Firm-Level Productivity and Transport
Evidence from Belgian Manufacturing

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Transportation has often been claimed as an import determinant of productivity and economic growth. Therefore, in the recent decades, there is a wide range of studies focusing on the macroeconomic impacts of transportation equipment or investments on economic growth and productivity (e.g. Gillen et al., 2014). The greater part of this research concludes that improvements in transportation infrastructure affect the firm's performance positively as it improves the firm's logistics and accessibility. The purpose of this analysis is, however, to investigate the microeconomic effects of transportation on the firm's performance. The argument of the European Commission (2006) that logistics, such as transport and storage, account for about 10 to 15 percent of the cost of a finished product is a good case in point.

Our methodology builds on the productivity estimation literature including Olley and Pakes (1996) and Levinsohn and Petrin (2003). Firm-level output is a function of the firm’s productivity – which is unobserved by the econometrician – and its inputs labor and capital. Similar to Levinsohn and Petrin (2003), the unobserved productivity is approximated by a polynomial in both capital and materials, since input choices such as materials hold information about the level of productivity. Over the years, empirical researchers have contributed to this literature on firm-level total factor productivity by investigating the outgoing spillovers of research and development (e.g. Czarnitzki and Thorwarth, 2012), innovation (e.g. Cassiman and Vanormelingen, 2013), energy efficiency (Sahu and Narayanan, 2011), trade (Amiti and Konings, 2007; De Loecker and Warzynski, 2012) ... To the best of our knowledge, we are the first ones to advance this literature by providing evidence for the importance of transport as an input in the firm’s production function. In order to investigate the extent to which firm-level productivity
is affected by its transport use, we propose a two stage procedure. In the first stage, we recover linear predictions for firm-level transport use using the firm’s rolling stock and a sector-specific transport dependency measure given that firm-level transportation data is not available. Although, there is no common opinion on how to include additional input factors other than labor, capital and/or materials into the estimation procedure, we estimate a Cobb-Douglas production in the second stage where the estimated firm-level transport use is included in the polynomial that approximates the unobserved productivity. Seeing that this specification might suffer from double-counting for the reason that firms that belong to sectors that depend heavily on road transport probably have an extensive rolling stock, we subtract the rolling stock from the firm’s capital.

We use comprehensive firm-level accounting data for the period 2007 to 2012 (Bureau van Dijk, 2013) to uncover the total factor productivity for Belgian manufacturing firms. The following variables are included: value-added, turnover, number of employees in full-time equivalent, tangible fixed assets, rolling stock, and material cost. The data set is augmented with a sector-specific use of transport indicator as measured by the annual road freight transport in tonne-kilometers by economic activity of the owner of the vehicle (Eurostat, 2013). We are convinced of the accuracy of this transport measure as a proxy because road transport accounts for more than two thirds of the total freight transport in Belgium (Eurostat, 2013). Moreover, about 20 percent of total transport is operated by the own account (Eurostat, 2013).

The results show evidence that total factor productivity is initially underestimated if the firm’s use of transportation is not controlled for. Using the estimation method proposed by Levinsohn and Petrin (2003), both the elasticities for labor and capital are positively related to the output and statically significant at the 1 percent level, which implies that more labor and capital intensive firms obtain a higher output. We find that a 1 percent increase in the labor force or the capital stock brings about an increase of respectively 0.77 or 0.14 percent in output. Introducing the estimated firm-level transport use as a proxy variable into the Levinsohn and Petrin (2003) estimation approach, the labor and capital elasticities have not noticeably been affected, but the productivity distribution has shifted rightwards. We find evidence for the importance of transport as an input in the production function, since other estimation methods underestimate the firm’s performance. A possible channel through which transport use improves productivity can be that these firms have fewer inventories and can therefore do just in time deliveries. Carrying out a sectoral analysis, we find that for transport intensive industries like the
food sector, transport use is crucial to the firm’s output and its productivity. As a robustness check, we estimate revenue production functions, and see that the results are similar, but not significant.

References


Table 1. Estimation Results of a Cobb-Douglas Value-Added Production Function for Belgian Manufacturing Firms

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1) log $V$</th>
<th>(2) log $V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>log $L$</td>
<td>0.768***</td>
<td>0.780***</td>
</tr>
<tr>
<td></td>
<td>(0.0994)</td>
<td>(0.1311)</td>
</tr>
<tr>
<td>log $K$</td>
<td>0.142***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0257)</td>
<td></td>
</tr>
<tr>
<td>log $R^T$</td>
<td>0.108***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0293)</td>
<td></td>
</tr>
<tr>
<td>log $T$</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>NACE 2-digit Sector FE</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>1,280</td>
<td>1,280</td>
</tr>
</tbody>
</table>

1 Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10.

The dependent variable is log $V$ which represents output measured as value-added. log$L$ represents the number of employees in full-time equivalents, log $K$ the total tangible fixed assets, log $R^T$ the total tangible fixed assets minus the rolling stock, and log $T$ the estimated transport use.

Figure 1. Log Productivity Distribution Obtained as the Residual of a Value-Added Production Function

Remark: The figure shows the log productivity distribution obtained after using the estimation approach proposed by Levinsohn and Petrin (2003). The productivity distribution shifts rightwards firm-level transport use is included in the Cobb-Douglas production function.