THE EFFECT OF COORDINATED DEVELOPMENT OF TRADE ON TYPES OF INNOVATION

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Different types of patents represent different types of technological innovation. China's patents are divided into invention patents, patents for utility models, and patents for designs. According to the relevant provisions of the Patent Law, the invention patent refers to a new technical method proposed for a product, the method or its improvement. The patent for utility models refers to new and practical technical methods pertaining to the shape and structure of a product, while the patent for designs refers to new designs pertaining to the beauty and industrial utilization related to the shape, pattern, etc. of a product. Therefore, the invention aspect of the patent not only involves the improvement of the product itself, but also involves the underlying technology and method of innovation, which is the basis of the formation of technology platforms and the implementation of independent innovation. In the patent application process, the invention patent has the highest requirements among the three kinds of patents. Patents for utility models are mainly for improving the product itself, including the shape, structure and function, etc. Patents for designs only focus on the appearance of the product and generally do not involve the actual function of the product, so this kind of improvement is often mainly pertaining to imitation innovation. In practice, the difficulty of applying for patents for designs and utility models is relatively low. Based on the definitions and descriptions in China's Patent Law for various types

of patents and the discussions in existing studies (Tan et al., 2014; Tong et al., 2014; Li and Zheng, 2016), this paper defines the invention patent as a radical innovation, while the patent for designs and patent for utility models are defined as incremental innovations.

The core independent variable is the coordinated development of domestic and foreign trade, which includes specialized and equalized development of the two sectors, similar to two sides of a coin. The measure of equalized development is discussed first. Due to the lack of direct statistical data, the variable needs to be built specifically according to the meaning of equalized development. The specific formula is as follows: Based on the developing level and contrasting relationship of domestic trade and foreign trade, the linkage in a regional market between them can be divided into the following three states. (a) State I: This indicates equalized development when domestic and the foreign trade are both highly developed. (b) State II: This indicates specialized development if domestic trade is developed but foreign trade is relatively underdeveloped or the opposite case occurs. (c) State III: This refers to the situation where foreign trade and domestic trade are less developed. State I and State II represent the aforementioned trade coordinations, while State III is not relevant to this paper. These different states are summarized in Table 1. What the paper attempts to test in the empirical section is that State I (equalized development) is relatively more conducive to incremental innovation, while State II (specialized development) is relatively more conducive to radical innovation.

In order to describe the degree of coordinate development between domestic and foreign trade with continuous variables, this paper adopts the method of proportion difference to construct the linkage indicators, referring to the difference between the proportions of domestic trade activities in a certain region in

the whole country's domestic trade and that of international trade activities. The calculation formula is as follows:

Among these, R it represents the total retail sales of consumer goods of the region i in year t, and E it represents the total import and export volume of the region i in year t. When a region's domestic trade and foreign trade have a higher or lower proportion at the same time, Trade it is larger (State I and State III), and when the trade volume of a particular trade sector is higher and that of the other is low, Trade it will be smaller (State II). However, if the empirical results show that the independent variable Trade has a positive effect on technological innovation, it implies two entirely distinct numerical adjustment directions. One is to promote the development of the trade sector with the lower proportion, making the proportions of the two sectors both reach a high level. The other is to restrain the development of the trade sector with the higher proportion so that the trade proportions of the two sectors are at a low level. The adjustment directions mentioned above can increase the value of Trade, but only the first scenario conforms to the real meaning of equalized development. The second scheme is not in line with policy practice. Nevertheless, the two development directions cannot be compared according to the empirical results based on the index Trade. To this end, this study further uses the indicator Trade 1 from another perspective to reflect the linkage effect of the development of domestic and foreign trade:

When domestic and foreign trade in a region reach a relative high level in the whole country, Trade 1 value is larger (State I). If both of the two sectors account for a low percentage, or one of them has a high proportion while the other occupies a relatively low proportion, Trade 1 has a smaller value (State II, III). Since it is impossible to determine which state has a relatively high Trade 1 value when the Trade 1 value is small, and the regression analysis based on the conditional mean is still unable to give a definite answer,Footnote2 this study

introduces quantile regression into our research. Combining values of Trade with Trade 1 of the provinces and regions whose technological innovation are in different quantiles, the corresponding state can be identified. In general, if the regression coefficient of the higher quantile is larger than that of the lower quantile, and the coefficient of the higher quantile regression is positive, it can be said that trade equalization is more favorable for technological innovation.

To summarize the above analysis, the logic of the empirical model regarding the relationship between domestic and foreign trade and technological innovation is as follows: This study compares whether State I or State II is more helpful in achieving radical innovation or incremental innovation. By using the regression result whose dependent variable is Trade, this study compares the relationship between States I, III and State II. If the regression coefficient is positive, it indicates that State I or State III is superior to State II. Further, using a regression with Trade 1 as a dependent variable, the relationship between State I and States II, III can be compared.

Specialized development and equalized development are like two sides of a coin. Therefore, the aforementioned Trade and Trade 1 also measure the specialized aspect of coordinate development of domestic and foreign trade. Only under the condition that there are constraints of the production possibility frontier, the tradeoff of specialization and equalization between domestic and foreign trade exists.

As a result, the development level of the trade sector also needs to be taken into account. In other words, assuming that Province A has a higher degree of specialization and relatively more developed trade sectors, while Province B has a higher degree of equalization and less developed trade sectors than A, the results show that Province A has a higher level of technological innovation than B.

Considering the positive effect that the development of trade sectors may have on technological innovation, it is difficult to determine whether this is due to the specialization of the trade sector or the development of the trade sector itself. Therefore, it is only when the development level of trade in specialized-trade areas is equal or inferior to equalized-trade areas that one can conclude that specialization is more conducive to technological innovation than equalization, and vice versa.

Therefore, the key to the construction of indicators is to identify two types of provinces mentioned above. Specifically, this study further compares the levels of domestic and international trade in different provinces and regions based on Trade 1 and Trade, which can identify equalized-trade provinces. If (a) the provinces of trade equalization are equally or less developed than the specialized provinces and (b) one can identify these provinces through different quantiles and (c) the coefficient of equalized provinces at the proper quantile is greater, it means that the equalization is more conducive to technological innovation. On the contrary, if the specialized provinces with higher coefficients are equally or less developed than the equalized provinces, it shows that the specialization is more favorable to technological innovation.

To summarize the empirical process, the key point is identifying trade equalization and trade specialization under a limited amount of resources. We construct two indicators and use traditional regression and quantile regression. They distinguish trade equalization and trade specialization at different development stages, which implies a certain amount of resources allocated to different sectors.

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