Int. J. Production Economics 131 (2011) 215–223

Contents lists available at ScienceDirect

Int. J. Production Economics

journal homepage: www.elsevier.com/locate/ijpe

# Labour productivity change: Drivers, business impact and macroeconomic moderators

Krisztina Demeter*, Attila Chikán, Zsolt Matyusz

*Corvinus University of Budapest, Fővám tér 8., Budapest H-1093, Hungary*

ARTICLE INFO

*Article history:*
Received 18 July 2008
Accepted 9 November 2010
Available online 23 November 2010

*Keywords:*
Labour productivity
Business performance
Industry
National context

ABSTRACT

This paper focuses on the operational drivers of labour productivity changes. We consider two sets of drivers: (a) current working practices and (b) changes in working practices through management programs. The relationship between these two sets of drivers and productivity changes are analysed. We also investigate the importance of productivity growth by looking at the impact of labour productivity changes on business performance changes. Finally, the moderating effects of industry and country on the use of drivers of productivity changes are examined. Data from an international survey, IMSS-IV, are used for the analysis.



## 1. Introduction

Productivity is a key performance indicator in all levels of economy, from the shop floor through business enterprises to the national economy. In the most general terms, it measures output relative to input. It is a core factor of economic growth (OECD, 2001) and an enabler of ensuring strategic advantage (Porter, 1980).

Irrespective of the importance of productivity at both the macro and the micro level, there are very few studies that approach it from an operational perspective (Wacker et al. 2006; Neely, 2005). Because macro-productivity is logically a kind of an aggregate measure of micro-productivity, there is a natural need to understand the relationship between the two.

To achieve this understanding, we believe that an important step can be taken if we study those productivity drivers, which influence micro- (firm-) level productivity. According to our view, the most important drivers can be found at the operational level.

If we want to explain the relationships between various levels of productivity, we have to disclose very complex causes and effects. In this paper, we have chosen to study the following issues:

- What are the drivers of productivity at the operational level?
- What is the influence of labour productivity growth on company-level business success?
- How do industry- and country-specific factors influence the effectiveness of various productivity drivers?

## 2. Literature review

There are several input resources in a transformation process: labour (at different levels of skills and experience) work on materials; machines operate unattended or facilitate labour's work; and they use energy, information and other services to produce outputs. Among the types of input resources (labour, capital and intermediate, see OECD, 2001), labour productivity plays a particular role. Although the level of capital invested in businesses has increased heavily in the last decades, first in the US and later in other industrialised countries, like Germany or Japan (Van Ark and Pilat, 1993), labour productivity shows even more dynamics. From our point of view, it is particularly important that labour productivity growth absorbs a large part of capital productivity growth. A good example is the high impact of ICT investments on labour productivity growth (Pilat et al., 2002; Brynjolfsson and Hitt, 2003). Gust and Marguez (2004) examined international macro-data to discover relationships between productivity growth and other measures. As they conclude, a more intense use of information technology and a less regulated labour market can lead to a higher increase in productivity growth. The OECD productivity book states (OECD, 2001) that although capital productivity can be measured separately, labour productivity measures incorporate some effects of capital productivity. Others also call attention to the strong relationship between total factor productivity and labour productivity (Bartelsman et al., 2009). Based on these results, we focus our attention exclusively on *labour productivity*.

As for the relationship between the various levels of labour productivity that we wish to examine (operational, business, macro), we have found the following in the literature:

(a) There are some papers that analyse the micro *sources of labour productivity change*, or even productivity change in general,

* Corresponding author. Tel.: +36 14825171; fax: +36 14825567.
*E-mail address:* krisztina.demeter@uni-corvinus.hu (K. Demeter).

0925-5273/$ - see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.ijpe.2010.11.003

in the operations management literature (Wacker et al., 2006; Hayes and Clark, 1986; Haasen, 1996; Gunasekaran et al., 1994; Siebers et al., 2008). Although there are some elements investigated in greater detail, their total contribution to labour productivity has not yet been researched. For example, the effect of team size, the incentive system, including wages and other payments (Conti, 2005; FitzRoy and Kraft, 1995), training (Conti, 2005) and employee participation (Zwick 2004) come up as typical issues.

A previous study (Hoegl, 2005) found that a smaller *team size* increases productive capacity. As the team size increases, individuals have less of an opportunity to contribute, and communication becomes more complex. Although Hoegl could not identify an optimal size, his results show that more than 10 people in a group is definitely less productive than smaller teams. Tohidi and Tarokh (2006) performed quantitative analysis on this issue and supported the idea of smaller teams. However, they added that technological improvements (e.g., the more intense use of ICT, which improves communication) can result in larger, still-productive teams.

The evergreen statement that we do what we measure is true for productivity, as well. Petersen and Snartland (2004) examined 6000 establishments and 165,000 employees in Norway. They found that the *piece-rate wage system* increases productivity by 29% as compared to the time-based systems. However, as Millea and Fuess Jr. (2005) pointed out, piece-rate systems or other rewards can be paid not only for existing productivity gains, but also as an *incentive* to improve labour efficiency. They showed that "pay is both driven by productivity and drives productivity in US manufacturing" (p. 803).

There are other not directly human-related programs at the operational level, however, that can drive labour productivity (Siebers et al., 2008). These programs usually target operational issues, which directly or indirectly also affect how workers have to move, work or think, all of which can influence their productivity.

For example, lean production – with U-shaped streamlined cells, pull production, fewer levels in organisational hierarchy, higher worker autonomy, worker involvement in problem solving and through suggestions systems – can be an important source of labour productivity growth (Crawford et al., 1988; Cua et al., 2001). It improves the way of work and the information flows, as well as direct human matters.

Similar things can be said about quality programs. Total quality management, continuous improvement programs built on worker involvement and on their ideas to improve the way of work as well as applied resources. Although these programs primarily focus on quality, their side effect on labour productivity through better processes, resources and systems as well as through higher worker motivation can be dramatic (Siebers et al., 2008).

As we already discussed, technology developments, such as automation and IT developments, can also have a positive impact on labour productivity (Pilat et al., 2002; Brynjolfsson and Hitt, 2003).

There are the papers that seek explanations for productivity differences through case studies. Hayes and Clark (1986) compared 12 factories in three companies. They identified the following factors that affect total factor productivity the most: (i) capital investment (connected with labour learning), (ii) waste reduction (due to less rejects), (iii) reduction in work-in-process (due to faster product cycle times, or faster feedback about product failures) and (iv) the reduction in confusion stemming from (i)–(iii). These results can be easily connected to the manufacturing programs, such as technology development, lean production or quality improvement programs.

(b) The relationship between labour productivity growth and *business growth* is less clear (Siebers et al., 2008). As total productivity growth means the use of fewer inputs compared to output, theoretically it can be an important factor in change in business success. We assume that labour productivity might also be a good predictor of business growth and leads to success in the long run. This is supported by Haltiwanger et al. (2008) who directly compared revenue-based productivity measures with measures of physical efficiency and found that they are highly correlated. This allows us to investigate the relationship between productivity and the business performance of the company.

However, we cannot forget that an increase in internal productivity is only one side of business success. The other side is that how customers think about products might overrate the effect of productivity achievements. It is enough to think about the effect of the economic world crisis: we can be very productive and competitive if customers do not have money to pay for products or simply do not need it. Therefore, even if the productivity gains are clear, for example when implementing a lean program, its impact on business-level performance is fuzzy (Demeter et al., 2009). Nevertheless, depending on how some contingency factors (e.g. market dynamics, size, resource flexibility) work out, the relationship between productivity and business performance exits.

(c) Labour productivity can depend on several *contingency factors*; we will address country and industry effects here.

Bartelsman et al. (2009) showed significant *cross-country differences* in firm characteristics. The average size of firms, for example, varied widely across sectors and countries. They found that new entrants in high-technology industries have a stronger contribution to productivity growth than new entrants in low-technology industries, leading to industrial differences between any observed countries. Nonetheless the authors also found that the differences between these two groups (firms in high-tech vs. low-tech industries) vary even more significantly across countries.

Following this line of thought, there are several international surveys that aim to compare operations management practices and strategies in various *countries*. Among them, Wacker et al. (2006) studied productivity issues in 16 countries and found that the productivity of resources varies. In some countries, production labour was the most productive resource, whereas in others, it was non-production labour or capital. It shows that the drivers of productivity can be very different in various countries.

An important question is what kind of *industries* we investigate. In Wacker et al. (2006), the small machine tool and non-fashion textile industries were used for the analysis, and researchers did not find significant differences between industries. Whybark (1997) also drew the conclusion that in the production area, country differences seem to be greater than industrial ones. He used the same classification of industries as Wacker (small machine tool and non-fashion textile) to make his statement. According to Pagell et al. (2005), national *culture* is an important predictive factor of labour productivity. They examined how national culture (for example uncertainty avoidance or individuality, see Hofstede, 1980) affects some typical operations decisions, such as supplier per parts, or ratio of export. Based on these results country-wise differences seem to be more important than industry-wise differences.

## 3. The problem and the research model

Business productivity has always been in the forefront of interest from both a macro and a micro point of view, as can be