Global Economic Perspectives Vol 3 Issue 3 2025

Original Research Article

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Research on Invention Patents and the Development of China's GDP

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Abstract: This paper conducts a statistical analysis of the number of invention patent applications filed in mainland China over the past 20 years, the number of overseas patent applications (including PCT applications, direct applications to foreign countries, and applications to Hong Kong, Macao, and Taiwan), and China's annual GDP figures over the same period. It explores in depth the linear relationships and mutual influences among these three variables. Based on the quantitative relationship between domestic invention patent applications, overseas patent applications, and China's GDP growth, the paper concludes that both domestic and overseas patent filings have significantly contributed to the high-quality development of China's economy over the past two decades. It also finds that overseas patent applications are still in an early stage of development, and that there is substantial room for growth in promoting China's high-quality economic globalization through overseas patent protection. This paper aims to provide a valuable reference for institutions and individuals engaged in research on patent policy and China's GDP development.

Keywords: Invention Patents; PCT Patents; China's GDP

Introduction

Although China's total economic output has firmly secured its position as the second largest in the world, its per capita GDP is only around USD 13,000 due to its large population—less than one-third of the average per capita GDP of developed economies. If China is to reach the per capita GDP levels of developed countries, based on its current population size, there remains vast room for economic growth. According to the overall strategic plan, China aims to basically achieve socialist modernization by 2035. To meet the target of reaching the per capita GDP level of moderately developed countries, the average annual GDP growth rate from 2020 to 2035 must reach 4.8%. Furthermore, to build China into a modern socialist power by 2050, the average annual GDP growth rate between 2020 and 2050 needs to be around 4.6% [1]. Scientific and technological innovation is the primary productive force and the core driver of modern economic development. The quantity and quality of technological innovation are the foundation of innovation itself. Technological advancement cannot thrive without patent protection. Research shows that the number of innovations positively impacts the quality of economic growth, with invention patents playing a more significant role than design patents or

utility models [2]. Therefore, it is of great significance to paper how invention patents can better promote the high-quality development of China's GDP, thereby contributing to the realization of a fully modernized socialist country. This paper conducts a quantitative analysis of the relationship between invention patent applications filed in mainland China (hereinafter referred to as "domestic applications"), those filed abroad (including PCT applications, direct foreign applications, and applications to Hong Kong, Macao, and Taiwan—hereinafter referred to as "overseas applications"), and the growth of China's GDP over the past 20 years. Relevant data on domestic applications, overseas applications, and GDP development have been collected and analyzed using standard statistical tools to explore the relationship among these three indicators. All data used in this paper are sourced from publicly available online resources, and the analysis reflects the author's personal perspective.

1. Trend Analysis of China's Total GDP Over the Past 20 Years

Gross Domestic Product (GDP) is a crucial indicator for evaluating the economic condition and development level of a country or region. It refers to the total value of all final goods and services produced within a country or region over a specific period (typically one year). GDP plays the following important roles:

(1) **Reflecting Economic Scale:** It provides a direct measure of the overall size of an economy.

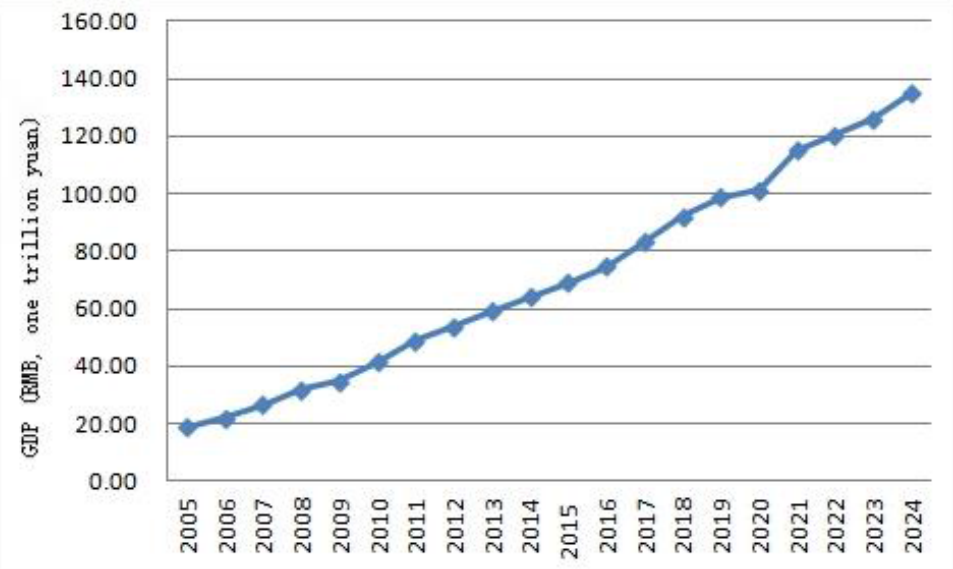
(2) **Assessing Economic Health:** The GDP growth rate helps determine whether the economy is growing, shrinking, or stagnating.

(3) **Supporting Policy Decisions:** Governments use GDP data to inform fiscal and monetary policy adjustments.

There are three primary methods for calculating GDP: the production approach, the income approach, and the expenditure approach. The expenditure approach is the most widely used, with the formula:

GDP = Consumption + Investment + Government Spending + Net Exports (Exports − Imports).

Focusing on the past two decades, the author compiled and analyzed the trends in China's GDP. The trend chart is shown below:

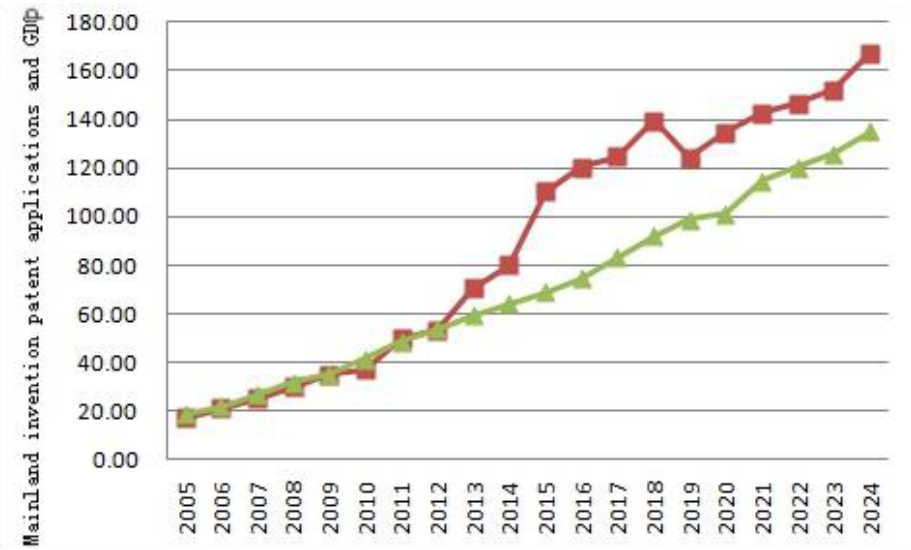


In 2005, China's GDP was RMB 18.73 trillion. By 2012, it had increased to RMB 53.9 trillion, and in 2024, it reached RMB 134.9 trillion. From this data, it is evident that China's GDP has increased by approximately 7.2 times over the past 20 years, demonstrating a consistent and stable upward trajectory. Over the past 10 years, China's GDP grew from RMB 53.9 trillion in 2012 to RMB 114.4 trillion in 2021, with an average annual growth rate of 6.6%—significantly higher than the global average of 2.6% and the average for developing countries at 3.7% during the same period. As China's economy grew rapidly, its share of global GDP also steadily increased—from 11.3% to over 18%. Meanwhile, per capita GDP

nearly doubled, rising from USD 6,300 to over USD 12,000. The Consumer Price Index (CPI) saw an average annual increase of around 2%, while per capita disposable income grew at an average annual rate of 7%, rising from RMB 16,510 to RMB 35,128. This represents a 112.8% nominal increase over 10 years, effectively doubling household disposable income and significantly improving both the living standards and quality of life of Chinese residents [3].

2. Trend Analysis of Mainland China's Invention Patent Applications and GDP Over the Past 20 Years

Patents in China are categorized into three types: invention patents, utility model patents, and design patents, each of which is strictly defined by the *Patent Law of the People's Republic of China*. According to Article 2 of the Patent Law, an invention refers to a new technical solution proposed for a product, a process, or an improvement thereof. From this definition, it is evident that inventions—technical solutions addressing new products, methods, or their improvements—require a high level of innovation and exert a profound influence on the economy. Studies have shown that invention patents contribute more significantly to the quality of economic growth than design or utility model patents. Therefore, this paper focuses primarily on the relationship between invention patents and GDP. By comparing the trends in invention patent applications filed in mainland China and China's GDP over the past 20 years, this paper provides a reasonable foundation for exploring their interrelationship. The trend chart comparing domestic application volume and GDP over the last 20 years is shown below:



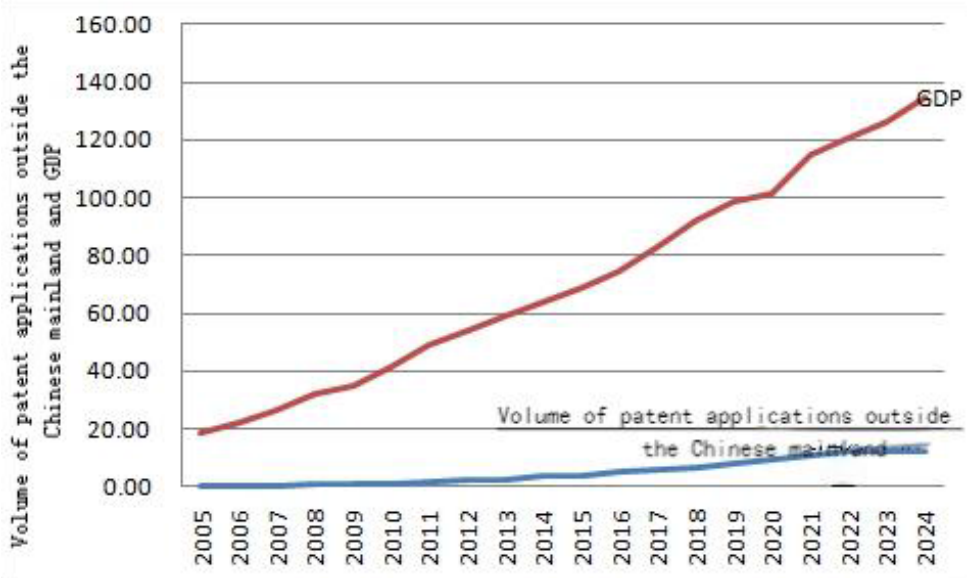
In 2005, the number of invention patent applications in mainland China was 173,000, and the GDP was RMB 18.73 trillion. By 2009, applications had increased to 350,000, and GDP had reached RMB 34.91 trillion. During this period, the ratio between applications and GDP was roughly 1:1 (ten thousand applications to one trillion RMB). In 2010, applications were 369,000 and GDP was RMB 41.3 trillion, giving a ratio of 1:1.12—the only time in the past 20 years where GDP exceeded the number of applications by more than 12%. From 2011, patent applications increased rapidly—from 500,000 in 2011 to 1.3939 million in 2018. At the same time, GDP grew steadily from RMB 48.79 trillion to RMB 91.93 trillion. In 2019, the number of applications dropped to 1.2446 million, 149,300 fewer than in 2018, while GDP continued to rise. This suggests a shift toward focusing more on the quality of applications since 2018. From 2019 to 2024, the growth trend of applications and GDP became roughly parallel. In 2022, applications reached 1.4646 million and GDP was RMB 120.47 trillion. By 2024, both reached record highs, with 1.672 million applications and GDP of RMB 134.91 trillion.

As shown in the chart above, GDP grew steadily over the years. From 2005 to 2009, the growth rates of patent applications and GDP were similar. In 2010, applications lagged behind GDP. Between 2011 and 2018, applications grew rapidly due to China's shift

from a real estate-driven economy to one focused on technological innovation. National and local governments encouraged patent filings, reflecting the importance of patents in promoting innovation and high-quality economic growth. The decline in patent applications in 2019 compared to 2018 was largely the result of regulatory action. In 2017, the China National Intellectual Property Administration (CNIPA) revised the Regulations on *Regulating Patent Application Behavior* (CNIPA Order No. 45), increasing efforts to combat abnormal applications. Subsequently, at the end of 2018 and the beginning of 2019, CNIPA issued two rounds of notifications to local authorities concerning suspected irregular applications. Since 2021, enforcement has intensified further, with CNIPA issuing notices mandating the complete cancellation of subsidies for patent applications, and various regions launching targeted rectification campaigns. Thus, the tightening of regulations in 2018 directly led to a decrease of 149,300 invention patent applications in 2019 compared to 2018. However, this reduction accounted for only about 10.7% of the 1.3939 million applications in 2018, indicating that the vast majority of mainland invention patent filings were legitimate efforts to protect innovation. From 2019 to 2024, the parallel growth between invention patent applications and GDP reflects a return to normalcy in patent filings, with invention patents once again playing a synchronized and supportive role in promoting the high-quality development of China's GDP.

3. Trend Analysis of PCT Applications and China's GDP Over the Past 20 Years

PCT stands for the Patent Cooperation Treaty, an international treaty that facilitates multi-country patent protection through a unified procedure. China joined the PCT in 1994, and the CNIPA acts as the receiving office, international search authority, and international preliminary examination authority for PCT applications submitted by Chinese applicants. PCT applications are characterized by the principle of "one application, multiple-country deployment," and thus reflect genuinely innovative technologies that seek protection across multiple PCT member states. In addition to PCT applications, domestic applicants may also apply directly for patents in foreign countries or in Hong Kong, Macao, and Taiwan (collectively referred to as "applications outside mainland China"). The trend chart of invention patent applications outside mainland China and China's GDP over the past 20 years is shown below:



From the chart above, it can be observed that in 2005, the number of applications outside mainland China was 2,400. It was not until 2010 that this number surpassed 10,000, reaching 12,300 applications. By 2014, this figure nearly tripled to 34,900; by 2018, it doubled again to 65,400, and by 2024, it reached 121,100. In terms of growth slope, the rate of increase in applications outside mainland China is significantly

lower than the growth rate of GDP. This suggests that the share of high-tech patented products with global market potential in China's GDP remains relatively low. In contrast, the slope of domestic applications has outpaced GDP, indicating that on one hand, China's innovative products—protected by invention patents—are still largely focused on the domestic market. On the other hand, the share of globally marketable high-tech patent products in GDP still has great potential for improvement, suggesting that China's global expansion of its innovative products is only just beginning.

4. Conclusion

In conclusion, by comparing and analyzing the trends of invention patent applications in mainland China and GDP growth over the past 20 years, we can clearly see that from 2005 to 2009, the growth rates of the two were roughly aligned. In 2010, patent application growth lagged behind GDP, during a period when the real estate sector dominated the economy. From 2011 to 2018, patent applications increased rapidly as China's economic structure shifted from real estate-driven growth to one led by technological innovation. This surge in applications reflects the important role of invention patents in protecting innovation and supporting high-quality GDP growth.

The sudden drop in applications in 2019 compared to 2018 was due to stricter regulations by the CNIPA targeting abnormal patent filings. From 2019 to 2024, the growth rate of patent applications closely paralleled that of GDP, showing that after the return to more regulated filing behavior, invention patents continued to provide strong support for high-quality economic development.

As for overseas patent filings, although they have generally increased over the past two decades, their growth rate has significantly lagged behind GDP growth. This indicates that China still has substantial room to expand its international patent portfolio. In particular, under the trend of globalization, the growth potential for overseas filings has not yet been fully realized. This suggests that there is still a long way to go in terms of protecting China's R&D and innovation outcomes abroad. Especially in high-tech sectors, the development of globally marketable patented products is still in its early stages, meaning that China has great potential for improvement in international innovation competitiveness.

With the steady increase in both domestic and overseas patent filings, the technological strength of China's economy will continue to rise, playing an increasingly important role in driving high-quality GDP growth. It can be said that the journey toward a more innovation-driven and globally integrated economic system in China has only just begun. With continuous improvement in innovation capacity and international competitiveness, China's patent system will increasingly serve as a powerful engine for technological progress and GDP growth. This promising future is just beginning.

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