

CAPCO

Journal

THE CAPCO INSTITUTE JOURNAL OF FINANCIAL TRANSFORMATION

Transformational

Banking 2025: The Bank of the Future

Rainer Lenz

APEX 2016 AWARD WINNER

FINANCIAL TECHNOLOGY

Download the full version of The Journal available at CAPCO.COM/INSTITUTE

#44
11.2016

EMPOWERING THE [FINANCIAL] WORLD

Pushing the pace of Financial Technology, together we'll help our clients solve technology challenges for their business – whether it's capital markets in Mumbai or community banking in Macon.

We leverage knowledge and insights from our clients around the world:

20,000

clients in towns everywhere are becoming more efficient, modern and scalable.

27 billion

transactions processed help solve clients' challenges — big and small.

\$9 trillion

moved across the globe in a single year empowers our clients' communities to build storefronts, homes and careers.

55,000

hearts and minds have joined forces to bring you greater capabilities in even the smallest places.

Empowering the Financial World

FISGLOBAL.COM



Journal

The Capco Institute Journal of Financial Transformation

Recipient of the Apex Award for Publication Excellence

Editor

Shahin Shojai, Global Head, Capco Institute

Advisory Board

Christine Ciriani, Partner, Capco

Chris Geldard, Partner, Capco

Nick Jackson, Partner, Capco

Editorial Board

Franklin Allen, Nippon Life Professor of Finance, University of Pennsylvania

Joe Anastasio, Partner, Capco

Philippe d'Arvisenet, Adviser and former Group Chief Economist, BNP Paribas

Rudi Bogni, former Chief Executive Officer, UBS Private Banking

Bruno Bonati, Chairman of the Non-Executive Board, Zuger Kantonalbank

Dan Breznitz, Munk Chair of Innovation Studies, University of Toronto

Urs Birchler, Professor Emeritus of Banking, University of Zurich

Géry Daeninck, former CEO, Robeco

Stephen C. Daffron, CEO, Interactive Data

Jean Dermine, Professor of Banking and Finance, INSEAD

Douglas W. Diamond, Merton H. Miller Distinguished Service Professor of Finance, University of Chicago

Elroy Dimson, Emeritus Professor of Finance, London Business School

Nicholas Economides, Professor of Economics, New York University

Michael Enthoven, Board, NLF, Former Chief Executive Officer, NIBC Bank N.V.

José Luis Escrivá, Director, Independent Revenue Authority, Spain

George Feiger, Pro-Vice-Chancellor and Executive Dean, Aston Business School

Gregorio de Felice, Head of Research and Chief Economist, Intesa Sanpaolo

Allen Ferrell, Greenfield Professor of Securities Law, Harvard Law School

Peter Gomber, Full Professor, Chair of e-Finance, Goethe University Frankfurt

Wilfried Hauck, Chief Financial Officer, Hanse Merkur International GmbH

Pierre Hillion, de Picciotto Professor of Alternative Investments and Shell Professor of Finance, INSEAD

Andrei A. Kirilenko, Visiting Professor of Finance, Imperial College Business School

Mitchel Lenson, Non-Executive Director, Nationwide Building Society

David T. Llewellyn, Professor of Money and Banking, Loughborough University

Donald A. Marchand, Professor of Strategy and Information Management, IMD

Colin Mayer, Peter Moores Professor of Management Studies, Oxford University

Pierpaolo Montana, Chief Risk Officer, Mediobanca

Steve Perry, Chief Digital Officer, Visa Europe

Derek Sach, Head of Global Restructuring, The Royal Bank of Scotland

Roy C. Smith, Kenneth G. Langone Professor of Entrepreneurship and Finance, New York University

John Taysom, Visiting Professor of Computer Science, UCL

D. Sykes Wilford, W. Frank Hipp Distinguished Chair in Business, The Citadel

WHAT ARE THE DRIVERS AND DISRUPTIONS THAT DETERMINE INNOVATION AND PROSPERITY?

CAN EVERY PROBLEM BE
SOLVED WITH A QUESTION?
YES, BUT NOT EVERY QUESTION
HAS A SINGLE ANSWER.

The Munk School's Master of Global Affairs program is developing a new class of innovators and problem solvers tackling the world's most pressing challenges.

- > Tailor-made, inter-disciplinary curriculum delivering the best of both an academic and a professional degree.
- > Access to world-leading research in innovation, economic policy and global affairs.
- > International internships with top-tier institutions, agencies and companies that ensure students gain essential global experience.

**COME EXPLORE
WITH US**

**BE A
MASTER OF
GLOBAL AFFAIRS**

MUNKSCHOOL.UTORONTO.CA
MGA@UTORONTO.CA

MUNK
SCHOOL
OF
GLOBAL
AFFAIRS



UNIVERSITY OF
TORONTO



Financial Technology

Operational

- 8 **Opinion: Time is Risk: Shortening the U.S. Trade Settlement Cycle**
John Abel
- 13 **Opinion: Where Do We Go From Here? Preparing for Shortened Settlement Cycles Beyond T+2**
Steven Halliwell, Michael Martinen, Julia Simmons
- 17 **Opinion: Seeing the Forest for the Trees – The Taming of Big Data**
Sanjay Sidhwani
- 20 **Development of Distributed Ledger Technology and a First Operational Risk Assessment**
Udo Milkau, Frank Neumann, Jürgen Bott
- 31 **Digital Finance: At the Cusp of Revolutionizing Portfolio Optimization and Risk Assessment Systems**
Blu Putnam, Graham McDannel, Veenit Shah
- 39 **Safety in Numbers: Toward a New Methodology for Quantifying Cyber Risk**
Sidhartha Dash, Peyman Mestchian
- 45 **Potential and Limitations of Virtual Advice in Wealth Management**
Teodoro D. Cocca
- 58 **Overview of Blockchain Platforms and Big Data**
Guy R. Vishnia, Gareth W. Peters

Transformational

- 67 **The Rise of the Interconnected Digital Bank**
Ben Jessel
- 79 **The Emergence of Regtech 2.0: From Know Your Customer to Know Your Data**
Douglas W. Arner, János Barberis, Ross P. Buckley
- 87 **U.S. Regulation of FinTech – Recent Developments and Challenges**
C. Andrew Gerlach, Rebecca J. Simmons, Stephen H. Lam
- 97 **Strains of Digital Money**
Ignacio Mas
- 111 **Banking 2025: The Bank of the Future**
Rainer Lenz
- 122 **Banks Versus FinTech: At Last, it's Official**
Sinziانا Bunea, Benjamin Kogan, David Stolin
- 132 **The Un-Level Playing Field for P2P Lending**
Alistair Milne
- 141 **Blockchain in a Digital World**
Sara Feenan, Thierry Rayna
- 151 **FinTech in Developing Countries: Charting New Customer Journeys**
Ross P. Buckley, Sarah Webster

Banking 2025: The Bank of the Future

Rainer Lenz – Professor for International Finance, University of Applied Sciences Bielefeld¹

Abstract

Developments in information technology are fundamentally changing many traditional business models. Progress in the IT area is bringing about one change in particular: it is reducing search costs and allowing buyers and sellers of products and services to find each other directly on web-based platforms, without the need for a mediator, broker, or intermediary. All business models of trade are affected by this development, and this means that financial trade is also affected. However, bank customers will only turn to the new business model of web-based financial intermediation if the economic advantage of a behavioral change, in which the individual approaches the unfamiliar, is so compelling that the associated transaction costs of learning the new, as well as the initial uncertainty of action, are justified. Once the number of new users reaches

a critical mass, the process of reorganization is no longer linear and continuous, but advances in bursts and exponentially. This means that, at a certain point in time, the process of system change gains so much momentum that it can hardly be controlled. In view of the inefficiency of the existing banking system, as well as the economic superiority of web-based alternatives, it seems that it is only a matter of time before a system change takes place in the banking business.

¹ Prof. Rainer Lenz is a member of the board of directors at Finance Watch in Brussels and advises the EU Commission as part of the "European Crowdfunding Stakeholder Forum" on the subjects of crowdfunding and peer-to-peer lending.

THE CURRENT “BANK” BUSINESS MODEL

Social privileges and their utilization

In economic textbooks, the bank is usually depicted in its role as an intermediary that collects deposits from individual savers on the liability side of its balance sheet and distributes them on the asset side as credit to the private sector. This intermediary function, i.e., as a simple mediator of capital, would mean that a commercial bank could only lend out the same volume of credit that savers had previously deposited. This, however, is a misconception. Every commercial bank receives two social privileges along with its banking license that enable it to expand its business, regardless of the volume of savings deposits. The first is the option of favorable refinancing via central bank credits, which means that commercial banks always have central bank money at their disposal.² The second is the privilege of creating its own deposit money through lending and fractional holding of minimum reserves on deposits. Each time a commercial bank lends out money, it creates new deposit money because the borrower usually has an account with it and the amount of the loan will be credited to this account. If one simply looks at the way balance sheets work, the bank grants a loan on the assets side and credits itself with the same amount on the liabilities side as a customer deposit.³ Since fractional reserve banking only requires a bank to hold a small fraction of the amount as a deposit with the central bank, banks can grant almost unlimited loans from a given volume of savers' deposits, thus creating money.⁴

The central bank has a limited control on money supply as commercial banks can procure the necessary central bank money on favorable terms at any time by availing themselves of central bank loans. The central bank can only influence money market rates, which indirectly affect demand for credit in the real economy via capital market interest rates and thus guide the creation of money [McLeay et al. (2014)]. However, this transmission mechanism of monetary policy is highly vague and uncertain because, as the current situation in Europe demonstrates, the demand for credit in the real economy is influenced by a variety of factors.⁵ The costs of financing are only one determinant of business investment decisions, and often they are not even the deciding determinant. The central bank is, of course, free to intervene directly in the market by purchasing or selling securities (so-called open market policy) to create or remove money, enabling it to control the money supply. Nevertheless, the central bank can only justify such measures of quantitative control of the money supply in extreme market situations. Aside from this, the monetary policy of the central bank regarding deposit money creation can best be described as accommodative rather than controlling and supervisory.

For commercial banks, the ability to create their own money is a lucrative source of profit because the interest margin between lending

and deposit rates is earned with every loan that is granted. No other type of private business has the privilege of automatically receiving financing (a bank deposit) on favorable terms for a (credit) claim at the point in time when the claim is created. The question is whether banks use this privilege in the interests of society, in other words for financing the real economy. Table 1 provides an overview of the formation and usage of deposit money created by German banks.

If one looks at the aggregated assets and liabilities of German banks, it becomes apparent that the (unsecured) credits granted to the real economy only account for an average of 40% of the overall balance sheet volume, while loans to banks make up 26%.⁶ However, when banks lend to banks, money is created that does not flow into the real economy and create real value there. Instead, it remains in the monetary or nominal financial sector. Banks primarily use this money to acquire securities, investments and derivatives, and this is documented by the fact that they account for approximately 30% of the balance sheet total. This means that only a fraction of banks' usage of the social privilege of creating deposit money is for the purpose of financing the real economy.

Macroeconomic risks of the business model

The pictures of savers queueing in front of the Northern Rock Bank in the U.K. in 2007 made it clear that there exists an inherent danger in our monetary system: the only basis for the value of money and, therefore, for our existing monetary system is the faith of citizens in being able to exchange their money for goods and services at stable prices at any time, i.e., their confidence in its purchasing power. If this confidence is lost, then the result is a run on the banks to physically secure money. However, cash only accounts for approximately 10% of the euro money supply, and the bitter realization that not everyone can exchange their account balances for cash leads to a desperate struggle to be the first at the bank counter. Sight deposits on accounts are ultimately bank bonds that include the right to exchange them for cash.⁷ The only thing that gives deposit money

2 Central bank money includes cash and sight deposits with the central bank.

3 This means that the process of deposit money creation takes place differently in reality than the way it is explained in many textbooks. The creation of money is primarily dependent on the demand for credit and not on the volume of savings deposits. The process begins with the bank granting the loan, which generates new deposits and new deposit money, not with the savings deposit [McLeay et al. (2014)].

4 The minimum reserve ratio of the ECB is 0.05%. The minimum reserves bear interest at the interest rate of the main refinancing facility for commercial banks at the European Central Bank. See EC Regulation No 1745 (2003).

5 Despite extremely low capital market interest rates, the private credit demand from non-banks in the Eurozone has been in decline since the 2008 financial crisis.

6 If one removes mortgage lending from that, on the grounds that mortgages are mainly used to transfer ownership of existing assets rather than create new productive capacity, the figure for lending to the real economy in Germany falls to a level of around 20%.

7 The English use the very tangible expression “I owe you” (IOU) for bonds. By making a deposit at a bank, savers have implicitly acquired IOUs from banks, even if individual bank customers are hardly aware of this.

Assets	€ bln	in %	Liabilities	€ bln	in %
Cash and cash equivalents	82.5	1.0%	Liabilities to banks	1743.6	22%
Lending to banks	2637.8	33.4%	Liabilities to non-bank	3375	43%
• thereof unsecured loans	2029	25.7%	Bank bonds	1157	15%
• thereof securities issued by banks	597.8	7.6%	Capital and reserves	466.6	6%
Lending to non-banks	3928.8	49.8%	Others	1149.7	15%
• thereof unsecured loans	3153.9	40.0%	thereof derivatives trading portfolio	800	10%
• thereof securities issued by non-banks	765.7	9.7%			
Shareholdings	132.7	1.7%			
Other	1110.1	14.1%			
• thereof derivatives trading portfolio	838.6	10.6%			
balance sheet total	7891.9	100.0%		7891.9	100.0%

Deutsche Bundesbank (2015)

Table 1 – Aggregated assets and liabilities of banks in Germany (November 2014)

value and acceptance as a means of payment is the confidence in being able to exchange it for cash at any time, although only cash is defined as legal tender and must be accepted.

In a monetary system in which money has no intrinsic value, but its value is derived solely through the attribution of purchasing power, the money supply must necessarily rise in proportion to the volume of goods.⁸ Given the current business model of banks, this is difficult or almost impossible to achieve because, as explained above, the central bank only has limited influence over the creation of money by commercial banks.

Since the introduction of the euro, the growth of the money supply has been much greater than the growth of the volume of goods. The reference value of 4.5% for the growth of the money supply specified

by the European Central Bank (ECB) was almost continuously exceeded in the period between 1998 and May 2009.⁹ A comparison of M3 growth rates with those of the GDP on a quarterly basis shows serious deviations, i.e., highly excessive growth of the money supply, prior to the financial crisis. As Figure 1 documents, commercial banks created significantly more money than the real economy produced in new goods over a period of several years, and the ECB did not intervene to correct this.

With the introduction of the euro, the ECB had explicitly defined monetary analysis and M3 growth as the second pillar of its strategy. However, in 2003, the ECB clarified that M3 growth has more a medium- to long-term significance in relation to the development of prices. Under no circumstances could a failure to adhere to the annual reference value for M3 growth be viewed as justification for the central bank to automatically implement short-term monetary policy measures. To emphasize this point, the ECB announced that it would no longer take any special notice of the annual deviation of monetary growth from its reference value in the annual evaluation of the success of its monetary policy [European Central Bank (2003)].

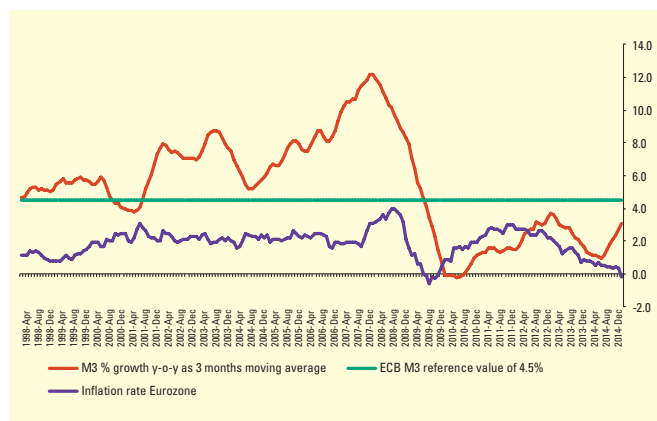


Figure 1 – M3 growth, the ECB reference value, and inflation rate

8 In Europe, money finally lost its intrinsic value with the collapse of the Bretton Woods system in 1973. In the Bretton Woods system of fixed exchange rates, participating currencies were still backed by gold, albeit implicitly, because the dollar was backed by gold, and this allowed a metal value to be calculated for each currency. During times when the gold standard existed, money had a direct connection to the price of gold via exchange ratios set by governments [Veit (1969); Jarchow and Rühmann (1984)].

9 The reference value is calculated as a three-month moving average of annual growth rates. The ECB guideline of 4.5% is based on the assumption of 2% annual inflation, 2% to 2.5% annual growth of production potential, and a decreasing velocity of money 0.5% to 1% per year [European Central Bank (1998)].

Debt growth percentage since 2000	France			Spain			Italy			Germany		
	2005	2010	2013	2005	2010	2013	2005	2010	2013	2005	2010	2013
Total economy	35%	92%	115%	105%	231%	232%	81%	83%	95%	16%	32%	30%
Corporates	23%	54%	74%	96%	204%	148%	61%	86%	82%	7%	19%	26%
Financial corporations	41%	148%	155%	490%	1137%	978%	390%	166%	172%	25%	39%	17%
Public sector	42%	94%	134%	14%	75%	207%	43%	32%	56%	27%	20%	81%
Households	46%	112%	132%	124%	210%	171%	72%	149%	148%	4%	1%	4%

Table 2 – Debt of selected countries in the Eurozone by sector

The development of inflation during the same period validated the ECB's position. The rate of inflation in the Eurozone was continuously close to the target of 2% up until the financial crisis. Hence, technically speaking, the ECB's monetary policy was successful because it sustainably ensured the monetary stability of the euro with a low inflation rate.

But is the focus of monetary policy on consumer price inflation as the exclusive measure to preserve monetary stability not an overly one-dimensional interpretation of the value of money? The excessive development of the money supply in recent years is also reflected in a sharp increase in debt in all sectors of the economy. As debt levels rise, the insolvency risk of debtors also increases. The imminent insolvency of governments or banks is a serious threat to the stability of the financial and the monetary system [Buttiglione et al. (2014)]. Table 2 shows how debt has developed in the different economic sectors of selected European countries in the period since 2000 (base year) [OECD (2015)].

The level of debt in the economies of France, Spain, and Italy has risen considerably during the last ten years. The financial sector and private households in particular have experienced an extraordinarily high credit growth. The figures for Spain are particularly dramatic. In that country, the indebtedness of the entire economy has more than tripled since the turn of the millennium. In direct comparison with the other euro countries, credit growth within the German economy was relatively moderate.

In the banking and financial sectors, this credit policy has particularly harmful effects:

- In most countries, the banking sector has reached a size that is several times as large as the national economic output. This means that the nominal monetary sector has largely decoupled itself from the real economy and is trading internally with securities and derivatives, and this is increasingly becoming a risk to the stability of the monetary system. With equity ratios of between

3% and 5%, banks are leveraged more than 20 to 30 times. Since a significant portion of the inflated credit volume is accounted for by interbank loans, not only does the sheer size of commercial banks lead to the “too-big-to-fail” problem but their mutual interdependence also poses a systemic risk [Cœuré (2014)].

- The expansive credit growth is driving stock and bond prices on the securities markets as well as real estate prices to increasing heights, and this is causing an uncontrolled rise in prices of assets. With the growing divergence between the nominal and real economy, asset prices lose their signaling and steering functions, which are extremely important for the efficient allocation of capital. Money flows into investments that have no connection with the real economy and, therefore, have no long-term value.
- Liberal lending to governments through the purchase of government bonds enables these governments to increase their budget deficits and debts far beyond their ability to sustain debt. Under current banking legislation, the purchase of government bonds, i.e., public financing, is privileged compared to the financing of businesses. In contrast to the purchase of corporate bonds, banks are not required to hold an additional amount of equity capital as a risk buffer when purchasing government bonds. Incidentally, this regulation has not been changed in the “new” Basel III guidelines [Deutsche Bundesbank (2014)]. The high monthly growth rates of government bonds and public sector loans on the balance sheets of European credit institutions shown in Figure 2 are evidence of a growing interdependence between nation states and national commercial banks.
- Governments are almost forced to rescue their creditors, the banks. If they were to lose their financiers, then sovereign default would be the consequence. The costs incurred by governments in rescuing banks are, of course, once again financed by banks, and the renewed increase of government loans on bank balance sheets from 2007 onwards is evidence of this.

Interest payments and loan redemptions represent claims on the future economic performance of the real sector [Gali (2010)]. Companies must generate a return on investments in order to service

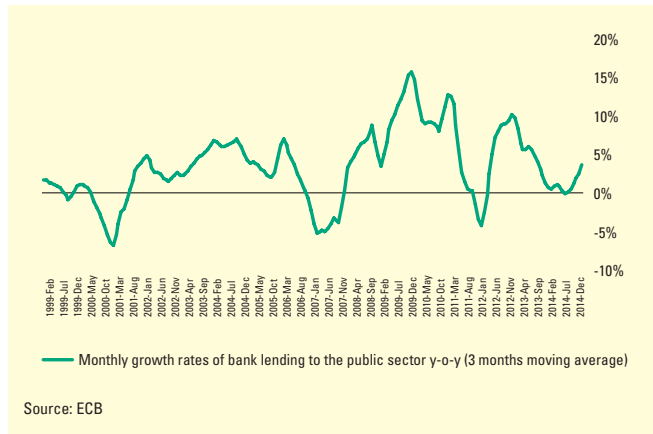


Figure 2 – Monthly growth rates of bank lending to public sector (1999 to 2014)

debt costs. In the case of private households, the interest and repayments have to be generated by labor income. Governments, in turn, pay interest and principal from the taxation of company profits and private income. However, since money has been created over the years without sufficient coverage from the real economy, these demands on real economic performance cannot be fulfilled. Nominal assets and liabilities have been created in the economy without any corresponding real economic values.

From a macroeconomic point of view, the financial crisis and the bankruptcy of debtors are the inevitable consequences of excess monetary assets and liabilities being devalued, resulting in the adjustment of corresponding claims on the aggregate production potential within the currency area.¹⁰ A monetary policy that focuses solely on the inflation rate as an indicator of monetary stability and ignores the development of the money supply as well as its impact on the stability of the financial system is clearly misguided.¹¹

Monetary policy and regulation of the “bank” business model

ECB monetary policy after the crisis

Since the financial crisis, the ECB has acted as a “lender of last resort,” preventing the collapse of insolvent debtors in the banking sector as well as governments and private households. It extended its credit facilities so that banks are able to take on long-term debt from the central bank at low interest rates. To reduce the burden on debtors and to stimulate the private demand for credit, they consequently reduced the interest on central bank lending to nearly zero. With the promise of unconditional purchases of government bonds from euro countries that are at risk of becoming insolvent, the ECB is shielding debtors from paying high-risk premiums on their liabilities. However, the private demand for bank credit - and consequently

the money creation machine of banks – does not seem to want to start up again, despite stimulation via low interest. Now the central bank steps in and fills the gap by creating money via its own open market instruments. At the beginning of 2015, citing an acute threat of deflation, the ECB announced a multi-year program for monthly purchases of securities on the market worth a total of €60 bln, which will ultimately lead to a direct expansion of the money supply in the trillions [European Central Bank (2015)].

This monetary policy saves the monetary and financial systems in the short term, but the problems of unsustainable debt in many sectors of the economy continue to exist. Ultimately, the ECB’s policy of quantitative easing is only perpetuating the banks’ pyramid scheme of deposit money creation, thereby keeping many insolvent debtors, including banks, governments (public sector at all levels), as well as private households, financially afloat in the short- to medium-term. An interest rate of almost zero or even negative interest rates may be advantageous for debtors in the short-term, but have a negative impact on the overall economy in the long run. Interest rates define the time value of money, which builds the basis of all valuation models for investment and financing decisions. If there is no more a difference between the present and the future value of cashflows then financial markets are sending the wrong signals to investors. This inevitably leads to a misallocation of capital. Bond and stock prices are being driven upwards to higher and higher levels by infusions of central bank money, signaling an economic strength and creditworthiness of borrowers that do not exist in reality.

Regulation of the banking and financial sector

Generally speaking, there are two ways to make the current “bank” business model resilient and useful for society. One option would be to take action at the point where money is created and either completely remove commercial banks’ ability to create their own deposit money or significantly reduce it by regulating lending and channeling the money that is created into the real economy. This regulatory intervention would reduce the current business model of banks towards the function of a simple intermediary between savers and investors. The second option would be to target risks arising from the use of (surplus) bank credit money, which would leave the existing “bank” business model unchanged and exclusively regulate

10 It would be ideal if the excess money in the economy could be easily written off by a symmetric devaluation of nominal assets and liabilities in an aggregated balance sheet restricted to the monetary area, without having real economic consequences. Unfortunately, this balance sheet mechanism does not exist. Debtors and creditors are neither identical economic operators nor are debts and assets distributed evenly among all individuals and institutions. For this reason, any financial and debt crisis has serious consequences for the real economy.

11 De Grauwe and Gros (2009) express similar criticism and propose a new two-pillar strategy for the ECB that explicitly defines financial stability in addition to price stability as an objective of monetary policy.

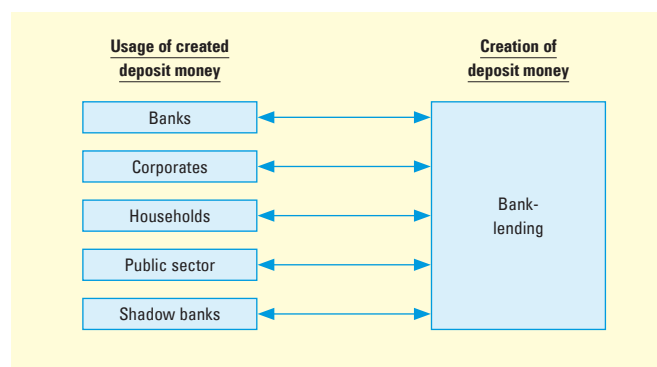


Figure 3 – Use and creation of deposit money

its consequences. Figure 3 outlines these two alternative approaches to government regulation of the banking sector.

Ever since the Basel I equity capital guidelines came into effect in the 1990s, the focus of financial market regulation has been to monitor and regulate the use of money, not its creation, i.e., the source or origin of money. The problem with this approach is that there are endless uses for (newly-created) money; the creativity and innovation of the financial sector in this respect knows no limits. Ideally, money that has been newly created by bank lending is used to finance real economy investments in the corporate sector. However, the disbursement of a loan can also be used by the debtor to purchase securities, derivatives, or investment certificates. Every use of money has its own risks and every debtor has their own risk-bearing capacity, each of which needs to be monitored and evaluated by financial supervision agencies. Debtors are those in a credit relationship with the banking sector, i.e., the banks themselves as borrowers, private households, businesses, governments, and shadow banks.¹²

The many uses of money and types of debtor give rise to a vast number of individual risks that can neither be controlled nor evaluated, and as if that were not enough they also influence each other. In seeking to identify and regulate every single risk, lawmakers and governmental financial supervisory agencies are letting themselves get pulled into a competition with financial institutions that revolves around the invention of an endless stream of new variations. With limited public resources, their chances of winning are slim. And even if banking supervisory agencies were halfway able to regulate the numerous risks in the banking sector, new risks caused by the uncontrolled financing of shadow banks and their mutual interdependence with commercial banks are emerging.

The same applies to the interface between the government and the banking sector; financial supervision has its limitations here as well.

If euro countries can take on debt that exceeds their economic ability to service that debt, then the threat of sovereign default of individual euro countries will continue to be a risk factor in the banking system that the European financial supervision authorities cannot control. In order to bring the risks resulting from the nexus between government and the banking system in the Eurozone under control, central European financial market supervision would need to be complemented by a central European fiscal policy with the authority to monitor and regulate government budgets. This shows how tightly monetary policy, fiscal policy, and the stability of the monetary and financial systems are interconnected.

The financial crisis in Europe permanently shook the confidence of policymakers and citizens in the stability of the euro and the banking and financial system [Gali (2014)]. Given the high cost of the bank bailout for government budgets and the real economic cost in Europe, this loss of confidence is hardly surprising.¹³ As always, when confidence in a business partner is lost, the reaction is to try to cover all risks contractually. This is the only explanation for the exceptionally high number of new laws that were passed to regulate the European banking and financial markets during the last five years. Table 3 provides an overview of institutional reforms to European financial supervision as well as legal initiatives to regulate the banking sector, financial markets, and shadow banking.

Banking and financial market legislation was relatively complex even before the financial crisis, but with this wave of new laws it has reached a degree of complexity and proliferation that can hardly be increased.¹⁴

Costs and benefits of the “bank” business model in 2015

In view of the effort that society puts into the regulation and supervision of the banking and financial sector, the question immediately arises as to whether the costs and benefits are proportionate. The economic benefit of the banking sector is to finance the real economy via lending and loan securitization as well as taking deposits from savers.¹⁵ But the current monetary system allows banks to expand their lending with nearly no constraints as the central bank lacks control over the process of money creation. The growth rate of bank

¹² The term “shadow bank” refers to financial investors such as private equity funds, hedge funds, or securitization platforms that perform highly-leveraged banking functions without having access to the refinancing facilities of the central bank.

¹³ In the “state aid scoreboard 2014,” the E.U. Commission provides a detailed list of all 450 governmental support measures authorized by the E.U. to stabilize the financial sector for the period between October 2008 and October 2014. The total volume of governmental support measures from 2008 to 2013 adds up to more than €700 bln euros or 5.5% of European GDP.

¹⁴ Haldane (2012) describes the extreme complexity of banking legislation as well as the public and private resources necessary for banking supervision, using a variety of examples, comparisons, and figures.

Institutional reform of financial supervision

2011 European Financial Supervisory System:

Three European supervisory authorities for banking, insurance, and securities markets (micro-prudential supervision) plus the ECB's European Systemic Risk Board (macro-prudential supervision)

2014 European banking union with three supporting pillars:

(1) Uniform supervisory mechanism with ECB (2) uniform settlement mechanism with resolution fund (3) deposit guarantee schemes

Regulation of the banking sector (Basel III – CRD IV – 2013)

Debt sustainability:

Risk adjusted equity 8%, leverage ratio 3%, liquidity requirements, macro-prudential risk provisioning

Global systemically important banks:

1% to 3.5% more equity for additional loss absorbency in steps from 2016 to 2018, FSB list of GSIBs

Bonus cap:

Variable remuneration not to exceed fixed remuneration

Implementation Act:

Corporate governance regulations including requirements for the supervisory board

2014 E.U. bank structure reform:

Proposal to separate investment banking activities from commercial banking under certain circumstances (based on Liikanen Report 2012); 2013 Germany and France introduce national "separated banking" laws

Financial market regulation

2012 E.U. regulation on short selling of credit default swaps:

Restrictive handling of short selling

2014 PRIIPs (Packaged retail and insurance-based investment products):

Investor protection through better information on the risks of structured products – 07/2016

2014 MiFID II – Review of the Markets in Financial Instruments Directive:

Investor protection: Independent investment advice, product governance, product intervention by supervisory agencies, obligation to keep records, reference rates (Libor, fixings, etc.)

Trading transparency for almost all types of securities: prices, volumes, mandatory reporting of trading in commodity derivatives, uniform tick sizes for ETFs

Authorization requirement for high-frequency trading and order-to-trade ratio limits
Obligation to trade with central counterparty for derivatives – and no more OTC

Regulation of credit rating agencies and shadow banks

2010 E.U. regulatory standards for rating agencies:

Obligation to provide information on costs; transparency of rating models of credit risks

2014 E.U. action plan to reduce dependency on ratings by rating agencies

2011 Alternative Investment Fund Managers Directive (AIFM):

Uniform E.U. rules and requirements for managing alternative investment funds (hedge, private equity as well as open and closed real estate funds)

2013 E.U. standards for money market funds:

Transparency in repo and lending transactions.

2016 E.U. regulation on financial benchmarks:

Supervision of benchmark administrators and critical benchmarks; measures to reduce conflicts of interests

Table 3 – Institutional reforms and regulation in European banking and financial markets

deposit money does not have to be backed by real economic growth nor the claims of creditors covered by the economic strength of the real economy. This inevitably leads to a nominal devaluation of assets and liabilities with damaging consequences for the real economy and thus for the prosperity of society: the insolvency of companies increases unemployment, debt-ridden governments must cut public spending (social transfers, education spending, etc.), and private households must restrict their consumption. This bank business model is embedded in a monetary system in which the central bank does not centrally control the development of the money supply in accordance with the production potential of the real economy. Instead, it continues to allow commercial banks to create their own deposit money to further their pursuit of profit, and this will lead to financial, economic, and political crises with predictable regularity.

Instead of changing the business model, its foundations are being cemented by the extremely complex regulation of the banking and financial sector. The approach of regulating the use of money in the various sectors of the economy instead of changing the creation of money only treats the symptoms, not the causes. In the end, the citizen pays the private and public costs of this extremely expensive financial legislation as a bank customer and taxpayer by covering the cost of numerous national and European supervisory institutions, as well as the banks' internal implementation of the laws. This regulation simultaneously deters potential competitors from acquiring a banking license and shields the banking industry from competition from other economic sectors.

To sum up, the cost-benefit balance of the bank business model in 2015 is clearly negative. The limited social benefits in terms of lending to the real economy are outweighed by extremely high social costs and risks. The current banking system is a high risk factor as well as a burden for society.

15 Organization and settlement of payments are also on the asset side of the banking sector's balance sheets. A comprehensive network of ATMs and branch offices ensures the supply of cash. Banks' internal payment transaction networks with clearing houses ensure the smooth processing of cashless payment transactions. However, banks no longer have a monopoly in this area; the increasing penetration of non-bank payment processors is an indicator that there are efficiency gains to be capitalized on here. In addition, a banking license is not needed for processing payment transactions.

THE “BANK 2025” BUSINESS MODEL

The monetary and financial systems are constructs created by humans to increase the prosperity of society as a whole. There is no law of nature that extrinsically determines the structure of the monetary system and the financial system. Organizational forms change with changing circumstances, and forms of organization that turn out to be negative factors for society do not last. For this reason, the question is not whether a new monetary and financial system will emerge in the coming years: in view of the state of the current monetary system, that seems to be certain. The more interesting question is how the new monetary system will be organized and what the change process might look like.

Process of change

Crises often lead to fundamental changes in the structure of organizations and processes. However, the European financial and euro crisis has apparently not had this effect. On the contrary, the reforms introduced after the financial crisis only serve to stabilize the current monetary system and can thus be labeled as system-compliant repairs. All of the reforms are objectively justifiable and are characterized by a self-contained, systemic logic. What is striking is the extremely high level of complexity, which makes expert knowledge necessary for the legislative process, supervision, and control, as well as on the part of the bank. In the spirit of “technocracy,” the current reforms in the financial sector are dominated by a kind of objective necessity and organizational determinism, and they are taking place without a societal evaluation of financial institutions and instruments. This technocratic method of managing the situation, which is completely removed from the context of its social effects, is hardly surprising: all of the proposals for legislation come from the Financial Stability Board, the Bank for International Settlements, the International Monetary Fund, and national central banks. That is to say, from institutions that are shielded by their status from direct democratic control by society or national parliaments. No impulses, proposals, or momentum for a system change are to be expected from these financial institutions. On the contrary, institutional economics teaches that institutions have an inherent urge to increase their power and influence. With the financial crisis, numerous new regulatory institutions were established for the financial sector and the responsibilities of the existing institutions expanded. A system change in money and finance would mean dismantling the rampant financial bureaucracy, and from the perspective of these institutions, this represents a risk.

In a society in which the majority of relations between individuals follow economic rationality, a system change will only occur if it is worthwhile for the economic operators. This means that the economic advantage of a behavioral change, in which the individual approaches the unfamiliar, must be so compelling that the associated transaction costs of learning the new as well as the initial

uncertainty of action are justified. At a certain point, the increasing number of users causes the network effect, and this gives the process of reorganization and system change its own momentum.

Such a development has been evident in the financial market for a number of years. In addition to conventional banking, which is protected by regulation, a parallel market consisting of an increasing number of web-based financial intermediation platforms is establishing itself. Initially, so-called “crowdfunding” was considered as a niche market for purely technology-focused business start-ups, but the platforms have now developed into a real alternative to bank loans. The high annual growth rates of this parallel market in Europe document the fact that more and more users are recognizing the economic advantages of web-based financial intermediation and are also willing to bear a higher risk [Wardrop et al. (2015)].

Peer-to-peer lending is attractive to both investors and borrowers because the existing bank margin between deposit and credit interest rates can be shared. The platform only receives a commission. These charges are much lower than a bank’s interest margin because they only need to cover the cost of operating an Internet platform for financial intermediation. Nevertheless, when investors purchase credit claims they also take the credit risk of an individual debtor. Investors can diversify the individual credit risk exposure (“unique risk”) by participating in various financing projects with small amounts or by joining together in groups of investors over the Internet. The platform only fulfills the role of intermediation and does not take on risk through its own contractual positions. In a pure peer-to-peer model there is also no systemic risk if a platform becomes insolvent because the risks are now spread across the users in a decentralized manner. Whereas banks accumulate risks, platforms decentralize the risks. The increased transparency and the central management and documentation within the transaction platform simplify the monitoring and supervision of financial market transactions considerably. The unbeatable homogeneity makes money into a product that is ideally suited for web-based mediation. Transparency, competition, and the mobility of capital are significantly increased by the use of information technology on transaction platforms compared to the oligopolistic banking market. Web-based platforms for credit intermediation do not require a banking license because they are not classified by the European supervisory institutions as credit institutions, but rather as payment providers [European Banking Authority (2015)]. This enables non-bank companies to also enter the market for financial intermediation without having to fulfill the demanding requirements of banking regulation. Increased transparency, increased competition, and, not least, the elimination of the bank margins all reduce the cost of capital and at the same time facilitate access to capital.

Despite all of the economic benefits, one might be skeptical as to whether the innovation of web-based intermediation can actually

prevail against the banking business in the financial market. Nonetheless, the current zero-interest monetary policy of the ECB, as well as extensive banking regulations, are forcing bank clients to change their behavior. Very low interest rates combined with low economic growth are to be expected in Europe over the next several years. A debt-based economy, such as the Eurozone simply cannot afford a rise in interest rates without risking the insolvency of many borrowers. Since many households, as well as governments, are already having to restrict their consumption due to the burden of interest and repayments, a rate increase will not be a stimulus for domestic demand and economic growth.

For the banking sector, this scenario means low profits because the essential advantage of money creation cannot fully come into play [Economist (2015)]. If the interest rate is zero, the interest margin that can be earned remains low because most customers will not accept a negative rate of interest on their bank deposits. At the same time, the costs of bank regulation will increase during the coming years. With these meagre profit prospects, it is becoming increasingly difficult for banks to raise additional capital on the market to cover the risks from their lending businesses. Some banks will have to reduce activities that require high amounts of equity, including lending. By contrast, simple financial intermediation in the sense of passing money through as an intermediary will become increasingly attractive because the bank does not take any risk that requires it to hold additional equity capital. The business of securitization of loans, which shrank after the financial crisis, could be revitalized. Nevertheless, regulations will require the quality standards of securitization techniques to be higher, meaning that previous profit margins can no longer be earned [European Commission (2015)]. These circumstances make entering the business of web-based financial intermediation via platforms, such as peer-to-peer lending, more attractive. Banks have all the prerequisites for this new business model: large customer bases, expertise in the assessment of credit risk, technical knowledge and experience in the area of online banking, and methods of processing payment transactions.

But, how can a separate web-based platform for financial intermediation with its own legal personality be integrated with the traditional “bank” business model? The platform will quickly prove to be much less expensive and can offer investors, as well as borrowers, better terms and faster processing. The traditional “bank” business model, burdened by the high fixed costs of regulation, buildings, staff, and so on, will not be able to compete with web-based intermediation in the long term. Banks are, therefore, facing a dilemma: zero-interest monetary policy means that money creation becomes less attractive, a social privilege which web-based platforms do not have in any case. In addition, the costs of the excessive amount of regulation are burdening their business model. All banks are affected by this. Their competitors, the non-bank companies that offer web-based financial

intermediation and operate outside of the regulatory walls of the banking sector, are not affected. The crowdfunding market in Europe has three-digit annual growth rates [Wardrop et al (2015)]. For banks not to enter this rapidly growing market segment would mean that they are leaving their very own business of financial intermediation, in which they have the core competency, to non-bank competitors. Embracing the new business model, however, carries the risk of radical restructuring or even completely phasing out the old business model, including all of the consequences that this would have for employees and the organization of business processes.

Unless forced by economic necessity, banks may not be willing to give up their existing business models and break new ground. But a long-term zero-interest scenario is forcing savers to accept a higher risk and pursue new forms of investment that offer a positive yield. Bank customers will increasingly ask their financial advisors about opportunities for peer-to-peer lending, and if an offer is not forthcoming, then they will look for investment opportunities outside of the banking sector. The same applies to the credit customers of the banks. Empirical studies show that it has become more difficult for small and medium-sized enterprises in particular to obtain a bank loan in the wake of the financial crisis, and if they are able to, then only at high interest rates [Öztürk and Mrkaic (2014); European Central Bank (2014)]. Instead of asking banks for a loan, many companies are already turning directly to P2P platforms because they offer two benefits from a business perspective. First of all, they provide quick and uncomplicated online processing of loans even outside of banking hours. Secondly, the terms of online lending are attractive compared to bank loans, often including the option of early loan redemption without a prepayment penalty.

Savers and borrowers who are turning away from banks and to crowdfunding will allow P2P platforms to achieve the critical mass of users that is required for the network effect. The more participants a platform has, the greater the benefit for individuals. Consequently, when a minimum number of users is reached, the number of transactions on platforms begins to grow exponentially because each user passes on their experience with the new application to individuals in their social environment, which in turn accelerates growth. For many of the younger users, investing and raising capital via a web-based platform will be the norm, much like shopping online and using a variety of mobile applications in their daily lives is also the norm.

The new organization of the monetary and banking system

Information technology is reducing the search cost, so that supply and demand can meet directly and independently of their physical distance on the Internet platform. Business models whose value creation is based entirely or partially on the intermediation of supply and demand will increasingly be driven out of the market by web-based intermediation platforms.

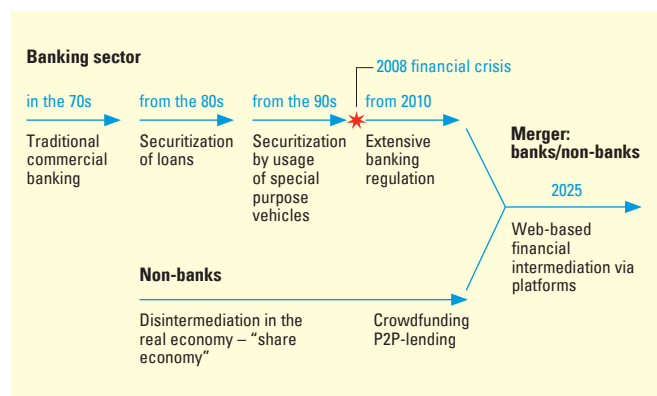


Figure 4 – Development of the reorganization of the banking business

In the banking sector, this process of disintermediation already began with the securitization of loans in the late 1970s. One could also refer to the securitization of loans as an initial form of crowdfunding because, with the acquisition of a tradable credit claim, a large number of bondholders are directly connected with the issuer of the bond. In the 1990s, banks increasingly established off-balance-sheet transaction platforms (“special purpose vehicles”) as an own legal entity because they were much more flexible in terms of securitization. However, unlike in the real economy, the financial crisis and its resulting increase in regulation put an end to this trend towards disintermediation in the banking sector. Figure 4 outlines the development of the reorganization of the banking business during the past decade and shows a possible prospect for further development.

The logical continuation of this trend is web-based financial intermediation via platforms, which gradually replaces the conventional bank as an intermediary. Commercial banks that recognize this trend early on and take the risk to enter the platform business could continue to exist but in a completely different organizational structure. These banks might set up their own platforms to offer their expertise in credit risk assessment, provide consultation to clients about investment opportunities on their own, as well as other providers’ platforms, and continue to process payments. Such banks could gradually become the “front end” for the underlying digital platforms without having any risk positions on their own books, instead operating exclusively in the business of financial intermediation. Customers could continue to use branch offices to seek personal advice and to process payments, but would have to pay a fee for these services in the future. In the finance platform business, banks compete with a variety of non-bank companies that also have a large customer base and many years of experience in digital processing of transactions, but which lack specific expertise in finance and their own payment transaction network. It remains to be seen who will ultimately prevail in this competition as an efficient mediator.

However, banks are not the only ones facing a process of radical restructuring. This also applies to the monetary system of the central banks. Web-based platforms are simple capital intermediaries that cannot create their own money. If the banks were to convert wholly to such a business model, the central bank would be missing a key element of its previous transmission mechanism of money supply. The central bank would then face the problem of managing the money supply directly in relation to economic growth without the previously existing creation of money via bank lending. In this scenario, deposit money, which hitherto represented the customer’s claim against the commercial bank, would need to be a direct claim against the central bank for cash in the future. This could be implemented as a two-stage system, much the same as it has been up to now:¹⁶ customers have accounts with commercial banks and these, in turn, have the same amount of credit as a mirror image with the central bank. The current fractional reserve requirements of commercial banks would de facto be replaced by reserve holdings of one hundred percent. The introduction of “full reserve money” would eliminate the risk of bank runs because each claim to deposit money would be covered by corresponding deposits with the central bank and be exchangeable for cash at any time. In addition, the central bank would now have complete control over the development of the money supply.

The question remains as to what method the central bank would use in the future to put the necessary additional money into circulation when economic growth is expected, without directly intervening in the real economy and running the risk of favoring individual economic groups with a windfall. Different suggestions exist among economists for this. One idea is to implement the “Chicago Plan” written by Irving Fisher in 1930, which provides for money to be transferred to the government on a regular basis via an account with the central bank. This direct form of government financing by the central bank would allow all citizens to benefit from the creation of money [Benes and Kumhof (2012)]. Another model suggests that all citizens should be equal beneficiaries of the annual windfall from the central bank. The central bank would then transfer an equal amount to all accounts through the commercial banks [Mayer (2014)].¹⁷ At this point, one could suggest a third model that would use the financial intermediation platforms directly as an entry point. For the purpose of creating money, the central bank could act as an investor on all registered platforms, helping to finance real economy investments by “sprinkling” money into the system. On the one hand, this would promote the volume of transactions on all platforms, including those of non-bank providers; on the other hand, it would ensure that the newly-created money is used for the real economy.

16 Technical progress would make it possible for every citizen to have an account directly with the central bank.

17 This model could be easily linked with the growing movement calling for a universal basic income (<http://basicincome.org/basic-income/>).

PROSPECTS

Web-based financial intermediation is going to prevail as an economically superior form of organization compared to the traditional banking business model. There is no doubt about this. The only question is the time period in which this system change takes place in the financial market. Whether this change occurs with or without the participation of banks depends on whether the banking industry recognizes the signs of the times and is in a position to gradually restructure its present business model of money creation towards web-based financial intermediation. However, if the European banking sector entrenches itself behind the thick walls of regulation, then non-bank companies that are already active in the platform business in other areas of the real economy will gradually conquer the financial market. The increasing market share of non-bank companies in the settlement of payments is a taste of things to come.

The problem is that the entire monetary system, including the central bank, banking supervision agencies, as well as exchanges, would be affected by a change in the bank business model. It is uncertain whether policymakers and governmental financial and banking supervision agencies can quickly switch from their current detail-obsessed, extremely complex regulation and control of all possible banking and market risks to the monitoring of financial platforms. Unlike banking legislation, consumer and data protection laws have the highest priority in web-based financial intermediation.

The worst thing that could happen would be for Europe to try to impose existing banking and financial legislation on the platforms. In doing so, Europe would miss its chance to provide a counterweight, at least in the financial market, to the U.S. dominance in IT driven platform business and in social media with its own European platform companies (banks or non-banks). Neither technological progress nor the economic benefits can be stopped. The only question is whether Europe has the courage to play a pioneering role or whether it prefers to follow global developments after they have happened.

REFERENCES

- Benes, J. and M. Kumhof, 2012, The Chicago Plan Revisited, IMF Working Paper, WP12/202
- Buttiglione, L., P. R. Lane, L. Reichlin, and V. Reinhart, 2014, "Deleveraging? What deleveraging?" Geneva Reports on the World Economy, No. 16
- Checherita, C., and P. Rother, 2010, "The impact of high and growing government debt on economic growth: an empirical investigation for the euro area," ECB Working Paper No. 1237
- Cœuré, B., 2014, "On the optimal size of the financial sector" speech in: <http://www.ecb.europa.eu/press/key/date/2014/html/sp140902.en.html>, accessed on 31.03.2015
- De Grauwe, P., and D. Gros, 2009, "A new two-pillar strategy for the ECB," CESifo Working Paper No. 2818
- Deutsche Bundesbank, 2014, "Ertragslage und finanzierungsverhältnisse deutscher unternehmen im Jahr 2013," monthly report, December, 37-48
- Deutsche Bundesbank, 2014, Finanzstabilitätsbericht 2014
- Deutsche Bundesbank, 2015, Statistische beiliefernde bankenstatistik, January
- Economist, 2015, "Global banks, A world of pain," volume 414, No., 8928, March 7th
- European Banking Authority, 2015, "Opinion of the European Banking Authority on lending-based crowdfunding," EBA/Op/2015/03, London
- European Commission, 2003, Regulation (EC) No 1745/2003, European Central Bank, September 12, 2003 on the application of minimum reserves (ECB/2003/9) Brussels.
- European Commission (2015), "GRÜNBUCH, Schaffung einer Kapitalmarktunion," CM(2015) 63 final, Brussels
- European Central Bank, 1998, "The quantitative reference value for monetary growth," press release, December 1, Frankfurt
- European Central Bank, 2003, Monthly bulletin, June
- European Central Bank, 2014, "Survey on the access to finance of small and medium-sized enterprises in the Euro-Area (SAFE), October 2013 to March 2014," April
- European Central Bank, 2015, "ECB announces expanded asset purchase program," press release, January 22
- Gambacorta L., J. Yang, and K. Tsatsaronis, 2014, "Financial structure and growth," BIS Quarterly Review, March, S. 21-35
- Gali, J., 2010, "The monetary pillar and the great financial crisis. ECB (Hrsg.), the great financial crisis, lessons for financial stability and monetary policy," An ECB colloquium held in honor of Lucas Papademos, May, S. 74 – 95
- Haldane, A. G., 2012, "The dog and the Frisbee," speech given at the Federal Reserve Bank of Kansas City's 36th economic policy symposium, "The changing policy landscape," Jackson Hole, Wyoming
- Jarchow, H.-J. and P. Rühmann, 1984, Monetary foreign trade, II. Internationale Währungspolitik, Göttingen
- Kumar, M. S., and J. Woo, 2010, "Public debt and growth," IMF Working Paper 10/174
- Mayer, T., 2014, Die neue Ordnung des Geldes: Warum wir eine Geldreform brauchen, Munich
- McLeay, M., A. Radia, and R. Thomas, 2014, "Money creation in the modern economy," Bank of England Quarterly Bulletin 2014, Q1, 14–27
- Öztürk, B., and M. Mrkaic, 2014, "Access to finance by SMEs in the Euro Area – what helps or hampers, IMF Working Paper, WP/14/78"
- Reinhart, C. M., V. R. Reinhart, and K. S. Rogoff, 2012, "Public debt overhangs: advanced-economy episodes since 1800," Journal of Economic Perspectives 26:3, S. 69-86
- Veit, O., 1969, Grundriss der währungspolitik, 3rd edition, Frankfurt a. M.
- Wardrop, R., B. Zhang, R. Rau, and M. Gray, 2015, "Moving mainstream, the European alternative finance benchmarking report," University of Cambridge and EY, London
- Wolf, M., 2014, The shifts and the shocks: what we've learned - and have still to learn – from the financial crisis, London

FINANCIAL COMPUTING & ANALYTICS STUDENTSHIPS

Four-Year Masters & PhD for Final Year Undergraduates and Masters Students

As leading banks and funds become more scientific, the demand for excellent PhD students in **computer science, mathematics, statistics, economics, finance** and **physics** is soaring.

In the first major collaboration between the financial services industry and academia, **University College London, London School of Economics, and Imperial College London** have established a national PhD training centre in Financial Computing & Analytics with £8m backing from the UK Government and support from twenty leading financial institutions. The Centre covers financial IT, computational finance, financial engineering and business analytics.

The PhD programme is four years with each student following a masters programme in the first year. During years two to four students work on applied research, with support from industry advisors. Financial computing and analytics encompasses a wide range of research areas including mathematical modeling in finance, computational finance, financial IT, quantitative risk management and financial engineering. PhD research areas include stochastic processes, quantitative risk models, financial econometrics, software engineering for financial applications, computational statistics and machine learning, network, high performance computing and statistical signal processing.

The PhD Centre can provide full or fees-only scholarships for UK/EU students, and will endeavour to assist non-UK students in obtaining financial support.



Imperial College
London

INDUSTRY PARTNERS

Financial:

Barclays
Bank of America
Bank of England
BNP Paribas
Citi
Credit Suisse
Deutsche Bank
HSBC
LloydsTSB
Merrill Lynch
Morgan Stanley
Nomura
RBS
Thomson Reuters
UBS

Analytics:

BUPA
dunnhumby
SAS
Tesco

MORE INFORMATION

Prof. Philip Treleven
Centre Director
p.treleven@ucl.ac.uk

Yonita Carter
Centre Manager
y.carter@ucl.ac.uk

financialcomputing.org

+44 20 7679 0359

Layout, production and coordination: Cypres – Daniel Brandt, Kris Van de Vijver and Pieter Vereertbrugghen

© 2016 The Capital Markets Company, N.V.

De Kleetlaan 6, B-1831 Machelen

All rights reserved. All product names, company names and registered trademarks in this document remain the property of their respective owners. The views expressed in The Journal of Financial Transformation are solely those of the authors. This journal may not be duplicated in any way without the express written consent of the publisher except in the form of brief excerpts or quotations for review purposes. Making copies of this journal or any portion thereof for any purpose other than your own is a violation of copyright law.

Centre for Global Finance and Technology

The Centre for Global Finance and Technology at Imperial College Business School will serve as a hub for multidisciplinary research, business education and global outreach, bringing together leading academics to investigate the impact of technology on finance, business and society.

This interdisciplinary, quantitative research will then feed into new courses and executive education programmes at the Business School and help foster a new generation of fintech experts as well as re-educate existing talent in new financial technologies.

The Centre will also work on providing intellectual guidance to key policymakers and regulators.

“I look forward to the ground-breaking research we will undertake at this new centre, and the challenges and opportunities posed by this new area of research.”
– Andrei Kirilenko, Director of the Centre for Global Finance and Technology

CAPCO

BANGALORE

BRATISLAVA

BRUSSELS

CHICAGO

DALLAS

DÜSSELDORF

EDINBURGH

FRANKFURT

GENEVA

HONG KONG

HOUSTON

KUALA LUMPUR

LONDON

NEW YORK

ORLANDO

PARIS

SINGAPORE

TORONTO

VIENNA

ZÜRICH