



# Does Foreign Direct Investment Lead to Productivity Spillovers? Firm Level Evidence from Indonesia

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**Summary.** — This paper examines whether spillovers from foreign direct investment (FDI) make any contribution to productivity growth in the Indonesian chemical and pharmaceutical firms using plant-level panel data. The spillover effects from FDI are analyzed using a stochastic frontier approach and productivity growth is decomposed using a generalized *Malmquist* output-oriented index. The results show positive productivity spillovers from FDI; higher competition is associated with larger spillovers; and domestic firms with R&D gain more spillover benefits compared to those without R&D. FDI spillovers are found to be positive and significant for technological progress and positive, but not significant, for technical and scale efficiency change.  
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**Key words** — FDI spillovers, frontier production function, *Malmquist* index, total factor productivity growth

## 1. INTRODUCTION

Foreign direct investment (FDI) is believed to provide recipient countries with knowledge<sup>1</sup> transfer as well as capital. The argument is that multinational corporations (MNCs) establish subsidiaries in overseas and transfer knowledge to their subsidiaries. The transferred knowledge has a certain public good quality and may spread through non-market mechanisms over the entire economy leading to productivity gains (hereafter productivity spillovers) in domestic firms (Blomstrom, 1989).

Expectation of productivity spillovers from knowledge transfers has been a major impetus to policy makers in many countries to provide FDI-friendly regime.<sup>2</sup> In developing countries, policies in favor of FDI have been introduced since the early 1980s. Since then, net inflows of FDI have increased dramatically and FDI has been the most significant part of private capital inflows to developing countries. From 1985 to 2006, for example, the net FDI inflows to developing countries have increased from US\$ 14 billion to US\$ 379 billion, rising more than 25-folds (UNCTAD, 2007). In recent years, FDI inflows have accounted for more than half of the total private capital inflows in developing countries (Ng, 2006).

Now an important question is whether these huge FDI inflows indeed bring about productivity spillovers for recipient countries, particularly for developing economies. The evidence is fairly mixed so far. Some empirical studies confirm positive productivity spillovers from FDI (e.g., Caves, 1974; Chakraborty & Nunnenkamp, 2008; Gorg & Strobl, 2005; Javorcik, 2004; Schiff & Wang, 2008), but others find negative or no spillovers (e.g., Aitken & Harrison, 1999; Barry, Gorg, & Strobl, 2005; Djankov & Hoekman, 2000; Haddad & Harrison, 1993). The mixed evidence intuitively implies that there is no universal relationship between FDI and domestic firms' productivity. Some studies, however, argue that the mixed findings may be attributed to domestic firms' characteristics or host countries' ability to absorb productivity spillovers (Gorg & Greenaway, 2004; Smeets, 2008). Nevertheless, differences in findings depend significantly on research design, methodological approach, types of data used, estimation strategy, and even on the construction of the spillover variable.

The present paper extends the current empirical literature to determine whether the FDI leads to productivity gains in the Indonesian chemical and pharmaceutical industries during 1988–2000. These two industries have been chosen as they continuously attracted the highest inflow of annual FDI since 1975 (Table 2). They belong to the group of the most productive sectors in the Indonesian manufacturing industries in terms of value added per worker (around 1.5 times of the manufacturing average),<sup>3</sup> while registering a consistent growth of an annual average of 17.71% during 1988–2000.<sup>4</sup> An overwhelming presence of MNCs in this sector provides a good basis to examine the role of firm-specific characteristics in determining the productivity spillovers.

We estimate FDI productivity spillovers using the Stochastic Frontier Approach (SFA). With this method we also address the importance of competition and firms' absorptive capacity for gaining productivity spillovers. Furthermore, we identify the sources of productivity growth in the presence of FDI in these two major industries of the Indonesian economy. A generalized *Malmquist index* is used to decompose total factor productivity (TFP) growth into technical efficiency change (TEC), technological progress (TP), and scale efficiency change (SEC). We then test the impact of FDI spillover effects on each of these components of productivity growth. The authors know of no other study that addresses the issue of decomposing the productivity effects of FDI using a generalized *Malmquist index*.<sup>5</sup>

The rest of this paper proceeds as follows: Section 2 provides an overview of the Indonesian manufacturing sector and the inflow of FDI, which is followed by a critical review of the theoretical and empirical studies on productivity spillovers in Section 3. Section 4 discusses estimation techniques followed by data sources and variable construction. Section 6 presents the results for model selection and estimation,

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followed by an analysis of empirical results. The summary of findings and policy implications is given in the final section.

## 2. AN OVERVIEW OF THE INDONESIAN MANUFACTURING AND FDI FLOWS

Indonesian manufacturing has been demonstrating spectacular growth and unprecedented transformation since the second half of 1970s. This transformation is evident not only in rapid output and in employment growth, but also in the transition to modern capital and skill-intensive industries, strong productivity and wage growth, and broadening the industrial base outside the capital city, along with a probable reduction in concentration levels (Hill, 1996). Decisive liberalization reforms have been introduced since the mid 1980s. These included reduction in tariff and non-tariff barriers,<sup>6</sup> privatization of public enterprises, relaxation of foreign investment rules, and lessening other restrictions. The reform package also included fiscal reform, financial liberalization, and the maintenance of a realistic and flexible exchange rate, together with trade liberalization, reduction in government intervention and improved management of public enterprises. The industrial development policies were focused on the priority industries and the creation of industrial zones. The reforms of the 1980s were designed to improve the productivity performance of manufacturing industries by encouraging competition from within the economy as well as from outside.

The change of policy direction from interventionist to liberalization encourages the expansion of export-oriented sub-sectors, such as chemicals and pharmaceuticals (ISIC 35), and woods and wood products (ISIC 33). As a result, since 1987 Indonesia has experienced a surge in manufactured exports, for example, during the period 1989–93 manufactured exports grew at an average annual rate of 27%, while manufacturing value added (MVA) grew at an average annual rate of 22% (UNIDO, 2000). Export-oriented manufacturing firms witnessed a higher growth than non-export firms, and at the same time, manufacturing firms experienced a substantial productivity growth.

Studies reveal that manufacturing sector experienced higher TFP (total factor productivity) growth at around 6% per annum in the post liberalization period (Ikhsan, 2007; Vial, 2006) compared to a negative growth of -4.9% during 1981–83 (Aswicahyono, 1988). One of the important factors contributing to these positive outcomes in the manufacturing sector during the post-liberalization period was a massive inflow of FDI.<sup>7</sup> The huge increase in FDI inflows, from a meager US\$ 0.2 billion in 1983 to US\$ 5.9 billion in 2006,<sup>8</sup> facilitated the high growth of manufacturing industries in terms of output, employment, and value added. Moreover, the growing FDI inflows helped create backward and forward linkages in the economy. Although there was a decrease in manufacturing growth during the East Asian crisis in 1997, this sector revived quickly and demonstrated further growth since 2000.

The manufacturing sector received a large proportion of total FDI inflows in the Indonesian economy. The share of approved FDI to this sector accounts for more than 50% of total approved FDI over the last three decades (Table 1). Although the total approved FDI decreased steadily after the economic crisis, the share of manufacturing FDI remains the largest part of the total FDI. Furthermore, within the manufacturing sector over the years (Table 2), the highest share of manufacturing FDI flowed to chemicals and pharmaceuticals (44.56%), followed by metal products (13.13%) and papers and paper products (11.96%). Food products have received an increasing

share of manufacturing FDI, particularly after the deregulation in 1984. However, the average percentage of FDI to this sector remains relatively small of the total approved manufacturing FDI.

Based on the high level of FDI, the present study focuses on chemical and pharmaceutical firms in examining the productivity spillovers of FDI. Another reason to focus on this sector rather than on pooling data for the whole Indonesian manufacturing is to reduce heterogeneity in data, as suggested by Bartelsman and Doms (2000). Firms in the chemical and pharmaceutical sectors have different characteristics, in terms of size and technology, compared to, for example, firms in food processing sector. Pooling firms from both industries together may give rise to persistent heterogeneity in data.

The chemical and pharmaceutical sectors (ISIC 35) represent about 18% of Indonesian manufacturing output and around 12% of the manufacturing employment in 2005. This sector employs some 540 thousand people with wages of around IDR 8,445 billions per year. Its contribution to the manufacturing value added (MVA) was the third highest of all industries after the food industry and textiles. During 1975–2005, this sector expanded rapidly, increasing in value added by more than 35 times.<sup>9</sup> It is a diverse industry ranging from large-scale petrochemical complexes to medium-sized establishments that simply mix chemicals to produce paint, pesticide, and traditional medicines. In the Annual Survey of Manufacturing Industries, the BPS divides this sector into six sub-sectors: industrial chemicals (ISIC 351), pharmaceutical and other chemicals (352), oil and gas refining (353 and 354), rubber and products (355), and plastic products (356). Among these sub-sectors, the oil and gas refining sub-sectors have only been surveyed since 1990 and cover only a few establishments. The other four sub-sectors have been surveyed since 1975.

In this study, the focus is on the sub-sectors industrial chemicals (ISIC 351) and pharmaceuticals and other chemicals (ISIC 352), as these two sub-sectors represent more than 70% of the sector value added. The trend and key indicators of the two sub-sectors (hereafter, chemical firms and pharmaceutical firms refer to firms in these two sub-sectors, respectively) during the studied periods are presented in Table 3. From the table, one might note that the combined sub-sectors expanded rapidly during 1988–98, which can be observed from an increase in output and value added by more than 10 times. Labor productivity, which is measured by value added per labor (VA/L), also increased considerably by almost eight times during the years.

Interestingly, the number of foreign firms, as a percentage of total firms across the two sub-sectors combined, increased quite significantly from 12.92% in 1988 to 18.65% in 1998. A similar pattern is also observed for foreign share (as a percentage of value added), as it rose drastically from 27% in 1988 to 61.23% in 1998, suggesting an important contribution of foreign firms to the value added in this sector. The exported outputs of the combined sub-sectors were less than 7% during 1988–98. In contrast, there was heavy reliance on imported materials, with 55.18% and 44.75% of total material was imported in 1988 and 1998, respectively.

## 3. RELATED LITERATURE AND HYPOTHESIS DEVELOPMENT

### (a) MNCs, superior knowledge, and productivity spillovers

When MNCs establish subsidiaries overseas, they come across disadvantages in the form of access to resources

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