*Ushus-Journal of Business Management*
2022, Vol. 21, No. 1, 45-65
ISSN 0975-3311 | https://doi: 10.12725/ujbm.58.3

# Impact of Outward FDI on Firms' Productivity in the Steel Industry: Evidence from India

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## Abstract

This paper examines the impact of Outward FDI (OFDI) on productivity and analyses its substantial effect on home countries' steel firms. For the analysis, the study classifies the steel companies into a treatment group and a control group. To analyse India's FDI investment objective and its impact on productivity, the study ranks economies into low- and middle-income, high- and middle-income, and tax havens to analyse productivity growth. The data for the analysis come from Prowess, a World Bank database. The data of outward FDI from Indian companies is compiled from the UNCTAD database. The study suggests that research on FDI does not focus on the impact on the issuing party, particularly FDI from low- and middle-income countries. The study analyses the effects of FDI with special reference to the Indian steel industry.

**Keywords:** Productivity, Steel industry, Indian manufacturing firms, Outward Foreign Direct Investment (FDI)

## 1. Introduction

Intensifying Outward FDI (OFDI) from low and middle-income countries like India demonstrates the progression made by

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Emerging Multinational Enterprises (EMNEs) in the global marketplace (Wells, 1983; Goldstein, 2008; UNCTAD, 2007). These EMNEs primarily undertake Outward FDI, to procure raw materials, access technology, brands, and strategic assets that allow them to expand their global reach. Upper-middle-income countries remained the foremost authority of outward FDI. With the rise in the aggregate outward FDI to the US $ 12.59 Billion in 2018, India emerged as a significant investor in these same upper-middle-income countries.

Outward FDI helps domestic firms enhance their exports, and improve profit margins and R&D in their home country (Zhao, 2010; De Beule, 2012; Du, 2015; Jing, 2016; Yang P. a., 2017). Outward FDI increases the domestic total factor productivity (TFP) through external channels known as outward FDI own-firm effects (Liu, H. &. Lu, J. 2011; Jiang, 2014; Zhao, 2010). However, firms have their motives and strategies for investments; similarly, the influence of outward FDI differs across industries (Lin, Chen, & Yabe, 2019; Blonigen, 2005; Chawla, 2015). The strategic motivations behind India's outward FDI include the following: (1) Firm-specific motivating factors like size, experience, R&D, export orientation, high productivity, and capital goods (Pradhan J. P., 2005; Thomas R. & Narayanan. K, 2017), (2) The advancement of enterprise competitiveness by restructuring institutional configurations, state policies, corporate finance and governance, skill formation and technological upgrading (Blomstrom, 2000; Li, 2012; Wen, 2017; Taylor, 2017).

The literature analyses that the impact of FDI on the productivity of national companies is limited. Earlier studies concentrated on the firm-level effects in upper-middle-income countries and the country-level effect in low- and middle-income countries (Al-sadiq, 2013). This paper examines outward FDI's impact on productivity by assessing the performance of India's outward FDI within the steel industry, which is seen as the engine of innovation and sectoral progress. Outward FDI from the Indian steel industry emerged parallelly from low technology products (e.g. food, textiles) and high technology products (e.g. chemicals) with the US $ 510.67 million invested in 2018. This study assesses the effect of outward FDI in low-and middle-income countries using firm-level

data, helping to frame policies for firms wanting to pursue increased outward FDI.

## 2. Theoretical Framework

The relationship between (1) Outward FDI and productivity, and (2) Outward FDI and Own firm substantial effect is analysed in the study. Prior studies on Outward FDI and productivity, including those focussing on the USA, Slovenia, and Japan (Damijan, 2008; Keller, 2004; Ryuhei, 2012), demonstrate that firms strengthen the foreign market through Outward FDI or exporting goods. Studies have consistently observed a mutually reinforcing and causal relationship between Outward FDI and productivity among upper-middle-income countries (Duran, 2005; Chen, Lin, & Yabe, 2019; Thomas & Narayanan, 2017). As MNEs in upper-middle-income countries achieve monopolies, they upgrade and implement associated technological dominance using Outward FDI (Hymer, 1960; Mao, Q. L., & J. Y. Xu, 2014).

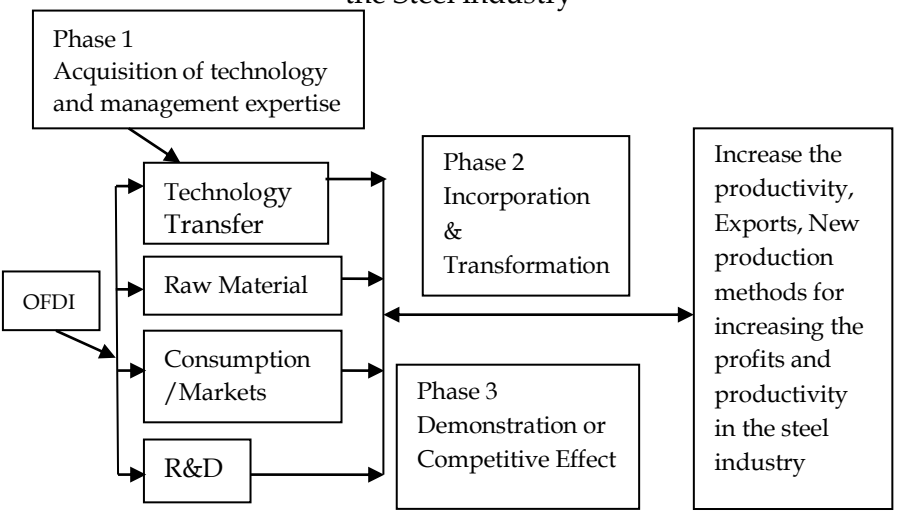
Studies of the own-firm outward FDI effect confirmed that outward FDI facilitates technology imports and that enterprises engaging in outward FDI have higher levels of productivity growth (Braconier, 2001; Kimura, 2006; Imbriani, 2011; Bai, 2009; Navaretti, 2006). An earlier study by Yang in 2013 finds a positive correlation between enterprises' outward FDI activities and technological advancement, while other studies note the negative effect of outward FDI on aggregate and firm-level productivity (Al-sadiq, 2013; Mishra, 2016; De Beule, 2012; Bai, 2009; Hijzen, 2007; Dhyne, 2014). However, Mucchielli in his study (2002) finds that firms cannot raise their productivity using monopolistic advantages. Furthermore, productivity improvements are subject to diminishing returns (Desai, 2005; Jiang, 2014; Syverson, 2010). Consequently, the attributes of steel firms are divided into sub-sectors, regions, and ownership types when qualified for analysis at the micro-level. Accordingly, Pradhan J. P. in 2008 stated that outward FDI from the Indian automobile sector has enhanced its productivity. Similarly, the reverse spillover effect studied for China and the UK reveals that outward FDI increases productivity and has a positive impact on domestic firms (Shen, 2016; Driffield, 2003).

The outcome of outward FDI on productivity is an essential topic as the literature is insufficient, and the study of attributes that influence the degree of outward FDI's own-firm effect at the micro-level is limited. This review is guided by the broad question, of whether outward FDI affects productivity and its substantial effect? The problem is analysed by examining the influence of productivity and the attributes that influence the outward DI own firm effect by the following hypothesis development.

## 3. Hypothesis Development

As illustrated in the introduction, Indian steel firms undertake outward FDI to enhance their production methods and utilise available technology. But the technique of influence of outward FDI on productivity remains unmapped. This paper analyses the means and further divides the adoption process into three phases (as shown in Figure 1).

Figure 1: Implementation of OFDI's impact on the productivity of the Steel industry




*Source: Authors compilation*

Acquisition of innovative technologies and administrative expertise is the first phase. The majority of steel firms engage in M&A in upper-middle-income countries to access innovative technology and managerial expertise. The intensifying the Level of

productivity achieved through technology transfers by internalising the external market and acquiring patented technologies through acquisition and reproduction, processing, and action planning. Hence, the phase split into three sub-phases: (1) Acquisition and reproduction (copying) – the firms acquire and replicate technologies, research methods, and strategic directions from leading firms, with multinational subsidiaries, continue to access the latest research methods and administrative models as they are closer to leading firms and research centres; (2) Processing – in which MNEs refine their technical competence, technology and intensify their ability to innovate in collaboration with foreign firms; and (3) Action planning – whereby multinational subsidiary employs advanced techniques utilising local resource platforms, R&D facilities, scientific research culture, and achievements.

The second phase is incorporation and transformation, where the parent steel firms internalise their technological advantages through personnel and product movements between multinational subsidiaries and parent firms. The third phase, where the firm extends its technology and expertise to the domestic steel industry, is such that local firms are encouraged to strengthen their R&D through the demonstration effect. The acquisition of innovative technology helps in intensifying domestic firms' innovation potential and raises their ability to compete within the industry (i.e. competition effect). The first and second hypotheses are formulated as follows based on the above discussion:

> *H1: Outward FDI increases the productivity of India's steel industry.*
>
> *H2: Outward FDI's own-firm effect differs as per the time required for the absorption and diffusion of technologies.*

India's Steel industry produces products including - Rolled Finished Products (RFPs), Semi-Finished Products (SFPs), and Crude Steel Products (CSPs). With each sector being at different levels of development, the outward FDI's substantial effect is accompanied by the natural spread of technology between firms in the industry. Consequently, productivity impact depends upon sub-sectors or final product types as follows. Firstly, the majority of outward FDI activities are performed by firms producing or adding

value to RFPs. With the outward FDI's firm effect on RFP, firms are different from others. Secondly, the recipient firm country's degree of economic development impacts the outward FDI's own-firm effects on steel firms. Thirdly, the impact of productivity varies according to the firm's ownership types (i.e. state-owned or privately owned firms). Finally, the destinations of outward FDI affect the own-firm effect, as firms represent different investment objectives. Usually, high-income destinations are preferred; as these endure to be more applicable for raising the issuing firm's productivity and allowing technological transfers. Through investment and other activities, low and middle-income countries emerge as both implementers and developers of innovative technologies. Outward FDI serves as a mechanism to increase productivity, thereby improving industries and promoting economic growth. However, not all outward FDI investments are expected to have equivalent impacts, as many firms only invest in "tax havens," which do not wish to enhance Total Factor Productivity (TFP). Based on the above discussion, the following hypothesis is framed as follows:

> *H3: Outward FDI's substantial firm effect differs between sub-sectors of the steel industry,*
>
> *H4: Outward FDI increases profitability among privately owned firms compared to state-owned firms.*
>
> *H5: Outward FDI investment in upper-middle-income destinations raises productivity more than investments in "tax havens" destinations.*

Besides the circumstance mentioned earlier, the outward FDI own-firm effect is induced by firms' attributes such as exports and innovation ability (Pradhan J. P., 2007; Lipsey, 1981; Lipsey, 1984; Kokko, 2006; Masso, 2013; Tao, Liu, Tian, Gu, & Cheng, 2019; Ahmad, 2016). Most of the outward FDI coming from low- and middle-income Asian countries is export-oriented. Firstly, export promoting outward FDIs takes priority, which is then exploited to its maximum by host countries (Pradhan J. P., 2007; Lipsey, 1981, 1984; Kokko, 2006; Tao, Liu, Tian, Gu, & Cheng, 2019). Secondly, firms focus on their R&D projects, and the incorporation of advanced technologies, to gain competitive advantages in domestic

markets. Finally, parent firms produce products on their own by employing acquired progressive techniques and enhancing their productivity. Thereupon, the following hypothesis is framed accordingly:

> *H6: Firms' R&D activities and exports raise the Outward FDI's firm effect.*

## 4. Methodology

### 4.1. Data Sources

The data for the study was obtained from the CMIE Prowess database, which includes statistics of state- and privately-owned enterprises. The data management is carried out according to guidelines established by Xie (2008) and Yang (2015). The study removes firms from the dataset when the key or negative variables are missing, outward FDI data obtained from The World Bank and UNCTAD's database.

This study analyses whether outward FDI's firm effect depends on firm-level attributes; by categorising the economies as low-and middle income, upper-middle-income destinations and Tax havens destinations (Hong Kong, The British Virgin Islands, and Macao). Johansen co-integration test and Granger causality to test the cause-and-effect relationship between firm attributes and outward FDI's firm effect.

### 4.2. Variable Description

**Firm-level productivity** (Total Factor Productivity (TFP)) - Plays a substantial role in motivating the outward FDI investment decision. A positive relationship between firm-level productivity and outward FDI is expected as firms incline to invest through outward FDI. In this study, TFP was calculated according to the Cobb–Douglas production function.

$$\ln Y_{it} = \beta_0 + \beta_1 \ln K_{it} + \beta_2 \ln L_{it,} + \beta_3 \ln AGE_{it} + \varepsilon_{it}$$

> where ln Yit is the log of output (total value) from firm i at time t, ln Kit capital input measured by total fixed assets. LP it is labour input, and in ln AGE it the firm's age and exit variable (εit) is exit according to whether the firm is not

included in the combined data, the exit is 1, otherwise, 0 if a firm is out of date.

**Age of the firm (Age):** AGE indicates the firm's experience in the market, determined by the difference between the year of formation to the year of calculation. Age of firms considered for analysis, as earlier studies indicate that experienced firms enjoy high productivity, reputation, absorb technology know-how (Kumar, 2008; Thomas R. &., 2017; Chen, Lin, & Yabe, 2019) considered the firm's age. Experienced firms with a high probability in the industry undertake outward FDI.

**Labour productivity (LP):** LP is described as the return per unit of labour input. The LP included for obtaining robust results, applied as the leading indicator in existing studies of Helpman in 2004 and Tomiura in 2007 (Chen, Lin, & Yabe, 2019).

**Capital Intensity (KL):** KL represents the efficiency of the company. It was weighted as the net value of fixed assets according to salaries to control the impact of different capital structures on the OFDI decision-making of companies (Ruan, Liu, Tan & Xue, 2019; Chen, Lin & Yabe, 2019; Thomas R. &., 2017; Zhou, 2020).

**Export Intensity (EXPINT):** EXPINT is used to govern the country's export potential. It is estimated as a percentage of exports relative to sales. Firms with export experience influence them to undertake OFDI (Thomas R. &., 2017; Chen, Lin, & Yabe, 2019; Chen & Tang, 2014).

**R&D Intensity (R&DINT):** R&D is undertaken by firms to foster innovation. Studies carried out in India highlight a positive and remarkable relationship (Narayanan, 2010; Kumar, 2008; Pradhan J. P., 2005) (Thomas R. &., 2017) (Chen & Yang, 2013). The ratio of firms' R&D expenditures to sales is captured as the R&D intensity (R&DINT).

**Capital Labour ratio (K/L):** The capital-labour (K/L) ratio computed the capital intensity of a firm. Firms tend to have a high K/L ratio over a point as they strive to upgrade productivity by investing in industrialising the production process (Huijie, 2018; Pradhan J. P., 2007; Thomas R. &. Narayanan, K. 2017; Chen, Lin, & Yabe, 2019).

## 5. Analysis Framework

The study analyses the outward FDI firm effect on business by categorising the steel firms into a treatment group (OFDI firms) and a control group (Non-OFDI firms). By employing firm-specific attributes as matching variables and considering differences between outward FDI firms and non-outward FDI firms (Jiang, 2014; Ye, 2016). A summary of the matching variable is provided in Table II. Indicating that the value of each variable of outward FDI firms and non-outward FDI firms are contradicting. Cronbach's alpha is applied to evaluate the reliability of the data, which is at 68 per cent. The t-test is used to determine the difference in TFP between the two groups.

**Table I: Description of matching variables**

| Variables | Variable Name | Calculation method |
|---|---|---|
| LP | Labour productivity | Log output of labour ratio |
| KLR | Capital labour ratio | Log output of capital ratio |
| SIZE | Firm size | The average number of employees per year |
| EXPINT | Export intensity | Total revenue from exports relative to total sales |
| RDINT | R&D intensity | R&D expenses in a year |
| AGE | Firm age | Number of years from the establishment of firm |
| KL | Capital intensity | Total assets relative to the average number of employees |
| ON | Ownership | One is state-owned and Zero is privately owned |

**Table II: Summary of matching variables**

| | Non-Outward FDI Firms | Outward FDI Firms | t-statistics |
|---|---|---|---|

| | Mean | Std Dev | SE | Mean | Std Dev | SE | |
|---|---|---|---|---|---|---|---|
| AGE | 40.4 | 26.28 | 8.48 | 50.7 | 16.911 | 5.348 | -.59282 |
| EXPINT | 7.88 | 3.7 | 1.17 | 1.216 | 0.559 | 0.1768 | -0.93643 |
| KLR | 0.0012 | 0.0005 | 0.0001 | 460.78 | 116.58 | 36.86 | 0.082632 |
| KL | 432.8 | 47.46 | 15.01 | 176.82 | 27.06 | 8.55 | -0.8418 |
| LP | 0.546 | 0.231 | 0.073 | 0.3933 | 0.055 | 0.017 | -5.22728 |
| TFP | 6084.29 | 1558.033 | 492.693 | 104328.3 | 16093.36 | 5089.169 | 13.87283 |
| SIZE | 5641.42 | 1543.26 | 488.02 | 8885.32 | 1370.03 | 433.24 | 13.53047 |
| ON | 1.000 | 0.000 | 0.0000 | 0.4000 | 0.516398 | 0.163299 | 0.002561 |

## 6. Results & Discussions

This study explores outward FDI's effect on firms and investigates the relationship between outward FDI and productivity (TFP), considering sectors, ownership, investment destinations, and firm-specific variables. The first hypothesis was tested by analysing the effect of outward FDI on the capital-labour ratio. The results show that the coefficient for the capital-labour rate is positive (i.e. 0.1815), suggesting that capital intensity has a positive effect on TFP.

### 6.1. Outward FDI - Own firm effect, Firms export and R&D activities

The second hypothesis of Outward FDI's own-firm effect differs according to the time required for the absorption and diffusion of technologies tested using firm-specific factors like firm size of the firm. The results reveal the firm-specific aspects to have a significant impact (i.e. 0.8515), showing that firms associated with outward FDI operate on a substantial scale and outward FDI helps in improving the firm's productivity (TFP). The hypothesis that firms' R&D activities and exports raise the outward FDI own firm effect is tested with export and R&D intensity. The export intensity coefficient is also positive (i.e. 0.098810), indicating that exports promote TFP growth, which is consistent with many previous studies (Thomas, R. & Narayanan, K. 2017; Damijan, 2008; Chen, Lin, & Yabe, 2019). So, it is clear that firms undertake export

activities to improve their outward FDI's firm effect. Thus, it's concluded that outward FDI from steel firms strengthens TFP among privately-owned enterprises compared to state-owned enterprises. Simultaneously, the outward FDI's firm effect differs accordingly based on time and subsectors. With this H1, H2, H3, and H6 were verified.

**Table III: Results of investment destinations**

| | Low- and middle-income destinations | Upper middle-income destinations | Tax haven destinations |
|---|---|---|---|
| Outward FDI | 9.05828 | 8.82866 | -0.39743 |
| Firms Characteristics | YES | YES | YES |
| Investment | YES | YES | YES |
| Year | YES | YES | YES |
| R2 | 0.91599 | 0.912850 | 0.23693 |

## 7. Investment Destinations

Another essential component that influences outward FDI's own-firm effect is the destination of investment. The hypothesis outward FDI investment in upper-middle-income goals raises productivity more than investments in "tax haven" destinations. Is tested by classifying India's outward FDI destinations into Low- and middle-income economies, upper-middle-income destinations, and tax haven destinations. Firstly, the results exhibit that the steel firm's outward FDI in non-tax havens promotes the advancement of TFP, and outward FDI in tax havens cannot significantly enhance the firm's TFP. Secondly, the coefficient for high-income destinations is positive, and the coefficient for low- and middle-income destinations is non-significant. These results show that steel firms achieve significant productivity advancement when invested in high-income destinations (i.e. Upper middle-income destinations) with the results exhibited in Table III.

## 8. Outward FDI and Non-Outward FDI firms

Whether Outward FDI increases profitability among privately owned firms compared to state-owned firms? By further grouping the outward FDI firms into state-owned and non-state-owned (i.e. privately owned) firms using heterogeneity tests. The analysis reveals that privately-owned firms' outward FDI effectively promotes the TFP of the firms investing in upper-middle-income destinations. Whereas no significant improvement is found in productivity when the investment is directed towards tax havens and low and middle-income destinations. Due to the substantial difference in productiveness and level of economic development across destinations. And eventually, the outward FDI own-firm effects have different effects in different regions. The coefficient of upper-middle state-owned firms is significant (i.e. 0.077), and privately owned firms are significant (i.e. 0.340). The steel firm's TFP demonstrates that the firm productivity in the state-owned firms is the lowest, due to decreasing marginal utility on TFP. The impact of Outward FDI on productivity is secure and more evident in areas with lower productivity. Therefore, it concluded that outward FDI cannot remarkably improve the TFP of state-owned firms but can substantially improve the TFP of privately owned firms.

## 9. Summary

Studies confirm that outward FDI significantly impacts TFP. Does this same phenomenon apply to the steel industry? If so, what are the attributes of outward FDI's own- firm effect on the steel industry? This study explores the impact of outward FDI on TFP using a data set on companies' outward FDI between 2011-2019 from UNCATAD and Prowess. The study analysis develops the following conclusions: First, outward FDI from the steel industry significantly increases TFP, steel firms undertake overseas investment primarily for capacity-building, the adoption of improved production mechanisms and technology from firms in the low-, middle- and upper-middle-income destinations. With the emergence of outward FDI from steel firms producing both low-tech products and high tech products, governments should

undertake initiatives and encourage the steel firm to invest overseas. Second, the outward FDI's own-firm effect finds a robust development initiated in the long run compared to the short run (Saikia & Borbora, 2018; Chowdhury, 2011). Third, the analysis reveals that the outward FDI's effect differs among sub-sectors based on the Level of growth in that sector

Fourth, compared to the state-owned outward FDI, privately owned firms increase their productivity through outward FDI. Therefore, the government should continue to promote the reform of state-owned firms, while encouraging fair competition between state-owned and privately-owned firms to promote the effective use of resources and promote innovation. Fifth, steel firms' outward FDI in upper-middle-income countries and tax havens have significant own-firm effects. Investment into tax haven destinations is abundant compared to low-, middle- and upper-middle-income economies and is a primary reason for reduced substantial effect in the short run. Hence, the government must be vigilant in directing outward FDI from steel away from "tax haven," destinations. Sixth, firms involved in technology and innovation (R&D) activities and exports raise their outward FDI's own firm effect. The critical restriction of this study is it has considered only the steel industry and also for a limited period due to data constraints. The study extended further to various other industries and sectors, and this kind of research helps to frame policies for firms desiring to engage favourably in outward FDI.

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