Economies of Agglomeration and Firm's Investment[1]

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Abstract

In this paper, I show how firms' investments are sensitive to local economies of agglomeration. By studying firms located in the 95 most populated U.S. MSAs, I explore the casual effect of local agglomeration – in terms of the potential density increase of the areas where firms are located – on firms' investment decisions and growth. My analysis indicate that firms located in more urban agglomerated areas with higher potential for density increase present higher levels of investments and issue higher amounts of debt. These results are explained by network effects and other potential benefits caused by the economies of scale fostered by city growth and the availability of investment opportunities.

Keywords: Investment, Economies of Agglomeration, Potential Density Increase

JEL Classification: E220, R300, O180

1. Introduction

Empirical models of business investment rely generally on the assumption of a "representative firm" that responds to prices set in centralized securities markets. However, all firms don't have equal access to capital markets and investment opportunities. An alternative research agenda, has been based on the view that how local agglomeration affects firms' investment decisions. Dougal et al. (2015) showed that firms' investments are significantly affected by the level of investments of other firms located in the nearby area. These results are explained by spillover effects of vibrant locations, such as network effects and other potential benefits caused by the economies of scale fostered by city growth and the availability of investment opportunities.

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According to this view, investment may depend on different factors would affect agglomeration. Despite the growing literature, no research has focused on how geographical characteristics of vibrant urban locations affect firms' investments. This question is theoretically important and practically relevant because it helps clarifying the link between spillover effects and urban geographical characteristics.

In this study, I show that the effect of spillovers on firms' investments depends on agglomeration and urban characteristics. I begin by reviewing the effect of urban characteristics agglomeration – in terms of the potential density increase of the areas where firms are located – on firms' growth opportunities located in the 95 most populated U.S. Metropolitan Statistical Areas (MSAs). I then empirically investigate the casual effect of local agglomeration on firms' investment decisions. I find the investment of firms is sensitive to the potential density increase of the MSA where they located. I show that firms located in more urban agglomerated areas with higher potential for density increase present higher levels of investments and more potential for growth. Moreover, I document, such firms tend to issue higher levels of debt so as to finance their investments.

I have examined the robustness of these results to alternative specifications. I address the concern of the potential bias caused by the choice of firm location. Capturing the idea that firms with better growth choose to locate in more agglomerated or high-tech cities, to the extent that the unobserved characteristics that may influence a firm's location choice become less important over time, the observed effect on the investment behavior of older firms that chose locations many years ago is unlikely to arise because of a cluster selection effect. Further, I account for the possible alternative explanation that the results are driven by firms' size. Srini Vasan[2] finds that internal finance is more volatile over the

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[2] Philip Vijay Srini Vasan, "Credit Rationing and Corporate Investment" (Ph.D. dissertation, Harvard University, October 1986).

business cycle in small and medium-sized corporations than in large corporations. Moreover, during downturns, large firms have greater relative access to short-term and long-term debt markets. Hence, I expect different effect on the growth rates and investment behavior of firms due to their size. Splitting the whole sample to the small and big firms I study the consistency of my results. Another dimension of firm heterogeneity that may be important for investment behavior is differences across industry categories. I tried further splits of those firms based on the industry they are specialized in. I investigate my argument for two subsamples of firms, one belongs to the electrical equipment, chemical and drug, and high-tech-related industries, which they are more affected by the agglomeration advantages and economies of agglomeration. While the other sample covers firms specializing in the rest of industry categories.

I conclude by discussing the implications of my findings. My approach emphasizes that spillover effects are partially explained by the competition for local resources – specifically lands and properties, which are more available in areas with higher potential for urban density increase.

2. Theoretical Predictions

How does spatial agglomeration1 contribute to economic growth? Factor mobility[3], increasing returns[4], and local externalities[5] have been identified in the literature as most instrumental in establishing the seeming agglomeration-growth nexus. Furthermore, Lee,

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[3] Labor mobility explains how different labor productivities between regions or countries cause economic growth through agglomeration. The process that mobile labor induces economic growth through agglomeration is set off by population concentration and increase in wages. Without labor mobility, geographic concentration would not materialize, since the cumulative process of agglomeration would not start.

[4] Increasing returns relates spatial agglomeration to economic growth through the effects of agglomeration on improved resource allocation. The process of agglomeration starts either from the availability of various intermediate goods, which lowers costs of final good production, or from the existence of a large final goods market, which provides a large local market for intermediate goods. The linkage of agglomeration to growth would be influenced by those parameters such as transport costs. See Fujita et al. (1999, Chapters 14, 15).

[5] Local externalities link agglomeration to growth through a “circular causality” in which growth and location decisions are jointly determined. Growth destabilizes the symmetric equilibrium, and causes geographic concentration, which results in real income growth. See Baldwin and Forslid (1999).

H. (2008), shows the influence of agglomeration *per se* on growth. Agglomeration of firms' innovation activity accounts for the expansion of innovation (that is, growth rate) which is contingent on localized externalities[6]. In this paper I try to investigate whether the density characteristic of the area would explain partially this agglomeration effect on firms' growth. Hence, I expect more opportunity growth existed for firms located in the areas with high potential for developments and density increase.

Hypothesis 1 *Firms located in urban areas with high potential for density increase and low geographical constraints, have more opportunity growth.*

There is a growing body of literature studies the sensitivity of investment to agglomeration in different terms such as investment of other firms headquartered nearby. These results are explained by spillover effects of vibrant locations, such as network effects and other potential benefits caused by the economies of scale fostered by city growth and the availability of investment opportunities. However they are silent about the influence of density characteristics in vibrant areas on investment. Hypothesis 2 outlines this prediction.

Hypothesis 2 *Firms located in fast-growing areas with high potential for density increase invest more because of the higher growth opportunities they have in those areas.*

Eventually, I expect to find some evidence about the source for such firms in order to finance their investments. Therefore, I build my third hypothesis based on this approach as below.

Hypothesis 3 *Such firms tend to issue higher levels of debt so as to finance their investments.*

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[6] Agglomeration may alternatively cause economic growth through changes in total factor productivity gains, innovation capacity enhancement (R&D intensity), factor supply increase, and per capita income growth.

3. Data

I begin by first identifying all public companies listed on the Compustat between years 2010 till 2014. Each firm is classified by industry, *i*, and headquarters location, *a*. For industry classification, firms are assigned to their relevant 2 digit primary Standard Industrial Class (SIC) code industry category. As is standard in the literature (see Chaney, Sraer, & Thesmar, 2012; Cvijanović, 2014), I omit the firms that belong to the finance, insurance, real estate, non-profit, government, construction, or mining industries. These industry groupings are intentionally broad as I are interested in measuring the extent to which local urban characteristics affect corporates within as well as across different industries. In robustness checks I repeat my analysis using alternative industry classifications. I create two subsamples of firms, one belongs to the electrical equipment, chemical and drug, and high-tech-related industries, which they are more affected by the agglomeration advantages and economies of agglomeration. While the other sample covers firms specializing in the rest of industry categories.

Next, I group firms by location with some subjectivity. I define a firm's location as the location of its headquarters. Although a firm's headquarters is often separated from its operations by miles, this separation may help rather than hurt my ability to identify the types of agglomeration advantages that are the focus of this study. I gathered firm-level data from Compustat. Having obtained the data on company names and zip codes from Compustat, I clarify the MSA in which each company is located. I use the mapping table between zip codes and metropolitan statistical area (MSA) codes maintained by the U.S. Department of Labor's Office of Workers' Compensation Programs (OWCP), and I match the zip codes from the two files and obtain the company's location. Eventually, I exclude the firms that are not located in my considered 95 MSAs from the sample and end up with 82 metropolitan areas. Because of the potential bias of the idea that big firms would have more growth and investment opportunities due to the more available resources and financial slacks they access to, in another robustness check I split the whole sample to the small and big firms. I consider small firms as the ones in the lower three quartiles of size from the whole sample.

I select the sample by first deleting any firm-year observations with missing data. Next, I delete any observations for which total assets, the gross capital stock, sales, gross property, plant, and equipment, depreciation, accumulated depreciation or capital expenditures either zero or negative. This leaves us with an unbalanced panel containing 13316 firm-year observations with 2,707 distinct firms spanning the years between 2010 and 2014.

I use the proxies of urban density characteristics; the potential density increase (PDI) and non-potential density increase (NDI) measures from the paper by Memarian & Vergara-Alert (2017). Firm's investment, which is equal to capital expenditures normalized by last year's assets is calculated as (Investment (t)=CAPX(t)/AT(t − 1)). Debt issuance is considered equal to the change in total long-term debt plus the change in long-term debt due in one year plus notes payable divided by last years assets. [Debt issuance(t)=[d.DLTT(t)+d.DD1(t)+NP(t)]/AT(t − 1)).; and Tobin's q, which is equal to long-term debt plus debt in current liabilities plus market equity all divided by current assets (q(t)=[DLTT(t)+DLC(t)+CSHO(t)*PRCC F(t)]/AT(t)). In order to cancel out industry effects and make firms from different industries comparable, I calculate industry adjusted Tobin's Q for firms. Every year, I form industry portfolios using two digit Standard Industrial Classification (SIC) codes and calculate the average Tobin's Q within each portfolio. The industry adjusted Tobin's Q of firms are the firms' Tobin's Q in excess of their industry averages. Throughout the rest of the paper, the "Tobin's Q" variable refers to the "industry adjusted real firm's Tobin's Q". Asset growth is considered as the percentage change in the total assets. The research and development expenditure is calculated as the research and development expense (XRD) divided by the gross PPE. ROA is computed as (net income IB – dividend on preferred DVP + income statement deferred taxes (TXDI)) divided by the total assets (TA). Corporate real estate holding is considered as (building + capitalized leases) divided by net property, plant, and equipment (PPE), in accordance with Tüzel (2010). In order to cancel out industry effects and make firms from different industries comparable, I calculate industry adjusted Real estate ratio for firms with the same methodology has been explained earlier. Cashflow, which is calculated equal to income before extraordinary items plus depreciation and amortization normalized by last year's assets (Cash flow(t)=[IB(t)+DP(t)]/AT(t − 1)). I compute the market-to-book ratio as the market value of equity plus the book value of assets minus the book value of equity, all divided by the book value of assets. Population density is calculated as Number of MSAs' inhabitants divided by the total MSA square kilometer area. Finally, I consider firm age as the number of years since the firm's first year of observation in Compustat. Table I provides the summary statistics of my measures, various firm characteristics, and the rest of my controls, while Table II reports the correlation between these main variables.

[Insert Table I & II around here]

4. Empirical Strategy and Empirical Results

4.1. Potential density increase and firms' growth

Using empirical analysis, this section provides evidence of a causal relationship between density characteristics and firms' investment expenditure. Regarding my hypothesis, to measure the extent to which they are true, I run series of panel regressions for the firm-level data I have. Accordingly, I consider firm's growth and firm's investment expenditures as my two dependent variables. My interest is the importance of the area-level potential for further density increase on firms' growth and their investment, relative to that captured by industry- and firm- level attributes. First, I run the following specification for the growth proxied by Tobin's Q of firm *i* with headquarters located in area *l* at time *t*, $Tobin's\ Q_{it}^{l}$;

$$Tobin's\ Q_{it}^{l} = \alpha_i + \beta.PDI + \gamma.NDI + Controls_{it} + \epsilon_{it}$$

Regression analysis is used to predict the effect of a potential density increase on firms' Tobin's Q as their growth proxy. The dependent variable is the industry adjusted firm's Tobin's Q. PDI and NDI are the measures of potential density increase and non-potential density increase from the literature.[7] I consider these two measures approximately constant for the urban density characteristics of each MSA in the period of five years from 2010 to 2014. Here I refer to the fact that urban density characteristics, geographical constraints, and the existing constructions of an MSA cannot change rapidly over time, consistent with the literature. $Controls_{it}$ denotes a set of firm-level controls. Following the existing literature on firms' growth and investment, I control for (1) firm size; (2) asset growth; (3) return on assets (ROA); (4) market-to-book ratio; (5) corporate real estate holding; (6) population; (7) firm's R&D expenditures; (8) debt issuance; and (9) company age.

Table III reports the results corresponding this part of analysis. In Column [1] of Table III, I find that on average a 1% higher PDI of an MSA results in 13.1% higher growth for the firms located in this MSA. At the same time results show the significant negative effect of NDI on firms' growth. Empirically, I show, on average a 1% higher NDI of an MSA results in 18.8% lower growth for the firms located in this MSA. In

[7] Using high-resolution satellite images from Google Earth in a paper by Memarian & Vergara-Alert (2017), two exogenous measures of potential density increase (PDI) and non-potential density increase (NDI), are developed for the 95 most populated metropolitan statistical areas (MSAs) in the US. This measures represent the proportion of area in the total area within a 1 hour drive from the center of the MSA that could rapidly increase its density or not due their land availabilities.

column [2], I account for the possible alternative explanation that the results are driven by the influence of firm size. I address the concern of the potential bias of the idea that big firms would have more growth and investment opportunities due to the more available resources and financial slacks they access to. I start by splitting my whole sample to two subsamples of big and small firms and I show that my results remain stronger and significant for the subsample of small firms in comparison of the whole sample. Table III provides compelling support for the link between density characteristic of the area where firms are located and their growth opportunity. Error terms are cluster at firm level in all regressions.

[Insert Table III around here]

4.2. Potential density increase and firms' investment expenditures

Building on the results I got in the previous section, here I try to study the effect of density characteristics on firms' investment directly, and indirectly by the influence they have on firms' growth. Specifically, I estimate the following specification:

$$Investment_{it}^{l} = \alpha_i + \beta . HighPDI\&LowNDI/TQ\ (PDI, NDI) + Controls_{it-1} + \epsilon_{it}$$

Running panel regressions first I study the urban density effect of the areas with higher potential density increase and lower geographical constraints on firms' investment. In order to do so, I define a dummy which has the value of 1 for the MSAs with PDI measure higher than the group median and NDI lower than the corresponding group median. Here I empirically find a positive and significant effect on firms' investment, as well as the positive and significant effect of Tobin's Q consistent with the literature. Based on this evidence, in the next regression, I try to see whether urban density affects firms' investment through the potential influence it has on their growth opportunity. Therefore I estimate the fitted values of the firms' Tobin's Q on my measures of urban density (Tobin's Q (PDI,NDI)), and I find evidence about its positive effect on firms' investment.

I empirically report, on average a 1% higher of Tobin's Q (PDI,NDI) results in 0.58% higher investment expenditures for the firms located in this MSA.

As I mentioned earlier, throughout all of the regressions in the paper, the "Tobin's Q" variable refers to the "industry adjusted real firm's Tobin's Q". Moreover, I find evidence which shows such firms tend to issue higher levels of debt so as to finance their investments. I empirically find on average a 0.3% higher debt issues of these firms for a 1% higher Tobin's Q (PDI,NDI). These results show that agglomeration advantages such spillover effects are partially explained by the competition for local resources – specifically lands and properties, which are more available in areas with higher potential for urban density increase. Error terms are cluster at firm level in all regressions.

[Insert Table IV around here]

5. Robustness Tests

I test the robustness of these results to a wide variety of changes in estimation techniques and specifications. In this section, I address some of the concerns by providing several robustness checks and showing the consistency of my results. In the first step, I show the consistency of the relation between a firm's investment and its location for older firms. Capturing the potential bias of the idea that firms with better growth choose to locate in more agglomerated or high-tech cities, to the extent that the unobserved characteristics that may influence a firm's location choice become less important over time, the observed effect on the investment behavior of older firms that chose locations many years ago is unlikely to arise because of a cluster selection effect. For this reason I explore whether the relation between a firm's investment and its location for older firms for all the previous different scenarios is indeed consistent with what I observe for the entire sample. To do so, I replicate my baseline regression for the subsample of firms aged at least 10 years. And I show my results remain robust to this test. Afterwards, I examine the robustness test of the results presented to this point about the difference of growth and investment opportunities accessible for firms due to their size. I start by splitting the sample into small and large firms. I consider small firms as the ones in the lower three quartiles of size from the whole sample and I show the consistency of the results I obtained before. Another dimension of firm heterogeneity that may be important for investment behavior is differences across industry categories. Eventually, I consider industry effect by some industry classifications. I divide my sample to two different groups of firms. One contains firms specializing in the electrical equipment, chemical and drug, and high-tech-related industries, which they are more affected by the agglomeration advantages and economies of agglomeration. While, the other covers the rest of the firms in the whole sample. The results reported Table V are robust to the alternative investment specifications reviewed before.

[Insert Table IV around here]

6. Conclusion

As already shown in the literature, a firm's location can potentially influence its opportunities in a number of ways. While initially, the urban economics literature emphasized the importance of proximity to resources and transportation, more recent work emphasizes the influence of location on human capital, also the influence of vibrant urban areas in attracting and creating more talented managers, whom great better investment opportunities for the firms that employ them. However, these studies are silent on how geographical characteristics of vibrant urban locations- such as the potential for further density increase- would affect firms’ investments. This gap motivates my analysis in this paper. I believe in the relevance and importance of this question theoretically and practically as it helps to clarify the link between agglomeration advantages such as spillover effects and urban geographical characteristics. This paper offers empirical evidence supporting the hypothesis that investment expenditures, as well as growth opportunities for firms are sensitive to the urban characteristics- in terms of higher potential for density increase. Moreover, such firms tend to issue higher levels of debt so as to finance their investments. Thus, density characteristic of the area where firm is located - as one of the components of agglomeration - is an important driver of firms' investment decisions.

Table I: Summary Statistics. This table provides the summary statistics for the main variables that I use in the paper with a short description.

Variable	Mean	Median	Std dev.	25th percentile	75th percentile	Obs.	Definition/Unit
Measures of urban density, geography, regulation, and macroeconomic variables:							
PDI	0. 3361	0. 2616	0.2485	0.1341	0.5766	10,316	Measure of potential density increase: the proportion of area in the total area within a one-hour drive from the center of the MSA that could rapidly increase its density.
NDI	0.2586	0.1603	0.2223	0.0762	0.3476	10,316	Measure of non-density increase: the proportion of area in the total area within a one-hour drive from the center of the MSA that cannot rapidly increase its density, either because it is already highly dense or because it is undevelopable.
Population	6,153,168	4,462,179	5,711,441	2,063,598	6,574,866	10,316	Number of MSAs' inhabitants.
Population density	686.2406	511.0632	1143.582	267.0272	739.0379	10,316	Number of MSAs' inhabitants divided by the total MSA square kilometer area.
Firm-level variables:							
Investment	0.0480	0.0306	0.0625	0.0152	0.0588	10,316	Capital expenditures normalized by last year's assets
Firm size	58,449.62	713.3246	3,181,232	181.5593	2,765.187	10,316	Market capitalization is defined as the common share outstanding multiplied by the price bid/ask average in dollars.
Asset growth	0.1495	0.0517	0.6239	-0.0261	0.1601	10,055	Difference in the current and the lagged total assets divided by the lagged total assets.
Debt issuance	0.0381	0	-0.0056	0.0388	0.2022	8,577	Change in total long-term debt plus the change in long-term debt due in one year plus notes payable divided by last years assets
ROA	-0.0359	0.0356	1.0441	-0.0295	0.0766	10,067	ROA is the income before extraordinary items minus dividends preferred plus income taxes, deferred, all divided by the total assets.
Tobin's Q	2.0740	1.3951	7.9959	0.9275	2.3646	6,434	Long-term debt plus debt in current liabilities plus market equity all divided by current assets
Market-to-book ratio	3.1427	2.1813	52.1390	1.3104	3.8751	10,125	
Real estate ratio	0.6044	0.4921	0.7291	0.1750	0.8192	10,316	Real estate ratio is defined as the buildings plus capitalized lease divided by the net PPE.
Firm R&D	1.1610	0.1595	7.5987	0.0156	0.6459	7,075	R&D is the research and development expense divided by the total PPE.
Company age	22.5690	18	16.6670	10	29	10,316	Years

Table II: Correlation table. This table provides the correlations between the main variables that I use in the paper.

	PDI	NDI	Population	Population density	Investment	Firm size	Asset growth	Debt issuance	ROA	Tobin’s Q	Market-to-book ratio	Real estate ratio	Firm R&D	Company age	mean
PDI	1														.3361032
NDI	.5476699	1													.2586815
Population	.6854982	.1383325	1												6153168
Population density	.189821	.1658018	.0818899	1											6.862.406
Investment	-.0538813	-.0121705	-.0522113	-.0201418	1										.0480875
Firm size	-.0079294	-.0142489	-.0149962	-.0079739	-.0054953	1									58449.62
Asset growth	.0132288	.0428459	-.0191017	.0097211	.1564031	-.0020099	1								.1495563
Debt issuance	.0019367	-.0025781	.012625	-.0041125	.1232597	-.0028206	.3520626	1							.0381891
ROA	-.0359418	-.037323	-.0164505	-.0091165	.0167065	.0014362	.0228026	-.0352477	1						-.0359669
Tobin’s Q	.0297291	.0313727	.0225211	.0065624	.0158423	.0064512	.0180933	.0340521	-.1325508	1					2.074.017
Market-to-book ratio	.0110042	.0142553	.0073198	.0050202	.0021856	-.0003847	.0112185	.0128609	.0019412	.0002603	1				3.142.799
Real estate ratio	.0558806	.032258	.0539075	.0325589	-.1552054	-.0141458	-.0315059	-.0388977	-.016313	.0073525	.0142438	1			.6044686
Firm R&D	.0252553	.0345045	.0084278	.0021265	-.067227	-.022294	.0645538	.0224134	-.048891	.0327396	.023912	-.0273328	1		1.161.014
Company age	-.0851063	-.2014003	-.0138379	-.0494846	-.0569557	.0315164	-.1126919	-.0184203	.0564027	-.066502	.0046692	-.0165062	-.107178	1	2.256.902

Table III. Urban density and firms' growth. This table studies the effect of proxies for urban density on firms' growth. The dependent variable is firms' Tobin's Q as the measure of firms' growth, standard with the literature. Column [1] shows the effect of potential density measures on firms' growth. Splitting the whole sample into small and large firms, I study the consistency of my results considering the potential bias caused by more growth and investment opportunities of the big firms. I consider small firms as the ones in the lower three quartiles of size from the whole sample. Columns [2] and [3] report the results for these subsamples. As the results show, this effect is stronger and significant for the subsample of small firms in comparison to the whole sample. However, results don't show any significant evidence about this effect for the subsample of big firms. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Model 1	Model 2	Model 3
	Whole sample	Subsample of small firms	Subsample of big firms
PDI	0.13145*	0.16362*	0.08088
	(0.0595)	(0.0667)	(0.1172)
NDI	-0.18783***	-0.20197**	-0.13944
	(0.0544)	(0.0625)	(0.1051)
Observation	9,868	7,401	2,467
Groups	2,615	2,155	692
R^2_ within	0.0131	0.0115	0.0492
R^2_between	0.1526	0.1575	0.0844
R^2_overall	0.0821	0.0831	0.0746
Wald χ^2	489.95	417.31	146.88
Prob> χ^2	0.0000	0.0000	0.0000
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Cluster error, Firm level	Yes	Yes	Yes
Rho	0.3341	0.2579	0.6227

Notes: ***p< 0.01; **p< 0.05; *p< 0.10.

Table IV. Urban density and firms' investment. This table studies the effect of proxies for density increase on firms' investment. The dependent variable is firms' investment, which is equal to capital expenditures normalized by last year's assets. Column [1] shows the positive and significant effect of urban characteristics of the areas with high potential for density increase and low geographical constraints on firms' investment. As I can the effect of Tobin's Q also has been shown to be significant and positive. In column [2] I try to study how urban characteristics, in terms of potential density increase affect firms' investment through its influence on firms' growth. My independent variable in this specification is the fitted value of firms' Tobin's Q on my two measures of PDI and NDI. In Columns [3] I report the results about the debt issuance of these firms. Standard errors are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Model 1	Model 2	Model 3
	Density measures effect	Tobin's Q effect caused by density measures	Debt issuance
High_PDI & Low NDI	0.15703**		
	(0.0494)		
Tobin's Q	0.05712***		
	(0.0127)		
Tobin's Q (PDI, NDI)		0.57992**	0.57724**
		(0.2049)	(0.2048)
Debit issuance			0.00371*
			(0.0018)
Observation	9,103	9,105	9,105
Groups	2,415	2,417	2,417
R^2_ within	0.0204	0.0179	0.0182
R^2_between	0.1467	0.1399	0.1404
R^2_overall	0.1098	0.1049	0.1052
Wald χ^2	354.47	328.52	334.34
Prob> χ^2	0.0000	0.0000	0.0000
Controls	Yes	Yes	Yes
Industry	Yes	Yes	Yes
Cluster error, Firm level	Yes	Yes	Yes
Rho	0.7560	0.7588	0.7588

Notes: ***p< 0.01; **p< 0.05; *p< 0.10.

Table V. Robustness tests. In this table I show the consistency of my results in several robustness checks. Column [1] reports the results of my baseline regression for the whole sample. Columns [2] shows the consistency of the relation between a firm's investment and its location for older firms. Capturing the potential bias of the idea that firms with better growth choose to locate in more agglomerated or high-tech cities, to the extent that the unobserved characteristics that may influence a firm's location choice become less important over time, the observed effect on the stock return of older firms that chose locations many years ago is unlikely to arise because of a cluster selection effect. For this reason I explore whether the relation between a firm's investment and its location for older firms for all the previous different scenarios is indeed consistent with what I observe for the entire sample. These columns report the baseline regressions for the subsample of firms aged at least 10 years. Considering the potential bias caused by the influence of the firms' size on their growth and investment opportunities, I start by splitting the sample into small and large firms. I consider small firms as the ones in the lower three quartiles of size from the whole sample. Columns [3] reports the results for the subsample of small firms while Column [4] shows the results for the big ones. Next, I compare firms' groups in different industries by two industry classifications. Columns [5] show the results for the group of firms specializing in the electrical equipment, chemical and drug, and high-tech-related industries, which they are more affected by the agglomeration advantages and economies of agglomeration. Columns [6] reports the results for the rest of the sample. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Whole sample	Subsample of firms with Age>10	Subsample of small firms	Subsample of big firms	Industry classification1	Industry classification2
Tobin's Q (PDI, NDI)	0.57724**	0.95037***	0.50358*	0.30568	0.44017*	-0.04031
	(0.2048)	(0.2367)	(0.2296)	(0.3540)	(0.2167)	(0.5003)
Debit issuance	0.00371*	0.00305	0.00357	0.00513**	0.00443*	0.00189
	(0.0018)	(0.0019)	(0.0026)	(0.0017)	(0.0021)	(0.0033)
Observation	9,105	6,706	6,799	2,306	7,271	2,026
Groups	2,417	1,700	1,985	647	1,941	528
R^2_ within	0.0182	0.0142	0.0186	0.0162	0.0124	0.0554
R^2_between	0.1404	0.1198	0.1649	0.0127	0.1438	0.1426
R^2_overall	0.1052	0.0965	0.1271	0.0209	0.1095	0.1241
Wald χ^2	334.34	225.76	317.22	37.27	259.89	69.24
Prob> χ^2	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Cluster error, Firm level	Yes	Yes	Yes	Yes	Yes	Yes
Rho	0.7588	0.7689	0.7179	0.8987	0.7388	0.7535

Notes: ***p< 0.01; **p< 0.05; *p< 0.10.

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