IARIW-ESCoE Conference
"Measuring Intangible Assets and Their Contribution to Growth"

Intangible investment, labour composition and productivity

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Research question: How does increased investment in intangibles impact labour composition and productivity at the firm level?

Both the capital stock of intangibles and the investments in intangibles have increased in most countries over time (Thum-Thysen et al., 2019; van Ark et al., 2009; Corrado et al., 2005, 2009). It is not hard to imagine that the current COVID-19 pandemic, if anything, has increased the importance of intangible assets even more, as working at home and purchasing and selling online became more important.

Given the increasing importance of intangible assets, we need to better understand the firm-level implications of these investments. However, the firm-level evidence on intangible assets is still limited. The focus has often been on single assets (R&D or ICT) in R&D or ICT intensive sectors and mainly on large firms. There are only few studies that analyze multiple (or all) intangible assets and productivity at the firm level (See for example Chappell and Jaffe, 2018; Crass and Peters, 2014). Most of the multiple asset studies have revolved around the estimation of the elasticity of the intangible assets and/or correlation regressions (i.e. Bontempi and Maitresse, 2015; Lin and Lo, 2015; Chappell and Jaffe, 2018; Montresor and Vezzani, 2016; Riley and Bondibene, 2018).

When looking at the impact of intangible investment, taking into account both smaller firms and sectoral differences will give a more complete picture. Berlingieri et al. (2018) find that the relationship between firm size and productivity is significantly weaker for the service sectors. This relates to findings of van Heuvelen et al. (2018) that smaller firms also frequently appear on the productivity frontier especially in service sectors. It is highly likely that intangible investments have different effects within different sectors. For example, Bessen (2019) shows that technologically mature industries tend to have a lower elasticity of demand and a weaker or negative employment response to innovation shocks. Also the intangible asset type and amount invested will differ per sector.

Contributions

The main contribution of this project is fourfold: First, we want to estimate the effect of intangible investment on firm-level productivity. Second, we want to assess how intangible investments lead to changes in the composition of the labour input within a firm (i.e. in terms of education/age/type of employees). Third, the scope of the analysis will be broad and cover the universe of non-financial corporations in the Netherlands. This allows us to study whether effects differ between firm sizes and sectors. Four, we adopt the method applied in Bessen and Righi (2019) and Bessen et al. (2019) to establish causal links between intangible investments, labour composition and productivity. By comparing firms with and without spikes in intangible investment, we can identify causal effects.

Approach

The method exploits that investment is a "lumpy" variable, that is investment is observed in spikes (See Olley and Pakes, 1996). Intangible assets have features that aggravate the lumpiness of investment. Firstly, the sunkenness of intangible assets leads to higher uncertainty and irreversibility than that of tangible assets. The sunkenness implies that it is harder to retrieve the investment's cost by selling the created asset. In theory, high uncertainty leads to lumpy behavior when the investment is irreversible and adjustment costs are nonconvex (Pindyck, 1990; Rothschild, 1971).

Secondly, intangible assets are known to have synergies with other (intangible assets and human capital) assets. Synergies arise from complementarities between asset types. Therefore, investing in a single intangible asset will not automatically improve productivity of the firm. Full utilization of intangible assets often requires complementary assets and investments. The synergies between intangible assets should lead to the clustering of investment to maximize the benefits. Therefore, only large intangible investments are expected to lead to observable changes within the firms (Bessen and Righi, 2019).

By applying the methodology of Bessen et al. (2019), we exploit the lumpiness of investment to establish causal links between intangible investments, labour composition and productivity. In their methodology, investment spikes are utilized to signal changes in work processes. A spike is defined as a sudden surge in investment expenditures within one year. Therefore, this spike can be used as a shock to assess how investment affects the labour composition and productivity of the firms. The shock is a firm-specific measure intended to identify intangible investments that are large for the firm. We can estimate a differences-in-differences model for which we match firms with observed spikes in intangible investment with firms in the control group without spikes.

Bessen and Righi (2019) use a similar method, but with a somewhat different identification strategy to evaluate the effect of investments on firm-level outcomes like productivity and the labour share. Bessen and Righi (2019) do not explicitly match observations but attempt to control for unobserved heterogeneity by using a control function approach. In addition, they rely on fixed effects to capture unobserved firm-level heterogeneity. The strategy of Bessen et al.

(2019) seems to identify better by relying on the matching of firms. However, the strategy of Bessen and Righi (2019) demands less from the time-series dimension of the data. For these reasons we aim to apply both methods.

Data

For this paper we use a firm-employee matched dataset that includes all non-financial firms that pay corporate tax in the Netherlands, covering the period 2006-2018. This database includes multiple variables that can be exploited. Firm characteristics include productivity, mark-ups and labour cost shares. Firm-level worker characteristics include age, wage, education, contract type (flexible versus fixed) and firing/hiring dates. In applying both estimation methods, we will include three years before and after the investment spike to allow enough time to observe the changes.

Hypotheses

Firms investing in intangible assets are expected to have more fixed contract workers and higher educated workers as retaining knowledge is more important. Due to synergies between intangible assets and labour inputs, we expect to find changes in the labour composition of firms to coincide with large intangible investment spikes. Moreover, we expect a positive effect on firm productivity. Intangible investments might have different effects across sectors.