垂直专业化分工下的环境规制与技术创新

ENVIRONMENTAL REGULATION AND TECHNOLOGICAL INNOVATION : A PERSPECTIVE OF VERTICAL SPECIALIZATION

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摘 要

垂直专业化是经济全球化的一个重要特征，在最近的十余年中逐渐成为国际分工体系中的主角。在这种新型国际分工模式下，跨国公司基于全球价值链的考虑将专注于生产价值链的高附加值环节，并逐渐将生产制造等不具备竞争力的生产环节外包出去。这一过程也为发展中国家制造企业从承担一些新兴产业中、低端环节入手嵌入全球价值链提供了新的机会和条件。以中国为例，由于在资源禀赋以及技术能力等方面与发达国家存在较大的差距，我国企业在参与国际垂直专业化促进中间产品贸易发展的同时，其背后蕴藏的环境污染与技术升级等问题日益凸显。出于环境保护考虑，作为社会性规制范畴的环境规制政策的引入，到底能否激励我国企业的技术创新？如果答案是肯定的，则随着时间性收敛，我国能够实现经济发展与环境保护的“双赢”，反之，则这种以牺牲环境为代价的外贸与经济发展模式不可持续。

为了对这一问题进行探讨，本书在垂直专业化视角下构建了一个环境规制影响技术创新的经济模型，探讨了环境规制对企业技术创新方向、要素资源配置及产出的影响。在此基础上，将环境规制的技术创新效应区分为对技术创新生产本身、技术创新经济效应的影响两个层次，分析了其内在的作用机理。然后以中国制造业为研究对象，从行业特征差异视角分析了垂直专业化与环境规制分别对企业技术创新绩效、绿色全要素生产率的影响，从地区差异视角分析了垂直专业化与环境规制对技术创新效率的影响。除了考察环境规制强度外，我们还探讨了不同类型环境规制工具对技术创新的激励效应，并采用离散计数模型进行了实证检验。研究表明：

(1)参与国际垂直专业化，通过获取进口中间品的技术外溢效应以及分工协作中的前、后向产业关联效应，总体上有利于我国企业的技术创新。基于行业特征差异视角，本书的实证研究表明，垂直专业化在低集中

度、低开放水平、高技术的行业中对技术进步的促进作用更大；基于地区差异视角，参与国际垂直专业化对东部地区企业的技术创新效率具有显著正向作用，但在中西部地区由于受到人力资本相对匮乏、基础设施条件相对落后等条件的制约，导致其对技术创新效率的积极效应并不十分明显。

(2)环境规制通过时期效应和强度效应对技术创新绩效产生一定的激励作用。本书在Julio等(2004)构建的环境投入产出模型基础上测算了中国进口中间品的CO_2含量，并将其引入对技术创新绩效的分析框架，基于27个制造行业面板数据的经验研究证实，加大环境规制力度能够促进科技活动人员占比及专利申请数量向着有利于提高本土企业技术创新绩效的方向发展，进口中间品碳排放与环境规制强度对技术创新绩效的影响在异质性行业间存在显著差异。

(3)环境规制可以通过创造新的市场需求、影响企业空间布局、改善信息交流功能等渠道对技术创新效率产生作用。基于异质性区域的实证检验发现，环境规制强度与企业技术创新整体效率在东部地区呈“U”形关系，在西部地区符合倒“U”形关系，而在中部地区尚未形成统计检验上显著的“U”形关系。基于产业集聚视角，对环境规制—产业集聚—技术创新过程效率这条路径的中介效应检验表明，环境规制对技术创新两个子阶段过程效率的作用方向在东、中、西三大经济区域间并不同步。

(4)环境规制的遵循成本效应与创新抵偿效应使得其与绿色全要素生产率之间的关系呈现并非简单的线性关系。采用中国制造业的经验研究证实，环境规制强度与绿色全要素生产率之间的关系整体上呈现“U”形关系，区分清洁型部门与污染密集型部门的回归检验表明，环境规制强度对清洁型部门绿色全要素生产率正向作用方向的拐点要先于污染密集型部门呈现。

(5)不同类型的环境规制工具对企业技术创新的激励效应大小存在差异。本书引入Fisher等(2003)理论框架分析表明，在排放税、免费分配可交易排污权与可拍卖排污权三种环境规制工具中，究竟哪种类型的环境规制政策工具能够实现对技术创新激励效应的最大化，在很大程度上依赖于污染削减成本效应、模仿效应、排放费支付效应与新专利的采纳价格效应这几个变量之间的综合权衡。浙江省25个工业行业的logit计量

模型的实证检验也表明，环境规制工具对技术创新的激励作用受经济发展水平、行业特征以及外部环境等多种因素的影响。

根据上述分析结果，本书提出了相应的政策建议，如鼓励制造企业主动融入国际垂直专业化分工；适度加强环境规制力度；考虑地区、行业差异，实行差异化的环境规制强度；提倡采取灵活多样的环境规制形式；完善体制、机制等方面的配套政策等。

Abstract

Vertical specialization, one of important features of economic globalization, has gradually played the leading role in the international division of labor system in the recent ten years. Under such new mode of labor division, focus of multinational corporations that is based on the consideration of global value chain is turning to high added value of the production value chain, and gradually manufacturing and other production links that were less competitive were outsourced. This process has provided new opportunities and conditions for manufacturing enterprises of the developing countries to get involved into the global value chain starting from undertaking some middle and low end links of emerging industries. Taking for China for example, there is a big gap in resources abundances and technological capabilities between China and the developed countries. Chinese manufacturing business has been overly dependent on the material resources input and the advantage of low-cost land and labor to participate in international vertical specialization. While facilitating the rapid development of intermediate products trading, they are confronted with increasingly prominent problems in environment pollution and technology upgrade. For environmental concerns, whether the introduction of environmental regulation policies which belong to the social regulation category can stimulate technological innovation of domestic enterprises, if the answer is yes, with the timeliness convergence, China will realize a "win-win" situation in economic development and environmental protection. Conversely, the foreign trade and economic development mode at the expense of environment is unsustainable.

To conduct investigation and discussion on this problem, an economic

model about the effect of environmental regulation on technological innovation was constructed in this paper based on the perspective of the vertical specialization, to discuss the effect of environmental regulation on the technological innovation direction of enterprises, allocation of element resources and output. On this basis, effect of environmental regulation on technological innovation can be divided into two categories: effects on the production itself and the economy. The internal function mechanism was analyzed, and the effect of vertical specialization and environmental regulation respectively on the enterprise technological innovation performance, green total factor productivity and the technological innovation efficiency was analyzed from the perspective of industry characteristic differences and regional differences, taking Chinese manufacturing industry as an example. In addition to study of the environmental regulation, the incentive effect of different types of environmental regulation tools on technological innovation was also discussed and the discrete counting model was adopted for empirical test, and the research showed that:

(1) Participation in the international vertical specialization is generally beneficial for technological innovation of enterprises in China through acquisition of the technological spillover effect of imported intermediate goods, and forward and backward industrial relevant effect of coordination and distribution. The empirical study of this paper found that from the perspective of the industrial characteristic difference, vertical specialization exerts better function in industries with low concentration, low level of opening up and high level of technology; from the perspective of regional difference, participation in the international vertical specialization has significantly positive effect on technological innovation efficiency of enterprises in the eastern region, but not obvious effect in the central and western regions restricted by the relative lack of human capital and backward infrastructure conditions.

(2) Environmental regulation exerts certain incentive role in technological

innovation performance through the period effect and strength effect. In this paper, based on the environment input-output model constructed by Julio et al. (2004), CO_2 emissions in the intermediate goods imported by China was calculated and introduced into the analysis framework of technological innovation performance. Empirical research of panel data of 27 manufacturing industries demonstrated that strengthening the environmental regulation can increase the proportion of scientific and technological practitioners and make the patent applications beneficial to improvement of the technological innovation performance of local enterprises, and the effect of carbon emissions of imported intermediate goods and environmental regulation strength on technological innovation performance showed significant difference among heterogeneous industries.

(3) Environmental regulation can exert effects on technological innovation efficiency through creation of new market demand influencing enterprise space layout, improvement of communication function and so on. The empirical test of the heterogeneous regions found that the strength of environmental regulation and the overall efficiency of enterprise technological innovation show a relationship of "U"type in the eastern region, inverted "U" type in the western regions, and no significant statistical test "U" type of relationship has not yet formed in the central area. Based on the industrial concentration, mesomeric effect on environmental regulation, industrial concentration, and technological innovation process showed that the effect of environmental regulation on efficiency of two subphase processes of technological innovation were not synchronous in the eastern, central and western economic zones.

(4) The cost effect and innovation counter effect did not present a simple linear relationship between the green total factor productivity and the environmental regulation. The empirical research of Chinese manufacturing industry proved that the environmental regulation strength and the green total factor productivity showed "U"type relationship on the whole, and regression test to distinguish the clean type sectors from the pollution

intensive sectors showed that the positive role of environmental regulation strength present an earlier inflection point on the green total factor productivity of clean type sectors than the pollution intensive sectors.

(5) Effects of various types of environmental regulation tools on technological innovation is different. Analysis made in this paper by introducing theoretical framework of Fisher et al. (2003) showed that in three kinds of environmental regulation tools including carbon tax, free permits and auctioned permits, the identification the environmental regulation policy tool which can maximize the incentive effect of technological innovation depends heavily on integrated balance of the variables among the pollution cost cutting effect, the imitation effect, emission fee payment effect and new patent adopted price effect. Empirical test based on logit measurement model of 25 industries in Zhejiang Province also showed that incentive effect of environmental regulation tools on technological innovation can be affected by many factors including the economic development level, industry characteristics and external environment.

According to the analysis result above, corresponding policy suggestions were put forward in this paper. Such as encouraging manufacturing enterprise to actively take part in the international vertical specialization; moderate strengthening of the environmental regulation; considering the regional and industrial differences, adopting the differentiated environmental regulation strength, advocating various environmental regulation forms, perfecting the system and mechanism and other supporting policies, etc.

目　录