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Bank of Japan

How Finance and ICT Combine: a Historical View on the Future

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Haruhiko Kuroda
Governor of the Bank of Japan

I. Introduction

Good afternoon. It is a great pleasure to welcome you all. Let me thank Chairman Weber, President Adams and the IIF Team for organizing this conference.

Looking back, the first IIF G20 conference was convened in London in early March 2009, when the global financial system remained under severe stress. One topic discussed at the conference was the role of the international financial institutions, including the Asian Development Bank I was leading at that time, in mobilizing liquidity for emerging market and developing countries. A month later, when the G20 leaders met in London and agreed to strengthen financial regulation to rebuild trust, they also agreed to increase very substantially the resources and enhance the tools available through these institutions to support the continued flow of capital to these countries.

That agreement was proved to be vital in fighting the crisis. With the assistance of the institutions, emerging market and developing countries were largely successful in avoiding the contagion of the crisis and their strong growth supported world growth. Following the tradition of the first and of subsequent conferences, I hope that this conference will also provide additional impetus for cooperation in order to pursue our G20 Agenda.

Reflecting the upcoming G20 Agenda, tomorrow's morning sessions will focus on the future of finance and the role of financial regulation and supervision against the backdrop of the rapid evolution in information and communications technology (ICT). Today, I would like to share my thoughts on this topic. Throughout history, finance and ICT have interacted and evolved closely together. Also throughout history, people have found ways to overcome the resultant challenges and have realized the opportunities. I believe we are at that point of challenge and opportunity now. Let me start by looking back at some key historical episodes because I think they are telling.

II. Historical Episodes of the Interaction between Finance and ICT

Finance enables money to travel from one person's pocket to another's across time and space. It reallocates resource, diversifies risk, and provides means for settlement. Throughout history, people have developed financial technologies to make use of the state of the art ICTs available at that time, in pursuit of defying the gravity that constrains the dynamic and cooperative use of available resources.

The earliest writing system known as cuneiform script was invented by the Sumerians of Mesopotamia about 5,000 years ago and can be seen as our first example of the interaction between the evolution in finance and ICT.

Scholars believe that the genesis of cuneiform writing is to be found in accounting.[1] Three-dimensional tokens whose shapes -- cones and spheres -- represented a specific amount of goods were used for trade. The tokens then developed into two-dimensional clay tablets with pictographs.

As the size of cities grew and society became more complicated, the clay tablets experienced a significant innovation. They incorporated an abstract number system, which allowed significant abstraction of data that could be communicated using the same size of tablets. It is probable that writing was further developed by the emerging need for debt contracts. Evolution in finance and ICT closely interacted in Sumerian cities.

Our next example, the invention of the printing press in the 15th century by Johannes Gutenberg, had a long-lasting effect in promoting the interaction between the evolution in finance and ICT on a global scale. One major impact of the new printing process was to diffuse knowledge in finance. For example, in Venice in 1494, mathematician Luca Pacioli, a friend of Leonardo da Vinci, published a book which included short yet comprehensive instruction on the principle of double-entry bookkeeping. From Venice, then the world's printing center, Pacioli's instruction, its commentaries, and applied examples disseminated one of the most fundamental principles in finance throughout Europe and the world.

And what about other major impacts of the new printing process on economic growth? Did the diffusion of the printing press have significant impact on aggregate productivity? In general, measuring the impact of ICT on aggregate productivity is a challenging task for

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[1] For details, see Denise Schmandt-Besserat, *How Writing Came About* (Austin: University of Texas Press, 1996).

economists and policymakers as Robert Solow wrote of a later time, "you can see the computer age everywhere but in the productivity statistics."[2] But recently, LSE economist Jeremiah Dittmar has provided evidence showing how the printing press did indeed contribute to productivity in certain cities.[3] He has shown that cities where printing presses were established in the 15th century experienced an accelerated economic growth. And it was in the Netherlands that cities adopted the printing press faster than in most other countries and these Dutch cities went on to accumulate great wealth.

This wealth was a necessary underpinning for exploration to Asia. But exploration also required wider access to capital. By the mid-17th century, the city of Amsterdam had risen to be the center of international finance and trade, the cradle of modern financial architecture. In Amsterdam were the first public company with limited liabilities, the first stock exchange, and one of the ancestors of the modern central bank.

And one more key interaction between the ICT and finance: the printing press assisted newspapers to become an important route of transmission for the timely distribution of the information necessary for active trading of shares and many commodities.[4] This, in turn, further widened access to capital.

These innovations were embodied in the rise of the Dutch East-India Company. Starting in 1602, the Company's share was traded freely on the city's first stock exchange and later, limited liability was admitted for major shareholders. Combining ample capital with advanced maritime technologies, the Company expanded its business throughout Asia.

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[2] Robert M. Solow, "We'd Better Watch Out," *New York Times Book Review* July 12 (1987). For Japan's study, see Takuji Fueki and Takuji Kawamoto, "Does Information Technology Raise Japan's Productivity?," *Japan and the World Economy* vol. 21, no. 4 (2009): 325-336; and for the U.S.'s study, see Robert J. Gordon, *The Rise and Fall of American Growth: The U.S. Standard of Living since the Civil War* (Princeton: Princeton University Press, 2016).

[3] Jeremiah E. Dittmar, "Information Technology and Economic Change: The Impact of the Printing Press," *Quarterly Journal of Economics* vol. 126, no. 3 (2011): 1133-1172.

[4] For details, see Peter Burke, *A Social History of Knowledge: From Gutenberg to Diderot* (Polity, 2000).

There is another story. The Company was particularly important for Japan because it was the only Western organization allowed to operate under the Tokugawa Shogunate's national seclusion policy. The Company's sole trading post was confined in a fan-shaped, man-made island called "Dejima" in the bay of Nagasaki.

The island, which was only the size of two football pitches, functioned as a solitary yet robust information hub to maintain the flow of ideas between Japan and the West for more than 200 years. People in Japan studied imported books and digested technologies from the West. Employees of the Company wrote books on what they learned in Japan. Harnessing the very latest ICT -- the printing press, the newspapers -- people in the Dutch cities of the Golden Age were able to find the opportunities of financial innovations.

III. Market Failures and the Role of Financial Regulation and Supervision

Financial innovations also held dangers. Now, let me turn to the risk of financial innovations. Historically, the wider access to capital through markets also became important sources of economic volatility. In 1776, Adam Smith warned that company managers exempt from being liable for company losses were the managers of "other people's money". He believed that these managers could not apply the "anxious vigilance" that partners with unlimited liabilities would apply. He concluded that, "negligence and profusion, therefore, must always prevail". His warning was proven to be significant. Today, the principal-agent problem he raised stands as one of the key market failures that justify public interventions for private companies.

Problems of limited liability are especially significant for financials since asymmetric information is more likely to exacerbate the magnitude of the problems. For example, under limited liability, investment managers would benefit from bubble blowing, but not necessarily suffer a symmetrical loss when it bursts. Some economists show that a combination of limited liability and asymmetric information among market participants can incentivize the investment managers to blow the bubble.[5] Although the evolution in ICT has

[5] For example, see Franklin Allen and Gary Gorton, "Churning Bubbles," *Review of Economic Studies* vol. 60, no. 4 (1993): 813-836; and Franklin Allen and Douglas Gale, "Bubbles and Crises," *Economic Journal* vol. 110, no. 460 (2000): 236-255.

contributed to developments in modern financial risk management technologies, such developments, even combined with enhanced disclosure, have not eradicated the problems.

Next year 2020 will mark the three-hundredth year of the bursts of the first internationally-correlated financial bubbles. In 1720, the burst of the South Sea Bubble in London, the bubble which inspired Adam Smith, was accompanied by a similar crash in Paris, known as the Mississippi Bubble. In the aftermath, people lost their trust in capital markets and the creation and trading of joint stock companies were sharply curtailed for a century. Stagnation of capital markets left large investment projects predominantly financed by a small group of rich people.[6]

Financial bubbles tend to associate with financial crises when accompanied by excessive credit creation. Economists who look into long-term cross-country data find that credit growth is indeed a powerful predictor of financial crises.[7] Financial crisis entails significant negative externalities to the economy. Our experience of Japan's crisis in the late 1990s and of the last global financial crisis in the late 2000s reminds us that the most important role of financial regulation and supervision is to address market failures in order to prevent financial crises.

The G20 financial reforms launched in 2009 to address the fault lines revealed by that crisis are nearly complete. The reason for seeking global cooperation through international negotiation is to realize the mutual benefits in addressing the risk of globalized financial activities.

Throughout the process of international negotiation, different cultures as well as different social and economic systems make contact with each other. I was involved in a number of negotiations and saw these differences surface in a myriad ways. Negotiators tend to feel

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[6] For details, see William N. Goetzmann, *Money Changes Everything: How Finance Made Civilization Possible* (Princeton: Princeton University Press, 2016).

[7] Moritz Schularick and Alan M. Taylor, "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008," *American Economic Review* vol. 102, no. 2 (2012): 1029-1061.

uneasy when the differences require alternative ways of thinking, which is an important aspect of international cooperation. In order to establish the common rules which are mutually beneficial to all relevant parties in the global markets, it is helpful to view the differences as dynamic and relative in nature and to accept the differences.

Now that the regulatory reform agenda is nearly complete, we must turn our focus onto the full, timely, and consistent implementation of the agreed reform in order to achieve the goal of maintaining global financial stability. At the same time, it is important to evaluate the effects of the agreed G20 reforms to assess whether reforms are operating as intended. And essentially we must identify and address possible sources of market fragmentation that may be harmful to global financial stability.

IV. Concluding Remarks

Let me finally add a few words on how I view the future of finance and the role of financial regulation and supervision against the backdrop of the current rapid evolution in ICT. Even though the Sumerian clay tablets of 5,000 years ago have today been substituted by tablet PCs and smartphones, the central role of finance to enable money to travel from one person's pocket to another's across time and space remains unchanged.

That said, the amount of information that can be communicated using tablet PCs and smartphones today is incomparably greater than using clay tablets. Our current evolution in ICT is paving the way for ever-growing digitalized information to be swiftly collected, processed and communicated at ever-decreasing cost across space. The new ICTs have the potential to provide not only economies of scale but also economies of scope and hence give market power to those who successfully apply those technologies. As we learned from Dutch history, the future shape of the financial industry will be significantly influenced by the contemporary evolution in ICT, although it may be difficult to predict today what the future shape of the industry will be. This afternoon, we talked about how banks could harness the power of technology to drive sustainable growth. Tomorrow, we will talk about how the financial sector will need to continue evolving to serve a transforming society. We will also talk about the implications of the evolution on the role of financial regulation and supervision.

On the opportunities side, the evolution will open up immense possibilities for many individuals and firms to carry out a wide range of financial transactions across time and space. For example, it has strong potential to promote financial inclusion. A World Bank report finds that 69 percent of adults had an account at a bank or mobile money provider in 2017, up from just 51 percent in 2011. It also reports that globally 1.7 billion adults remain unbanked, yet two-thirds of them own a mobile phone that could help them access financial services.[8] A joint report from the Center of Financial Inclusion at Accion and the IIF shows that the market for inclusive insurance is also vast and potentially profitable, based on the confluence of rising income in emerging markets and ICT that is bringing down the cost of distributing insurance and measuring risks.[9]

On the challenges side, the degree of market failures could be magnified by our current evolution in ICT. We hear concerned voices that the current evolution could lead to concentration of data and resources in a small number of economic agents. The economies of scale and scope derived from the new ICTs could encourage greater reliance of core banking services on globally concentrated third-parties. This, in turn, could seriously complicate the existing principal-agent problem and magnify market failures. Although the key role of financial regulation and supervision remains unchanged, we should leverage innovative technology in financial supervision. And we should continue to monitor and assess the impact of evolving market structures and of the evolution in ICT on the nature of the market failures that need to be addressed by financial regulation and supervision.

Let me wrap up. I see our current evolution in ICT as having strong potential to magnify both the opportunities and the risks of finance. We face a difficult yet rewarding challenge to control and limit the downside while encouraging the upside of the evolution. History tells us that we can find ways to overcome the challenges and realize the opportunities. Is this time any different? I believe not. Since the global financial crisis, our framework of international

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[8] Asli Demirgüç-Kunt et al., "The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution," World Bank Group (2018).

[9] Susy Cheston et al., "Inclusive Insurance: Closing the Protection Gap for Emerging Customers," A Joint Report from the Center for Financial Inclusion at Accion and the Institute of International Finance (2018).

cooperation among authorities and market participants has significantly strengthened. Through our critical discussions and cooperation, I believe together we shall overcome the new challenges and unleash our potential opportunities.

Thank you.