OECD Regional Development Working Papers

The geography of Swedish SMEs' investments

Financial constraints across the urban-rural hierarchy in a wealthy country with low regional disparities

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This paper advances our knowledge of the spatial determinants of productivity by empirically demonstrating one such mechanism – clear differences along the urban-rural continuum in the sensitivity of SMEs' investments to own cash flow. Whereas the literature has established uneven availability of credit across space, the evidence on whether this translates into differences in actual business investments remains scarce. We answer this question in the context of Sweden – a highly digitalised country with low regional inequalities. We find that the world of financing is not yet flat for the majority of Swedish SMEs. Companies located in non-metro regions are most dependent on own cash flow in their investments. The results hold for all firms, firms of different sizes, firms operating in low-end services, unaffiliated firms and those belonging to domestic corporations. In contrast, investment – cash flow sensitivity of firms operating in high-tech services and those belonging to a multinational enterprise does not differ geographically. On average, regional investment-cash flow sensitivity is lower in bigger, denser and more educated local labour market regions; it is higher in regions with greater concentration of SMEs.

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Keywords: Sweden, SMEs, financial constraints, urban-rural continuum, access to finance, investment decisions

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1 Introduction

A slow-down of productivity growth and widening subnational disparities in productivity performance in many OECD countries are of increasing policy concern (OECD, 2018[1]). Multiple explanations for these trends are put forth in the literature, from mismeasurement issues to weakening innovation diffusion (Andrews, Criscuolo and Gal, 2016[2]; Keller, 2000[3]). The OECD systematic analyses consistently point to negative productivity effects of insufficient investments, in particular in machinery and equipment (OECD, 2017[4]; OECD, 2019[5]). Business investments, in turn, critically depend on availability of financing. A lack of access to finance could be a major impediment to firms' innovativeness and growth (Alessandrini, Presbitero and Zazzaro, 2009[6]; World Bank, 2015[7]; Heil, 2017[8]). The literature so far paid ample attention to the firm-level sources of uneven finance access (Beck, Demirgüç-Kunt and Singer, 2013[9]) documenting challenges of attracting financing by small, young and otherwise disadvantaged companies.

The spatial dimension of these processes and how they link to *regional* productivity is still not fully understood. The ongoing work only now starts to "unpack" the spatial nature of the productivity determinants that are traditionally studied at the level of firms or industries (Tsvetkova et al., 2020[10]). Among such determinants, access to finance has been shown to vary considerably along the urban-rural continuum (Lee and Luca, 2019[11]; Ughetto, Cowling and Lee, 2019[12]) and appears to influence the amount of local lending (Nguyen, 2019[13]; Gustafsson, Manduchi and Stephan, 2019[14]). Whether this poses challenges for firms' investments, however, remains an open question. Some observers point to the increasing tradability of financial services, which may imply that firms have increasing possibilities to tap into capital markets outside of the place of their location. If this is the case, the technology may be "breaking the tyranny of distance" (Petersen and Rajan, 2002, p. 2535[15]) and local access to finance can become irrelevant for business investments and regional productivity growth in the developed countries.

We assess whether this is the case in Sweden, a world leader in digitalisation (OECD, 2018[16]) including among SMEs (OECD, 2019[17]) and a country characterised by high living standards and low interregional inequality (OECD, 2018[18]). To do so, we estimate the sensitivity of investments made by Swedish firms to their own cash flow. The rationale is that greater reliance on internal financial resources signals difficulties of securing external funding and may limit the ability of companies to engage in innovative and productivity-enhancing activities. Most importantly, we test whether the cash flow sensitivity differs along the urban – rural hierarchy using two types of regional groupings, the OECD classification of TL3 regions based on urbanization, density and agglomeration access (Fadic et al., 2019[19]) and a more traditional population-based classification of (smaller than TL3) Swedish functional/local labour market regions (large cities, medium-sized cities and rural areas).

Despite the recent evidence that access to finance becomes less of a challenge for the small companies in the OECD countries (OECD, 2019[20]), we find that firms in Sweden do face financial constraints and their investment behavior changes systematically along the urban-rural hierarchy. The severity of the constraints is the highest in rural areas. The findings are robust with regard to size, sectors (manufacturing[1] and low-end services) and "local" ownership structure (domestic corporation or independent firm) of SMEs. Firms whose activities or ownership structure allow them to transcend the spatial dimension (high-end services and companies belonging to a multinational enterprise or MNE) do not display geography-related

[1] Only in regional classification based on labour market areas.

differences in their investment behavior when it comes to reliance on own cash flow. Our results imply that the world of financing is yet not flat for the majority of SMEs and geography matters for their investment behavior.

To further probe our results, we estimate cash flow sensitivities for local labour market regions and then assess how these correlate with a set of basic regional characteristics. We find that the estimated average cash flow sensitivity of firms is negatively associated with the size of regional labour market, its density and human capital. In addition, the average cash flow sensitivity of firms is higher in regions with higher density of SMEs. The link is insignificant for the banking sector concentration measured by the share of banking employment and by the total number of bank branches in a region.

This analysis advances our knowledge of the spatial determinants of productivity by empirically demonstrating one such mechanism, namely pronounced geographical differences in the ability of SMEs to finance their investments externally. While the literature has already established highly uneven availability of credit across space, the evidence on whether this translates into differences in business investment strategies remains scarce. The example of Sweden – a country that has comparatively low regional inequality and is by international standards highly digitalised – reinforces our conclusion on the importance of geography for productivity-enhancing investment decisions by SMEs.

Another contribution of this research is to offer evidence on the spatial frictions in capital markets and investment cash flow sensitivities for firms. While most existing research on these issues focuses on larger listed companies, our analyses use data on non-listed SMEs. Given the role of smaller enterprises in employment and employment growth (Tsvetkova, Partridge and Betz, 2019[21]), this is an important business population to consider. As firm size distribution differs along the urban-rural continuum, research that elucidates the determinants of small business performance can inform efficient place-based policy strategies to mitigate obstacles to growth of both smaller firms and non-central regions.

2 Geography, access to finance and business performance

Availability of finance has long been linked to economic growth. The literature suggests that financial systems contribute to economic performance of firms and regions via allocating capital, investment monitoring, facilitating diversification and management of risks, mobilising savings and easing exchange of goods and services (Levine, 2005[22]). At the firm level, financial pressure was shown to be negatively linked to labour productivity potentially due to the inability of financially constrained companies to invest (Ferrando and Ruggieri, 2018[23]). As firms' competitiveness and growth prospects increasingly depend on adoption of recent technologies, the ability to finance innovation becomes an important factor of business success. While firm-level determinants of uneven capital access are well-documented (North, Baldock and Ekanem, 2010[24]), the geographical origins of these variations are still not well understood.

More than 15 years ago, Pollard (2003[25]) observed that financing is a black box in economic geography. Focusing on small firms in particular, the author calls for more research into the role of geography in access to finance and the resultant differences in development. The importance of geography for financing choices of firms comes from three main observations: (1) the firms tend to be place-bound, which is even more so for smaller firms; (2) economic relations, including those related to financing, are social in nature, which means physical proximity and interactions are important and (3) the financial relations by nature are asymmetric (Pollard, 2003[25]).

Another stream of research document pronounced differences in availability of finance across space and the differing access to financing for SMEs and start-ups in particular (Ughetto, Cowling and Lee, 2019[12]). Intuitively, companies located in remote regions are likely to lack access to finance enjoyed by their counterparts in larger cities. Yet, the disadvantages related to a location outside of a central region could be declining in the last decades, as technological advances allow for remote access and offer new mixes of financing mechanisms (Mills and McCarthy, 2016[26]; Petersen and Rajan, 2002[15]; Ughetto, Cowling and Lee, 2019[12]). Rapid innovation in information and communication technologies (ICT) and credit scoring coupled with increasing tradability of financial services may potentially break the "tyranny of distance" (Petersen and Rajan, 2002, p. 2535[15]), making the world of (small business financing) flat.

Despite these processes, it appears that even in developed countries, the world of financing is not yet flat and distance still matters. In Sweden, presence of local bank branches was found to be linked to the availability of credit for SMEs. During 2000-2016, increasing distance to nearby commercial bank offices was linked to higher interest rates and smaller loan amounts (Kärnä, Manduchi and Stephan, 2020[27]). In the US, closures of bank branches led to decrease in local small business lending (Nguyen, 2019[13]). A review of evidence for the UK suggests that a firm's location plays an important role in the ability to access finance (Brown, 2018[28]), although it is not clear whether it is the effect of location or of firm characteristics (Lee and Drever, 2014[29]). Nevertheless, there is evidence that UK SMEs in remote and less vibrant areas are more likely to utilise suboptimal financing strategies, such as the use of credit cards (Brown, Liñares-Zegarra and Wilson, 2019[30]).

Moving to the link between financing and innovation, availability of financing is an important prerequisite for business investments in new technologies (Heil, 2017[8]), although spatial variations in both credit

access and innovative performance differs across countries. Fritsch and Wyrwich (2020[31]) show that innovation activities in Germany are spatially decentralised in a sense that a significant portion of patent applications is attributed to firms located in non-urban regions. Germany with its lack of clear-cut divergence in patenting along the urban-rural continuum appears, however, an exception. One explanation for this pattern is a relatively good local access to finance in non-urban regions in Germany (Fritsch and Wyrwich, 2020[32]). In countries with prominent differences in the financing availability along the urban-rural hierarchy, however, innovation is a phenomenon firmly linked to the size or density of a place (Bettencourt, Lobo and Strumsky, 2007[33]; Duranton and Puga, 2001[34]; Arbesman, Kleinberg and Strogatz, 2009[35]). In Sweden, companies located farther away from banks report that funding innovation is more challenging (Backman and Wallin, 2018[36]).

Three important observations follow from the existing literature. First, financing opportunities are still disproportionally concentrated in large cities across the world (with very few exceptions). As a result, companies located in larger cities are less likely to perceive access to finance as a pressing concern (Lee and Luca, 2019[11]). Second, credit supply is related to the local availability of financial institutions, i.e. recent technological development of the sector has not been able to eliminate the importance of distance. Finally, geographical variation in the local financial markets maturity is indeed related to the ways companies fund their activities (Zhao and Jones-Evans, 2017[37]; Brown, Liñares-Zegarra and Wilson, 2019[30]).

In Sweden, despite relatively high digitalisation (41% of Swedish SMEs had access to high-speed broadband in 2018 and the country is a leader in ICT training offered to employees by SMEs (OECD, 2019[17])), the penetration of digital banking (or fintech) is relatively low (Bertsch and Rosenvinge, 2019[38]). Academic literature finds that companies located farther away from banks and those in areas with fewer banks experience greater difficulties in obtaining external financing for innovative activity (Gustafsson, Manduchi and Stephan, 2019[14]). In Italy, firms in the South, which lags behind in economic performance compared to the North of the country, appear to be more reliant on cash flow for their growth (Donati and Sarno, 2015[39]).

This evidence is important; however, it does not offer insights in the mechanism of the relationship between cash flow and innovations. The literature also mostly focuses on regions defined by the presence of financial institutions or on larger regions within a country ignoring the urban-rural continuum. This paper fills these gaps.

3 Measuring investment-cash flow sensitivity of non-listed firms

In perfect capital markets with no frictions, investments should be independent from how the investment is financed (Modigliani and Miller, 1959[40]). However, going back to Fazzari, Hubbard and Petersen (1988[41]), there is a large literature on financial frictions and capital market imperfections, which demonstrates that investments are not independent from the source of financing. Fazzari et al. (1988[41]), for example, find that firms facing financial constraints relay more heavily on cash flow (see Hubbard (1998[42]) for a review of the literature). External capital is costlier due to both the transaction costs associated with raising it and information asymmetries (see, for example, Myers and Majiuf (1984[43])).

Hubbard (1998[42]) derives the following empirical investment model: $\frac{I_t}{K_t} = a_i + bQ_{it} + c\frac{CF_{it}}{K_{it}} + \varepsilon_{it}$, where *I* stands for investments, *K* is capital, *Q* is the Tobin's Q and *CF* is cash flow. Assuming that Q adequately controls for investment opportunities, we expect *c* to be equal to zero if capital markets are perfect. If *c* is positive, this indicates imperfect capital market where firms are subject to financial constraints. Focusing on large companies, Kaplan and Zingales (1997[44]) argue that cash flow may be a poor measure of capital market imperfections and that cash flow may be capturing investment opportunities. Their study have in turn been criticised by Fazzari, Hubbard, Petersen (1988[41]) who defend investment-cash flow sensitivity measures. In our case, however, we focus on spatial variations in cash flow sensitivity across SMEs and identify differences between small and medium firms in different regions operating in similar industries.

Most studies of cash flow – investment sensitivity rely on the market to book measures of Tobin's Q to control for investment opportunities. These measures, however, restrict the sample of firms to only listed companies, which is a serious limitation due to the prevalence of the non-listed companies in the economy.

Since it is not possible to obtain a measure of the Tobin's Q in the non-listed firms, we have to rely on other measures to control for investments opportunities. To this end, we use a method based on the capital stock adjustment principle (also known as an accelerator approach). The accelerator model is based on the assumption that the capital stock is proportional to output and, thus, investments respond to growth in output. Our model is similar and theoretically linked to the model used by Hubbard (1998[42]) and others, but we control for investment opportunities using an accelerator instead.

At each point in time, the output of a firm can be assumed to be proportional to the capital stock:

$$Y_t = (\frac{1}{k})K_t^* \qquad \text{Equation 1}$$

where K_t^* is the desired capital stock given the level of output and *k* is the capital coefficient (i.e. capital – output ratio). For simplicity, we assume that the desired level of capital is equal to the actual level of capital. This means that net investments, NI_t, $(K_t - K_{t-1})$ are proportional to the changes in the desired capital stock, $K_t^* - K_{t-1}^*$.

Net investments, *NI*, can, thus, be expressed as:

$$NI_t = \lambda(Y_t - Y_{t-1})$$ **Equation 2**

If $K_t^* = K_t$, k = λ. This equilibrium assumption is typically not fulfilled, which we will return to

$$I_t = \delta K_{t-1} + \lambda \Delta Y_t$$ **Equation 3**

Dividing by K_{t-1} we get:

$$\frac{I_t}{K_{t-1}} = \delta + \lambda \frac{\Delta Y_t}{K_{t-1}}$$ **Equation 4**

Remembering that $K_t^* = kY_t$, we can rearrange and obtain:

$$\frac{I_t}{K_{t-1}} = \delta + \lambda^* \frac{\Delta Y_t}{Y_{t-1}}$$ **Equation 5**

where $\lambda^* = \lambda/k$, which is the elasticity of the capital stock with respect to output. For empirical purposes, this equation is useful since it achieves normalization. Note that the assumption of $K_t^* = K_t$ implies that $k = \lambda$ and that the elasticity of the capital stock, $\lambda^* = 1$.

If there are adjustment costs of the capital stock, which is typically the case, the adjustment towards the desired capital stock is partial ($\lambda^* < 1$) in each period implying $K_t^* \neq K_t$ and that investments in period *t* will depend on multiple lags of Y.

Fazzari, Hubbard and Petersen (1988[41]) argue that firms who are unable to respond to investment opportunities and adjust towards desired capital stock will depend on cash flow for their investments ($I_t = f(CF_t)$). Following Fazzari, Hubbard and Petersen (1988[41]) and Hubbard (1998[42]), we incorporate cash flow, *CF*, into Equation (5). Thus, we use the following base-line equation:

$$\frac{I_t}{K_{t-1}} = \delta + \beta_1 \frac{CF_t}{K_{t-1}} + \lambda^* \frac{\Delta Y_t}{Y_{t-1}} + \varepsilon_t$$ **Equation 6**

4 Hypotheses, data and empirical estimation

In more developed financial markets, it is easier for companies to attract external financing. As a result, companies are less likely to be financially constrained. This conjecture has found abundant empirical support in the international literature that looks at country-level data (Giannetti, 2003[45]; Khurana, Martin and Pereira, 2006[46]; Love, 2003[47]). Although *within* countries variation in the maturity of the local and regional financial markets is less pronounced, differences between large cities and rural areas are still sizable. Regions in the developed countries differ substantially in terms of both concentration (amount) of the available credit and the variety of financing mechanisms available to companies (Lee and Luca, 2019[11]; Grilli, 2019[48]). As financial markets are the most developed in large urban areas, hence

H1a. Investment – cash flow sensitivity is lowest in urban areas, ceteris paribus.

The cash flow in rural and less vibrant areas is likely to be lower on top of generally weaker availability of external financing opportunities. Thus, we expect to observe the highest investment-cash flow sensitivity in rural and remote areas.

H1b. Investment – cash flow sensitivity is highest in rural and/or most remote areas, ceteris paribus.

To test the hypotheses developed in this paper, we use register firm-level panel data that cover all unlisted Swedish SMEs (companies with 10-249 employees) in manufacturing and services for the period 2003-2015 in the private sector (the financial sector is excluded). These data are audited and maintained by Statistics Sweden[2]. The firm-level statistics include balance sheet information such as value-added, sales, number of employees (average number of full-time equivalents in each year), investments and gross profits. The data also include a 5-digit industry classification of each firm as well as a spatial identifier indicating the municipality of main operations of the firm. To separate between independent unaffiliated firms and firms that are a part of domestic corporate groups and multinational corporations, we merge firm-level data with corporate register which, for each firm, provides information on whether an individual firm is independent (unaffiliated with a corporate group) or belongs to either a domestic corporate group or an MNE. In total, we have over 275 000 firm-year observations and about 50 000 unique firms in the dataset[3].

Equation 7 shows empirical specification, which follows from the theoretical discussion:

$$Investments_{it} = \alpha + \beta_1 CashFlow_{it} + \beta_2 SalesGrowth_{it} + \beta_3 FE_t + \beta_4 FE_s + \beta_5 [FE_s * FE_t] + \varepsilon_{it} \quad \text{Equation 7}$$

Where $Investments_{it}$ stands for firm *i*'s investments in year *t* as a fraction of its capital in the previous year ($Investments_{it} = \frac{I_{it}}{K_{it-1}} = \frac{K_{it}-K_{it-1}}{K_{it-1}}$). To derive a measure of investments as well as the capital stock for each

[2]Practically, the data are accessed through a remote desktop connection system provided by Statistics Sweden (www.scb.se/mona).

[3] For comparison, there are about 300 firms listed on Stockholm Stock Exchange.

firm, we use accounting data on fixed total assets. Investments in year *t* are measured as the change in fixed total assets between years *t* and *t*-1 and, following the theoretical model in Equation (6), are standardised by capital stock in the previous year measured by fixed total assets. The resulting value for each firm is used as the dependent variable.

The two main independent variables are cash flow measured as operating profits before depreciation in year *t* normalized by the capital stock in *t-1*[4] and sales expressed as the percentage change in the net turnover between *t* and *t-1.* All variables are in nominal Swedish kronor (SEK). The model also includes three sets of dummy variables. Annual time effects, FE_t, account for cyclical fluctuations that affect all firms equally. Industry-level fixed effects, FE_s factor out the influence of the technological characteristics and other industry-level invariant attributes for the firms that change their industrial affiliation[5]. The year-industry interaction fixed effects $FE_s * FE_t$ control for industry-specific shocks that affect firms in our sample over time.

The role of geography can be assessed in several ways. One is to estimate Equation 7 separately by type of a region. Such approach would allow for a preliminary evidence on potential differences but is unable to prove statistically significant differences in investment – cash flow sensitivity across types of regions because estimation would be performed on separate groups of firms. An alternative approach, used in this paper, is to include interaction terms between the cash flow variable and types of a region along the urban-rural continuum.

Two regional classifications are used in this paper. The first one is developed by the OECD Centre for Entrepreneurship, SMEs, Regions and Cities (Fadic et al., 2019[19]). This classification groups TL3 (small) administrative regions based on metropolitan population, density and remoteness from urban areas. Metropolitan regions (those with more than half of population living in functional urban areas of at least 250 000 residents) are broken into large metro and metro. Non-metropolitan TL3 regions can be remote, with access to a metro or with access to a small/medium city. There are 21 TL3 regions in Sweden; only one is classified as large metro (and three more as metro). There is also only one TL3 region classified as having access to metro; the remaining regions are split between non-metro remote and non-metro with access to small/medium city. For the purposes of this paper, three broad regional types are used, metro (combining large metro and metro regions), non-metro with access (combining two types of non-metro regions with access to any agglomeration) and non-metro remote.

Although TL3 regions are 'small' by some standards, they are still quite big in Sweden and often do not coincide with the boundaries of economic activity clusters. Local labour markets is a regional delineation specifically designed to overcome such a limitation. We, thus, also use an alternative classification of regions. Firms are grouped as operating within large city regions, within medium-sized city regions and within rural areas. Large city regions consist of all municipalities that belong to Stockholm, Göteborg or Malmö local labour markets.[6] Medium-sized city regions are local labour markets around such cities as Linköping, Jönköping, Örebro, Växjö, Luleå and Umeå. Countryside or rural areas comprise municipalities belonging to smaller and remote local labour market regions. Out of all Swedish municipalities, 84 (29%)

[4] In order to reduce the impact of outliers, we winsorize all three variables using the winsor module in STATA (Cox, 2006[51]). This module takes the non-missing values of a variable and generates a new variable identical except that the fraction *p* of the highest and fraction *p* of the lowest values are replaced by the next value counting inwards from the extremes. We implement this command with *p* set to 0.1.

[5] The dummy accounts for the fixed effects associated with change in the industrial affiliation because Equations (7a) and (7b) is estimated using fixed effects panel regression, which factors out firm-level invariant characteristics including time-invariant industry effects.

[6] Local labour market regions consist of municipalities that form an integrated local labour market and are delineated based on data on inter-municipal commuting flows. We use a delineation developed by Statistics Sweden that identify 72 local labour market regions in Sweden.

are classified as belonging to large city regions, 121 (42%) to mid-sized regions and 85 (29%) as countryside.

We estimate Equation (8) using the OECD regional classification. Equation (8) differs from Equation (7) by the inclusion of two interaction terms of the cash flow measure with regional type indicator. $NonMetroWithAccess$ is a dummy variable that takes on value of one if a firm is located in a TL3 region classified as non-metro region with access to agglomeration, i.e. to metro or large metro region. $NonMetroRemote$ is a dummy variable indicating a firm located in a region classified as non-metro remote. Metro regions are an omitted (reference) category.

$$Investments_{it} = \alpha + \beta_1 CashFlow_{it} + \beta_2 SalesGrowth_{it} + \beta_3[CashFlow_{it} * NonMetrowAccess_i] + \beta_4[CashFlow_{it} * NonMetroRemote_i] + \beta_5 FE_t + \beta_6 FE_s + \beta_7[FE_s * FE_t] + \varepsilon_{it}$$

Equation 8

where subscript *i* refers to a firm and subscript *t* to a year. The set of fixed effects is as described above. The equation is estimated using fixed effects panel regression with robust standard errors.

For the labour market-based specification, $NonMetroWithAccess$ is replaced with an indicator variable that takes the value of one if a firm is located in a municipality belonging to a medium-sized city. The $NonMetroRemote$ indicator in Equation (8) is replaced with a dichotomous variable, which indicates if a firm is located in a rural municipality.

To gain more detailed insights into possible differences in investment responses of different types of companies, we repeat estimation separately for groups of firms with certain attributes. We separately consider companies that are small (10-49 employees) and larger (50-249 employees), as well as firms within various sectors (manufacturing, low-end services, high-end services) and by ownership structure (unaffiliated, a part of a national corporation, a part of a multi-national enterprise).

Table 4.1 offers summary statistics for dependent and independent variables, as well as for main groups of firms (the mean shows the fraction of firms by attribute), for the whole sample and by three regional types based on the OECD classification.

Table 4.1. Summary statistics for the variables used in estimation

Variable	All regions				Metro regions			
	Mean	Standard Deviation	Minimum	Maximum	Mean	Standard Deviation	Minimum	Maximum
Net investments (I_t/K_{t-1})	0.060	0.403	-0.544	0.932	0.058	0.421	-0.544	0.932
Cash flow (CF_t/K_{t-1})	1.693	2.642	-0.509	8.641	1.922	2.843	-0.509	8.641
Sales (dS_t/S_{t-1})	0.085	0.214	-0.349	0.532	0.087	0.218	-0.349	0.532
High-end services	0.150	0.357			0.190	0.392		
Low-end services	0.640	0.480			0.656	0.475		
Manufacturing	0.190	0.392			0.138	0.345		
MNE	0.230	0.421			0.271	0.445		
Domestic corporation	0.381	0.486			0.361	0.480		
	Non-metro regions with access to metro				Non-metro remote regions			
	Mean	Standard Deviation	Minimum	Maximum	Mean	Standard Deviation	Minimum	Maximum
Net investments (I_t/K_{t-1})	0.059	0.380	-0.544	0.932	0.065	0.373	-0.544	0.932
Cash flow (CF_t/K_{t-1})	1.433	2.369	-0.509	8.641	1.294	2.195	-0.509	8.641
Sales (dS_t/S_{t-1})	0.081	0.209	-0.349	0.532	0.082	0.209	-0.349	0.532
High-end services	0.099	0.298			0.085	0.279		
Low-end services	0.596	0.491			0.632	0.482		
Manufacturing	0.282	0.450			0.252	0.434		
MNE	0.190	0.392			0.153	0.360		
Domestic corporation	0.419	0.493			0.402	0.490		

Note: Number of observations is 275 480 for all regions; 163 808 for metro regions; 49 326 for non-metro regions with metro access and 62 346 for non-metro remote regions.
Source: Aggregation from data by Statistics Sweden.

Table 4.1 shows that, on average in our sample, an individual firm invests about 6% of the value of its total assets[7]. There is quite significant variation in this measure across companies (the variable is dispersed with the standard deviation exceeding the mean). In terms of firm groupings accounted in this analysis, the breakdown along the urban-rural continuum following the OECD classification is 60% of companies are located in metro regions; about 18% of firms are in non-metro counties with access to agglomeration and 22% in non-metro remote counties. According to an alternative classification, 54% of firms are located in large cities; 32% are in medium-sized city regions and the rest are in the rural areas.

The majority of firms are in the low-end services (64%) with remaining firms split between manufacturing (19%) and high-end services (15%)[8].Concentration of firms in high-tech services clearly follows the rural-urban hierarchy with the share of such companies in metro regions being more than twice as high as in rural remote regions. Manufacturing firms are the most concentrated in non-urban regions with access to agglomerations. Concentration of low-end services exceeds 60% in both metro and non-metro remote regions. Nationally, 23% of all firms are a part of a MNE and about 38% belong to a national group. MNEs

[7] The mean value of net investments appear rather close to the value of the cash flow variable, which is not uncommon as reported by other studies (Fazzari, Hubbard and Petersen, 1988[41]), although there are systematic differences across industrial sectors.

[8] High-end services include knowledge-intensive business services and other more advanced services (NACE 2-digit 58-75). Low-end services include Wholesale and Retail trade as well as other less advanced services (NACE 2-digit 41-56 and 77-96). Less than 2 % of the firm-year observations in the data refer to firms that are not classified to these service industries or manufacturing. These firms are not part of the estimations by industry.

tend to be more prevalent in more agglomerated regions, while companies belonging to a domestic corporation are more concentrated in outside of metro areas.

In the second step of the analysis, we explore potential explanations for the observed differences in the firm-level cash flow sensitivity of investments along the urban-rural continuum. The literature so far seems to offer only one predominant explanation for what can account for the regional differences in the investment – cash flow sensitivity. As documented by the existing research, the presence of banks (or other lending institutions) in the area is likely to increase credit supply that can be used by local firms. While this explanation is highly plausible, other alternative mechanisms may be at play. For example, the ability of local entrepreneurs to reach out for financing beyond their region likely depends on the educational levels and extra-regional networks of the SME owners, managers and employees. An alternative explanation comes from the presence of agglomeration economies. SMEs located in larger areas may be better prepared to seek financing within or outside of their region due to knowledge spillovers and other agglomeration-related factors. On the other hand, a high density of SMEs can translate into intensified competition for local financing, which may result in companies relying more on internal resources as a result.

We perform a preliminary check by calculating average investment – cash flow sensitivity for each labour market region and correlating it with selected regional characteristics. These characteristics are: size of a region (log of employment), agglomeration economies (employment density per square kilometre), human capital (share of population with a college degree), banking sector concentration (share of employment in the banking sector and the number of bank branches), manufacturing concentration (share of employment in manufacturing), services concentration (share of employment in services), and SME concentration (share of employment in SMEs).

We have to note, however, that the data do not allow testing these explanations rigorously and to establish causal relationship. Instead, we perform preliminary checks, which may suggest the starting points for future more detailed analyses. Most importantly, we seek to determine whether geography still plays a role in explaining business investment decisions after we carefully factor out firm-level, industry-level and national economy-level fixed effects.

5 Estimation results and discussion

Firm-level estimates

We first describe the empirical results of the firm-level models. Table 5.1 shows estimation coefficients and robust standard errors (in parentheses) derived from Equation 8 (estimation based on the OECD classification of regions).

Table 5.1. Estimation results (OECD classification of regions)

Dependent variable: Investments normalised by capital stock in preceding period.

	All firms	Small firms	Larger firms	Manufacturing	Low-end services	High-end services	Unaffiliated	MNE	Domestic corporation
Cash flow	0.045***	0.046***	0.048***	0.055***	0.046***	0.041***	0.051***	0.041***	0.050***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Sales	0.157***	0.147***	0.172***	0.079***	0.179***	0.147***	0.171***	0.132***	0.118***
	(0.004)	(0.005)	(0.012)	(0.008)	(0.006)	(0.012)	(0.007)	(0.009)	(0.007)
NM with access	0.004***	0.006***	-0.014***	0.007**	0.004***	-0.001	0.006***	0.002	0.005**
	(0.001)	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
NM remote	0.006***	0.005***	0.011***	0.001	0.006***	0.001	0.005**	0.005	0.005**
	(0.001)	(0.001)	(0.004)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.002)
Observations	275 480	237 689	37 791	52 232	176 317	41 282	107 312	63 338	104 830
R-sq.	0.073	0.074	0.084	0.068	0.074	0.071	0.091	0.073	0.078

Note: Significance levels: *** - 0.01; ** - 0.05; * - 0.1. Fixed effects regression with robust standard errors in parentheses. The models include year, industry and industry-year fixed effects. Small firms are those with 10-49 employees; larger firms are those with 50-249 employees.

The first important observation that follows from the table is that, after controlling for the growth in sales and an exhaustive set of fixed effects, the variable *Cash flow* is highly statistically significant for all groups of firms regardless of the size, sectoral affiliation or ownership status. [9] The coefficient (which can also be interpreted as a measure of reliance on own cash flow to fund investments) tends to be the lowest in metro regions (the interaction terms are mostly positive and statistically significant signalling higher reliance on own cash flow in non-metro TL3 regions). The estimated coefficient increases along the urban-rural hierarchy for all firms. For various groupings of firms, changes in investment – cash flow sensitivity mostly follow the dichotomous urban-rural divide (for small, low-end services, unaffiliated firms and firms belonging to a domestic corporation) or an individual pattern. For example, estimation results suggest that there are no differences along the urban-rural continuum for high-end services and companies, which are affiliated with multi-national corporations. Investment behaviour of these groups of companies (at least

[9] One needs to keep in mind that the reported coefficients, which may appear small, are average *firm-level annual* estimates, which translate into a sizable amount when aggregated. The estimates can also be interpreted as elasticity, indicating an average increase in investments in response to increase in cash flow (as percentage of capital stock).

when it comes to reliance on cash flow), does not change geographically. Larger firms (50-249 employees) located in TL3 non-metro regions with access to agglomerations enjoy the lowest sensitivity, while sensitivity of manufacturing firms in rural remote regions is no different from sensitivity of those located in metro regions.

The analysis above has uncovered significant differences in investment behaviour of Swedish SMEs located in metro regions and the non-metro ones. Yet, one would expect a more consistent decrease in investment – cash flow sensitivity with proximity to agglomeration if geography indeed plays a role as hypothesised. A lack of such smooth decrease in the reported results may be an artefact of a large size of the administrative units (counties or TL3 regions) used in the analysis, which are often considerably larger than the functional areas defined by flows of economic activity in Sweden.

To assess whether a consistent increase in investment – cash flow sensitivity is observed with degree of urbanisation, we use types of local labour regions to capture the urban-rural hierarchy. These regions (described in Footnote 6), which align closer with patterns of economic activity in Sweden, are grouped by their population into large cities, medium-sized cities and rural areas. Table 5.2 shows the estimation results.

Table 5.2. Interaction estimation results (classification by size of labour market regions)

Dependent variable: Investments normalised by capital stock in preceding period

	All firms	Small firms	Large firms	Manufacturing	Low-end services	High-end services	Unaffiliated	MNE	Domestic corporation
Cash flow	0.045***	0.045***	0.048***	0.055***	0.045***	0.041***	0.050***	0.041***	0.050***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001))
Sales	0.157***	0.147***	0.172***	0.078***	0.178***	0.147***	0.171***	0.132***	0.118***
	(0.004)	(0.005)	(0.012)	(0.008)	(0.006)	(0.012)	(0.007)	(0.009)	(0.007))
Medium-sized city	0.005***	0.006***	-0.005	0.003	0.005***	-0.001	0.006***	0.003	0.005***
	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)
Rural	0.008***	0.008***	0.012**	0.009**	0.006***	0.005	0.008***	0.007*	0.007**
	(0.002)	(0.002)	(0.005)	(0.004)	(0.002)	(0.005)	(0.003)	(0.004)	(0.003)
Observations	275 480	237 689	37 791	52 232	176 317	41 282	107 312	63 338	104 830
R sq.	0.073	0.074	0.084	0.068	0.074	0.071	0.091	0.073	0.078

Note: Significance levels: *** - 0.01; ** - 0.05; * - 0.1. Fixed effects regression with robust standard errors in parentheses. The models include year, industry and industry-year fixed effects. Small firms are those with 10-49 employees; larger firms are those with 50-249 employees.

The table clearly demonstrates a decreasing investment – cash flow sensitivity with the size of a region. Along the urban rural continuum, companies in urban areas appear to rely the least on cash flow in their investment behaviour and companies located in rural areas rely the most. This patterns is observed for all subsamples of firms except for high-end services and MNEs where investment – cash flow sensitivity does not change geographically, the patterns that also emerges in Table 5.1. For the subsamples where it does change, sensitivity of companies located in medium-sized cities falls in between those of firms in urban and rural areas with the exception of manufacturing and large firms whose investment – cash flow sensitivity is not statistically different in large and smaller cities. It appears manufacturing and large firms are able to secure external funding equally well in urban settings but such ability is diminished in rural environments.

Regional estimates

As the second step, we calculate average investment – cash flow sensitivity measures (β_1 in Equation (7)) for each functional region in Sweden (56 total)[10]. To derive regional values, we estimate Equation (7) separately by region. Given that the model accounts for firm-level, industry-level and business cycle fixed effects, one would expect to obtain estimates of sensitivity that are unrelated to regional characteristics should geography play no role. To ascertain that this is not the case, we correlate the estimates with several regional characteristics that can plausibly be linked to the investment behaviour of SMEs. Table 5.3 shows correlation coefficients and indicates those significant at the 95% level with an asterisk.

The table attests that geography still matters. After factoring out all invariant firm-level, industry-level and industry-specific annual shocks, the level of the average investment – cash-flow sensitivity in a region is negatively correlated with its size (the coefficient of -0.5 is significant at the 0.95 level). This implies that investments of companies located in smaller regions depend on own cash flow considerably more compared to their counterparts located in larger regions. The sensitivity also tends to be higher in places with lower employment density and lower levels of human capital. Noteworthy is a relatively low and statistically insignificant correlation coefficient for the banking sector presence. Average investment – cash flow sensitivity tends to be higher in regions with greater shares of employment in SMEs.

Table 5.3. Correlations between regional measure of sensitivity and regional characteristics

	Investment-CF sensitivity	Size of a region	Employment density	Human capital	Banking concentration, employment share	Banking concentration, number of branches	Manufacturing concentration	Services concentration	SME concentration
Investment-CF sensitivity	1.0000								
Size of a region	-0.5142*	1.0000							
Employment density	-0.3331*	0.7626*	1.0000						
Human capital	-0.3681*	0.8691*	0.6854*	1.0000					
Banking concentration, employment share	-0.2499	0.3680*	0.5086*	0.4277*	1.0000				
Banking concentration, number of branches	-0.2246	0.6553*	0.8834*	0.6756*	0.6375*	1.0000			
Manufacturing concentration	-0.0948	-0.2120	-0.2330	-0.4406*	-0.4239*	-0.3077*	1.0000		
Services concentration	-0.1547	0.4377*	0.5311*	0.4881*	0.6241*	0.5535*	-0.7447*	1.0000	
SME concentration	0.4575*	-0.4209*	-0.3163*	-0.2747*	-0.1460	-0.2216	-0.1448	-0.0225*	1.0000

Note: * indicates statistical significance at the 0.95% level.
Source: Own calculations based on Statistics Sweden data.

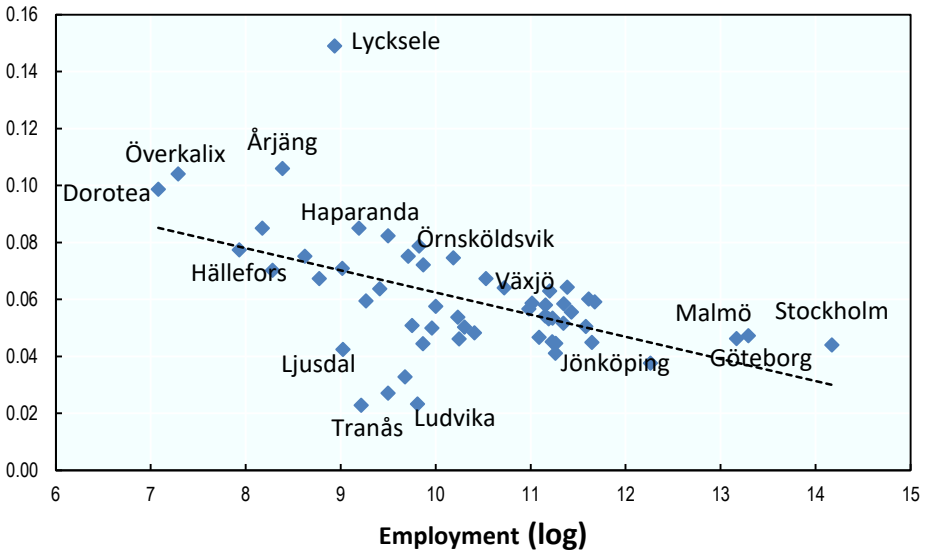
Figures below plot average regional investment – cash flow sensitivity against statistically significant regional characteristics in Table 5.3. Plots of the relationship between the remaining regional characteristics in Table 5.3 and investment – cash flow sensitivity are given in Appendix A. Noteworthy

[10] For some regions estimates could not be obtained due to a small number of observations.

from these plots is that banking sector concentration, the main explanation for the geographical differences in credit constraints proposed in the literature, appears very weakly correlated with the investment – cash flow sensitivity. The slope of the fitted line in Figure A.1 and Figure A.2 is relatively small (much smaller than for size of a regions, its agglomeration level or educational attainment) and the corresponding coefficients in Table 5.3. are statistically insignificant.

Figure 5.1 shows average regional β_1 estimates against size of a region measured by the log of total employment. There is a clear downward trend consistent with regression estimation results. Investments of companies located in largest urban centres, such as Stockholm, Göteborg and Malmö, depend on own cash flow the least. On the other extreme, firms in smaller places like Dorotea, Överkalix, Årjäng and Lycksele depend on own cash flow the most.

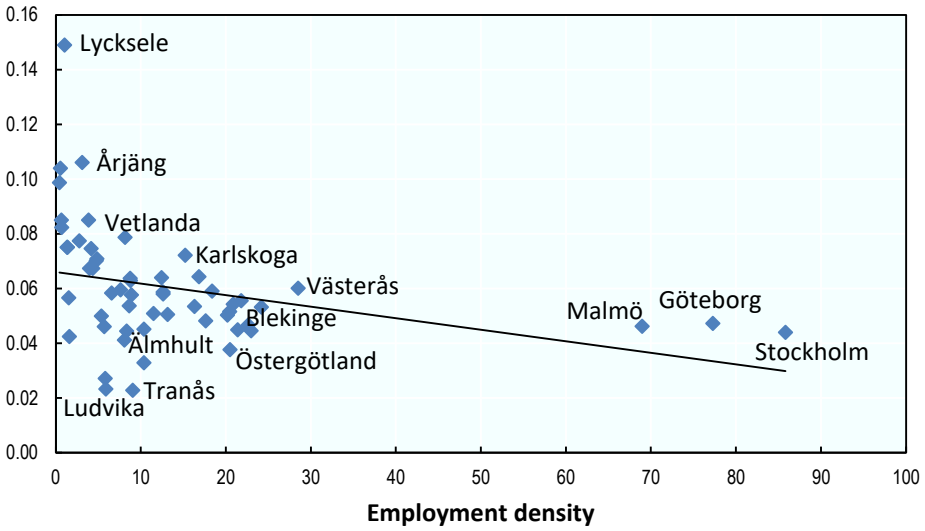
Figure 5.1. Average investment – cash flow sensitivity against size of a region



Source: Own calculations based on Statistics Sweden data.

Figure 5.2 shows the relationship between the average investment – cash flow sensitivity in a region and the degree of agglomeration measured by employment density. As expected, reliance on own cash flow (when it comes to investments) decreases in more agglomerated regions, which indicates that business investments are less likely to be constrained in more urbanised areas.

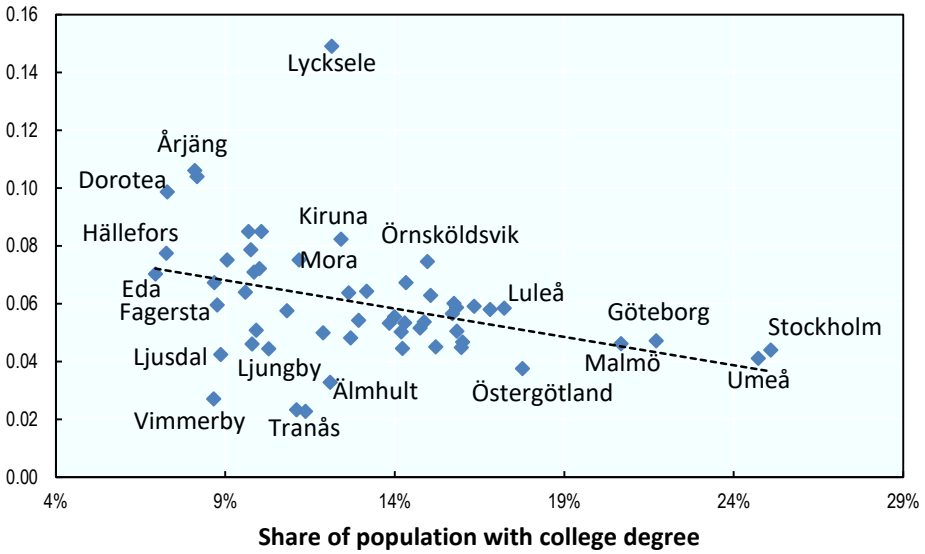
Figure 5.2. Average investment – cash flow sensitivity against level of agglomeration



Note: Employment density is measured by the number of employees per square kilometre of land area.
Source: Own calculations based on Statistics Sweden data.

Figure 5.3 plots the relationship between regional investment – cash flow sensitivity and the level of human capital. There is also a clear downward trend suggesting that in regions with a larger share of population who has a college degree, companies depend on own resources less in their investments. The opposite holds true for places where the level of human capital is relatively low. Places with large universities such as Stockholm, Umeå, Göteborg and Malmö tend to have lower values of investment – cash flow sensitivity.

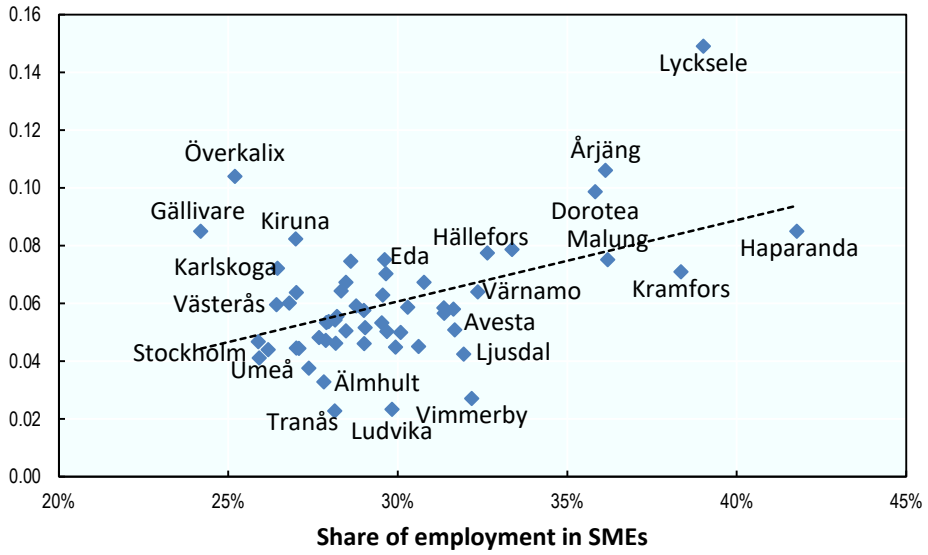
Figure 5.3. Average investment – cash flow sensitivity against level of human capital



Source: Own calculations based on Statistics Sweden data.

Lastly, we inspect the relationship between the regional investment – cash flow sensitivity and SME concentration in a region. As follows from Figure 5.4 and Table 5.3, there is a clear positive link. Firms in regions with a greater share of employment in small and medium enterprises appear to fund their investments from the cash flow more compared to companies in regions where SMEs are less prevalent.

Figure 5.4. Average investment – cash flow sensitivity against SMEs concentration



Source: Own calculations based on Statistics Sweden data.

Recap and conclusions

Productivity of regional economies is important for local living standards, economic resiliency and future prospects. Yet, the OECD regions differ widely in their productivity, and sometimes more so within countries than across countries. The quest to better understand productivity determinants from a subnational perspective is gaining momentum.

A more established, sector-level international research consistently points to the importance of investments for productivity. Investments are also shown to be important for regional productivity performance (Gal and Egeland, 2018[49]). The ability of companies to invest in R&D and other productivity-enhancing activities critically depends on availability of financing. This is especially the case for small and medium-sized enterprises, whose own resources tend to be limited compared to larger corporations.

Existing research demonstrates that there are sizable differences in the availability of financing across space and there is some evidence that SMEs in remote and smaller areas find it harder to access finance even in countries with more developed financial markets. The literature generally does not, however, link location and access to finance to investment behaviour of SMEs. A possible explanation can be that, as banking and finance become an increasingly tradable sector, new forms of financing tailored to a variety of business segments emerge and digitalisation offers a promise of a flat financing world where distance does not matter.

To test whether subnational geography matters for the investment decisions of SMEs, we turn to the recent experience of Sweden, a country with relatively small interregional differences and a high level of SME digitalisation. It offers an ideal test-bed – intuitively, geographical disparities in investment behaviour are least likely to exist in the context of a country like Sweden.

Using data on all unlisted small and medium companies in manufacturing and services over 2003-2015, we empirically assess whether their investments depend on own cash flow. Higher dependence would indicate external financial constraints[11]. Our main contribution comes from estimating the investment – cash flow sensitivity along the urban-rural continuum. Investments of companies in the most urban (or largest) centres are the least dependent on own cash flow and they are the most dependent in (remote) rural areas. This conclusion remains generally unchanged for firms of various sizes, those belonging to different sectors or with different ownership structure (with a notable exception of the high-end services and SMEs, which are a part of an MNE).

Our findings clearly show that as access to agglomerated economies decreases, financial constraints faced by the SMEs increase. SMEs outside of vibrant urban areas, in a sense, have to overcome a double hurdle. Their investment ability depends on own cash flow more but revenues in smaller regions tend to be smaller too – implying that the cash flow is likely to be lower. As a result, SMEs in smaller and more remote places would find it harder to invest and, as a consequence, to stay up-to-date on recent

[11] Whilst for large companies, equating higher investment-cash flow sensitivity to greater financing constraints might not be justified (Kaplan and Zingales, 1997[44]), it is generally the case for SMEs in Europe (Mulier, Schoors and Merlevede, 2016[50]).

technological developments and to improve productivity performance. The fact that such a consistent pattern of increasing investment-cash flow sensitivity is clearly observable in Sweden, one of the least regionally unequal countries, only reinforces the importance of considering the spatial dimension in productivity analysis and policies.

A targeted policy response, however, should rely on additional research[12]. The analysis presented in this paper only discovers the presence of consistent spatial variation but its design is not able to identify the causes. SMEs in smaller regions can be more financially constrained for a variety of reasons, from unavailability of credit to inability to secure needed funding due to various circumstances to a lack of interest in innovation. Sectoral/industrial composition of a region can also influence both the degree of dependence on own cash flows in individual SME investment behaviour and regional differences in investment – cash flow sensitivity. The results of our analysis, however, indicate that there is space for improvement of investment (and productivity) performance in Swedish SMEs outside of urban/metro regions by helping them overcome reliance on own cash flow.

[12] A carefully crafted firm-level survey can shed additional light on the obstacles faced by companies along the urban-rural continuum. Some general insights can be obtained from the Swedish Community Innovation Survey.

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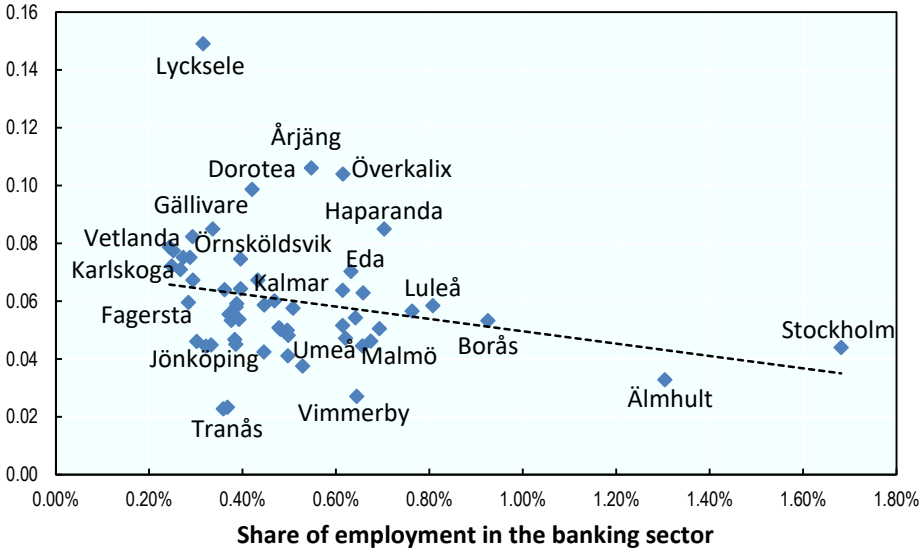
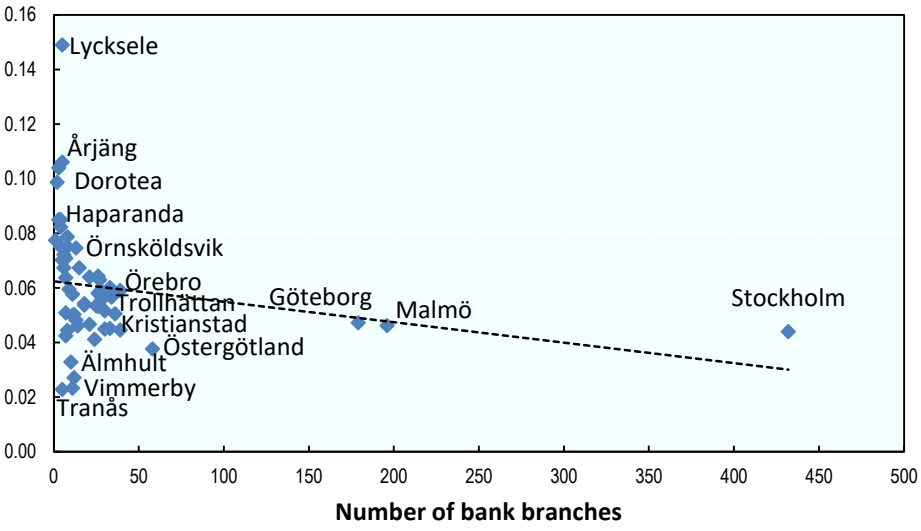
Annex A. Plots of average investment – cash flow sensitivity and sectoral concentration in a region

Figure A.1. Average investment – cash flow sensitivity against banking sector concentration



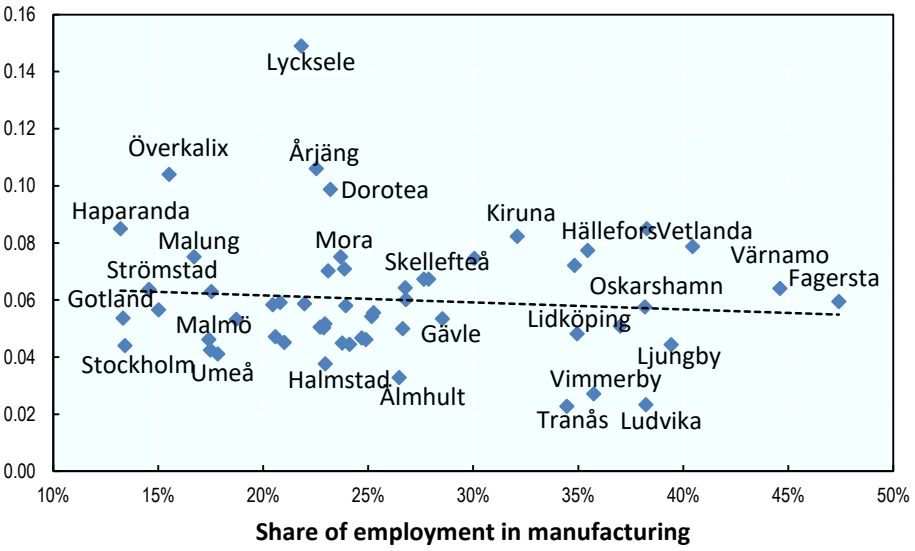
Source: Own calculations based on Statistics Sweden data.

Figure A.2. Average investment – cash flow sensitivity against the number of bank branches



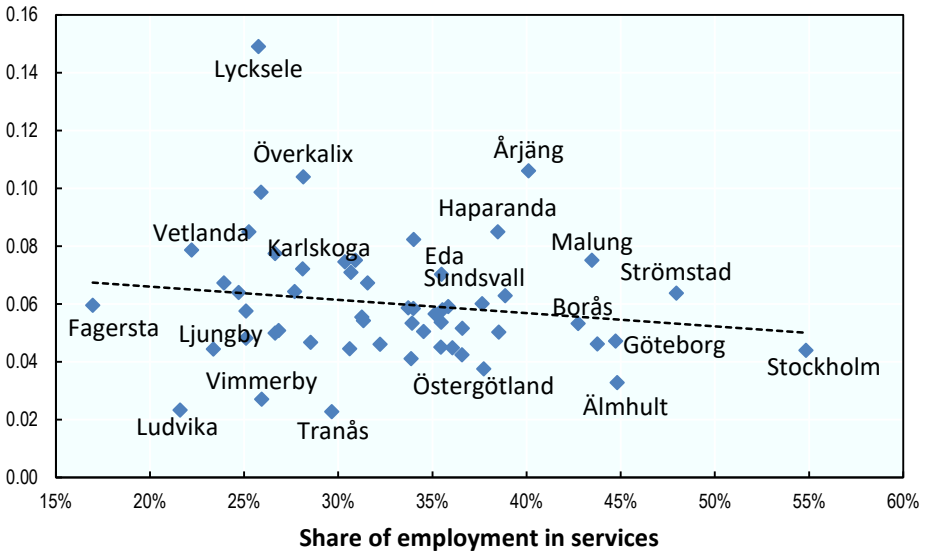
Source: Own calculations based on Statistics Sweden data.

Figure A.3. Average investment – cash flow sensitivity against manufacturing concentration



Source: Own calculations based on Statistics Sweden data.

Figure A.4. Average investment – cash flow sensitivity against services concentration



Source: Own calculations based on Statistics Sweden data.