Bankruptcy, and the Creditors' Bargain Model, *International Review of Law and Economics*, 11 (2), pp.203-221.
- Communication 2015/468 from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (30 September 2015). Action Plan on Building a Capital Markets Union.
- Gilligan, J. and M. Wright (2014). *Private Equity Demystified. An Explanatory Guide*, London: IACEW.
- Hoge Raad (2004). Dutch Supreme Court 7 May 2004, NJ 2004/360 (Muller q.q./Rabobank)
- European Central Bank (2017). Guidance on leveraged transactions.
- Enriques, L. and J.R. Macey (2001). Creditors versus Capital Formation: The Case against the European Capital Rules, *Cornell Law Review*, 86 (6), pp.1165-1204.
- Enriques, L. (2006). EC Company Law Directives and Regulations: How Trivial Are They?, *University of Pennsylvania Journal of International Economic Law*, 27 (1), pp.1-78.
- Euromoney (1 August 2017). ECB botches leveraged finance guidelines. Available via <https://www.euromoney.com/article/b143rphong4yjg/ecb-botches-leveraged-finance-guidelines>.
- Ferran, E. (2004). Corporate Transactions and Financial Assistance: Shifting Policy But Static Law, *Cambridge Law Journal*, 63 (1), pp. 225-243.
- Ferran, E. (2007). Regulation of Private Equity – Backed Leveraged Buyout Activity in Europe, ECGI Law Working Paper No 84/007.
- Ferran, E. and L.C. Ho (2014). *Principles of Corporate Finance Law*, Oxford: Oxford University Press.
- Fluit, R. (2017). Onttrekkingen door aandeelhouders en de (niet benijdenswaardige) rol van het bestuur, *Onderneming en Financiering*, aflevering 2.
- Ginsberg, J.H., M. Burgess, D.R. Czerwonka and Z.R. Caldwell (2011). Befuddlement Betwixt Two Fulcrums: Calibrating the Scales of Justice to Ascertain Fraudulent Transfers in Leveraged Buyouts, *American Bankruptcy Institute Law Review*, pp. 71-112.
- Goode, R. (2011). *Principles of Corporate Insolvency Law*, Londen: Sweet & Maxwell.
- Hooft, K. (2011). The Financial Assistance Prohibition: Origins, Evolution, and Future, *European Company Law*, 8 (4), pp. 157-160.
- International Monetary Fund (2016). Fiscal Monitor.
- Jonkers, A.L. (2016). Het is tijd voor wat minder zekerheid, *Ins Updates*.
- King, B.W. (2007). Past its Prime. Financial Assistance is an Old Idea Whose Time Has Passed, *International Financial Law Review*, 26 (9), pp. 28-30.
- Kuhner, C. (2006). The Future of Creditor Protection through Capital Maintenance Rules in European Company Law – An Economic Perspective, *European Company and Financial Review*, Special Volume 1, pp. 341-364.
- Kuil, N. (2020). De Leveraged Buy Out, Over risicoafwenteling op en compensatie voor ongesecureerde crediteuren, final thesis UvA.

- Lahart, J. (28 February 2016). Share Buybacks: The Bill Is Coming Due, *Wall Street Journal*.
- Ligterink, J.E., J.K. Martin and A.W.A. Boot (2017). Zorgt private equity voor waardecreatie?, *Maandblad voor Accountancy en Bedrijfseconomie*, 91 (7/8), pp. 236-243.
- Ligterink, J.E., J.K. Martin, A.W.A. Boot, K. Cools and Phalippou (2017). Private Equity in Nederland: een stakeholders-perspectief. Available via <https://www.rijksoverheid.nl/documenten/kamerstukken/2017/04/13/bijlage-private-equity-in-nederland-een-stakeholder-perspectief>
- McCormack, G. (2004). *Secured Credit under English and American Law*, Cambridge: Cambridge University Press.
- Miller, M. (1988). The Modigliani-Miller Propositions after Thirty Years, *Journal of Economic Perspectives* 1988, 2 (4), pp. 99-120.
- Mission Statement of the ACCF (2020). Available via: https://www.accf.nl/7/publication_series.html
- Myerson, R.B. (2013). *Rethinking the principles of Bank Regulation: A review of Admati and Hellwig's Bankers' New Clothes*, December 2013, <http://home.uchicago.edu/~rmyerson/research/newcloth.pdf>.
- Peelen, W. (2019). Revising the Dutch Financial Assistance Prohibition: a Legal Proposal to Restrain the Negative Externalities of Leveraged Buyouts, final thesis UvA.
- Perotti, E. (16 December 2016). Public Policy in a Zero-Growth Scenario, *Vox EU*. Available via: <https://voxeu.org/article/public-policy-zero-growth-scenario>
- Philips, J.S. and T.J. Hope (2012). *The Comeback of the Dividend Recap*.
- Pinto, J.M. (2017). What is Project Finance?, *Investment Management and Financial Innovations*, 14 (1), pp. 200-2010.
- Schwartz, A. (1984). The Continuing Puzzle of Secured Debt, Faculty Scholarship Series, paper 1120.
- Tappe, A. (14 January 2020). The World is Drowning in Debt, CNN Business. Available via: <https://edition.cnn.com/2020/01/13/economy/global-debt-record/index.html>).
- United Nations Commission on International Trade Law - UNCITRAL (2010). Legislative Guide on Secured Transactions.
- US Guidance (2013). Interagency Guidance on Leveraged Finance.
- Van Bekkum, S., M. Gabarro, R.M. Irani and J-L Peydro (2019). Take It to the Limit? The Effects of Household Leverage Caps. Available at: <https://ssrn.com/abstract=3284670> or <http://dx.doi.org/10.2139/ssrn.3284670>.
- Warren, E.A. (1997). Making Policy with Imperfect Information: The Article 9 Full Priority Debates, *Cornell Law Review*, 82 (6), pp. 1373-1396.
- Wigglesworth, R. (4 July 2019). Why Parts of Wall Street are Fretting over 'Toxic' Loans, *Financial Times*. Available via: <https://www.ft.com/content/a7c25d6a-9b79-11e9-9c06-a4640c9feebb>.

2 FINTECH: WHAT'S OLD, WHAT'S NEW?¹

Arnoud Boot, Peter Hoffmann, Luc Laeven and Lev Ratnovski

2.1 INTRODUCTION

The past decade has presented massive challenges to financial institutions, including the great financial crisis, regulatory reform, low profitability, and deteriorating public trust. Against this background, technological change in the financial industry is accelerating. The ongoing COVID-19 crisis, which has increased demand for digital services, is if anything speeding up this process. Incumbents face disruption from innovative start-ups and large technology firms. This raises a number of important issues. What are the key dimensions of innovation in the provision of financial services? Are they genuinely new developments, or rather the continuation of past trends? How will banks respond? What are the regulatory challenges associated with these developments? Answering these questions is crucial for anticipating future changes in the financial system, and distilling public policy priorities.

In this paper, we develop a simple conceptual framework that distinguishes between two key dimensions of financial innovation: information (data collection and processing) and communication (relationships and distribution). We argue that both are essential ingredients in the financial intermediation process, and allow incumbent banks to exert market power through informational and spatial capture. Both are affected by technological change. We identify the proliferation of hard information and the shift away from in-person interactions as long-standing developments in information and communication, respectively. The existing literature offers useful insights that remain valid in an environment where those forces are accelerating.

We contrast the continuation of past trends with more novel developments, such as the rise of machine learning and artificial intelligence enabled by an abundance of (non-financial) data, and the dominance of digital platforms and smartphones. These

¹ This discussion paper updates CEPR Policy paper 15004 (July 6, 2020) and ECB Working paper 2438 (July, 10, 2020). The views expressed are those of the authors and do not necessarily reflect those of the European Central Bank or the Eurosystem. We thank Iftekhar Hasan (the editor of the *Journal of Financial Stability*), two anonymous referees, Thorsten Beck, Andreas Beyer, Jean-Edouard Colliard, Florian Heider, Gerard Hertig, Simone Manganelli, Alberto Martin, Steven Ongena, Glenn Schepens, Maurits de Vries Robles-Kroon, as well as audiences at the ECB, ESCP Paris, ETH Zurich, and the ADB-NUS conference on Fintech for useful comments and suggestions. Anna Stelzer provided valuable research assistance.

new developments constitute a substantial disruption to financial services. Novel communication channels enable specialized providers to side-step banks' distribution networks and offer financial services that do not require access to a balance sheet (i.e. do not involve credit risk taking or maturity transformation), for example in the areas of payments and wealth management. At the same time, digital platforms can interject themselves between banks and their customers, introducing another layer of intermediation that captures most rents.

We then discuss how banks may respond to these disruptions. Naturally, they can attempt to stave off the competitive pressures from platforms and specialized entrants by investing into the digitalization of their own business processes. However, such transformation tends to face significant hurdles in terms of costs, entrenched organizational cultures, and reputational risks. Less ambitious banks will try to keep pace by acquiring expertise from Fintech firms, while the more ambitious ones may aim to develop their own platform-based ecosystems.

There are some barriers to entry for specialized service providers and digital platforms, including their lack of access to deposit funding and a focus on retail consumers. However, some of the factors may prove temporary. For example, a widespread adoption of cloud computing may enable large technology firms to create B2B ecosystems that include large corporate customers. This will likely create information and communication advantages that enable the provision of financial services to these clients as well.

Ultimately, technological progress may lead to the vertical and horizontal disintegration of the traditional bank business model. Specialized service providers can chip away services that do not rely on access to deposit funding, such as payments and asset management services. And digital platforms can become the new middlemen between banks and their customers (borrowers and depositors). In the extreme, this could relegate banks to upstream providers of maturity transformation services – engendering a fundamental transformation in the structure of the financial system.

We discuss a number of public policy priorities related to the impeding transformation of financial services provision. The most direct challenges are in the area of prudential policy, which will need to cope with a more pro-cyclical financial system. While the use of new data sources and analysis tools promises efficiency gains, they may be less transparent, and their performance is yet to be tested in crisis times. Cyber risk and regulatory arbitrage will be important risks to be monitored, and some non-financial firms (e.g. cloud providers and platforms) may become systemically important. Similarly, monetary policy strategies and implementation may need to adapt to a less bank-centric financial system. Regulators will also face challenges concerning the role of platforms as quasi-natural monopolies, the use and ownership of data, and the design of standards and public infrastructure associated with a data-driven financial landscape.

Our paper contributes to the literature on technological disruption in finance. Claessens et al. (2018) document the rise of Fintech lending across countries, while Thakor (2020) compares credit provision by banks and non-banks. The overview of

Vives (2019) highlights the competitive challenge from large technology firms and its impact on business strategies, whereas Petralia et al. (2019) and Stulz (2019) discuss the impact of Fintech and Bigtech on banking. Compared to this literature, our analysis focuses on articulating the key dimensions of financial innovation—information and communication—and on distinguishing pre-existing trends from genuinely new developments in each of these two dimensions. This helps us clarify the economic forces at play, identify the key challenges for banks, and refine the resulting policy implications.

The remainder of the paper proceeds as follows. Section 2.2 introduces our analytical framework and briefly discusses the roles of information and communication for financial services provision. Sections 2.3 and 2.4 discuss the effects of innovation in each of these fields, distinguishing between the continuation of past trends and genuinely new developments. Section 2.5 highlights the horizontal and vertical disintegration of the integrated bank business model as a major threat posed by recent innovation. We discuss the resulting policy implications in section 2.6, and conclude in section 2.7.

2.2 FINANCIAL INTERMEDIATION AND TECHNOLOGICAL PROGRESS

In this section, we develop a simple conceptual framework to guide our analysis. We argue that information and communication lie at the heart of financial intermediation, and are deeply affected by technology.

2.2.1 The Role of Information and Communication in Financial Intermediation

The function of the financial system is to transform savings into investment, which helps to ensure an efficient allocation of resources in the economy. Financial intermediaries focus on overcoming information (moral hazard and adverse selection) and communication (“match-making”) frictions that can hamper the efficient allocation of resources.

To resolve informational frictions, financial intermediaries screen and monitor risky investments on behalf of the savers who lack their own capacity to do so (Diamond, 1984, Ramakrishnan and Thakor, 1984). Banks commit to exerting effort by using their financial capital, or “skin in the game” (Hölmstrom and Tirole, 1997). Other financial intermediaries, such as ratings agencies, use their reputation to achieve similar commitment (Boot et al., 1993). Securities underwriters use both reputational and financial exposure to assure customers of the quality of their due diligence. Also, financial intermediaries tend to engage in repeated interactions with their customers. This facilitates the collection, processing, and re-use of customer information (Boot, 2000), and increases the efficiency of monitoring (Lopez-Espinoza et al., 2017).

To resolve communication frictions, financial intermediaries invest in the creation and maintenance of customer relationships and product distribution channels. Banks have historically leveraged upon their branch networks to act as customers’ “first

point of contact” for financial services. Other financial intermediaries such as brokers and exchanges specialize in communication to facilitate match-making among interested parties. While the role of communication in financial intermediation has received less attention in the literature historically, we argue that its importance for determining the industry structure of the financial sector has been growing, and may now eclipse that of information.

Superior information and communication enable financial intermediaries to exert market power. Private information generates informational capture as outside competitors face adverse selection (Rajan, 1992; Sharpe, 1990). Similarly, search, switching, and transportation costs lead to communication-related “spatial” capture, which allows banks to price discriminate among customers (Degryse and Ongena, 2005; Agarwal and Hauswald, 2010; Armstrong and Vickers, 2019), cross-sell additional financial services (Puri and Rocholl, 2008), and enjoy cheap and stable deposit funding (Drechsler et al., 2018).

Since information and communication frictions act as barriers to entry, they make financial services less contestable. At the same time, they permit financial intermediaries to generate charter value, which makes them more stable and forward-looking, and creates incentives for reputation-building (Hart, 1995; Boot et al., 1993). Furthermore, together with deposit insurance and other forms of regulation, it helps banks and other intermediaries to create and maintain customer trust (including customer comfort and loyalty; see Guiso et al., 2008; Thakor and Merton, 2018). The forward-looking nature of financial institutions also benefits customers and the economy as a whole. For example, banks tend to cushion credit terms for their long-term customers during downturns (Petersen and Rajan, 1995; Bolton et al., 2016), while the lower risk taking incentives of financial intermediaries reduce bank instability and systemic risk.

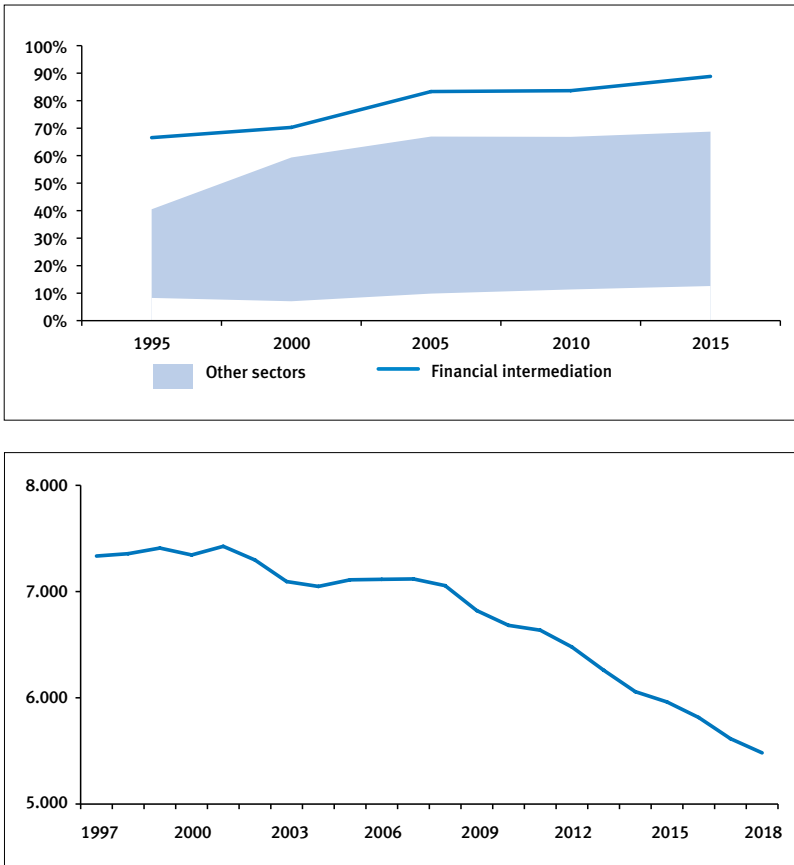
2.2.2 *Conceptual Framework*

Innovation in information and communication has been accelerating over the past decades, driven by growing computing power and the proliferation of the internet. While the underlying technological progress is affecting virtually all sectors of the economy, its effects on financial intermediation are particularly profound. This is illustrated by Figure 1. The left Panel is based on the European Working Conditions Survey, and shows that Financial Intermediation (blue line) dwarfs all other industries (range indicated by shaded area) in the use of personal computers. In 2015, 89% of all employees in financial intermediation made heavy use of personal computers in the EU-15 countries.² The right panel shows that the increase of automation has led to a steady decline in the number of employees in financial intermediation. Between 1997

² The EU-15 area countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

and 2018, the number of bank employees declined from 7,300 to 5,500 per million inhabitants in the EU-15, corresponding to a decline of roughly half a million jobs.

Figure 1: Computer Use and Employment in Financial Intermediation



Note. The upper Panel shows the share of employees that report using computer at work, across NACE-1 sectors. The blue line shows the share for Financial Intermediation, while the shaded grey area indicates the range for other sectors. Source: European Working Conditions Survey. The lower Panel shows the number of bank employees per million inhabitants. Source: ECB Statistical Data Warehouse. All data cover EU-15 countries.

The financial industry has already experienced many waves of technological innovation. Advances on the information side led to the rise of passive investing in the 1980s and to the credit scoring and securitization revolution in the 1990s. Similarly, innovations in communication included ATMs in the 1970s; telephone banking in the 1980s; attempted entry into banking by supermarket giants Walmart and Tesco in UK in the 1990s; and the increased use of online banking and retail electronic payments in the 2000s. While these innovations have been shifting the balance in the financial

system from banks towards markets and specialized players, the overall structure of the financial industry with banks at its core remained remarkably robust (Philippon 2015).³ In this paper, we argue that the ongoing changes are more fundamental than the previous ones, and may lead to deeper shifts in the financial industry structure.

To assess the implications of financial technology, we distinguish between the continuation of established trends (which may be accelerating) and genuinely new developments. To this end, we structure our discussion on the basis of the matrix depicted in Table 1. The first row summarizes the roles of information and communication in financial intermediation. The second and third rows indicate key technology-induced changes in each of those fields, distinguishing between what is old and what is new. Among the established trends, we highlight the proliferation of hard information and the change in financial sector communication from branch-based interaction to more distant links. Regarding new developments, the growth of the digital economy gives rise to new types of data, often non-financial in nature. The abundance of data in turn enables the use of big data analytics such as machine learning and artificial intelligence. Innovations in communication give rise to the dominance of digital platforms and mobile devices that take over an increasing share of customer communication.

Table 1: Technological Progress and Financial Intermediation

	Information	Communication
Role in financial intermediation	Collect and process data for screening and monitoring	Establish relationships and distribution networks
Established Trends	Codification of soft information	Move from in-person to distant (telephone and online) interactions
New developments	New types of (non-financial) data; Data abundance enables AI & machine learning	Low-cost search, matching, and distribution through digital platforms and mobile devices

2.3 INFORMATION INNOVATION: ESTABLISHED TRENDS AND NEW DEVELOPMENTS

Innovations in the collection and processing of information have several dimensions. One is codification, which describes the conversion of soft information into hard information that can be processed and transmitted (Liberti and Petersen, 2018).

3 Over twenty-five years ago, Boyd and Gertler (1994) asked “Are Banks Dead? Or Are the Reports Greatly Exaggerated?” and concluded that the role of banks had in fact not diminished. Banks were neither driven to irrelevance by the disruption caused by the Global Financial Crisis.

Another is the emergence of vast non-financial data on consumer choices and preferences. The scale of these new data enables the use of analytical tools such as machine learning and artificial intelligence (AI) to deliver new insights, including for financial decision-making (Athey and Imbens, 2019; Philippon, 2020). More generally, the diffusion of the internet and advances in computing have led to a massive increase in the overall availability of data, often at negligible cost.

2.3.1 Established Trends

Much of the recent surge in information-related innovation in the financial industry can be seen as a continuation of past developments at an accelerated pace. The IT revolution of the 1990s boosted the ability to create and use hard information in finance. This gave rise to securitization, helped the proliferation of financial markets, increased financial sector competition, and induced bank consolidation. A well-established literature discusses the effects of hard information on financial intermediation. While it highlights the benefits in terms of access to finance, it also stresses a “dark side” of greater reliance on hard information.

On the positive side, hard information enables borrowers to obtain credit in larger volumes and at better terms. Credit scoring and information sharing via credit registries alleviate information-related frictions between borrowers and lenders (Jappelli and Pagano, 1993), which especially benefits riskier and more opaque borrowers (Berger and Udell, 2007). Moreover, the ability to securitize and sell loans insulates borrowers from lender financial conditions (Loutskina and Strahan, 2009), and decreases the cost of credit (Jaffee and Rosen, 1990; Jappelli and Pagano, 2002). More generally, there is evidence that IT-adoption helps banks to select better borrowers and thus increases their resilience in crisis times (Pierri and Timmer, 2020).

Despite these positive effects, the existing literature also highlights a “dark side” of hard information. Its use can worsen borrowing conditions for customers for which hard information is more difficult or impossible to generate, such as SMEs (Petersen and Rajan, 1994; Berger et al. 2005) or young and innovative firms (Dell’Ariccia et al., 2020). Moreover, at the aggregate level, a financial system that relies on hard information can be more volatile. Banks that engage in soft information-based relationships with customers tend to smooth lending over the cycle, which helps to soften credit contractions in downturns (Allen and Gale, 1997; Bolton et al., 2016; Boot and Ratnovski, 2016; Beck et al., 2018). By contrast, hard information allows for the design of high-powered managerial contracts that can encourage financial sector risk-seeking and myopia (Rajan, 2006).

The nature of information also affects how collateral is used in credit markets. When lending is based on soft information, banks use collateral to alleviate asymmetric information and moral hazard problems (Cerqueiro et al., 2020). However, in the context of repeated customer interaction, the use of collateral may become less critical over time and is possibly substituted by reputation (Botsch and Vanasco, 2019; Boot

and Thakor, 1994).⁴ The use of collateral is more time-invariant in lending based on hard information, which lacks repeated interaction and reputation mechanisms. Whether lending based on soft or hard information uses more collateral is subject to debate. For example, whereas loans based on hard information are often secured by fixed assets such as land and structures, soft information-based loans may also use “movable” collateral that requires monitoring, such as inventories. Also, the more hands-off nature of hard information lending might go hand in hand with overcollateralization (Berger et al., 2019). At the same time, Gambacorta et al. (2020) suggest that high quality hard information can substitute for collateral.

Hard information also facilitates the creation of collateral through the securitization of debt claims, and thus supports the functioning of wholesale funding markets. In addition, securitization enables lenders to diversify or hedge risks, and increase their lending capacity. However, securitization also gives rise to new risks. For example, banks that target a certain risk profile can respond to these opportunities by weakening their lending standards (Keys et al., 2010; Loutskina and Strahan, 2011). Also, securitization has historically contributed to leverage–fire sale cycles (Lorenzoni, 2008; Stein, 2010; Gorton and Metrick, 2012; Gennaioli et al., 2013) and enabled regulatory arbitrage (Shin, 2009; Acharya et al., 2013). Additionally, the re-use of collateral within the financial system (“re-hypothecation”) deepens the interconnectedness of financial intermediaries and increases systemic risk (Singh and Aitken, 2010; Park and Kahn, 2019; Infante and Vardoulakis, 2020).

The fact that hard information is easy to transmit favors large organizations (Stein, 2002), which induces consolidation in the financial system and thus can increase systemic risk (Berger et al., 2005; Laeven et al., 2016). Moreover, a proliferation of hard information can be used to price discriminate among customers (Shiller, 2013), and may amplify discrimination against minorities and socially disadvantaged groups due to statistical biases (Fuster et al., 2018). Finally, an increased availability of information can also undermine risk-sharing through the so-called “Hirshleifer effect”, i.e., the destruction of risk-sharing possibilities through the revelation of information (Hirshleifer, 1971).⁵

2.3.2 *New Developments*

Technological progress perpetuates the trend towards a greater use of hard information in finance, with its benefits and drawbacks. As the volume of codified information increases, its use will expand from the current realm of standardized products such as mortgages into more complex business segments such as commercial lending

4 Boot and Thakor (1994) analyze a setting with only moral hazard (and no learning). Borrowers initially accept secured contracts at above-market terms, and over time (if successful) switch to below-market unsecured loans.

5 See section 8.3 in Vives (2010) for a discussion.

and financial advisory services. While this will further increase efficiency and reduce costs, it can also amplify existing incentive problems or create new ones.

Traditionally, banks rely on the analysis of customer financial information from payment flows and accounting records. The rise of the internet permits the use of new types of non-financial customer data, such as browsing histories and online shopping behavior of individuals, or customer ratings for online vendors. The literature suggests that such non-financial data are valuable for financial decision making. Berg et al. (2019) show that easy-to-collect information such as the so-called “digital footprint” (email provider, mobile carrier, operating system, etc.) performs as well as traditional credit scores in assessing borrower risk. Moreover, there are complementarities between financial and non-financial data: combining credit scores and the digital footprint further improves loan default predictions. Thus, the incorporation of non-financial data can lead to significant efficiency gains in financial intermediation.⁶

Large technology firms collect vast amounts of non-financial data through their consumer-facing platforms in the areas of e-commerce, social networking, and online search. The sheer amount of data enables the use of “big data” analysis tools such as artificial intelligence and machine learning. The literature confirms their usefulness in finance. For example, Dobbie et al. (2018) show that the use of machine learning can lead to significantly improved default risk predictions. Moreover, the ability of new entrants to collect and process non-financial data may, at least in part, substitute for their lack of access to soft information on borrowers. Therefore, information-related innovation can erode the competitive advantage of banks linked to soft information that is accumulated over time in the context of relationship banking (Berger et al. 2005; Boot, 2000; Botsch and Vanasco, 2019).

Accordingly, Bigtech firms have the informational capacity to compete, and possibly even outperform banks in financial service provision. This is corroborated by Frost et al. (2019), who show that the internal ratings of MercadoLibre, an online marketplace in Latin America, predict default risk better than credit scores. There is also evidence that Bigtech finance is most effective when traditional financial intermediation is undersupplied. Hau et al. (2019) document that Ant Financial, an arm of the Alibaba online marketplace, extends more credit lines in rural areas of China with a limited presence of banks.

More generally, the proliferation of the internet increases the overall availability of public information, as large amounts of data can be acquired at low cost via web-scraping. This reduces informational capture and increases the contestability of financial services. Accordingly, consumers and firms can reap a higher share of the surplus created by financial intermediation. In contrast, banks face pressure on rev-

6 While banks often do not have access to non-financial data, they also face regulatory uncertainty as to whether these data are allowed to be used for the provision of financial services.

venues generated from the provision of information provision services. For example, buy-side investors have increased their reliance on “alternative data” such as satellite images, credit card sales, and mobile geolocation data.⁷

There is a tension between the private accumulation of data on the one hand and the increased public availability of data on the other hand. As pointed out by Hauswald and Marquez (2003), these two developments imply exactly the opposite for informational capture. Accordingly, the net effect of innovations in the collection and processing of information crucially depends on which of these two effects dominates. Public concerns about the risk that (hard) information is becoming monopolized are increasing, fueled by Bigtech firms’ privileged access to customer data.⁸ Since data is non-rival, information sharing across firms could lead to potentially large efficiency gains. However, as shown by Jones and Tonetti (2020), firms will typically refrain from doing so due to the fear of creative destruction, which limits competition and stifles innovation. In this context, giving data property rights to consumers can lead to better data sharing, and at the same time allow them to protect their privacy if desired.

At the same time, Acemoglu et al. (2019) argue precisely in the opposite direction. In their model, consumers that share their data also reveal information about others. This externality leads consumers to ignore their privacy concerns, depresses the price of data, and thus generates excessive data sharing.

Technological progress also affects the structure and the efficiency of financial markets. Bai et al. (2016) study the extent to which stock prices predict future earnings, and conclude that the U.S. stock prices have become significantly more informative since the 1960s, a finding that they attribute to increased information production. However, Farboodi et al. (2020) show that this development is exclusively driven by large firms, while price informativeness has in fact declined for smaller firms.

The mixed empirical evidence is echoed by recent theoretical models of technological progress and information acquisition. Dugast and Foucault (2020) show that advances in computing power increase market efficiency by reducing the cost of searching for signals. However, data abundance can have the opposite effect, because investors must now search among many potential signals and may ultimately find it more costly to acquire information (the “needle in the haystack” effect). Consistent with developments such as the rise of high-frequency trading, Farboodi and Veldkamp (2020) argue that technological progress induces investors to divert resources from information production to the extraction of others’ information by mining through vast amounts of financial transactions data. While overall price informativeness still increases with technological progress (the average trader is more informed), market liquidity is hurt through an increase in “information risk”: future prices become more sensitive to future news, which makes assets riskier today.

7 See “Asset managers double spending in new data in hunt for edge”, *Financial Times*, May 9, 2018.

8 See “Free the data serfs!”, *The Economist*, October 22, 2020.

2.4 COMMUNICATION INNOVATION: NOVEL AND INCREASINGLY PERTINENT

The concept of “communication” refers to the establishment and maintenance of customer relationships as distribution channels for financial services. The finance literature has traditionally focused on the role of informational frictions in financial intermediation, because the effects related to communication are also present in non-financial industries and thus typically studied in the broader industrial organization literature.⁹ However, technological progress increases the importance of distribution channels in finance. As a consequence, the role of communication in financial intermediation may in fact become more central than that of information.

2.4.1 *Established Trends*

Historically, banks were local businesses that liaised with customers in a physical branch location. The associated spatial capture of clients who demanded financial services allowed banks to exert considerable market power. While early technological innovations, such as the ATM and telephone banking, increased convenience for customers and reduced costs for banks, banking largely remained a brick-and-mortar business.

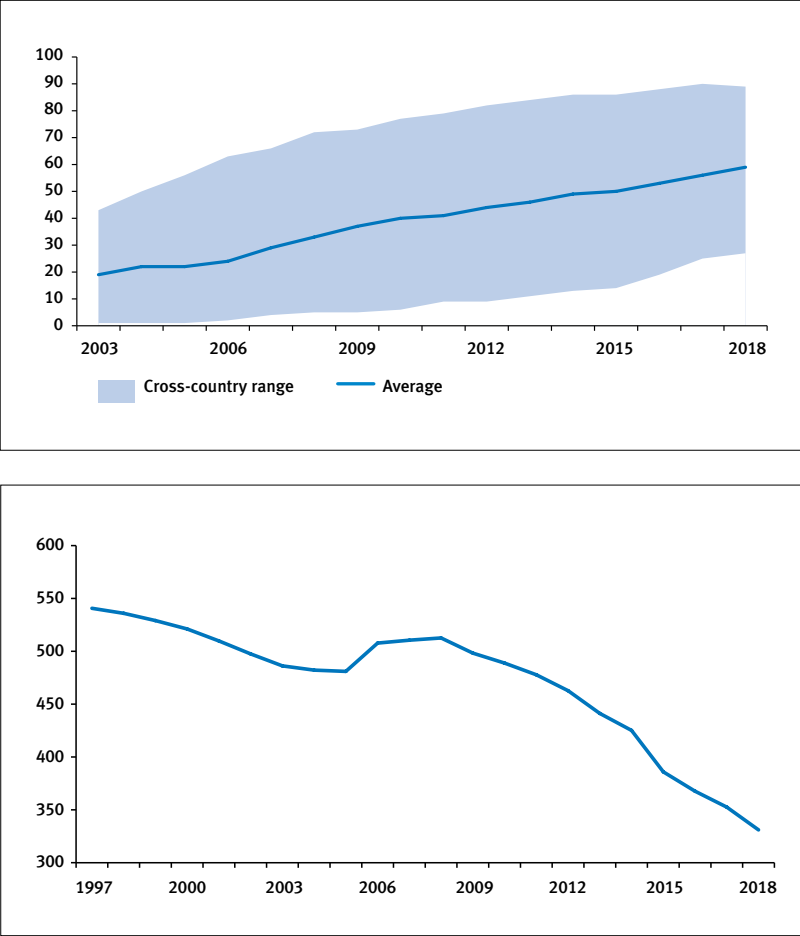
Communication started exerting a deeper influence on the structure of financial intermediation in the late 1990s and early 2000s, when the diffusion of the internet reached a critical mass and enabled the adoption of online banking, with increased process automation and deeper convenience benefits to customers. This enabled the entry of specialized players that focused on communication as a comparative advantage. In the market for deposits, it gave rise to direct banks that operated without a physical branch network and relied on third-party ATMs. In lending markets, independent mortgage originators offered faster credit approval relative to traditional banks. The new entrants competed with incumbent institutions on price and convenience, and were able to accumulate meaningful market shares. Interestingly, many such focused businesses were deeply affected by the global financial crisis of the 2008. Direct banks suffered large deposit outflows, while independent mortgage originators faced collapsing demand and losses on their pipeline. This may indicate either the insufficient resilience of new business models, or the fact that these business models lacked the customers’ trust necessary for the stable provision of financial services over the cycle, due to their short track record (Thakor and Merton, 2018).

Figure 2 illustrates the evolution from brick-and-mortar to online banking. The

9 One exception is the literature on financial networks, which focuses on the effects of financial sector network structure on financial stability (see Allen and Babus, 2009, for an overview). In contrast, we discuss how communication frictions affect the connectivity of financial intermediaries with their customers, with implications for competition and business models.

use of online banking services in the EU-15 stood at only 19% in 2003, but increased steadily to 59% in 2018. By contrast, the number of branches declined drastically, from 540 branches per 1 million inhabitants in 1997 to only 331 in 2018.

Figure 2: Use of Online Banking and the Number of Bank Branches in Europe



Note. The upper Panel shows the share of survey respondents that report regular use of online banking services. The blue line indicates the average, while the shaded grey area shows the cross-country range. Source: Eurostat. The lower Panel graphs the number of bank branches per million inhabitants. Source: ECB Statistical Data Warehouse. All data cover EU 15 countries.

Innovation in communication sparked a trend towards bank consolidation that led to the creation of large universal banks and the repeal of the Glass-Steagall Act in 1999. At least in part, this development was fueled by banks’ desire to reinforce their distribution networks (Houston et al., 2001), so as to strengthen their “first point of

contact” advantages and the associated rents from cross-selling. Consolidation also enabled banks to reduce overhead and eliminate overcapacities associated with redundant geographically overlapping branches (Houston and Ryngaert, 1994).

2.4.2 New Developments

There is little doubt that the days of brick-and-mortar banking – and the associated opportunities for cross-selling through a “first point of contact” advantage of branch banking – are largely over. Today, new entrants can set up efficient communication channels via web portals and mobile apps at very low cost, and reach targeted audiences via direct marketing tools, including social media. Moreover, the ability to source IT infrastructure through cloud services considerably lowers the barriers to entry. Consistent with this, so-called “neo banks”, such as Axos, Revolut, and N26, are challenging incumbents by offering customer-friendly interfaces and employing more efficient IT processes. In mortgage markets, the market share of non-bank originators with a focus on customer convenience has doubled from pre-crisis levels (Buchak et al., 2018).¹⁰ In payments, new entrants such as Paypal, Adyen, and Stripe, specialize on facilitating payments for online purchases, and more broadly provide interconnections between payment systems in an increasingly globalized world.¹¹ And new apps for stock trading (e.g. Robinhood) and robo-advising (cf. D’Acunto et al., 2019) are disrupting the markets for brokerage and asset management. Many of the new entrants have accumulated a significant market share in the respective services, which suggests that competition in retail financial services provision is likely to further intensify in the future.¹²

Peer-to-peer (P2P) platforms are a distinct type of new entrants. They represent a new business model that is enabled by innovations in both communication and information. They use superior communication technology to match individual borrowers and lenders, and enable informed lending decisions through the collections and sharing of hard information. P2P technologies can provide external financing for firms and households that may not qualify for borrowing from traditional banks. Consequently, P2P lenders in part complement, and in part substitute bank lending (De Roure et al., 2019; Vallée and Zeng, 2019; Tang, 2019).

The internet has also given rise to digital platforms as powerful intermediaries that consolidate information, match buyers and sellers, and enable peer-to-peer communication. Their nature as two-sided markets gives rise to significant network externalities, which limit contestability and favor few large players (Rochet and Tirole,

¹⁰ In this context, convenience is associated with the ability to complete mortgage applications online through customer-friendly interfaces, as well as fast and automated approval (Fuster et al., 2019).

¹¹ While these entrants started their business as non-bank payments processors, some recently have acquired banking licenses (e.g. Adyen and Paypal).

¹² See “Race to become UK digital banking leader heats up”, *Financial Times*, October 5, 2019.

2003).¹³ Many of the underlying products and services have penetrated much of consumers' everyday lives, resulting in a very high "contact rate". Platform operators strive to provide an ever-increasing range of products and services in an attempt to generate spatial capture and become the "first point of contact" for a complete set of customer needs.¹⁴

Financial services fit well into such digital ecosystems, both as standalone products (e.g. savings accounts) and through synergies with other goods and services offered on the platform (e.g. consumer credit in e-commerce). These synergies give platforms a strong communication-based competitive advantage in financial service provision, especially because the consumption of financial services is typically not a motive in itself, but rather complements the ultimate consumption of non-financial goods or services. For example, consumers take mortgages to enable home ownership, and use payments to purchase goods and services. They do not derive utility from borrowing or transferring money in itself.¹⁵ Accordingly, digital platforms have a natural interest to include financial services into their offerings.

Digital platforms also exhibit significant feedback effects between information and communication. Their communication advantage—i.e. their role as a first point of contact—gives them abundant data on consumers and sellers, and thus also generates an informational advantage. Thus, platforms are able to exert both informational and spatial capture. For banks, these developments are challenging in two ways. One is the loss of the customer interface, and thus of their strong communication-based competitive advantage. The other is that specialized entrants now become more forceful competitors as they can easily distribute their services through platforms.

The final novel dimension of platforms is that their overwhelming market power over distribution channels gives them an advantage over banks at enforcement. The threat to exclude customers after missing credit repayments may weigh heavily, especially in weaker institutional environments.

13 A product or service exhibits positive (negative) network externalities if its utility is increasing (decreasing) in the number of people consuming it. These effects can be direct or indirect. For example, social networks such as Facebook exhibit direct effects, since it is easier to find friends if more people sign up. Search engines such as Google display indirect effects: while users do not care about other users per se, increased usage improves the quality of search through more data. Finally, in two-sided markets, there can also be network effects across different sides. For example, consumers and merchants attract each other in online marketplaces.

14 In Asia, this development has culminated in the rise of so-called Super-Apps (WeChat, AliPay, Gojek, Grab) that offer a large variety of services (messaging, transportation, food delivery, entertainment) seamlessly through a single platform. See "Fintech: the rise of the Asian super app", *Financial Times*, December 13, 2019.

15 A rare exception where financial services have their own utility is wealth management. But even here, wealth managers engage in bundling by offering access to "life style" products and services. See "People Over Products: Why Private Banks Should Focus On Relationships, Not Sales", *Forbes*, May 5, 2020.

2.5 THE FUTURE OF BANKS

The rapid pace of technological progress raises questions about the future of banks. Banks typically are vertically and horizontally integrated financial intermediaries. In vertical terms, they use their balance sheet to perform maturity transformation, and directly interact with customers when raising deposits and making loans. Horizontally, banks provide services that do not directly rely on a balance sheet, but have informational or communication synergies with deposit-taking or loan-granting. For example, payment information can help monitor loans (Puri et al., 2017; Parlour et al., 2019), information from lending can assist underwriting (Kroszner and Rajan, 1994; Drucker and Puri, 2005), and established communication channels with retail depositors enable the cross-selling of savings or insurance products, which boosts bank revenues and helps income diversification (Stiroh and Rumble, 2006).

Innovations in information and communication pose two fundamental challenges for the integrated bank business model. First, they enable the entry of specialized competitors with a focus on financial services that require little or no access to a balance sheet, thus challenging banks' horizontal integration. Second, digital platforms compete with banks for direct access to customers, thus challenging banks' vertical integration. We discuss these challenges in turn.

2.5.1 *Challenge 1: Horizontal Disintegration through Specialized Competitors*

Aside from their core maturity transformation business, banks provide a wide range of services where they act as agents or brokers. In this case, they take on little or no risk, and collect fees for providing services. The most prominent activities of this type are asset and wealth management, insurance, brokerage, advisory services, and payments.

Historically, banks' position as a first point-of-contact for financial services enabled them to capture rents through the cross-selling of their own or third-party products. For example, the asset management industry in Europe and Japan is still dominated by banks, despite their underperformance compared to non-bank providers of similar services (Ferreira et al., 2018).

Since horizontally integrated banking services require no access to a deep balance sheet, they can also be performed by non-banks. Novel distribution channels diminish banks' position as gatekeepers to financial services, and enable specialized providers to gain direct access to customers. These specialized entrants can avoid the organizational inefficiencies present in large banks (Scharfstein and Stein, 2000), which helps them to be agile and efficient in their use of technology. Consequently, they may be able to beat banks on price, speed, and convenience (Fuster et al., 2019).

In addition to technological drivers, the horizontal disintegration of financial services is also facilitated by regulation. Offering specialized financial services often does not require a full banking license. For example, several jurisdictions now grant

licenses for the provision of electronic payment services. This lowers the regulatory compliance costs of specialized entrants.

The communication-driven horizontal disintegration of financial service provision is different from past experiences that were information-driven. The rise of hard information in the 1990s enabled independent mortgage originators, which used ratings-based certification to securitize and sell mortgage exposures to end-investors. The originate-to-distribute model was associated with well-known incentive problems, driven by moral hazard and adverse selection. Since the current disintegration is driven by communication, it is less impeded by information frictions, and can induce deeper structural changes in financial service provision.

2.5.2 Challenge 2: Re-Intermediation through Platforms

The rise of digital platforms fundamentally changes the way goods and services are distributed. Consumer choice was historically constrained by significant search costs. These have now dropped to near zero: prices and features of most goods and services can be compared with a few clicks or swipes. Network externalities inherent in two-sided markets lead to the dominance of a few large platforms competing for users' attention. To strengthen lock-in effects and maximize data generation, platforms are offering an ever-expanding range of products and services. The inclusion of financial services would naturally complement most platforms' business model.

While consumers are likely to embrace the integration of financial services into digital ecosystems, such a transition poses a severe threat to banks. When online platforms interject themselves between banks and customers, they introduce another layer of intermediation. By becoming middlemen between customers and financial institutions, they may capture most of the existing rents, and much of customer data.¹⁶ As a consequence, banks can lose direct access to their customers and face the risk of vertical disintegration.

The most potent digital platforms are the ecosystems of Bigtech firms, which can leverage upon a large customer base of their non-financial core activities that allows them to exert market power. They also have access to vast amounts of customer data to support their venture into finance. Another type of platforms is price comparison sites for financial products such as mortgages and deposits. The absence of an established "outside" business means that they need to grow quickly in order to reach the critical mass required to become a "gatekeeper" for customer access.¹⁷ Once successful, however, financial comparison sites may morph into "financial

16 For example, platforms such BankBazaar (India), Check24 (Germany) or Comparis (Switzerland) effectively intermediate between consumers and banks in the market for certain standardized financial products such as mortgages and consumer loans. Basten and Ongena (2020) study how such platforms affect banks' loan portfolios.

17 Formally, comparison sites cannot engage in "platform envelopment", see Eisenmann et al. (2011).

supermarkets” – specialized online platforms that offer access to the full range of financial services.

Importantly, platforms do not need to provide financial services themselves: they can monetize their comparative advantages without maintaining a dedicated balance sheet. On the communication side, the platforms’ activity can be viewed as “match-making”, which does not require risk-taking. On the information side, customer data can be passed on to other financial service providers. The recently announced partnerships between Apple and Goldman Sachs as well as Google and Citigroup are consistent with this view, and most likely only mark the beginning of Bigtech platform involvement in financial services provision.¹⁸ Importantly, such partnerships need not stay exclusive over time, as platforms may prefer to create competition among several participating banks to maximize their own rents. In addition, digital platforms also enable specialized financial players to distribute their products more widely. This means that the vertical disintegration of the bank business model amplifies its horizontal disintegration. Not providing financial services directly also allows platforms to avoid compliance costs, and, especially in the case of Bigtech firms, political resistance.

The involvement of non-financial firms in the provision of financial services is not novel per se. Historically, large manufacturers have facilitated trade credit, loans for consumer durables, project finance, and leasing. Yet, the scope of their involvement was typically bounded by the limited range of circumstances in which they had a comparative advantage over banks in terms of information or communication.¹⁹ The rise of digital platforms may change this fundamentally, since Bigtech firms offer a vast range of products and services, and at the same time appear to have an edge over banks in both communication and information.

2.5.3 *Limiting Factors and Banks' Response*

Based on the two challenges outlined above, the future of banks appears bleak. In the extreme, digital platforms and specialized competitors can induce a complete vertical and horizontal disintegration of the traditional bank business model. In this case, banks will be relegated to the role of upstream (not customer-facing) suppliers of

18 See “Apple Debuts Titanium Credit Card With Goldman, Mastercard”, *Bloomberg*, March 25, 2019, and “Google Makes a Bid for Banking, Where Tech Firms Go to Stumble”, *New York Times*, November 13, 2019.

19 For example, trade credit can serve as a monitoring tool for suppliers (Smith, 1987). Similarly, specialized firms can be more efficient than banks at re-deploying repossessed assets (Mian and Smith, 1992; Habib and Johnsen, 1999) or assessing collateral values (Brennan et al., 1998; Stroebel, 2016). Petersen and Rajan (1997) argue that critical suppliers have a superior enforcement capability if they can threaten to disrupt a borrower’s business continuity in response to non-payments. The provision of financing also enables producers to increase product demand via cross-subsidization of lending and sales (Banner, 1958; Barron, Chong, and Staten, 2008).

maturity transformation services, while downstream (customer-facing) services will be taken over by platforms and specialized providers. Yet, there are a number of limiting factors to this extreme outcome.

First, banks will aim to improve their capabilities in communication and in information processing through massive IT investment. This involves upgrading outdated systems and processes, unifying geographically segmented systems, shifting to cloud computing, and developing new, digital-oriented financial products and services that match customer needs (such as new customer interfaces and significantly faster credit decision systems). Banks may also acquire or cooperate with specialized Fintech firms in order to procure expertise for the digitalization of key processes.

However, the organizational complexity of large banks will complicate the transition. Moreover, banks may be slow in adopting new technologies due to higher (perceived) reputational risks relative to new entrants. This can be amplified by uncertainty about the regulatory stance, and a lack of regulatory guidelines regarding the use of new digital tools. Finally, low profitability and labor market frictions can prevent the required organizational changes, especially in Europe.

The most digitally ambitious banks may try to develop their own platform-based ecosystems as a means of staying competitive. To this end, they can enrich their core service offering with complementary financial and non-financial services. For example, banks may offer alternative lending arrangements (e.g. P2P lending) for riskier customers, or integrate real estate brokerage services into their mortgage lending business. However, such changes would challenge banks to leave their established realm of expertise and be open to changing their overall business model.

A second limiting factor to the disintegration of bank business models are limits to the reach of digital platforms. Bigtech firms and price comparison sites are mainly focused on retail consumers. While this enables them to distribute retail financial services such as payments and consumer loans, as well as SME loans for online merchants, banks may—at least for now—be able to maintain their competitive advantage in serving corporate clients.²⁰

This may change, however, with the fast-growing adoption of cloud computing. Bigtech firms that provide such services—Amazon, Microsoft, Google, and Alibaba—are establishing communication channels with a wide range of corporate clients, including very large firms and the public sector. They may then be able to develop broader ecosystems around their cloud services, including business-to-business (B2B) marketplaces that could also supply financial services. High contact rates and potential access to non-financial information on corporate customers would enable the providers of cloud services to rival banks' information and communication advantages in the corporate segment.

²⁰ Using data up to 2012, Berger et al. (2017) show a continuing distinct value of soft information and relationship banking in alleviating firm financial constraints, and link this explicitly to the economic role of small banks.

A third limiting factor is that banks may succeed in preserving the integrated provision of financial services for their most information-intensive customers. Indeed, the literature has emphasized how banks may respond to a proliferation of hard information by “retrenching” to their relationship-based business anchored in soft information and repeated interactions (Boot and Thakor, 2000). This will likely lead to further market segmentation, where only the most informationally opaque borrowers will continue to depend on relationship lending, while others are served with arm’s length lending that builds on hard information. In arm’s length lending, banks will face intense competition from non-bank lenders, including peer-to-peer platforms, which will operate either independently or through ecosystem platforms.

To strengthen their competitive position, banks may further seek to intensify trust as their distinctive asset. This can potentially lead to the revival of merchant banks – “trusted advisors” that provide tailored solutions for corporate customers with complex needs. Technological innovation may in fact foster standalone merchant banking, since it becomes easier to source services and infrastructures that were previously shared within financial conglomerates, such as hedging, funding, compliance, and IT. A re-emergence of merchant banking would be consistent with the long-held view in the literature that relationship banking can survive competition by increasing its relationship intensity.

Finally, another factor that can limit non-bank entry in financial services provision is banks’ access to cheap and stable deposit funding, which is supported by deposit insurance, implicit too-big-to-fail government guarantees (O’Hara and Shaw, 1990; Krishnamurthy and Vissing-Jorgensen, 2012), retail customers’ trust (Thakor and Merton, 2018), and banks’ market power in retail deposit markets (Drechsler et al., 2017). In addition to providing cheap funding, the safety of deposits also makes banks more efficient in providing other, horizontally integrated services such as payments (Merton and Thakor, 2019). However, this limiting factor may weaken over time. If bank deposits will become increasingly intermediated by online platforms²¹, banks may no longer be able to exert market power and lose part of their funding advantage (Vives, 2019). In addition, if banks diminish in importance, so will their funding advantage that builds on implicit guarantees. At the same time, some non-banks, in particular large Bigtech platforms, may become effectively too-big-to-fail, which would enable them cheaper and more ample access to funding (but also more regulatory constraints).²²

21 See, e.g., “Thiel-backed fintech Deposit Solutions launches in United States”, Reuters, September 29, 2020.

22 While trust may grant banks an advantage over standalone entrants (Thakor and Merton, 2018), it is important to note that brands like Apple and Amazon also enjoy high levels of customer loyalty. This may enable them to quickly gain customers’ trust in the intermediation of financial services as well.

2.6 POLICY CHALLENGES

Innovation in information and communication, and the consequent shift in the financial industry structure from banks to specialized entrants and digital platforms create novel challenges for public policy. Below we list a number of priorities across various domains. The key risk throughout is that policymakers fall behind the curve by protecting outdated business models, having no structured approach vis-à-vis the new entrants, and not being ready to deal with new technologies.²³ Network effects may give rise to tipping points with rapid changes and costly ex-post adjustment. Moreover, the scale of potential entrants – particularly Bigtech firms – will enable them to accumulate political power.

Note that the question of whether other entities can efficiently fulfil the economic role of banks remains open. However, even if this were the case, the transition will be complex and require fundamental adjustments by policymakers because banks are currently at the core of monetary and macroprudential policies.

2.6.1 Prudential Policy: New Dimensions

Prudential regulation corrects excessive financial risk-taking. Micro-prudential regulation addresses risks driven by leverage and focuses on individual firms (Dewatripont and Tirole, 1994). Macro-prudential regulation corrects for externalities, and focuses on the system as a whole (De Nicolo et al., 2012). New technologies will challenge both forms of prudential regulation along several dimensions.

First, a financial system more reliant on hard information is more cyclical and crisis-prone, as discussed in section 2.3. These effects will get amplified if online platforms are able to introduce competition in deposit markets, which will make banks' funding more flighty and discourage the establishment of long-term relationships. The whole financial system would become more susceptible to liquidity freezes – as the 2008 crisis has abundantly illustrated. The increased cyclicality will also call for a more pronounced role for macroprudential policy (Claessens, 2015). Careful design will be needed to avoid the risk of past failures (Behn et al., 2016), and to ensure that these policies are not rendered ineffective by an increased relevance of non-banks (Bengui and Bianchi, 2018). Furthermore, an increased contestability of financial service provision may amplify the risk-taking incentives of financial institutions, while making it costlier for them to maintain appropriate capital and liquidity buffers (Schaeck and Cihak, 2012). This is to the detriment of bank customers, and ultimately financial stability.

23 This also points at transition issues that supervisors and policymakers need to be aware of. These do not just involve understanding new technologies and players (and the associated trial & error), but also anticipating and understanding the problems faced by incumbents when adjusting to the new competitive realities.

Second, technological progress gives rise to new risks. The robustness of new lending technologies (such as credit-scoring based on digital footprint data) is untested in downturns. In fact, the financial fallout from the COVID-19 pandemic is likely to be the first major test of the resilience of the new lending technologies. More generally, regulators need to find consistent supervisory approaches to the use of new types of data and new data analysis tools in financial services. In this context, the rise of AI and machine learning pose particular challenges because they have no underlying models. Accordingly, it can be difficult to interpret their results, extrapolate them to stressed scenarios, or conduct cross-validation exercises. The rapid rise of new business models and processes can create operational risks that may be hard to monitor and quantify.²⁴

In addition, cyber risk is becoming a first-order concern from a prudential policy perspective. Compared to the real sector, financial institutions have fared rather well in this domain thanks to proportionately greater investment in IT security (Aldasoro et al., 2020). However, the potential fallout from a large-scale cyberattack on systemically important financial institutions cannot be underestimated. Indeed, recent literature confirms that cyberattacks can generate financial spillovers and consequently have systemic risk implications (Crosignani et al., 2020). Accordingly, there are large social benefits of regulators working towards the incorporation of cyberattack scenarios into stress-testing exercises, as well as on the design of appropriate contingency plans and infrastructures in collaboration with the financial sector (Duffie and Younger, 2019; Kashyap and Wetherilt, 2019).

Third, regulators need to keep an eye on regulatory arbitrage. The disintermediation of financial supply chains enables risks to be “hidden” in complex network structures, placed in less regulated entities or more lenient jurisdictions. Establishing a level playing field across entities²⁵ and avoiding a race-to-the bottom across jurisdictions is paramount. At the same time, concerns about regulatory arbitrage must be balanced with the scope for experimentation, including through the use of regulatory “sandboxes” for innovative firms and novel data-driven supervisory methods, “regtech” (Arner et al., 2017; Bromberg et al., 2017). More broadly, a shift towards hard information on the regulatory side also implies an increased reliance on models.

When these models have pitfalls, or can be gamed, regulatory outcomes can be inefficient or even counterproductive (Benoit et al., 2019; Behn et al., 2016). Moreover, an increased reliance on hard information by regulators may limit the scope of

24 The recent failure of Wirecard, a German payment processor, illustrates the difficulty of critically assessing new business models.

25 Early evidence suggests that prudential regulation can be effective in creating a more even playing field between banks and Bigtech firms. Claessens et al. (2018) show that Bigtech firms play a less prominent role in financial services provision in countries with more stringent prudential regulation. See also Berger and Udell (2006) on the impact of public policy on the financial industry structure.

expert judgement based on soft information, and therefore reduce reputation-building incentives among regulated entities.²⁶

Fourth, the concept of systemically important financial institutions and infrastructures widens. Platforms engaged in financial service provision are likely to become systemically important. Large providers of cloud services may need to be designated as systemically important infrastructures. However, this may prove difficult in practice, because such designation for non-banks has proven controversial in the past.²⁷ In addition, prudential policy will also have to monitor risks that arise from stronger interlinkages between the financial and non-financial activities of platforms and cloud providers.²⁸

Finally, regulatory agencies must keep pace with innovation and its outcomes. They will need to adjust more rapidly to new business processes and a less bank-centric financial industry structure. Legacy banks should be guided to adjust in a forward-looking manner, through restructuring, consolidation, or exit.²⁹ Critically, regulatory agencies have historically struggled to ensure that their expertise matches that of the industry (Hakenes and Schnabel, 2014). This may become even harder as innovation intensifies and more talent enters the financial technology sphere.³⁰ Ensuring expertise is critical not only for quality supervision and regulation, but also so that regulators can guide the social debate on the innovation-stability trade-off, fending off pressures for unbridled innovation as the memories of past financial crises fade.

2.6.2 Prudential Policy: New Dimensions

The changes in the structure of the financial industry induced by technology will affect monetary policy transmission and implementation. Information and communication innovations render deposit and loan markets more contestable, which will likely amplify the pass-through of policy rates to lending conditions and deposit rates (e.g. Drechsler et al. 2017, 2018). As the importance of bank lending diminishes (e.g. because it is replaced by non-bank or P2P lending), so does the importance of bank capital and financial conditions for monetary policy transmission (Van den Heuvel, 2002).

26 A regulatory focus on hard information may also undermine relationship lending, which critically relies on soft information.

27 See “MetLife Defeats U.S. Government’s Too-Big-to-Fail Labeling”, *Bloomberg*, March 30, 2016, and Dokic (2017).

28 See <https://www.cnbc.com/2019/10/24/senators-urge-investigation-of-amazons-role-in-capital-one-hack.html>.

29 To ensure continued viability of legacy banks, supervisors may need to collect different data than in the past, including information on IT investments, customer contact channels, etc.

30 According to Alekseeva et al. (2020), finance is among the top three industries with the highest demand for AI jobs, which command a wage premium of 11% compared to other jobs.

The introduction of central bank digital currencies (CBDCs) – also in response to innovations in payment technologies – may make monetary policy transmission more direct, and change the effective lower bound on interest rates (Bordo and Levin, 2017; Grifoli et al., 2018). A better pass-through might be welcome, as a more cyclical and hard information-based financial system may require more countercyclical monetary policy.

In terms of monetary policy implementation, the increased use of collateral enabled by the proliferation of hard information will further weaken the importance of unsecured funding markets. This, and the diminishing role of banks, will make unsecured interbank interest rates a less effective operational target (English, 2002), and call for benchmarks based on secured transactions among a wide set of market participants. Also, the decreasing number and importance of bank counterparties for central bank operations strengthens the case for allowing non-banks to access central bank reserves.

2.6.3 *Competition Policy: Platforms as Natural Monopolies for Communication and Data*

The “first point of contact” advantages of digital platforms give rise to natural monopolies in communication and data collection.³¹ Competition policy should balance platforms’ incentives to invest with outsiders’ ability to access their communication infrastructure and data pools. For example, recent national regulation in Germany provides an example of policy towards natural monopolies in communication in the context of financial services provision. Starting in 2020, new legislation mandated, on competition grounds, that Apple should open the iPhone’s near-field communication (NFC) port to third party payment providers, enabling them to compete with the company’s “Apple Pay” service.³² This represents, however, a one-off solution and a more holistic policy dealing with the natural monopoly aspects of platforms is more appropriate.

2.6.4 *Public Standards and Infrastructures: Focus on Data and Interconnections*

Standardization and infrastructure are public goods. Private markets can converge on suboptimal information sharing and communication protocols that may become entrenched due to network effects, giving rise to inefficiencies and rents.³³ Public policy can help market participants coordinate on better standards. Innovations

31 The fact that platforms are two-sided markets with strong network externalities renders many standard models of antitrust inappropriate, and regulators continue to struggle with this new environment. See Evans and Schmalensee (2015) for the analysis of antitrust issues in two-sided platforms.

32 “Apple warns of risks from German law to open up mobile payments”, Reuters, 16 October 2019.

33 Competition between two standards is often referred to as a “standard war”. More efficient standards do not necessarily end up dominating the market. For example, in the 19th century more cost-efficient alternative current has replaced Edison’s direct current. At the same time, a more ergonomic Dvorak keyboard has never been able to replace the entrenched QWERTY standard.

in information and communication give rise to two areas where standardization is needed: data treatment and exchange, and communication protocols.

Data is crucial for financial services provision: it helps manage risks and overcome adverse selection. This is beyond its role in non-financial services, where it is mainly used for targeting customers with product offerings. The scope for market failures in the collection, protection, use, and exchange of data is large. Data ownership rules are often undefined; the use of data is non-rivalrous, but exhibits large economies of scale and scope especially under AI and big data; data collection can entail externalities (Garratt and van Oordt, 2019) and display natural monopoly properties when done by platforms. Public policy should consider standards in the areas of data ownership, maintenance, and exchange – including the templates to classify data (and thus assign ownership) and to standardize data (and thus enable its efficient exchange). Repositories for data generated by platforms and other non-bank financial service providers (similar to traditional credit registries) can be part of a solution.

The increasing use of private data for financial services also raises a myriad of consumer protection and privacy issues that require the government to set standards for data collection and use. International data standards are needed, to balance data protection within jurisdictions with the benefits of their cross-border use. The public debate on the efficiency-privacy trade-off in financial services provision (the “society of the future” debate) is not advanced enough yet to converge on desirable outcomes. For example, fair lending rules such as the Equal Credit Opportunity Act and the Fair Housing Act in the United States ban the use of certain data (e.g., on gender or race) for making lending or insurance decisions, primarily to avoid discrimination. Bigtech firms face no similar “equal opportunity”-related restrictions.³⁴

There is also a need for level playing field in data standards between banks and non-banks. Banks are subject to stringent data privacy requirements, which their competitors often do not face. And while “open banking” initiatives such as PSD2 make bank information available to third parties, no similar information sharing requirement is imposed on non-bank financial service providers.

Communication innovation and the disintegration of financial service value chains imply much larger demand for connectivity. It is this demand that is already pushing authorities to strengthen existing payments infrastructures (possibly also through the use of CBDC, though the scope and benefits of CBDC remain to be fully explored). Authorities also have a key role to play in creating a system of digital identities to help households and firms operate in a digital economy, including within the financial sector.³⁵ Standardization protocols and public infrastructure need to

34 Policy-making is complicated by the fact that the economics of data is a nascent field (see Carrière-Swallow and Haksar, 2019, for a review).

35 The “India Stack” initiative is a prime example in this direction. Also, authorities need to ensure that those lacking digital literacy (e.g. the elderly or the socio-economically disadvantaged) do not suffer severe limitations on their access to finance as a consequence of technological progress.

also support cross-border interconnections, an aspect especially important in the EU single market.

2.7 CONCLUSIONS

This paper provides an overview of the effects of recent innovations in information (data collection and processing) and communication (distribution and connectivity) on the structure of financial intermediation.

We have argued that information-related innovation follows past trends such as credit scoring and securitization. The key new development is the abundance of non-financial data, including from digital footprints, which can be used in financial services provision. Thanks to large volumes, these data can be analyzed using machine learning and artificial intelligence, which gives rise to economies of scale in data usage and thus benefits large technology firms and other platform intermediaries. While the role of communication has been studied less extensively in the existing literature, we argue that recent innovations render communication advantages a key competitive factor in financial services by reducing barriers to entry and weakening banks' traditional role as the "first point of contact" for financial services. New distribution channels enable the entry of specialized financial service providers with a focus on activities that do not require access to deep balance sheets, such as payments and asset management. Furthermore, it allows digital platforms to include financial services into their ecosystems to further reduce search and connectivity costs.

These developments pose a formidable challenge to the traditional business model of universal banking, which is based on horizontally and vertically integrated financial service provision. Specialized service providers can chip off the most lucrative horizontally integrated services, while platforms can take over communication with savers and borrowers, leading also to vertical disintegration of financial value chains. In the extreme case, this trend can relegate banks to upstream providers of maturity transformation services. While digital platforms' focus on retail customers and SMEs limits their reach, the increasing relevance of cloud computing services enables large technology firms to directly engage with large corporate clients, and thus compete with banks in financial services provision to this clientele as well.

We discuss a number of public policy priorities related to innovations in information and communication. Prudential regulation will be challenged in responding to new technologies in banking. Monetary policy will need to operate through a wider set of counterparties and in an environment of a more cyclical financial system. And competition policy, data regulation and the provision of public standards will have key roles to play in ensuring optimal market outcomes.

Technological change is a medium-term process. Yet external shocks – such as the ongoing COVID-19 crisis – can make the adoption of financial innovation more rapid, and amplify its effects on the financial industry structure. Digital platforms

may strengthen their market position thanks to higher demand for digital services, and leverage upon their balance sheet strength to penetrate new markets more easily. By contrast, banks may have to prioritize crisis management and postpone investment in digital transformation. Prudential regulators may be softer in responding to medium-term prudential risks, including those from new technology-driven entrants, as they focus on restarting lending. In this context, the ongoing COVID-19 crisis makes the response to information and communication innovation in finance an even more urgent policy priority.

REFERENCES

- Acemoglu, D., A. Makhdoumi, A. Malekian and A. Ozdaglar (2019). Too Much Data: Prices and Inefficiencies in Data Markets, National Bureau of Economic Research Working Paper No. 26296.
- Acharya, V.V., P. Schnabl and G. Suarez (2013). Securitization without Risk Transfer, *Journal of Financial Economics*, 107 (3), pp. 515-536.
- Agarwal, S. and R. Hauswald (2010). Distance and Private Information in Lending, *Review of Financial Studies*, 23 (7), pp. 2757-2788.
- Aldasoro, I., L. Gambacorta, L. Giudici and T. Leach (2020). The Drivers of Cyber Risk, BIS Working Papers, No. 865.
- Alekseeva, L., J. Azar, M. Gine, S. Samila and B. Taska (2020). The Demand for AI Skills in the Labor Market, CEPR Discussion Paper No. 14320.
- Allen, F. and A. Babus (2009). Networks in Finance, The Network Challenge: Strategy, Profit, and Risk in an Interlinked World, No 367.
- Allen, F. and D. Gale (1997). Financial Markets, Intermediaries, and Intertemporal Smoothing, *Journal of Political Economy*, 105 (3), pp. 523-546.
- Armstrong, M. and J. Vickers (2019). Discriminating Against Captive Customers, *American Economic Review: Insights*, 1 (3), pp. 257-72.
- Arner, D.W., J. Barberis. and R.P. Buckley (2017). FinTech and RegTech in a Nutshell, and the Future in a Sandbox, CFA Institute Research Foundation.
- Athey, S. and G.W. Imbens (2019). Machine Learning Methods that Economists Should Know About, *Annual Review of Economics*, 11, pp. 685-725.
- Bai, J., T. Philippon and A. Savov (2016). Have Financial Markets Become More Informative?, *Journal of Financial Economics*, 122 (3), pp. 625-654.
- Banner, P.H. (1958), Competition, Credit Policies, and the Captive Finance Company, *Quarterly Journal of Economics*, 72 (2), pp. 241-258.
- Barron, J.M., B.U. Chong and M.E. Staten (2008). Emergence of Captive Finance Companies and Risk Segmentation in Loan Markets: Theory and Evidence, *Journal of Money, Credit and Banking*, 40 (1), pp. 173-192.
- Basten, C. and S. Ongena (2020). The Geography of Mortgage Lending in Times of FinTech, CEPR Discussion Paper No. DP14918.
- Beck, T., H. Degryse, R. De Haas and N. Van Horen (2018). When Arm's Length is Too Far: Relationship Banking over the Credit Cycle, *Journal of Financial Economics*, 127 (1), pp. 174-196.
- Behn, M., R. Haselmann and V. Vig (2016). The Limits of Model-Based Regulation, Working Paper ECB, No. 1928.
- Bengui, J. and J. Bianchi (2018). Macroprudential Policy with Leakages, National Bureau of Economic Research Working Paper No. 25048.

- Benoit, S., C. Hurlin and C. Pérignon (2019). Pitfalls in Systemic-Risk Scoring, *Journal of Financial Intermediation*, 38, pp. 19-44.
- Berg, T., V. Burg, A. Gombović and M. Puri (2019). On the Rise of Fintechs: Credit Scoring Using Digital Footprints, *The Review of Financial Studies*, 33 (7), pp. 2845-2897.
- Berger, A.N. and L.K. Black (2019). Small Business Lending: The Roles of Technology and Regulation from Pre-Crisis to Crisis to Recovery, in *The Oxford Handbook of Banking* (A. Berger, Ph. Molyneux and J.S. Wilson, Eds.), Oxford University Press (Third Edition), pp. 431-469.
- Berger, A., C. Bouwman and D. Kim (2017). Small Bank Comparative Advantages in Alleviating Financial Constraints and Providing Liquidity Insurance Over Time, *Review of Financial Studies*, 30 (10), pp. 3416-3454.
- Berger, A.N. and W.S. Frame (2007). Small Business Credit Scoring and Credit Availability, *Journal of Small Business Management*, 45 (1), pp. 5-22.
- Berger, A.N., N.H. Miller, M.A. Petersen, R.G. Rajan and J.C. Stein (2005). Does Function Follow Organizational Form? Evidence From the Lending Practices of Large and Small Banks, *Journal of Financial Economics*, 76 (2), pp. 237-269.
- Berger, A.N. and G.F. Udell (2006). A More Complete Conceptual Framework for SME Finance, *Journal of Banking & Finance*, 30 (11), pp. 2945-2966.
- Bolton, P., X. Freixas, L. Gambacorta and P.E. Mistrulli (2016). Relationship and Transaction Lending in a Crisis, *Review of Financial Studies*, 29 (10), pp. 2643-2676.
- Boot, A.W.A. (2000). Relationship Banking: What do we Know?, *Journal of Financial Intermediation*, 9 (1), pp. 7-25.
- Boot, A.W.A., S.I. Greenbaum and A.V. Thakor (1993). Reputation and Discretion in Financial Contracting, *American Economic Review*, 83 (5), pp. 1165-1183.
- Boot, A.W.A. and L. Ratnovski (2016). Banking and Trading, *Review of Finance*, 20 (6), pp. 2219-2246.
- Boot, A.W.A. and A.V. Thakor (1994). Moral Hazard and Secured Lending in an Infinitely Repeated Credit Market Game, *International Economic Review*, 35 (4), pp. 899-917.
- Boot, A.W.A. and A.V. Thakor (2000). Can Relationship Banking Survive Competition?, *Journal of Finance*, 55 (2), pp. 679-713.
- Bordo, M.D. and A.T. Levin (2017). Central Bank Digital Currency and the Future of Monetary Policy, National Bureau of Economic Research Working Paper, No 23711.
- Botsch, M. and V. Vanasco (2019). Learning by Lending, *Journal of Financial Intermediation*, 37, pp. 1-14.
- Boyd, J.H. and M. Gertler (1994). Are Banks Dead?, *The Region*, No Sep, pp. 22-26.
- Brennan, M.J., V. Maksimovic and J. Zechner (1988). Vendor Financing, *Journal of Finance*, 43 (5), pp. 1127-1141.

- Bromberg, L., A. Godwin and I. Ramsay (2017). Fintech Sandboxes: Achieving a Balance Between Regulation and Innovation, *Journal of Banking and Finance Law and Practice*, 28 (4), pp. 314-336.
- Buchak, G., G. Matvos, T. Piskorski and A. Seru (2018). Fintech, Regulatory Arbitrage, and the Rise of Shadow Banks, *Journal of Financial Economics*, 130 (3), pp. 453-483.
- Carrière-Swallow, M.Y. and M.V. Haksar (2019). The Economics and Implications of Data: An Integrated Perspective, International Monetary Fund, No WP/19/16.
- Cerqueiro, G., S. Ongena and K. Roszbach (2020). Collateral Damaged? Priority Structure, Credit Supply, and Firm Performance, forthcoming in *Journal of Financial Intermediation*, 44, 100824.
- Claessens, S. (2015). An Overview of Macroprudential Policy Tools, *Annual Review of Financial Economics*, 7, pp. 397-422.
- Claessens, S., J. Frost, G. Turner, and F. Zhu (2018). Fintech Credit Markets Around the World: Size, Drivers and Policy Issues, BIS Quarterly Review September.
- Crosignani, M., M. Macchiavelli and A.F. Silva (2020). Pirates without Borders: The Propagation of Cyberattacks through Firms' Supply Chains, FRB of New York Staff Report, No. 937.
- D'Acunto, F., N. Prabhala and A.G. Rossi (2019). The Promises and Pitfalls of Robo-Advising, *Review of Financial Studies*, 32 (5), pp. 1983-2020.
- De Nicoló, M.G., G. Favara and L. Ratnovski (2012). Externalities and Macroprudential Policy, IMF Staff Discussion Note, No SDN/12/05.
- Degryse, H. and S. Ongena (2005). Distance, Lending Relationships, and Competition, *Journal of Finance*, 60 (1), pp. 231-266.
- De Roure, C., L. Pelizzon and A.V. Thakor (2019). P2P Lenders versus Banks: Cream Skimming or Bottom Fishing?, mimeo.
- Dell'Araccia, G., D. Kadyrzhanova, C. Minoiu and L. Ratnovski (2020). Bank Lending in the Knowledge Economy, *Review of Financial Studies*, forthcoming.
- Dewatripont, M., and J. Tirole (1994). *The Prudential Regulation of Banks*, MIT Press.
- Diamond, D.W. (1984). Financial Intermediation and Delegated Monitoring, *Review of Economic Studies*, 51 (3), pp. 393-414.
- Dobbie, W., A. Liberman, D. Paravisini and V. Pathania (2018). Measuring Bias in Consumer Lending, National Bureau of Economic Research Working Paper, No 24953.
- Dokic, D. (2017). Challenging nonbank SIFI designations: GE, Metlife, and the Need for Reform, *Brooklyn Journal of Corporate, Financial & Commercial Law*, 11 (2), pp. 565-588.
- Drechsler, I., A. Savov and P. Schnabl (2017). The Deposits Channel of Monetary Policy, *Quarterly Journal of Economics*, 132 (4), pp. 1819-1876.
- Drechsler, I., A. Savov and P. Schnabl (2018). Banking on Deposits: Maturity Transformation without Interest Rate Risk, National Bureau of Economic Research Working Paper 24582.

- Drucker, S., and M. Puri (2005). On the Benefits of Concurrent Lending and Underwriting, *Journal of Finance*, 60 (6), pp. 2763-2799.
- Duffie, D. and J. Younger (2019). Cyber Runs, Hutchins Center Working Paper, Brookings Institution.
- Dugast, J. and T. Foucault (2020). Equilibrium Data Mining and Data Abundance, HEC Paris Research Paper No. FIN-2020-1393.
- Eisenmann, T., G. Parker and M. Van Alstyne (2011). Platform Envelopment, *Strategic Management Journal*, 32 (12), pp. 1270-1285.
- English, W.B. (2002). Financial Consolidation and Monetary Policy, FRBNY Economic Policy Review, 8 (1), pp. 271-284.
- Evans, D.S. and R. Schmalensee (2015). The Antitrust Analysis of Multi-Sided Platform Businesses, in *The Oxford Handbook of International Antitrust Economics* (R.D. Blair and D.D. Sokol, Eds.), No 1.
- Farboodi, M., A. Matray, L. Veldkamp and V. Venkateswaran (2020). Where has all the Data Gone?, National Bureau of Economic Research Working Paper 26927.
- Farboodi, M. and L. Veldkamp (2020). Long-Run Growth of Financial Data Technology, *American Economic Review*, 110 (8), pp. 2485-2523.
- Ferreira, M.A., P. Matos and P. Pires (2018). Asset Management within Commercial Banking Groups: International evidence, *Journal of Finance*, 73 (5), pp. 2181-2227.
- Frost, J., L. Gambacorta, Y. Huang, H.S. Shin and P. Zbinden (2019). BigTech and the Changing Structure of Financial Intermediation, BIS Working Paper 779.
- Fuster, A., P. Goldsmith-Pinkham, T. Ramadorai and A. Walther (2018). Predictably Unequal? The Effects of Machine Learning on Credit Markets, Working Paper.
- Fuster, A., M. Plosser, P. Schnabl and J. Vickery (2019). The Role of Technology in Mortgage Lending, *Review of Financial Studies*, 32 (5), pp. 1854-1899.
- Gambacorta, L., Y. Huang, Z. Li, H. Qiu and S. Chen (2020). Data vs Collateral, Bank for International Settlements working paper No. 881.
- Gao, M. and J. Huang (2020). Informing the Market: The Effect of Modern Information Technologies on Information Production, *Review of Financial Studies*, 33 (4), pp. 1367-1411.
- Garratt, R. and M.R. Van Oordt (2019). Privacy as a Public Good: A Case for Electronic Cash, Bank of Canada Staff Working Paper, No 2019-24.
- Gennaioli, N., A. Shleifer and R.W. Vishny (2013). A Model of Shadow Banking, *Journal of Finance*, 68 (4), pp. 1331-1363.
- Gorton, G. and A. Metrick (2012). Securitized Banking and the Run on Repo, *Journal of Financial Economics*, 104 (3), 425-451.
- Griffoli, M.T.M., M.M.S.M. Peria, M.I. Agur, M.A. Ari, M.J. Kiff, M.A. Popescu and M.C. Rochon (2018). Casting Light on Central Bank Digital Currencies, IMF Staff Discussion Note, No SDN/18/08.
- Guiso, L., P. Sapienza and L. Zingales (2008). Trusting the Stock Market, *Journal of Finance*, 63 (6), pp. 2557-2600.

- Habib, M.A. and D.B. Johnsen (1999). The Financing and Redeployment of Specific Assets, *Journal of Finance*, 54 (2), pp. 693-720.
- Hakenes, H. and I. Schnabel (2014). Regulatory Capture by Sophistication, Mimeo. University of Bonn.
- Hart, O. (1995). *Firms, Contracts, and Financial Structure*, Clarendon Lectures in Economics, Oxford: Clarendon Press.
- Hau, H., Y. Huang, H. Shan and Z. Sheng (2019). How Fintech enters China's Credit Market, AEA Papers and Proceedings, No 109, pp. 60-64.
- Hauswald, R. and R. Marquez (2003). Information Technology and Financial Services Competition, *Review of Financial Studies*, 16 (3), pp. 921-948.
- Hirshleifer, J. (1971). The Private and Social Value of Information and the Reward to Inventive Activity, *American Economic Review*, 61 (4), pp. 561-574.
- Holmstrom B. and J. Tirole (1997). Financial Intermediation, Loanable Funds, and the Real Sector, *The Quarterly Journal of Economics*, 112 (3), pp. 663-691.
- Houston, J.F. and M.D. Ryngaert (1994). The Overall Gains from Large Bank Mergers, *Journal of Banking & Finance*, 18 (6), pp. 1155-1176.
- Houston, J.F., C.M. James and M.D. Ryngaert (2001). Where Do Merger Gains Come From? Bank Mergers from the Perspective of Insiders and Outsiders, *Journal of Financial Economics*, 60 (2-3), pp. 285-331.
- Infante, S. and A. Vardoulakis (2020). Collateral Runs, *The Review of Financial Studies*, forthcoming.
- Jaffee, D.M. and K.T. Rosen (1990). Mortgage Securitization Trends, *Journal of Housing Research*, 1 (1), pp. 117-137.
- Jappelli, T. and M. Pagano (2002). Information Sharing, Lending and Defaults: Cross-Country Evidence, *Journal of Banking & Finance*, 26 (10), pp. 2017-2045.
- Jones, C. I. and C. Tonetti (2020). Nonrivalry and the Economics of Data, *American Economic Review*, 110 (9), pp. 2819-58.
- Kashyap, A.K. and A. Wetherilt (2019). Some Principles for Regulating Cyber Risk, *American Economic Review Papers and Proceedings*, 109, pp. 482-87.
- Keys, B. J., T. Mukherjee, A. Seru and V. Vig (2010). Did Securitization Lead to Lax Screening? Evidence from Subprime Loans, *Quarterly Journal of Economics*, 125 (1), pp. 307-362.
- Krishnamurthy, A. and A. Vissing-Jorgensen (2012). The Aggregate Demand for Treasury Debt, *Journal of Political Economy*, 120 (2), pp. 233-267.
- Kroszner, R.S. and R.G. Rajan (1994). Is the Glass-Steagall Act justified? A Study of the US Experience with Universal Banking before 1933, *American Economic Review*, 84 (4), pp. 810-832.
- Laeven, L., L. Ratnovski and H. Tong (2016). Bank Size, Capital, and Systemic Risk: Some International Evidence, *Journal of Banking & Finance*, 69, pp. S25-S34.
- Liberti, J.M. and M.A. Petersen (2018). Information: Hard and Soft, *Review of Corporate Finance Studies*, 8 (1), pp. 1-41.

- López-Espinosa, G., S. Mayordomo and A. Moreno (2017). When Does Relationship Lending Start to Pay?, *Journal of Financial Intermediation*, 31, pp.16-29.
- Lorenzoni, G. (2008), Inefficient Credit Booms, *Review of Economic Studies*, 75 (3), pp. 809-833.
- Loutskina, E. and P.E. Strahan (2009). Securitization and the Declining Impact of Bank Finance on Loan Supply: Evidence from Mortgage Originations, *Journal of Finance*, 64 (2), pp. 861-889.
- Loutskina, E. and P.E. Strahan (2011). Informed and Uninformed Investment in Housing: The downside of diversification, *Review of Financial Studies*, 24 (5), pp. 1447-1480.
- Merton, R.C. and R.T. Thakor (2019). Customers and Investors: a Framework for Understanding the Evolution of Financial Institutions, *Journal of Financial Intermediation*, 39, pp. 4-18.
- Mian, S.L. and C.W. Smith Jr (1992). Accounts Receivable Management Policy: Theory and Evidence, *Journal of Finance*, 47 (1), pp. 169-200.
- O'Hara, M. and W. Shaw (1990). Deposit Insurance and Wealth Effects: the Value of Being 'Too Big to Fail', *Journal of Finance*, 45 (5), pp. 1587-160.
- Pagano, M. and T. Jappelli (1993). Information Sharing in Credit Markets, *The Journal of Finance*, 48 (5), pp.1693-1718.
- Park, H. and C.M. Kahn (2019). Collateral, Rehypothecation, and Efficiency, *Journal of Financial Intermediation*, 39, pp. 34-46.
- Parlour, C.A., U. Rajan and H. Zhu (2019). Fintech Disruption, Payment Data, and Bank Information, Mimeo.
- Petersen, M.A. and R.G. Rajan (1994). The Benefits of Lending Relationships: Evidence from Small Business Data, *Journal of Finance*, 49 (1), pp. 3-37.
- Petersen, M.A. and R.G. Rajan (1995). The Effect of Credit Market Competition on Lending Relationships, *The Quarterly Journal of Economics*, 110 (2), pp. 407-443.
- Petersen, M.A. and R.G. Rajan (1997). Trade Credit: Theories and Evidence, *Review of Financial Studies*, 10 (3), pp. 661-691.
- Petralia, K., T. Philippon, T. Rice and N. Veron (2019). Banking Disrupted. Financial Intermediation in an Era of Transformational Technology, Geneva Report on the World Economy, No. 22.
- Pierri, N. and Y. Timmer (2020). Tech in Fin before Fintech: Blessing or Curse for Financial Stability?, IMF Working Paper, WP20/14.
- Philippon, T. (2015). Has the US Finance Industry Become Less Efficient? On the Theory and Measurement of Financial Intermediation, *American Economic Review*, 105 (4), pp. 1408-38.
- Philippon, T. (2020). On Fintech and Financial Inclusion, BIS Working Papers, No 841.
- Pozsar, Z. (2013). Institutional Cash Pools and the Triffin Dilemma of the US Banking System, *Financial Markets, Institutions & Instruments*, 22 (5), pp. 283-318.

- Puri, M. and J. Rocholl (2008). On the Importance of Retail Banking Relationships, *Journal of Financial Economics*, 89 (2), pp. 253-267.
- Puri, M., J. Rocholl and S. Steffen (2017). What Do a Million Observations Have to Say about Loan Defaults? Opening the Black Box of Relationships, *Journal of Financial Intermediation*, 31, pp. 1-15.
- Rajan, R.G. (1992). Insiders and Outsiders: The Choice between Informed and Arm's Length Debt, *Journal of Finance*, 47 (4), pp. 1367-1400.
- Rajan, R.G. (2006). Has Finance Made the World Riskier?, *European Financial Management*, 12 (4), pp. 499-533.
- Ramakrishnan, R.T. and A.V. Thakor (1984). Information Reliability and a Theory of Financial Intermediation, *Review of Economic Studies*, 51 (3), pp. 415-432.
- Rochet, J.C. and J. Tirole (2003). Platform Competition in Two-Sided Markets, *Journal of the European Economic Association*, 1 (4), pp. 990-1029.
- Schaeck, K. and M. Cihak, M. (2012). Banking Competition and Capital Ratios, *European Financial Management*, 18 (5), pp. 836-866.
- Scharfstein, D.S. and J.C. Stein (2000). The Dark Side of Internal Capital Markets: Divisional Rent Seeking and Inefficient Investment, *Journal of Finance*, 55 (6), pp. 2537-2564.
- Sharpe, S.A. (1990). Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships, *Journal of Finance*, 45 (4), pp. 1069-1087.
- Shiller, B.R. (2013). First Degree Price Discrimination Using Big Data, Working Paper, Brandeis University.
- Shin, H.S. (2009). Securitisation and Financial Stability, *The Economic Journal*, 119 (536), pp. 309-332.
- Singh, M.M. and J. Aitken (2010). The (Sizable) Role of Rehypothecation in the Shadow Banking System, International Monetary Fund working paper 10-172.
- Smith, J.K. (1987). Trade Credit and Informational Asymmetry, *Journal of Finance*, 42 (4), pp. 863-872.
- Stein, J.C. (2002). Information Production and Capital Allocation: Decentralized versus Hierarchical Firms, *Journal of Finance*, 57 (5), pp. 1891-1921.
- Stein, J.C. (2010). Securitization, Shadow Banking & Financial Fragility, *Daedalus*, 139 (4), pp. 41-51.
- Stiroh, K.J. and A. Rumble (2006). The Dark Side of Diversification: The Case of US Financial Holding Companies, *Journal of Banking & Finance*, 30 (8), pp. 2131-2161.
- Stroebel, J. (2016). Asymmetric Information about Collateral Values, *Journal of Finance*, 71 (3), pp. 1071-1112.
- Stulz, R.M. (2019). Fintech, Bigtech, and the Future of Banks, *Journal of Applied Corporate Finance*, 31 (4), pp. 86-97.
- Tang, H. (2019). Peer-to-Peer Lenders versus Banks: Substitutes or Complements?, *Review of Financial Studies*, 32 (5), pp. 1900-1938.

- Thakor, A.V. (2020). Fintech and Banking: What Do we Know?, Forthcoming in *Journal of Financial Intermediation*, 41, 100833.
- Thakor, R.T. and R.C. Merton (2018). Trust in Lending, National Bureau of Economic Research Working Paper No. w24778.
- Vallée, B. and Y. Zeng (2019). Marketplace Lending: a New Banking Paradigm?, *Review of Financial Studies*, 32 (5), pp. 1939-1982.
- Van den Heuvel, S. (2002). Does Bank Capital Matter for Monetary Transmission?, *FRBNY Economic Policy Review*, 8 (1), pp. 259-265.
- Vives, X. (2008). *Information and Learning in Markets: The Impact of Market Microstructure*, Princeton; Oxford: Princeton University Press.
- Vives, X. (2019). Digital Disruption in Banking, *The Annual Review of Financial Economics*, 11 (1), pp. 243-272.
- Zhou, C. (2010). Are Banks Too Big to Fail? Measuring Systemic Importance of Financial Institutions, *International Journal of Central Banking*, 6 (34), pp. 205-250.

NOTES ON THE CONTRIBUTORS

ROLEF DE WEIJS is Professor of National and International Insolvency Law at the University of Amsterdam and practices law as an attorney and a court appointed trustee in bankruptcy at Houthoff, a law firm in Amsterdam. De Weijs specializes in property law, insolvency law, corporate law and corporate finance. He has been involved in large bankruptcies such as Jomed, Van der Hoop Bankiers, DSB Bank and the Dutch entities in the bankruptcies of Swiss Air and Lehman Brothers. In addition, De Weijs advises on the opportunities and responsibilities of companies, directors, shareholders and financiers in the twilight zone, both in situations where bankruptcy seems imminent and in retrospect when bankruptcy is pursued.

AART JONKERS is Assistant Professor at the Amsterdam Centre for Transformative Private Law at the University of Amsterdam. In 2020 he obtained his PhD for his research on the economic analysis of insider guarantee relationships in corporate finance under Dutch, US and German Law at the University of Amsterdam. His research combines an economic and a comparative law approach and offers a critical perspective on the current regulation of externalities in corporate finance. His research focuses on the regulation of the economic dynamics involved in corporate finance and insolvency, more specifically on security rights and limited liability.

ARNOUD BOOT is Professor of Corporate Finance and Financial Markets at the University of Amsterdam. He is member of the Dutch Scientific Council for Government Policy (WRR) and chairman of the European Finance Association (EFA). Arnoud Boot is member of the Royal Netherlands Academy of Arts and Sciences (KNAW) and Research Fellow at the Centre for Economic Policy Research (CEPR) in London. His publications have appeared in major academic journals, including the *American Economic Review* and the *Journal of Finance*.

PETER HOFFMANN is a senior economist and works in the Financial Research Division of the European Central Bank in Frankfurt. His research mainly deals with the microstructure of financial markets. He published in major academic journals as the *Journal of Finance*, the *Review of Financial Studies* and the *Journal of Banking and Finance*. In 2011 he graduated with a Ph.D. in Finance at Universitat Pompeu Fabra.

LUC LAEVEN is Director-General, Directorate General Research at the European Central Bank. Formerly, he was a Senior Economist in the Research Department of the International Monetary Fund. Prior to this, he was a Senior Financial Economist at the World Bank and worked at ABN AMRO Bank. His research focuses on international banking and corporate finance issues and has been published in top academic

journals, including the *Journal of Finance* and the *Journal of Financial Economics*. He has also co-edited a book on *Systemic Financial Crises: Containment and Resolution* published by Cambridge University Press. He is a Research Affiliate of the Financial Economics Programme of the Centre for Economic Policy Research in London.

LEV RATNOVSKI is Lead Economist at the European Central Bank (Directorate General Research), on leave from the International Monetary Fund. He works on financial sector issues, such as fintech, liquidity, regulation, and crises. At the IMF, he covered Canada, China, Korea, Mongolia, Ireland, Spain, Portugal, Ukraine, and USA. He has published in the *Review of Financial Studies*, *Review of Finance*, and *Journal of Financial Intermediation*, among other journals. He started his career at the Bank of England after receiving a Ph.D. from the University of Amsterdam.

**EARLIER PUBLICATIONS
IN THE TOPICS IN CORPORATE FINANCE SERIES**

- 27 Sustainable Finance and Government Policy, by D. Schoenmaker, R. van Tilburg, E. Achterberg and M. van Son, 2019.
- 26 Understanding Fintech and Private Equity, by A.W.A. Boot, J.E. Ligterink and J.K. Martin, 2018.
- 25 Private equity: waardecreatie, herverdeling en excessen (in Dutch), by J.E. Ligterink and J.K. Martin, 2017.
- 24 Understanding the Crisis: Bank Funding Structures as Source of Instability, by T. Yorulmazer, 2015.
- 23 Towards a Better Understanding of the Capitalization of Banks, by A.R. Admati and others, 2014.
- 22 Transactiemaatschappij en financiële markten: op zoek naar een nieuwe balans (in Dutch), by A.W.A. Boot, 2013.
- 21 Macro-economische oplossingen gezocht: naar integrale oplossingen voor de onevenwichtigheden in wonen, pensioen, ouderenzorg en het bancaire landschap (in Dutch), by L. Bovenberg, 2012.
- 20 Towards a Final Resolution of the Euro and Banking Crisis, by P. de Grauwe and A.W.A. Boot, 2011.
- 19 The Global Banking Crisis and the Post-Crisis Banking and Regulatory Scenario, by D.T. Llewellyn, 2010.
- 18 Regulating Private Equity, by L. Phalippou, 2010.
- 17 Towards a Fundamental Understanding of Financial Sector Developments, with contributions of F. Partnoy, A.W.A. Boot and A.V. Thakor, 2009.
- 16 Corporate finance theorie en financiële crisis in breder perspectief (in Dutch), by A.W.A. Boot, 2008.

- 15 Private equity en aandeelhoudersactivisme (in Dutch), with contributions of A.W.A. Boot, H. T. J. Smit and W.A. van den Berg, A. Schmeits, J. Fidrmuc and P. Roosenboom, and D. van Dijk, A. Schwienbacher, L. Goossens and S. Manigart, and M. Meuleman, J.A. McCahery and E.P.M. Vermeulen, 2007.
- 14 Headquarters and Innovation: Does Location Matter?, by X. Vives and V. Strauss-Kahn, 2007.
- 13 The Quality of Corporate Law and the Role of Corporate Law Judges, with contributions of L. Bouchez, A. Karpf, J. Winter, W.W. Bratton, J.A. McCahery, J.B. Jacobs, J.L. Reed, L. Timmerman, M.J. Kroeze, M.W. Josephus Jitta and L. Enriques, 2006.
- 12 Understanding (Un)incorporated Business Forms, by J.A. McCahery and E.P.M. Vermeulen, 2005.
- 11 Recent Research on the Investment Behavior of Private Equity Fund Managers, by D. Cumming, G. Fleming and A. Schwienbacher, 2005.
- 10 Corporate governance: een agenda voor de toekomst (in Dutch), by M.J.G.C. Raaijmakers, G. van Solinge en P. Frentrop, 2005.
- 9 Entrepreneurship and Venture Capital, by A. Bhidé, 2004.
- 8 Perspectives on the Theory and Practice of Corporate Finance, by V. Maksimovic, D. Brounen, A. de Jong and K. Koedijk, 2004.
- 7 Securitisation: economics en Europees perspectief (in Dutch), by J.J.A. Lee-naars, 2003.
- 6 Global Corporate Governance and Accounting Transparency, by U. Bhattacharya, 2003.
- 5 The Role of Bank Funding for the Corporate Sector: the Netherlands in an International Perspective, by A. Saunders and A. Schmeits, 2002.
- 4 Management Compensation in the Netherlands: Theory, Evidence, and Best Practice, by T.T. Milbourn, 2001.
- 3 De efficiëntie van de Nederlandse faillissementswetgeving (in Dutch), by A.W.A. Boot and J.E. Ligterink, 2000.

- 2 Perspectives on the Regulation of the Financial Services Industry, with contributions of E.I. Altman and A. Saunders, and A.W.A. Boot, T.T. Milbourn, and S. Dezelan, 2000.
- 1 The Future of Banking: Two Essays on the Consolidation in the Financial Sector, by I. Walter and A.W.A. Boot, 1999.

For more information check the website: <http://www.accf.nl>.

Amsterdam Center for Corporate Finance

The Amsterdam Center for Corporate Finance (ACCF) is a thinktank specializing in the financial management of corporations and the operations of the financial sector. The ACCF promotes high quality research on the interface between financial theory and corporate policy. With a variety of activities, it provides a forum for dialog between academics and practitioners. The ACCF is an independent foundation and is supported by major financial and industrial corporations, consultancy agencies and (semi) government bodies. It is affiliated with the University of Amsterdam.

Director

A.W.A. Boot

Board

J.E. Ligterink
J.B.M. Streppel

Address

Plantage Muidersgracht 12
1018 TV Amsterdam
P.O. Box 15953
1001 NL Amsterdam
The Netherlands
Phone: +31 20 525 4162
E-mail: office@accf.nl
<http://www.accf.nl>