Peripheries in Peripheries – Within-Region Differences in Financial Constraints

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Abstract: Earlier literature has analysed regional finance gaps by comparing metropolitan areas with peripheral areas on a relatively high level of aggregation and most often in a U.S. or U.K. venture capital context. Financial capital has been found to be concentrated in metropolitan areas and access to capital easier because entrepreneurs leverage on proximity to capital providers. However, regardless of whether it is metropoles, when there is an urban centre of a certain size or relative dominance in a region, it can be hypothesized that financial capital is likely to be attracted to this urban centre even within a peripheral region. The literature has been silent regarding financial 'centres' within peripheral areas. Survey responses from managers in 834 firms are used in the empirical analyses. We find that even within the periphery there is a periphery-core difference. We also find indications of differences in whether firms are financially constrained depending on the levels and types of geographical aggregation that are used in the models. Intra-regional differences accentuate the need for considering the appropriate regional level of policy making and the policy instruments. The paper contributes specifically to the analysis of geographical scale in regional financial constraints. The issue of scale is in the core of economic geography yet often disregarded both in research and in the process of designing regional policies.

Keywords: regional development, financial constraints, entrepreneurship innovation, periphery, economic geography, public policy

1. Introduction

The literature on financial constraints has primarily focused on characteristics and behaviour of firms pertaining to their liabilities of smallness and newness, or to their risk profile stemming from their industry, market, or innovativeness. However, additional characteristic of financially constrained firms concerns their location. Regional innovation policies at super-national, national, and regional levels of aggregation have therefore introduced an array of regional innovation financing instruments and –institutions such as regional venture capital funds, Regional Development Agencies, regional loan funds, ERD funding etc.

Despite the policy interest, we know relatively little on this aspect of financial constraints, and the studies we do have suffer from fundamental limitations. Generally, the approach adopted in the literature consists of analysing regional disparities with respect to financial capital between prosperous and peripheral regions. For example, Zhao and Jones-Evans (2017) study differences in access to finance in Nuts1 regions in the UK. The present paper adopts a novel approach by exploring whether there are intra-regional differences in the financial gaps between firms in urban areas and firms in peripheral areas even *within* a peripheral region. Hence, when Zhao and Jones-Evans find that access to finance is difficult in Wales compared to other regions in the UK it would perhaps be more interesting to know if there are e.g. differences between Cardiff in Wales and the rest of Wales, or if the patterns found for e.g. Scotland hide within-Scotland differences.

Therefore, the core research question and hypothesis tested in this paper is that in the context of an urban centre of a certain size or relative dominance, financial capital is likely to be attracted to such an urban centre despite the general tendency for the capital in a country to be clustered in the major city. If so, then the use of only averages to compare regions defined at a high level of aggregation, and possible by political-administrative boundaries may be misleading or may render incomplete results and lead to inexpedient policy conclusions. Earlier studies have called such research (Lee and Drever, 2014, Zhao and Jones-Evans, 2017), however, most data sources do not allow a sufficient geographical break down.

Our study has several contributions. A large share of the earlier studies of access to finance in a geographical perspective focus on venture capital finance, fx Boston and Silicon Valley in the U.S. or Cambridge and the Southeast region in the U.K. These are places in which industrial evolution and finance functions well, and they are not representative for the vast majority of regions. Even if specialised forms of finance like venture capital may be important to industrial evolution in these areas the broad majority of firms do not access venture capital rather relies on bank finance. By incorporating all types of finance for investment purposes, we obtain more

complete information on the access to finance landscape. We focus on cities in Denmark that in an international context are relatively small, which in itself is novel in this literature. Finally, our data allows a geographical break down that entail small areas. The analysis is based on data from surveys of 834 private firms in North Jutland covering different aspects of access to capital. Our case region is well suited for answering the question of a potential 'second-order' periphery, as it is a peripheral area in Denmark but has a clear urban centre. Denmark is said to have relatively small regional differences, which makes it an expedient context to study these problems in because potential problems, if identified in this context, are likely to be stronger in other countries.

2. Earlier literature on the geography of financial constraints

The economic geography literature on financial constraints has generally been relatively scarce (Pollard, 2003). Likewise, the entrepreneurial finance literature has not sufficiently examined the geographical aspects of finance (Mason, 2010). Studies of the geography of venture capital shows that a disproportionate share of financial capital is managed and invested in metropolitan areas (Martin et al., 2003; Mason and Harrison, 2002), and the location of venture capital firms has typically been in metropoles. Not only quantitative, also qualitative differences persist; the venture capital funds in more peripheral areas involve public funds to a greater extent, and (related) the differences in amounts invested persist to a larger extent than the number of investments (Mason and Pierrakis, 2013). The informal venture capital market is generally regarded as more evenly dispersed (Harrison et al., 2010), but there is also a concentration of this type of finance, again in the UK in the London and Southeast regions (Jones-Evans and Thomson, 2009). The concentration of financial capital in prosperous, urban areas is found in virtually all countries but to a varying degree. Comparing concentrations of financial capital in the U.K. and Germany, Martin et al. (2003) found that German financial capital is less concentrated and involves a greater number of financial centres. This finding may relate to differences in political-administrative structures and to different city structures, as there are relatively many larger cities dispersed throughout Germany.

Several studies of the geography of entrepreneurial finance have found that investors prefer investing in firms that are not excessively distant from their own locations. Preference for proximity to investee firms stem from the fact that transaction costs and search costs are reduced with close spatial proximity. Investors monitor their portfolio firms by providing guidance and act as a sounding board to the management of a firm. Some of the information in this interaction, such as budgets, progress reports and similar codified information can be transferred across distance by mail. However, to build a business relationship with a portfolio firm, investors engage in personal interactions with the portfolio firm to facilitate the transfer of tacit knowledge. Because tacit knowledge is dependent on the building of common means of understanding, communication and, above all, personal trust, tacit knowledge is often spatially grounded (Gertler et al., 2000; Zook, 2002, 2004). Such personal interactions require a certain frequency of face-to-face interaction, which adds to transaction costs.

Transaction costs related to post-investment monitoring may be reduced by spatial proximity, geographical proximity is also important prior to the investment process. Because investors use referrals and their networks to both generate a deal flow and assist the due diligence process, local informants reduce search costs. Information on the potential of investment opportunities is not publicly available and is often spatially bounded (Zook, 2004, Kolympiris et al., 2017) and interpreted by actors in the same socio-economic context (Allessandrini et al., 2010, Wray, 2012). Moreover, interactions between parties (i.e., a financier and a firm in this case) are also affected by social, institutional, organisational and cognitive proximity (Boschma, 2005), not only spatial.

Depending on the extensiveness of networks of financial community, intermediaries and firms, the pure awareness of sources of capital may also differ (Mason and Harrison, 1998, Mason, 2007). Demand for finance may differ between localities, as business activities are often unevenly distributed (Mason 2007, Lee and Drever, 2014, Lee and Brown, 2017). Earlier literature (Lee and Brown, 2017) has found that both actual and the non-articulated demand for external finance differ between peripheries and urban centres, both types of demand being less in peripheries.

In sum, we hypothesize that

1. Within peripheries concentration of capital and resulting distances between investor and investee leads to relatively higher financial constraints outside urban areas
2. The possible effect in Hyp.A is enhanced by firms' innovativeness, smallness, newness, actual short-term economic performance, projected short-term economic performance.
3. Demand for external finance is lower for firms in peripheries of the periphery

3. The data and case region

The *data* are based on surveys of private firms with at least five employees in North Jutland, Denmark. The respondents were asked about their views of the past and future development of a number of variables including innovation and access to financial capital. In turbulent periods of time as in financial crisis especially issues of access to finance are affected, which means that responses from a single year may not be representative. As our primary interest is not on the level of financially constrained firms per se but rather the relative proportions (periphery – center) the effects from financial crisis is reduced as it affects firms in both sub-samples. Only to the extent that the crisis has different effects on urban and rural areas the analyses should account for the effect of the crisis. We reduce this possible effect by using data from surveys in several years. In order to maximize the number of observations and to eliminate possible effects from variations over time we cluster the responses from four consecutive years, 2010-13 and obtain a total of 834 responses. Data collection methodology and questions were constant over all year. Firms were phoned to ask for participation in the survey, then emailed a questionnaire. The core question re dependent variable was: 'Did your firm during the past year experience problems in obtaining external finance for development activities?' Yes/No/Did not apply/DKNA.

Response rates are incomparable to other surveys that rely on random sampling. In our case response rates may be interpreted and measured during the process of phoning firms to ask for participation, or they could be interpreted as the share of respondents who accepted to participate in the survey, but nevertheless did not fill in the on-line questionnaire. The firms included in the gross sample represent approximately 30% of the employment in the region.

Our *case region* is located in the north of Denmark and has traditionally been characterised as a peripheral area within Denmark, evidenced by economic indicators of regional development. Aalborg is the metropolitan centre of the region. By January 2017, the city had 139,000 inhabitants. The cities of Frederikshavn, Hjørring and Hobro may thus be classified as urban areas, although they only have 23,500, 25,700 and 12,000 inhabitants, respectively. In many contexts such cities would be classified as villages. In this small region (in a small country with only one large city, Copenhagen), these cities are relatively large and contain several well-known and relatively large firms.

4. Empirical analyses

We split the sample of firms in different geographical areas (as explained below) and estimate a model that takes into account multivariate and interaction effects and control for possible effects from differences in firm characteristics. In robustness checks, different geographical aggregations are tried out.

4.1 Geographical scale
The test of the overall hypothesis regarding the relevant geographical scale of financial constraints is based on two geographical aggregations stemming from three geographical areas. The first area is Aalborg as the urban centre. The second area is the three above-mentioned areas that are smaller but perhaps still urban. The third area contains the residual peripheral areas within North Jutland. Our sample is split in 31% of firms in the Aalborg city, 17% in the semi-sized towns, 52% in the remainder of the region.

4.2 Variables
The answers to survey questions are self-reported and subjective; however, there is no reason to believe that a potential bias from this should be either particularly severe or systematically distributed in the geographical areas we compare. Table 1 provides an overview of variables used in the analysis. The dependent variable is a dichotomic variable based on the respondents' statement on whether the firm has in the latest year experienced financial constraints on their development activities. Firms were also asked about how dependent their development activities were on external finance. In our analyses we use this variable for filtering out firms who do not feel constrained, however, we perform analyses on the full sample as well.

Table 1: Measurement of variables

Variables	Indicator
Independent	
Geographical areas	Aalborg, Aalborg+Semi-urban, Peripheral. Based on post codes
Size of firm 'firm size'	Log of number of empl. in full time equivalents

Innovation intensity 'e_inno'	No of innovations per employee
Age of firm 'firm_age'	Log of years since establishment
Short term economic performance 'r_result_n'	experienced improved/unchanged/worsened development in economic results in the quarter prior to the survey
Short term economic prospects 'r_result_p'	foresee improved/unchanged/worsened development in economic results in the next quarter following the survey
Industry 'firm indu_ 1,2'	NACE2 sectors
Organisational form	Subsidiary etc
Incremental innovation 'innoinc_ln'	Has incremental product, service-, process innovation within the past year
Radical Innovation 'innorad_ln'	Has radical product, service-, process innovation within the past year
Dependent	
Constrained access to capital	Perception of the constraint – Yes/No/do not know.
Filter	
Need for finance	External finance valued highly in development processes

4.3 Empirical approach

The literature has discussed potential endogeneity problems in analyses of financial constraints (Mina et al., 2013, Lee and Drever, 2014, Lee and Brown, 2017, Zhao and Jones-Evans, 2017), that is, firms who do not demand external financial capital will not feel constraints on their financing and should therefore be accounted for in the empirical analyses. One could assume that potential endogeneity problems are similar across sub-regions but in recent literature (Lee and Brown, 2017) we do have indications of different patterns in the demand for finance among firms in the peripheral and urban regions, and therefore choose both to do a two-stage estimation to account for potential differences in demand for finance, and to use a filtering variable for the same purpose.

4.4 Correlations and frequencies

Table 2 and 3 shows correlations between our main variables. The survey includes a selection question regarding whether firms express demand for finance and we proposed that this may work as a selection devise for disregarding firms who were not in demand for finance. In the second correlation table this selection is applied, reducing the focused sample to 399 firms.

Table 2: Correlation Coefficients (full sample)

	constra ints	need_ financ e	firm_siz e_ln	firm_ age_ln	r_ result _p	r_ result _n	e_ inno	innoi nc_ln	innor ad_ln	region 1	region 2	region 3	region 12	region 23

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	constraints	need_finance	firm_size_ln	firm_age_ln	r_result_p	r_result_n	e_inno	innoinc_ln	innorad_ln	region1	region2	region3	region12	region23
constraints		0.485***	-0.150***	-0.091***	0.088**	0.087**	0.054	0.013	0.022	0.091*	-0.006	0.089*	0.089	0.091**
need_finance	0.485***		-0.074**	-0.043	0.150***	0.096***	-0.008	0.089***	-0.015	0.101**	-0.009	0.100**	0.100***	0.101**
firm_size_ln	-0.157***	-0.067*		0.294***	0.037	-0.055	0.155***	0.145***	-0.043	-0.039	-0.043	0.068*	-0.068**	0.039
firm_age_ln	-0.075**	-0.040	0.293***		0.040	0.028	0.020	0.061*	-0.002	-0.035	0.081**	-0.030	0.030	0.035
r_result_p	-0.088**	0.150***	0.025	0.035		0.361***	0.064*	-0.005	0.067*	0.022	0.006	-0.025	0.025	-0.022
r_result_n	0.087**	0.096**	-0.035	0.032	0.361***		-0.050	0.004	-0.042	-0.033	-0.016	0.043	-0.043	0.033
e_inno	0.054	-0.008	0.145***	0.019	0.064*	-0.050		-0.051	0.214***	0.079*	-0.056	-0.031	0.031	-0.079*
innoinc_ln	-0.004	0.068*	0.178***	0.055	-0.013	0.012	-0.027		0.009	-0.167***	0.095***	0.082*	-0.082**	0.167**
innorad_ln	0.046	0.015	0.003	0.020	0.036	-0.039	0.160***	0.248***		0.101**	0.094***	-0.164**	0.164***	-0.101**
region1	-0.091**	0.101**	-0.037	-0.042	0.022	-0.033	0.079**	-0.092***	0.047		-0.305***	0.692**	0.692***	-1.000**
region2	-0.006	-0.009	-0.045	0.096***	0.006	-0.016	-0.056	0.054	0.088**	-0.305**		-0.477**	0.477***	0.305**
region3	0.089*	0.100**	0.068**	-0.034	-0.025	0.043	-0.031	0.044	-0.110***	0.692**	-0.477***		1.000***	0.692**
region12	-0.089*	-0.100**	-0.068**	0.034	0.025	-0.043	0.031	-0.044	0.110***	0.692**	0.477***	-1.000**		-0.692**
region23	0.091**	0.101**	0.037	0.042	-0.022	0.033	-0.079**	0.092***	-0.047	-1.000**	0.305***	0.692**	-0.692***	

Lower-triangular cells report Pearson's correlation coefficients, upper-triangular cells are Spearman's rank correlation

*** p<0.01, ** p<0.05, * p<0.1

We note from table 2 and 3 that correlation coefficients are all below the 0.5 threshold indicating no multicolinarity issues. In table 2 firm characteristics like size and age and economic results correlate with constraints. The table also provides the first indications of regional differences in financial constraints: the Aalborg city region is significantly and negatively correlated with constraints, whereas the peripheral parts of the region is positively and significantly correlated. The results regarding the need for finance variable are also interesting. Age does not seem to matter for demand, but unsurprisingly economic results do. Correlations with regions are highly significant indicating demand variations among regions. In the reduced sample (table 3) firm size is still correlated with constraints. Although the expected signs are at the regional correlations with constraints the statistical significance is no longer there.

Table 3: Correlation Coefficient (reduced sample)

	constraints	firm_size_ln	firm_age_ln	r_result_p	r_result_n	e_inno	innoinc_ln	innorad_ln	region1	region2	region3	region12	region23

	constraints	firm_size_ln	firm_age_ln	r_result_p	r_result_n	e_inno	innoinc_ln	innorad_ln	region1	region2	region3	region12	region23
constraints		-0.185***	-0.117**	-0.026	0.063	0.095*	-0.056	0.047	-0.074	-0.003	0.067	-0.067	0.074
firm_size_ln	-0.207***		0.271***	0.051	-0.062	0.181***	0.166***	-0.059	-0.070	-0.078	0.121**	-0.121**	0.070
firm_age_ln	-0.094*	0.260***		0.090*	0.047	0.039	0.084*	0.026	-0.042	0.112**	-0.048	0.048	0.042
r_result_p	-0.026	0.032	0.087*		-0.339***	0.097*	-0.049	0.027	-0.047	-0.039	0.071	-0.071	0.047
r_result_n	0.063	-0.031	0.052	-0.339***		-0.076	-0.052	-0.022	-0.047	0.048	0.005	-0.005	0.047
e_inno	0.095*	0.187***	0.042	0.097*	-0.076		-0.082*	0.256***	0.067	-0.035	-0.033	0.033	-0.067
innoinc_ln	-0.062	0.214***	0.058	-0.048	-0.042	-0.058		0.020	-0.195***	0.065	0.123**	-0.123**	0.195***
innorad_ln	0.062	0.053	0.009	0.028	-0.036	0.177***	0.330***		0.112**	0.107**	-0.180***	0.180***	-0.112**
region1	-0.074	-0.058	-0.055	-0.047	-0.047	0.067	-0.100**	0.068		0.267***	0.681***	0.681***	-1.000***
region2	-0.003	-0.084*	0.120**	-0.039	0.048	-0.035	0.009	0.061	-0.267***		0.523***	-0.523***	0.267***
region3	0.067	0.115**	-0.043	0.071	0.005	-0.033	0.082	-0.107**	-0.681***	0.523***		1.000***	-0.681***
region12	-0.067	-0.115**	0.043	-0.071	-0.005	0.033	-0.082	0.107**	0.681***	0.523***	1.000***		-0.681***
region23	0.074	0.058	0.055	0.047	0.047	-0.067	0.100**	-0.068	-1.000***	0.267***	0.681***	-0.681***	

Lower-triangular cells report Pearson's correlation coefficients, upper-triangular cells are Spearman's rank correlation

*** p<0.01, ** p<0.05, * p<0.1

In table 4 we list results from comparing constraints and demand in different regional aggregations. In the top part of the table we compare Aalborg and the rest of the region, and in the lower part of the table Aalborg is merged with the semi-sized towns. Both demand and constraints are shown for the full and reduced sample. T-tests indicate that there is a difference in demand between periphery and urban areas the demand being less in peripheries. Constraints also display a difference, however, in the reduced sample the statistical significance disappears. This is partly caused by the fact that the number of observations is less than half of the full sample, but it also indicates differences between firms in these two types of regions.

Table 4: Frequency analysis

	Rest of NJ	Aalborg	Difference	(p-value)

Firm in need for external finance	0.51	0.40	0.11	0.00
Firms experienced finance constraints (no selection)	0.20	0.13	0.08	0.01
Firms experienced finance constraints (selection)	0.39	0.31	0.08	0.14

	Rest of NJ	Aalborg + semi	Difference	(p-value)
Firm in need for external finance	0.53	0.43	0.10	0.00
Firms experienced finance constraints (no selection)	0.20	0.13	0.08	0.01
Firms experienced finance constraints (selection)	0.40	0.33	0.07	0.18

4.5 Regression results

Finally, Table 5 and 6 provides the results of the estimations of a random effect logit model. Again, we estimate both the full sample models and the reduced model.

Table 5: Financial constraints, Full sample

	(1) constraints	(2) constraints	(3) constraints	(4) constraints	(5) constraints	(6) constraints
_Ifirm_indu_1	-0.887	-0.628	-0.671	-0.671	-0.663	-0.628
	(-0.987)	(-0.705)	(-0.752)	(-0.752)	(-0.738)	(-0.705)
_Ifirm_indu_2	-1.466*	-1.179	-1.125	-1.125	-1.160	-1.179
	(-1.762)	(-1.408)	(-1.344)	(-1.344)	(-1.376)	(-1.408)
firm_size_ln	-8.578***	-8.326***	-8.283***	-8.283***	-8.402***	-8.326***
	(-3.187)	(-3.052)	(-3.055)	(-3.055)	(-3.102)	(-3.052)
firm_age_ln	-1.066	-1.178	-0.969	-0.969	-0.841	-1.178
	(-0.480)	(-0.530)	(-0.433)	(-0.433)	(-0.376)	(-0.530)
r_result_p	-0.351	-0.371	-0.392	-0.392	-0.401	-0.371
	(-0.816)	(-0.860)	(-0.906)	(-0.906)	(-0.925)	(-0.860)
r_result_n	0.932**	0.918**	0.907**	0.907**	0.906**	0.918**
	(2.053)	(2.019)	(1.995)	(1.995)	(1.988)	(2.019)
e_inno	1.331**	1.338**	1.312**	1.312**	1.298**	1.338**
	(2.428)	(2.449)	(2.402)	(2.402)	(2.375)	(2.449)
innoinc_ln	0.560	0.449	0.469	0.469	0.497	0.449
	(0.329)	(0.263)	(0.274)	(0.274)	(0.289)	(0.263)
innorad_ln	1.414	1.371	1.547	1.547	1.615	1.371
	(0.618)	(0.596)	(0.669)	(0.669)	(0.695)	(0.596)
_Ifirm_regi_2	0.273					
	(0.417)					
_Ifirm_regi_3	1.459**					
	(2.430)					
region1		-1.181*	-1.386**			
		(-1.940)	(-2.185)			
region2		-0.863		0.523		
		(-1.184)		(0.639)		
region3				1.386**		
				(2.185)		
region12					-1.192**	
					(-2.194)	
region23						1.181*
						(1.940)
_cons	-0.508	0.080	0.152	-1.234	0.117	-1.101
	(-0.314)	(0.049)	(0.094)	(-0.732)	(0.072)	(-0.654)
/						
lnsig2u	2.586	2.608	2.598	2.598	2.619	2.608
	(-3.455)	(-2.455)	(-2.604)	(-2.604)	(-2.627)	(-2.455)
_diparm1:sigma_u	3.643	3.683	3.666	3.666	3.705	3.683
	(-1.897)	(-1.333)	(-1.421)	(-1.421)	(-1.418)	(-1.333)
_diparm1:rho	0.801	0.805	0.803	0.803	0.807	0.805
	(-21.706)	(-15.630)	(-16.483)	(-16.483)	(-16.847)	(-15.630)
N	834	834	834	834	834	834

Table 5 shows that firm size is still highly significant and in accordance with extant literature smaller firms are more constrained. Both economic results and innovation intensity are also significant. The same pattern applies

regarding regional differences. Coefficient for Aalborg city ('region1') has negative sign, for periphery positive, indicating a significant difference between regions in how financially constrained they are; in the periphery more firms are constrained. In this model we also try out a different geographical aggregation where the basic is municipalities rather than postcodes. This aggregation is expected to be less precise compared to the city-oriented aggregation based on postcodes. The regi_3 variable covers areas south of Aalborg, which can be characterized as peripheral in North Jutland. There is a positive and significant coefficient for this region, however, not for the area north of Aalborg.

Table 6: Financial constraints, Reduced sample

	(1) constraints	(2) constraints	(3) constraints	(4) constraints	(5) constraints	(6) constraints
_Ifirm_indu_1	-0.889	-0.608	-0.681	-0.681	-0.682	-0.608
	(-0.987)	(-0.688)	(-0.762)	(-0.762)	(-0.762)	(-0.688)
_Ifirm_indu_2	-0.951	-0.674	-0.591	-0.591	-0.598	-0.674
	(-1.140)	(-0.802)	(-0.698)	(-0.698)	(-0.708)	(-0.802)
firm_size_ln	-7.367***	-6.996***	-7.101***	-7.101***	-7.122***	-6.996***
	(-2.777)	(-2.633)	(-2.662)	(-2.662)	(-2.675)	(-2.633)
firm_age_ln	-2.080	-2.146	-1.827	-1.827	-1.804	-2.146
	(-0.892)	(-0.922)	(-0.776)	(-0.776)	(-0.769)	(-0.922)
r_result_p	0.323	0.311	0.279	0.279	0.280	0.311
	(0.645)	(0.620)	(0.554)	(0.554)	(0.556)	(0.620)
r_result_n	0.808	0.784	0.794	0.794	0.796	0.784
	(1.636)	(1.590)	(1.601)	(1.601)	(1.604)	(1.590)
e_inno	1.118*	1.108*	1.093*	1.093*	1.090*	1.108*
	(1.952)	(1.936)	(1.905)	(1.905)	(1.901)	(1.936)
innoinc_ln	-0.942	-1.149	-1.277	-1.277	-1.276	-1.149
	(-0.485)	(-0.590)	(-0.650)	(-0.650)	(-0.649)	(-0.590)
innorad_ln	2.024	1.731	2.045	2.045	2.056	1.731
	(0.771)	(0.663)	(0.776)	(0.776)	(0.781)	(0.663)
_Ifirm_regi_2	-0.199					
	(-0.298)					
_Ifirm_regi_3	1.064*					
	(1.698)					
region1		-0.846	-1.137*			
		(-1.333)	(-1.676)			
region2			-1.052	0.084		
			(-1.383)	(0.101)		
region3				1.137*		
				(1.676)		
region12					-1.102*	
					(-1.887)	
region23						0.846
						(1.333)
_cons	2.219	2.466	2.574	1.437	2.573	1.620
	(1.340)	(1.510)	(1.561)	(0.839)	(1.559)	(0.953)
/						
lnsig2u	2.052	2.052	2.068	2.068	2.071	2.052
	(-2.142)	(-1.460)	(-1.645)	(-1.645)	(-1.653)	(-1.460)
_diparm1:sigma_u	2.790	2.790	2.812	2.812	2.816	2.790
	(-1.535)	(-1.047)	(-1.170)	(-1.170)	(-1.174)	(-1.047)
_diparm1:rho	0.703	0.703	0.706	0.706	0.707	0.703
	(-10.259)	(-6.993)	(-7.928)	(-7.928)	(-7.975)	(-6.993)
N	399	399	399	399	399	399

Table 6 shows results for the reduced sample. Generally the significance and size of coefficients drop indicating that the heterogeneity in demand has a substantial impact on results, in line with findings in other literature (Lee and Brown, 2017). Our frequency analyses did, though, indicate that in our case demand in the periphery seem to be higher than in the urban centres, contrasting findings in Lee and Brown (2017). Overall results still hold. Firms in Aalborg city are less constrained, in periphery more constrained. In the semi-sized towns there is no significant coefficient. Firm size remains highly significant. Increased innovation intensity is, as in the full sample model, associated with more financial constraints. Incremental and radical innovation variables have the expected sign – radical innovation rendering more constraints – but none of these two variables are statistically significant. Overall, the results reveal parameter estimations on our variables of primary interest in line with the proposed hypothesis. Specifically, the variable representing the urban area defined as Aalborg in addition to the semi-sized towns is negative and significant indicating that firms in the urban area is less constrained than in the

periphery. However, the geographical aggregation where Aalborg is defined as the only urban area has stronger significance and larger coefficient.

5. Conclusions, discussion, and policy implications

We found in the empirical analysis of the 'periphery of the periphery' of financing' hypothesis, evidence that the perceptions of the extent of a possible financial constraint in the North Jutland region differed between firms that are located in urban centres and peripheral areas, especially if urban areas are considered to be the primary centre, Aalborg. Thus, intra-regional financial constraints do appear to differ between these two geographical areas. Apparently, Aalborg is considered the primary growth pole as firms in the semi-sized towns also reported significantly higher financial constraints. It was clear that some of the differences were driven by differences among regions in how much firms demand external finance. The size and level of significance of coefficients decreased when firms with less dependence upon external finance were filtered out. Using different forms of geographical aggregation changed results.

Generally the results show that geography is important; the level and type of geographical aggregation is vital to a meaningful discussion of the financial constraints that firms face. This message may be simple but is important and should not be overlooked because the results have implications for the assessment of the need and rationale for policies. Usually averages are used in access to finance analyses and in the policy process, however, this study points to a potential second-order problem: the averages comparing the major metropolitan area in a country and peripheries may find disparities between their respective accesses to capital. However, if intra-regional differences exist, then the need for policy may be enhanced or should be re-oriented. The typical method of comparing means across regions may obfuscate the real problems, as firms within regions in peripheries may differ in terms of financial constraints depending on whether they are located in a central urban area or not, rather than if they are located in the peripheral region as such.

Generally, our findings suggest the substantial need for a research agenda on the extent of intra-regional disparities. Related, the findings spurred interest in testing even more types of geographical aggregation such as including individual firm level indices for location in dense business environments.

A number of limitations apply to this study. Because we used a case from Denmark in this paper, one may question the generalisability of the results. However, replicating this study in other geographical contexts with larger disparities is likely to render even stronger results.

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