Industrial productivity, investment, and corporate performance expectations

Olga-Chara Pavlopoulou[1]
School of Business
Athens University of Economics and Business

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[1] Email: pavlopoulou@aueb.gr
Orcid: 0000-0002-0804-0379
Address: Athens University of Economics and Business, School of Business. 76 Patission Str., GR-10434, Athens Greece.

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ABSTRACT

Using financial data from a sample of European listed firms during the period 2004 – 2021, this study empirically investigates the associations between investment efficiency and firm-level productivity at the micro level and corporate performance expectations. The study uses an estimate of investment efficiency at the firm level and additionally employs a measure that captures the improvement in total factor productivity to examine the effects of not only the size but also the quality of corporate investment. The findings indicate that investment efficiency and improvements in firm-level productivity are positively associated with corporate performance expectations. Financial analysts, the primary capital markets information intermediaries, incorporate the effects of investment / productivity improvement into their forecasts but exhibit an under-reaction that is pronounced for firms with more complicated international operations, and for the more R&D-intensive firms.

Keywords: firm-level productivity; investment efficiency; corporate profitability; analyst forecasts

JEL codes: G14; G24; L20; L23; M41

1. Introduction

Empirical research has documented that firm fundamentals such as size, book-to-market ratio, and corporate investment can forecast future stock returns. To explain the associations between firm characteristics and returns, the recent literature at the intersection of finance with microeconomics has introduced neoclassical investment models where ex-ante identical firms are exposed to firm-level total factor productivity (TFP) shocks that lead to different firm characteristics (e.g., Gomes et al., 2003; Zhang, 2005; Li et al., 2009; Lin, 2012; Belo and Lin, 2012). In a more recent study, Imrohoroglu and Tuzel (2014) directly estimate the relationship between TFP, firm characteristics, and stock returns, and document that higher TFP leads to higher stock returns and lower implied risk (ex-ante discount rates). These findings suggest that firms with lower productivity are more vulnerable to business cycles, with low productivity representing a risk factor that is priced by the market with significant variation over business cycles. On the association between investment at the firm-level and analysts' forecasts, Chen et al. (2017) find that high quality forecasts are associated with higher investment if the firm is more likely to under-invest and lower investment if the firm is more likely to over-invest, suggesting that analysts play a regulating role in investment.

Equity valuation entails predicting the expected profitability of the firm to derive the series of implied future earnings and discounting this series to obtain an estimate of intrinsic value. Consequently, expectations of higher future earnings are viewed as positive stock market signals. Following this line of thought, several studies have documented that analysts' earnings forecasts are signals that convey value-relevant information, and that the capital markets move in the direction of these forecasts (e.g., Abarbanell et al., 1995; Cheng, 2005; Frankel et al., 2006; Kothari et al.,

2016). Analysts' expectations of corporate performance can thus be viewed as a representation of the unobservable market expectations.

Motivated by the importance of analyst expectations for capital markets valuation, and the evidence of a link between firm-level productivity and market valuation, this study aims to fill a gap in the related literature by investigating the incorporation of investment efficiency and firm-level productivity characteristics into analysts' forecasts of corporate performance. We examine an international sample of European listed firms during 2004-2021 to present empirical evidence on the associations between firm-level productivity, investment efficiency, and analysts' forecasts, and offer some theoretical explanations that may drive the empirical findings.

The study contributes to the relevant literature at the intersection of microeconomics and finance, providing new evidence of a link between improvements in investment efficiency and productivity at the firm level and expectations of corporate profitability. To approximate firm – level investment efficiency and firm – level TFP the study uses the framework for over-under investment of free cash flows developed by Richardson (2006), and a measure that captures the resulting improvement in total factor productivity to examine the effects of not only the size but also the quality of corporate investment (Olley and Pakes, 1996), respectively. First, the findings indicate that investment efficiency and improvements in firm-level productivity are incorporated into financial analysts' forecasts and are positively associated with their corporate performance expectations. Second, the findings document that financial analysts incorporate the effects of investment / productivity improvement into their forecasts but exhibit a systematic under-reaction for firms with more complicated international operations, and for the more R&D-intensive firms.

The rest of the paper is organized as follows. The following section discusses the prior literature and motivation and sets forth the research hypotheses. Section 3 explains the research methodology while Section 4 offers a description of the sample. Section 5 presents the empirical findings and Section 6 offers the concluding remarks.

2. Literature Review and Hypothesis Development

2.1. Corporate investment, productivity, and firm performance

There are two strands of literature related to this study: a) the impact of innovation and investment on corporate profitability through productivity improvement, and b) the incorporation of the impact of corporate investment into financial analyst forecasts.

Various definitions of productivity have been offered in the literature (see Appendix 1 for examples). For instance, Hill (1993) defines productivity "as the ratio of what is produced to what is required to produce it. Productivity measures the relationship between output such as goods and services produced, and inputs that include labor, capital, material and other resources"[2]. Ghobadian and Husband (1990) suggest that, within the similar definitions, there are three broad categorizations of productivity definitions[3]: (a) *the technological concept* (the relationship between ratios of output to the inputs used in its production), (b) *the engineering concept* (the relationship between the actual and the potential output of a process), and (c) *the economist concept* (the efficiency of resource allocation).

[2] Also see Tangen (2005).

[3] Almstrom (2023) generally defines productivity as "output over input. The choice of outputs and inputs are dependent upon the intended application. For example, the standard definition for productivity at national level gross domestic product (GDP) over total amount of work hours for the total population. On a factory level the productivity may be defined as added value per employee and on cell or station level a typical productivity measure is the number of products produced per hour planned production time."

On the impact of innovation / investment on profitability, the academic literature has mainly focused on single country and single sector designs due to availability of data, (e.g., Ireland, UK, Canada, US). Innovation and improvement in the efficiency of resource use will lead to a decline in the production cost reflected on COGS. Sales increase as production capacity increases and we have greater flexibility to select the more profitable projects[4] / orders to complete, potentially leading to an increase in market share and profitability. Biddle et al. (2009) measure investment efficiency as the deviation from predicted levels of investment reflected in the error terms of a model that predicts optimal levels of investment based on sales growth opportunities. Finally, availability of credit is a crucial factor to consider. For instance, recent theoretical contributions to the ongoing debate relating to the decline[5] in aggregate productivity growth in the U.S. economy (Miao and Wang, 2012; Moll, 2014) argue that the slowdown could be due to the tightening of credit constraints during bubble collapses; the difficulty in obtaining external financing during these times may force firms to forego productivity-increasing projects.

But the importance lies not on the size of corporate investments but rather the quality of corporate investments, as proxied by productivity gains. Therefore, gains in TFP cannot simply be the result of an increase in the size of corporate investments. It follows that we should not only focus on a specific driver of long-term growth (investment in innovation) but rather on the overall investment policy of the firm. Total factor productivity TFP, as employed in Imrohoroglu and Tuzel (2014) is a particularly appropriate measure to capture this distinction since it is calculated as the difference

[4] According to neo-classical theory, corporate investment should be driven by positive net present value (NPV) projects (Modigliani & Miller, 1958) and end when marginal benefit and marginal cost are equal.
[5] See for example Cardarelli and Lusinyan (2015) and Gordon (2016).

between expected output, given the inputs used in production, and the actual output produced by the firm.

Empirical research has documented that firm fundamentals such as size, book-to-market ratio, and corporate investment can forecast future stock returns. A growing strand of literature has introduced neoclassical investment models to explain such differences in firm characteristics and returns where ex ante identical firms are exposed to firm-level total factor productivity (TFP) shocks, which lead to different firm characteristics (e.g., Gomes et al. 2003; Zhang 2005; Li et al. 2009; Belo and Lin 2012). Imrohoroglu and Tuzel (2014) investigate the relationships between TFP, firm characteristics, and stock returns, and show that higher TFP lead to higher stock returns and lower ex-ante discount rates (implied risk). Furthermore, they find that the hiring rate, fixed investment to capital ratio, asset growth, profitability, and inventory growth are all monotonically increasing in firm-level TFP.

In addition, corporate events such as mergers and spin-offs can have an effect on efficiency and productivity. Healy et al. (1992) show that merged firms have significant improvement in asset productivity relative to their industries after the merger, leading to higher post-merger operating cash flow returns. Sample firms maintain their capital expenditure and R&D rates relative to their industries after the merger, indicating that merged firms do not reduce their long-term investments. There is a strong positive relation between post-merger increases in operating cash flows and abnormal stock returns at merger announcements, indicating that expectations of economic improvements underlie the equity revaluation of the merging firms.

What is more, foreign direct investment (FDI) and macro conditions can also affect productivity patterns. FDI is thought to contribute to host economies by increasing their efficiency either directly or through technology diffusion. Dimelis and

Louri (2004) study how the impact of FDI on efficiency is differentiated depending on size and degree of (foreign) ownership. They use a sample of manufacturing firms operating in Greece and find that while the efficiency impact is largest for majority-held foreign firms that exhibit higher productivity, spillovers are important for small domestic firms where the foreign partner owns a minor part of equity. Large firms can be expected to achieve economies of scale and thus operate at a lower average production cost curve (e.g., Dimelis and Louri 2004; Tsionas and Papadogonas 2006). Finally, macroeconomic conditions and periods of crisis can significantly affect firm productivity growth. Vettas et al. (2022) examine the growth rate of TFP for fifteen 2-digit sectors of the Greek economy during the period 2005-2019 (as the sum of the rate of technical change, the rate of change in technical efficiency and the rate of change in returns to scale). Their findings indicate that most of the sectors suffered negative TFP growth[6], primarily during the period of the economic crisis and in the first 3-4 years of implementation of the economic adjustment programs, whereas in the subsequent years this negative rate of change slowed down.

Finally, the literature has examined regulation effects as selective industrial policy can have negative effects on corporate investment efficiency by boosting over-investment. Zhou and Zhao (2022) empirically examine the impact of selective industrial policy[7] on corporate investment efficiency. They employ the accounting-based framework to measure over-investment and free cash flow developed by Richardson (2006)[8]. Zhou and Zhao (2022) show that a revitalization plan of industrial

[6] Exporting firms, and medium-sized and large firms exhibited less negative TFP growth.

[7] See Juhasz et al. (2024) for a review of the standard rationales and critiques of industrial policy and provide broad overview of new empirical approaches to measurement.

[8] Richardson (2006) finds that over-investment is concentrated in firms with the highest levels of free cash flow, and that certain governance structures, such as the presence of activist shareholders, appear to mitigate over-investment.

plants in China has a significant and negative effect on corporate investment efficiency by boosting over-investment while having little influence on under-investment. They explore two potential channels underlying these findings and find that the mediating effects of capital allocation efficiency and managerial overconfidence are significant. Barwick et al. (2025) examine a recent industrial policy in China aiming to propel the country's shipbuilding industry to the largest globally to assess the long-term performance of different industrial policy instruments, which include production subsidies, investment subsidies, entry subsidies, and consolidation policies. Their results highlight the critical role of firm heterogeneity, business cycles, and firms' cost structure in policy design.

2.2. Investment, corporate efficiency and financial analysts

But how is investment and its efficiency and productivity growth perceived by the markets and market agents?

Understanding the source of competitive advantage and of how to sustain it has been an important area of strategic management research. Barney (1991) examines the link between firm resources and sustained competitive advantage by analyzing four empirical indicators of the potential of firm resources to generate sustained competitive advantage (value, rareness, imitability, and substitutability). To maximize firm value managers must invest new capital efficiently. Yet, the research on corporate investment efficiency suggests that managers are not always efficient in allocating resources (Jensen, 1986). Although they are corporate agents, managers are inclined to pursue personal interest and use funds to expand the scale of investment (He, Chen, & Hu, 2019). They have the tendency to misallocate capital by over-investing in valueless projects, or under-investing by holding funds regardless of profitable opportunities (Naeem & Li, 2019). Adhvaryu et al. (2023) combine granular garment production data

with survey data on managers across 120 production lines in India, to investigate whether productivity and managerial quality vary within the firm. They document substantial productivity dispersion both across teams producing overlapping products and within team and link this variation to an assessment of supervisor quality.

On the effect of corporate investment efficiency on financial analysts and their output, Chen et al. (2017) find that high quality forecasts (higher accuracy and lower dispersion) are associated with higher investment if the firm is more likely to under-invest and lower investment if the firm is more likely to over-invest. Their results indicate that analysts play a moderating role, a regulating role in investment. The effects are stronger for firms with higher information asymmetry and lower institutional stock ownership. Brogaard et al. (2022) find that analysts play a role in information acquisition and price efficiency. Investment sensitivity significantly decreases after losing an analyst, so the analyst coverage plays a role in the investment sensitivity of the firm. In addition, To et al. (2018) find that greater analyst coverage leads to higher total factor productivity within firms. They further identify that the positive effect of analysts on firm-level productivity emanates from their critical role in information distribution and external monitoring within more opaque and financially constrained firms, and also firms with weaker investor protection. They do not postulate a positive relationship between analyst coverage and the size of corporate investments but rather for the quality of corporate investments, as proxied by productivity gains (TFP). Their results indicate that high quality forecasts increase external monitoring and increase investment efficiency.

Others have pointed to a darker side of financial analysts: by focusing investors' attention on quarterly earnings, they may force managers to forego valuable long-term

investments, such as R&D, to meet the short-term expectations[9] (Graham et al., 2005; He and Tian, 2013; Irani and Oesch, 2016). Moreover, investments in intangibles (R&D) might increase difficulty in forecasting company earnings, higher forecast dispersion and forecast errors, higher cost of capital, lower market value for the firm. Dehning et al. (2006) use a residual income valuation model to develop hypotheses about the relationship between IT spending, earnings expectations, and firm value.

Equity valuation entails predicting the expected profitability of the firm to derive the series of implied future earnings and discounting this series to obtain an estimate of intrinsic value. Consequently, expectations of higher future earnings are viewed as positive stock market signals. Following this line of thought, several studies have documented that analysts' earnings forecasts are signals that convey value-relevant information, and that the capital markets move in the direction of these forecasts (e.g., Abarbanell et al., 1995; Cheng, 2005; Frankel et al., 2006; Kothari et al., 2016). Analysts' expectations of corporate performance can thus be viewed as a representation of the unobservable market expectations. Accurate earnings forecasts can lead to superior stock recommendations and are highly valued by the stock market.

Prior work indicates that analysts use their earnings forecasts to justify stock recommendations (Block, 1999). The analysts' expertise and sophistication allow them to thoroughly evaluate management accuracy and reporting quality (e.g., Williams, 1996) and reliably estimate the persistence of accounting fundamentals (Gu and Chen, 2004). Since analysts are important market information intermediaries who produce informative reports (Lys and Sohn, 1990; Frankel et al., 2006) and affect the markets' direction, we argue that they will be efficient when they consider firm fundamentals

[9] This will lead to a negative relation between analyst coverage and TFP since managers are likely to forego investments in product and process innovation, human capital development, and long-term productive projects as they do not yield short-term results.

that are value relevant such as investment and firm-level productivity growth, leading to hypotheses H1 and H2:

> **H1:** Financial analysts incorporate investment efficiency and firm-level productivity into their corporate earnings forecasts.
>
> **H2:** Analysts' forecasts are efficient with respect to investment efficiency and firm-level productivity.

That is, investment efficiency and firm-level productivity are significant factors that are incorporated into analysts' forecasts (H1). In addition, investment and firm-level productivity are not able to systematically predict variation in the analyst forecast error (H2).

3. Research Methodology

3.1. Investment efficiency / TFP and analyst forecasts of corporate profitability

To test H1 and H2 on the incorporation of investment efficiency (TFP) into analysts' expectations of corporate profitability we estimate Models 1 and 2 (Models 3 and 4) using pooled OLS panel regressions. The models control for country and industry fixed effects. To address cross-sectional dependence and heteroskedasticity of the residuals, the reported t-statistics are based on clustered standard errors clustered by firm.

$$NETINCOMENEWS_{t+1,i} = \beta_0 + \beta_1 INVEFFICIENCY_{t,i} + Controls + CountryFE + IndustryFE + YEARFE + \varepsilon_{t+1,i} \quad (1)$$

$$FE(NETINCOME)_{t+1,i} = \beta_0 + \beta_1 INVEFFICIENCY_{t,i} + Controls + CountryFE + IndustryFE + YEARFE + \varepsilon_{t+1,i} \quad (2)$$

$$NETINCOMENEWS_{t+1,i} = \beta_0 + \beta_1 TFP_{t,i} + Controls + CountryFE + IndustryFE + YEARFE + \varepsilon_{t+1,i} \quad (3)$$

$$FE(NETINCOME)_{t+1,i} = \beta_0 + \beta_1 TFP_{t,i} + Controls + CountryFE + IndustryFE + YEARFE + \varepsilon_{t+1,i} \quad (4)$$

To test H1 (related to analyst incorporation of information about investment efficiency and firm productivity) the study estimates Models 1 and 3. A significant estimated slope β_1 will indicate that analysts incorporate investment efficiency / productivity and their impact on expected profitability into their forecasts. To test H2 (related to investment-related analyst efficiency), the study estimates Models 2 and 4 that regress the analysts' forecast errors ($FE(NETINCOME)_{t+1,i}$) on *INVEFFICIENCY* (*TFP*). A non-statistically significant estimated regression coefficient β_1 will indicate that *INVEFFICIENCY* / *TFP* have no predictive ability over variation in the analyst forecast error and that analysts efficiently incorporate investment efficiency and total factor productivity and their impact on expected profitability into their forecasts. A significant estimated regression coefficient β_1 will indicate systematic inefficiency.

NETINCOMECNEW[10] is the analyst consensus of net income t+1 minus the realized net income of t (standardized by lagged total assets) per firm-year as reported in IBES LSEG database. *FE(NETINCOME)* is the analyst forecast error measured as the difference between the actual (realized) net income minus the analyst consensus per firm-year (t+1). To separately investigate the effects of investment efficiency on revenues and operating expenses, we additionally estimate the models using the respective Revenue and Opex variables as dependent variables.

[10] Alternatively, the study uses operating profit *EBITDA* forecasts.

Models 1 – 4 control for several fundamental and market variables measured at t-1, including firm size computed as the natural logarithm of *MV* (*lnMV*), book-to-market value ratio (*B/M*), a dividend indicator variable (*DIV*), dividend-to-book value (*D/B*), leverage (*LEV*), international sales (*INTSALES*), capital intensiveness, inventory intensiveness etc. The models also include analyst related variables such as the natural logarithm of analyst following (*lnANALYST*)[11].

3.2. Estimation of Investment efficiency

We compute corporate investment efficiency in line with Richardson (2006), who developed an investment expectation model and separated total investment expenditure into expected investment expenditure and unexpected investment expenditure (also see Zhou and Zhao, 2022). The framework is based on the extensive literature in economics and finance on firm level investment decisions (e.g. Hubbard, 1998). By using the investment expectation model, we estimate the expected investment expenditure (the predicted value in Model 5) and the unexpected investment expenditure (the residual in Model 5). The investment expectation model specification is:

$$Invest_{i,t} = \beta_0 + \beta_1 Growth_{i,t-1} + \beta_2 Leverage_{i,t-1} + \beta_3 Cash_{i,t-1} + \beta_4 Age_{i,t-1} + \beta_5 Size_{i,t-1} + \beta_6 Returns_{i,t-1} + \beta_7 Invest_{i,t-1} + CountryIndicator + IndustryIndicator + \varepsilon_{i,t} \quad (5)$$

In Eq. (5), $Invest_{i,t}$ refers to the fixed assets investment level of firm i in year t. $Growth_{i,t-1}$, $Leverage_{i,t-1}$, $Cash_{i,t-1}$, $Age_{i,t-1}$, $Size_{i,t-1}$ and $Returns_{i,t-1}$ represent firm i's growth opportunities (Tobin's Q[12]), leverage (debt to assets ratio), cash and equivalent

[11] We also control for other technological innovation variables to reflect the level of technological intensity of the firm / industry (R&D expenditure relative to sector average, etc.).
[12] Tobin's Q is measured as the ratio of the market value of assets to the current replacement cost of those assets, in line with Ryngaert and Thomas (2012) as a measure of growth opportunities.

holdings, firm age, firm size (natural logarithm of total assets) and stock return ratio in year t-1. The fitted value of regression (5) is the estimate of the expected level of new investment while the unexplained portion (residual) is the estimate of over-investment. If the residual is positive (negative), it indicates over-investment (under-investment). Therefore, $INVEFFICIENCY_{t,i}$, the absolute value of the residual, is a proxy for investment efficiency. The larger the $INVEFFICIENCY_{t,i}$ the lower the investment efficiency.

3.3. Estimation of firm productivity

Total factor productivity is a measure of the overall effectiveness with which capital and labor are used in a production process. We assume that the industry produces a homogeneous product with Cobb-Douglas technology, and that the factors underlying profitability differences among firms are neutral efficiency differences. The Cobb-Douglas functional form has the advantage that it is the simplest form that enables calculation of the relevant quantities of interest without introducing so many terms that the estimates are imprecise. We estimate the production function given in:

$$Y_{it} = \beta o + \beta_k k_{it} + \beta_l l_{it} + \omega_{it} + \eta_{it} \quad (6)$$

Y_{it} is the log of value added for firm i in period t; l_{it} and k_{it} are log values of labor and capital of the firm, respectively; ω is the productivity; and η is an error term not known (it can represent a shock of productivity not a priori known).

The main data sources for firm level productivity estimation are Datastream Worldscope and LSEG Eikon. We exclude observations of financial firms, REITS and regulated firms. The sample for production function estimation is comprised of all remaining firms with positive data on sales, total assets, number of employees, gross property, plant, and equipment, depreciation, accumulated depreciation, and capital expenditures. The initial sample is an unbalanced panel with approximately 2,686

distinct firms; the total number of firm-year observations is approximately 46,633. The key variables for estimating the firm level productivity are the firm level value added, employment, and physical capital. Firm level data is supplemented with price index for Gross Domestic Product as deflator for the value added and price index for private fixed investment as deflator for investment and capital, (sources are the World Bank and European Commission), and national average wage index as obtained by OECD.

More specifically, value added (*Yit*) is computed as Sales - Materials, deflated by the GDP price deflator. Sales is net sales from Eikon. Materials is measured as Total expenses minus Labor expenses. Total expenses is approximated as [Sales - Operating Income Before Depreciation and Amortization]. Labor expenses is calculated by multiplying the number of employees from Eikon by the average wages from OECD. The stock of labor (*lit*) is measured by the number of employees from Eikon. Capital stock (*kit*) is given by gross property, plant, and equipment from Eikon, deflated by the price deflator for investment following the methods of Hall (1990). Since investment is made at various times in the past, we need to calculate the average age of capital at every year for each company and apply the appropriate deflator (assuming that investment is made all at once in year [current year - age]). Average age of capital stock is calculated by dividing accumulated depreciation (Gross PPE - Net PPE) by current depreciation. Age is further smoothed by taking a 3-year moving average. The resulting capital stock is lagged by one period to measure the available capital stock at the beginning of the period.

Following the methodology of Imrohoroglu and Tuzel (2014), the study employs the semiparametric procedure[13] developed by Olley and Pakes (1996) to

[13] Deals with the introduction of some very general non-linear functional forms in regression analysis. Generally used to t a parametric model in which the functional form of a subset of the explanatory variables is not known and/or in which the distribution of the error term cannot be assumed to be of a specific type beforehand. Most popular semiparametric regression models are the partially linear models.

estimate the parameters of the production function (6) to control for selection and simultaneity biases and deal with the within firm serial correlation in productivity. Once we estimate the production function parameters (βo, β_l, β_k), we obtain the firm level (log) TFPs by:

$$\omega_{it} = y_{it} - b_o - b_l * l_{it} - b_k * k_{it} \quad (7)$$

In the estimation, we use industry-specific time dummies. Hence, firm TFPs are free of the effect of industry or aggregate TFP in any given year[14]. We compute TFPs for each year using that year's financial data and the corresponding production function estimates for that year.

4. Sample Description

The sample spans 2004 – 2021 and includes financial data for 26 listed countries in the European Union[15]. We have an unbalanced initial panel dataset with approximately 2,686 distinct firms; the total number of firm-year observations is approximately 46,633. Table 1 offers a description of the sample and the number of distinct firms and observations per country. Table 2 offers some descriptive statistics for the variables of the study.

[Insert Table 1 about here]

[Insert Table 2 about here]

5. Empirical Findings

5.1. Investment efficiency and analyst forecasts of corporate profitability

Tables 3 and 4 presents the results of the estimation of Models 1 and 2 that investigate H1 – H2. Table 3 shows the results of the regressions of analyst consensus

[14] The production function parameters are estimated every year using all data available up until that year to mitigate a potential lookahead bias in the TFP estimates.
[15] The sample excludes Latvia due to unavailability of related data.

of Net Income and their forecast errors (regression results (2) – (3)) on investment efficiency *INVEFFICIENCY* computed as per Richardson (2006). Alternatively, regression results (4) – (6) use firm EBITDA as the firm performance (dependent) variable. Columns (1) and (4) show the relationship between investment efficiency and actual (realized) firm profitability to establish the Models and expectations about the analyst forecast error are meaningful. The regressions are performed as pooled OLS panel regressions, with country, industry, and year effects, with standard errors clustered at the firm level. The results show that *INVEFFICIENCY* is significantly and negatively associated with future firm performance; a decline in *INVEFFICIENCY* (the absolute residual of the estimation of Equation 5) represents and improvement in investment efficiency that leads to profitability growth (Table 3 regression results (1) and (4)). In line with H1, the analysts incorporate this association into their forecasts (Table 3 regression results (2) and (5)). As per H2, analysts are efficient with respect to the incorporation of investment efficiency as *INVEFFICIENCY* is not able to systematically predict variation over future analyst forecast errors (Table 3 regression results (3) and (6)); estimated β_1 is non-significant in the results of Model 2.

[Insert Table 3 about here]

The decomposition of profitability into expectations of Revenues and Operating expenses (see results of Table 4) reveals that the empirical findings are strongly deriving from the revenue component. Due to low availability of observations on operating expense expectations however, we are not able to generalize the results, and further study on the mechanics and effects of investment efficiency on the revenue and expense side is required, as well as an attempt to examine the effects of sunk costs and ramp up.

[Insert Table 4 about here]

5.2. TFP and analyst forecasts of corporate profitability

Table 5 presents the results of the estimation of Models 3 and 4 that investigate H1 – H2 with respect to the incorporation of firm level productivity into analysts' expectations. Table 6 presents the results after the decomposition of profitability to revenues and operating expenses. In line with H1 and H2 firm-level productivity improvement is positively reflected in future analysts' expectations of firm profitability for both net income and operating income EBITDA (Table 5 regression results (2) and (5)). The *TFP* variable has no systematic predictive ability over variation in the analyst forecast error, indicative of analyst efficiency. Table 6 shows that TFP changes have an effect on both revenues and operating expenses, the relevant sample however is small to allow for inferences.

[Insert Table 5 about here]

[Insert Table 6 about here]

5.3. Additional Analysis and suggestions for future research

The study performed some additional analysis with respect to the factors of capital intensiveness, inventory intensiveness, R&D / Intangibles, international sales exposure (untabulated). Investment / Capex is positively and statistically significantly associated with future profitability, and for purely industrial firms the effect is increasing. Capital intensiveness is also positively associated with future profitability. Inventory intensiveness[16] is weakly but negatively associated with future profitability. In addition, Intangibles and international sales are positively related to profitability.

[16] *Inventory Intensiveness* is measured as Inventory scaled by lagged total assets. Change in the manufacturing backlog of orders, orders that the firm has received but has yet to start or complete. When the backlog is increasing this may indicate growth in business but can also show that output is below its maximum potential (indicates the possibility of non-sufficient inventories or production capacity to meet the new orders). Can serve as a leading indicator of the expansion of capacity through either investment or hiring.

When we segment the sample into high and low capital intensiveness[17] sub – samples, the effect of investment on profitability is significantly higher for the low capital intensiveness firms in the industry. Finally, the study attempted to capture active destocking vs reactive destocking cycles using the inventory-to-sales ratio[18]. When in a destocking phase, the capex effects on profitability are amplified. Future research can examine whether this can be attributed to constrained Opex, thus cost effects of lean management of inventories.

The findings indicate analysts' difficulty in incorporating the international sales breakdown impact on profitability, as they are likely to encounter difficulty in identifying effects of capex on sales and the opex side internationally (factories and cost centers in a different mix of countries, compared to sales and revenue centers in a different mix of countries). Analysts also exhibit some systematic inefficiency with respect to the intangibles' effects (patents etc.) on profitability, even though intangible intensiveness amplifies the positive impact of investment on profitability. For the high R&D sub-sample (R&D - intensive) analysts are more inefficient in the incorporation of the effects of capex on profitability. Can we surmise that the more R&D intensive firms (compared to industry peers) are the leaders instead of the followers? And that it is more difficult to gauge the effects of investment on their performance as they are more likely to invest in new technologies (no precedent)?

[17] *Capital Intensiveness* measured by Net property, plant and equipment scaled by lagged total assets. Alternatively, we log(net fixed assets).

[18] Indicator variable based on Δ(inventory/sales) of the firm (either >0 restocking phase or <0 destocking). Active destocking is an active decision to reduce the inventory-to-sales ratio to improve its efficiency, free up cash and reduce its costs. Reactive destocking is a reduction of the inventory when expected demand goes down. When a company is only doing reactive destocking the inventory-to-sales ratio remains unchanged.

6. Conclusion

Motivated by the importance of analyst expectations for capital markets valuation, and the evidence of a link between firm-level productivity and market valuation, this study aims to fill a gap in the related literature by investigating the incorporation of investment efficiency and firm-level productivity characteristics into analysts' forecasts of corporate performance. The study uses an estimation of investment efficiency developed by Richardson (2006) and additionally employs a measure that captures the resulting improvement in total factor productivity to examine the effects of not only the size but also the quality of corporate investment (Olley and Pakes, 1996). We examine an international sample of listed firms during 2004-2021 and present empirical evidence on the associations between firm-level productivity, investment efficiency, and analysts' forecasts. The findings document that investment efficiency and improvements in firm-level productivity are positively associated with corporate performance expectations. Financial analysts, the primary capital markets information intermediaries, incorporate the effects of investment / productivity improvement into their forecasts but exhibit an under-reaction, pronounced for firms with more complicated international operations, and for the more R&D-intensive firms.

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Appendix 1. Various definitions of productivity in the Literature (Tangen, 2005)

Productivity = units of output/units of input	(Chew, 1988)
Productivity = actual output/expected resources used	(Sink and Tuttle, 1989)
Productivity= total income/(cost + goal profit)	(Fisher, 1990)
Productivity is defined as the ratio of what is produced to what is required to produce it. Productivity measures the relationship between output such as goods and services produced, and inputs that include labour, capital, material and other resources	(Hill, 1993)
Productivity (output per hour of work) is the central long-run factor determining any population's average of living	(Thurow, 1993)
Productivity = the quality or state of bringing forth, of generating, of causing to exist, of yielding large result or yielding abundantly	(Koss and Lewis, 1993)
Productivity means how much and how well we produce from the resources used. If we produce more or better goods from the same resources, we increase productivity. Or if we produce the same goods from lesser resources, we also increase productivity. By "resources", we mean all human and physical resources, i.e. the people who produce the goods or provide the services, and the assets with which the people can produce the goods or provide the services	(Bernolak, 1997)
Productivity is a comparison of the physical inputs to a factory with the physical outputs from the factory	(Kaplan and Cooper, 1998)
Productivity = efficiency * effectiveness = value adding time/total time	(Jackson and Petersson, 1999)
Productivity = (output/input) * quality = efficiency * utilisation * quality	(Al-Darrab, 2000)
Productivity is the ability to satisfy the market's need for goods and services with a minimum of total resource consumption	(Moseng and Rolstadas, 2001)

Table 1. Sample Description per country

EU Country	No of distinct firms	Firm-years
Austria	35	624
Belgium	67	1182
Bulgaria	83	1232
Croatia	23	412
Cyprus	24	408
Czech Republic	5	90
Denmark	88	1458
Estonia	13	221
Finland	104	1852
France	316	5506
Germany	593	10312
Greece	83	1466
Hungary	22	386
Ireland	9	129
Italy	201	3571
Lithuania	11	196
Luxembourg	3	54
Malta	16	286
Netherlands	59	1005
Poland	280	4923
Portugal	26	451
Romania	75	1323
Slovak Republic	2	36
Slovenia	11	189
Spain	127	2212
Sweden	410	7109
Grand total	**2,686**	**46,633**

Notes: The study includes listed companies from 26 out of the 27 European Union countries. Latvia is not included due to unavailability of relevant data.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Median	SD	25%	75%
Analyst forecasts						
$NETINCOMENEWS_{t+1}$	11,670	0.0013	0.0002	0.0631	-0.0150	0.0144
$NETINCOMEFE_{t+1}$	11,670	-0.0029	0.00003	0.0269	-0.0056	0.0045
$EBITDANEWS_{t+1}$	11,121	-0.0018	-0.0005	0.0735	-0.0206	0.0181
$EBITDAFE_{t+1}$	11,121	-0.0013	0.0005	0.0274	-0.0048	0.0055
$REVENUENEWS_{t+1}$	13,355	-0.0252	-0.0020	0.3711	-0.0884	0.0711
$REVENUEFE_{t+1}$	13,355	-0.0105	0.0003	0.0949	-0.0141	0.0135
$OPEXNEWS_{t+1}$	2,672	-0.1098	-0.0470	0.4536	-0.1660	0.0021
$OPEXFE_{t+1}$	2,672	0.0966	0.0398	0.2420	0.0048	0.1060
Investment Efficiency						
$INVEFFICIENCY_{it}$	19,027	0.0288	0.0181	0.0411	0.0092	0.0307
$Invest_{i,t}$	19,027	0.0533	0.0339	0.0726	0.0137	0.0658
$Growth_{i,t-1}$	19,027	1.5948	1.1398	2.0191	0.9127	1.5874
$Leverage_{i,t-1}$	19,027	0.2577	0.2046	0.3536	0.0805	0.3439
$Cash_{i,t-1}$	19,027	0.1112	0.0734	0.1183	0.0310	0.1475
$Age_{i,t-1}$	19,027	2.8863	2.8904	0.8542	2.3979	3.4340
$Size_{i,t-1}$	19,027	19.7723	19.4294	2.3292	18.0587	21.3406
$Returns_{i,t-1}$	19,027	0.1280	0.0363	0.6052	-0.2005	0.3124
$Invest_{i,t-1}$	19,027	0.0560	0.0350	0.0779	0.0145	0.0681
TFP						
TFP_{it}	3,747	2.6802	2.8060	1.1393	1.8018	3.5148
Controls						
capitalintlag1	29,947	0.2632	0.1783	0.2830	0.04098	0.3972
inventoryintlag1	25,605	0.1487	0.1082	0.1626	0.0203	0.2187
intangibleslag1	25,596	0.0811	0.0226	0.1455	0.0037	0.0886
intsalesratiolag1	19,552	0.4804	0.4300	0.5681	0.0739	0.7468
divpayoutlag1	20,141	0.4375	0.3106	0.6161	0	0.5782
debtequitylag1	31,900	0.8774	0.4508	1.4205	0.1180	1.0089
btmlag1	28,898	1.0349	0.6827	1.4537	0.3617	1.1853
lnfirmagelag1	33,128	2.641	2.7081	0.9903	2.0794	3.2958
sizelag1	32,925	19.3549	19.0677	2.4441	17.6057	20.9921
lnAnalysts	14,313	1.4153	1.3863	1.1243	0.6932	2.3979

Notes: *NETINCOMECNEW* is the analyst consensus of net income t+1 minus the realized net income of t (standardized by lagged total assets) per firm-year as reported in IBES LSEG database. *FE(NETINCOME)* is the analyst forecast error measured as the difference between the actual (realized) net income minus the analyst consensus per firm-year (t+1). The EBITDA, Revenue, and Opex variables are similarly constructed. $Invest_{i,t}$ refers to the fixed assets investment level of firm i in year t. $Growth_{i,t-1}$, $Leverage_{i,t-1}$, $Cash_{i,t-1}$, $Age_{i,t-1}$, $Size_{i,t-1}$ and $Returns_{i,t-1}$ represent firm i's growth opportunities (Tobin's Q), leverage (debt to assets ratio), cash and equivalent holdings, firm age, firm size (natural logarithm of total assets) and stock return ratio in year t-1. The fitted value of regression of Model (5) is the estimate of the expected level of new investment while the unexplained portion (residual) is the estimate of over-investment. $INVEFFICIENCY_{t,i}$, the absolute value of the residual, is a proxy for investment efficiency. The larger the $INVEFFICIENCY_{t,i}$ the lower the investment efficiency. *TFP* is the firm-level total factor productivity estimated using a methodology similar to Imrohoroglu and Tuzel (2014) and Olley and Pakes (1996).

Table 3. Investment efficiency incorporation into analysts' forecasts

DEP.VAR	(1) *NET INCOME*	(2) *NETINC NEWS*	(3) *NETINC FE*	(4) *EBITDA*	(5) *EBITDA NEWS*	(6) *EBITDA FE*
INVEFFICIENCY	-0.110***	-0.072**	-0.008	-0.145***	-0.130***	-0.014
	(-3.371)	(-2.123)	(-0.506)	(-3.521)	(-2.928)	(-0.580)
Controls						
capitalintlag1	0.003	0.001	-0.001	-0.004	-0.001	-0.002
	(0.802)	(0.367)	(-0.394)	(-0.940)	(-0.341)	(-1.034)
inventoryintlag1	-0.006	-0.007	-0.000	-0.015***	-0.012*	-0.003
	(-1.290)	(-1.515)	(-0.232)	(-2.612)	(-1.949)	(-1.070)
intangibleslag1	-0.007	0.002	-0.004	-0.010	-0.009	-0.001
	(-1.342)	(0.308)	(-1.413)	(-1.472)	(-1.253)	(-0.395)
intsalesratiolag1	0.005***	0.004***	0.000	0.004***	0.005***	-0.000
	(3.987)	(3.203)	(0.124)	(4.268)	(4.206)	(-0.194)
divpayoutlag1	0.005***	0.003**	-0.000	0.005***	0.005***	-0.000
	(3.853)	(2.527)	(-0.182)	(4.343)	(4.680)	(-0.267)
debtequitylag1	0.002***	0.002***	-0.000	0.003***	0.003***	-0.000
	(3.579)	(3.938)	(-1.171)	(3.527)	(3.307)	(-0.036)
btmlag1	0.006***	0.006***	-0.001	0.007***	0.007***	-0.001
	(3.342)	(3.576)	(-1.116)	(3.047)	(3.064)	(-0.562)
lnfirmagelag1	0.001	0.001	-0.000	0.001	0.001	-0.000
	(0.836)	(1.314)	(-1.189)	(0.620)	(1.017)	(-0.621)
sizelag1	0.001	0.001	0.000*	0.001	0.001	0.000
	(1.588)	(1.072)	(1.652)	(1.346)	(1.540)	(0.105)
lnAnalysts	-0.002**	-0.002**	0.000	-0.003**	-0.004***	0.001
	(-2.224)	(-2.361)	(0.117)	(-2.528)	(-3.122)	(0.971)
Constant	-0.026**	-0.022*	-0.005	-0.014	-0.019	0.002
	(-2.338)	(-1.895)	(-0.904)	(-1.070)	(-1.397)	(0.237)
Year Effects	Included	Included	Included	Included	Included	Included
Industry Effects	Included	Included	Included	Included	Included	Included
Country Effects	Included	Included	Included	Included	Included	Included
Clustering SE	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.111	0.110	0.020	0.121	0.131	0.020
Adjusted R^2	0.101	0.101	0.009	0.111	0.122	0.008
Observations	4916	4916	4916	4720	4720	4720

Table notes: This table presents the results of the pooled OLS regression of Models 1 – 2. The models control for country, industry, and year effects. All the variables are defined in the Appendix. Continuous variables are winsorized at 1% at both sides. t-statistics (in parentheses) are based on clustered standard errors (clustered by firm). ***, **, and * represent significance levels of 1, 5, and 10 percent, respectively.

Table 4. Investment efficiency incorporation into analysts' forecasts. Decomposition of profitability into Revenues and Operating Expenses.

DEP.VAR	(1) *REVENUE*	(2) *REVENUE NEWS*	(3) *REVENUE FE*	(4) *OPEX*	(5) *OPEX NEWS*	(6) *OPEX FE*
INVEFFICIENCY	-0.534***	-0.596***	0.020	-1.052**	-0.647	-0.462*
	(-3.849)	(-3.845)	(0.320)	(-2.584)	(-1.493)	(-1.835)
Controls						
capitalintlag1	0.012	0.013	0.012	0.087**	0.163***	-0.076
	(0.859)	(0.606)	(1.487)	(2.000)	(2.658)	(-1.580)
inventoryintlag1	-0.057**	-0.200***	0.036**	-0.028	-0.256**	0.225**
	(-2.230)	(-3.039)	(2.501)	(-0.240)	(-2.085)	(2.207)
intangibleslag1	0.023	0.004	0.023**	0.114	0.082	-0.001
	(1.092)	(0.136)	(2.385)	(1.449)	(0.796)	(-0.009)
intsalesratiolag1	0.016***	0.022***	-0.005	0.017	0.039**	-0.020
	(3.361)	(3.960)	(-1.399)	(1.515)	(2.458)	(-1.566)
divpayoutlag1	0.026***	0.020***	0.003**	0.031**	0.010	0.018
	(6.330)	(3.721)	(2.135)	(2.245)	(0.572)	(1.310)
debtequitylag1	0.008***	0.009**	-0.002	-0.013	-0.003	-0.005
	(2.886)	(2.330)	(-1.273)	(-0.763)	(-0.298)	(-0.490)
btmlag1	0.031***	0.034***	0.000	0.011	0.034	-0.016
	(4.470)	(3.672)	(0.004)	(0.774)	(1.378)	(-1.200)
lnfirmagelag1	0.002	0.004	0.000	-0.001	-0.001	-0.004
	(0.465)	(0.885)	(0.145)	(-0.124)	(-0.067)	(-0.389)
sizelag1	0.003	0.008**	-0.003**	-0.005	0.014	-0.014
	(1.190)	(2.364)	(-2.012)	(-0.555)	(1.110)	(-1.551)
lnAnalysts	-0.012**	-0.021***	0.004	0.008	-0.010	0.009
	(-2.422)	(-3.082)	(1.564)	(0.438)	(-0.401)	(0.504)
Constant	-0.097*	-0.177**	0.038	-0.032	-0.509**	0.359**
	(-1.739)	(-2.512)	(1.601)	(-0.157)	(-1.970)	(2.134)
Year Effects	Included	Included	Included	Included	Included	Included
Industry Effects	Included	Included	Included	Included	Included	Included
Country Effects	Included	Included	Included	Included	Included	Included
Clustering SE	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.132	0.127	0.039	0.052	0.101	0.097
Adjusted R^2	0.123	0.117	0.028	0.017	0.068	0.063
Observations	4984	4984	4984	1256	1256	1256

Table notes: This table presents the results of the pooled OLS regression of Models 1 – 2 studying the effect of *INVEFFICIENCY* on firm Revenues and Operating expenses separately. The models control for country, industry, and year effects. All the variables are defined in the Appendix. Continuous variables are winsorized at 1% at both sides. t-statistics (in parentheses) are based on clustered standard errors (clustered by firm). ***, **, and * represent significance levels of 1, 5, and 10 percent, respectively.

Table 5. Firm productivity incorporation into analysts' forecasts.

DEP.VAR	(1) *NET INCOME*	(2) *NETINC NEWS*	(3) *NETINC FE*	(4) *EBITDA*	(5) *EBITDA NEWS*	(6) *EBITDA FE*
TFP	0.011***	0.011***	-0.000	0.015***	0.015***	-0.000
	(4.646)	(5.017)	(-0.768)	(4.829)	(4.769)	(-0.345)
Controls						
capitalintlag1	0.007	0.006	-0.000	0.054***	0.059***	-0.005
	(0.629)	(0.647)	(-0.166)	(3.184)	(3.478)	(-1.549)
inventoryintlag1	0.034**	0.020	0.009**	-0.010	-0.014	0.003
	(2.009)	(1.292)	(2.210)	(-0.398)	(-0.520)	(0.500)
intangibleslag1	-0.012	-0.018	0.002	0.027	0.033	-0.007
	(-0.750)	(-1.116)	(0.534)	(0.855)	(1.072)	(-1.382)
intsalesratiolag1	0.002	0.001	0.001	0.000	0.000	-0.000
	(0.599)	(0.215)	(1.451)	(0.008)	(0.020)	(-0.074)
divpayoutlag1	0.005**	0.003	0.002**	0.004	0.005	-0.001
	(2.532)	(1.412)	(1.987)	(1.354)	(1.623)	(-0.553)
debtequitylag1	-0.010***	-0.009***	-0.000	-0.009***	-0.009***	0.000
	(-4.655)	(-4.802)	(-1.054)	(-3.526)	(-3.541)	(0.029)
btmlag1	-0.024***	-0.022***	-0.001	-0.028***	-0.027***	-0.001
	(-4.663)	(-4.371)	(-1.116)	(-4.106)	(-4.015)	(-1.241)
lnfirmagelag1	-0.004	-0.004	0.000	-0.001	-0.000	-0.001
	(-1.295)	(-1.600)	(0.327)	(-0.277)	(-0.067)	(-0.916)
sizelag1	0.000	-0.000	0.001***	-0.004*	-0.005**	0.001*
	(0.277)	(-0.336)	(3.167)	(-1.818)	(-2.144)	(1.917)
lnAnalysts	-0.000	0.002	-0.002***	0.003	0.004	-0.001
	(-0.137)	(0.539)	(-2.851)	(0.663)	(0.917)	(-1.475)
Constant	0.099***	0.118***	-0.019***	0.273***	0.286***	-0.011
	(3.569)	(4.319)	(-2.939)	(5.589)	(5.815)	(-1.105)
Year Effects	Included	Included	Included	Included	Included	Included
Industry Effects	Included	Included	Included	Included	Included	Included
Country Effects	Included	Included	Included	Included	Included	Included
Clustering SE	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.214	0.244	0.046	0.278	0.284	0.032
Adjusted R^2	0.195	0.225	0.023	0.259	0.265	0.007
Observations	1298	1298	1298	1229	1229	1229

Table notes: This table presents the results of the pooled OLS regression of Models 3 – 4. The models control for country, industry, and year effects. All the variables are defined in the Appendix. Continuous variables are winsorized at 1% at both sides. t-statistics (in parentheses) are based on clustered standard errors (clustered by firm). ***, **, and * represent significance levels of 1, 5, and 10 percent, respectively.

Table 6. Firm productivity incorporation into analysts' forecasts. Decomposition of profitability into Revenues and Operating Expenses.

DEP.VAR	(1) *REVENUE*	(2) *REVENUE NEWS*	(3) *REVENUE FE*	(4) *OPEX*	(5) *OPEX NEWS*	(6) *OPEX FE*
TFP	0.068***	0.067***	0.001	0.112***	0.069**	0.028
	(2.918)	(2.969)	(0.292)	(3.550)	(2.053)	(1.633)
Controls						
capitalintlag1	-0.477***	-0.494***	0.016**	-0.255	-0.190	-0.096
	(-3.470)	(-3.624)	(2.049)	(-1.235)	(-0.856)	(-1.598)
inventoryintlag1	0.511*	0.442	0.040*	0.260	-0.125	0.142
	(1.683)	(1.571)	(1.939)	(0.737)	(-0.318)	(1.074)
intangibleslag1	-0.749***	-0.760***	0.021	-0.629*	-0.720**	-0.003
	(-3.614)	(-3.871)	(1.346)	(-1.930)	(-2.161)	(-0.012)
intsalesratiolag1	0.005	0.007	-0.000	-0.003	-0.021	0.006
	(0.142)	(0.197)	(-0.188)	(-0.105)	(-0.766)	(0.475)
divpayoutlag1	0.056**	0.056**	0.001	0.106***	0.094***	0.013
	(1.978)	(2.050)	(0.448)	(3.563)	(3.099)	(0.832)
debtequitylag1	-0.032	-0.033	-0.001	-0.013	-0.058**	0.029
	(-1.374)	(-1.427)	(-0.582)	(-0.477)	(-2.233)	(1.551)
btmlag1	-0.077*	-0.092**	0.008	-0.034	-0.019	-0.014
	(-1.862)	(-2.317)	(1.444)	(-1.034)	(-0.514)	(-1.136)
lnfirmagelag1	-0.078***	-0.076***	-0.001	-0.103***	-0.069**	-0.022*
	(-2.694)	(-2.696)	(-0.211)	(-3.200)	(-2.181)	(-1.761)
sizelag1	-0.033*	-0.032*	-0.002*	-0.080***	-0.085***	-0.004
	(-1.965)	(-1.962)	(-1.712)	(-3.522)	(-3.025)	(-0.393)
lnAnalysts	-0.079**	-0.082**	0.003	-0.040	-0.028	-0.005
	(-2.381)	(-2.507)	(0.873)	(-0.626)	(-0.349)	(-0.118)
Constant	2.344***	2.334***	0.034	3.188***	3.136***	0.260
	(6.452)	(6.799)	(1.160)	(6.535)	(5.579)	(1.520)
Year Effects	Included	Included	Included	Included	Included	Included
Industry Effects	Included	Included	Included	Included	Included	Included
Country Effects	Included	Included	Included	Included	Included	Included
Clustering SE	Firm	Firm	Firm	Firm	Firm	Firm
R^2	0.416	0.431	0.038	0.553	0.484	0.064
Adjusted R^2	0.402	0.417	0.015	0.519	0.444	-0.007
Observations	1312	1312	1312	339	339	339

Table notes: This table presents the results of the pooled OLS regression of Models 3 – 4 studying the effect of *TFP* on firm Revenues and Operating expenses separately. The models control for country, industry, and year effects. All the variables are defined in the Appendix. Continuous variables are winsorized at 1% at both sides. t-statistics (in parentheses) are based on clustered standard errors (clustered by firm). ***, **, and * represent significance levels of 1, 5, and 10 percent, respectively.