

## **2. INVESTMENT CLIMATE AND ENTERPRISE PRODUCTIVITY**

28. This chapter considers the relationship of investment climate (IC) indicators with productivity in Thailand. First, the importance of productivity growth for economic development, and the possible impact of investment climate thereon, is briefly outlined. Three different productivity indicators are then introduced and their level and variation is examined both for Thailand as a whole and across regions and industries. Finally, the results of regressions of firm productivity on indicators of investment climate and firm characteristics are discussed and the key relationships are highlighted.

### **PRODUCTIVITY GROWTH**

#### **The Importance of Productivity Growth**

29. “Productivity isn’t everything, but in the long run it is almost everything.”<sup>14</sup> If growth depended purely on factor accumulation, sustaining a high growth rate would not be possible in the long run due to the diminishing marginal contribution of capital. However, this limitation may be overcome if growth is driven by productivity gains—for instance, if economies of scale yield increasing returns.

30. The increase in labor cost in recent years, accompanied by the appreciation of the Thai Baht, has contributed to a decline in the competitiveness of several industries in Thailand. Moving from cost- to value- or knowledge-based competitive advantages has thus become increasingly important to sustain Thailand’s growth.<sup>15</sup>

#### **Investment Climate and Variations of Productivity and Growth across Locations**

31. Locations with superior investment climate tend to attract more firms and investments and are therefore likely to experience higher growth. This is because firms choose their location in order to minimize costs and maximize profits. Profitability, in turn, is influenced by the investment climate which conditions costs, risks, and barriers to entry.

32. Growth and productivity of firms at a given location can improve with business climate through two channels: A better IC can increase the size of investments as well as

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<sup>14</sup> Paul Krugman (1997) *The Age of Diminished Expectations: U.S. Economic Policy in the 1990s*. Cambridge, Mass.: MIT Press.

<sup>15</sup> See also: World Bank (2008), *Towards a Knowledge Economy in Thailand*. Washington DC: World Bank.

enhancing firm performance by cutting unnecessary costs. By contrast, an unstable macro environment, uncertain economic policy, limited access to productive factors (for instance, a shortage of skilled labor and difficulties in accessing finance), burdensome bureaucratic regulation or unreliable infrastructure services will result in less value added to the same amount of inputs. In other words, in locations where investment climate is better, firm performance tends to be higher, all other things being equal.

### **Differences in the Impact of Investment Climate Changes on Productivity across Firms and Industries**

33. The productivity impact of changes in the investment climate may alternate across firms and industries. This is because different firms are subject to particular constraints to a varying extent. For example, access to reliable power supply is important to every firm; but smaller firms are likely to suffer a higher loss (relative to their sales) than larger firms, because having their own generators may impose a disproportionate burden on them. Similarly, efficient customs clearance may have a much larger impact on firms that export and import on a regular basis than on those which only occasionally buy or sell a small amount abroad.

34. Firms tend to perceive the investment climate as an integrated package. Addressing only isolated aspects of the business climate may thus not have the expected impact on productivity. For example, if a fundamental concern about macro instability has not been addressed, improvements in access to finance may not have much impact on firms' investment decisions. Similarly, a tax break may unleash growth in an industry for which excessive taxation is the only major binding constraint; but it could have a much less pronounced impact in other industries which are hemmed in by other obstacles for which the tax cut is insufficient compensation.

## **MEASURING FIRM PRODUCTIVITY**

### **Labor Productivity, Total Factor Productivity, and Sales Growth**

35. This section introduces three common measures of productivity – labor productivity, total factor productivity (TFP), and sales growth. These capture different aspects of firm performance. The first two measure the level of productivity in a relatively objective way, while the last captures the change in sales, which can be the result of productivity as well as a host of other endogenous and exogenous factors that influence a company's success.

36. **Labor productivity:** Labor productivity is the value-added produced by each worker. The calculation of labor productivity is straightforward mathematically, equaling the value-added divided by the number of workers. Higher labor productivity mainly results from four factors: more capital or machinery per worker; better skills; more advanced or adapted technology; and a better business environment. The first two factors are often industry-specific. For instance, *ceteris paribus*, workers are likely to have higher labor productivity in a more capital intensive industry. Thus labor productivity may be a better proxy of productivity for comparisons among firms with similar

characteristics than across firms with different capital-to-worker ratios and with a labor force of different quality.

37. **Total Factor Productivity:** TFP is defined as the residual of output or value-added that cannot be explained by factor inputs. It measures the contributions to output beyond those made by skilled and unskilled labor, the intermediate input, and the machinery/capital used. As the contribution of capital and skills is already accounted for in the production function estimation, TFP is often considered a more appropriate measure for across-industry comparisons of firms' productivity, capturing primarily the impact of technology and investment climate. The estimation of TFP, however, differs subject to the econometric methods applied.<sup>16</sup> This report uses TFP measured as the residuals from a production function estimated for each industry following the Levinsohn and Petrin (2003) techniques.<sup>17</sup> In order to capture the impacts of skills, skilled and unskilled labor is included separately in the production function estimation.<sup>18</sup> The higher marginal contribution of skilled labor than unskilled labor to production is consistent with the observations on the high demand of skilled labor in Thailand.

38. **Sales growth:** Sales growth is measured as the annual growth rate of sales. Assuming that firms can choose the level of output to maximize profit in a free market, firms that have more rapid sales growth should have higher productivity. In this case, sales growth can be a direct measure of productivity as well as providing information on which firms actually expand and which contract in the market. It is thus a useful indicator to complement discussions on which firms are more efficient in transforming physical inputs into outputs.

### **Firm Productivity in Thailand**

39. The three measures of Thai productivity – labor productivity, TFP, and sales growth – show different trends (Figure 11). Labor productivity increased from US\$12,294 per worker in 2003 to US\$16,600 per worker in 2006 and TFP increased about 1.5 percent from 2003 to 2004, but only 0.5 percent from 2004 to 2006. Sales growth dropped from 18 percent in 2003/04 to 9 percent in 2005/06, which is consistent

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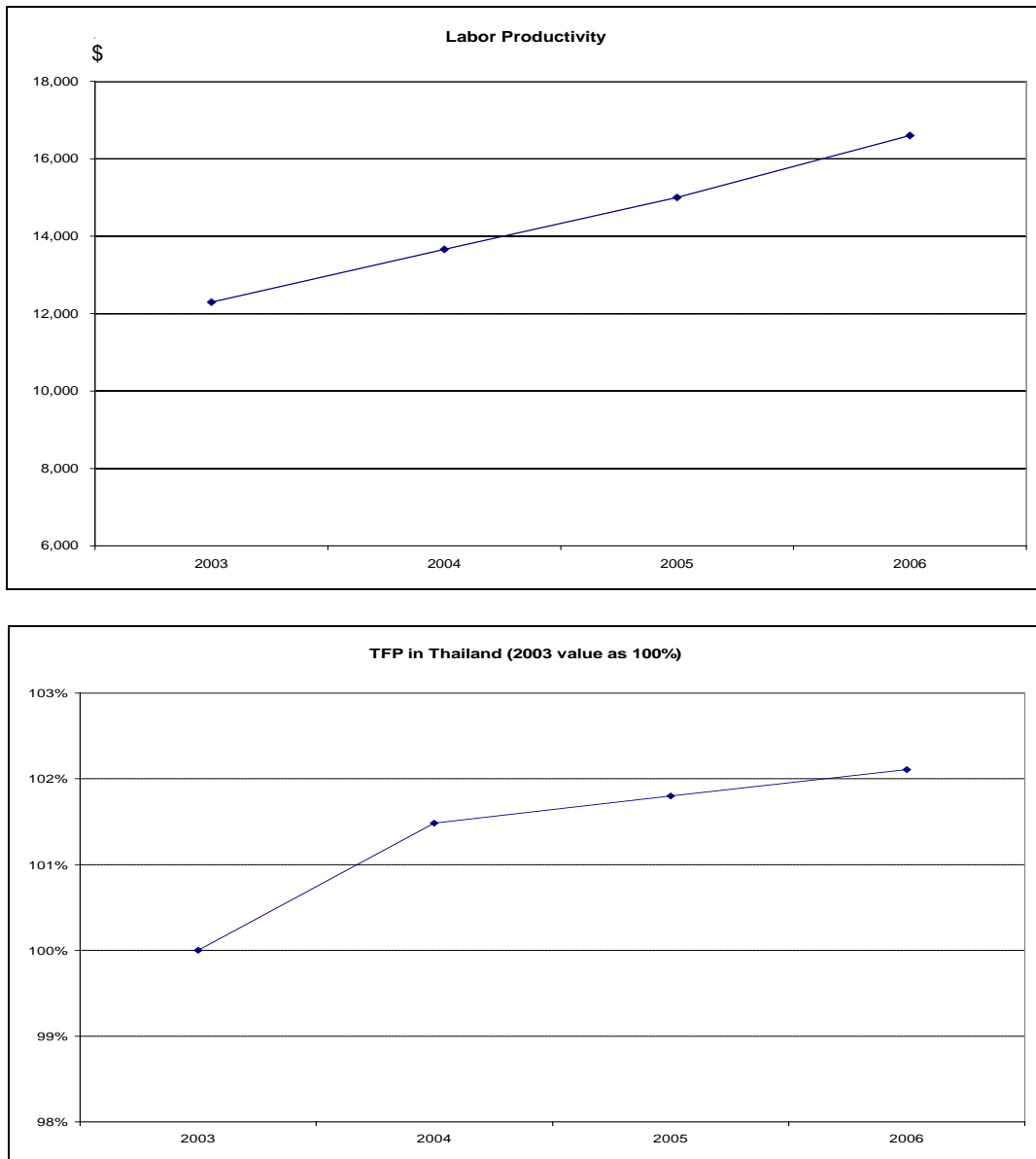
<sup>16</sup> Firms that experience a large positive productivity shock may respond by using more inputs. Potentially, there is correlation between input levels and the unobserved firm-specific productivity shocks in the estimation of the parameters of the production function. Ordinary least squares (OLS) estimates of production functions will thus yield biased parameter estimates of productivity. Different methods have been developed to correct this. Olley and Parkes (1996) use investment to control for correlation between input levels and the unobserved firm specific productivity process. Levinsohn and Petrin's (2003) contribution adds to existing methods of correcting for the potential endogeneity between the choice of inputs and firm productivity by conditioning out serially correlated unobserved shocks to the production technology.

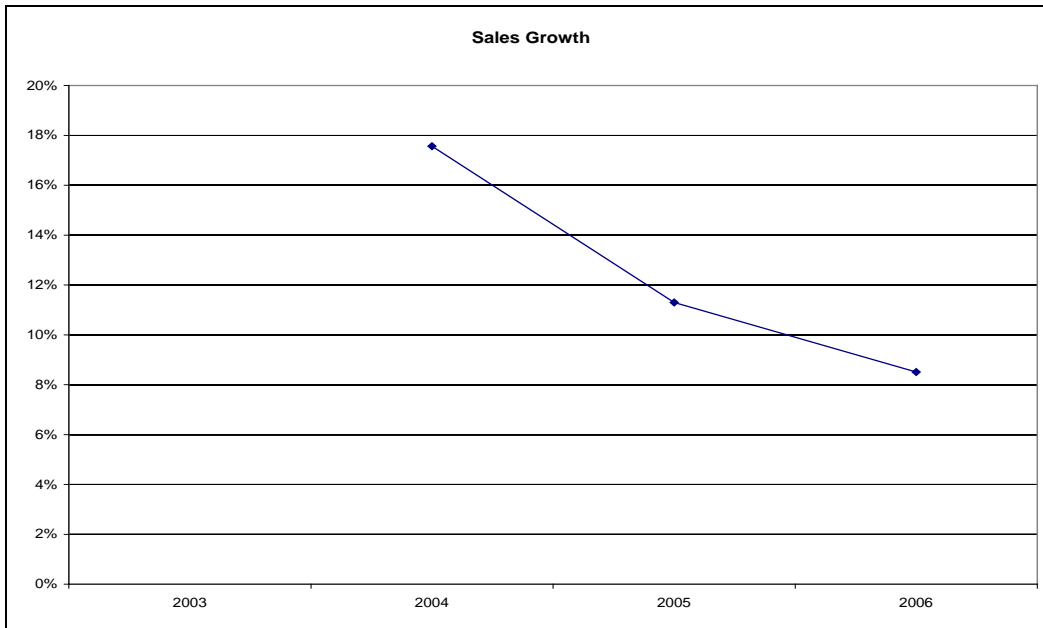
<sup>17</sup> The production function considered assumes that output is produced by labor, intermediate inputs, and capital. The report also includes production function estimates using the Generalized Linear Squares (GLS) method as a robustness check. For most industries, the coefficient of labor estimated with Levinsohn-Petrin method is larger and the coefficient of capital smaller than that estimated with GLS. This is consistent with the general assumption that labor is more likely to be correlated with a productivity shock and overestimated. See details in Table 33 to Table 36.

<sup>18</sup> See technical details on the production function estimation in annex.

with the sluggish growth of private investment in recent years. This suggests that although firm productivity increased, firms failed to expand as rapidly as before. Sales growth, which depends not only on changes in productivity, but also factors such as firms' investments based on their perception of the investment climate, slowed down at least in part due to firms' pessimistic subjective assessment.

**Figure 11. Firms' Labor Productivity, TFP, and Sales Growth in Thailand, 2003-2006**



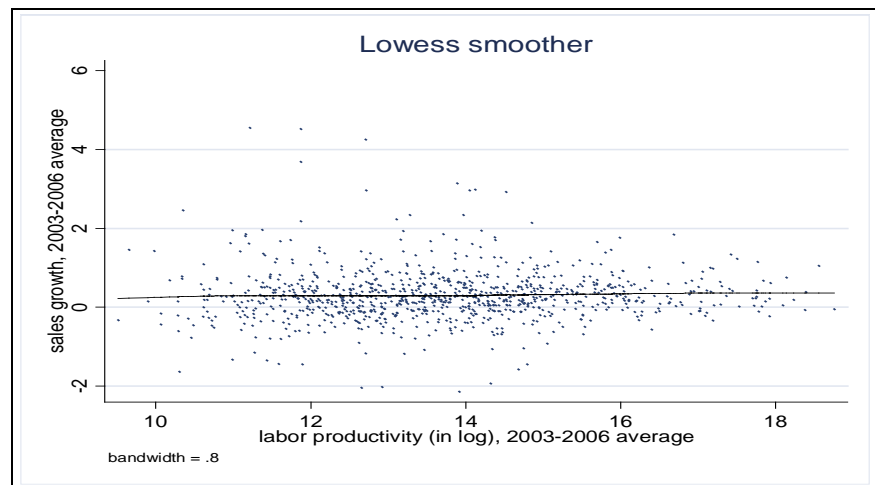
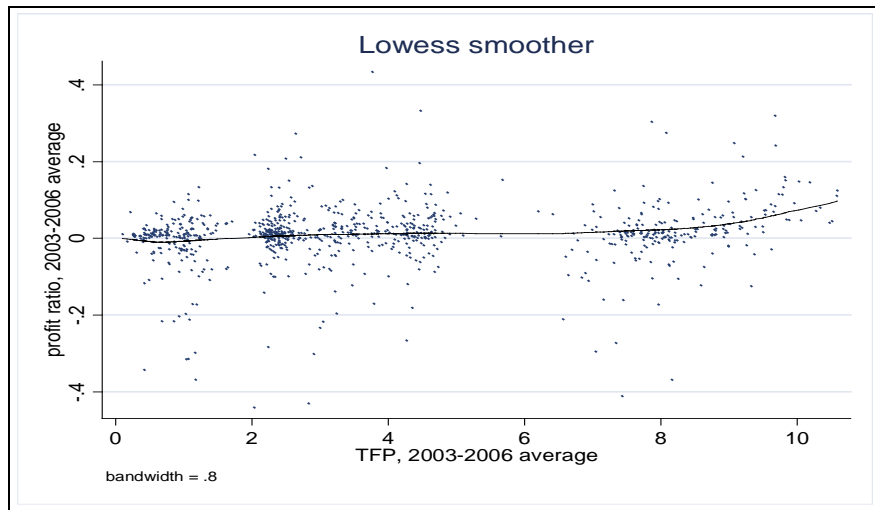
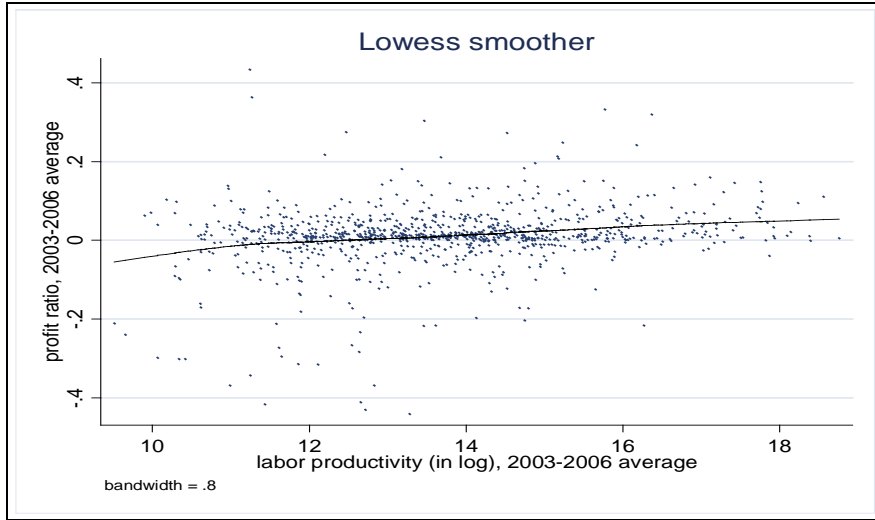


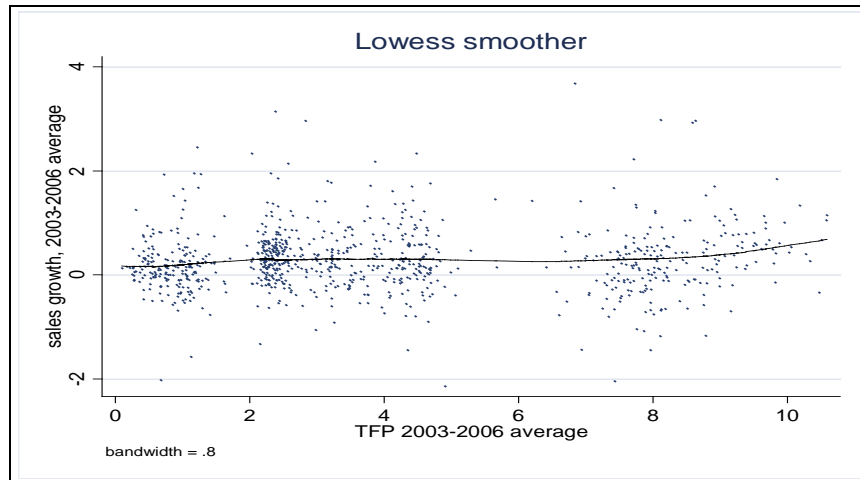
40. Thai firms' profit ratios and sales growth are generally both positively associated with their labor productivity and TFP (Figure 12).<sup>19</sup> Firms in the highest quartile, for example, have a significantly higher profit ratio; those in the lowest quartile often have a negative net profit (loss). Firms with productivity around the median level tend to break even. This suggests that more productive firms make a higher profit. The positive correlation between sales growth and TFP indicates that the overall Thai market is efficient – the more productive firms expand more rapidly.

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<sup>19</sup> Profit ratio is measured as the ratio of net profit over operating revenue.

**Figure 12. Correlates between Firm Productivity and Profit Ratio and between Firm Productivity and Sales Growth**



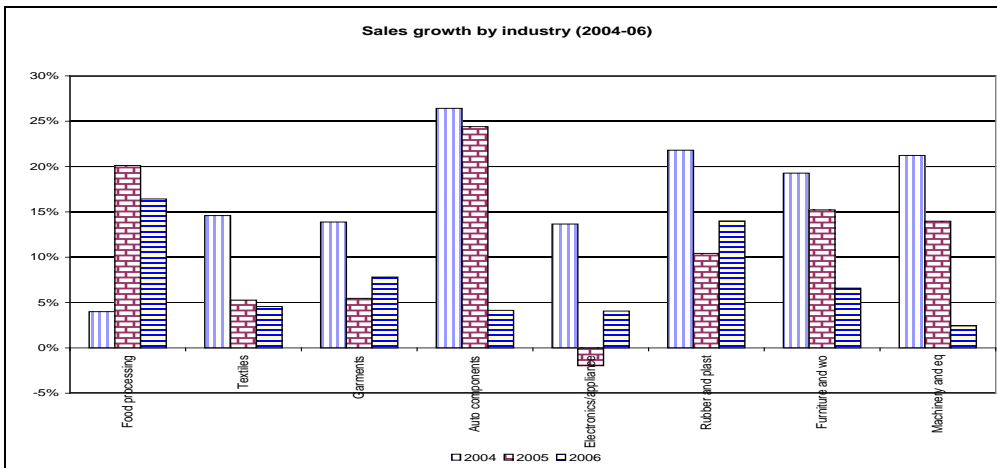
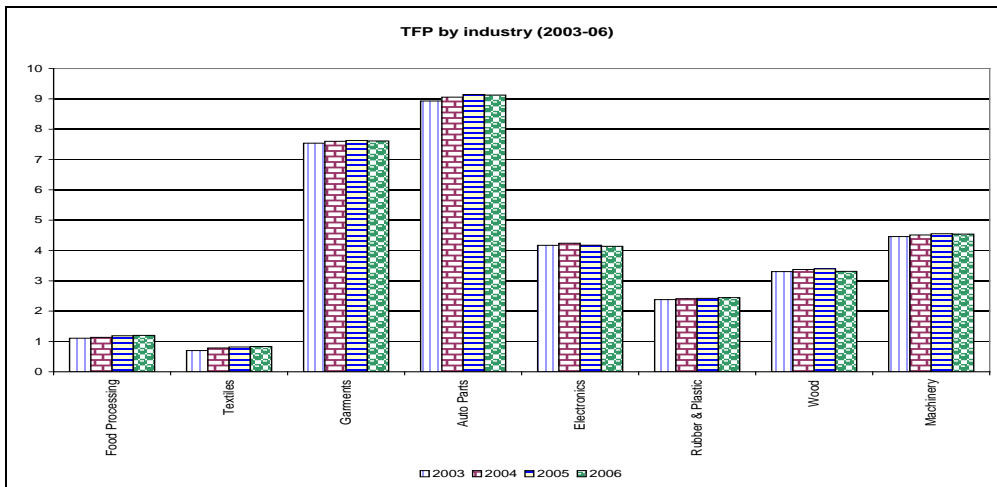
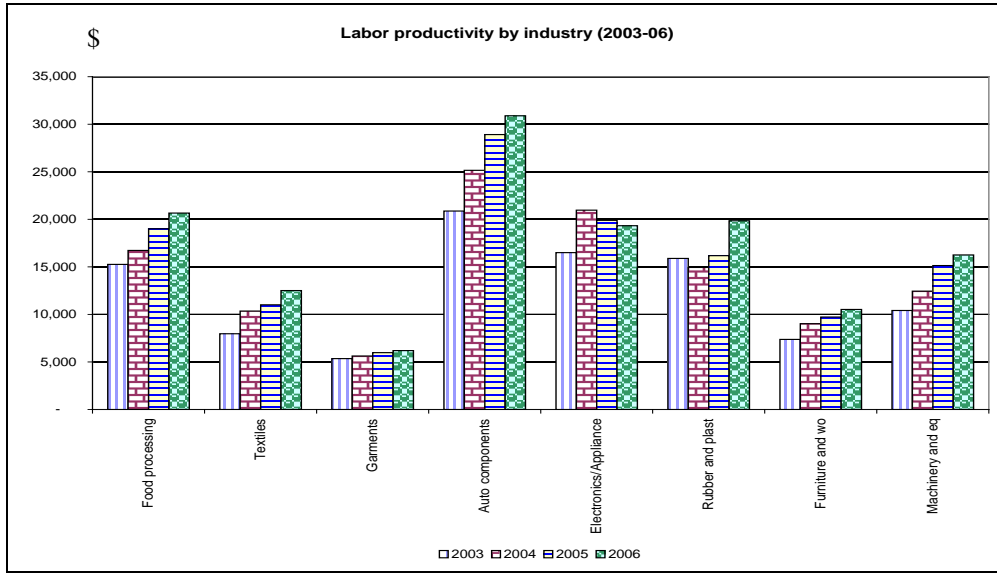


### Variations of Productivity within Thailand

41. Productivity varies widely within Thailand. Firms thrived to a varying extent associated partly with the different investment climates they faced.

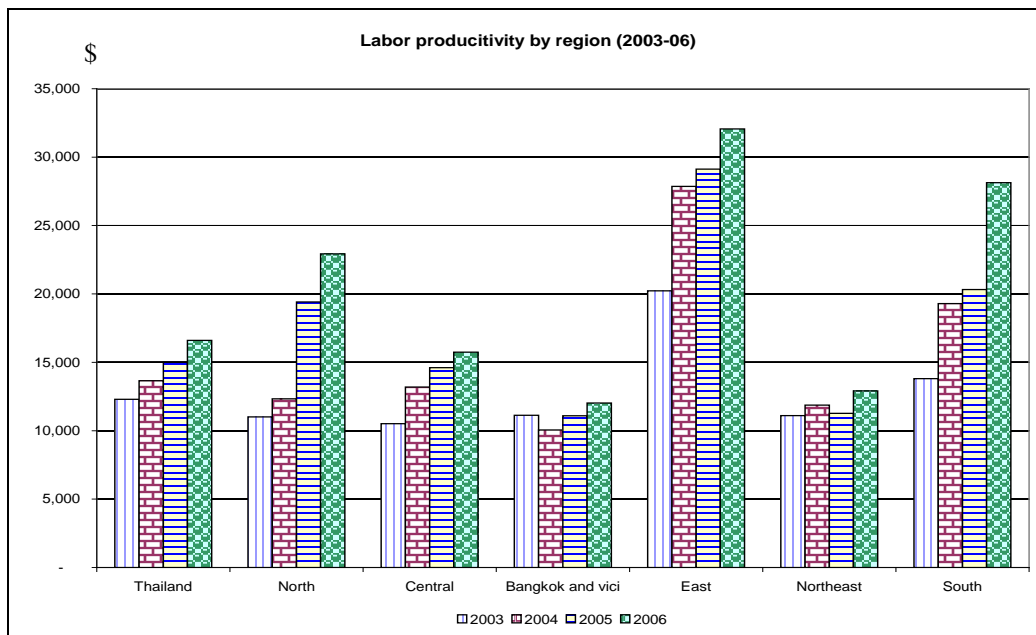
42. Productivity differs considerably across industries, but there were relatively few changes in the productivity ranking of industries over time. Firms producing auto-parts had the highest labor productivity and TFP in all periods, while firms producing garments had the lowest labor productivity and firms producing textiles had the lowest TFP (Figure 13). Within industries, increases in TFP were uniformly small, whereas labor productivity increased strongly in some industries (auto components, textiles, food processing) and much less so in others (garments, furniture and wood products). The rapid sales growth of firms producing auto-parts suggests a link between productivity and sales growth in this industry. The sluggish growth of the electronics industry may have resulted from fierce competition in international markets and limited demand. Changes in sales growth were relatively large. Seven out of eight industries had lower sales growth in 2005/06 compared with 2003/04. The food processing industry is the only exception, experiencing a higher sales growth in recent years.

**Figure 13. Firm Productivity by Industry, 2003-2006**

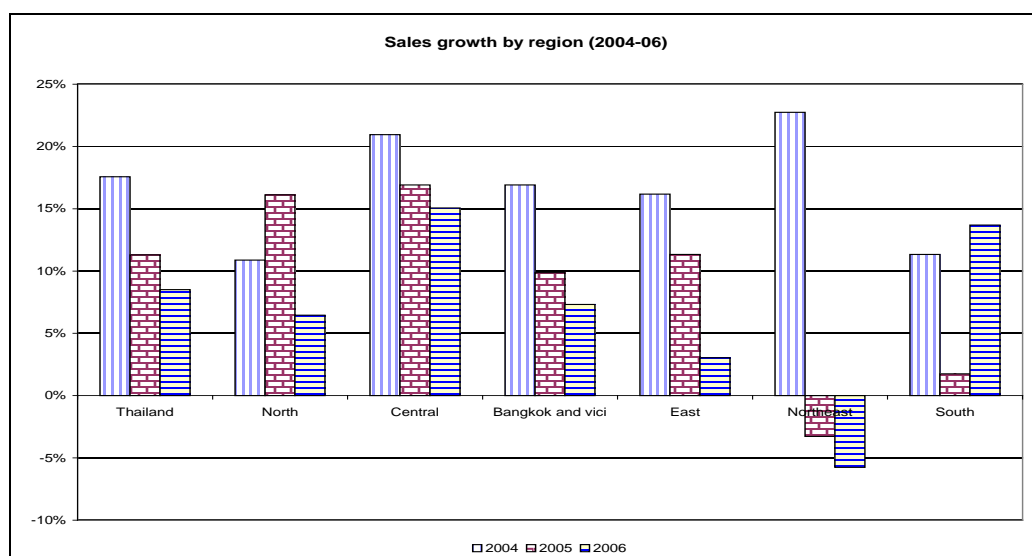
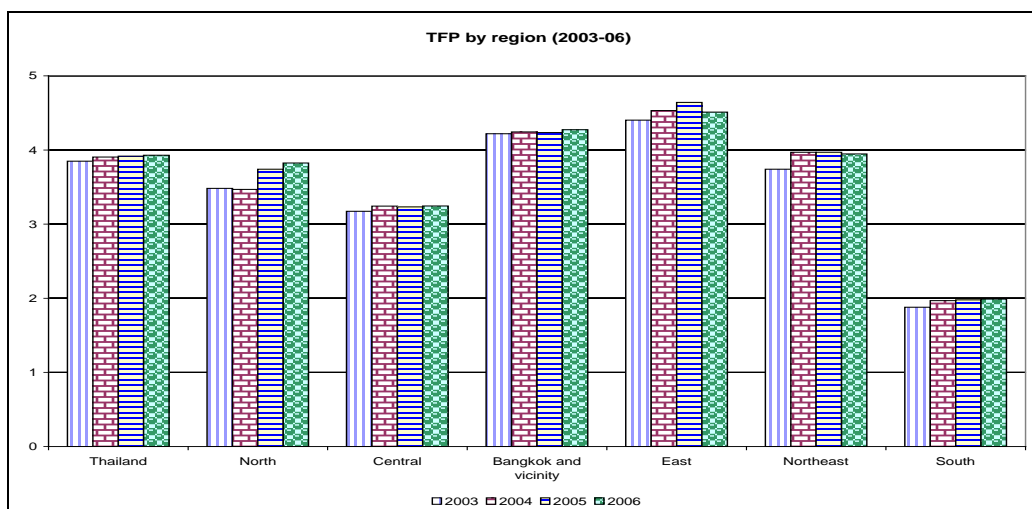


43. In all regions both labor productivity and TFP increased in 2003-2006, while sales growth slowed everywhere except in the South<sup>20</sup> (Figure 14). Variations of firm productivity in different regions depend on, among other factors, regional industry structure and investment climate. Labor productivity and TFP are the highest in the East, while sales growth is the highest in the Central region. The relatively high labor productivity and low TFP in the South region mainly reflects the special characteristics of the two major industries in the region – food processing and rubber and plastics. The high level of TFP and low level of labor productivity in Bangkok and vicinity may capture the strong role of technology and investment climate driving up TFP in the region while the large presence of labor intensive industries pushes down value-added per worker. Overall, the variation in firm productivity is consistent with the regional investment climate indicators – the three regions with better investment climate, Bangkok and vicinity, East, and Central, have more productive firms and these firms expand more rapidly.

**Figure 14. Firm Productivity by Region, 2003-2006**



<sup>20</sup> Sales growth in the South increased sharply in 2005/2006 after a deep decrease in 2004/05, which may result from the undiversified production structure in the region, where 90 percent of firms produce rubber and plastic or process food and their high sensitivity to demand (price) change.



## International Comparison of Labor Productivity

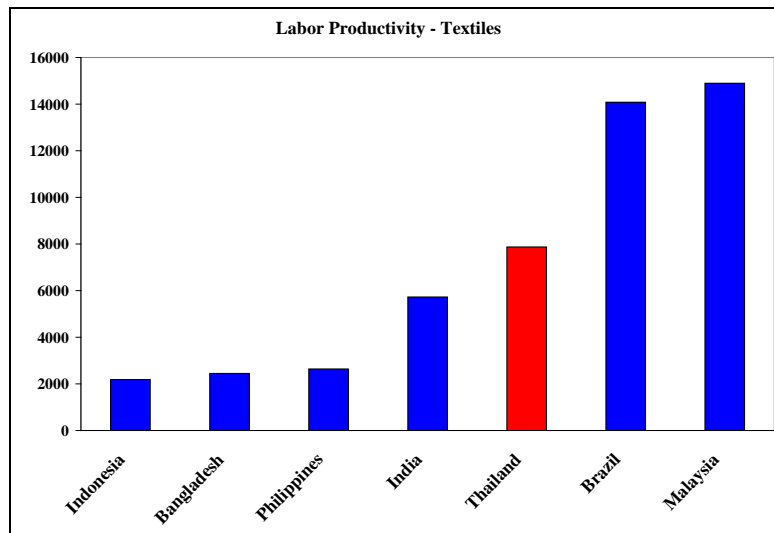
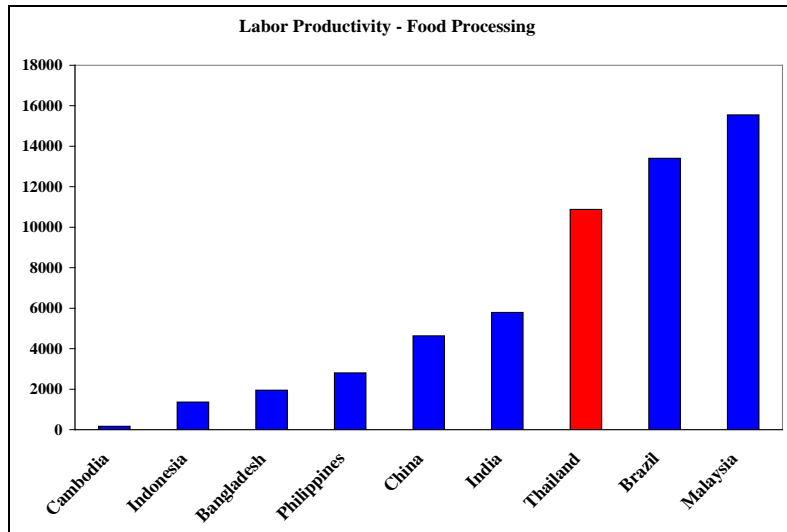
44. Comparing Thai labor productivity in selected industries to a set of low and middle income countries, we find Thai productivity relatively high, if still lagging behind neighboring Malaysia as well as Brazil (Figure 15).<sup>21</sup> Labor productivity in Thailand is relatively higher in food processing and the electronics/electrical appliances industries. This suggests that Thailand still commands a reasonable labor productivity premium relative to competitors in these industries.<sup>22</sup> However, Thailand's premium in the important textile and garment (export) industries is barely higher than India's. As Thailand's economy develops to a higher stage, it is important to move up the

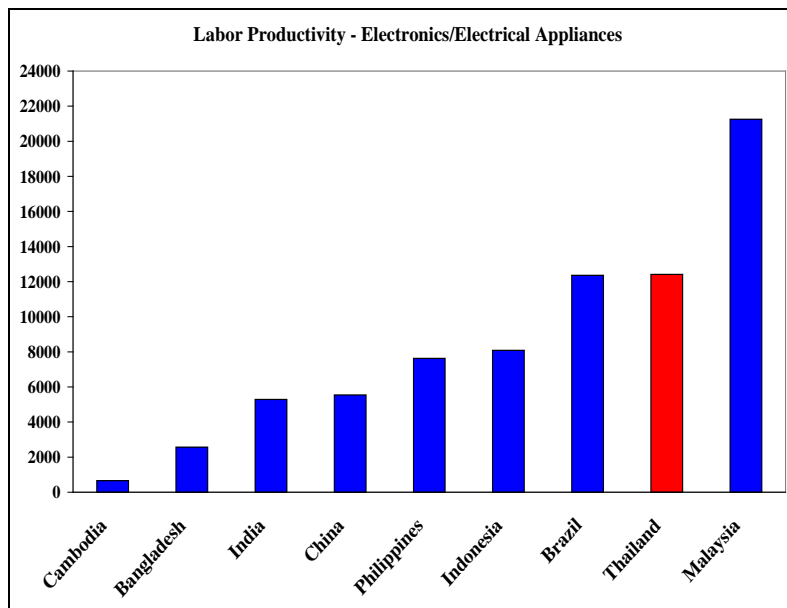
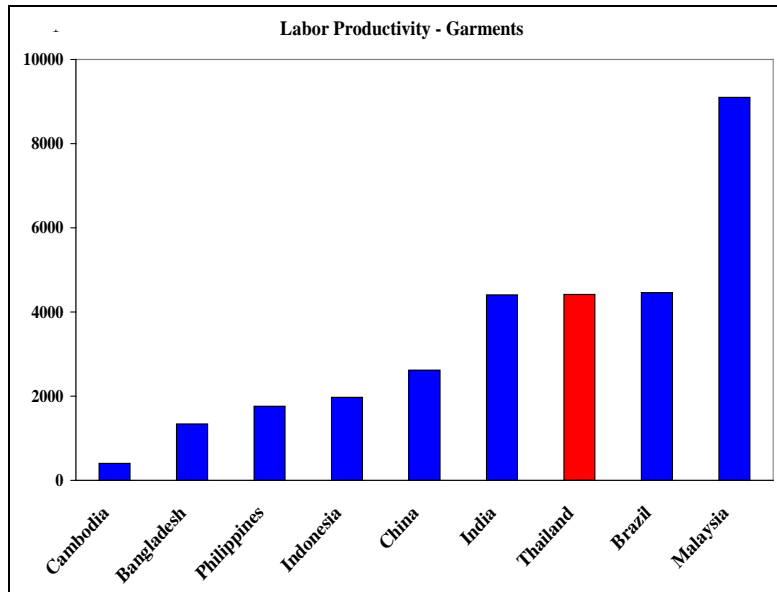
<sup>21</sup> The four industries presented in the report are selected based on data availability in comparator countries. The data of Cambodia is from PICS 2003, Bangladesh PICS 2003, Philippines PICS 2003, Brazil PICS 2003, Malaysia PICS 2003, Philippines, China PICS 2003, and India PICS 2002.

<sup>22</sup> The wage level is higher in Thailand than in these comparator countries in Asia with lower GDP per capita level.

technological ladder and rely more on value-based competitiveness rather than labor cost advantages.

**Figure 15. Labor Productivity in Different Industries – International comparison  
(Median Value-Added per Worker, 2001 U.S. dollar)**





### REGRESSING PRODUCTIVITY ON INVESTMENT CLIMATE INDICATORS AND FIRM CHARACTERISTICS

45. In what follows, the key results of a set of panel data regressions of productivity on firm characteristics and investment climate indicators are highlighted. The panel data set used for the analyses consists of 426 firms that participated in both PICS 2004 and PICS 2007. The distribution of these 426 firms is similar to the full samples of PICS

2004 and PICS 2007.<sup>23</sup> The precise specification of the regression equations is provided in the Technical Note (Annex 2).

46. The analytical results allow basic insights into the relationships between productivity, IC and firm characteristics. However, a number of analytical caveats need to be borne in mind. Firstly, some important aspects such as macro instability, which is likely to have played a key role in Thai firm performance in recent years, cannot be directly captured in the estimations due to limited information. Secondly, the regressions may suffer from a reverse causality problem if specific investment climate indicators at the firm level are themselves determined by productivity. For instance, the size of a firm can impact firm performance through economies of scale, but firm size can in turn be influenced by productivity if firms hire more workers as their profits increase. A third problem is that using firm-level investment climate indicators results in smaller samples, because some firms did not answer certain questions. For instance, some firms might not have tried to recruit skilled labor in the survey period, or may not have recent experience in ordering a new telephone line, but they would face similar constraints as other firms if they had done so.

47. To minimize the problems of endogeneity and sample constraint, this report uses regional industry mean levels of the investment climate indicators instead of the firm level data.<sup>24</sup> These can be considered largely exogenous to a specific firm, and are also used to replace missing values.<sup>25</sup> Firm characteristic variables are kept at firm level.

### **Correlates between Firm Characteristics and Performance**

48. Firms' productivity is associated with their specific characteristics. Table 37 and Table 38 show the correlates of labor productivity, TFP, and sales growth with a set of key firm characteristics, including age, size, foreign/domestic ownership status, export status<sup>26</sup>, measures of technology and innovations (percentage of computer controlled machines, percentage of machinery under five-years of age, R&D status) for Thailand during the period of 2001-2002 and 2003-2006 respectively. Dummies are included to capture the effects of regional, industry, and time specific characteristics.<sup>27</sup> The results of PICS 2004 and PICS 2007 are in general consistent.

49. Firm age is associated with higher labor productivity and TFP, but lower sales growth. This suggest that older firms in general have better performance compared with

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<sup>23</sup> Productivity of these subsamples, however, is higher than that of the full samples. One reason may be that the subsample consists only of firms that participated in both surveys. Those firms not available in the 2007 survey may partly be those who exited the market because of their low productivity performance.

<sup>24</sup> See the Technical Note for more detail

<sup>25</sup> See Dollar, Hallward-Driemeier and Mengiste (2005) for detailed discussion.

<sup>26</sup> As export status and foreign ownership status are often closely associated with each other in the case of Thailand, dummy variable "domestic export" rather than "export" is included in the estimation.

<sup>27</sup> No significant changes in impact of firm characteristics on performance are associated with the inclusion of dummies. The report focuses on the results with all three dummies included, i.e. regressions [3], [6], and [9] if not otherwise mentioned.

younger firms but a slower growth rate, which is consistent with the findings of many studies on the life-cycle of firm performance.

50. Firm size measured by the number of employees is positively associated with labor productivity and sales growth in a significant way. This suggests that larger firms are in general more productive and have higher growth rates due at least partly to the importance of economies of scale.<sup>28</sup>

51. Foreign-owned firms are more productive, measured by labor productivity as well as by TFP. According to the results of PICS 2007, labor productivity of foreign firms is 12 percent higher than that of domestic firms, and their TFP is 25 percent higher. This is consistent with findings in many other countries. Foreign firms tend to be more productive as they often have access to more advanced technology and management. However, the sales of foreign firms have been slower in recent years, which may be resulted from the slower growth of foreign indirect investment.

52. Performance of domestic firms that export<sup>29</sup> is higher than those that do not export, measured by labor productivity as well as by TFP. This suggests that the edge of competitiveness of Thai exporters over non-exporter firms remains. Exporter firms gain in productivity from exposure to international market and competition. However, as the competitiveness of many exporter firms was mainly cost- rather than value- or knowledge-based, their gains in productivity may soon reach a ceiling. Further improvement may need to come from other sources, such as skills and knowledge. The competition from other countries, for instance Cambodia, Vietnam and China in the garments market, is fierce and may affect export performance of Thai firms, especially with the appreciation of the Baht.

53. Firms better equipped with machinery tend to have higher productivity. As expected, firms that have a higher percentage of computer-controlled machines have significantly higher labor productivity and TFP. Their sales growth, however, does not show significantly different trends compared with firms that have a lower percentage of computer-controlled machinery. Firms that have a share of machines under five-years of age have higher labor productivity, TFP, and sales growth. This suggests that, in general, recently purchased machinery embodies the appropriate technology and has contributed to improving firm productivity.

54. Firms engaging in R&D activities generally achieve a higher labor productivity and TFP, while the association of R&D with sales growth is insignificant.<sup>30</sup> However, only 23 percent of firms surveyed reported they have engaged in R&D. This percentage is virtually unchanged since the early 2000s. As technology and innovation are associated

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<sup>28</sup> However, the aforementioned caveat regarding reverse causality should be kept in mind.

<sup>29</sup> Domestic exporter firms are defined here as firms with more than 10 percent sales from exports and with less than 10 percent foreign ownership.

<sup>30</sup> As exporter firms and foreign-owned firms often invest more in R&D, the effect of R&D dummies might be partially captured by other firm characteristics.

with better firm performance, it is important to provide incentives for firms to invest in R&D.

55. In short, older firms, firms of larger size, foreign-owned firms, exporter firms, firms with a higher share of computer-controlled machinery, firms that have a higher percentage of new machines, and firms engaging in R&D have higher labor productivity and TFP in Thailand. Larger firms, and firms having a higher percentage of new machines, experienced more rapid growth in sales in recent years, while older firms expanded less.

56. The correlates between firm characteristics and performance in Thailand, however, vary across industries (Table 39 to Table 41). For example, the positive correlation between the percentage of computer-controlled machines and labor productivity only holds for industries with higher technology, such as auto-parts, electronics, rubber and plastics, and machinery. This suggests that the use of computer-controlled machine, though it can be labor-saving in general, is more closely related to firm performance increases in industries which have a higher technology component; their use in more labor-intensive industries, where other factors play a more important role in the production function, may not significantly improve labor productivity at the current stage. The significantly positive association between capital vintage and TFP in textiles, rubber and plastics, and machinery, and the insignificant association in other industries, show that the productivity-enhancing effect of new machinery is stronger in the former than the latter. This can be explained by the different appropriateness of the technologies embodied in the machinery newly purchased and by the different capital depreciation rates across industries. The positive association between firm size and sales growth is significant for auto parts, electronics, and rubber and plastics and insignificant for other industries. This offers some support for the idea that economies of scale are stronger in these three higher-tech industries. The negative association between firm size and TFP for some industries, such as food processing, textiles, and rubber and plastics, may result from the nonlinear relationship as the optimal firm size and actual size of each industry differ.

### **Correlation between Investment Climate and Firm Performance**

57. Firm performance is also associated with the investment climate where firms locate. For firms with similar characteristics, those that face a more conducive investment climate are more likely to have higher productivity.

58. As skills, access to finance, infrastructure and regulation and logistics are the key constraints for doing business in Thailand, this report focuses on assessing the impacts on firm productivity of investment climate indicators that capture these four aspects, while controlling for firm specific characteristics. Various elements of investment climate are interrelated. This report selectively includes two key variables for each aspect of investment climate in order to balance the need to include “more indicators”, to limit the potential omitted variable bias, and that to include “fewer indicators” to minimize the potential bias linked to multi-collinearity.

59. This section focuses on examining the correlates between each of the four key aspects of investment climate – skills/knowledge, regulation/logistics, infrastructure, and access to finance – and TFP of Thai firms in 2003-2006 controlling for firm specific characteristics (Table 42).<sup>31</sup>

60. Skills play an important role in firms' TFP. A higher percentage of employees with a college degree and a shorter period of time to fill vacancies for professionals are both significantly associated with higher TFP. If the percentage of employees with college degree is considered as a proxy of the quality of the labor force, and the number of weeks to fill vacancies for professionals a proxy of the skill shortage in the market, then the important role of these two factors in TFP suggests that improving the skills of the existing labor force and increasing the supply of skilled labor to match market demand are both critical for enhancing firm performance. Investing in human capital is important.

61. Regulations and logistics are important binding constraints for many Thai firms. The two indicators of regulations and logistics that were chosen – the number of days to obtain an import permit and the number of days to clear export customs – are both negatively associated with TFP in a significant way. This suggests that improvements such as accelerating the process of obtaining business licenses and permits, and facilitating customs clearance, have considerable potential to enhance firm performance by reducing unnecessary costs.

62. Infrastructure, such as the public power supply,<sup>32</sup> conditions firm performance in a significant way. The number of annual power outages, and the production losses due to these, are both negatively associated with TFP. If the former can be considered as a proxy for the reliability of infrastructure services, and the latter a proxy of the financial loss resulting from unreliable service, this suggests that investing in infrastructure to improve reliability is important. As an interim step, strengthening firms' (especially smaller firms') abilities to deal with unexpected ruptures in infrastructure services will help reduce financial losses, other things being equal.

63. Access to finance, measured by the percentage of firms with bank loans and the number of days required to clear checks, is closely associated with firm performance. Firms with better access to bank loans and to better financial services tend to have higher performance.<sup>33</sup>

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<sup>31</sup> TFP is often a better measure of firm performance than labor productivity, because it is by definition isolated from the effects of different capital-to-worker ratios across firms. The correlates between investment climate and labor productivity as well as sales growth are presented in Table 43 and Table 44.

<sup>32</sup> Other aspects of infrastructure services, such as electricity and transport facilities, are closely correlated with power supply. The report chooses two key indicators – yearly number of power outages and production loss due to power outages – as proxies for infrastructure services.

<sup>33</sup> The negative correlation between firms with overdraft facility and TFP may have resulted from the close association between the three indicators that are used to measure access to finance. The correlation between firms with overdraft facility and labor productivity is positive.

64. The investment climate indicators are also jointly correlated with firm productivity in a significant way.<sup>34</sup> Investing in skills, providing a good regulatory framework, improving infrastructure services, and increasing access to finance are important measures for alleviating the binding constraints on doing business and enhancing firm performance.

### **Correlates between Changes in Investment Climate and Changes in Productivity**

65. An improvement in investment climate is often associated with an increase in firm productivity, other things being equal. As firms perceive various aspects of investment climate as more or less binding obstacles to doing business, an improvement of a specific aspect of investment climate may have different marginal effects on productivity of different firms. This section focuses on studying the correlates between changes in investment climate and changes in productivity based on the panel data.<sup>35</sup> The results shed light on how closely an improvement of a specific aspect of investment climate is associated with productivity changes.

66. Changes in most investment climate indicators are correlated with changes in TFP with the expected signs (Figure 16).<sup>36</sup> Controlling for firm characteristics, they are jointly significant, indicating that improvements in investment climate are associated with increases in productivity (Table 47). Improving infrastructure services – reducing the number of power outages and the production loss due to power outages – is associated with the largest increase in TFP. This is consistent with findings in other studies<sup>37</sup> on the importance of infrastructure services in firm performance. It suggests that although creating new infrastructure and improving existing facilities may involve high costs, the beneficial long-run impacts may justify such investments. The same is true for investing in human capital. Improving the quality of the labor force and addressing skill shortages can have large impacts on firms' productivity. In the shorter run, focusing on reducing unnecessary regulations and logistics will be a cost-effective way of providing a better business climate and the associated productivity improvements. Improving financial services is important in the short run as well as in the long run.

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<sup>34</sup> All indicators of each of the four aspects are jointly associated with TFP, labor productivity, and sales growth in a significant way.

<sup>35</sup> 426 firms participated in both rounds of PICS. See Table 45 and Table 46 for details on production function estimations using the panel data.

<sup>36</sup> Changes in investment climate are measured as the difference between observations in PICS 2004 and PICS 2007; changes in TFP are measured as the difference between the TFP in the initial year 2001 and the final year 2006, both estimated using the Levinsohn-Petrin method. It is not unexpected that the correlations between changes in most investment climate indicators and changes in TFP are not individually significant given the limited number of observations. The unexpected sign of the coefficient of “number of days to obtain import permit” may be a result of the collinearity between this variable and “number of days to clear export customs”.

<sup>37</sup> See for example, Dollar et al. (2005).

**Figure 16. Correlates between Changes in Investment Climate and Changes in TFP, PICS 2004 and PICS 2007 Panel Data**

