Big Data and SME financing in China

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Abstract. Big Data is becoming more and more prevalent in recent years, and it attracts lots of attention from various perspectives of the world such as academia, industry, and even government. Big Data can be seen as the next-generation source of power for the economy. Today, Big Data represents a new way to approach information and help all industry and business fields. The Chinese financial market has long been dominated by state-owned banks; however, these banks provide low-efficiency help toward small- and medium-sized enterprises (SMEs) and private businesses. The development of Big Data is changing the financial market, with more and more financial products and services provided by Internet companies in China. The credit rating models and borrower identification make online financial services more efficient than conventional banks. These services also challenge the domination of state-owned banks.

1. Introduction

Big Data in recent years has grown more and more popular within academia, industry fields, and even the government, and has aroused widespread concern. Researchers view Big Data as the next-generation source of economic energy [1]. Well-known management and consulting firm McKinsey claims that Big Data, as an important factor in production, has penetrated all areas of today's industry and business functions. Big Data is associated with data files, and the size of data files in the current database system is higher than the likelihood of its capture, storage, processing, and analysis. As its name suggests, Big Data involves a large amount of data, and the data collected over time is hard to analyze and process through common tools used in unified database services. This data can be employed for analyzing market trends, manufacturing, and medical science. The categories of input data include transactions histories, e-mails, photos, camera records, activity reports, and unstructured content from blogs and social media as well as data generated by various sensors. Big Data provides a description of the rapid growth and practicality of structured and unstructured data. Big Data can serve as a meaningful tool for today's Internet business and organization, as such data can lead to more accurate analysis.

Small- and medium-sized enterprises (SMEs) remain as the key driver to trigger the competitiveness, growth, innovation, and employment of European countries particularly during the economic crises when the large corporations downsize their work force [2]. The global crisis (2007-
2009) and the European sovereign debt crisis (2011-2013) have led to significant changes in financial market, especially in SME financing sector. The world’s economy is more and more relying on the energy of SMEs. Not only in Europe, but also in China, SMEs provided important contribution in the fast developing economy. However, compared with large companies, SMEs faced many obstacles in the process of development, such as finance, tax, competition, and political. Finance problems is the biggest obstacles among them. The difficulty of raising capital restricts the development of SMEs.

As a developing country, China faces the problem of the lower penetration of financial services when compared with developed countries [3]. Lending services in the country disproportionately tend toward significant economic and political interests such as state-owned enterprises [4]. According to a report in 2013 from the National Bureau of Statistics of China, SMEs provide around 80% of urban employment, contribute 50% of fiscal and tax revenue, and account for 60% of the GDP in China [5]. State holding banks in China have a huge branch network, dominating the Chinese financial market. For example, as shown in Table 1 below, as of 2015, the Agricultural Bank of China (ABC) has about 24,000 branches, Industrial and Commercial Bank of China (ICBC) has about 18,000 branches, China Construction Bank (CCB) has 13,000 branches, and Bank of China (BOC) has 11,000 branches [6]. However, most SMEs in China cannot acquire enough support from these banks.

| Bank Name | Branches |
|-----------|----------|
| ABC       | 24,000   |
| ICBC      | 18,000   |
| CCB       | 13,000   |
| BOC       | 11,000   |

For a long time, China has been viewed as a country with an underdeveloped financial system and imperfect institutional system [7]. However, recently, China's conventional financial system has transformed into an advanced system stage by stage. With the rapid development of information and communication technology, China's financial industry has developed rapidly, especially in financial services, using Big Data and information technology to improve the financial system. At this new stage, several large financial technology companies have appeared in China. As an e-commerce company, Alibaba is becoming one of the world's largest financial technology companies. This organization is expanding its e-commerce business globally and transforming conventional payment systems [8]. However, conventional financial service companies are cautious about the new financial technology start-up companies, which are disrupting traditional finance areas.

2. Big Data

Big Data is a freely defined term that describes a large number of complex data sets and describes innovative techniques for collecting and storing volumes of data [9]. In relation to information and communication technology, Big Data represents a rapidly changing and expanding area. Big Data is mainly connected to modern, trendy technologies that generate or use large amounts of data, such as semantic technology, voice and voice processing, and networking. Therefore, it is hard to define the concept of Big Data clearly. Another reason for this ambiguity is the temporal change in rapid technological development; that is, the data that represents Big Data that was difficult to approach in the 1990s can be handled by traditional computers or mobile devices through recent technological developments [10].

Today, Big Data technology represents a modern way to deal with information, which is a purpose many organizations underestimate. Big Data can be misused among organizational management; IBM's survey shows that 18% of executives only treat Big Data as a source of large amounts of data [11].
In general, it can be said that there are three basic characteristics of the information handled in Big Data. First of all, Big Data is too broad to process easily and in a short period of time. Second, it involves unstructured data (for example, browsing data via text, video, or audio files) and real-time information (e.g., traffic data from thousands of cameras and satellites) [10]. Third, Big Data indicates that there is a very large amount of data, and usually dealing with and managing it introduces serious logistical challenges.

Internet Data Center (IDC) defines Big Data as the next-generation architecture and technology with a cost-effective design for high-frequency, high-capacity, and diverse types of data structure. The term Big Data is used to describe and define the new era of information explosion, resulting in a lot of data, and is associated with technology development and innovation. Through the effective integration and accurate analysis of multi-source heterogeneous data, it is possible to analyze trends and better predict future events.

IBM's Big Data platform introduces the possibility of providing a large amount of data related to the organization's business adventure. This platform contains traditional technologies for handling structured and unstructured data, which links to new technologies, focusing on speed, flexibility, targeted exploration, discovery, and analysis of data. IBM defined Big Data with the following characteristics, as illustrated in Figure 1 below: Firstly, it is diverse, which means that the data is both structured and unstructured. For instance, data is taken regarding the types of messages, images, GPS signals, and other forms of data generated by the Internet and telecommunications. Second, it is gathered at great speed, which means that the data must be very quickly acquired and processed, that is, in actual or almost real-time, which allows the organization to flexibly respond to market changes or acquire a competitive advantage. Third, it demonstrates veracity, introducing the possibility of obtaining distortion output, because different data processes cause a large amount of data containing sand or distortion (such as data from a social network) simultaneously. The volume represents a large amount of data collected for analysis, which is a requirement of summary process for the organization to organize large amounts of data in a single database structure [12] [13].

![Figure 1. The Characteristics of Big Data](image)

Source: (IBM, 2012)

Big Data comes with great value, from an information industry point of view. Big Data is the next generation of the IT industry, with a powerful driving force through cloud computing, mobile Internet, and social networks. IDC predicts that, by 2020, the third IT platform will reach $5.3 trillion in market size; from 2013 to 2020, 90% growth in the IT industry will be driven by the third IT platform [14]. Big Data will turn into a new area of economic growth, and Big Data organizations will update their eco-environments that have progressed to analytics-as-a-benefit (AaaS) models to change the IT business. Organizations, for example, IBM, Google, Microsoft, and Oracle have prepared development project on Big Data age [14].
3. SMEs Financing Problem and Big Data in China

China's economy has seen rapid development in the past three decades through the central planned economy to the market economy as the mainstay of the economy. From 1978 to 1993, China's annual GDP growth rate was 9.3 percent, 9.0 percent from 1993 to 2004, and around 9.3 percent from 2005 to 2016 (Word Bank, 2017). According to the National Bureau of Statistics of China, small- and medium-sized enterprises accounted for 99.4% of Chinese enterprises in 2012, accounting for 59% of China's gross domestic product and for 60% of total sales [15]. China's huge economic growth mainly came from the private sector in the form of small- and medium-sized enterprises, which is a major achievement of reform. However, compared with industrialized countries, China and other developing countries have a lower penetration of financial services [3]. Small- and medium-sized enterprises in emerging economies are more serious and struggle with competition from large enterprises. General consumers and commercial finance companies and microfinance institutions have achieved limited success in terms of cost-effective and sustainable demand for these groups [5].

The problems associated with SME financing come mainly from asymmetric information between lenders and SMEs. Potential default risk and lack of collateral motivate banks to refuse to lend to SMEs. There are diverse situations facing SMEs in different industries and the bank's traditional credit verification system is not compatible for all SMEs. Compared with the amount of SMEs borrowing, banks try to measure the credit cost of SMEs with the higher cost of information. High capital costs also lead banks and financial institutions to be reluctant to issue loans to SMEs.

Improving financial accessibility and affordability is thus an urgent task and issue of great concern related to economic recovery. The latest developments in computing and telecom technologies have changed the financial landscape by changing the method under which the financial industry operates to reflect an economically active microenterprise perspective [6]. Experts say that the SMEs’ financial problem could be greatly remitted by creating better risk controls by using powerful computing technology and information sources [16]. A key factor in this transformation is the use of Big Data in assessing, identifying, and improving the reputation of potential borrowers and reducing transaction costs. Some possible sources could be data from social media, mobile phone usage patterns, and utility billing history [16].

Today, the world is increasingly interconnected, and a great deal of information is generated every day from social networks, search engines, and e-mail clients. Users’ log files are also sent as machine-generated data like real-time monitoring for dams or bridges from sensor networks and aircrafts, cars, boats, and other vehicles. Big Data requires superior technology to efficiently handle large amounts of data efficiently. Applications for Big Data include large-scale parallel processing of databases, data mining grids, distributed file systems, distributed databases, cloud computing platforms, and scalable storage systems. Real-time or near-real-time information transfer is one of the defining features of Big Data analysis, therefore, delay of information must be avoided. Various techniques have been developed for aggregating, manipulating, analyzing, and visualizing Big Data. These technologies come from several different areas such as statistics, computer science, applied mathematics, and economics. This means that an organization that intends to obtain value from Big Data must adopt a flexible, multidisciplinary approach.

Alibaba, one of China's largest Internet companies, uses Big Data to improve risk management and control in order to improve the financing market. Alibaba developed its own credit rating and risk control model based on its payment and e-commerce transaction information. This risk control model mainly draws upon its huge online ecosystem. As of early 2015, the Alibaba Group market share consisted of more than 300 million registered users and 37 million small businesses, including Taobao and Tmall.com [17].

With the emergence of its business needs, Alibaba used optimized systems and platforms to develop advanced methods and methods to deal with its daily 10 billion users. Data processing and analysis also improved to near-real-time mode.

Alibaba, through the adjustment of Big Data technology, highlights the progress of fraud risk management. The company invented a risk management system called the Counter-Terrorist Unit
(CTU) serving as real-time payment fraud prevention monitoring system. CTU is one of the most advanced online payment fraud management systems in China. This system can track and analyze the behavior of users or accounts, identify suspicious activity, and apply different levels of treatment based on intelligent arbitration [18]. Alibaba's fraud risk management is completely different from the traditional financial and banking system. In order to deal with real-time fraud, the company has gradually developed new engineering methods to handle such data. For the hardware system, a risk prevention framework has been established to support new methodologies and algorithms. There are several different risk prevention frameworks. Alibaba uses a basic framework for fraud risk as a multi-level risk prevention framework, and Big Data make it possible to adopt real-time risk prevention online. Figure 2 illustrates the CTU operating process.

Figure 2. The Counter-Terrorist Unit (CTU)
Source: (Chen, Tao, Wang and Chen, 2015)

4. Big Data based lending services in China
Big Data has facilitated the potential transformation of China's banking sector. China Internet companies have entered the financial market and have launched various categories of financial products and services that focus on the use of Big Data. In 2015, China Rapid Finance, China's largest online consumer loan market, announced that 50 million consumers pre-approved a loan of 500 yuan (about 80 US dollars), including QQ pre-screening users, the online communication software developed by Tencent. These quotes are based on analysis data from social and financial sources to make a prediction regarding borrowers’ responses and whether default or fraud is present. China Rapid Finance estimates that about 500 million consumers could be viewed as potential borrowers. The company aims to use a mobile-based channel to automatically gain credibility based on the data from several different sources [19].

Compared to traditional bank loans, the transaction costs of online financial services are lower. The Internet has greatly reduced the transaction costs associated with financial and banking business. For example, the average cost of bank transactions is estimated at $1.27, ATM transactions are $0.27, and the Internet transaction is $0.01. A study shows that no-branch banks face 38% lower expenses than commercial banks and 54% less than informal remittance channels [20]. Internet companies that provide these financial services help change the situation in China's financial markets, reducing the barriers to small businesses into the financial markets.

As of December 2013, the Alibaba cloud accumulated more than 650,000 customers and has borrowed more than 1,600 billion yuan; the average loan balance is less than 40,000 yuan, the average
loan amount is 130,000 yuan, and the non-performing loan interest rate control in 1% [21]. Internet financial models, compared with traditional financial institutions, offer additional information on trade, services, costs, and other advantages. Compared with the traditional financial institutions, Internet finance models fundamentally solve the problems facing small- and medium-sized enterprises, for which financing costs are difficult problems.

MYbank, launched in 2015, for example, is an entire Internet bank and runs within the Internet environment. MYbank was established by a financial subsidiary of Alibaba. MYbank views rural customers as an important group. The company provides funds to help farmers purchase agricultural machines and tools [22]. The loans are offered up to the US $800,000 provided for SMEs and retail consumers. MYbank plans to increase its lending services to $10 million SMEs in the next five years (Bloomberg.com, 2015). The current situation has changed the traditional credit score and is more dependent on Big Data information. MYbank utilizes the service of Alibaba who launched credit evaluation companies Ant Financial and Zhima Credit, a personal credit scoring service company. These companies provide data for MYbank to evaluate borrowers. The credit information comes from Big Data such as online transactions, rented car return conditions, and if there are any court reports about default debts.

Another China Internet company, Tencent, also launched an Internet bank, WeBank, in 2015. Similar to MYbank, WeBank offers all services on the Internet with no brick-and-mortar outlets. Big Data is also involved in the operation of WeBank; borrowers just need to upload pictures from their cellphone cameras. WeBank uses Big Data to match the information of borrowers and identify their credit status. The credit information based on consumer data comes from various sources, such as online shopping behavior, activities on social network websites, online game activity, and other online behavior. The money that borrowers could obtain is based on the result of banks’ analysis of credit information [23].

5. Discussion
The efforts made by companies using Big Data only capture a very small share of China’s lending market, whose value was estimated at US $4 trillion in 2015 by Bloomberg.com. Nonetheless, Big Data has had a strong impact on China's financial markets. It is an encouraging sign that China's banks' interest in acquiring customer data and the lending decisions are based on economic fundamentals rather than on political considerations [6]. However, they experienced varying degrees of success and failure. It is reasonable to expect that the Chinese financial market will be reshaped by the development of Big Data.

Our critical review highlights the rapid development of Big Data in China and its application in the financial market. However, pertinent challenges relating to the role of Big Data in China financial market also remain to be explored. Such challenges could include the extent of accurate analysis by Big Data and whether Big Data can be applied to conventional financial institutions. Meanwhile, inexistence of a comprehensive rules and regulations also challenge the development of Big Data in the financial sector. Hence, future research should focus on investigating these challenges.

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