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# Assessing relationship and contribution of China's technological entrepreneurship to socio-economic development

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ABSTRACT

As a driver of global economic growth, the development of emerging economies has been a highly significant trend over the past decade. China has adopted technological entrepreneurship as a national strategy for future economic development. In this paper, we applied a statistical description, contribution rate, gray absolute correlation, and elastic coefficient analysis to assess contributions of technological entrepreneurship to national development. We found that: (1) The number of technology enterprises has been growing and their contributions to the country's output value, exports, employment, and tax are increasing; (2) From 2010 to 2014, the industrial output value of technological entrepreneurship accounted for 41.49% of the average GDP growth. There is a high correlation between technological entrepreneurship and economic growth with a gray correlation coefficient of 0.8296. (3) Technological entrepreneurship has made a significant contribution to the promotion of technological progress and foreign trade. Invention patents created by entrepreneurs accounted for approximately 71% of domestic invention patents. The total export value of high-tech products accounted for approximately 22.6%. (4) Technological entrepreneurship didn't have a clear impact on employment with an employment elasticity of only 2.79%. (5) The contribution rate of technological entrepreneurship to state tax revenue was approximately 8.49%. We considered the paper as the first endeavor to study technological entrepreneurship in China from macro perspectives which have both theoretical value and practical significance for socio-economic development.

## 1. Introduction

Over the past decade, emerging economies have driven global economic growth in a highly significant trend (Li, 2017). Emerging economies, such as India, Russia, and Brazil, account for an increasing proportion of the world's exports, including technological exports. Consistent with the trend, the Chinese government is paying more and more attention to technological entrepreneurship, offering policy support, and increasing capital investment (Greeven, 2004; Peng et al., 2008). Given the policy and managerial implications of this issue, an understanding of the relationship between technological entrepreneurship and socio-economic change is necessary.

In 1970, “technology entrepreneurship” was first proposed in a seminar at Purdue University (Shane and Venkataraman, 2000). Technological entrepreneurship is a vital way to commercialize technological innovations, whether by creating a new business entity or establishing a new venture within an existing company (Hindle and Yencken, 2004; Hisrich et al., 2016; Lei et al., 2016). Thus, technological entrepreneurship transforms promising technologies into value. In recent years, many scholars have extended this concept. According to Bayers et al. (2014), technological entrepreneurship is a business leadership style that identifies high-potential and technology-intensive commercial opportunities; gathers resources such as talent and capital; and manages rapid growth and significant risks using principled decision-making skills. Bailetti (2012) defined technology entrepreneurship as a project investment to assemble and deploy specialized individuals and heterogeneous assets which are closely related to scientific and technological knowledge advances for creating and capturing value. Therefore, more efficient usages of increasing innovation, new assets, and competitiveness can lead to the development of products and services (Badzinska, 2016).

Generally, technological entrepreneurship has two research streams in the literature. One is the study of high-technology entrepreneurship (Kenney and Burg, 1999; Siqueira and Bruton, 2010; Zhang et al.,

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2012), and the other explores public research commercialization and applications of academic research (Trune and Goslin, 1997; Wright et al., 2004; Yuan and Jia, 2005). China's technology capability has significantly developed by collaborating inventive activities with other major inventive countries (Ma et al., 2009). With the fluctuated global economy, any policy to encourage economic growth for either developed or developing countries is likely to nurture new entrepreneurial high-technology firms (Smith and Sharmistha, 2012). The role of high-technology firms in economic growth and innovation practice has received significant attention due to these firms' contributions to economic development and job/wealth creation (Mcgowan et al., 2011). In this context, the level of national technological entrepreneurship can be measured through relevant data on high-technology and new technology enterprises in the country.

In recent years, scholars have addressed emerging technological entrepreneurship such as Internet, big data, cloud computing, IoT (Internet of things), and etc. (B. Xu et al., 2014; Bag et al., 2016; Bendre and Thool, 2016; Cai et al., 2014; Civerchia et al., 2017; Fan et al., 2014; Fang et al., 2014, 2015; Furtado et al., 2017; Jiang et al., 2014; L. Xu et al., 2014; Li et al., 2013, 2014; Liu et al., 2017; Sabar et al., 2016; Whitmore et al., 2015; Xie et al., 2017; Xu, 2016; Xu et al., 2016; Yang et al., 2018; Zheng et al., 2014). Cloud technologies facilitate the development of internationally oriented small- and medium-sized enterprise (SME) entrepreneurship by providing greater access to global markets, lowering opportunity costs, and supporting collaboration and innovation in an increasingly connected world (Bi et al., 2014; Ross and Blumenstein, 2014; Assante et al., 2016). Manyika et al. (2011) presented big data as the next frontier for innovation, competition, and productivity. Cordon (2015) discussed whether big data creates or destroys jobs. The Radio Frequency Identification (RFID) innovation expanded organizations' productivity with adequacy and precision. RFID also assisted in improving operational complexity in a short period of time. Consequently, the application of RFID would bring benefits to organizations and customers (Qureshi et al., 2016; Alyahy et al., 2016; Mao et al., 2016; Zhai et al., 2016). In summary, emerging technologies have a significant impact on society, economics, and culture.

As an emerging economy, China is developing its technological entrepreneurship in many areas (Li, 2013) such as cloud computing, big data, mobile Internet, and IoT. The software industry's revenue had reached 4.3 trillion in 2015 and it is expected to exceed 8 trillion Yuan with an average annual growth rate of 13% or more by 2020. The big data industry was 280 billion Yuan in 2015 and it is expected to reach 1 trillion Yuan in 2020 with an average annual growth rate of approximately 30%. In 2015, the IoT industry's revenue reached 750 billion Yuan. In 2020, the total industrial value of IoT including sensor manufacturing, network transmission, and intelligent information service will exceed 1.5 trillion Yuan. The number of Chinese netizens reached 710 million, of which the number of mobile phone users was 656 million in June 2016. The proportion of mobile Internet users also increased from 90.1% to 92.5% by the end of 2015 (Ministry of Industry and Information Technology, 2017).

Although transformation occurs rapidly in emerging economies, few studies measure the contribution of technological entrepreneurship to socio-economic change by using direct methods and applications. Most scholars have conducted research in specific fields from their own perspectives (e.g., economic growth). Phan and Foo (2004) argued that many developing countries have identified technological entrepreneurship as a key driver for the next phase of economic growth. Such countries such as Singapore, Israel, Ireland, India, and China have tried to duplicate the Silicon Valley experience by recreating technological universities, venture capital funding, exit markets, attractive lifestyles, and a highly educated workforce. Using the structural equation modeling, Rostamnezhad et al. (2014) concluded that technological entrepreneurship has a significant positive effect on economic development in Iran. The high-tech industry has been the most important sector of the technology economy in China since the reform and opening policy implemented in 1978 (Greeven, 2004). An and Ahn (2016) emphasized the importance of technological forecasting to commercialize emerging technologies. Over the past 30 years, market-based reform (often known as marketization) of the Chinese economy has fostered technological entrepreneurship and contributed to the creation of successful high-tech firms such as Baidu, Sohu, and Alibaba. Technological entrepreneurship represented China's endeavor to become a modern economy (Charles and Jian, 2014). Based on comparative studies across countries, some scholars emphasized the important role that the central government plays as well as highlighted limitations within each system (Kao, 2012; Soofi, 2016).

The technological entrepreneurship has promoted socio-economic growth with the growth of China's high-technology enterprises (Jiao et al., 2016; Wu et al., 2017). However, the literature does not clarify the development of technological entrepreneurship or its contributions to socio-economic change. In general, research on the socio-economic impact of technological entrepreneurship is still in its exploratory stages. Therefore, we focused on the developmental status of China's technological entrepreneurship and presented empirical and quantitative evidence to show the extent of its contribution to socio-economic change. Four aspects are highlighted in this paper: industrial production output, export trade, social employment, and national tax. A clear understanding of the relationship between technology entrepreneurship and socio-economic change will help policy and decision makers to design more detailed policies. These policies, in turn, may foster the healthy and orderly development of technological entrepreneurship in China.

The paper is structured as follows. In Section 2, we describe the developmental status of China's technological entrepreneurship. Section 3, we present the model and data used to measure contributions of technological entrepreneurship to socio-economic change. In Section 4, we use proportion, gray correlation, and elastic correlation methods to assess technological entrepreneurship's contributions to the economy and society. Finally, we conclude and offer suggestions for the development of China's technological entrepreneurship.

## 2. The developmental status of technological entrepreneurship in China

### 2.1. Technological entrepreneurship achievements in China

China has systematically formed a scientific research system since 1978. The strategy of China's science and technology sector was to turn towards economic growth, emphasizing that the economy would be built on scientific and technological progress. This policy was a driving force to promote technological entrepreneurship. Technological entrepreneurship took place earlier in China than in other emerging economies. China's technological entrepreneurship achievements are reflected in three primary ways.

The market-oriented science and technology reforms created a number of opportunities. China has made great efforts to promote market-oriented science and technology by emphasizing the combination of technology and economics and accelerating the transformation of applied research institutions since 1985. Business has become the main field for technological innovation. Additionally, a large number of science and technology enterprises have been cultivated. Thanks to these reforms, such well-known high-tech enterprises as Lenovo, Founder, and Huawei have emerged and others run by colleges and universities.

China has enhanced its industry competition by promoting the implementation of scientific and technological achievements in the private sector. Moreover, through its national industrialization plan, China has achieved major breakthroughs to upgrade its industrial structure and promote socio-economic development. In 2014, China's technical market trading continued to flourish. The national technical contract turnover exceeded 800 billion Yuan, an increase of 14.8% over the