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Spatial variations in financial constraints of SMEs—evidence from firm-level estimates of investment-cash flow sensitivities in Sweden

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Abstract It is well established that there is uneven availability of credit across space, in particular for SMEs. The evidence on whether this translates into differences in actual business investments remains scarce. We assess this question by using firm-level data for Swedish firms and estimate the extent to which the average investment-cash flow sensitivities of firms vary across the urban–rural hierarchy. 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.

Plain English Summary We show that small- and medium-sized enterprises (SMEs) located outside the main city regions are more dependent on internal cash flow in their investments compared to SME urban city regions. Our findings clearly show that, as access to agglomerated economies decreases, financial constraints faced by the SMEs increase. The investment ability of SMEs in rural regions 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, therefore, to grow or increase productivity. 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 policies targeted at closing SME financing gap.

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1 Introduction

Small and medium enterprises (SMEs) are in many ways the backbone of modern economies. They account for the lion's share of employment and gross value added in both developed and developing countries. Their share in total firm count universally exceeds 95%. In Sweden, SMEs account for 99.9% of the total number of firms, 65% of employment and 62% of the total value added (European Commission, 2019). Besides their contribution to economic activities, SMEs are central to reducing disparities, broadening innovation and driving regions and nations towards Sustainable Development Goals (Rao et al., 2021). As SMEs often lag in productivity, closing productivity gaps in this population of firms can contribute to reverse the slowing down of the national productivity growth observed in the developed countries after the turn of the millennium.

Despite their prominent position, SMEs tend to be disadvantaged compared to larger companies. Due to their smaller size, limited resources and other constraints, SMEs often fail to live up to the expectations of multiple positive effects associated with this group of firms. While the list of challenges faced by SMEs is quite long, access to finance is perhaps the most pressing one (Rao et al., 2021). Inability of SMEs to access finance can hamper their investment and growth opportunities. As a result, SMEs might not be able to increase their productivity, diversify their offer and scale up production when demand surges.

An important attribute of SMEs is their embeddedness in local and regional economies. SMEs are the closest to the needs and conditions of a specific territory as they constitute "the economic fabric" of a place. This makes SMEs the natural target of local economic development policies. While overcoming some disadvantages of SMEs with policy interventions might be hard (e.g. firm size), helping small and medium enterprises to access finance appears considerably more amenable to policy action. Mitigating SMEs' financing constraints can help these companies grow and strengthen their contribution to local, regional and national economies. Yet, the design of policies to alleviate finance constraints of SMEs is not straightforward given this business population's vast heterogeneity. The conditions faced by SMEs undoubtedly depend on industry, product and other aspatial factors but the mostly local nature of SMEs means that they are sensitive to local and regional conditions. This sensitivity is likely to be stronger if SMEs are stand-alone firms and if they operate in the non-tradable sectors.

Existing research on financing constraints and financing decisions of SMEs, however, mostly focuses on firm-, product-, industry-level and macroeconomic and legal environments (Beck et al., 2013; Moritz et al. 2016; Rao et al., 2021) and pays relatively limited attention to regional variations. This is despite the fact that geographical variation in access to finance is well documented (Lee & Luca, 2019; Ughetto, Cowling and Lee, 2019). The literature also shows that such variation does indeed translate in differences in the amount of local lending available to firms (Nguyen, 2019; Gustafsson, Manduchi and Stephan, 2019).

Whether this poses challenges for firms' investments (and, by extension, for their ability to increase their productivity and employment), 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 & Rajan, 2002, p. 2535) 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, 2018a, 2018b, 2018c) including among SMEs (OECD, 2019a, 2019b) and a country characterised by high living standards and low interregional inequality (OECD, 2018a, 2018b, 2018c). 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 grow. Most importantly, we test whether the cash flow sensitivity differs along the urban–rural hierarchy using classification of 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, 2019a, 2019b), we

find that firms in Sweden do face financial constraints and their investment behaviour 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 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 differences in their investment behaviour when it comes to reliance on own cash flow. Our results imply that the world of financing is yet not flat for most SMEs and geography matters for their investment behaviour.

To further probe our results, we estimate average cash flow sensitivities of firms in different local labour market regions and then assess how these average sensitivities 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 a 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 makes two important contributions. First, it shows that SMEs' access to finance does play a role in their investment decisions. Second, the subnational dimension (urban–rural hierarchy) is an important factor that influences SMEs' finance access (and, as a consequence, their investments). 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 growth-enhancing investment decisions by SMEs. The clear spatial dimension of the SME credit constraints documented in this paper complements the large body of research work that looks at financing decisions and access to finance for SMEs but limits its focus to firm-, product-, industry-level and microeconomic characteristics. Especially when it comes to designing policies, place-based approach appears better suited to respond to the local and regional needs of SMEs including in the area of access to finance. Clearly understanding the spatial dimension of this process can contribute to more efficient policy design.

2 SME financing: why, how and where

The literature on SME financing pays close attention to the SME financing gap and the crucial role that external finance plays in SMEs' success. While it is widely recognised as a problem that needs policy attention (Boschmans & Pissareva, 2018; Koreen et al., 2018), on average, the gap in developed countries is less severe compared to the rest of the world (OECD, 2006). In the developed countries, the often cited consequences of the SME financing gap include lower than the potential investment and innovation as well as lower employment and productivity growth rates (OECD, 2006; OECD, 2021; Ferrando & Ruggieri, 2018; Heil, 2017; Eldridge, 2021; Martinez-Cillero et al., 2020).

Bridging the gap requires solid knowledge of the actual ways small and medium enterprises fund their activities including investments and of the reasons for a suboptimal use of external funding. Within the research strand that builds this knowledge, the studies most broadly fall within a "firm" or an "environment" perspective. The firm perspective is generally concerned with SME financing decisions and the link between characteristics or activities of a firm, its owner(s) or manager(s) and choices of finance sources. The environment perspective studies the conditions within a firm's industry, location or other "external" factors and how they shape availability of finance together with the mixes of financing that the firms end up relying on.

On the "firm" side, for example, past research has documented that young and small firms are disadvantaged when it comes to securing bank financing due to a lack of experience and a track record of success or of a suitable collateral (North et al., 2010). Female entrepreneurs tend to be less growth-oriented and more risk-averse (Kepler & Shane, 2007; van Hulten, 2012), which may translate into lower demand for external financing, although the evidence on such demand is inconclusive (compare Cole et al., 2021 to van Hulten, 2012, for instance). Overconfidence of the owners, on the other hand, can harm financing prospects in SMEs but there is an optimal level, which increases the likelihood of external financing and is associated with more favourable financing conditions (Cole et al., 2021).

When it comes to the "environment" perspective on SME financing gap (to which this study contributes), the literature points to 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). 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 & McCarthy, 2016; Petersen & Rajan, 2002; Ughetto, Cowling and Lee, 2019). 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 & Rajan, 2002, p. 2535), 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, the presence of local bank branches was found to be linked to the availability of credit for SMEs. A study by Kärnä, Manduchi and Stephan (2020) shows that an increasing distance to nearby commercial bank offices is linked to higher interest rates and smaller loan amounts. In the USA, closures of bank branches led to decrease in local small business lending (Nguyen, 2019). 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), although it is not clear whether it is the effect of location or of firm characteristics (Lee & Drever, 2014). 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 et al., 2019).

In terms of the link between availability of financing and SME performance, academic literature reveals 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) or more generally report that funding innovation is more challenging for them (Backman & Wallin, 2018). 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 & Sarno, 2015).

A related line of inquiry explores the effects of non-traditional financing for SMEs, for example, equity crowdfunding as well as various support schemes that are available to small and medium firms. Eldridge et al. (2021) focus on SMEs in the UK and find that using crowdfunding is not linked to innovation in small firms but does improve their growth prospects. A detailed study of the practices and the impacts of Credit Guarantee Schemes and Mutual Guarantee Societies covering OECD member countries and non-OECD economies shows a countercyclical use of these policy instruments to ease access of SMEs to financing (Cusmano, 2018). Acknowledging the diversity of practical applications and the outcomes, the study concludes that the schemes are generally successful in mobilising large amounts of funds for SMEs and improving access to finance, although at the expense of a potentially higher risk exposure of this group of companies.

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 such as Germany, see Fritsch & Wyrwich, 2020a, 2020b). As a result, companies located in larger cities are less likely to perceive access to finance as a pressing concern (Lee & Luca, 2019). 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. 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, 2019a, 2019b)), the penetration of digital banking (or FinTech) is relatively low (Bertsch & Rosenvinge, 2019). Finally, geographical variation in the availability of finance is indeed related to the ways companies fund their activities (Zhao & Jones-Evans, 2017; Brown et al., 2019).

This evidence is important; however, it often does not explain if variation in availability of finance is linked to SMEs' investment decisions. The literature also mostly focuses on regions defined by the presence of financial institutions (for example, bank branches) or on larger regions within a country ignoring the urban–rural continuum. This paper addresses these gaps.

3 Investment-cash flow sensitivity of non-listed firms

In perfect capital markets with no frictions, investments should be independent from sources of financing (Modigliani & Miller, 1959). However, there is a large literature on financial frictions and capital market imperfections, which demonstrates that investments depend on how they are financed. Fazzari et al. (1988), for example, find that firms facing financial constraints relay more heavily on cash flow (see Hubbard (1998) 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)).

Hubbard (1998) 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) argue that cash flow may be a poor measure of capital market imperfections and that cash flow may be capturing investment opportunities. Their study has in turn been criticised by Fazzari, Hubbard and Petersen (1988) 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 must 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 assumes 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) 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:

$$Y_t = (\frac{1}{k})K_t^* \tag{1}$$

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, $\mathrm{NI_t}$, $(K_t - K_{t-1})$ are proportional to the changes in the desired capital stock, $K_t^* - K_{t-1}^*$.

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

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

If $K_t^* = K_t$, $k{=}\lambda$. This equilibrium assumption is typically not fulfilled, which we will return to:

$$I_t = \delta K_{t-1} + \lambda \triangle Y_t \tag{3}$$

Dividing by K_{t-1}, we get:

$$\frac{I_t}{K_{t-1}} = \delta + \lambda\frac{\triangle Y_t}{K_{t-1}} \tag{4}$$

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

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

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 normalisation. 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) 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) and Hubbard (1998), we incorporate

cash flow, *CF*, into Eq. (5). Thus, we use the following base-line equation:

$$\frac{I_t}{K_{t-1}} = \delta + \beta_1 \frac{CF_t}{K_{t-1}} + \lambda^* \frac{\triangle Y_t}{Y_{t-1}} + \varepsilon_t \quad (6)$$

4 Hypotheses, data and empirical models

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; Khurana et al., 2006; Love, 2003). Although within countries variation in the maturity of the local and regional financial markets is less pronounced, differences between large cities and rural areas can be 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 (Grilli, 2019; Lee & Luca, 2019). As financial markets are the most developed in large urban areas, investment-cash flow sensitivity should be lowest in urban areas and highest in rural areas, keeping everything else constant (H1). Additionally, SMEs that are more likely to be able to tap into credit markets outside of their location (for example those belonging to a Multinational Enterprise or those operating in high-tech sectors) should be less sensitive to own cash flow in investment decisions (H2).

To test the hypotheses, 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.[1] 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.[2]

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

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

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 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 Eq. (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* normalised by the capital stock in *t*-1 and sales expressed as the percentage change in the net turnover between *t* and *t*-1.[3] 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.[4] The year-industry interaction fixed effects $FE_s * FE_t$ control for industry-specific shocks that affect firms in our sample over time.

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

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

[3] In order to reduce the impact of outliers, we winsorize the variables using the winsor module in STATA (Cox, 2006). 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.

[4] The dummy accounts for the fixed effects associated with change in the industrial affiliation because all models are estimated using fixed effects panel regression, which factors out firm-level invariant characteristics including time-invariant industry effects.

The role of geography can be assessed in several ways. One is to estimate Eq. 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 (see Eq. 8).

Regional classification is performed using local labour markets.[5] 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. 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%) are classified as belonging to large city regions, 121 (42%) to mid-sized regions and 85 (29%) as countryside.

Equation (8) is the main empirical model and differs from Eq. (7) by the inclusion of two interaction terms of the cash flow measure with regional type indicator. *MediumCity* is a dummy variable that takes on value of one if a firm is located in municipality belonging to a labour market of a medium-sized city. *Rural* is a dummy variable indicating a firm located in a rural municipality. *Large regions* are an omitted (reference) category.

$$Investmentsitalpha + \beta_1 CashFlow_{it} + \beta 2SalesGrowth_{it} + \beta_3[CashFlow_{it} * MediumCity_i] + \beta_4[CashFlow_{it} * Rural_i] + \beta_5 FE_t + \beta_6 FE_s + \beta_7[FE_s * FE_t] + \varepsilon_{it} \quad (8)$$

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.

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 multinational enterprise).

Table 1 Summary statistics for the variables used in estimation

Variable	Mean	Standard deviation	Minimum	Maximum
Net investments (I_t/K_{t-1})	0.060	0.403	−0.544	0.932
Cash flow (CF_t/K_{t-1})	1.693	2.642	−0.509	8.641
Sales (dS_t/S_{t-1})	0.085	0.214	−0.349	0.532
High-end services	0.150	0.357		
Low-end services	0.640	0.480		
Manufacturing	0.190	0.392		
MNE	0.230	0.421		
Domestic corporation	0.381	0.486		

The number of observations is 275,480

Table 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.

On average in our sample, an individual firm invests about 6% of the value of its total assets.[6] 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, 54% of firms are located in large cities, 32% are in medium-sized city regions and the rest are in the rural areas (not reflected in the table for brevity). The majority of firms are in the low-end services (64%) with remaining firms split between manufacturing (19%) and high-end services (15%).[7]

[5] 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.

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

[7] 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.

We supplement the main part of our analysis (testing H1 and H2) with an exploration of 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[8]), manufacturing concentration (share of employment in manufacturing), services concentration (share of employment in services) and SME concentration (share of employment in SMEs).

We must 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 Results

5.1 Firm-level estimates

We first describe the empirical results of the firm-level models. Table 2 shows the estimation coefficients and robust standard errors (in parentheses) derived from Eq. 8.

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, which are the omitted categories (the interaction terms for the medium-sized cities and rural regions are mostly positive and statistically significant signalling higher reliance on own cash flow in these two groups of regions compared to large cities). The table clearly demonstrates a decreasing investment-cash flow sensitivity with the size of a region. This pattern is observed for all subsamples of firms except for high-end services and MNEs where investment-cash flow sensitivity does not change geographically.[10] 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 except for manufacturing and large firms whose investment-cash flow sensitivity is not statistically different in large and smaller cities. It appears manufacturing and large firms can secure external funding equally well in urban settings, but such ability is diminished in rural environments.

[8] Bank concentrations are a number of bank branches in a region (NACE Rev. 2, 5 digit code 64,190).

[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).

[10] This result is consistent with evidence derived from using an alternative classification (OECD TL3) of regions as reported in Andersson at al. (2020).

Table 2 Fixed effects estimation results. Dep. 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))
Cash flow* 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)
Cash flow* 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

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

5.2 Regional estimates

As the second step, we calculate average investment-cash flow sensitivity measures (β_1 in Eq. (7)) for each functional region in Sweden (56 total).[11] To derive regional values, we estimate Eq. (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 plays 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 3 shows correlation coefficients and indicates those significant at the 95% level with an asterisk.

The table attests that geography 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. The average investment-cash flow sensitivity tends to be higher in regions with greater shares of employment in SMEs. There is a statistically insignificant correlation for the banking sector present, whereas the correlation between cash flow sensitivity and shares of employment in the major sectors (manufacturing and services) is low and statistically insignificant.

Figures 1, 2, 3 and 4 plot average regional investment-cash flow sensitivity against statistically significant regional characteristics in Table 3.[12] Figure 1 shows the 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 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

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

[12] Plots of the relationship between the remaining regional characteristics in Table 3 and investment-cash flow sensitivity are given in Figs. 7 and 8 in the Appendix.

Table 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

* indicates statistical significance at the 0.95% level

regions, which indicates that business investments are less likely to be constrained in more urbanised areas.

Figure 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, Blekinge, Jönköping, Göteborg and Malmö tend to have lower values of investment-cash flow sensitivity.

We also inspect the relationship between the regional investment-cash flow sensitivity and SME concentration in a region. As follows from Fig. 4 and Table 3, there is a clear positive link. Firms in regions with a greater share of employment in small

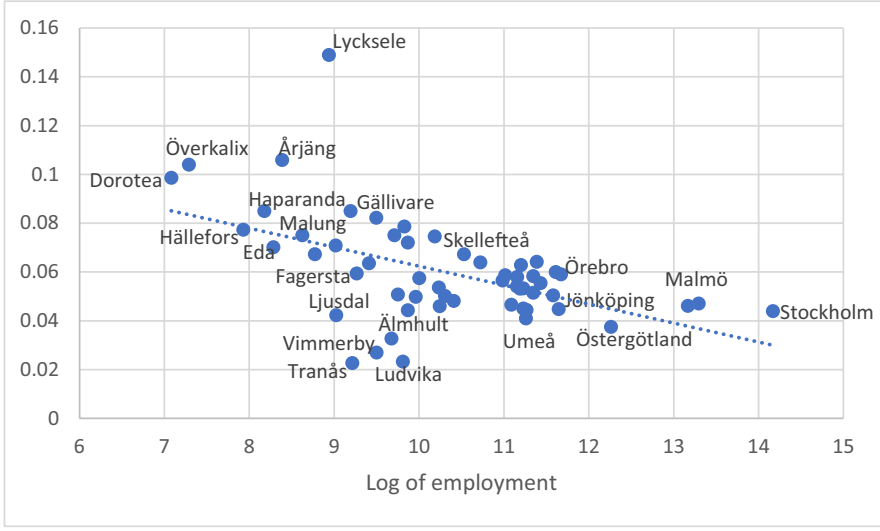

Fig. 1 Average investment-cash flow sensitivity against size of a region

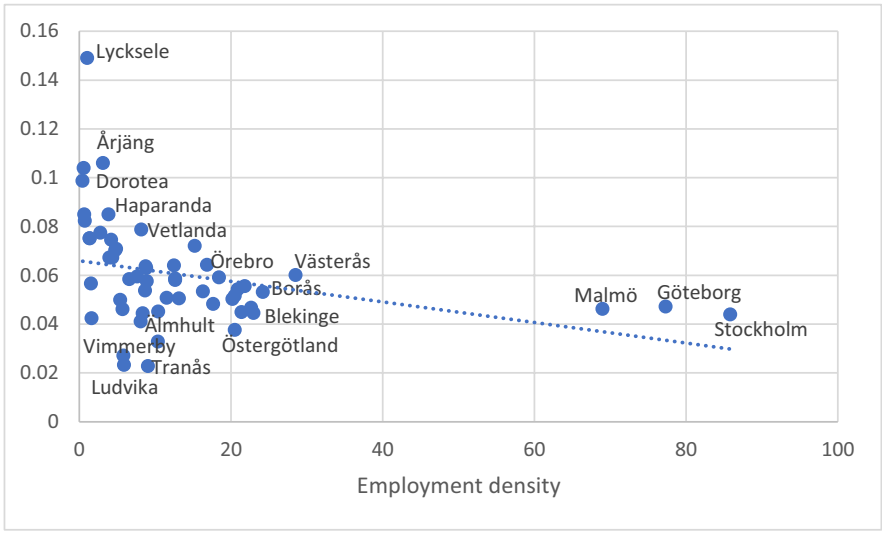

Fig. 2 Average investment-cash flow sensitivity against level of agglomeration. Note: Employment density is measured by the number of employees per square kilometre of land area

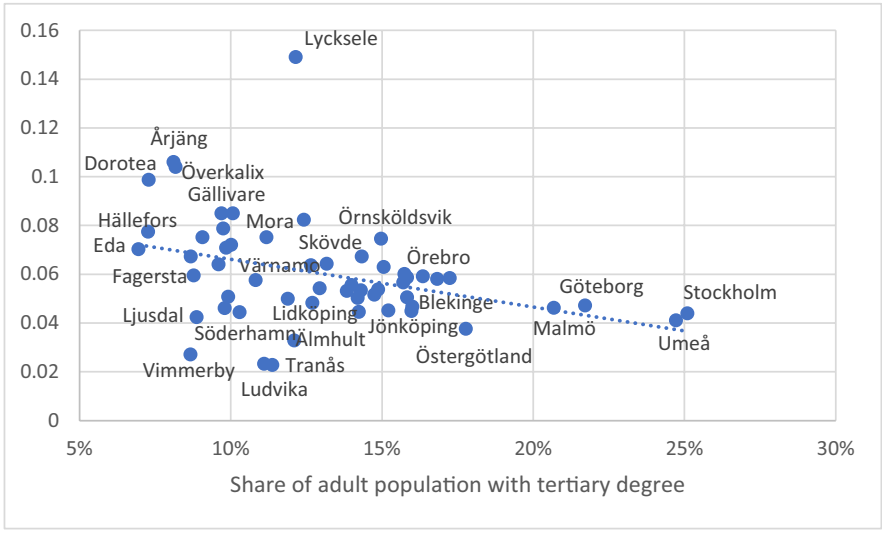

Fig. 3 Average investment-cash flow sensitivity against level of human capital

and medium enterprises appear to fund their investments from the cash flow more compared to companies in regions where SMEs are less prevalent.

In the next step, we look at the link between investment-cash flow sensitivity and banking sector concentration, something that the literature on SME financing has paid very close attention to. Banking sector intensity (in terms of the number of branches, their proximity or shares of employment) is considered in the literature as a main explanation for the geographical differences in credit constraints. This variable, however, is insignificant in the correlation analysis reported in Table 3, which is confirmed by a relatively small slope in the Figs. 5 and 6 (compared

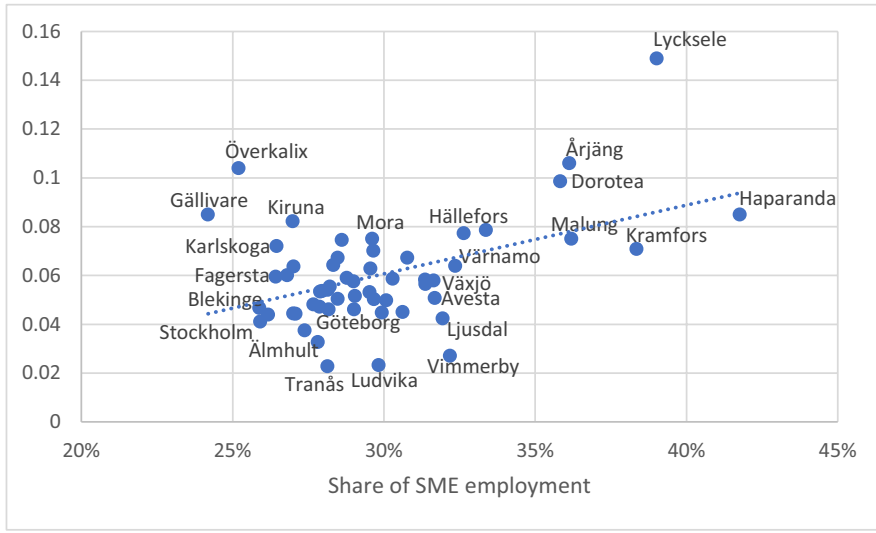

Fig. 4 Average investment-cash flow sensitivity against SMEs concentration

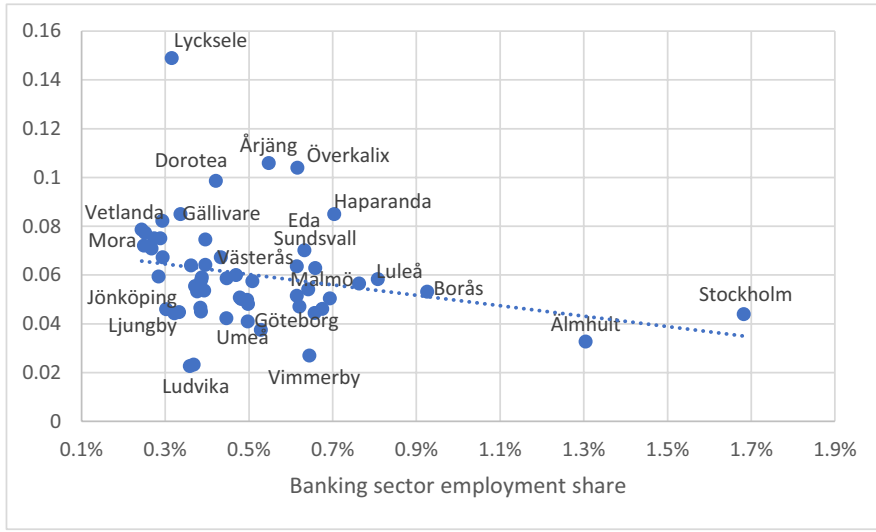

Fig. 5 Average investment-cash flow sensitivity against banking sector employment share

to the relationships shown for the levels of agglomeration and educational attainment).[13], [14]

6 Conclusions and discussion

Existing research demonstrates that there are sizable differences in the availability of financing across space and there is 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.

[13] We also ran a regression analysis for the regional estimates, which includes bank concentration. The coefficient is significant at 10% but when adding regional size, this effect becomes insignificant. We conclude that we do not have sufficient variation in the data to disentangle regional size effects from bank concentration. We also observe a decline in local banks in Sweden from 2002 and onwards. We are unable to detect any significant effects of this decline. There is a (weak) correlation between bank offices and cash flow sensitivities shown in Fig. 6. The correlation is mostly driven by high bank concentration in Stockholm, which also has a low cash flow sensitivities.

[14] Plots for shares of employment in manufacturing and services are provided in Figs. 7 and 8 in the Appendix.

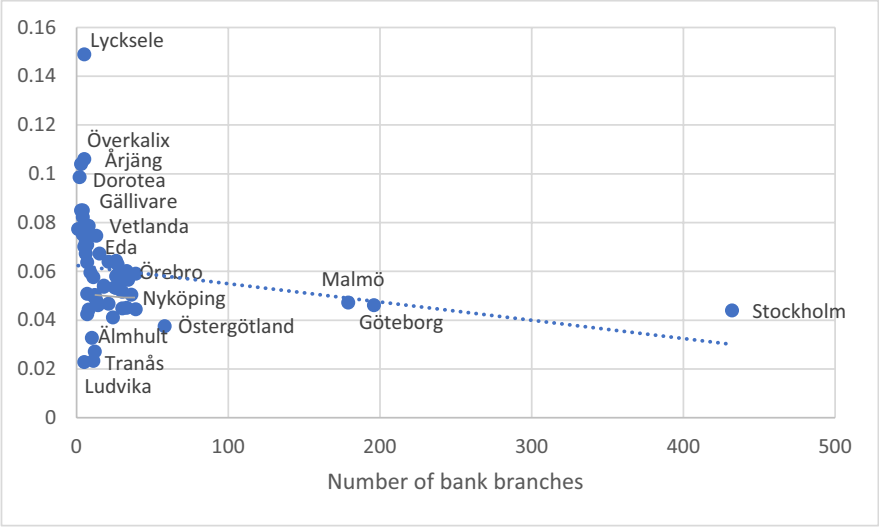

Fig. 6 Average investment-cash flow sensitivity against the number of bank branches

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.[15] Our main contribution comes from estimating the investment-cash flow sensitivity along the urban–rural continuum. Investments of companies in the largest cities are the least dependent on own cash flow and they are the most dependent in 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 belonging to 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, must 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, therefore, to grow or increase productivity. 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 policies targeted at closing SME financing gap.

A targeted policy response, however, should rely on additional research.[16] The analysis presented in this paper does show 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. The results of our analysis, however, indicate that there is space for improvement of investment performance in Swedish SMEs outside of urban/metro regions by helping them overcome reliance on own cash flow.

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Declarations

Desclaimer The opinions expressed and arguments employed are those of the authors and should not be reported as representing the official views of the OECD or of its member countries.

[15] While for large companies, equating higher investment-cash flow sensitivity to greater financing constraints might not be justified (Kaplan and Zingales, 199), it is generally the case for SMEs in Europe (Mulier, Schoors and Merlevede, 2016).

[16] 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.

Appendix

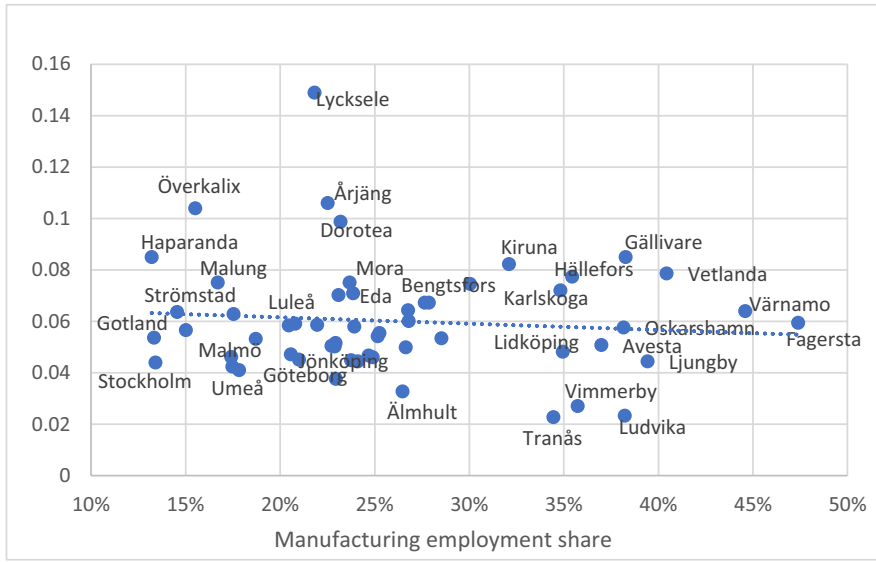

Fig. 7 Average investment-cash flow sensitivity against manufacturing employment share

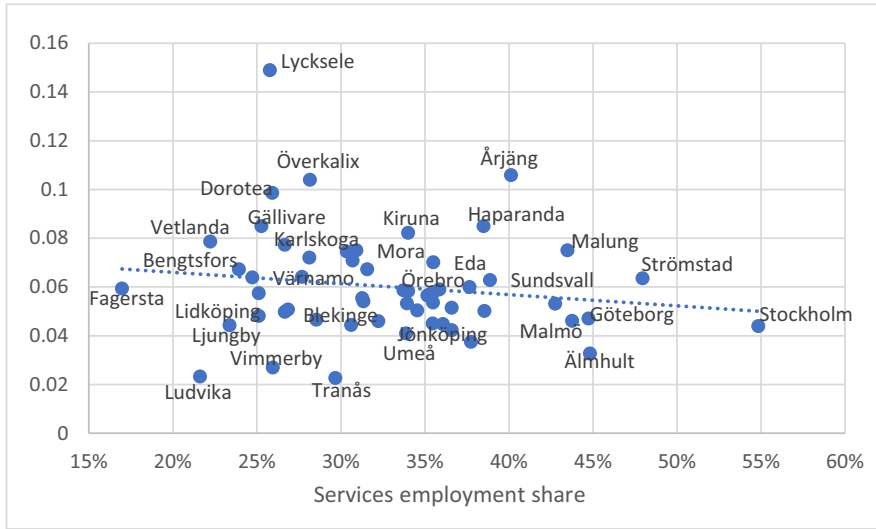

Fig. 8 Average investment-cash flow sensitivity against services employment share

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