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Financial market integration: risks and opportunities

Prof.dr. Mary Pieterse-Bloem
Inaugural Lecture 28 June 2019

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Address delivered at the occasion of accepting the appointment of Endowed Professor Financial Markets at the Erasmus School of Economics, Erasmus University Rotterdam, on Friday 28 June 2019.

Colophon

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Introduction

Dear Rector Magnificus,

Dear members of the Executive Board,

Dear Dean of the Erasmus School of Economics,

Dear colleagues, students, friends and family,

Dear distinguished guests,

Erasmus University has honoured me with a Chair on Financial Markets at the Erasmus School of Economics (ESE). Studying the financial markets' field is a broad and important remit. In this Lecture, I will paint it's landscape and detail how I am navigating through it in order to fulfil my Chair's mission.

Financial markets is where the creation and trading of financial assets takes place. The crucial role that financial markets play in our economy is to act as intermediary between those who have access funds and those who have a need for additional money. Financial markets, in other words, bridge the gap between borrowers and lenders, between savers and investors. The trading that takes place on financial markets, in stocks, bonds, commodities, currencies, derivatives and other financial assets, brings about an allocation of financial resources and a spreading of financial risks. The more efficient financial markets are, the more effective financial risks are shared. This sounds like an economists' jargon, but this is about real-life important issues such as the company that can sell shares to grow its business, about the government that can borrow money to improve hospitals and roads, and about you and me who can get a mortgage at an attractive rate for our homes. This is why, in principle, modern economies prefer efficient financial markets. My Chair's remit is to study the discipline of financial markets; the way they function, if they perform their role well, and what that results in for market participants and society at large.

It is a very broad remit. Intermediation and risk sharing is what markets do, and financial markets are no different. It is just that the number of financial products has become so large and the size of financial markets has become so enormous. The Bank for International Settlements (BIS) observes that the financial cycle is now dominating the business cycle in the real economy. There was a time, before the large expansion of financial sector in the 1980's, where it was the other way around. I join this observation with a dual mix of admiration and anguish: admiration for the creativeness of the bright professionals in finance to create new financial products, and to open up new markets; and anguish because the large streams of money that flow through these markets around the globe

have led to large boom-bust cycles which have hurt common people. We all still probably remember the bursting of the IT stock bubble in 2001. Today, we have still not fully recovered from the most recent, and in my working life time the largest of such busts which was global financial crisis in 2008. These events show that it is really important to study how well, or not so well, financial markets function.

Leaving aside the importance of financial markets, I would like to sketch it's terrain some more. Not only is it enormous, it is also very diverse. This is because the market place for each financial asset is different due to its unique institutional setting. Each financial asset trades on a different platform, is subject to its own regulation, has its own set of financial institutions that act as market makers and its own set of borrows and investors that participate in this market. That is why the market for American stocks is very different from the market for European government bonds, or the market for Gold bullion. There is, naturally, to a greater or lesser degree, interaction between these individual markets, but they are at the same time different.

Navigating through the landscape of financial markets is therefore like the joy of a world traveller who can choose to visit an area dominated by mountains, woodland or lakes. The analogue probably appeals to you because we all have our personal favourite. "Oh, I would choose the mountains" is what I can hear some of you think. With financial markets, it's the same. Some us prefer to work in stock markets, others in bond markets and yet others in commodities' markets. My favourite is the bond market, for four reasons. First of all, the bond market is in and off itself a heterogeneous market: the market for government bonds is again somewhat different from the market for corporate bonds and emerging market debt. Secondly, the bond market is also very big. When I tell my students in my first lecture that the world bond markets are almost 1,5 times the size of world stock markets, and that it is a multiple of that if you would include their derivatives' markets, they nearly fall of their chair. Thirdly, the size of this market is not emulated in the number of academic studies, which are far greater for stocks. Access to data for the average researcher, understanding what the data really represents and how it needs to be reworked to make it suitable for academic research is evidently a significant barrier. I have as a practitioner a better-than-average access to and understanding of the data and this has given me a real advantage as an academic researcher. Already for these three reasons are bond markets fascinating to work in and interesting study material. Even more so because it fuses risk factors of the currency and money markets on the one hand, with risk factors of the stock markets on the other hand. Last but not least, the market for bonds is very influential for other financial markets, because it determines the level of interest rates. If interest rates fall, then, all other things equal, stocks prices rise because the rate at which the future stream of dividends is discounted with falls. This is true for many financial assets. A bond person will therefore always argue that the bond markets are the cradle of all financial markets.

My personal journey in financial markets starts in 1993, with my bond analyst role in the dealing room of a large European investment bank in the City of London. Six months into my job, the Federal Reserve, which is the central bank of the United States, starts to hike interest rates aggressively. The bloodbath that this causes in financial markets was my

baptism. The wild interplay between the macro and monetary economics that I had so extensively studied at university and that was being played out through the bond markets with large spill-over effects to other financial markets caused an instant infatuation that has never left me. It marked the start of a journey that has, to date, taken me twenty-six years of learning, by practicing in and by studying financial markets.

Today I will give you an account of this journey. As is always the case when travelling through a vast landscape, you will only see what is right beside the road and the area of the temporary destination it leads to. I will take you through the fields of international financial integration and market liquidity, which have been my two main research interests so far. As we travel along, I will take you to themes that are reshaping the landscape of financial markets. I will specifically discuss financial regulation, monetary policy, technological advances and the quest for sustainable finance. I will finish with some concluding remarks and a word of thanks.

International financial integration

When I started my career, bond markets in Europe were segregated along national currency lines. I worked for a bank where the Board recognised that the Economic and Monetary Union (EMU) was, more than anything else, a political project, and that as such, it was destined to come into being. Therefore, from the middle of the 1990's I, now as the Chief ECU Bond Strategist, was tasked to assist our clients in preparing for this new financial market based on one single European currency. I travelled the world to advise large institutional investors, such as Teachers in Ontario, on how to re-allocate their asset portfolio. I also discussed with central banks, such as the People's Bank of China, what the impact on their foreign exchange currency reserves composition could be. I presented proposals to regular bond issuers such as the European Investment Bank that would strategically reposition their issuance program. With several other financial analysts, I advised the European Commission on the redenomination of existing securities' contracts.

In the run-up to the 1st January 1999, the designated birthday of the Euro, there was some speculation, scepticism even among market participants, that is was going to take some time before the market would accept it. The European Union's transition plan made it technically possible to issue for another two years in legacy currency. But as it happened, the changeover was almost immediate. In a matter of a few days the second largest internal market in the world was born, where interest rates at the short end where anchored by the monetary policy of one central bank. Very soon, the vast majority of bonds were traded and issued in Euro's and other financial markets in the Eurozone moved over to the Euro as well.

It was a very exciting time, and one that would inspire me, years later, to make it the subject of my PhD thesis. I had experienced the European bond markets some seven years before and after the introduction of the Euro, and I was curious to what extend this market was truly integrated for investors. My two promoters, Dick van Wensveen and Sylvester Eijffinger, gave me two volumes that Sylvester had published together with Jan Lemmen in 2003 on international financial integration[1]. These volumes reflected the state of the academic debate on international financial integration at the time. The nearly forty benchmark articles document the extend and speed of financial integration from either an interest-rate parity, savings-investment correlation or consumption-growth correlation perspective.

1 Eijffinger, S.C.W. and Lemmen, J.J.G. (Ed.), 2003. *International Financial Integration.* Volume I and II. Edward Elgar Publishing Ltd, UK

Each perspective represents a strand in this literature. The interest-rate parity strand builds on the law-of-one-price and postulates that if markets are financially integrated then identical securities should be priced identical in all of them. The savings-investment correlation strand postulates that with perfect long-term capital mobility, there should be no relation between domestic savings and domestic investments. The consumption-growth correlation strand postulates that in fully integrated and complete markets, consumers in different countries that have access to the same risk-free asset and have a desire to smooth their consumption over time will have similar consumption growth patterns. Having read all this literature, I came to the inconvenient conclusion that the evidence from all these testable measures was not pointing in the same direction on the state of international financial integration: consumption growth is not so well correlated among countries, neither are domestic savings and investments within countries. Only interest-parity seemed to hold for a certain set of countries, but only up until covered nominal interest rates and not so much for uncovered nominal interest rates, and mostly for interest rates on short-dated money market securities and not so much for interest rates on longer-dated instruments[2].

I also was little the wiser on the benefit for investors. My underlying motivation was to learn to what extend the integrated Eurozone market had created the ability for more optimal portfolio allocations. A more integrated financial market would at least give investors that opportunity. It then also remains to be seen whether they would seize that opportunity with more optimal diversification strategies. Luckily, the European Central Bank (ECB) had also taken an interest in the state of integration of the different segments of the Eurozone financial markets. It is important for the effectiveness of the transmission of their monetary policy that financial markets are fully integrated. The European Central Bank had to that end set up a research network on capital markets and financial integration in Europe with the Centre for Financial Studies. This resulted in 2004 in an ECB occasional paper that lists three categories of measures of integration for the bank credit, bond and equity markets: price-based measures that capture discrepancies in prices or returns caused by their geographic origin, news-based measures that isolate the proportion of price changes caused by news common to assets across all countries, and quantity-based measures such as cross-border merger and acquisitions activity[3].

Among the list of measures for the various types of bonds there was one that caught my attention. A novel measure, borrowed from the finance literature, was proposed for Eurozone corporate bonds, extracting the proportion of cross-sectional return variance explained by country effects. The idea being that the lower the country effects, the higher the integration of this market in the Eurozone. To me, this way of looking at integration seemed highly relevant.

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2 Pieterse-Bloem, M.A., 2011. *The effect of EMU on bond market integration and investor portfolio allocations: an empirical study of factor decomposition and diversification in European bond returns.* Tilburg University CentER Dissertation Series, nr 279

3 Baele, L., Ferrando A., Hordahl, P., and Monnet, C., 2004. *Measuring financial integration in the Euro area.* ECB Occasional Paper 14

In the run-up to EMU, we as practitioners had quickly figured out that the Euro would spur the development of the credit bond market in Europe. This prediction came to pass, and in the early years of the monetary union, lots of new corporates were issuing in Euro, encouraged by a growing investor demand. Whereas Eurozone government bond yields were converging strongly, indicating a well-integrated bond market, in my view the real test for integration would be with bonds of more dissimilar risk characteristics. Besides being able to say something with this research on the state of financial integration, it would also be able to say something on how to construct optimal investment portfolios. The finance literature included lots of studies on the country versus industry factors in equity returns resulting in a rich debate since Heston and Rouwenhorst introduced this in 1994[4], but only one study existed for corporate bonds. An empty research spot therefore that cried for filling.

Thus I set out to build the database needed to analyse what is driving European corporate bond returns. This is the data obstacle that I mentioned earlier, because for stocks, the country and industry indexes are readily available, but not so for corporate bonds. It took me more than a year to build those indexes up, from some 4,500 corporate bond price series for the period 1991 to 2008. Together with Ronald Mahieu, I built and published the results of a static decomposition of those returns in country and industry factors in the *Journal of International Money and Finance* in 2013[5]. Our main finding was that country factors dominate the variation of corporate bond returns before, but even more so after the introduction of the Euro. The latter surprised us, because comparable studies for stocks show that country factors tended to decline after the turn of the millennium. We concluded that investors cannot afford to ignore country factors in a portfolio of European corporate bonds. We also concluded that this market is signalling that financial integration is not as complete.

Since our conclusions were based on the comparison of the average strength of the country and industry factors in the period before and after EMU, the natural follow-on question was how these factors had actually behaved over time. I conducted this research with Zhaowen Qian, who took this on for her own PhD, under the supervision of myself, Willem Verschoor and Remco Zwinkels. The four of us made the factors time-varying and extended our data to 2013 so that we could also analyse the effect of the global financial crisis. We published our results of the time-varying country and industry factors

4 Heston, S.L. and Rouwenhorst, G.K., 1994. *Does industrial structure explain the benefits of international diversification?* Journal of Financial Economics 36, 3-27

5 Mahieu R.J. and Pieterse-Bloem, M. A., 2013. *Factor decomposition and diversification in European corporate bond markets.* Journal of International Money and Finance 32 (1), 194-213

in European corporate bond returns in the *Journal of Empirical Finance* in 2016[6]. The dynamic picture of the factors shows that only briefly after the introduction of the Euro, industry factors had dominated country factors. The strength of industry factors started to subside before the global financial crisis, signalling that the corporate bond market was not all that convinced about the internal cohesion of the Eurozone, in contrast to what European government bond yields signalled. After the global financial crisis, country factors returned with a vengeance. They did not fall to their pre-crisis lows in 2013, which was as far as we could see with our data. Our results coincide with a change of tone in the academic literature, which now starts to talk more about financial fragmentation in Europe.

Our next project, was to study whether constructing portfolio's from the corporate bonds' future exposure to country and industry factors have the ability to outperform a naïve allocation. Our results show that for a portfolio constructed from individual bonds, this is indeed possible[7]. This is an exciting result, because it makes it very tangible for market practitioners.

Our current project is studying to what extend country and industry factors differ in the returns of bonds and stocks that are issued by the same company. We find that they can differ considerably over time. While there are some logical factors that can explain these differences, it also shows that the corporate bond market and the stock market are not fully integrated in Europe. This work fulfils my current ambition to look much more across markets. There are few academic studies in the field of international financial integration that incorporate more markets. As I said, everyone has its favourite, but investors often need to allocate over several financial asset classes. There is plenty of scope for future research in this cross-asset area where I intend to venture.

6 Pieterse-Bloem, M.A, Qian, Z., Verschoor, W.F.C. and Zwinkels, R.C.J., 2016. *Time-varying importance of country and industry factors in European corporate bonds.* Journal of Empirical Finance 38, 429-448

7 Pieterse-Bloem, M.A., Qian, Z., Verschoor, W.F.C. and Zwinkels, R.C.J., 2017. *Optimal portfolio choice in corporate bond markets.* SSRN working paper

Financial market liquidity

My other main research interest has been on market liquidity. I actually rolled into this area when I was asked by a colleague from our econometrics department to be the second reader on a Master thesis on liquidity factors. The student, Boyd Buis, had produced a fairly technical analysis, proposing an easier-to-compute alternative for a price-based funding liquidity factor calculated from the mispricing of US government bonds, or so-called US Treasuries. Recognising the unique contribution of this to the academic work that relates the lack of funding of financial intermediaries to their ability to exploit arbitrage opportunities, I insisted that it should be published. We did so in 2015, in the *International Review of Economics and Finance*[8].

This joint work drew my attention to the importance of market liquidity. Good market liquidity is important for institutions, to obtain the funding that they need at an attractive price. Good market liquidity is also important for investors, to buy and sell securities with low search and transaction costs. The liquidity of stocks can be observed and studied relatively easily, because they trade on an exchange. Bonds, however, do not trade so much on an exchange, but trade predominantly over-the-counter. Traditionally, transactions in bonds take place via voice-trading and hence trade details tend not be recorded in databases that can subsequently be analysed by academics. Because of the difficulty to obtain data for bonds, it is again an area with empty research spots.

Since the 1990's the market place for bonds is, slowly but gradually, moving to electronic platforms. This 'electronification' of the bond market has naturally happened first in the most liquid segments. So, for example in the United States, the market for US Treasuries is almost fully electronic, and the market for US corporate bonds has been following suit. Europe is not quite as far as the United States, but the market for European government bonds is largely and increasingly electronic. This is a very advantageous development for the transparency of market liquidity, for both market practitioners and academics.

The government bond market in the Eurozone is where the member states of the monetary union fund themselves. This market is a significant barometer and mediator of the economic integration of these countries. This all seemed to be going well in the early years of EMU. Looking at the development of Eurozone government bond yields was as boring as watching paint dry between 1999 and 2007. These yields traded within half a percent of each other with very low volatility. Then, when the global financial crisis morphed into a global sovereign debt crisis in Europe in 2009, these yields started to trade wide apart. The finance literature on the determinants of these yields has predominantly focussed on credit risk and not so much on liquidity risk. From the few

8 Bouwman, K., Buis, B., Pieterse-Bloem, M.A., Tham, W.W., 2015. *A practical approach to constructing price-based funding liquidity factors.* International Review of Economics and Finance 40, 90-97

studies that have incorporated liquidity risk we know that liquidity risk matters, that it interacts with credit risk and that it can be a channel for contagion. Liquidity can also freeze up for sovereign issuers in extreme circumstances, meaning that governments can longer fund themselves via the bond market. It is important, therefore, that we obtain a much better understanding on how liquidity works in this market.

In order to study liquidity, we need order book data. Fortunately, the dominant electronic trading platform for Eurozone government bonds, the Mercado Telematico dei Titoli di Stato (MTS), started recording quote and trade prices and volumes in 2003. The good news is that this high-frequency data of this quality exists. The bad news is that it is expensive. With the generous support of my faculty, the Erasmus Research Institute of Management (ERIM) and a research grant from the Observatoire de l'Epargne Européenne (OEE), I have been able to purchase MTS order book data for the years 2008 to 2015. This MTS market, which is a dealer-to-dealer market, is the subject of Boyd Buis' PhD research, which he is conducting under my supervision, and again that of Willem Verschoor and Remco Zwinkels.

There are many things that one can study with this data, but the four of us decided that we first wanted to understand the main factors that drive liquidity in this market. Very quickly we realised that in the Eurozone government bond market, the institutional setting of the market place may, besides all the regular factors that influence liquidity, play an important role. This institutional setting takes the form of primary dealerships, where the banks, that act as market maker for government bonds, are incentivised to provide liquidity through fee earning transactions. An important type of such fee earning transaction is the lead-management of the syndicated bond issues of these sovereigns, for which we were also able to obtain data. Our analysis proves that a fee-driven mechanism exists and is significant for the liquidity of Eurozone government bonds. The paper in which we describe this mechanism is currently reviewed for further revisions by a top finance journal[9]. When published, which is what we strive to, no other academic or market practitioner can take liquidity in this market at face value again. Such is the significance of this work, in my view.

Market makers provide liquidity, by intermediating between those who offer and those who bid for the government bond securities. They do not do this out of generosity, but generally to better themselves. At the minimum, they want to avoid making a loss. Market making is like a game, with lots of players who act to obtain an expected gain for a level of risk that they are prepared to take subject to the general constraints of their environment. It is imperative to understand this game if we want to understand what drives liquidity. With the uncovering of the fee-driven mechanism we understand a part of it, but we need to understand it to a finer detail. This is indeed the subject of our current project, and one that will contribute to the literature of market microstructure studies, which is in the case of other financial markets already a lot more advanced.

9 Buis, B., Pieterse-Bloem, M.A., Verschoor, W.F.C. and Zwinkels, R.C.J., 2018. *Expected issuance fees and market liquidity.* SSRN working paper

Our current set of MTS data on the quoting and trading of Eurozone government bonds ends in a year where the real fun in this market is actually starting. Because in March 2015, the ECB starts buying these government bonds as part of their Quantitative Easing (QE) program. The purpose of this exercise was to push interest rates down along the entire yield curve of Eurozone sovereigns, in order to facilitate a 'beautiful deleveraging'. This aspect of QE is already being widely researched. From this research, the effect on yields is more or less evident.

However, the effect that QE may have had on market liquidity has, to date, scarcely been researched. Yet, the impact that the ECB has had is likely to be significant. From the perspective of the market maker, a huge price-indiscriminate buyer creates adverse selection. In other words, it skews liquidity. Charles Goodhart, wrote in his handbook that we used for our monetary economics class at LSE (*Money, Information and Uncertainty,* 2nd Ed.) that he believed that it is important to implant monetary analysis firmly within the context of the micro-economic market structure. He wrote this in 1989. While I accredit Professor Goodhart with lots of wisdom and foresight, even he could not have foreseen at the time how directly and on what scale central banks would engage in bond markets, and therefore how much more pertinent such a monetary analysis on the functioning of financial markets is.

With the generosity of the Erasmus Trustfonds, who have recently given me a grant to purchase three more years of MTS data, I can add precisely the years in which the ECB's QE program was active. With this additional data, I will be able to study the effect of the ECB's transactions on market making behaviour in Eurozone government bonds, and by implication on the liquidity in this market. I will also, through a new research project that the Trustfonds supports, study the dual-interaction between credit risk and liquidity risk in this market with prominent researchers from two Spanish universities. This new research project intends to make a significant contribution to the fields of the determinants of government bond yields and contagion in the Eurozone from the point of view of liquidity.

The changing shape of financial markets

I will now take you to some pastures new and highlight four major themes that are changing the landscape of financial markets, being financial regulation, monetary policy, technological advances and sustainable finance. These themes were also addressed in the equally named conference this afternoon and very eloquently and intelligently elaborated upon by my distinguished guest speakers. I wish that I could have written this Lecture now, after the conference, for they have inspired me with yet more ideas. I will highlight what I already saw before as the main effects of these themes on market practices, how they are to some extend already interwoven in my research and how they will give rise to new research opportunities on financial markets for academics.

Financial regulation

Regulation is one of the determining elements of the microstructure of a market place. It is part of the institutional setting, and influences how market makers and market participants behave. Financial markets have always been subject to regulation, so that is nothing new. However, following the global financial crisis, this regulation has changed dramatically, both in nature and in bulk. The idea of this new regulation has been to prevent another such crisis from ever happening again.

Some of this regulation was indeed necessary to contain the negative force of financial boom–bust cycles on the real economy. In the laissez-faire regime of the 1980's and 1990's we probably had too little of it, which contributed to an unabated expansion of the financial sector and a free reign of animal spirits. However, my intuition is that we now live in a regime where the regulation is so overbearing that it is having a significant impairing effect on the functioning of financial markets as the by-product of good intentions.

This intuition is based on what I see around me as a market practitioner. Examples are plentiful and include the rules that are meant to strengthen bank balance sheets and which are, as a side effect, also increasing the cost of market making; rules that are meant to protect retail investors and which are, as a side effect, also decreasing direct access to certain markets for these investors; rules that are meant to increase price transparency through the reporting of pre- and post-trade activity and which are, as a side effect, reducing liquidity in some markets for large institutional investors while flow traders are having a ball; rules that are meant to reduce the reinforcing role of credit rating agencies in a sovereign debt crisis and which have, as a side effect, probably made them more pro-active. As these examples illustrate, there is plenty of scope for academic research on the impact of regulation on financial markets.

Monetary policy

Monetary policy has ventured from the conventional to the unconventional. This was already the case in Japan following their financial crisis in the early 1990s and has taken place in many other parts of the Western world following the global financial crisis. The result is, by and large, that Central banks no longer try to control price stability by just setting the level of short-term interest rates according to a simple Taylor rule. Both their toolbox, and I would argue also their objective function have expanded. These central banks, to varying degrees, nowadays engage in forward guidance, set negative interest rates, run large asset purchase programs under the label of Quantitative Easing and inadvertently conduct debt monetization. Only overt money financing, otherwise known as helicopter money, has not been tried, at least not yet. The shift from conventional to unconventional is not going to be reversed any time soon. It is through the bond markets where the effects of this major and structural monetary policy shift are transmitted, to other financial markets and to the real economy.

I have already highlighted the potential effect of the ECB's buying of government bonds on the liquidity in this market. However, the ECB bought more than just government bonds under its QE program. They also bought corporate bonds for instance. Important research questions are what this activity did for liquidity in that market, and what corporates did with the lower refinancing rates, to determine whether it had the desired effect. The suppression of interest rates has, in all likelihood, also raised the appetite for risk-taking on the part of investors. There is scope for academic research to study how this has affected asset allocation choices. As these examples illustrate, there is plenty of scope also for academic research on the impact of unconventional monetary policy on financial markets.

The broader question of what this shift to unconventional monetary policy does for the independence of central banks and the trust in our monetary system I will happily leave for monetary economists to tackle in their research. There is no doubt in my mind however, that financial markets, and the bond market in particular, will be the bearer and the transmitter of this risk. This will also, for years to come, provide plenty of market action and opportunities for new research.

Technological advances

In the last three decades of the previous century, it was globalisation first and technological advances second that drove the development, innovation and integration of financial markets. In our increasingly digital age, technological advances definitely have the upper hand in driving this change. Some, including the leaders at the World Economic Forum, speak of a Fourth Industrial Revolution which is described in the like-titled book by Klaus Schwab. They argue that we have just come out of the third industrial revolution which started in the 1980's. This was the digital revolution that brought us the personal computer, the internet, and information and communications technology. The Fourth Industrial Revolution builds on the digital revolution, and is marked by further

technological breakthroughs such as robotics, artificial intelligence, nanotechnology, quantum computing and biotechnology.

Fourth industrial revolution or not, we can already see the impact of these technological advances on financial markets. I have highlighted the increased 'electronification' of markets and that with enlarged computational power we can handle huge high-frequency datasets to study how these markets operate. In the regulatory environment that I described, which is limiting direct access to the underlying securities for retail investors, and the monetary regime that I described, which is keeping interest rates very low and thereby putting downward pressure on fees, exchange-traded products (ETPs) have come up very strongly as a new investment vehicle. ETPs are designed to track benchmark indexes, and therefore give investors exposure to a broad market segment via one transaction, which they can effectuate on an exchange with intra-day price transparency and liquidity at a very low cost. At the end of 2018, nearly 5 trillion US dollars was invested in ETPs. The majority of those, some 77% are based on equities and only 18% on bonds but ETPs on bonds is the fastest growing sector. It is safe to say that ETPs are quickly becoming the new pool of liquidity, especially in the more esoteric parts of the bond market where liquidity in the underlying securities is poor. The use of ETPs is transforming the landscape of financial markets in terms of these liquidity flows and also through the access that they provide for retail investors to financial markets. There have to date only been a few academic papers that have made the use of ETPs subject of their studies, but I predict that there will soon be more.

Apart from new innovative products, technological advances are also making it easier for retail investors to access financial markets. In the area where I work, private wealth management, I see how robo-advisory is taking off, tempting individuals with some but not necessarily a lot of wealth to place their savings in investment vehicles through attractive applications on their mobile phones and tablets. Artificial intelligence, or machine learning, has the ability to improve the way financial intermediaries serve these investors, by offering products that are even more suited for their individual needs. Artificial intelligence has the ability to reshape financial markets in more than one way. Think how artificial-intelligence-based solutions can be used for trading strategies, for example for technical analysis and pattern recognition, and the use of predictive algorithms to select which instrument to transact in. Machine learning requires large data sets and data analysts that can build algorithms to understand trading and investor behavioural patterns. You can imagine that this data is a golden future mining field for academics.

Sustainable finance

One of the hoped-for impacts of the Fourth Industrial Revolution is that the technological advances will help to reduce income inequality, improve the quality of life in an inclusive way and regenerate the natural environment through better asset management. The transition that this requires in our economy, from an old system that was generating wealth but also lots of waste to a new system that is creating wealth in a sustainable way, will only come about through lots of financial support. There is, fortunately, a growing willingness to

make this transition, as is shown by the adoption of the UN Sustainable Development Goals by more than 150 countries and the Climate Change Agreement by some 195 countries in 2015. It is also shown by the support that sustainable parties and policies are increasingly receiving from the electorate and by the way that businesses are latching on to this and sometimes even lead the way in the sustainable transformation. This support is needed because the amount of funds that is necessary to make the transformation should not be underestimated. Governments can play a role in the redirection of funds, through taxes and subsidies. Companies too, by transforming business models to businesses-for-good, as per the like-titled book by Marga Hoek. And, the finance industry can play an important role by redirecting savings, credit and investments to governments, institutions, corporates and projects that act in the most sustainable way. The role that financial markets play is to channel this growing stream of sustainable finance, between investors and borrowers.

In the asset management industry, sustainable investing is growing rapidly. Asset managers in Northern Europe, and therefore also in the Netherlands where I am currently based, are leading the pack. This trend started with large institutional investors, such as our pension funds, who invest with a long term horizon and who want to deploy their assets under management into more sustainable investments. They followed a development trajectory that went from the exclusion of investing into the most damaging type of activities to investing into activities with the most positive sustainable impact. Given the large assets under managements of these institutions, asset management funds had a strong commercial incentive to create sustainable investment products. Private wealth management providers are now quickly following in this growing slipstream. At ABN Amro's private bank, the assets under management in our sustainable product line has more than doubled since 2015. There is clearly a growing desire amongst our clients for sustainable investing and our bank decided to make the sustainable offering the norm in 2018. We are now going through the same development trajectory of exclusions, inclusions and impact, albeit more rapidly than our forebears. Very soon, investors will see the impact of their investments in terms of the sustainable return, meaning the contribution to the sustainable goals, besides their financial return.

In academia, the number of studies on sustainable investing has also taken flight. To build sustainable investment products, data is needed that scores borrowers on the Environmental, Social and Governance (ESG) quality of their activities, data that flags up controversies when they engage in damaging activities and data that scores their contribution towards the Sustainable Development Goals (SDG). This data gives a quantitative base to exclusion rules that are used to reduce the investable universe, and ESG and SDG best-in-class rankings that tilt the investment portfolio towards sustainable performance. There are already a large number of studies that compare the financial performance of such 'green' portfolios with the performance of classic 'brown' portfolios and broad-market indexes. Specifically in the area of bonds, so-called green bonds, whose proceeds finance green projects, were first issued just over ten years ago. This market has since grown rapidly and has attracted several of my students to compare the financial performance of green bonds with that of the normal bonds of the same issuer, for their Master thesis. I now see the first peer-reviewed papers being published on the topic of the green bond premium.

So the financial performance of sustainable investment strategies, portfolios and products is a relatively crowded space. When I look at the potential for future research, it is again mostly in the behavioural sphere. One example is whether the quest for sustainable investment induces governments and corporates to change their behaviour. And when investors say that they would like to invest sustainably, to what extend do they actually do so. When a company is in the newspapers for all the wrong reasons, because it has caused a large oil spill off the coast of Florida or because it has messed around with fuel emissions of their cars, do investors take action and divest the assets of those companies. It is those types of research questions that I am about to explore with colleagues from Oxford University, who are also training several hundred of our bankers at ABN Amro on sustainable investing.

Concluding remarks

To conclude, I trust that with this Lecture I have enthralled you with this journey through the landscape of financial markets. An important mission of my Chair is to bridge academic theory and industry practice in my teachings and in my research on topics that are relevant to our society. The two areas that I have explored with you, international financial integration and market liquidity, are essential for the fabric of financial markets and how they operate. I have with my research already contributed to the understanding of both but more work needs to be done, on the risks and the opportunities they represent for policy makers, market practitioners and ultimately the public at large.

Financial markets are as important for our society as they are dynamic. Regulation, monetary policy, technological developments and trends towards sustainability are important drivers of change. I intend to incorporate these themes in my research agenda going forward. Bringing it into the classroom and fusing what I experience in practice with findings from such research will better prepare the future generation of financial economists for the challenges of our evolving society, but also for the new chances that it brings.

Word of thanks

I would like to express thanks to many people – colleagues, friends and family - because I could not have come this far without their support, inspiration, encouragement and loving patience.

In this Lecture, I have already mentioned a few names. They have been very important to me during the various stages of my academic endeavours. Charles Goodhart was my mentor at LSE when I was there for one year to absorb everything that the Master's in Economics had to offer. I thank him for his wisdom, and Rick van der Ploeg, my mentor at the University of Amsterdam, for encouraging me to go to LSE. Charles' monetary economics course has been inspirational and defining in more ways than he actually knows, because it was in his classroom that my husband Folker and I met.

Although the whole idea of LSE was that it would prepare me for a PhD, I got side tracked by a career in investment banking in London. When thirteen years later, I decided that time had come to write my PhD, I joined the Faculty Club of Pjotr Hesseling, who is unfortunately no longer with us, and Norman Schreiner. I am grateful that they introduced me to Dick van Wensveen who first gave me his listening ear on my research ideas. He introduced me to Sylvester Eijffinger and both of them became my supervisors. I thank them for their courage to swim against the conventional tide in academia by supervising a "buitenpromovenda". Thanks to Sylvester, Simone Manganelli, who is now the head of the financial research division at the ECB invited me to spend a couple of months there to work on my PhD. I thank Simone for the wonderful time I had there, and even more so for the fact that he also invited Marta Gomez-Puig. Marta is indeed one of the two researchers from Spain who I will now join forces with. Most importantly, Dick and Sylvester introduced me to Ronald Mahieu. I conducted my econometric research for my PhD together with Ronald, and I wrote my first serious academic paper with him. Ronald is one of the most selfless researchers I have come to know in academia and I am forever grateful that I had the ability to work together with him. When it came to my promotion, Norman Schreiner was my paranimf, together with Folker. That Friday the 13th May in 2011 was one of my most memorable and enjoyable days, until today of course. I am still grateful to them and the members of my promotion committee, and especially to Lex Hoogduin who made it all the way from a turbulent DNB in Amsterdam to Tilburg. I thank Lex for that and for the many inspiring discussions we have had since.

Following my promotion, I was determined not to let go of academia the way I had after LSE. Willem Verschoor gave me the chance to stay involved. Jaap Spronk who is my leading example of entrepreneurship in research, suggested that I should talk to Willem because ESE had a bit of a gap on fixed income. I thank Jaap for this suggestion, because a couple of months later, on 1st September 2011, I was given a desk and a phone number in the H-building for 0,2fte. Willem asked me to redesign a course on fixed income for the Master's program. I had some ideas, but I can now in all honesty, share with you that

I could not have put them together so well without the help of Nico van der Sar. I thank my students, for the joy that teaching them gives me. The education of a new generation of financial economists is a very fulfilling task and also one that keeps me sharp. Whereas in my days as a student we had to do with half the data and the technology that they have at their fingertips, for them the world is also a more dynamic and challenging place.

Willem introduced me to Remco Zwinkels at ESE. Together we supervise two PhDs: Zhaowen Qian and Boyd Buis. Co-authoring research papers is the closest form of cooperation you can have with anyone in academia. You experience the ups and downs of new discoveries and journal rejections and acceptances together. With Willem, Remco, Zhaowen and Boyd, this has been a very enjoyable ride that has mostly gone up. I am very grateful for the contribution they allow me to make and for their challenge to continuously expand my boundaries of knowledge. I am convinced that the best still lies ahead of us.

As for the creation of this Chair, my special thanks goes out to Patrick Verwijmeren, the Head of our Finance Section. He asked me, ever so carefully, in June 2016 whether I wanted to go up for Endowed Professor. There are no guarantees he said because the bar at ESE is high. Sure, I said, let's go for it. I thank Patrick for recognising that a Professorship that is meant to bridge academic research and industry practice ideally suits my profile and for the contribution that he saw that I could make with such a Chair to the School. I thank Bas Donkers for guiding me through the appointment trajectory, and Benedict Dellaert who took over from him, both in their capacity as Head of our Business Economics department. I would also like to thank Philip Hans Franses, the former Dean of ESE, for evidently sharing Patrick's vision. He was like Adam Smith's invisible hand because I never once spoken to him during this trajectory but somehow things turned out all right. The one person I spoke to a lot, probably more than she could bear at one point, was Linda Klaver, our Operations Manager. I thank her for her organisational and emotional skills of dealing with me and my dossier.

I would also like to thank all other colleagues at ESE who have made me feel very welcome, including Han Smit, Sjoerd van Bekkum and Vadym Volosovych, and Jan Lemmen en Sjoerd van den Hauwe for co-reading so many theses' with me. I am especially pleased to have Guido Baltussen and my friend Onno Steenbeek as my roommates in our not so temporary E-Building, because they were also dear colleagues of mine at respectively ING IM and APG AM. I would like to thank Cia, Shirley and Suzanne for all the assistance they have given me over the years, and in turning this into a great day. I would also like to thank the Pedel and her office in this respect, and the Erasmus Alumni club, the Erasmus Trustfonds and the FSR for their support.

I combine my academic work with a position in the financial sector. Angelien Kemna, whom I first met when I was about to obtain my doctorate, advised me that a 4:1 combination is the best. She was right, on paper, for this is how it is. In practice, the balance swings a bit, between 5:0 and 3:2. I thank all the employers that I have had the joy to work for, being ING, APG and now ABN Amro, for the room that they have given me to perform my academic tasks. At ABN Amro, I have enjoyed the endearing encouragement of Richard de Groot, and Gerben Jorritsma before him. Richard understands that this is what makes me complete.

I owe it to Angelique Schut and her team for finding my public voice and face. Ronald de Groot, our Communications Officer, certainly noticed for he had to deal with my exponentially growing media attentions that this generated. I also thank Olivier Raingeard and Reinhard Pfingsten and their teams for being such great investment colleagues, and Han de Jong and his economics bureau for the many wonderful exchanges on the macroeconomic outlook. Together we have solved many world problems, at least in our own minds. I want to pour heaps of thanks on my wonderful, fast-and-furious fixed income team. Thanks Chris Huys, Roel Barnhoorn, Willem Bouwman, Fidel Kasikci, Thomas Smid, Torben Kruhmann, Florian Bardy, Matias Grinberg and Maarten Scherjon for the joy of working with you every day on the bond portfolios and for keeping the show on the road when I have to be in Rotterdam. I want to express gratitude to Alen Zeljcovic and Pieter van Mierlo who were with me all the way in my appointment trajectory, and were very proud when it came through. They have the vision to recognise the benefits of my Chair for the bank and the wonderful things we can do with it for our clients.

I thank all of you, mentors and colleagues, for setting me on the right track in this journey, for nudging and cheering me on, for opening new pathways and for pointing me in the right direction when I hit a cross-road.

A special word of thanks is reserved for those who have travelled this journey with me in private. To Eline van der Linden, my life-long friend, and Hanneke Veringa, Caroline Muste and Marga Hoek who have become dear friends since I have returned to the Netherlands. Your mission in life is the same as mine: to pursuit your talents and balance this with your family. Your capacity, like me, to not always chose the easiest route to fulfil this, is the bedrock of our friendship. I also thank the friends of my husband, Willem-Frederik Metzelaar, Stephan Poelsma and Joost van Vlijmen, who have also become my friends over the years. In fact, many of you from Hermes have welcomed me into your society and I want you to know how much this has lifted me up. I am similarly thankful to our many friends in Bloemendaal, including the ones from the Rotary.

My dear family is mentioned last, but they actually always come first in all of this. I am forever indebted to my parents for their unconditional love. They have always believed in me and backed me up, even when I ventured on a course that they could not immediately follow. Together with my dear brother Fred, my wonderful sister-in-law Jeannette and cousins Max and Mikki, we form a clan of eleven with whom I can truly be myself. My own family is the ultimate bedrock to my being. My greatest thanks goes out to my husband Folker. Our loving bond allows both of us to be everything that we need for each other, and is vital for what I can and want to achieve. So is the support and understanding that I have received from our wonderful children Femke, Roderick and Ophelia.

I thank you all, dear friends and family, for being my loving companions on this journey.

My journey continues.

Ik heb gezegd.

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Mary Pieterse-Bloem is since 1 September 2018 Endowed Professor Financial Markets at the Erasmus School of Economics. With this Chair she will raise the international research profile of the School in the field of financial markets. A key aspect of her Chair is to bridge academic theory and industry practice through research and education that is relevant for the broader academic community, policy makers and market practitioners. With her Chair she creates strong links with the finance industry and enhances the visibility of the School through her active participation in the public debate.

Mary obtained her MSc in Economics at the London School of Economics and Political Science in 1993. She obtained program certificates from London Business School, Kiel Institute for the World Economy, INSEAD, Barcelona GSE and Oxford University. She obtained her PhD at Tilburg University in 2011 when she was also a visiting researcher at the IMF in Washington and the ECB in Frankfurt on the topic of international financial integration. Besides this field, her other research interests are in the fields of market liquidity and sustainable investing. She has published, among others, in the Journal of International Money and Finance, the International Review of Economics & Finance and the Journal of Empirical Finance. Since 2011, she directs the fixed income research and education program at the Erasmus School of Economics. She also teaches at the summer school of Barcelona GSE.

Mary combines her Chair with a senior position in the financial sector. She is currently Member of the Global Investment Committee and Global Head Fixed Income at ABN Amro private bank, Chair of the Dutch Rates Guild and sits on the Advisory Boards of the ESAA Certified Pension Executive program and of IEXProfs. Previously in her working career she held positions at APG AM and NNIP in the Netherlands and at Lehman Brothers, Dresdner KW and BNP Paribas in London.

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