

外资技术扩散与中国经济增长： 理论、实证与政策

Technological Diffusion via FDI
and Economic Growth in China:
Theory, Empirical Analysis and Policy
Zhang Haiyang

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本书部分内容得到了教育部人文社会科学青年项目“自主研发、人力资本对外资技术扩散的影响”（06JC790038）的资助。

前 言

改革开放以来，特别是上世纪 90 年代以来，中国的外商直接投资快速增长。大量外资的流入积极地促进了中国的资本存量增加、投资效率和资源配置效率的提高以及人力资本的开发和利用，成为经济持续快速增长的一个有力支撑点。然而，引进了外资并不意味着一定能够掌握外资企业的先进技术。成功地掌握内含在外资中的先进技术有一个消化、吸收和创新的技术扩散过程。那么，改革开放以来，中国消化、吸收外资先进技术，外资技术扩散对中国经济增长的影响程度怎样？这一问题构成了本书的研究主题。

首先，本书就研究的背景、目的和问题进行了阐述，界定了技术与技术扩散的概念，指出技术扩散与技术转移、技术溢出的区别，并且介绍了技术扩散的动态和静态路径及其分类，明确了以外商直接投资为载体的技术扩散与其他形式技术扩散的区别。

然后，本书对技术扩散理论以及技术扩散的机制、证据和方法等实证研究进行了评述，并详细地介绍和评述了以领导者——跟随者模型等为代表的近年来发展起来的技术扩散模型。接下来，本书给出了一个跨国公司、人才流动与技术扩散的分析框架，形式化了人才流动对外资技术扩散的作用机制以及跨国公司技术扩散发生的

条件。研究认为：一旦跨国公司对东道国进行投资，为了防止人才流失造成向本地企业的技术扩散，将支付给本地工人较高的工资。这样，即使跨国公司对本地企业的技术扩散没发生，东道国的福利也得到了改进；技术扩散是有条件的，技术难度越小，本地企业吸收能力越强，技术扩散程度就越强。

第三，本书对中国区域和工业部门的外资技术扩散程度进行了实证分析。实证分析包括五部分内容：一是利用前人的分析框架，检验了中国全国和区域外资技术扩散的程度，并比较东部、中部和西部外资技术扩散程度的差异。由于中国外资流入在 1992 年以后发生了很大的变化，我们还对中国外资技术扩散程度在时域上的变迁进行比较。研究发现，在各个时段上，中国无论是在全国范围内还是在各区域范围内都不存在显著的外资技术扩散；二是对中国外商直接投资地区选择因素变迁进行了实证分析，发现中国各地区的外商直接投资地区选择因素存在很大的差别，并且这些因素随时间的推移发生了变化。在 1991 年以前，广东和福建地区吸引的外商直接投资绝大多数来自中国香港和中国台湾，地理毗邻和相同文化背景是其吸引外商直接投资选择的主要因素。在其他沿海地区，当地的劳动力质量和本地市场大小是其吸引外商直接投资的主要因素。而外商直接投资在中西部地区地点选择的主要因素是市场大小和劳动力质量。1992 年以后，在沿海地区，由于市场的进一步开放，竞争加剧，外商直接投资更愿意选择竞争对手较少、竞争相对不激烈、基础设施较好、劳动成本较低的地区。而外商直接投资在中西部地区地点选择的主要因素仍然是当地市场大小和市场需求；三是对中国行业外资技术扩散程度进行了实证研究。我们提出了一个衡量行业外资技术扩散程度的框架。在这个框架下，行业外资技术扩散程度用内资 R&D 投资和外商直接投资的交互项来衡量。研

研究发现, 外资对中国整个内资工业部门和高技术行业没有明显的技术扩散效应, 而对一般传统行业有显著的技术扩散效应; 四是通过建立分析框架, 运用平行数据模型方法, 以广东为例分析了外资溢出效应与竞争效应对中国内资工业部门以及不同所有制工业部门的影响。研究发现, 外资对中国内资工业部门存在正向的溢出效应和负向的竞争效应, 而负向的竞争效应超过正向的溢出效应, 外资对内资工业部门的净效应是为负的。这说明至少在短期, 外资对内资工业部门冲击很大。研究还发现, 外资对不同所有制工业部门的溢出效应和竞争效应是不同的: 对国有工业企业冲击最大, 有不显著的正向溢出效应和显著负向的竞争效应; 对国有及国有控股工业企业有不显著的正向溢出效应和显著的正向竞争效应; 对集体工业企业有显著正向的溢出效应和不显著负向的竞争效应; 私营、三资经济为主的其他工业企业受益最大, 外资的溢出效应和竞争效应都显著为正; 五是运用基于 DEA 的 Malmquist 生产率指数对中国内资工业部门生产率、技术效率和技术进步进行了测算, 然后检验了在控制自主 R&D 的情况下, 外资活动对内资工业部门生产率增长的影响。通过考察 R&D 的创新能力和吸收能力, 我们将外资外部性区分为外资技术扩散效应与竞争效应, 进而检验了外资促进内资工业部门技术效率和技术进步的途径。我们发现, 在控制自主 R&D 的情况下, 外资活动对内资工业部门生产率提高没有显著影响, 主要原因是内资部门较低的 R&D 吸收能力抑制了生产率的增长; 外资活动产生的负向竞争效应抑制了内资部门技术效率的增长; R&D 和外资活动都推动了内资工业部门技术进步, 但来源分别为 R&D 创新能力和正向竞争效应, 而不是技术扩散; 由于高科技行业 R&D 吸收能力较低, 内资部门不仅没能吸收外资先进技术, 反而呈现显著的逆向技术扩散。一般行业吸收能力比高科技行业强,

但外资技术扩散也不显著。

第四，既然 R&D 吸收能力不是决定外资技术溢出的因素，那么是什么因素促进外资技术溢出的成功发生？我们认为，不仅金融市场的发展有利于外资技术溢出，而且其他市场化进程中的制度变迁内容，比如政府与市场关系的改善、非国有经济的发展、要素和产品市场的发展以及市场中介组织发展和法律制度环境的改善等等都将促进外资技术溢出。在市场机制的作用下，低效率企业要么提高效率，要么被淘汰出局。在这种“优胜劣汰”机制的作用下，相对技术水平较低的内资企业必须尽最大努力去学习、模仿、吸收消化外资先进技术，不断提高技术水平，才能避免被淘汰的命运。而相对技术水平较高的外资企业也将时刻面临可能被追上的危险，所以，不得不通过引入新的技术或改进现有技术来保持领先地位。因此，市场机制不仅促进静态的外资技术溢出，而且将推动外资技术溢出的动态发展。在这部分，我们计量检验了中国市场化进程对外资技术溢出的影响。研究发现，市场化进程不仅促进了中国工业生产率的增长，而且是促进外资技术溢出的决定性因素。市场化进程的各项制度变迁内容都显著地促进了外资技术溢出。要素市场发育将在推动中国生产率增长中扮演重要角色。在地区比较后，研究进一步发现，东部地区外资技术溢出的决定因素是市场化进程，要素市场发育是决定外资技术溢出的最重要的制度变迁内容；由于市场化进程缓慢，中西部地区 R&D 吸收能力相对更重要一些，非国有经济的发展是该地区促进外资技术溢出的主要制度变迁因素。

最后，在前面的理论和实证分析的基础上，本书提出了有关中国外资的总体政策、制度政策、区域政策与产业政策的建议，主要包括：外资政策不宜优惠、完善市场经济制度和投资环境、给中西部地区更多的倾斜政策、实施有差别的产业政策等等。并且通过回

顾外资技术扩散途径和影响因素的相关理论，给出了一个外资技术扩散与武汉光通信产业发展的案例分析。从技术扩散行为主体的角度，即技术的供给方、需求方和中间渠道三个方面分析了外资技术扩散的主要制约因素，并结合对武汉光通信产业链的分析，提出了促进外资技术扩散，加快湖北高新技术产业发展的政策建议。

PREFACE

Since reforming and opening—up, particularly after 1990' s, the foreign direct investment flowing into China has increased rapidly. Large mount of foreign direct investment flowing into China has promoted actively the accumulation of capital, the elevation of the investment and resource allocation efficiency and the exploitation and utilize of human capital. Foreign direct investment has become one of powerful underlies for sustained and fast economic growth of China. However, introducing foreign direct investment does not mean mastering the advanced technology, successfully mastering the advanced technology embodied in the foreign direct investment has a process of assimilation, absorbability and creation. How is the extent of technological diffusion via foreign direct investment effecting on the economic growth of China? And it is the subject and objective this dissertation want to study.

Firstly, the backgrounds, objectives and problems of this book are expatiated, the concept of technology and technological diffusion are defined, the difference between technological diffusion and

technological transfer and technological spillovers, and the dynamic and static paths of technological diffusion and its classify are introduced, the distinction between technological diffusion via foreign direct investment and others channels is indicated definitely.

Then, technological diffusion theories, mechanisms, evidences, and methodologies are reviewed in the literature summarize, the theories of technological change and technological diffusion developed in recent years including models with an expanding variety of products, models with improvements in the quality of products and the leader—follower model are introduced and commented. Following up, an analytic framework for multinational company, talent mobility and technological diffusion is given to formalize the mechanisms how talent mobility effects the technological diffusion and the conditions how technological diffusion occurred. We find that once the multinational company invests in host country, in order to prevent technology lost as talent dismissal, it will pay higher wage for the local employees. Therefore, the welfare of host country will be improved, though the technological diffusion via multinational company to local enterprises did not occur.

Five empirical analyses for China on the technological diffusion via foreign direct investment across regions and industries are provided. Firstly, using predecessor's analytic framework, the degree of technological diffusion via foreign direct investment across regions in China is tested, the difference of technological diffusion between the eastern, middle and western regions are compared. As

the foreign direct investment flowing into China has been changed greatly after 1992, the variation of technological diffusion degree before and after 1992 are compared in temporal level. We find that in both periods, either in the country level or in each region level, the technological diffusion from foreign direct investment across China does not exist significantly. Secondly, the variation on determinants of FDI location distribution across China is analyzed. We find that there are many differences of determinants of FDI location distribution between regions across China, and these determinants have been changed timely. Before 1991, most of inflow FDI in Guangdong and Fujian provinces are from Hong Kong and Taiwan respectively. The main factors are geography and culture. Most of FDI is export—process orientation. In the other coastal areas, the main determinants of attracting FDI are local labor quality and larger local market size. The higher the labor quality and the market size are, the more FDI flows into. At the same period, the determinants of FDI location selection in the remote middle—western provinces are the market size and the labor quality. In the middle—western areas, even though the labor cost is relative high, the higher the labor quality is, the more FDI flows into. After 1992, the determinants of FDI location selection in various areas varied hugely. In the coastal provinces, Most of FDI is still export—process orientation. With the further opening—up of the market, the competition is more and more intensive, FDI prefers to the areas where there are little competitors, good infrastructures, and low labor cost. At the same stage, the determinants of FDI location se-

lection in middle—western provinces are still the local market size and the market demand. Thirdly, we analyzed the technological diffusion of foreign direct investment in industries level. A framework testing the technological diffusion degree in industries is submitted. In this framework, the technological diffusion is estimated by interaction term between domestic R&D investment and FDI. We find, there is no significant effect of technological diffusion from foreign direct investment to all industries or high—tech industries. However, there is significant effect of technological diffusion to traditional industries. Fourthly, constructing the analytic framework, using the panel data model, we analyzed the effect of spillovers and competition of foreign direct investment on the Chinese domestic industrial enterprises and various ownership industrial enterprises. We find the spillovers effect is positive and the competition effect is negative. The negative competition effect passes over the positive spillovers effect; the net effect of foreign direct investment on the domestic industrial enterprises is negative. This means that the pressure on the domestic industrial enterprises from FDI is very large. We also find the spillovers effect and competition effect of foreign direct investment on different ownership industrial enterprises are distinguished. The state—owned industrial enterprises are most impinged, whose spillovers effect and competition effect are insignificantly positive and significantly negative respectively. The stated—owned or controlling share hold industrial enterprises have insignificantly positive spillovers effect and significantly positive competition effect. The collective—owned industrial enterpri-

ses have significantly positive spillovers effect and insignificantly competition effect. The other enterprises including private enterprises and foreign owned enterprises are most benefit, whose both effects are positive significantly. Lastly, the total factor productivity, technical efficiency and technical progress are measured by the Malmquist productivity index based on the data envelope analysis (DEA). Controlling the R&D, the effect of the activities of FDI on the total factor productivity (TFP) of the domestic manufacturing is estimated. The extenality of FDI is divided into the technological diffusion and competitive effect; the channels of technical efficiency and technical progress are examined. We find that controlling the R&D, the activity of FDI does not have significant effect on domestic manufacturing. Lower absorptive capacity of R&D cumbars the growth of TFP. The negative competitive effect combars the growth of technical efficiency. Through the self-innovative and positive competitive effect, but not technological diffusion, R&D and FDI both prompt the technical progress of domestic manufacturing. In high-tech industries, the domestic industries could not absorb the advanced technology embodied in FDI as the low absorptive capacity of R&D, and there is the converse technological diffusion from the domestic sectors to the foreign ones. In the traditional industries, their absorptive capacity is higher than hi-tech ones, but the technological diffusion is also not significantly.

The conclusion we obtain in the last section is that the R&D absorptive capacity is not the determinant factor of technological diffusion via FDI. What is the determinant factor of technological

diffusion via FDI. We believe, not only the finance market development in favor of technological diffusion via FDI, but also other institution transition in marketization process, such as the melioration of relation between the government and market, the development of non — state owned economy, the development of factors and goods market, the development of market agency organization, the improvement of law institution environment. In the market mechanism, the inefficient and low efficient enterprises either improve efficiency, or be washed out. In the mechanism of the superior win and the inferior wash out, the relative low technology level domestic enterprises must try their best to study, imitate, absorb the advanced foreign technology, continuously improve their technology level to avoid the fate of being washed out. And the relative high technology level domestic enterprises face the danger of caught up momentarily, they have to import advanced technology or improve existing technology to keep ahead position. Therefore, market mechanism not only prompts the static technological diffusion via FDI, but also pushes the dynamic development of technological diffusion via FDI. In this section, the impact of marketization process on the technological spillovers via FDI is analyzed empirically. We find, the marketization process not only promotes the growth of TFP of home industry, but also is the decisive factor to promote technological spillovers via FDI. All of institutional transitions in marketization process significantly promote technological spillovers via FDI. The development of factor market will play more and more important role in promoting the growth of TFP of

home industry. Further more we find, the marketization process is a crucial factor to promote technological spillovers via FDI in east region. The development of factor market is the most important institutional transition in marketization process. However, in the middle—west region, as marketization process move slowly, the adoptive capacity of R&D is relative more important, the development of non—state—owned economy is the main institutional factor for promoting the technological spillovers via FDI.

Finally, based on the previous theories and positive analysis, the relevant regions and industries policies attracting foreign direct investment to China are submitted, including the policies of foreign capital should not be more preferential, the market—economy system and investment environments should be more consummated, the policies for middle and western region should be more inclined and the industrial policies should be distinguished and so on. Lastly, a case regarding technological diffusion via FDI and the development of hi—tech industries in hubei province, is analysed. We review the the related theories on the channels and effect factors of technological diffusion via FDI, the restrictive factors of technological diffusion via FDI are indicated on the viewpoints of behavior entities of technological diffusion including supply, demand and middle entities. Then combined with the analysis to the industry chain of Optic communications industry in Wuhan, the counter-measures to promote technological diffusion via FDI, develop the hi—Tech Industry in Hubei Province are given.

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