TWO ESSAYS ON INVESTMENTS:
CORPORATE AND INSTITUTIONAL PERSPECTIVE

JIE ZHU

A DISSERTATION SUBMITTED TO
THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

GRADUATE PROGRAM IN BUSINESS ADMINISTRATION
YORK UNIVERSITY
TORONTO, ONTARIO

August 2017

ABSTRACT

In my dissertation, I study factors that influence investments from either corporate or institutional perspective. First, I examine the sensitivity of corporate investment to internally generated cash flow and its pattern of change over time across countries. Second, I investigate how a firm's customer profile can shape its ownership structure of institutional investors.

Existing studies have documented a puzzling disappearance of investment-cash flow (ICF) sensitivity in the U.S.. In the first chapter, I explore whether economic and financial development can explain the extent of a country's ICF sensitivity and its evolution through time. I find that, in aggregate, ICF sensitivity has also faded around the world; yet it has remained high in countries with low economic and financial development. Further, I find that the access to external finance, especially equity finance, is a key channel through which country-level development affects the sensitivity of investment to internal cash flow. In more developed countries, external finance has become more accessible for firms when their internal cash flow is insufficient, thereby reducing their reliance on internal cash flow. The results indicate that once a country advances to a certain degree of financial and economic development, it becomes more efficient in allocating resources and therefore financial constraints at the individual firm level become less binding.

A growing literature has documented different financial implications of a concentrated customer base. In the second chapter, I examine how customer concentration affects institutional investors' investment decisions. I find that a firm's customer concentration tends to attract different groups of institutional investors, depending upon their investment horizons. Specifically, those institutions who trade actively (short-term) would buy the stocks of firms with a more concentrated customer base. Conversely, those institutions who trade less actively (long-term) would buy the stocks of firms with a less concentrated customer base. While the preference of long-term investors is supported by the increased risk associated

with the dependency on a few large customers, I find that the improved stock liquidity is the channel through which a concentrated customer base attracts short-term investors. Further, my findings cannot be explained by information transfer along the supply chain.

ACKNOWLEDGMENTS

I would like to thank my advisors, Professor Lilian Ng and Professor Yelena Larkin. I have enjoyed weekly meetings with them in our productive and cozy area meeting room and countless conference calls. They have taught me how interesting research ideas are generated and how thorough research analyses are conducted. They have set me an excellent example as an enthusiastic, self-motivated, and hardworking scholar. I appreciate their inspirations and encourages when I was in tough times during my studies. Their advice on both my research and career are invaluable.

I would like to thank my committee members, Professor Kee-Hong Bae and Professor Mark Kamstra for their constructive suggestions on my dissertation. Professor Bae guided me to start my first research study. Under his supervision, I began my first step to conduct high quality research. I thank him for his belief in my potentials and his patience on my growth. Professor Kamstra introduced me to the field of empirical asset pricing. I learned fundamental empirical skills from him. I thank him for his suggestions whenever I have questions on methodology issues. I would also like to thank Professor Gordon Roberts. As his RA and TA, I was deeply influenced by his contagious passion in research and teaching. He was always open to share with me his experience in academia. I will always remember his sense of humor and generous spirit.

Lastly, I would like to thank my family. My parents had a great vision on my personal development path when I was a child. They have been always supportive and optimistic in all my pursuits. I thank them for all the love on me. I would like to thank my beautiful wife, Jiajia Li. This wonderful journey would not have been possible without her support and sacrifices.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter One:

The Fading of Investment-Cash Flow Sensitivity and Global Development

1.1 Introduction

Recent research has discovered puzzling evidence that investment-cash flow (ICF) sensitivity in the U.S. has faded over the past fifty years and vanished in the last decade.[1] A number of studies have put forth various explanations for this phenomenon but were unable to identify the mechanism that is responsible for the trend (see, for example, Chen and Chen (2012)). In this paper, we examine whether financial development and economic growth can explain a country's ICF sensitivity and how it changes over time. Economic theory and empirical evidence suggest that well developed financial systems eradicate firms' external financing constraints and spur economic growth (see Levine, 2005). Hence, individual firms from developed countries would have easier access to external financing and no longer have to rely on internal cash flow to finance their investment opportunities, and their ICF sensitivity will decline.

We begin by examining ICF sensitivity on a sample of 419,318 firm-year observations from 43 countries across the globe for the period 1991-2014. We divide the whole sample period into three subperiods of equal length, and perform a pooled analysis by estimating ICF

[1]See Allayannis and Mozumdar (2004), Agca and Mozumdar (2008), Brown and Petersen (2009), and Chen and Chen (2012) for evidence of a declining ICF sensitivity over time.

sensitivity across firms from all countries in the sample. Our findings provide strong evidence of a fading ICF sensitivity worldwide; the time trend of investment sensitivity to cash flow is generally similar to that found in the U.S. Specifically, sensitivity is high and statistically significant during the first subperiod (1991-1998) of our sample, declines substantially during the second subperiod (1999-2006), and disappears in recent years (2007-2014). Our results remain robust after we exclude the U.S. and account for research and development (R&D) as part of the investment policy.[2]

We further investigate whether the ICF sensitivity pattern is universal by repeating the analysis for each individual country, but find evidence of substantial cross-country variation in ICF sensitivity. On the one hand, nations, such as Australia, Norway, and the U.K., have experienced a decline similar to that of the U.S.: the sensitivity is statistically and economically significant in the 1990s, declines in the 2000s, and becomes non-existent or even negative in the last decade. On the other hand, in countries such as Brazil, Indonesia, and Venezuela, ICF sensitivity has remained high, and in some cases, has even increased over time.

We next explore plausible explanations for cross-country and time-series variations in ICF sensitivity and ask whether such phenomena could be driven by varying financial and economic environment. We hypothesize that larger availability of economic and financial resources, as well as more efficient allocation of these resources within the economy, could generate positive externalities and reduce financial constraints at the individual firm level. Our argument is based on studies by Fazzari, Hubbard, and Petersen (1988), Hoshi, Kashyap, and Scharfstein (1991), and McLean, Zhang, and Zhao (2012) who show that financial constraints stem from capital market imperfections, as well as the availability of economic resources at the country level, which give rise to differences between the costs of internal and external financing. We contend that over the past couple of decades the increasing global-

[2]Untabulated results show that redefining corporate investment to include selling, general, and administrative expenses, in addition to R&D, also does not materially alter our main findings.

ization could have relaxed the severity of financial constraints at the firm level and led to the disappearance of ICF sensitivity in highly developed countries, but not in developing ones.

To conduct an initial test of this hypothesis, we examine whether the degree of ICF sensitivity could be related to a country's level of development, as measured by its overall scope of resources available, which is proxied by the country's gross domestic product per capita (GDPC). We sort countries into terciles based on their level of GDPC (in constant dollars of 2005) in the following way. For each subperiod, we first calculate each country's average GDPC and then use these country-subperiod average GDPC values to sort all countries independently on time and GDPC dimensions, forming nine bins. It is important to stress that since independent sort keeps the thresholds of GDPC constant over the entire period, it accounts for the overall trend of the world-wide GDPC growth. As a result, once a country reaches a certain threshold of financial and economic development, it moves to a higher tercile of GDPC in the following period. Since GDPC has increased in a majority of countries throughout our sample period, there are more (fewer) countries that fall into the bottom (top) tercile of economic development in the first subperiod than countries that have low (high) level of development in the most recent period. We then repeat the estimation of ICF sensitivity based on the cross-section of firms in each of the resulting nine bins. We find that ICF sensitivity is stable across all subperiods in countries from the lowest GDPC tercile, but experiences a steep decline, especially in firms that belong to the top tercile. Our results suggest that the level of a country's overall development is an important determinant of the ICF sensitivity pattern across countries.

Since GDPC is a broad measure of economic and financial environment, it could capture various aspects of a country's progress. These aspects include the growth of economic resources available owing to access to education, technological progress, better infrastructure, and more cross-border investments, as well as the development of financial systems, including lower intensity of capital control, stronger investor protection, and greater market

transparency. To zoom in on which aspects of development are crucial in determining the strength of the ICF link, we repeat our analysis using more specific proxies for economic and financial development. To capture the extent of a country's economic development, we use the secondary school enrollment ratio, amount of electricity consumption, investment in R&D, and cross-border FDI to proxy for the quality of education, infrastructure, technological changes, and foreign direct investments, respectively. To test whether financial development plays a role in explaining ICF sensitivity, we employ broad measures of financial market quality (such as stock market development, cost of equity, private credit, and foreign portfolio equity inflows), as well as more specific measures of market transparency and corporate governance.[3] Consistent with the findings based on the GDPC measure, ICF sensitivity remains high in countries with low levels of development, but vanishes for financially and economically developed countries, suggesting that factors that increase the overall wealth of the economy, as well as its efficient distribution, affect individual firms' reliance on internally generated capital.

Next, we explore the channel through which country-level development potentially drives the disappearance of ICF sensitivity in developed countries in recent decades, but not in emerging markets. To gauge the mechanism at work, we examine whether individual firms' access to external financing has enhanced as the country becomes wealthier and financially developed. If country-level development facilitates removal of financial barriers for individual firms, we should observe more firms turning to external capital to finance their investment opportunities when internally generated cash flows are insufficient. The reliance on external capital will, in turn, reduce the sensitivity of investment to internally generated resources and hence, engender the pattern of decaying sensitivity of investment to cash flow in developed countries.

To test our conjecture, we estimate the sensitivity of equity and debt issuances to firm-

[3]The definition and construction of these measures are presented in Appendix A.

level cash flow. If firms raise more external capital when they have not generated sufficient internal funds, the sensitivity of external issuances to cash flow should be negative. Alternatively, in the presence of limited resources, only established, or otherwise privileged, firms may enjoy access to external capital markets, and therefore, the sensitivity of equity/debt issuances to internal cash flow would be insignificant, or even positive. We find that for developed countries, the sensitivity of cash flow to equity issuance becomes significantly negative starting from the second subperiod of 1996-2006, which corresponds to the start of the vanishing ICF sensitivity. The larger magnitude in the last subperiod support the notion that external equity capital has become more available to firms in need. In contrast, we find a positive relationship between cash flow and external equity capital in less developed countries, suggesting that firms operating in economies with limited resources cannot access external equity capital when they need to do so. Furthermore, the findings indicate that firms from developed countries are substituting debt for cash flow, while firms from developing countries show little access to debt finance. Our results remain unaltered when we account for additional sources of financing (e.g., cash reserves), as well as other aspects of financial policy (e.g., corporate payouts). Combined, the results provide evidence that ease of enhanced access to external equity and debt finance is the channel through which country development influences ICF sensitivity.

Finally, we explore alternative explanations that our main findings can be a result of (i) measurement error in Tobin's q; (ii) cash flow persistence; (iii) decreasing importance of tangible investment; and (iv) industry composition. We address these concerns by employing Erickson, Jiang, and Whited's (2014) cumulant estimators, augmenting our main model to include a lagged cash flow, reestimating our main models based on terciles of asset tangibility, and also performing subsample analyses by sector. Our findings are insensitive to these alternative tests.

Overall, our research expands prior empirical U.S.-based studies that debate on the rea-

sons behind the declining ICF sensitivity.[4] We show that an international examination of the trend in ICF sensitivity sheds light on the causes of its disappearance over time. Our evidence suggests that firm-level financial constraints are binding largely in an environment of scarce financial and economic resources. Once a country reaches a certain threshold of economic, financial, and legal development, external capital becomes available, which reduces firms' reliance on internally generated funds.

The two closest papers to our work are McLean, Zhang, and Zhao (2012) and Moshirian et al. (2017), who also examine ICF sensitivity in an international setting. McLean, Zhang, and Zhao show that countries with weak legal protection exhibit higher ICF sensitivity. Our research complements their work by examining the evolution of ICF sensitivity over time and demonstrating that country-level financial development and economic progress play an important role. Moshirian et al. attribute the decline in ICF around the world to changes in asset tangibility. However, we show that this mechanism alone cannot explain the results and offer a broader framework of explanations based on various aspects of economic growth and financial development.

More broadly, our findings on the relationship between external capital and internal cash flow suggest that even for financially developed countries, the relaxation of financial constraints has been gradual over time. For example, Bekaert et al. (2016) show that developed countries, including the U.S., have been in the process of liberalizing their capital markets throughout the 1980s and part of 1990s. As financial constraints become less binding in developed countries, firms are able to gain access to external capital and hence, no longer have to rely on internally generated funds. In comparison, emerging markets have started to experience a wave of liberalizations mainly in the last two decades. This observation underscores the gradual process of globalization and highlights the importance of implicit and explicit financial barriers faced by firms, especially in emerging markets.

[4]For e.g., see Allayannis and Mozumdar (2004), Agca and Mozumdar (2008), Ascioglu, Hegde, and McDermott (2008), Brown and Petersen (2009), Chen and Chen (2012), among others.

The paper is organized as follows. The next section describes the empirical methodology and data, and establishes the international evidence of ICF sensitivity and also its variation over time. Section 3 explores various plausible explanations at the country level for the disappearing ICF sensitivity, and Section 4 examines the channel through which country development affects the sensitivity. In Section 5, we evaluate alternative explanations, and the final section concludes.

1.2 Empirical framework and data

In this section, we describe the empirical methodology that is employed to estimate ICF sensitivity and the data used to construct our sample.

1.2.1 Empirical specification

Following the existing literature,[5] we employ the following empirical model to estimate the ICF sensitivity.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t}, \tag{1}$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by $A_{i,t-1}$; $CF_{i,t}$ is firm i's net income plus depreciation and amortization scaled by $A_{i,t-1}$; β_1 is the investment-q sensitivity; β_2 is ICF sensitivity; α_i, $\alpha_{c,i}$, and $\alpha_{ind,i}$ denote firm, country-year, and industry-year fixed effects, respectively.

Equation (1) postulates that a firm's investment depends on not only its investment opportunities, as proxied by Tobin's q, but also its internally generated cash flow. Fazzari, Hubbard, and Petersen (1988) argue that when a firm relies on internal funds to finance its

[5] See, for example, Fazzari, Hubbard, and Petersen (1988) and Baker, Stein, and Wurgler (2003).

investment, it is financially constrained; otherwise, the firm would have access to external financing by way of equity and debt issuances.

Recent U.S.-based studies show that the ICF sensitivity has been declining and disappeared in recent years. To facilitate a comparison of our results with those of prior studies, we employ (1) as our baseline model. Specifically, we first conduct pooled regressions of equation (1) on a sample of firms from 43 countries for the entire period (1991-2014), as well as three subperiods (i.e., 1991-1998, 1999-2006, and 2007-2014). Using subperiod analyses allows us to examine evidence of a declining ICF sensitivity in both U.S. and non-U.S. countries over time.

1.2.2 Sample and descriptive statistics

Our sample is obtained from Worldscope for the period from 1991 to 2014. The selection of the sample period is constrained by the availability of data on emerging markets that mainly begin in the 1990s. Worldscope contains annual firm-level data, including financial statement variables and the market value of equity. Following Baker, Stein, and Wurgler (2003) and McLean, Zhang, and Zhao (2012), we exclude financial firms and firms with negative book values of equity. We further winsorize all financial variables at the 1st and 99th percentiles in each year. Our final sample includes only firms with non-missing main variables and therefore contains 419,318 firm-year observations across 43 countries from 1991 to 2014.

Table 1-1 provides descriptive statistics of the variables employed in estimating our baseline model (1) by country and by subperiod, with the last row of the table showing mean values of the variables for all countries. For each country and each subperiod, we report the number of observations and mean values of the three variables: investment ($\frac{I_{i,t}}{A_{i,t-1}}$), Tobin's q ($q_{i,t-1}$), and cash flow ($\frac{CF_{i,t}}{A_{i,t-1}}$).

The summary statistics show substantial cross-country variation in the number of firm-

Table 1-1
Means of Key Variables Across Periods by Country

This table presents the number of firm-year observations (N), average values of investment ($\frac{I_{i,t}}{A_{i,t-1}}$), Tobin's q ($q_{i,t-1}$), and cash flow ($\frac{CF_{i,t}}{A_{i,t-1}}$) for three subperiods by country, where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by $A_{i,t-1}$; $CF_{i,t}$ is firm i's net income plus depreciation and amortization, scaled by $A_{i,t-1}$. The sample period is between 1991 and 2014.

	N			$\frac{I_{i,t}}{A_{i,t-1}}$			$q_{i,t-1}$			$\frac{CF_{i,t}}{A_{i,t-1}}$		
Country	1991-1998	1999-2006	2007-2014	1991-1998	1999-2006	2007-2014	1991-1998	1999-2006	2007-2014	1991-1998	1999-2006	2007-2014
Argentina	144	387	499	0.117	0.045	0.072	1.243	1.146	1.740	0.106	0.063	0.082
Australia	1,449	6,233	10,767	0.087	0.100	0.118	1.528	2.014	2.140	0.084	-0.104	-0.187
Austria	448	529	463	0.072	0.072	0.069	1.401	1.470	1.392	0.085	0.073	0.080
Belgium	504	676	626	0.082	0.080	0.053	1.329	1.710	1.501	0.095	0.103	0.067
Brazil	695	1,521	1,657	0.249	0.071	0.067	0.976	1.227	1.534	0.150	0.083	0.084
Canada	2,847	7,609	13,987	0.125	0.136	0.135	1.640	2.320	2.236	0.080	-0.071	-0.195
Chile	392	977	1,067	0.111	0.059	0.063	1.626	1.341	1.614	0.132	0.093	0.087
China	362	6,243	16,713	0.074	0.074	0.073	1.408	1.821	2.287	0.065	0.055	0.075
Colombia	90	155	197	0.060	0.041	0.069	1.108	0.805	1.292	0.072	0.082	0.095
Denmark	891	907	846	0.079	0.070	0.056	1.472	1.637	1.780	0.093	0.082	0.033
Finland	583	906	854	0.091	0.077	0.048	1.242	1.830	1.552	0.104	0.104	0.073
France	3,171	4,409	3,804	0.066	0.061	0.046	1.304	1.751	1.446	0.086	0.077	0.063
Germany	2,866	4,431	3,925	0.094	0.062	0.049	1.530	1.711	1.588	0.093	0.050	0.058
Greece	52	855	1,741	0.089	0.070	0.050	1.489	1.613	1.083	0.136	0.076	0.021
Hong Kong	1,262	4,569	6,203	0.074	0.052	0.047	1.338	1.471	1.522	0.075	0.023	0.015
India	1,309	3,037	14,340	0.129	0.090	0.095	1.759	1.654	1.405	0.108	0.120	0.084
Indonesia	632	1,491	2,211	0.130	0.060	0.075	1.488	1.201	1.590	0.072	0.076	0.096
Ireland	391	448	384	0.077	0.068	0.041	1.526	2.460	1.767	0.059	0.014	0.013
Israel	127	972	2,688	0.087	0.045	0.036	1.645	1.678	1.517	0.076	0.041	0.007
Italy	1,008	1,368	1,497	0.064	0.057	0.043	1.149	1.527	1.279	0.065	0.061	0.044
Japan	5,376	23,111	26,431	0.052	0.038	0.035	1.395	1.256	1.135	0.047	0.046	0.052
Luxembourg	50	151	191	0.091	0.061	0.063	1.341	1.741	1.602	0.104	0.082	0.094
Malaysia	1,526	4,606	6,411	0.096	0.050	0.046	2.084	1.167	1.117	0.083	0.057	0.061
Mexico	436	729	666	0.094	0.055	0.061	1.524	1.115	1.587	0.096	0.081	0.091
Netherlands	1,082	1,183	889	0.083	0.066	0.050	1.514	1.903	1.592	0.126	0.090	0.071
New Zealand	271	620	786	0.074	0.074	0.061	1.419	1.820	1.779	0.106	0.064	0.009
Norway	684	976	1,162	0.136	0.098	0.086	1.606	1.868	1.622	0.089	0.046	0.008
Pakistan	339	706	1,416	0.083	0.090	0.068	1.418	1.206	1.299	0.093	0.124	0.103
Peru	104	428	630	0.104	0.057	0.071	1.569	1.062	1.508	0.136	0.120	0.128
Philippines	295	840	1,007	0.138	0.049	0.061	1.660	1.153	1.926	0.091	0.032	0.079
Poland	119	664	2,235	0.149	0.086	0.067	1.499	1.453	1.563	0.136	0.101	0.063
Portugal	281	399	315	0.077	0.057	0.044	1.070	1.231	1.163	0.081	0.072	0.059
Singapore	894	2,831	4,063	0.097	0.059	0.055	1.535	1.306	1.279	0.071	0.067	0.057
South Africa	999	1,980	1,789	0.082	0.078	0.072	1.608	1.604	1.635	0.124	0.099	0.094
South Korea	1,074	5,398	11,831	0.097	0.060	0.060	1.068	1.070	1.203	0.036	0.049	0.035
Spain	797	855	822	0.057	0.068	0.048	1.195	1.589	1.529	0.082	0.096	0.059
Sweden	946	1,946	2,615	0.085	0.053	0.039	1.502	2.225	2.092	0.094	0.008	-0.011
Switzerland	933	1,399	1,327	0.067	0.052	0.043	1.282	1.749	1.740	0.093	0.075	0.064
Thailand	967	2,164	3,339	0.101	0.067	0.061	1.500	1.191	1.349	0.085	0.101	0.095
Turkey	194	1,094	1,810	0.243	0.090	0.059	2.546	1.708	1.400	0.311	0.126	0.070
United Kingdom	8,902	9,357	8,823	0.078	0.065	0.050	1.694	2.110	1.892	0.089	0.006	-0.018
United States	27,512	41,519	32,372	0.085	0.064	0.061	1.986	2.449	2.201	0.072	-0.029	-0.022
Venezuela	49	111	76	0.081	0.045	0.068	1.001	0.687	0.925	0.108	0.094	0.122
Total	73,053	150,790	195,475	0.086	0.065	0.067	1.689	1.834	1.709	0.080	0.020	0.010

year observations and main variables. The total number of observations increases from 73,053 in the first subperiod to 195,475 in the last subperiod, as Worldscope's coverage of many developing countries increases.

On average, there is a gradual fall in a firm's investment and a steep decline in cash flow over the three subperiods. In contrast, during these two corresponding subperiods, Tobin's q rises. For example, the average investment of firms relative to total assets declines from 8.6% during the first subperiod (1991-1998) to 6.7% in the last subperiod (2007-2014), and the decline is more pronounced in emerging than in developed countries. Similar to investment, cash flow on average also declines considerably from 8.0% in the first subperiod to 1.0% in the third subperiod. The majority of countries experience a decrease in cash flow; among these countries, Australia, Canada, Sweden, the U.K., and the U.S. have an average negative cash flow in the third subperiod. In light of the large drop in both investment and cash flow during this sample period, it is important that our subsequent analysis evaluates the economic significance of the cash flow impact on investment.

1.2.3 **ICF sensitivity: cross-country evidence**

In this section, we first confirm the existence of ICF sensitivity around the world. Next, we examine whether the sensitivity has disappeared over time. Analyzing a large international sample provides more robust evidence on whether the disappearing sensitivity is specific to the U.S., or is prevalent across both developed and developing countries.

Table 1-2 reports the estimates of β_1's and β_2's from firm-level panel regressions of equation (1). Throughout this study, all $t-$statistics (shown in parentheses) associated with the regression coefficients are adjusted for standard errors clustered at the country level. For robustness, we employ different definitions of the dependent variable. In Panel A of the table, the dependent variable is defined as a firm's capital expenditure relative to the firm's beginning-of-period total assets, whereas in Panel B, it is computed as the ratio of the sum

of the firm's capital expenditure and R&D spending to the firm's beginning-of-period total assets.[6] The latter definition incorporates the intangible investment of the firm; its importance has increased significantly over the last decades (see, for example, Peters and Taylor (2017)). In the last four columns of Panels A and B, we exclude the U.S. to ensure that our results are not driven by the large number of U.S. firms in the sample.

Our results show strong international evidence of investment-q effects but less robust finding in ICF effects. On average, investment is positively and strongly associated with q across the entire sample period and three subperiods, but not robustly related to cash flow. For example, in Panel A, the coefficient of q is 0.011 (t =7.64) for the whole sample period, and ranges between 0.007 (t =9.00) and 0.017 (t =23.94) for the individual subperiods. Of particular interest is the monotonically declining cash flow effect on investment. Specifically, the investment sensitivity to cash flow, as captured by β_2, drops from 0.124 (t =4.60) to -0.003 (t =-0.21) across the subperiods, with an overall effect of 0.018 (t =1.39) for the full period. Figure 1 shows the declining sensitivity for all countries with and without the U.S. and compares these graphs with that of the U.S. only. It is apparent that the diminishing sensitivity is not unique to the U.S.; non-U.S. countries have very similar ICF sensitivity trends.

Next, we evaluate the economic significance of the impact of cash flow on investment. Examining economic significance of coefficients in the context of ICF sensitivity is especially important. Beyond providing an intuitive way to evaluate the magnitude of cash flow impact on investment, economic significance also accounts for time-series trends in the distribution of variables of interest that could affect the interpretation of our results. For example, Table 1-1 indicates that the level of investment has declined by about 22.1% from the first to the last subperiod (8.6% vs. 6.7%). While this decline is consistent with the increasing role of technology and diminishing importance of tangible capital in many nations, especially more

[6]The results remain qualitatively similar when we add R&D with SG&A expenses.

Table 1-2
ICF Sensitivity Around the World

This table reports coefficients obtained from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$ in Panel A and capital expenditure plus R&D in Panel B; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment.

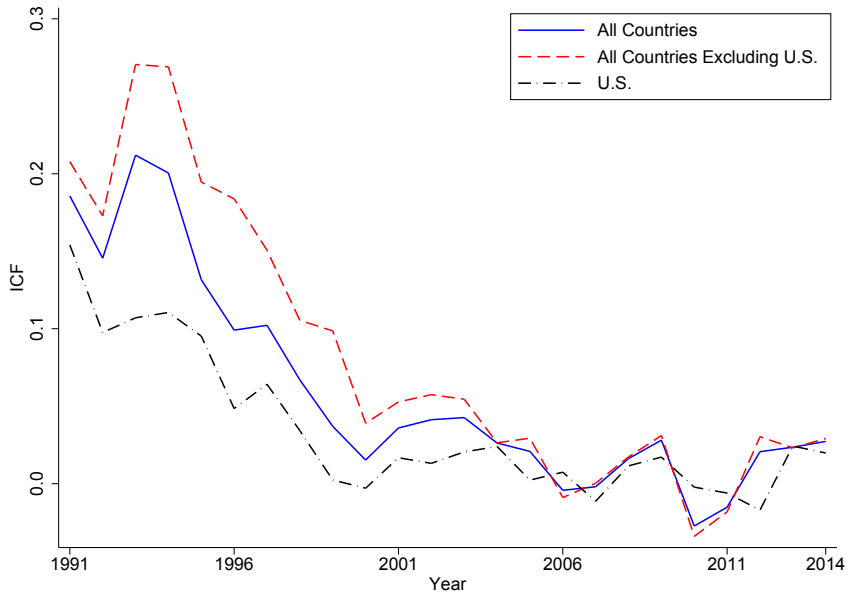
	Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	All Countries				**All Countries Excluding U.S.**			
	Panel A: Dependent Variable: Investment (Capital Expenditure Only)							
q	0.011***	0.017***	0.007***	0.013***	0.012***	0.016***	0.009***	0.014***
	(7.64)	(23.94)	(9.00)	(7.19)	(7.24)	(12.06)	(6.98)	(7.80)
CF	0.018	0.124***	0.017*	-0.003	0.020	0.176***	0.029**	-0.001
	(1.39)	(4.60)	(1.96)	(-0.21)	(1.05)	(7.59)	(2.62)	(-0.07)
N	419318	71667	146642	194075	317896	44692	106061	162204
$\bar{R}^2$	0.46	0.56	0.52	0.47	0.45	0.54	0.52	0.46
Economic Significance	0.061	0.196	0.064	-0.012	0.061	0.228	0.089	-0.005
	Panel B: Dependent Variable: Investment (Capital Expenditure and R&D)							
q	0.014***	0.019***	0.011***	0.016***	0.014***	0.016***	0.011***	0.017***
	(11.44)	(15.26)	(16.05)	(8.61)	(7.31)	(9.87)	(6.97)	(7.57)
CF	0.031*	0.163***	0.035***	0.001	0.029	0.199***	0.046***	0.001
	(1.93)	(8.23)	(4.10)	(0.05)	(1.24)	(7.94)	(3.52)	(0.06)
N	419318	71667	146642	194075	317896	44692	106061	162204
$\bar{R}^2$	0.52	0.62	0.59	0.53	0.48	0.55	0.55	0.49
Economic Significance	0.078	0.209	0.094	0.003	0.072	0.242	0.116	0.004

Figure 1-1
ICF Sensitivity Across All Countries and the U.S. by Year

This figure presents yearly cross-sectional regression estimates of investment-cash flow sensitivity (ICF) based on three different samples: firms from all 43 countries, firms from all countries except for U.S., and firms from U.S. only. The investment-cash flow sensitivity, denoted by β_2, is estimated from the following model.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_t + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization. All variables are demeaned at firm level.



developed countries, it could also provide a plausible explanation of the decline in ICF. A similar argument applies to the evolution of ICF sensitivity over time. Increased cash flow volatility in the recent period (Moshirian et al.; 2017) could also mechanically reduce the coefficient of cash flow in our estimation.

Our results indicate that a one-standard deviation increase in a firm's cash flow leads to a 6.1% increase in the mean investment in the full sample period. A closer analysis indicates that across subperiods, a one-standard deviation increase in a firm's cash flow induces a 19.6% increase in mean investment in the first subperiod but a decrease of 1.2% in mean investment in the third subperiod. Thus, the decline in ICF sensitivity is also economically important; its decreasing economic magnitude also implies that our findings cannot by explained by the declining importance of tangible capital and by higher volatility of cash flow over time.

Arguably, our evidence of the disappearing ICF sensitivity could also be driven by a single country or a group of countries. Prior studies have documented that ICF sensitivity of U.S. firms has been decreasing over time (Allayannis and Mozumdar, 2004; Agca and Mozumdar, 2008; Ascioglu, Hegde, and McDermott, 2008; Brown and Petersen, 2009) and has disappeared in the past decade (Chen and Chen, 2012). Given the robust evidence of the diminishing ICF sensitivity in the U.S., as well as the relatively high proportion of U.S. firms in the international sample, it is possible that our international evidence could be driven by the presence of U.S. firms. To rule out this possibility, we exclude the U.S. from our analysis and find that the results shown in the last four columns of the panel remain materially unchanged.

Panel B shows the results based on the alternative expanded investment definition. The inclusion of R&D spending in our definition of investment also does not qualitatively affect our key finding. The coefficients of ICF sensitivity, along with their $t-$statistics, are slightly larger than their counterparts reported in Panel A of the table. Based on the economic

significance of the cash flow magnitude, it suggests that the cash flow impact on investment decreases through time, regardless of the definition of corporate investment. The implication of these findings is that while asset intangibility accounts, to some extent, for the reduced cash flow effects on investment, it is not able to fully explain the disappearing phenomenon during the last subperiod.

For further robustness checks, Table 1-3 reports regression results by country and type of markets (developed vs. emerging). Over the entire sample period, ICF sensitivity is 0.111 for emerging markets, compared to 0.004 for developed markets; the former is statistically different from zero but the latter is not. The larger sensitivity in emerging markets suggests that firms from these markets rely more on internally generated cash flow to finance their investment than their developed counterparts. Overall, the results further reinforce our key evidence that in aggregate, ICF sensitivity has faded across the globe, especially in developed markets, and that the sensitivity varies substantially across countries.

1.3 Why has ICF sensitivity disappeared in some countries?

Corporate finance theory and empirical studies suggest that market imperfections arising from underdeveloped economic and financial systems may constrain firms' ability to finance investment projects (for example, King and Levine (1993), Demirgü -Kunt and Maksimovic (1998), Rajan and Zingales (1998), Wurgler (2000), Bekaert, Harvey, and Lundblad (2001), among others.) Recent trends of worldwide globalization, financial development, and economic growth could have relaxed the severity of financial constraints at the firm level and led to the disappearance of ICF sensitivity around the world, especially in more developed countries. Thus, guided by theory, this section explores whether country development is the driver of the fading ICF sensitivity and whether this sensitivity is a manifestation of financial constraints at the country level.

Table 1-3
ICF Sensitivity by Country

This table reports coefficients on cash flow obtained from regressing investment on Tobin's q and cash flow by country, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_t + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity; α_i and α_t are firm and year fixed effects, respectively. Robust $t-$statistics are computed based on standard errors clustered at the firm level. DEV denotes developed market, whereas EMG represents emerging market. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Market	Full Period	Subperiods		
Country	Type	1991-2014	1991-1998	1999-2006	2007-2014
Argentina	EMG	0.108***	0.677***	0.051*	0.115**
Australia	DEV	-0.031***	0.117**	-0.013	-0.040***
Austria	DEV	0.139**	0.374***	0.044	0.203*
Belgium	DEV	0.131**	0.388***	0.016	0.035
Brazil	EMG	0.130***	0.142**	0.108***	0.108**
Canada	DEV	-0.022***	0.181***	0.041**	-0.042***
Chile	EMG	0.132***	0.097	0.149	0.056
China	EMG	0.183***	0.345	0.088***	0.198***
Colombia	EMG	0.246***	0.242	0.205*	0.279*
Denmark	DEV	0.055*	0.176*	0.059	0.025
Finland	DEV	0.125***	0.288***	0.141***	0.085***
France	DEV	0.109***	0.308***	0.086**	0.063***
Germany	DEV	0.076***	0.318***	0.032**	0.043***
Greece	EMG	0.138*	0.231	0.262***	0.096
Hong Kong	DEV	0.049***	0.113**	0.058***	0.019*
India	EMG	0.272***	0.473***	0.233***	0.238***
Indonesia	EMG	0.151***	0.143***	0.168**	0.156***
Ireland	DEV	0.052	0.220***	-0.006	0.065*
Israel	EMG	0.005	0.141	0.022	-0.001
Italy	DEV	0.070	0.363***	0.014	-0.054
Japan	DEV	0.060***	0.186***	0.032***	0.050***
Luxembourg	DEV	0.144**	0.196	0.162	0.089
Malaysia	EMG	0.131***	0.218***	0.084***	0.110***
Mexico	EMG	0.144***	0.071	0.112**	0.144*
Netherlands	DEV	0.042	0.208***	0.058***	-0.062
New Zealand	DEV	0.040	0.660	-0.040	0.036
Norway	DEV	0.055**	0.224**	0.022	0.041
Pakistan	EMG	0.186***	0.168	0.299***	0.098**
Peru	EMG	0.098**	0.132	0.160**	-0.033
Philippines	EMG	0.027	0.472***	0.023	-0.046
Poland	EMG	0.099***	0.367	0.170**	0.088***
Portugal	DEV	0.063*	0.205	-0.018	0.058
Singapore	DEV	0.099***	0.262**	0.103***	0.079***
South Africa	EMG	0.074***	0.317***	0.072***	0.052
South Korea	EMG	0.049***	0.087**	0.039	0.045***
Spain	DEV	0.174***	0.228***	0.263**	0.069**
Sweden	DEV	0.022*	0.165**	0.023*	0.013
Switzerland	DEV	0.046**	0.313***	0.004	0.013
Thailand	EMG	0.079***	0.019	0.124***	0.074*
Turkey	EMG	0.120***	0.417*	0.117***	0.057*
United Kingdom	DEV	0.023***	0.119***	0.000	0.003
United States	DEV	0.014***	0.077***	0.003	-0.009
Venezuela	EMG	0.211***	0.292***	0.121	0.393***
DEV		0.004	0.113***	0.009	-0.022**
EMG		0.111***	0.193***	0.090***	0.099***

1.3.1 **Country development and ICF sensitivity**

We first ask whether changes of a country's financial and economic environment influence the severity of financial constraints faced by firms within the country. The extent of a country's development could impact ICF sensitivity in several ways. First, the growth of national output increases the propensity of households in the economy to save. As a result, the amount of resources that could be channeled to firms in the form of external financing also grows. Second, developments of financial systems facilitate the flow of capital and contribute to more efficient allocation of existing resources. Taken together, the two forces could have improved access of individual firms to external capital and relaxed financial constraints of individual firms. To test this prediction, we start with the most expansive and general measure of growth, and ask whether the level of GDPC, which captures both economic and financial aspects of country-level development, could explain the observed variation in ICF sensitivity. We perform our empirical analysis in the following way.

For each subperiod, we first calculate each country's average GDPC (in constant dollars of 2005). Next, we rank these country-subperiod values from the largest to the smallest and find the GDPC thresholds that split the resulting distribution into three groups of equal size. The thresholds are time-invariant by construction. The bottom tercile contains the least developed countries, whereas the top tercile consists of the most developed countries. Within each tercile, country-subperiod average GDPC values are then grouped by their respective subperiods. This approach is essentially equivalent to an independent time-GDPC sort and permits us to capture time variation in the degree of economic and financial development of each country, as well as the overall rising trend. In this way, once a country attains a certain threshold of financial and economic development, it moves to a higher tercile.

Table 1-4 reports the distribution of countries across GDPC-formed terciles. Given that the majority of countries have enjoyed tremendous economic growth and improvements in financial systems in the past two decades, there are more countries that fall into the top

GDPC-formed tercile of economic and financial development in the most recent subperiod than countries that have a high level of development in the first period. For example, the top GDPC tercile contains 18 countries in the last subperiod, but only 8 countries in the first subperiod. Not surprisingly, the U.S. remains in the top tercile throughout the three subperiods, whereas emerging markets such as the Philippines and South Africa fall consistently in the bottom tercile. Other countries, however, experience substantial movements across the terciles. For example, Singapore is in the middle tercile in the first two subperiods, but move to the top tercile in the last subperiod. On the other hand, Argentina and Turkey are in the bottom tercile in the first two subperiods, consistent with the economic crises in both countries during these subperiods, but move to the middle tercile in the third subperiod.

Within each subperiod-tercile, we estimate β_2 of equation (1) using firm-level panel regressions. Table 1-5 presents regression results, with the last row showing economic significance of the cash-flow coefficient. The table yields several interesting findings. First, time-series patterns of ICF sensitivity distinctly differ across the terciles. For firms from the least developed tercile, their average cash-flow coefficients are all positive and statistically significant, showing no sign of vanishing sensitivity. In contrast, for firms from the most developed tercile, their cash-flow coefficient is positive only in the first subperiod, is insignificant in the second subperiod, and becomes negatively singificant in the last period. These striking differences in the coefficient of ICF sensitivity across terciles reflect varying extents to which firms from countries with varying degrees of economic wealth and development utilize internal funds for their investment opportunities. Furthermore, consistent with prior studies,[7] the coefficient of q is positive and statistically significant across all terciles and over time. For a given period, the magnitude of q is fairly similar across different terciles.

[7]See, for example, McLean, Zhao, and Zhang (2012).

Table 1-4
Distribution of Countries across GDPC-Subperiod Terciles

This table shows the distribution of countries sorted independently based on their average GDP per capita (GDPC) computed over each subperiod. The entire sample period is divided into three subperiods: 1991-1998, 1999-2006, and 2007-2014. We sort countries into terciles based on their level of GDPC (in constant dollars of 2005) in the following way. For each subperiod, we first compute each country's average GDP per capita and then sort the country-subperiod averages from the largest to the smallest and find the thresholds that split the resulting distribution into three groups of equal size. As a result, we end up with nine GDPC-subperiod bins based on two time-invariant breakpoints.

Low GDP per Capita			**Middle**			**High GDP per Capita**		
1991-1998	**1999-2006**	**2007-2014**	**1991-1998**	**1999-2006**	**2007-2014**	**1991-1998**	**1999-2006**	**2007-2014**
Countries that Remain in the Same Tercile througout the Sample Period								
Brazil	Brazil	Brazil	Greece	Greece	Greece	Denmark	Denmark	Denmark
China	China	China	Hong Kong	Hong Kong	Hong Kong	Japan	Japan	Japan
Colombia	Colombia	Colombia	Israel	Israel	Israel	Luxembourg	Luxembourg	Luxembourg
India	India	India	Italy	Italy	Italy	Netherlands	Netherlands	Netherlands
Indonesia	Indonesia	Indonesia	New Zealand	New Zealand	New Zealand	Norway	Norway	Norway
Malaysia	Malaysia	Malaysia	Portugal	Portugal	Portugal	Sweden	Sweden	Sweden
Pakistan	Pakistan	Pakistan	South Korea	South Korea	South Korea	Switzerland	Switzerland	Switzerland
Peru	Peru	Peru	Spain	Spain	Spain	United States	United States	United States
Philippines	Philippines	Philippines						
South Africa	South Africa	South Africa						
Thailand	Thailand	Thailand						
Venezuela	Venezuela	Venezuela						
Countries that Move from a Lower to a Higher Tercile Across the Sample Period								
Argentina	Argentina				Argentina			
Chile				Chile	Chile			
Mexico				Mexico	Mexico			
Poland				Poland	Poland			
Turkey	Turkey				Turkey			
			Australia				Australia	Australia
			Austria				Austria	Austria
			Belgium				Belgium	Belgium
			Canada				Canada	Canada
			Finland				Finland	Finland
			France				France	France
			Germany				Germany	Germany
			Ireland				Ireland	Ireland
			Singapore	Singapore				Singapore
			United Kingdom				United Kingdom	United Kingdom

Table 1-5
GDP Per Capita and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on GDP per capita. We rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low GDP per Capita				**Middle**				**High GDP per Capita**			
q	0.009***	0.013***	0.007***	0.011***	0.011***	0.017***	0.008***	0.011***	0.010***	0.018***	0.007***	0.013***
	(7.86)	(6.38)	(3.36)	(6.67)	(7.34)	(11.91)	(4.86)	(6.06)	(6.94)	(55.69)	(8.36)	(5.46)
CF	0.149***	0.205***	0.103***	0.148***	0.067***	0.161***	0.060***	0.034***	-0.004	0.081***	0.006	-0.024**
	(5.64)	(5.85)	(7.42)	(4.49)	(6.01)	(6.06)	(6.39)	(3.82)	(-0.38)	(8.27)	(1.24)	(-2.45)
N	83044	8449	24195	49632	78834	26416	19333	32040	256433	36724	103060	112353
$\bar{R}^2$	0.39	0.54	0.43	0.37	0.41	0.52	0.40	0.34	0.51	0.59	0.56	0.53
Economic Significance	0.237	0.231	0.195	0.232	0.164	0.226	0.168	0.112	-0.018	0.152	0.025	-0.112

Second, the economic significance of the cash flow coefficient shows a clear distinction in the cash-flow impact on investment between the two extreme terciles of countries. While the cash-flow effect on investment is consistently high in the bottom tercile, it has fallen dramatically from the first to second and third subperiods in the top tercile. In fact, for the latter tercile, their investment is no longer sensitive to the level of cash flow during the last two subperiods of our sample. As seen in the table, a one-standard deviation increase in a firm's cash flow, on average, leads to a 19.5%-23.7% increase in mean investment in low $GDPC$ countries, compared with -11.2%-15.2% in high $GDPC$ countries.

Arguably, firms can also use existing cash reserves to finance their investment. Given the increasing importance of cash holdings (for example, Bates, Kahle, and Stulz, 2009), this could explain the declining ICF sensitivity in developed countries. To rule out this explanation, we control cash holdings in our analysis, and the untabulated results suggest that our key findings remain qualitatively similar to those shown in Table 1-5.

In summary, the results suggest that country development plays a critical role in the disappearance of ICF sensitivity in highly developed markets over the past two decades.

1.3.2 The role of economic versus financial development

In this subsection, we attempt to take a closer look at economic versus financial aspects of country-level progress and try to establish more specific aspects of development that have contributed to the decline in ICF sensitivity. It is important to note that disentangling the two in a precise way is a notoriously difficult task, since financial development and economic growth are closely linked. As a country becomes wealthier, potential benefits of international trade may call for lifting of cross-border capital constraints. At the same time, more developed financial systems reduce the cost of capital, leading to more profitable investment opportunities, and in turn, stimulate economic growth. Moreover, both economic and financial development could be driven by a common omitted variable, such as political

regime. While the set of variables we propose cannot disentangle the aspects of financial versus economic development in a precise manner, the collective evidence on the importance of economic and financial development factors lends support to the country development channel and helps mitigate alternative explanations.

Effects of economic development

We assume a standard form of production function and use characteristics of input factors that could affect a country's total output. Our study employs four different measures of economic development; the information of which is available from World Development Indicators (WDI). The first measure captures the characteristics of labor capital and is proxied by the ratio of secondary school enrollment. As more people have access to education, the labor force in the economy grows, and the marginal productivity of labor capital increases. The second measure of economic development accounts for the role of infrastructure, as proxied by electricity. Access to electricity increases the marginal productivity of capital, such as machinery, and also reduces reliance on capital in fixed supply, such as land. The use of electricity could also be viewed as a measure of technological development for underdeveloped countries, since manual tasks can be automated using electronic machinery and equipment. The third measure is the country-level R&D scaled by GDP, which serves as a more direct measure of technological changes, which foster entrepreneurial activity and hence economic development. The last measure is the foreign direct investment (FDI), which serves as a means to gauge the extent of a country's economic development through the benefits of cross-border investments.

Appendix A contains the definitions and sources of these proxies for economic development and those for financial development; the latter of which will be discussed in the subsequent subsection. Appendix B depicts the cross-correlation between these measures of economic and financial development, GDPC, and ICF sensitivity. As expected, our proxies

for a country's development are highly correlated with ICF sensitivity and that their correlation with ICF sensitivity is all negative, except for ICOC, which bears a positive correlation (i.e., the higher the ICOC, the greater is the sensitivity of investment to cash flow).

We employ the same methodology that we used to form GDPC terciles to test whether specific characteristics of economic development explain the fading ICF sensitivity. We sort the countries based on the average measure of development for each subperiod and then determine two time-invariant breakpoints that allow us to allocate countries into their respective tercile bins. The bottom tercile contains the least economically developed countries, whereas the top tercile consists of the most developed ones. Within each tercile, country-subperiod averages are then grouped by their respective subperiods.

Table 1-6 reports the panel regression results based on each measure of economic development and its format is the same as that of Table 1-5. As the results suggest, economic development plays a critical role in explaining the disapperance of ICF sensitivity. In highly economically developed countries, ICF sensitivity vanishes in the last two subperiods, compared with the highly positive and significant ICF sensitivity in underdeveloped countries. For example, ICF sensitivity becomes statistically insignificant or negative in the top tercile of countries during the last two subperiods, consistent with the U.S. evidence. But the sensitivity in the bottom tercile of countries remains positive and statistically significant across the subperiods. The middle tercile yields broadly similar results to those of the top tercile.

The importance of economic development in explaining ICF sensitivity is also evidenced in the economic magnitude of the cash-flow coefficient. A one-standard deviation increase in a firm's cash flow in the first subperiod, on average, leads to a 16.4%-23.5% increase in the mean investment in the most economically developed countries and a similar magnitude increase in the mean investment in the least developed group (17.8%-24.7%). This evidence suggests that internally-generated cash flows are important in funding investment opportunities in

Table 1-6
Economic Development and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on proxies for economic development (electricity consumption per capita, secondary school enrollment ratio, R&D expenses, and FDI). For each proxy, we rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low Electricity Consumption				**Middle**				**High Electricity Consumption**			
q	0.009***	0.013***	0.006***	0.013***	0.010***	0.015***	0.007***	0.010***	0.010***	0.018***	0.007***	0.013***
	(5.38)	(6.02)	(3.43)	(10.20)	(16.31)	(9.92)	(9.52)	(11.23)	(5.93)	(31.86)	(7.29)	(5.46)
CF	0.151***	0.205***	0.113***	0.147**	0.052***	0.162***	0.029	0.044*	-0.002	0.092***	0.007	-0.023*
	(4.46)	(5.68)	(7.58)	(2.91)	(3.15)	(4.85)	(1.65)	(1.81)	(-0.17)	(5.07)	(1.21)	(-2.06)
N	59890	7623	23936	27760	103864	23613	27691	51208	254462	40343	94959	115065
$\bar{R}^2$	0.40	0.54	0.43	0.35	0.39	0.47	0.43	0.40	0.51	0.59	0.56	0.52
Economic Significance	0.229	0.232	0.203	0.216	0.147	0.232	0.097	0.142	-0.008	0.164	0.031	-0.100
	Low Secondary School Enrollment				**Middle**				**High Secondary School Enrollment**			
q	0.010***	0.013***	0.008***	0.011***	0.009***	0.018***	0.007***	0.010***	0.014***	0.016***	0.009***	0.016***
	(10.69)	(5.67)	(6.22)	(6.54)	(18.72)	(143.81)	(9.37)	(12.13)	(6.32)	(5.06)	(3.47)	(7.56)
CF	0.141***	0.215***	0.087***	0.151***	0.023***	0.093***	0.008	0.010	-0.020*	0.195***	0.005	-0.032***
	(5.48)	(5.31)	(6.48)	(4.61)	(2.89)	(5.33)	(1.40)	(0.75)	(-1.94)	(7.90)	(0.31)	(-4.04)
N	87660	10801	27574	48565	238694	46347	95285	93646	87427	13736	20966	51802
$\bar{R}^2$	0.35	0.39	0.43	0.37	0.51	0.58	0.57	0.48	0.47	0.53	0.46	0.50
Economic Significance	0.242	0.247	0.196	0.239	0.088	0.170	0.035	0.046	-0.071	0.233	0.016	-0.127

Table 1-6 - Continued
Economic Development and ICF Sensitivity

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low R&D				**Middle**				**High R&D**			
q	0.010***	0.014***	0.006***	0.012***	0.013***	0.016***	0.008***	0.016***	0.009***	0.018***	0.007***	0.011***
	(7.61)	(4.91)	(5.76)	(5.08)	(5.13)	(8.42)	(7.57)	(6.50)	(9.23)	(118.08)	(7.45)	(5.53)
CF	0.079***	0.212***	0.093***	0.041**	0.018	0.149***	0.021	-0.002	0.010	0.094***	0.008	-0.011
	(4.02)	(3.99)	(4.80)	(2.35)	(0.59)	(6.80)	(1.23)	(-0.05)	(0.80)	(4.19)	(1.31)	(-0.80)
N	50094	7962	21149	20491	115637	18921	24467	71109	248191	42622	99895	101738
$\bar{R}^2$	0.35	0.38	0.42	0.35	0.43	0.54	0.45	0.43	0.50	0.57	0.56	0.52
Economic Significance	0.183	0.246	0.223	0.119	0.051	0.214	0.061	-0.006	0.039	0.169	0.036	-0.051
	Low FDI				**Middle**				**High FDI**			
q	0.010***	0.017***	0.006***	0.011***	0.009***	0.019***	0.007***	0.012***	0.012***	0.011**	0.009***	0.015***
	(3.60)	(24.53)	(4.22)	(3.46)	(5.19)	(12.15)	(8.18)	(6.49)	(4.74)	(4.11)	(5.89)	(4.68)
CF	0.102***	0.105***	0.068***	0.097*	0.005	0.152***	0.003	-0.004	-0.000	0.185***	0.027**	-0.019
	(4.22)	(3.98)	(3.89)	(2.06)	(0.38)	(6.20)	(0.69)	(-0.23)	(-0.02)	(5.17)	(2.79)	(-1.04)
N	136403	45270	39055	51196	178663	20241	63792	93127	100747	5557	43762	49728
$\bar{R}^2$	0.50	0.59	0.48	0.41	0.46	0.54	0.50	0.49	0.47	0.35	0.55	0.48
Economic Significance	0.198	0.178	0.155	0.192	0.022	0.215	0.014	-0.017	-0.002	0.235	0.090	-0.081

both developed and developing countries in the earlier period of our sample. However, the results differ substantially across the development-formed terciles during the last subperiod. For example, a one-standard deviation increase in a firm's cash flow in the last subperiod, on average, reduces 5.1%-12.7% in the mean investment in the top tercile, compared to a 11.9%-23.9% increase in the bottom tercile, suggesting that the advancement of economic development contributes to the fading ICF sensitivity in the recent decade.

Effects of financial development

We now zoom in on the financial side of country-level development. Existing research shows that well-functioning financial markets and availability of capital resources are the key to economic growth as they improve firms' access to outside capital and reduce the cost of raising outside capital (Rajan and Zingales, 1998; Levine, 2005). Easy access to external finance allows firms with limited internal cash flow to pursue profitable investment opportunities that require large investment. Rajan and Zingales show that industries that depend on external financing have the ability to grow faster in countries with better developed financial systems. Wurgler (2000) shows that the development of financial systems facilitates efficient allocation of resources to productive industries. Love (2003) shows that a country's financial development mitigates investment obstacles by reducing information asymmetries and contracting imperfections.

The above discussion suggests that firms from countries with fewer financial imperfections should be able to raise external funds to exploit their growth opportunities. With greater access to external finance, a firm's investment becomes less contingent upon the availability of internal capital. Therefore, as financially developed countries greatly reduce market impediments to their sources of external capital, ICF sensitivity of firms from these countries could decrease and then vanish in recent years. In contrast, firms from less financially developed countries, where capital is scarce, could still face greater financial barriers even

today and hence, continue to have limited access to external finance. These firms would rely more on internally generated cash flows, and therefore, their ICF sensitivity should remain significant.

To test these predictions, we first construct general measures of financial development. We follow King and Levine (1993), La Porta et al. (1997), and Rajan and Zingales (1998) and employ the size of a country's equity markets relative to its GDP as a proxy for the general level of financial development. We also measure the aggregate cost of equity financing by employing the average of four different implied cost of equity (ICOC) estimates as a proxy for each firm's yearly cost of capital. For each country and for each year, we then employ the value-weighted average of firms' ICOCs as a proxy for the country's cost of equity financing.[8]

As a second step, we consider particular aspects of financial system development. Specifically, we look at the availability of domestic versus foreign resources to determine whether the source of capital matters in determining the financial constraints faced by individual firms. To capture the availability of within-country resources, we use the amount of available private credit scaled by GDP (Private Credit). To examine whether lifting of cross-border constraints could be another mechanism that allows more efficient allocation of resources across countries, we employ the flows of portfolio equity into a country (Portfolio Equity Inflows).

Finally, we look at investor protection. Existing studies find that regulatory environment, particularly investor protection, promotes efficient allocation of financial capital and enhances firms' access to external finance.[9] Thus, firms that operate in countries where investor protection laws have remained weak could be more sensitive to the existence of financial constraints due to contracting imperfections and high degrees of information asymmetries. To test this hypothesis, we use an investor protection index (Protection) and a

[8]See Hail and Leuz (2006) and Lau, Ng, and Zhang (2010) on the specifications and assumptions of the four models we use to estimate the ex ante cost of equity capital as implied by each model.

[9]See, for example, Demirguc-Kunt and Makismovic (1998) and Levine and Zervos (1998).

financial disclosure index (Disclosure). Countries with strong investor protection tend to have a more transparent information environment and lower level of information asymmetries (Lau, Ng, and Zhang, 2012). With lower information asymmetries, external financing costs associated with information acquisition should be lower.

The six different measures of financial development are detailed in Appendix A, with their correlation matrix in Appendix B. Note that the measures of investor protection and disclosure are time-invariant and therefore, do not allow for countries to switch categories over time. As a result, we cannot allocate countries into bins over time in the same flexible manner as we did in the previous analysis. Due to the limitation of these measures, it is still possible that ICF sensitivity fades in groups of varying levels of investor protection. Yet if the financial system has advanced more rapidly in countries with strong investor protection and transparent information environment, we should observe a steeper decline in ICF sensitivity in these countries than in countries with weak investor protection and opaque information environment.

Consistent with the analysis in Tables 5-6, we sort countries into terciles based on their level of financial development, with the bottom tercile consisting of firms from least financially developed countries and the top tercile consisting of those from most developed ones. Within each group of countries, we conduct firm-level panel regressions of model (1) for the full sample period and for three subperiods. Table 1-7 presents regression results for each measure of financial development. The findings are broadly consistent with those shown in Tables 5 and 6 in terms of the levels of statistical and economic significance of the cash-flow coefficient, and are independent of the proxy for financial development we employ. Specifically, the cash-flow coefficient is lower for countries with most advanced financial devlopment compared with that for countries with least financially developed economy. The sensitivity disappears in 1999-2006 and 2007-2014 subperiods for the top tercile but remains strongly significant for the bottom tercile. For example, for terciles formed based on the level of

Table 1-7
Financial Development and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on proxies for financial development (stock market capitalization, cost of equity financing, private credit, portfolio equity net inflows, protection, and disclosure). For each proxy, we rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low Stock Market Development				**Middle**				**High Stock Market Development**			
q	0.010***	0.013***	0.005***	0.016***	0.007***	0.014***	0.006***	0.009***	0.011***	0.018***	0.008***	0.014***
	(4.29)	(5.45)	(3.55)	(4.70)	(6.31)	(5.99)	(5.73)	(7.09)	(6.10)	(39.89)	(6.75)	(6.05)
CF	0.126***	0.225***	0.098***	0.067***	0.070***	0.173***	0.042***	0.074**	0.005	0.097***	0.011	-0.013
	(9.01)	(6.93)	(6.39)	(4.61)	(4.41)	(4.36)	(3.82)	(2.53)	(0.47)	(5.54)	(1.45)	(-0.94)
N	38697	14586	13025	10751	125121	11767	45645	66814	253969	45249	87918	116459
$\bar{R}^2$	0.47	0.56	0.40	0.37	0.45	0.47	0.49	0.44	0.47	0.57	0.54	0.48
Economic Significance	0.208	0.259	0.179	0.162	0.156	0.209	0.097	0.177	0.021	0.174	0.046	-0.054
	High Cost of Equity Financing				**Middle**				**Low Cost of Equity Financing**			
q	0.010***	0.013***	0.006**	0.012***	0.015***	0.018***	0.006**	0.016***	0.009***	0.017***	0.007***	0.011***
	(8.28)	(6.07)	(2.94)	(8.07)	(6.04)	(13.82)	(2.67)	(5.79)	(9.72)	(25.99)	(8.06)	(5.25)
CF	0.109***	0.183***	0.092***	0.101**	-0.000	0.140***	0.056**	-0.018	0.009	0.102***	0.010	-0.018
	(3.26)	(6.03)	(4.33)	(2.79)	(-0.02)	(6.98)	(2.65)	(-0.91)	(0.77)	(3.74)	(1.53)	(-1.45)
N	83738	8604	17483	56768	85293	16843	13738	54372	247065	45869	115200	82818
$\bar{R}^2$	0.39	0.56	0.41	0.37	0.47	0.54	0.41	0.47	0.51	0.56	0.55	0.54
Economic Significance	0.205	0.227	0.194	0.197	-0.001	0.197	0.112	-0.071	0.035	0.179	0.041	-0.088

Table 1-7 - Continued
Financial Development and ICF Sensitivity

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Less Private Credit				**Middle**				**More Private Credit**			
q	0.009***	0.011***	0.003**	0.014***	0.011***	0.017***	0.011***	0.010***	0.010***	0.018***	0.007***	0.013***
	(4.32)	(3.92)	(2.23)	(7.89)	(7.90)	(11.28)	(5.08)	(7.86)	(7.09)	(85.86)	(9.10)	(6.22)
CF	0.162***	0.215***	0.130***	0.146**	0.053***	0.167***	0.015	0.052***	0.002	0.081***	0.012	-0.018
	(4.30)	(5.54)	(5.54)	(3.02)	(2.86)	(5.80)	(0.81)	(4.36)	(0.14)	(8.33)	(1.51)	(-1.48)
N	45836	7046	11614	26646	96841	27631	34979	33038	273838	36876	100002	133199
$\bar{R}^2$	0.40	0.59	0.42	0.35	0.44	0.51	0.46	0.36	0.50	0.57	0.56	0.51
Economic Significance	0.241	0.249	0.231	0.217	0.134	0.223	0.045	0.158	0.007	0.153	0.054	-0.079
	Less Portfolio Equity Inflows				**Middle**				**More Portfolio Equity Inflows**			
q	0.013***	0.017***	0.008***	0.011***	0.013***	0.017***	0.009***	0.014***	0.009***	0.016***	0.007***	0.012***
	(6.06)	(26.12)	(3.49)	(10.46)	(5.25)	(7.16)	(3.83)	(5.06)	(7.33)	(11.29)	(9.36)	(5.37)
CF	0.078***	0.091***	0.090***	0.058***	0.007	0.202***	0.011	-0.009	0.010	0.131***	0.015	-0.009
	(7.40)	(5.21)	(3.94)	(5.07)	(0.30)	(6.30)	(0.56)	(-0.37)	(0.84)	(7.97)	(1.64)	(-0.48)
N	79105	34334	9307	35145	137659	20866	25945	90322	197215	15872	111312	68586
$\bar{R}^2$	0.46	0.56	0.36	0.35	0.49	0.61	0.47	0.49	0.50	0.46	0.55	0.48
Economic Significance	0.165	0.166	0.185	0.149	0.024	0.238	0.033	-0.035	0.040	0.197	0.064	-0.038

Table 1-7 - Continued
Financial Development and ICF Sensitivity

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Weak Protection				**Middle**				**Strong Protection**			
q	0.008***	0.014***	0.007***	0.009***	0.005***	0.012***	0.004***	0.007***	0.011***	0.018***	0.008***	0.014***
	(7.88)	(3.87)	(10.45)	(4.50)	(6.73)	(5.19)	(5.17)	(3.93)	(5.68)	(32.59)	(6.16)	(5.96)
CF	0.060***	0.218***	0.045***	0.039***	0.069***	0.195***	0.048***	0.045***	0.006	0.101***	0.010	-0.017
	(6.57)	(4.57)	(4.68)	(5.79)	(5.22)	(8.39)	(3.23)	(3.17)	(0.46)	(5.09)	(1.35)	(-1.21)
N	63073	10186	20966	30795	93990	13965	36648	42240	235374	46942	82062	101887
$\bar{R}^2$	0.35	0.45	0.40	0.36	0.50	0.64	0.48	0.46	0.47	0.56	0.54	0.48
Economic Significance	0.151	0.248	0.119	0.121	0.165	0.250	0.114	0.136	0.022	0.177	0.043	-0.068
	Low Disclosure				**Middle**				**High Disclosure**			
q	0.006***	0.010**	0.005***	0.009***	0.010***	0.014***	0.008***	0.012***	0.011***	0.018***	0.007***	0.014***
	(5.05)	(2.20)	(4.12)	(7.86)	(4.00)	(8.53)	(3.56)	(4.45)	(5.55)	(34.62)	(7.09)	(4.74)
CF	0.100***	0.223***	0.070***	0.064***	0.000	0.183***	0.007	-0.015	0.014	0.100***	0.014	-0.008
	(6.76)	(6.11)	(3.40)	(3.02)	(0.01)	(6.30)	(0.48)	(-0.74)	(1.03)	(5.08)	(1.38)	(-0.43)
N	40149	8315	14709	16568	134930	17114	48833	66939	217329	45656	76106	91417
$\bar{R}^2$	0.47	0.63	0.38	0.41	0.45	0.45	0.50	0.50	0.47	0.56	0.55	0.47
Economic Significance	0.193	0.269	0.151	0.150	0.001	0.218	0.022	-0.059	0.054	0.175	0.059	-0.034

stock market development, the ICF sensitivity is positive and highly significant across all subperiods in countries with the lowest stock market development, but it disappears in the last two subperiods in countries with high stock market development.

In summary, we find that a country's economic and financial development contribute to the declining or disappearing ICF sensitivity. It is possible that firms in these countries are likely to have better access to external finance and hence, their investments are less sensitive to cash flow.

1.4 External financing

In this section, we test a possible channel through which economic and financial developments could reduce firms' reliance on internally generated funds. Theory and empirical evidence suggest that financial liberalization, economic growth, and capital openness reduce financing constraints and in turn, improve efficient capital allocation of resources (e.g., Love, 2003; Bekaert, Harvey, and Lundblad, 2001, 2005). Therefore, constrained firms are better off in more economically and financially advanced countries rather than in their less developed peers, where the cost of capital is substantially greater owing to a limited pool of resources available. Our evidence, thus far, is consistent with the argument that economically and financially developed countries ease financial constraints and hence, facilitate greater access to external sources of capital than do their less developed counterparts. As a result, their investment is insensitive to internally generated capital. To further support this conjecture, we explicitly test the relationship between equity or debt financing and internal cash flow, in order to assess whether firms rely more on equity and debt capital in recent decades if they have insufficient internal funds to finance their investment.[10]

[10]We have also tested whether equity flows from foreign investors offer another possible channel, but unreported results show no evidence to support this channel.

1.4.1 **Univariate analysis**

Financial development facilitates the removal of financial barriers facing countries and provides opportunities for firms to raise external finance.[11] If firms from more economically and financially developed countries have better access to external sources to finance their investment opportunities, then much of the firms' investments would be financed externally when firms have insufficient internal resources. As a result, the effect of internal cash flow on investment should decline, and hence, the relation between external funding and internally generated cash flow would be negative.

To examine the validity of this channel, we start by conducting a univariate analysis. We compute the yearly change in firms' equity and debt within terciles formed based on each of our earlier defined measures of economic and financial development over the full sample period and three subperiods. Given that the results are consistent across our diverse set of country development measures, to conserve space, we only report those based on GDPC-formed terciles.

Table 1-8 shows the average of the annual change in firms' equity and debt by GDPC-formed tercile. The table reveals distinct cross-sectional and time-series patterns. First, over the entire sample period, firms from the top tercile of developed countries issue substantially more equity and debt than their counterparts from the bottom tercile. With more advanced financial systems, it is not surprising that the firms in developed countries have the ability to raise large amounts of external funds in the form of equity and debt. For example, during the full sample period, top tercile firms issue 12.3% equity and 2.7% debt, compared with 6.4% and 0.5% for the bottom tercile firms. Notice that firms from both developed and developing countries tend to raise more equity than debt.

[11] Hubbard (1998) provides an excellent review of theoretical and empirical studies that have shown a strong relationship between firms' financial status and investments.

Table 1-8
Means of Equity and Debt Issuances by GDP Per Capita

This table presents average values of the change in equity and debt. $\Delta\text{Equity}_{i,t}$ is firm i's annual change in equity; $\Delta\text{Debt}_{i,t}$ is firm i's annual change in debt. Both are scaled by the beginning-of-period total assets, $A_{i,t-1}$. We divide the sample into terciles based on GDP per capita. We rank country-period averages into high, middle, and low terciles. All definitions are in Appendix A.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low GDP per Capita				**Middle**				**High GDP per Capita**			
$\Delta Equity$	0.064	0.236	0.053	0.039	0.054	0.056	0.049	0.054	0.123	0.070	0.134	0.130
$\Delta Debt$	0.050	0.118	0.035	0.045	0.033	0.036	0.028	0.035	0.027	0.042	0.027	0.023

Second, across the subperiods, both equity and debt issuances decline dramatically from the first to third subperiods in the bottom tercile, but in contrast, equity issuances shoot up in the top tercile. These results indicate that firms in most developed countries are increasingly relying on external finance, especially on equity, in recent decades. Importantly, equity issuances by firms from high GDPC countries rise from 0.070 in 1991-1998 to 0.130 in 2007-2014, whereas issuances by those from low GDPC countries fall from 0.236 to 0.039. On the other hand, debt issuances by top tercile firms fall slightly from 0.042 to 0.023, compared to a larger drop from 0.118 to 0.045 by bottom tercile firms. In comparison, equity and debt issuances by middle tercile firms are fairly stable across the sample period; equity issuances are 0.049-0.056 and debt issuances are 0.028-0.036.

Taken together, these statistics provide a preliminary explanation of why firms from developed markets are no longer dependent on internally generated cash flow.

1.4.2 **Multivariate analysis**

We next examine the relation between external finance and internal cash flow in a multivariate setting. To test our hypothesis, for each GDPC-formed tercile, we run the following firm-level regression within a subperiod.

$$\frac{\Delta\text{Equity}_{i,t}[\text{or } \Delta\text{Debt}_{i,t}]}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \gamma_1 q_{i,t-1} + \gamma_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t}, \tag{2}$$

where $\Delta\text{Equity}_{i,t}$ is defined as the change in book equity, plus the change in deferred taxes, minus the change in retained earnings, and $\Delta\text{Debt}_{i,t}$ is defined as the annual percentage change in total debt. The remaining variables are as defined earlier. All regressions include unreported firm, country-year, and industry-year fixed effects, respectively.

Table 1-9
Equity Issuance-Cash Flow Sensitivity and GDP Per Capita

This table reports coefficients estimated from regressing a firm's annual change in equity financing on Tobin's q and cash flow, as follows.

$$\frac{\Delta\text{Equity}_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \gamma_1 q_{i,t-1} + \gamma_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $\Delta\text{Equity}_{i,t}$ is firm i's annual change in equity, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on GDP per capita. We rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean of the change of equity. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low GDP per Capita				**Middle**				**High GDP per Capita**			
q	0.036***	0.043***	0.030**	0.047***	0.080***	0.076***	0.083***	0.089***	0.082***	0.079***	0.077***	0.094***
	(5.11)	(3.94)	(2.67)	(5.49)	(15.78)	(7.05)	(9.95)	(9.17)	(13.40)	(25.51)	(16.66)	(11.98)
CF	0.374*	0.559**	0.186	0.493*	-0.264***	0.293***	-0.122	-0.411***	-0.803***	-0.056	-0.687***	-0.930***
	(1.99)	(2.63)	(0.98)	(2.13)	(-3.39)	(3.91)	(-1.42)	(-4.98)	(-11.05)	(-1.21)	(-11.30)	(-12.48)
N	82021	8318	23774	49160	77724	26064	19001	31596	249851	36205	99970	109522
$\bar{R}^2$	0.67	0.94	0.13	0.14	0.18	0.18	0.19	0.21	0.47	0.31	0.44	0.50
Economic Significance	0.724	0.318	0.461	1.464	-0.781	0.611	-0.411	-1.367	-1.826	-0.120	-1.437	-2.183

Table 1-9 reports the results of estimating equation (2), with the annual change of equity as the dependent variable. The findings indicate that the cash flow coefficients and their levels of statistical significance vary substantially across the subperiods and across terciles. The key observation is that, on average, the effect of cash flow on equity issuances is negative for firms from most developed countries, but is positive for those from least developed ones. Consistent with our prediction, evidence indicates that firms from the most developed markets have greater access to external equity finance, which is in accord with the firms' decreasing reliance on cash flow over time. For example, the cash flow coefficient of these firms varies from -0.056 (t =-1.21) in 1991-1998 to -0.930 (t =-12.48) in 2007-2014. In terms of economic significance, a one-standard deviation decrease in the cash flow will lead to a 12.0% increase in equity issuances in the former subperiod and to a 218.3% increase in the latter.

In contrast, for firms from the lowest GDPC-formed countries, the cash flow effect is positive and mainly statistically significant, indicating that firms with low cash flow have limited or no access to external finance. The implication is that in an economy with limited resources, only profitables firms are able to raise external capital. This finding is consistent with our earlier results which show a strong positive relation between investment and cash flow for these firms. With limited access to external finance, these firms have to depend on internal cash flow to finance their investment. As seen in the table, their cash flow coefficients vary from 0.186 (t =0.98) in 1999-2006 to 0.559 (t =2.63) in 1991-1998. Furthermore, for firms from the middle tercile, the sign of cash flow switches from positive in 1991-1998 to negative in 2007-2014, implying that these firms have limited access to equity finance in the first subperiod, but have more access to sources of external finance in the recent subperiod when their countries become more developed.

It is plausible that the sensitivity of equity financing to cash flow could be driven by firms' other financial policies, such as corporate payouts. For example, profitable firms in developed countries may consistently repurchase shares, and this will lead to the observed

negative relation between changes in equity and cash flow. If firms in developed countries are more concerned about catering to investors and choose to pay out instead of investing, this would also explain the decline in ICF sensitivity. It is also possible that firms in developed countries raise capital in order to pay dividends, rather than to invest (Ferra-Mensa, Michaely, and Schmalz, 2017), which will undermine the validity of the external equity channel that drives the fading ICF sensitivity. To eliminate these concerns, we conduct two tests. First, we construct a modified measure of equity issuance by assigning the value of zero to all observations with a negative change in equity. Second, we define a new variable, net equity issuances, as the difference between the change in equity and payouts. We then repeat our estimation of model (2) using each of the modified issuance measures, and find that the relationship between cash flow and equity issuance is still negative for developed countries in the past two subperiods (the results are unreported for the sake of brevity).

Table 1-10 reports the results of equation (2), with the annual change of debt as the dependent variable. The results, while weaker, are broadly consistent with those of Table 1-9. Firms from the top tercile of countries are substituting debt for cash flow throughout the entire sample period. The cash-flow effect is negative, but statistically significant in the last subperiod (i.e., -0.026 with a t-statistic of -2.57), suggesting a 33.2% rise in debt issuances following a one-standard deviation fall in cash flow. However, firms from the bottom tercile of countries show little access to debt finance. The substitution between debt and cash flow, to a large extent, results from the gradual reduction of barriers to external finance. Their cash-flow coefficient is positive across the period, but only statistically significant in the last subperiod. Combined, the results provide evidence that ease of enhanced access to external equity and debt finance is the channel through which country development affects ICF sensitivity.

Table 1-10
Debt Issuance-Cash Flow Sensitivity and GDP Per Capita

This table reports coefficients estimated from regressing a firm's annual change in debt financing on Tobin's q and cash flow, as follows.

$$\frac{\Delta\text{Debt}_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \gamma_1 q_{i,t-1} + \gamma_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $\Delta\text{Debt}_{i,t}$ is firm i's annual change in debt, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on GDP per capita. We rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean of the change of debt. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low GDP per Capita				**Middle**				**High GDP per Capita**			
q	0.012***	0.025***	0.010**	0.015***	0.018***	0.027***	0.017***	0.017***	0.010***	0.025***	0.008***	0.009***
	(9.90)	(4.67)	(2.49)	(11.40)	(12.08)	(9.44)	(6.23)	(6.16)	(14.44)	(36.18)	(17.16)	(5.03)
CF	0.094**	0.059	0.042	0.130***	0.014	0.193***	0.030*	-0.040*	-0.023*	-0.002	-0.028	-0.026**
	(2.76)	(1.05)	(1.46)	(3.51)	(0.55)	(4.33)	(2.12)	(-1.89)	(-1.82)	(-0.09)	(-1.38)	(-2.57)
N	83000	8447	24189	49596	78768	26415	19309	31999	256053	36708	102985	112063
$\bar{R}^2$	0.26	0.59	0.12	0.13	0.07	0.12	0.09	0.05	0.10	0.16	0.10	0.09
Economic Significance	0.233	0.067	0.159	0.338	0.067	0.632	0.174	-0.209	-0.231	-0.007	-0.284	-0.332

1.5 Alternative Explanations

1.5.1 Measurement errors

A number of studies such as Erickson and Whited (2000, 2012) have argued that q may be measured with error. If this is the case, then it is possible that a decline in stock market inefficiencies over time could have improved the informativeness of average q, making it a better proxy for Tobin's q. The decline in measurement error will, in turn, reduce the investment sensitivity to cash flow.

It is important to note that this interpretation is still consistent with our main finding that the extent of country-level development plays a critical role in explaining the fading of ICF sensitivity in developed countries. The main difference is the underlying channel. According to the measurement error explanation, economic and financial development has affected ICF sensitivity through higher informativeness of the shadow value of capital, rather than through availability of external capital. It is possible that our estimations include a certain extent of measurement errors, but measurement errors alone cannot explain all of our results. Specifically, if measurement error in q is the only channel at work, we should observe a similar pattern of declining cash flow sensitivity in the estimation of equity issuances. Instead, we find that external capital issuance is negatively and significantly associated with cash flow in the recent period. The only way to explain this result within the measurement error framework is by assuming that cash flow has become negatively correlated with growth opportunities in more developed countries over time.

To address the measurement error issues based on a more formal empirical analysis, we employ Erickson, Jiang, and Whited's (2014) higher-order cumulant estimator to re-estimate the results of Table 1-2 for both the full sample and subsamples. Table 1-11 shows the results based on the fifth-order cumulant estimator; the unreported results remain materially unaffected even if either the third- or fourth-order cumulant estimator is used.

Table 1-11
Measurement Errors and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. The above model is estimated using the fifth order of cumulants following Erickson, Jiang, and Whited (2014). All variables are demeaned by firm and year separately. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment.

	Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	All Countries				**All Countries Excluding U.S.**			
q	0.059***	0.083***	0.027***	0.081***	0.070***	0.093***	0.033***	0.085***
	(37.94)	(19.20)	(26.68)	(44.17)	(34.43)	(10.64)	(18.39)	(40.88)
CF	0.048***	0.099***	0.035***	0.044***	0.046***	0.169***	0.035***	0.044***
	(15.68)	(9.32)	(10.57)	(9.29)	(11.80)	(8.70)	(7.51)	(8.17)
N	422970	73609	152111	197250	319944	45826	109875	164243
Economic Significance	0.09	0.12	0.08	0.08	0.08	0.17	0.06	0.08

The ICF sensitivity still fades over time.

1.5.2 **The role of intangible assets and cash flow persistence**

Moshirian et al. (2017) show that changes in asset composition could play a role in explaining the fading of ICF sensitivity over time. Specifically, lower intensity of physical investment in developed countries over time can explain the cross-country variation in the sensitivity, as well as the time trend. Consistent with this explanation, our earlier findings suggest that technological development, measured by access to electricity and R&D intensity, plays a role in the disappearance of ICF sensitivity in the top tercile of developed countries, and that investment in intangible assets could be part of technological progress. However, we also show that this is not the only channel, as cross-country variation in other aspects of economic growth, such as education, as well as various dimensions of the development of financial systems, including legal systems, transparency, and institutional environment, also contribute to the vanishing ICF in most developed countries. Moreover, in Panel B, Table 1-2, we include R&D as part of the investment and re-estimate ICF sensitivity and find similar results. The sensitivity of both tangible and intangible investments falls across the entire sample period, but disappears in the last subperiod. This phenomenon is robust across developed and developing markets. The evidence indicates that asset intangibility cannot be the key factor that contributes to the fading ICF sensitivity, and is also consistent with the results shown in Panel B, Table 1-2.

Nevertheless, to further rule out the possibility that asset tangibility is the key driver of our results, we perform several additional tests. In line with our previous analyses, we form terciles of countries based on measures of country-level tangibility (which is defined by the aggregate property, plant, and equipment divided by aggregate total assets within a country-subperiod). The results, presented in Table 1-12, show that tangibility does not fully explain cross-country variation in ICF sensitivity, as it declines in groups of countries

that rely heavily on tangible assets, as well as countries with little reliance on tangible assets.

Finally, we further examine whether the increasing importance of intangible assets affects ICF sensitivity through cash flow persistence. If operations based on tangible assets generate more predictable cash flows, ICF sensitivity should be high. One might also argue that firms that invest in intangible assets may not implement their investment decisions immediately, or investment may react to changes in expected cash flow. In both cases, firm-level investment could be more related to lagged than to current cash flow, and such effects might not be captured in the widely studied contemporaneous relation between investment and cash flow. To address this issue, we follow Lewellen and Lewellen (2016) who find that adding lagged cash flow to the regression of investment on contemporaneous cash flow significantly increases ICF sensitivity. To ensure that our results are not driven by cash flow persistence, we re-estimate the results in Table 1-5 by incorporating a lagged cash flow. Results reported in Table 1-13 indicate that the sensitivity to lagged cash flow either is fairly stable in the bottom and middle terciles, or has fallen in the top tercile. More importantly, the sensitivity to contemporaneous cash flow has declined over time and vanished in the last two subperiods, especially in the top tercile of developed countries.

To summarize, we find that while asset composition plays a role in the economic development of a country, our results cannot be explained by mechanical changes in ICF sensitivity due to changes in cash flow and investment characteristics.

1.5.3 **Cross-industry evidence**

In this subsection, we explore the possibility that the fading ICF sensitivity may be driven by a certain type of industries whose investments are less dependent on internally generated cash flow. Due to recent market globalization, some countries have become hubs to certain industries (for example, support services in India, or electronic manufacturing in China). As a result, the differences in ICF sensitivity across countries could be essentially driven

by countries' specialization in certain industries, which may not be fully picked up by asset tangibility. To address this concern, we estimate the ICF sensitivity within each industry. Based on their SIC codes, we sort firms into manufacturing (SIC codes between 2000 and 3999) vs. non-manufacturing firms (SIC codes outside 2000-4000). Manufacturing firms are further sorted into industry groups, namely durable goods, nondurable goods, and high-tech sectors. Firms in the durable sector have SIC codes between 2400 and 2599 or between 3200 and 3899, while firms belonging to the non-durable sector have SIC codes between 2000 and 2399 or between 2600 and 3199. Firms in the high-tech sector have three-digit SIC codes 283, 357, 366, 367, 382, or 384. Results are summarized in Table 1-14.

We find that ICF sensitivity exhibits similar patterns across different industries. For manufacturing firms, sensitivity declines from 0.116 ($t-$statistic=4.50) in the first subperiod to 0.035 ($t-$statistic=1.88) in the third subperiod, and the sensitivity for the overall sample period is 0.045 ($t-$statistic=2.79). Correspondingly, the sensitivity of their non-manufacturing peers falls from 0.130 ($t-$statistic=4.48) to -0.018 ($t-$statistic=-1.28). Our results remain robust even when we further split the manufacturing sector into durables, non-durables, and high tech groups. Even though ICF sensitivity disappears in the high-tech industry during the last two subperiods, it also has faded in both durables and non-durables industries, further reinforcing our earlier finding that intangible assets cannot explain the ICF sensitivity disappearance.

Table 1-12
Intangibility and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based country-level tangibility, measured by the aggregate net property, plant, and equipment (PPE) divided by aggregate total assets within a country. We rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF on sample mean investment. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low Intangibility				**Middle**				**High Intangibility**			
q	0.017***	0.016***	0.012***	0.019***	0.014***	0.018***	0.010***	0.015***	0.007***	0.014***	0.006***	0.009***
	(15.68)	(8.64)	(6.03)	(32.12)	(8.20)	(47.17)	(5.06)	(9.16)	(32.81)	(4.33)	(32.55)	(14.02)
CF	-0.001	0.156***	0.046***	-0.038***	0.024	0.087***	0.016	0.017	0.013	0.287***	0.008	0.004
	(-0.06)	(6.11)	(4.59)	(-3.94)	(0.75)	(6.67)	(0.98)	(0.42)	(1.32)	(13.98)	(1.15)	(0.46)
N	74876	19162	33734	20756	142833	36454	30783	74958	198590	15987	82077	98319
$\bar{R}^2$	0.49	0.60	0.55	0.46	0.42	0.54	0.48	0.42	0.47	0.50	0.51	0.50
Economic Significance	-0.004	0.209	0.126	-0.129	0.066	0.158	0.057	0.048	0.062	0.336	0.036	0.020

Table 1-13
Lagged Cash Flow, GDP Per Capita, and ICF Sensitivity

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \beta_3 \frac{CF_{i,t-1}}{A_{i,t-2}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; $CF_{i,t-1}$ is firm i's net income plus depreciation and amortization in the previous year; β_1 is investment-q sensitivity; β_2 is ICF sensitivity; β_3 is investment-lagged cash flow sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. We divide the sample into terciles based on GDP per capita. We rank country-period averages into high, middle, and low terciles. The above regression is conducted separately for each tercile. All definitions are in Appendix A. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Economic significance measures the impact of a one-standard deviation change in CF (lagged CF) on sample mean investment. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Low GDP per Capita				**Middle**				**High GDP per Capita**			
q	0.009***	0.011***	0.006***	0.011***	0.011***	0.018***	0.008***	0.010***	0.010***	0.015***	0.008***	0.013***
	(7.33)	(3.63)	(3.14)	(7.59)	(8.81)	(9.02)	(4.19)	(7.61)	(6.22)	(33.24)	(6.79)	(5.43)
CF_t	0.120***	0.203***	0.102***	0.119***	0.055***	0.143***	0.058***	0.029***	0.002	0.073***	0.012**	-0.015*
	(6.26)	(5.42)	(8.42)	(4.39)	(5.20)	(5.36)	(5.37)	(4.13)	(0.22)	(7.23)	(2.64)	(-1.77)
CF_{t-1}	0.067***	0.084***	0.054***	0.062***	0.027***	0.047***	0.033***	0.017*	0.001	0.050***	0.009	-0.007
	(3.67)	(3.11)	(3.29)	(3.13)	(3.97)	(3.56)	(4.92)	(1.83)	(0.09)	(17.55)	(1.30)	(-1.24)
N	72987	6416	20545	45272	68561	20876	16488	30533	229177	28183	91704	106112
$\bar{R}^2$	0.39	0.57	0.42	0.37	0.41	0.53	0.41	0.33	0.51	0.61	0.56	0.54
Economic Sign. (CF_t)	0.190	0.229	0.194	0.186	0.134	0.201	0.163	0.097	0.009	0.136	0.052	-0.070
Economic Sign. (CF_{t-1})	0.100	0.088	0.094	0.094	0.064	0.060	0.083	0.055	0.004	0.084	0.033	-0.033

Table 1-14
ICF Sensitivity by Industry

This table reports coefficients estimated from regressing investment on Tobin's q and cash flow, as follows.

$$\frac{I_{i,t}}{A_{i,t-1}} = \alpha_i + \alpha_{c,t} + \alpha_{ind,t} + \beta_1 q_{i,t-1} + \beta_2 \frac{CF_{i,t}}{A_{i,t-1}} + \epsilon_{i,t},$$

where $I_{i,t}$ is firm i's capital expenditure, scaled by its beginning-of-period total assets, $A_{i,t-1}$; $q_{i,t-1}$ is Tobin's q, measured as total assets minus the book value of equity plus the market value of equity divided by total assets; $CF_{i,t}$ is firm i's net income plus depreciation and amortization; β_1 is investment-q sensitivity; β_2 is ICF sensitivity. All regressions include unreported α_i, $\alpha_{c,t}$, and $\alpha_{ind,t}$, denoting firm, country-year, and industry-year fixed effects, respectively. The above regression is conducted separately for manufacturing and non-Manufacturing firms. Manufacturing firms are further divided into durables, non-durables, and high-tech firms. Industries are based on SIC codes. Robust $t-$statistics are computed based on standard errors clustered at the country level and reported in parentheses; N is the number of firm-year observations, and $\bar{R}^2$ is the adjusted R-squared value. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Manufacturing				**Non-Manufacturing**			
q	0.009***	0.015***	0.007***	0.010***	0.011***	0.020***	0.008***	0.014***
	(11.09)	(28.43)	(10.70)	(8.36)	(6.97)	(11.51)	(7.93)	(6.86)
CF	0.045***	0.116***	0.025*	0.035*	0.004	0.130***	0.012	-0.018
	(2.79)	(4.50)	(1.93)	(1.88)	(0.31)	(4.48)	(1.63)	(-1.28)
N	199932	37548	69016	90540	219377	34110	77626	103535
$\bar{R}^2$	0.38	0.51	0.42	0.38	0.48	0.58	0.55	0.50
Economic Significance	0.150	0.202	0.100	0.128	0.014	0.187	0.043	-0.067

Table 1-14 - Continued
ICF Sensitivity by Industry

	Full Period	Subperiods			Full Period	Subperiods			Full Period	Subperiods		
Variable	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014	1991-2014	1991-1998	1999-2006	2007-2014
	Durables				**Non-Durables**				**High-Tech**			
q	0.012***	0.020***	0.009***	0.014***	0.012***	0.017***	0.010***	0.012***	0.007***	0.012***	0.006***	0.007***
	(12.29)	(9.27)	(6.05)	(10.96)	(18.49)	(6.99)	(9.35)	(9.02)	(11.88)	(27.78)	(13.55)	(4.88)
CF	0.072***	0.155***	0.050**	0.050**	0.086***	0.153***	0.060***	0.075**	0.014**	0.059***	0.005	0.008
	(4.19)	(5.83)	(2.59)	(2.45)	(3.71)	(6.21)	(3.18)	(2.28)	(2.31)	(10.34)	(1.03)	(0.85)
N	76488	14772	26105	34620	69640	13818	23409	31518	49901	8118	18028	22849
$\bar{R}^2$	0.40	0.54	0.42	0.39	0.38	0.50	0.43	0.36	0.38	0.52	0.42	0.39
Economic Significance	0.178	0.205	0.147	0.136	0.185	0.192	0.149	0.176	0.078	0.168	0.030	0.050

1.6 Conclusion

This paper shows that ICF sensitivity has faded worldwide and has vanished mostly in highly developed countries. The results suggest that financial development and economic growth can explain ICF sensitivity across countries and over time. Specifically, firms operating in less economically and financially developed countries still rely heavily on internally generated cash flow, and their investment-sensitivity to cash flow has remained fairly stable over time. These findings are robust to various definitions of investment, hold across industry subsamples, and also, are not attributed to measurement errors or changes in asset tangibility.

Firms from most developed countries with fewer or virtually no financial constraints enjoy the benefits of greater access to external finance. As these firms depend less on internal cash flow, their investment has become insensitive to the internal cash flow in recent two decades. Such access to external funding is not that apparent in least developed countries. In support of this argument, we find that the sensitivity of cash flow to external capital issues is consistently negative in countries that have experienced most advancement in economic and financial development, but persistently positive in underdeveloped countries. Overall, the results are consistent with the notion that firms operating in countries with limited and inefficient allocation of resources have to resort to internally generated capital, while firms in more developed countries can access external capital market if they need it.

Chapter Two:

Does Customer Clientele Shape Investor Clientele?

2.1 Introduction

A growing literature on economics, finance, and accounting has been emphasizing the importance of firms with major customers, and the impact of customer concentration on the operating performance, investment decisions, and financial policy of firms. Yet the overall implications of having established, but concentrated customer base are ambiguous. On the one hand, one strand of literature highlights the benefits of operating efficiency due to lower selling expenses and higher asset turnover rates (for e.g., Patatoukas, 2012). On the other hand, reliance on a limited group of customers increases the risk profile of a firm, leading to more frequent loan failures and higher systematic and idiosyncratic risk (Campello and Gao, 2017; Dhaliwal et al., 2016).

In this paper we evaluate the trade-off between benefits and costs of concentrated customer base by examining how institutions - the dominant and, by large, sophisticated players in financial markets, evaluate the customer-based profile of a firm. Institutional ownership has increased dramatically over the past two decades, and their presence affects management decisions of a firm whether through direct monitoring or through the threat of exit. Institutions are also considered sophisticated investors who have the ability to collect and process information. Therefore, the presence of institutional clientele can shed light on the

implications of customer concentration on investor welfare.

To conduct the empirical analysis, we identify firms that report major customers (each customer firm that accounts for at least 10% of the total sales of a supplier firm) in Compustat Customer Segment Files, and augment this sample with identities of major customers relying on name-matching algorithms. Institutional investors' holdings data is from Thomson Reuters Institutional Holdings (13F). Their investment horizons are defined based on how frequently they rotate their equity portfolio holdings.

We start with the baseline analysis and estimate institutional ownership as a function of customer concentration, as well as a vector of commonly used control variables. We do not find any significant link between customer concentration and total institutional holding, yet the lack of relationship at the aggregate level is masked by the opposing behaviors of short-term versus long-term institutions. Specifically, we find that short-term investors are attracted to firms with large customer concentration, while long-term institutions shy away from these firms. These findings are robust to a battery of alternative definitions of customer concentration. We also address concerns related to non-linearity of investor-customer concentration relationships, as well as some omitted factor issues by repeating the analysis using a matched sample technique.

After establishing the baseline results, we turn to addressing endogeneity concerns. Our results indicate that while short-term and long term investors exhibit diametrically opposing investment behavior in firms with customer concentration, it is also possible that institutions actively affect managerial decisions, which, in turn, impact customer concentration. For example, it is likely that there are some unobserved characteristics that are related to customer concentration on the one hand, and institutional preferences on the other. To mitigate endogeneity issues, we use the instrumental variable analysis and implement two different approaches in constructing the instrument. In the first approach, we instrument (IV) for concentration of an individual supplier firm using the lagged average industry con-

centration in the suppliers industry (Dhaliwal et al., 2016). Lagged concentration is unlikely to be an outcome of future pressure by institutional investors. Using the average concentration across SIC 2-digit industries as our instrument, we find that our IV results are consistent with the baseline findings. One remaining concern of this analysis is that customer concentration is fairly persistent over time, and therefore, may reflect future levels of concentration at a firm or industry levels. To further improve our identification strategy, we construct an alternative instrument using M&A activity in the customer industry (Campello and Gao, 2017). High M&A activity increases the probability of a merger for customers that, in turn, increases their buyer power and the customer concentration of a supplier firm. At the same time, M&A activity of the supplier firm is unlikely to affect the institutional holdings of the supplier through channels other than increased concentration. We find that using the alternative way to instrument for customer concentration, short-term investors are attracted to firms with concentrated customer base, whereas long-term investors choose to underweight these firms in their portfolio.

In the second part of the paper, we explore potential channels that could explain heterogeneous preferences of institutions towards firms with concentrated customer base. Perhaps the most intuitive explanation of the observed pattern is stock returns. Existing literature (see, for example, Yan and Zhang, 2009) demonstrates that short-term institutions are better informed and exploit informational advantage through trading strategies that lead to abnormal returns. If customer concentration base can generate abnormal stock performance due to slow information transfer along the supply chain (Menzly and Ozbaz, 2010), this mechanism would explain the larger share of holdings by short-term investors. We test the validity of this explanation in two ways. First, for each supplier we construct a measure of customers performance as past performance of each customer (returns, profitability, sales growth) weighted by its share of sales of the supplier's total sales. If institutional holding is explained by market segmentation along the supply chain, we should find that the

performance-adjusted concentration measure explains institutional holdings. We repeat the estimation of institutional holding using the alternative measure, but find no significant relation. Second, we test whether firms with high customer ownership generate abnormal future performance by using a standard asset-pricing test to evaluate the performance of portfolios sorted based on customer concentration levels. We find that a zero-investment strategy of buying firms with high customer concentration levels and shorting firms with the lowest levels of concentration, whether equally or value-weighted, does not generate abnormal performance after controlling for standard risk factors.

The second channel that we consider is risk. Although both short- and long-term institutions are likely to be risk-averse, the existing literature demonstrates that the two types vary in their sensitivity to different sources of risk. Investors with high portfolio turnover are more sensitive to short-term price volatility, and put greater emphasis on stock liquidity, as stable trading volume and depth insure timely liquidation of outstanding positions at fair prices (Bushee and Noe, 2000). At the same time, institutions with long investment horizon and low portfolio turnover prefer low bankruptcy risk and high stability to short-term liquidity benefits. If customer concentration improves liquidity but increases long-term risk of bankruptcy and financial distress, this mechanism could explain the different preferences of short and long-term institutions towards firms with concentrated sales distribution. Several prior studies provide ample evidence that customer concentration increases the long-term risk profile of the firm (Titman, 1984; Campello and Gao, 2017; Wang, 2008; Dhaliwal et al., 2016). Yet the link between customer concentration and liquidity has not been formally established, so we turn to gauging this channel.

Customer concentration may improve stock liquidity through several mechanisms. First, securing a contract with a large customer is an important event in the life of a supplier firm, which is reported in company announcements, annual reports, and potentially media sources. As a result, a supplier, typically a relatively small firm compared to the overall

universe of publicly-traded firms, becomes more visible to market participants, increasing trading volume in the stock. Second, a concentrated customer base is likely to reduce information asymmetry. As required by regulations, a supplier must disclose information of major customers who account for at least 10% of its total sales. Investors demand information on a firm's customer base, because they can access risks inherent in sales (See Ellis, Fee, and Thomas, 2012; Patatoukas, 2012), and evaluate the supplier's investments, as dependency on a few major customers is associated with relationship-specific investments (See Titman and Wessels, 1988; Kale and Shahrur, 2007). Besides, existing literature shows that large customers often require higher levels of information disclosure (see Hui, Klasa, and Yeung, 2012; Samuels, 2016). Greater information disclosure lessens the price impact of individual trades, which in turn, facilitates trading in a stock and hence improves liquidity (Diamond and Verrecchia, 1991; Bushee and Noe, 2000; Balakrishnan, Billings, Kelly, and Ljungqvist, 2014). To test the validity of these arguments, we estimate stock turnover as a function of customer concentration and find a positive and significant relationship. To address alternative explanations related to omitted firm characteristics that could potentially affect both variables, we repeat the IV analysis using turnover as the dependent variable and find results in support of causal effect of customer concentration on liquidity. To further support the liquidity channel as the mechanism behind the preference of short-term institutions, we ask whether the effect of customer concentration on ownership is stronger for short-term institutions with a particularly high portfolio liquidity. We split short-term institutions into high and low portfolio liquidity subcategories and re-estimate the main specification. We find that the magnitude of the impact of customer concentration on institutional holding is economically more significant for short-term investors who hold more liquid portfolio, consistent with their higher demand for liquidity.

To summarize, we find that institutional groups exhibit heterogeneous preferences towards firms with high customer concentration: Short-term investors increase holdings in

these stocks, whereas long-term institutions reduce their investment. We examine potential mechanisms that could explain this pattern, and find that customer concentration alters the risk profile of supplier firms by reducing short-term risk of trading through higher liquidity, but increasing the long-term risk through higher probability of distress. We also consider alternative mechanisms and find that our results cannot be explained by abnormal performance of firms with high customer concentration and information transfer along the supply chain.

Overall, our paper has several contributions to the existing literature. First, we re-examine the debate on benefits versus costs of customer concentration from a novel angle by adding the institutional perspective. We show that the benefits of customer concentration are potentially short-term, whereas the costs are of long-term. This, in turn, suggests that the answer to the question of whether customer concentration is beneficial to shareholders is more complex than previously believed, and the trade-off depends on individual preferences of a particular clientele.

Our second contribution to the literature is discovering a new channel through which customer concentration affects the financial profile of supplier firms. We show that firms with customer concentration enjoy improved stock liquidity, which shapes investor clientele by attracting short-term investors. Our findings open avenues for future research that could test whether improved liquidity due to higher concentration has other implications, such as reducing cost of equity capital, affecting investment decisions, etc.

Lastly, we add to the literature on institutional holdings and firm characteristics. While recent literature has devoted a lot of attention to studying the impact of institutional holdings on firms managerial decisions and performance outcomes, there is still scant information about the selection process that institutions implement in their decisions making beyond standard firm characteristics such as size, book-to-market ratios, and past stock performance. Our work shows that product market characteristics play an important role in portfolio

management decisions of both short- and long-term institutional investors.

The rest of our paper is structured as follows. Section 2 describes the databases used in this study and provides descriptive statistics of the sample. Section 3 summarizes the main results, and Section 4 addresses endogeneity tests. In Section 5 we explore potential mechanisms, and the final section concludes.

2.2 Sample selection, variable measurement, and descriptive statistics

We obtain supplier-customer sales data from Compustat Customer Segment Files to estimate the customer concentration, institutional holdings data from Thomson Reuters Institutional Holdings (13F) database to define short-term/long-term institutional investors and their ownership. The financial statement data and stock market data are from Compustat and CRSP, respectively. Our main sample consists of all firms with non-missing information for our main variables from all the databases above during the years 1980 to 2015 [12]. We exclude all financial firms (SIC from 6000 to 6999) and utilities firms (SIC from 4900 to 4999). We winsorize all continuous variables at their top and bottom 1% to reduce the effects of outliers. Our variables are defined in Appendix. Summary statistics are provided in Table 2-1.

The Statement of Financial Accounting Standard (SFAS) No.14 of Financial Accounting Standards Board (FASB) requires all public firms to disclose all major customers that account for 10% or more of their total sales. Compustat Customer Segments Files provide names of major customers and the dollar amount of sales derived from each major customer at every fiscal year-end. We use this data to identify major customers and estimate all proxies of customer concentration. A major customer is defined as a customer firm which represents at least 10% of its supplier's total sales. Although not required by regulations, firms often voluntarily report customers that account for less than the threshold 10% of their total

[12]Thomson Reuters Institutional Holdings (13F) data starts its coverage in 1980, while Compustat Customer Segment Files start in 1976.

Table 2-1
Descriptive Statistics

This table presents the descriptive statistics for our main variables. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015. A major customer is defined as a customer that accounts for at least 10% of its supplier's total sales. Variables are defined in Appendix C.

	N	Mean	Median	Std	P25	P75
ST %	46,700	0.072	0.043	0.083	0.003	0.110
LT %	46,700	0.128	0.087	0.128	0.024	0.198
Total %	46,700	0.348	0.275	0.299	0.075	0.586
Total Customer Sales	46,700	0.435	0.370	0.284	0.200	0.610
Customer HHI	46,700	0.163	0.081	0.210	0.032	0.198
Largest Customer	46,700	0.309	0.240	0.205	0.160	0.390
Number of Customers	46,700	1.741	1.000	0.921	1.000	2.000
Tobin's q	46,700	1.994	1.406	1.780	1.041	2.177
Size	46,700	4.592	4.438	2.137	3.009	6.088
Age	46,700	15.903	12.000	12.217	7.000	22.000
Payout	46,700	0.006	0.000	0.014	0.000	0.001
Volatility	46,700	0.167	0.146	0.092	0.104	0.204
Turnover	46,700	1.187	0.680	1.448	0.288	1.493
Log Price	46,700	1.972	2.108	1.326	1.119	2.970
$Return_{-3,0}$	46,700	0.021	-0.002	0.314	-0.162	0.157
$Return_{-12,-3}$	46,700	0.132	0.012	0.655	-0.223	0.317

sales. To reduce the selection bias, we keep firms that have at least one major customer representing 10% or more of their total sales.

To conduct tests that require specific information on individual customers, we match each customer name in Compustat Customer Segment Files with the corresponding firm name in Compustat to get the customer's gvkey code. The initial matching process is based on Levenshtein distance and Phonetic matching algorithms. After the automatic matching, we manually check every matched pair to ensure accuracy.

2.2.1 **Customer concentration**

Following previous studies (Patatoukas, 2012; Irvine, Park, and Yildizhan, 2016; Campello and Gao, 2017; Dhaliwal, Judd, Serfling, and Shaikh, 2017), we choose the following three measures to capture the extent of a firm's customer base concentration.

The first measure is the sum of sales to all major customers of a supplier, scaled by the total sales of the supplier.

$$Total\ Customer\ Sales_{i,t} = \sum_{c=1}^{k} \frac{Sales_{i,c,t}}{Sales_{i,t}}$$

where $Sales_{i,t}$ represents the total sales of supplier i in year t, $Sales_{i,c,t}$ represents supplier i's sales to its major customer c in year t, and k is the number of major customers of supplier i in year t. A higher $Total\ Customer\ Sales$ captures a more concentrated customer base. The more the supplier sells to its major customers, the more concentrated is its customer base.

The second measure is a modification of the Herfindahl-Hirschman Index (HHI), applied to the distribution of sales to major customers. It is defined as the sum of squared sales percentages to major customers.

$$Customer\ HHI_{i,t} = \sum_{c=1}^{k} (\frac{Sales_{i,c,t}}{Sales_{i,t}})^2$$

where $Sales_{i,t}$ represents the total sales of supplier i in year t, $Sales_{i,c,t}$ represents supplier i's sales to its major customer c in year t, and k is the number of major customers of supplier i in year t. Compared to the first measure, $Customer\ HHI$ puts more weight on the larger share of sales.

In the third measure, we focus on the largest share of total sales. It is the share of sales

to the customer firm that represents the largest share of the supplier's total sales.

$$Largest\ Customer_{i,t} = \frac{\max_{c}\ Sales_{i,c,t}}{Sales_{i,t}}$$

where $Sales_{i,t}$ represents the total sales of supplier i in year t, $Sales_{i,c,t}$ represents supplier i's sales to its major customer c in year t.

To ensure robustness of our results, we also use alternative samples that include firm-year observations from the Compustat universe without any major customer reported in Compustat Customer Segment Files. For those observations, each of the above concentration measures is set to zero.

2.2.2 **Institutional ownership**

We define short-term and long-term institutional investors based on their portfolio turnover. Following Gaspar, Massa, and Matos (2005), for every institutional investor we calculate the quarterly Churn rate to measure how frequently institutional investors rotate their portfolio stock holdings over a quarter. The Churn rate is defined as follows:

$$Churn_{i,t} = \frac{\sum_{j \in Q} |N_{i,j,t}P_{j,t} - N_{i,j,t-1}P_{j,t-1} - N_{i,j,t-1}\Delta P_{j,t}|}{\frac{1}{2}\sum_{j \in Q} N_{i,j,t}P_{j,t} + N_{i,j,t-1}P_{j,t-1}}$$

where Q is a set of stocks investor i held in quarter $t-1$ or t, $N_{i,j,t}$ is the number of shares of stock j held by investor i in quarter t, $P_{j,t}$ is the price of stock j in quarter t, and $\Delta P_{j,t}$ is the change in stock j's price from quarter $t-1$ to t [13].

Each quarter, we sort all institutions into terciles based on their average equity portfolio

[13]This measure captures the change in an investor's portfolio value net of price changes over a quarter. Yan and Zhang (2009) use a different measure that separates total buys from total sells and chooses the smaller one. Our results are robust to this alternative measure as well.

churn rates over the last four quarters. Institutions in the top tercile are defined as short-term institutions, while those in the low tercile are defined as long-term institutions. Quarterly short-term/long-term ownership is the number of shares owned by all short-term/long-term institutions divided by the number of shares outstanding. Total institutional ownership is the number of shares owned by all institutions divided by the number of shares outstanding. For all tests, we match all financial variables, including customer concentration, with institutional ownership one quarter after the fiscal year-end to ensure that the most recent financial information is available for institutional investors [14].

2.2.3 Descriptive statistics

Table 2-1 presents the descriptive statistics for our main sample. The average total institutional ownership is 34.8%. On average, short-term institutional investors hold 7.2%, while long-term institutional investors hold 12.8%. We report three different measures of customer concentration. Among firms that have at least one major customer, on average the percentage of sales to all major customers is 43.5%, and the HHI index is 16.3%. For the number of major customers, the median is one and the 75 percentile is 2. Most of our sample firms have only one or two major customers that account for at least 10% of the supplier's total sales. Thus, it is not surprising to see the average percentage of sales to the largest customer is 30.9%. For most firms, the customer base is dominated by their largest customer.

2.3 Empirical results

2.3.1 Baseline regressions

To assess how customer concentration attracts different groups of institutional investors with different investment horizons, we estimate the following model:

[14] Our results hold if we choose two quarters after the fiscal year-end.

$$Inst\%_{i,t} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t} \quad (3)$$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), and $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration defined in section 2: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ is a set of firm characteristics.

Following Gompers and Metrick (2001) and Yan and Zhang (2009), we include Tobin's q, firm size, age, payout ratio, volatility, stock turnover, the log of stock price, and historical stock returns over the previous year as controls. All regressions include industry-year interacted fixed effects. Standard errors are clustered by firm and year. All variables are defined in Appendix C.

Table 2-2 presents the results from regressions of institutional ownership on three different measures of customer concentration. In the first three columns, we use the total sales to all major customers as a measure of customer concentration. In the first column, the dependent variable is the ownership of short-term institutional investors, and the coefficient on customer concentration is positive and statistically significant. One standard deviation increase in a firm's total sales to all major customers yields a 7% increase in short-term institutional ownership relative to the sample median short-term institutional ownership. Interestingly, the association between the ownership of long-term institutional investors and customer concentration is opposite. In the second column where the ownership of long-term institutional investors is the dependent variable, the coefficient on customer concentration is negative and statistically significant. One standard deviation increase in a firm's total sales to all major customers leads to a 2% decrease in long-term institutional ownership relative to the sample median long-term institutional ownership. When the dependent variable is replaced with the total institutional ownership in third column, the coefficient on concentration is

Table 2-2
Investor Clienteles and Customer Concentration

This table presents results from our baseline OLS regressions. We estimate the following model:

$$Inst\%_{i,t} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	ST %	LT %	Total %	ST %	LT %	Total %	ST %	LT %	Total %
Total Customer Sales	0.009***	-0.005*	0.008						
	(3.82)	(-1.78)	(1.35)						
Customer HHI				0.010***	-0.009**	0.006			
				(3.56)	(-2.56)	(0.78)			
Largest Customer							0.009***	-0.009**	0.004
							(3.48)	(-2.58)	(0.51)
q	-0.004***	-0.007***	-0.019***	-0.004***	-0.007***	-0.019***	-0.004***	-0.007***	-0.019***
	(-10.34)	(-9.79)	(-13.77)	(-10.31)	(-9.82)	(-13.77)	(-10.25)	(-9.83)	(-13.74)
Size	0.013***	0.026***	0.074***	0.013***	0.026***	0.074***	0.013***	0.026***	0.074***
	(11.94)	(14.69)	(29.93)	(11.86)	(14.74)	(30.02)	(11.85)	(14.75)	(30.02)
Age	-0.011***	0.017***	-0.005	-0.011***	0.017***	-0.006	-0.011***	0.017***	-0.006
	(-6.51)	(8.53)	(-1.06)	(-6.52)	(8.49)	(-1.08)	(-6.52)	(8.49)	(-1.08)
Payout	-0.503***	0.102	-1.075***	-0.505***	0.104	-1.076***	-0.504***	0.104	-1.076***
	(-8.80)	(1.16)	(-5.40)	(-8.85)	(1.18)	(-5.40)	(-8.85)	(1.18)	(-5.40)
Volatility	-0.030***	-0.066***	-0.208***	-0.030***	-0.066***	-0.207***	-0.030***	-0.066***	-0.207***
	(-3.39)	(-5.46)	(-6.73)	(-3.37)	(-5.47)	(-6.74)	(-3.37)	(-5.46)	(-6.74)
Turnover	0.012***	0.003***	0.025***	0.012***	0.003***	0.025***	0.012***	0.003***	0.025***
	(13.61)	(3.49)	(9.52)	(13.66)	(3.48)	(9.53)	(13.66)	(3.48)	(9.53)
Price	0.009***	0.015***	0.045***	0.009***	0.015***	0.045***	0.009***	0.015***	0.045***
	(5.58)	(6.56)	(9.04)	(5.58)	(6.57)	(9.04)	(5.59)	(6.57)	(9.04)
$Return_{-3,0}$	0.007***	-0.021***	-0.041***	0.007***	-0.021***	-0.041***	0.007***	-0.021***	-0.041***
	(4.03)	(-6.62)	(-6.18)	(4.03)	(-6.63)	(-6.17)	(4.02)	(-6.62)	(-6.17)
$Return_{-12,-3}$	0.010***	-0.016***	-0.019***	0.010***	-0.016***	-0.019***	0.010***	-0.016***	-0.019***
	(10.12)	(-10.35)	(-6.63)	(10.13)	(-10.34)	(-6.63)	(10.15)	(-10.33)	(-6.64)
N	46,700	46,700	46,700	46,700	46,700	46,700	46,700	46,700	46,700
$\bar{R}^2$	0.33	0.61	0.70	0.33	0.61	0.70	0.33	0.61	0.70

not statistically significant, suggesting that the extent of customer concentration varies with the composition of investor clienteles with different investment horizons, but not with the overall level of institutional ownership.

We then use two alternative measures for customer concentration: the sum of squared sales percentages to major customers in columns 4-6, and the largest sales percentage to a major customer in columns 7-9. Using the alternative definitions of customer concentration, we find consistent results. The coefficients on customer concentration are positive and significantly significant in columns 4 and 7, where the short-term institutional ownership is the dependent variable, and negative and statistically significant in columns 5 and 8, where the long-term institutional ownership is the dependent variable. One standard-deviation increase in the sales to the largest customer is associated with a 5% increase in short-term but a 3% decrease in long-term institutional ownership relative to the sample median. As shown in columns 6 and 9, the effect of customer concentration is not significant on the total institutional ownership.

In Table 2-2, most of the coefficients on control variables are statistically significant. We see that short-term and long-term institutional investors share some common favorite firm characteristics. Both short-term and long-term institutional investors prefer stocks of firms with a low Tobin's q and a large market capitalization. They both favor stocks with low volatility, high turnover, and high price. Although institutions in general prefer high turnover stocks, the coefficient on turnover in models where short-term ownership is the dependent variable is three times larger than that in models where long-term ownership is the dependent variable. The difference is more dramatic in terms of economic significance. One standard deviation increase in stock turnover is associated with a 40% increase in short-term ownership, while with a 5% increase in long-term ownership relative to the sample median. This suggests that short-term institutions are more concerned about stock liquidity than long-term institutions. Later, we will explore the possibility that stock liquidity is

the channel through which a concentrated customer base attracts short-term institutional investors.

Short-term and long-term institutional investors also have very different preferences for other features. Short-term institutions prefer young firms, while long-term institutions prefer mature firms. Short-term institutions show a strong preference for stocks with low dividend payout. For long-term institutions, however, firm payout seems not to be a concern, as the coefficient is not statistically significant on payout when the dependent variable is long-term institutional ownership. The preferences for past stock returns are different between short-term and longterm institutions. The coefficients on past stock returns are positive when the dependent variable is short-term ownership, but negative when the dependent variable is long-term ownership. The results suggest that short-term institutions are momentum traders as they prefer stocks with high past returns, while long-term institutions like those with low past returns.

Short-term and long-term institutional investors have heterogeneous preferences for certain firm characteristics, such as firm age, dividend payout, and past stock returns. In this section, we show that the extent of a firm's customer base concentration is another firm characteristic that tends to attract different groups of institutional investors, depending upon their investment horizons. Specifically, short-term institutions would buy the stocks of firms with a more concentrated customer base. Conversely, long-term institutions would buy the stocks of firms with a less concentrated customer base.

2.3.2 **Alternative samples**

Our sample firms are all from Compustat Customer Segment Files, and therefore have at least one major customer representing 10% or more of their total sales. As a result, our baseline results are conditional on the fact that all firms have at least one major customer. To offer more insights on the association between customer concentration and institutional

ownership, we extend our sample by including firms without any major customer. We estimate our baseline model by using the following two different samples.

First, we include all firms from the Compustat universe. If a firm does not report any major customer in Compustat Customer Segment Files, none of its customers accounts for more than 10% of its total sales. We then set each of our three measures of customer concentration to zero. Second, instead of using all firms from Compustat universe, we choose a matched sample. Specifically, for each supplier that discloses at least one major customer that accounts for at least 10% of the supplier's total sales, we choose a matched firm with no major customer outside the Compustat Customer Segment Files based on 2-digit SIC industry, year, size, and book-to-market. Specifically, we start from the same industry and year. For each firm in our main sample, we then require a matched firm to fall within the range between 90% and 110% for both size and book-to-market. Finally, we keep the closest match based on firm size if we find multiple matches.

Table 2-3 presents the regression results based on the two alternative samples. In Panel A, the sample size is three times as large as our main sample when we include all firms from the Compustat universe. Across all three measures of customer concentration, we still have a positive relationship between short-term institutional ownership and customer concentration, and a negative relationship between long-term institutional ownership and customer concentration. All coefficients are statistically significant. As in our main sample, there is no statistically significant effect of customer concentration on the total institutional ownership. Panel B presents estimates based on the matched sample. We have consistent results.

Taken together, we find that customer concentration is associated with the ownership structure of institutional investors who have different investment horizons. Though a concentrated customer base has no effect on the level of total institutional ownership, it is strongly associated with more short-term, but less long-term institutional ownership. The

Table 2-3
Investor Clienteles and Customer Concentration: Alternative Samples

This table presents results from our baseline OLS regressions on two alternative samples. In Panel A, we include all firms from Compustat from 1980 to 2015. In Panel B, we use a matched sample. For each firm in our main sample, we find a matched firm outside Compustat Customer Segment Files based on industry, year, size, and book-to-market. For both samples, we estimate the following model:

$$Inst\%_{i,t} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year.

Panel A: Firms with and without Major Customers

	ST %	LT %	Total %	ST %	LT %	Total %	ST %	LT %	Total %
Total Customer Sales	0.005**	-0.007***	-0.003						
	(2.63)	(-3.37)	(-0.56)						
Customer HHI				0.007**	-0.011***	-0.004			
				(2.54)	(-3.57)	(-0.59)			
Largest Customer							0.004*	-0.010***	-0.008
							(2.02)	(-3.72)	(-1.23)
q	-0.004***	-0.006***	-0.018***	-0.004***	-0.006***	-0.018***	-0.004***	-0.006***	-0.018***
	(-12.67)	(-10.35)	(-15.06)	(-12.69)	(-10.37)	(-15.07)	(-12.64)	(-10.35)	(-15.03)
Size	0.010***	0.023***	0.062***	0.010***	0.023***	0.062***	0.010***	0.023***	0.062***
	(10.28)	(18.30)	(33.02)	(10.24)	(18.40)	(33.05)	(10.23)	(18.36)	(32.99)
Age	-0.011***	0.018***	-0.007*	-0.011***	0.018***	-0.007*	-0.011***	0.018***	-0.007*
	(-7.15)	(11.35)	(-1.70)	(-7.16)	(11.36)	(-1.69)	(-7.15)	(11.35)	(-1.70)
Payout	-0.428***	0.108	-0.979***	-0.429***	0.109	-0.979***	-0.429***	0.108	-0.980***
	(-7.41)	(1.38)	(-6.24)	(-7.42)	(1.40)	(-6.23)	(-7.41)	(1.39)	(-6.23)
Volatility	-0.016*	-0.085***	-0.235***	-0.016	-0.085***	-0.235***	-0.015	-0.085***	-0.234***
	(-1.69)	(-7.18)	(-7.90)	(-1.69)	(-7.20)	(-7.90)	(-1.68)	(-7.18)	(-7.90)
Turnover	0.014***	0.003***	0.030***	0.014***	0.003***	0.030***	0.014***	0.003***	0.030***
	(15.33)	(3.38)	(10.75)	(15.36)	(3.35)	(10.74)	(15.35)	(3.37)	(10.75)
Price	0.011***	0.017***	0.054***	0.011***	0.017***	0.054***	0.011***	0.017***	0.054***
	(7.19)	(6.97)	(10.51)	(7.19)	(6.97)	(10.50)	(7.19)	(6.97)	(10.51)
$Return_{-3,0}$	0.010***	-0.022***	-0.038***	0.010***	-0.022***	-0.038***	0.010***	-0.022***	-0.038***
	(5.02)	(-7.56)	(-6.72)	(5.02)	(-7.57)	(-6.72)	(5.02)	(-7.56)	(-6.72)
$Return_{-12,-3}$	0.011***	-0.018***	-0.021***	0.011***	-0.018***	-0.021***	0.011***	-0.018***	-0.021***
	(12.09)	(-11.39)	(-7.78)	(12.06)	(-11.39)	(-7.79)	(12.07)	(-11.38)	(-7.78)
N	113,762	113,762	113,762	113,762	113,762	113,762	113,762	113,762	113,762
$\bar{R}^2$	0.30	0.61	0.68	0.30	0.61	0.68	0.30	0.61	0.68

Table 2-3 - Continued
Investor Clienteles and Customer Concentration: Alternative Samples

	Panel B: A Matched Sample								
	ST %	LT %	Total %	ST %	LT %	Total %	ST %	LT %	Total %
Total Customer Sales	0.009***	-0.006**	0.002						
	(4.35)	(-2.13)	(0.33)						
Customer HHI				0.016***	-0.009**	0.009			
				(4.43)	(-2.18)	(1.02)			
Largest Customer							0.012***	-0.009**	0.001
							(4.18)	(-2.46)	(0.19)
q	-0.005***	-0.009***	-0.023***	-0.005***	-0.009***	-0.023***	-0.005***	-0.009***	-0.023***
	(-6.99)	(-8.21)	(-12.44)	(-7.09)	(-8.18)	(-12.44)	(-7.02)	(-8.21)	(-12.43)
Size	0.013***	0.024***	0.072***	0.013***	0.024***	0.072***	0.013***	0.024***	0.072***
	(9.24)	(14.01)	(30.57)	(9.30)	(14.04)	(30.61)	(9.25)	(14.03)	(30.60)
Age	-0.012***	0.018***	-0.010*	-0.012***	0.018***	-0.010*	-0.012***	0.018***	-0.010*
	(-6.92)	(8.61)	(-2.03)	(-6.95)	(8.61)	(-2.01)	(-6.92)	(8.60)	(-2.03)
Payout	-0.612***	-0.005	-1.537***	-0.615***	-0.003	-1.537***	-0.614***	-0.004	-1.538***
	(-8.82)	(-0.05)	(-7.27)	(-8.85)	(-0.03)	(-7.25)	(-8.84)	(-0.04)	(-7.26)
Volatility	-0.021	-0.109***	-0.315***	-0.020	-0.109***	-0.315***	-0.020	-0.109***	-0.315***
	(-1.54)	(-6.32)	(-7.44)	(-1.52)	(-6.36)	(-7.46)	(-1.52)	(-6.34)	(-7.46)
Turnover	0.013***	0.000	0.022***	0.013***	0.000	0.022***	0.013***	0.000	0.022***
	(13.57)	(0.43)	(8.82)	(13.57)	(0.39)	(8.78)	(13.58)	(0.43)	(8.80)
Price	0.011***	0.024***	0.068***	0.011***	0.024***	0.068***	0.011***	0.024***	0.068***
	(4.71)	(10.03)	(14.96)	(4.69)	(10.03)	(14.95)	(4.71)	(10.04)	(14.96)
$Return_{-3,0}$	0.015***	-0.018***	-0.033***	0.015***	-0.018***	-0.032***	0.015***	-0.018***	-0.033***
	(6.19)	(-6.93)	(-5.53)	(6.17)	(-6.92)	(-5.53)	(6.18)	(-6.93)	(-5.53)
$Return_{-12,-3}$	0.013***	-0.017***	-0.018***	0.013***	-0.017***	-0.018***	0.013***	-0.017***	-0.018***
	(10.15)	(-10.34)	(-5.85)	(10.11)	(-10.35)	(-5.84)	(10.11)	(-10.34)	(-5.85)
N	44,868	44,868	44,868	44,868	44,868	44,868	44,868	44,868	44,868
$\bar{R}^2$	0.29	0.61	0.68	0.29	0.61	0.68	0.29	0.61	0.68

results are robust when we include firms that do not have any major customer into the sample.

2.4 Instrumental variables regressions

Our baseline results point to an economically and statistically significant relationship between a firm's customer concentration and the investment horizon of its institutional investors. One interpretation of this link is that a concentrated customer base attracts short-term, but deters long-term institutional investors. It is possible, however, that managers actively pursue large customers under the pressure from short-term institutional investors, and this decision would be beneficial in the short run, but detrimental to the firm in the long run. Moreover, some omitted characteristics could affect both institutional ownership and customer concentration, and hence drive the observed relationship. To address these endogeneity concerns, we implement instrumental variables regressions using the following two different instrumental variables.

2.4.1 Customer industry M&A intensity

We need to estimate the effect of an exogenous shock to customer base concentration on institutional ownership. Our first identification strategy is to use merger and acquisition activity in customer industries as a source of exogenous variation in customer concentration, following Campello and Gao (2017). They show that sales to a major customer increase substantially after that customer conducts a horizontal merger within its industry. The customer industry consolidation potentially provides customers a stronger buying power, and therefore increases the supplier's customer concentration.

Our identification assumption is that the merger and acquisition activity in a customer's industry is exogenous to the ownership structure of the supplier firm, except through its effect on the supplier's customer base concentration. That is, the M&A activity in a cus-

tomer's industry should not directly affect the short-term/long-term institutional ownership of the supplier. Rather its effect on institutional ownership only exists through its effect on customer concentration.

Our empirical procedure is based on a two-stage least-squares estimation. In the first stage, a supplier's customer concentration is a function of M&A intensity in its customer industries. The second stage tests the effect of instrumented customer concentration on institutional ownership. Formally, we estimate the following two-stage model:

$$\begin{aligned} &Customer\ Concentration_{i,t} = \beta_0 + \beta_1 Customer\ Industry\ M\&A_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t} \\ &Inst\%_{i,t} = \gamma_0 + \gamma_1 Customer\ Concentration_{i,t} + \gamma_2 X_{i,t} + \eta_{i,t} \end{aligned} \tag{4}$$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration defined in section 2, $Customer\ Industry\ M\&A_{i,t}$ represents the average industry M&A intensity across industries to which supplier i's major customers belong, and $X_{i,t}$ includes the same set of control variables in Eq. (3).

We obtain the firm-level M&A costs from Compustat (Item AQC). The industry M&A intensity is measured as the aggregate M&A costs divided by the aggregate sales over all firms within an industry (2-digit SIC) in a year, and it is averaged over the last five years. For each supplier, the instrumental variable $Customer\ Industry\ M\&A_{i,t}$ is the weighted average customer industry M&A intensity over all its customer industries, and the weights are determined by sales percentages derived from individual major customers.

Table 2-4 presents the two-stage least-squares estimates of institutional ownership on customer concentration. In columns 1, 5 and 9, we report the first-stage coefficient estimate of customer concentration on customer industry M&A intensity for three customer concentration measures, respectively. Across all three measures, the coefficient on the average

Table 2-4
Instrumental Variables Regressions: Customer Industry M&A

This table presents results from two-stage instrumental variables regressions. We estimate the following models:

$Customer\ Concentration_{i,t} = \beta_0 + \beta_1 Customer\ Industry\ M\&A_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$
$Inst\%_{i,t} = \gamma_0 + \gamma_1 Customer\ Concentration_{i,t} + \gamma_2 X_{i,t} + \eta_{i,t}$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, $Customer\ Industry\ M\&A_{i,t}$ represents the average industry M&A intensity across industries to which supplier i's major customers belong, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	(1) First-stage	(2) ST %	(3) LT %	(4) Total %	(5) First-stage	(6) ST %	(7) LT %	(8) Total %	(9) First-stage	(10) ST %	(11) LT %	(12) Total %
Customer Industry M&A	17.459***				13.102***				14.283***			
	(34.16)				(29.51)				(32.93)			
Total Customer Sales		0.023***	-0.016*	0.003								
		(3.07)	(-1.69)	(0.12)								
Customer HHI						0.030***	-0.022*	0.004				
						(3.07)	(-1.70)	(0.12)				
Largest Customer										0.028***	-0.020*	0.003
										(3.06)	(-1.70)	(0.12)
q	0.011***	-0.004***	-0.007***	-0.018***	0.010***	-0.004***	-0.007***	-0.018***	0.010***	-0.004***	-0.007***	-0.018***
	(5.56)	(-6.81)	(-10.62)	(-12.08)	(6.57)	(-6.78)	(-10.38)	(-11.97)	(6.71)	(-6.79)	(-10.45)	(-12.01)
Size	-0.019***	0.009***	0.022***	0.061***	-0.008***	0.009***	0.022***	0.061***	-0.013***	0.009***	0.022***	0.061***
	(-6.02)	(9.77)	(16.39)	(18.90)	(-4.38)	(9.68)	(16.72)	(19.06)	(-6.24)	(9.75)	(16.55)	(18.96)
Age	-0.038***	-0.011***	0.018***	-0.007	-0.016***	-0.012***	0.018***	-0.007	-0.020***	-0.012***	0.018***	-0.007
	(-7.22)	(-7.34)	(8.48)	(-1.55)	(-5.54)	(-7.74)	(8.80)	(-1.59)	(-5.87)	(-7.65)	(8.74)	(-1.58)
Payout	0.480**	-0.403***	0.216**	-0.795***	0.497***	-0.407***	0.219**	-0.795***	0.605***	-0.409***	0.220**	-0.796***
	(2.06)	(-6.22)	(2.24)	(-4.24)	(3.49)	(-6.31)	(2.27)	(-4.23)	(3.58)	(-6.32)	(2.28)	(-4.22)
Volatility	0.053	-0.022**	-0.077***	-0.240***	0.053**	-0.022**	-0.077***	-0.240***	0.037	-0.022**	-0.077***	-0.240***
	(1.46)	(-2.10)	(-6.41)	(-8.53)	(2.27)	(-2.14)	(-6.39)	(-8.51)	(1.41)	(-2.08)	(-6.43)	(-8.54)
Turnover	0.006***	0.013***	0.003***	0.028***	0.001	0.013***	0.003***	0.028***	0.002	0.013***	0.003***	0.028***
	(2.92)	(18.99)	(4.16)	(14.22)	(0.60)	(19.20)	(4.06)	(14.30)	(1.43)	(19.13)	(4.09)	(14.28)
Price	-0.003	0.011***	0.019***	0.056***	-0.006**	0.011***	0.019***	0.056***	-0.004	0.011***	0.019***	0.056***
	(-0.70)	(8.11)	(9.52)	(13.10)	(-2.26)	(8.18)	(9.49)	(13.09)	(-1.35)	(8.14)	(9.52)	(13.10)
$Return_{-3,0}$	0.008	0.012***	-0.020***	-0.029***	-0.001	0.012***	-0.020***	-0.029***	0.001	0.012***	-0.020***	-0.029***
	(1.27)	(6.32)	(-9.77)	(-6.26)	(-0.30)	(6.41)	(-9.88)	(-6.26)	(0.32)	(6.37)	(-9.84)	(-6.26)
$Return_{-12,-3}$	0.008**	0.013***	-0.019***	-0.019***	0.003	0.013***	-0.019***	-0.019***	0.005**	0.013***	-0.019***	-0.019***
	(2.56)	(12.23)	(-18.31)	(-8.31)	(1.34)	(12.27)	(-18.48)	(-8.32)	(2.38)	(12.22)	(-18.38)	(-8.31)
N	19,500	19,500	19,500	19,500	19,500	19,500	19,500	19,500	19,500	19,500	19,500	19,500
$\bar{R}^2$	0.27	0.23	0.39	0.54	0.34	0.23	0.40	0.53	0.32	0.22	0.40	0.53

customer industry M&A intensity is positive and statistically significant. The coefficient is economically significant as well. One standard-deviation increase in a supplier's average customer industry M&A intensity leads to an 11% increase in its customer concentration, measured by the total sales to all major customers.

We report the second-stage estimates of institutional ownership on the instrumented customer concentration and other control variables in the next three columns following the first-stage. We regress short-term, long-term, or total institutional ownership on the instrumented customer concentration. With the variation in customer concentration stemming from M&A activities in customer industries, our baseline results still hold. All coefficients on customer concentration remain positive and statistically significant in models where the dependent variable is short-term institutional ownership, while negative and statistically significant in models where the dependent variable is long-term institutional investors. In terms of economic significance, one standard-deviation increase in customer concentration leads to a 14% increase in short-term institutional ownership and a 5% decrease in long-term institutional ownership, each relative to its corresponding sample median. When we replace the dependent variable with the total institutional ownership, the coefficient on customer concentration is not statistically significant.

2.4.2 **Industry average customer concentration**

We use an alternative instrumental variable for customer concentration following Dhaliwal, Judd, Serfling, and Shaikh (2017). The instrumental variable is the historical industry average customer concentration. For each of our three measures of customer concentration, we calculate the two-year lagged industry average in the supplier's industry based on its 2-digit SIC with the supplier itself excluded. An individual firm's customer concentration is correlated with its industry average. But it is less likely that a firm's institutional ownership structure is driven by the historical industry average customer concentration, except through

its effect on the firm's customer base. The historical industry average customer concentration is also unlikely to be an outcome of future pressure by institutional investors.

Table 2-5 presents the two-stage least-squares estimates. The first-stage estimate is positive and statistically significant across all three proxies of customer concentration. The second-stage estimates confirm that the customer concentration attracts different groups of institutional investors, depending on their investment horizons. The coefficients on the instrumented customer concentration are positive and statistically significant when the dependent variable is short-term ownership, but negative and statistically significant when the dependent variable is long-term ownership. As the customer base concentration increases, firms become more attractive to short-term institutional investors, but less attractive to long-term institutional investors. The coefficients on customer concentration when the dependent variable is total institutional ownership is not statistically significant.

Taken together, our results of instrumental variables regressions support a causal effect of customer concentration on the institutional ownership structure after controlling for potential endogeneity issues. Though it has no effect on total institutional ownership, a concentrated customer base appears to attract short-term, but deters long-term institutional investors.

2.5 Mechanisms

In this section, we turn to exploring possible economic channels behind the heterogeneous preferences of different clienteles towards firms with a concentrated customer base. Specifically, we ask how a concentrated customer base attracts short-term institutional investors, but deters long-term institutional investors. As follows, we will discuss information transfer along the supply chain, risks associated with customer concentration, and stock liquidity.

Table 2-5
Instrumental Variables Regressions: Supplier Industry Averages

This table presents results from two-stage instrumental variables regressions. We estimate the following models:

$Customer\ Concentration_{i,t} = \beta_0 + \beta_1 Supplier\ Industry\ Average_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$
$Inst\%_{i,t} = \gamma_0 + \gamma_1 Customer\ Concentration_{i,t} + \gamma_2 X_{i,t} + \eta_{i,t}$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, $Supplier\ Industry\ Average_{i,t}$ is the average customer concentration measure in the supplier's 2-digit SIC industry, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	(1) First-stage	(2) ST %	(3) LT %	(4) Total %	(5) First-stage	(6) ST %	(7) LT %	(8) Total %	(9) First-stage	(10) ST %	(11) LT %	(12) Total %
Industry Average	0.742***				0.708***				0.673***			
	(20.62)				(17.62)				(17.43)			
Total Customer Sales		0.027***	-0.020*	0.033								
		(2.90)	(-1.68)	(1.18)								
Customer HHI						0.029**	-0.048***	0.002				
						(2.12)	(-2.69)	(0.04)				
Largest Customer										0.035**	-0.054***	0.012
										(2.33)	(-2.66)	(0.24)
q	0.013***	-0.005***	-0.008***	-0.022***	0.014***	-0.005***	-0.007***	-0.021***	0.013***	-0.005***	-0.007***	-0.021***
	(8.06)	(-13.52)	(-18.18)	(-20.91)	(9.55)	(-12.39)	(-15.09)	(-18.37)	(10.29)	(-12.33)	(-14.49)	(-18.00)
Size	-0.019***	0.013***	0.025***	0.072***	-0.012***	0.013***	0.024***	0.071***	-0.013***	0.013***	0.024***	0.071***
	(-5.96)	(21.70)	(28.37)	(34.60)	(-5.41)	(21.63)	(27.98)	(34.25)	(-6.05)	(21.59)	(27.59)	(33.97)
Age	-0.026***	-0.011***	0.017***	-0.004	-0.017***	-0.011***	0.017***	-0.005	-0.016***	-0.011***	0.017***	-0.004
	(-5.02)	(-10.02)	(12.11)	(-1.09)	(-4.75)	(-10.25)	(11.91)	(-1.35)	(-4.78)	(-10.09)	(11.77)	(-1.29)
Payout	-0.052	-0.528***	0.089	-1.200***	0.165	-0.538***	0.096	-1.214***	0.153	-0.538***	0.096	-1.213***
	(-0.26)	(-12.67)	(1.38)	(-8.62)	(1.17)	(-12.90)	(1.48)	(-8.67)	(1.06)	(-12.91)	(1.48)	(-8.68)
Volatility	0.097***	-0.035***	-0.067***	-0.229***	0.067***	-0.035***	-0.066***	-0.226***	0.070***	-0.035***	-0.065***	-0.226***
	(3.42)	(-5.83)	(-9.22)	(-13.33)	(3.13)	(-5.73)	(-8.94)	(-13.11)	(3.40)	(-5.79)	(-8.79)	(-13.09)
Turnover	0.004***	0.011***	0.003***	0.024***	0.001	0.011***	0.003***	0.024***	0.002*	0.011***	0.003***	0.024***
	(2.64)	(24.15)	(6.85)	(18.71)	(0.87)	(24.46)	(6.77)	(18.87)	(1.67)	(24.33)	(6.85)	(18.81)
Price	0.005	0.009***	0.016***	0.047***	0.003	0.009***	0.016***	0.047***	0.001	0.009***	0.016***	0.047***
	(1.19)	(10.82)	(12.66)	(17.41)	(0.77)	(10.84)	(12.67)	(17.44)	(0.44)	(10.86)	(12.59)	(17.42)
$Return_{-3,0}$	0.000	0.008***	-0.020***	-0.036***	-0.003	0.008***	-0.020***	-0.036***	-0.003	0.008***	-0.020***	-0.036***
	(0.08)	(6.96)	(-15.80)	(-12.11)	(-0.72)	(7.01)	(-15.94)	(-12.20)	(-0.72)	(7.01)	(-15.89)	(-12.17)
$Return_{-12,-3}$	-0.002	0.011***	-0.016***	-0.017***	-0.003*	0.011***	-0.016***	-0.017***	-0.003*	0.011***	-0.016***	-0.017***
	(-0.86)	(16.48)	(-25.34)	(-11.50)	(-1.79)	(16.44)	(-25.19)	(-11.52)	(-1.65)	(16.44)	(-25.14)	(-11.48)
N	45,693	45,693	45,693	45,693	45,693	45,693	45,693	45,693	45,693	45,693	45,693	45,693
$\bar{R}^2$	0.10	0.32	0.60	0.69	0.09	0.32	0.60	0.69	0.08	0.32	0.60	0.69

2.5.1 Information along the supply chain

Existing literature (see, for example, Yan and Zhang, 2009) demonstrates that short-term institutions are better informed and have the ability to exploit informational advantage through trading strategies that lead to abnormal returns. If customer concentration base can generate abnormal stock performance due to the segmentation effect and slow information transfer along the supply chain (Cohen and Frazzini, 2008; Menzly and Ozbaz, 2010), this mechanism would explain the larger share of holdings by short-term investors. We test this mechanism in the following two ways.

Average customer performance

First, short-term institutional investors presumably are more sensitive than others to the information through the supply chain, which provides them abnormal returns when stock prices fully incorporate the information. If this is the case, we expect the effect of customer concentration on short-term ownership to be stronger when major customers are more profitable and more dominant in their own industries. To examine this potential channel, we adjust our concentration measures based on the performance of individual customers as follows:

$$Customer\ Market\ Share_{i,t} = \sum_{c=1}^{k} \frac{Sales_{i,c,t}}{Sales_{i,t}} \times Market\ Share_{c,t}$$

$$Customer\ ROA_{i,t} = \sum_{c=1}^{k} \frac{Sales_{i,c,t}}{Sales_{i,t}} \times ROA_{c,t}$$

$$Customer\ Sales\ Growth_{i,t} = \sum_{c=1}^{k} \frac{Sales_{i,c,t}}{Sales_{i,t}} \times Sales\ Growth_{c,t}$$

$$Customer\ Stock\ Return_{i,t} = \sum_{c=1}^{k} \frac{Sales_{i,c,t}}{Sales_{i,t}} \times Stock\ Return_{c,t}$$

where $Sales_{i,t}$ represents the total sales of supplier i in year t, $Sales_{i,c,t}$ represents supplier i's sales to its major customer c in year t, $Market\ Share_{c,t}$ is customer c's total sales divided by aggregate sales in its industry (2-digit SIC) in year t, $ROA_{c,t}$ is customer c's ROA in year t, $Sales\ Growth_{c,t}$ is customer c's sales growth rate in year t, $Stock\ Return_{c,t}$ is customer c's cumulative stock return in year t, and k is the number of major customers of supplier i in year t.

These measures are very close to our first customer concentration measure, but adjusted for customer performance. They capture both customer concentration and customer performance. If short-term institutional investors have an information advantage along the supply chain, we would expect that a supplier is more attractive to them if its major customers perform better. We estimate our baseline model Eq. (3) and replace our customer concentration measures with performance-adjusted ones.

Table 2-6 presents the regression results. All coefficients on customer performance are statistically insignificant in models where the dependent variable is the short-term institutional ownership. Short-term institutional investors are not attracted by a stronger customer

Table 2-6
Investor Clienteles and Customer Performance

This table presents results from regressions of institutional ownership on customer performance. We estimate the following model:

$Inst\%_{i,t} = \beta_0 + \beta_1 Customer\ Performance_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$

where $Inst\%_{i,t}$ is short-term (ST%), long-term (LT%), or total institutional ownership (Total%), $Customer\ Performance_{i,t}$ is Customer Market Share, Customer ROA, Customer Sales Growth, or Customer Stock Return, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	ST %	LT %	Total %	ST %	LT %	Total %	ST %	LT %	Total %	ST %	LT %	Total %
Customer Market Share	-0.001	-0.018	-0.023									
	(-0.05)	(-0.52)	(-0.31)									
Customer Sales Growth				0.001	-0.011**	-0.022**						
				(0.17)	(-2.67)	(-2.19)						
Customer ROA							0.031	-0.091*	-0.006			
							(1.05)	(-1.96)	(-0.07)			
Customer Stock Return										0.006	-0.017**	-0.011
										(0.96)	(-2.45)	(-0.77)
q	-0.004***	-0.008***	-0.019***	-0.004***	-0.008***	-0.019***	-0.004***	-0.008***	-0.019***	-0.004***	-0.008***	-0.020***
	(-5.46)	(-7.93)	(-9.11)	(-5.89)	(-7.92)	(-9.10)	(-5.51)	(-7.77)	(-9.03)	(-5.94)	(-7.73)	(-8.62)
Size	0.009***	0.023***	0.062***	0.009***	0.023***	0.062***	0.009***	0.023***	0.062***	0.009***	0.023***	0.062***
	(5.91)	(12.86)	(17.77)	(6.05)	(12.66)	(17.65)	(5.95)	(12.81)	(17.77)	(6.30)	(12.71)	(17.53)
Age	-0.012***	0.017***	-0.010	-0.012***	0.016***	-0.011	-0.012***	0.016***	-0.010	-0.012***	0.017***	-0.008
	(-5.55)	(6.37)	(-1.39)	(-5.75)	(6.07)	(-1.56)	(-5.57)	(6.28)	(-1.40)	(-5.15)	(6.30)	(-1.12)
Payout	-0.392***	0.183	-0.946***	-0.369***	0.189	-0.908***	-0.392***	0.181	-0.950***	-0.409***	0.145	-1.005***
	(-4.47)	(1.59)	(-3.65)	(-4.25)	(1.62)	(-3.43)	(-4.49)	(1.56)	(-3.66)	(-4.56)	(1.23)	(-3.74)
Volatility	-0.019	-0.087***	-0.246***	-0.018	-0.086***	-0.243***	-0.019	-0.087***	-0.246***	-0.011	-0.089***	-0.241***
	(-1.46)	(-5.13)	(-6.55)	(-1.45)	(-4.94)	(-6.40)	(-1.46)	(-5.12)	(-6.55)	(-0.88)	(-5.39)	(-6.19)
Turnover	0.013***	0.004***	0.030***	0.013***	0.004***	0.030***	0.013***	0.004***	0.030***	0.013***	0.004***	0.031***
	(13.66)	(3.50)	(9.79)	(13.53)	(3.80)	(10.23)	(13.69)	(3.53)	(9.80)	(13.17)	(3.80)	(9.76)
Price	0.011***	0.020***	0.060***	0.011***	0.020***	0.060***	0.011***	0.020***	0.060***	0.011***	0.019***	0.059***
	(4.57)	(6.81)	(9.49)	(4.40)	(6.86)	(9.44)	(4.57)	(6.84)	(9.50)	(4.94)	(6.55)	(9.25)
$Return_{-3,0}$	0.011***	-0.020***	-0.031***	0.012***	-0.021***	-0.032***	0.011***	-0.020***	-0.031***	0.011***	-0.020***	-0.031***
	(4.36)	(-6.33)	(-4.27)	(4.48)	(-6.53)	(-4.49)	(4.38)	(-6.31)	(-4.28)	(3.69)	(-5.77)	(-4.13)
$Return_{-12,-3}$	0.011***	-0.019***	-0.023***	0.011***	-0.019***	-0.023***	0.011***	-0.019***	-0.023***	0.012***	-0.019***	-0.022***
	(6.94)	(-10.02)	(-5.79)	(7.15)	(-10.07)	(-5.70)	(6.98)	(-9.94)	(-5.82)	(7.34)	(-8.94)	(-5.62)
N	17,693	17,693	17,693	17,399	17,399	17,399	17,693	17,693	17,693	16,242	16,242	16,242
$\bar{R}^2$	0.29	0.60	0.68	0.29	0.60	0.68	0.29	0.60	0.68	0.30	0.60	0.68

performance. Interestingly, coefficients on customer performance are negative and statistically significant in models where the dependent variable is long-term institutional ownership. It could be due to the fall of profit margin when dealing with dominant and profitable major customers. We will later discuss the risk associated with customer concentration and the preference of long-term institutional investors.

Portfolio returns

Second, if short-term institutional investors have informational advantage regarding the customer base, then they would be able to earn abnormal returns by holding stocks of firms with more concentrated customer base. To directly test this mechanism, we conduct a standard asset pricing test by forming portfolios based on firms' customer concentration.

We sort firms into five quintile portfolios ranked on customer concentration every year at the end of June. The customer information is from the most recent reporting date before each June end. Firms in quintile 1 have the lowest level of customer concentration, while firms in quintile 5 have the highest level of customer concentration. Within each quintile portfolio, we equal or value weight the stocks to form one time-series of monthly returns. The returns of a long-short portfolio are portfolio returns of quintile 5 minus those of quintile 1. We regress monthly returns of each portfolio on two sets of risk factors, Fama-French three factors plus momentum and Fama-French five factors.

Table 2-7 presents raw returns and time-series alphas from regressions of monthly portfolio returns on risk factors. We report results for both equal-weighted and value-weighted portfolio returns. In the first column, ranks 1-5 refer to monthly returns of each quintile portfolio from the least concentrated portfolio 1 to the most concentrated portfolio 5. The last row 5-1 refers to the difference in monthly returns between portfolios 5 and 1. The average monthly raw return is 0.7% for portfolio 5, and 1.2% for portfolio 1. The difference

Table 2-7
Portfolios Sorted by Customer Concentration

This table presents value-weighted and equal-weighted portfolio monthly returns and alphas. We sort firms into five quintile portfolios based on customer concentration every year at the end of June. The customer concentration is measured as the total sales to all major customers at the most recent fiscal year-end before June. Firms in the quintile 1 have the lowest level of customer concentration, while firms in quintile 5 have the highest level of customer concentration. We rebalance portfolios every 12 months. Row 1 to 5 refers to monthly returns of each quintile portfolio. The last row 5-1 refers to the difference in monthly returns between portfolio 5 and 1. We regress monthly returns of each portfolio on either Fama-French three factors plus momentum or Fama-French five factors. For each portfolio, we report the average raw return and alphas. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

		Value-weighted			Equal-weighted		
Rank	N	Mean	Alpha FF-3 + Mom	Alpha FF-5	Mean	Alpha FF-3 + Mom	Alpha FF-5
1	414	0.012	0.002	0.001	0.014	0.004***	0.003**
			(1.50)	(0.83)		(3.60)	(2.13)
2	414	0.010	-0.000	0.001	0.012	0.003**	0.002
			(-0.00)	(0.78)		(2.11)	(1.33)
3	414	0.009	-0.000	0.002	0.012	0.003*	0.002
			(-0.05)	(1.54)		(1.89)	(1.36)
4	414	0.008	-0.001	0.000	0.011	0.001	0.001
			(-0.49)	(0.11)		(0.67)	(0.31)
5	414	0.007	-0.003*	-0.001	0.010	0.001	0.001
			(-1.91)	(-0.51)		(0.33)	(0.57)
5-1	414	-0.005	-0.005**	-0.002	-0.004	-0.003**	-0.002
		(-1.10)	(-2.53)	(-0.99)	(-0.85)	(-2.39)	(-1.18)

between the two is not significant. Alpha is only statistically significant for the most concentrated portfolio when we regress value-weighted returns on Fama-French three factors plus momentum, but it is negative. The long-short portfolio has a significant alpha based on the four factor model, but it is still negative. Firms with higher customer concentration do not have either higher raw returns or higher excess stock returns after controlling for risk factors than firms with low customer concentration. This finding suggests that customer concentration does not contain profitable information for short-term institutional investors to trade on.

In summary, results in this section suggest that the information transfer along the supply chain is not likely the channel through which customer concentration attracts short-term institutional investors. The effect of customer concentration on short-term ownership is not enhanced by the performance of customers. In addition, stocks of firms with a more concentrated customer base do not have a higher stock return than firms with a less concentrated customer base.

2.5.2 **Risk**

Existing literature provides ample evidence that customer concentration increases the long-term risk profile of a firm. Starting from Titman (1984) who has formally outlined the link between specificity of a firm sales and bankruptcy risk, a number of subsequent empirical papers have supported this argument in the context of customer concentration. Campello and Gao (2017) find a positive and significant relation between the significance of major customers and loan failure rates. Moreover, they show that customer concentration reduces loan duration, consistent with the long-term risk argument. Wang (2008) explores the link between customer concentration and payout policy and finds evidence in support of the distress risk. Dhaliwal (2016) shows that higher firm risk is embedded in the cost of equity capital. Finally, firms are facing a trade off between the benefits of reducing information asymmetry

and the costs of aiding competitors by disclosing information of major customers (Ellis, Fee, and Thomas, 2012). Firms have to disclose major customers required by regulations, but at the same time they risk losing their competitive edge.

Institutional investors with long investment horizon and low portfolio turnover prefer firms with low bankruptcy risk and high financial stability. The increased risk associated with a supplier's dependency on few large customers could explain why long-term institutional investors are less inclined to invest in these firms. However, this risk is not necessarily a concern for short-term institutional investors given their short-term trading strategies. We then turn to the next section to explore the reason why they prefer investing in firms with a concentrated customer base.

2.5.3 **Stock liquidity**

Increased stock liquidity and customer concentration

Both short-term and long-term institutional investors favor liquidity. Apparently, short-term investors demand liquidity because of their short-term trading strategies. For long-term investors, liquid stocks provide them with more monitoring power because the threat of exit comes from the ease of liquidating their positions (see Edmans, 2009). In Table 2-2, the coefficient on stock turnover is positive and statistically significant in all models. It is 0.012 in models where short-term institutional ownership is the dependent variable, three times larger than that where long-term institutional ownership is the dependent variable. One standard-deviation increase in stock turnover ratio increases short-term institutional ownership by 41%, while increases long-term institutional ownership by 5% relative to their corresponding sample median values. The sharp difference indicates that short-term institutional investors are more concerned about liquidity than long-term investors. In this section, we examine whether stock liquidity is a channel through which a concentrated customer

base attracts short-term investors. Customer concentration can improve a supplier's stock liquidity through several mechanisms.

First, securing a contract with a large customer is an important event in the life of a supplier firm, which is reported in company announcements, annual reports, and potentially media sources. As a result, a supplier, typically a relatively small firm compared to the overall universe of publicly-traded firms, becomes more visible to market participants, thereby increasing trading volume in the stock.

Second, both theoretical and empirical studies document that greater public disclosure reduces information asymmetry and improves stock liquidity [15]. A concentrated customer base is likely to reduce information asymmetry through disclosure. As required by regulations, a supplier must disclose information of major customers who account for 10% or more of its total sales. With no customer above the threshold, a firm does not have to disclose, although they could still disclose voluntarily. Investors demand information on a firm's customer base, because they can access risks inherent in sales (see Ellis, Fee, and Thomas, 2012; Patatoukas, 2012), and evaluate a firm's investments, as the dependency on a few major customers is associated with relationship-specific investments (see Titman and Wessels, 1988; Kale and Shahrur, 2007). Besides, major customers also influence information disclosure. Hui, Klasa, and Yeung (2012) find that customers demand accounting conservatism to limit risk. Samuels (2016) finds that contracting with government improves the supplier's external reporting.

To determine whether customer concentration improves future stock liquidity, we regress future liquidity on customer concentration, controlling the current level of liquidity and other stock characteristics.

[15] In a theoretical study, Diamond and Verrecchia (1991) shows that public disclosure improves future liquidity and attracts large institutional investors. Graham, Harvey, and Rajgopal (2005) find survey evidence that managers voluntarily disclose information to reduce the information risk that investors assign to our stock. Empirically, Balakrishnan, Billings, Kelly, and Ljungqvist (2014) find that managers disclose more earnings guidance to improve liquidity and firm value when facing an exogenous loss of public information.

$$Liquidity_{i,t+1} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 Liquidity_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t} \quad (5)$$

where $Liquidity_{i,t+1}$ is either monthly stock turnover or monthly illiquidity (Amihud, 2002) at the end of year $t+1$, $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration defined in section 2, and $X_{i,t}$ is a set of stock characteristics as control variables, including book-to-market, size, payout, volatility, the log of stock price, and past stock return.

Table 2-8 Panel A presents the OLS regression results. In the first three columns where the liquidity is measured by stock turnover, the coefficient on customer concentration is positive and statistically significant. In the last three columns, the liquidity is measured by Amihud's illiquidity, and the coefficient on customer concentration is negative and statistically significant. The results support that a more concentrated customer base is associated with higher future stock liquidity.

As in the previous section, we also test this effect of customer concentration on future liquidity based on the exogenous variation in customer concentration stemming from the customer industry M&A intensity. Panel B presents the estimates from instrumental variables regressions. Consistent with our OLS results in Panel A, all instrumented customer concentration measures are positively correlated with stock liquidity, and all coefficients are statistically significant. In the first column, one standard-deviation in the total sales to all major customers is associated with a 10% increase in the future stock turnover relative to the sample median. The IV results support the view that customer concentration leads to higher future stock liquidity.

Table 2-8
Stock Liquidity and Customer Concentration

This table presents results from regressions of future stock liquidity on customer concentration. In Panel A, we estimate the following model:

$$Liquidity_{i,t+1} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 Liquidity_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t}$$

where $Liquidity_{i,t+1}$ is either monthly stock turnover or monthly illiquidity at the end of year $t+1$, $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ includes a set of firm characteristics: Book-to-Market, Size, Payout, Volatility, Price, and Stock Return. In Panel B, we instrument each customer concentration measure by Customer Industry M&A, measured as the average industry M&A intensity across industries to which supplier i's major customers belong. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	Panel A: OLS					
	$Turnover_{t+1}$			$Illiquidity_{t+1}$		
Total Customer Sales	0.128***			-0.055***		
	(2.89)			(-3.08)		
Customer HHI		0.156***			-0.089***	
		(2.85)			(-3.60)	
Largest Customer			0.116**			-0.078***
			(2.41)			(-3.23)
$Turnover_t$	0.459***	0.459***	0.460***			
	(23.50)	(23.65)	(23.67)			
$Illiquidity_t$				0.546***	0.546***	0.546***
				(24.20)	(24.19)	(24.16)
Book-to-Market	0.022	0.022	0.021	-0.031*	-0.031**	-0.031**
	(1.59)	(1.59)	(1.53)	(-2.01)	(-2.05)	(-2.04)
Size	0.151***	0.150***	0.150***	-0.144***	-0.143***	-0.143***
	(8.99)	(8.93)	(8.91)	(-10.07)	(-10.08)	(-10.06)
Payout	-6.492***	-6.524***	-6.525***	-0.100	-0.084	-0.085
	(-8.93)	(-8.95)	(-8.95)	(-0.20)	(-0.16)	(-0.17)
Volatility	0.973***	0.976***	0.983***	-0.130	-0.129	-0.131
	(4.60)	(4.58)	(4.61)	(-1.02)	(-1.01)	(-1.03)
Price	-0.044**	-0.044*	-0.044**	-0.030*	-0.030*	-0.030*
	(-2.04)	(-2.03)	(-2.05)	(-1.75)	(-1.78)	(-1.77)
Stock Return	-0.039**	-0.039**	-0.039**	0.013*	0.013*	0.013*
	(-2.08)	(-2.07)	(-2.07)	(1.85)	(1.85)	(1.85)
N	34,988	34,988	34,988	39,080	39,080	39,080
$\bar{R}^2$	0.40	0.40	0.40	0.54	0.54	0.54

Table 2-8 - Continued
Stock Liquidity and Customer Concentration

	Panel B: IV					
	$Turnover_{t+1}$			$Illiquidity_{t+1}$		
Total Customer Sales	0.245**			-0.229***		
	(2.46)			(-5.33)		
Customer HHI		0.333**			-0.309***	
		(2.46)			(-5.35)	
Largest Customer			0.305**			-0.283***
			(2.45)			(-5.32)
$Turnover_t$	0.484***	0.486***	0.486***			
	(31.72)	(31.93)	(31.88)			
$Illiquidity_t$				0.590***	0.590***	0.590***
				(40.08)	(40.13)	(40.13)
Book-to-Market	0.028	0.029	0.029	-0.041**	-0.042***	-0.042***
	(1.37)	(1.41)	(1.41)	(-2.54)	(-2.60)	(-2.61)
Size	0.143***	0.141***	0.143***	-0.115***	-0.113***	-0.114***
	(12.24)	(12.34)	(12.30)	(-17.04)	(-16.98)	(-17.05)
Payout	-5.657***	-5.730***	-5.748***	0.233	0.324	0.331
	(-8.75)	(-8.87)	(-8.88)	(0.47)	(0.66)	(0.67)
Volatility	1.358***	1.363***	1.370***	-0.255**	-0.264**	-0.268***
	(7.02)	(7.05)	(7.11)	(-2.44)	(-2.54)	(-2.59)
Price	-0.031*	-0.029*	-0.030*	-0.038***	-0.039***	-0.038***
	(-1.75)	(-1.66)	(-1.71)	(-3.72)	(-3.87)	(-3.79)
Stock Return	-0.005	-0.005	-0.005	0.001	0.000	0.001
	(-0.23)	(-0.21)	(-0.23)	(0.12)	(0.04)	(0.10)
N	13,869	13,869	13,869	18,118	18,118	18,118
$\bar{R}^2$	0.43	0.43	0.43	0.56	0.56	0.56

Firms with few short-term institutional investors

The increased future stock liquidity associated with customer concentration could also be a result of the active trading of short-term institutional investors, and these investors might be attracted by a concentrated customer base for reasons other than liquidity. If it is the case, then the relation between customer concentration and liquidity would be much weaker for firms owned by few short-term institutional investors. To mitigate this concern, we sort firms into three tercile groups based on their short-term institutional ownership. To see how different firms owned by few short-term institutional investors are from the rest, we compare firms in the bottom tercile (ST% Tercile 1) with the rest of the firms (ST% Terciles 2 and 3). For firms in ST% Tercile 1, the short-term institutional ownership is less than 1.36% in our sample. We estimate Eq. (5) using both samples and report the results in Table 2-9. The dependent variable is monthly stock turnover at the end of the next year. Across all models, the coefficient on customer concentration is always positive and statistically significant. More importantly, the correlation between customer concentration and future liquidity is not weaker for firms with few short-term institutional investors. Instead, it is very close to that for the rest of the firms. In the first column, one standard deviation increase in the total sales to all major customers is associated with a 10% increase in future stock turnover for firms in ST% tercile 1.

Admittedly, the active trading by short-term institutional investors could contribute to stock liquidity. But for firms with very few short-term institutional investors, the impact of their active trading on liquidity should be limited. However, in these firms we still find that future stock turnover strongly increases in customer concentration. Thus, it is less likely that customer concentration increases stock liquidity only through short-term institutional investors' trading. Instead, our results support the hypothesis that increased liquidity is a channel through which customer concentration attracts short-term institutional investors.

Table 2-9
Stock Liquidity and Customer Concentration: Subsamples

This table presents results from regressions of future stock liquidity on customer concentration. We sort firms into three terciles based on their short-term institutional ownership. Firms in the bottom tercile have the lowest short-term ownership. We estimate the following model on the bottom tercile and the rest, respectively:

$$Liquidity_{i,t+1} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 Liquidity_{i,t} + \beta_3 X_{i,t} + \epsilon_{i,t}$$

where $Liquidity_{i,t+1}$ is monthly stock turnover at the end of year $t+1$, $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ includes a set of firm characteristics: Book-to-Market, Size, Payout, Volatility, Price, and Stock Return. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	$Turnover_{t+1}$					
ST % Tercile	1	2&3	1	2&3	1	2&3
Total Customer Sales	0.128***	0.139**				
	(2.91)	(2.62)				
Customer HHI			0.189***	0.174**		
			(2.77)	(2.35)		
Largest Customer					0.126**	0.146**
					(2.28)	(2.20)
$Turnover_t$	0.329***	0.464***	0.329***	0.464***	0.330***	0.464***
	(7.08)	(25.47)	(7.09)	(25.62)	(7.09)	(25.65)
Book-to-Market	-0.007	0.004	-0.006	0.005	-0.007	0.004
	(-0.34)	(0.20)	(-0.31)	(0.25)	(-0.36)	(0.21)
Size	0.068***	0.150***	0.068***	0.149***	0.068***	0.149***
	(4.15)	(7.87)	(4.07)	(7.77)	(4.09)	(7.74)
Payout	-2.956***	-7.348***	-2.996***	-7.380***	-2.990***	-7.382***
	(-3.90)	(-7.17)	(-3.93)	(-7.20)	(-3.92)	(-7.21)
Volatility	0.821***	1.251***	0.821***	1.255***	0.828***	1.261***
	(4.20)	(4.45)	(4.15)	(4.40)	(4.19)	(4.43)
Price	-0.062***	-0.025	-0.061***	-0.024	-0.062***	-0.024
	(-3.18)	(-0.71)	(-3.12)	(-0.69)	(-3.19)	(-0.69)
Return	-0.083***	-0.032	-0.084***	-0.032	-0.083***	-0.032
	(-3.80)	(-1.27)	(-3.86)	(-1.26)	(-3.85)	(-1.26)
N	11,027	23,628	11,027	23,628	11,027	23,628
$\bar{R}^2$	0.20	0.40	0.20	0.40	0.20	0.40

Liquidity preference and customer concentration

To further support the liquidity channel, we turn to the liquidity preference of institutional investors. If liquidity is a channel through which customer concentration attracts short-term institutional investors, we would expect that customer concentration only attracts short-term institutional investors who indeed favor liquidity. On the other hand, as shown in our baseline results, long-term institutional investors also like liquidity, although not as strong as short-term investors do. The increased liquidity associated with customer concentration should mitigate the risk concern of long-term investors who prefer liquidity as well.

We proxy the liquidity preference of institutional investors by the average liquidity over their portfolio holdings. An institutional investor's portfolio liquidity is measured as the value-weighted average turnover of all stock holdings in her portfolio. Every quarter, we sort institutional investors into terciles based on their portfolio liquidity. Institutional investors in the top tercile hold the most liquid portfolios and are categorized as investors who prefer liquidity. Institutional investors in the bottom tercile hold the least liquid portfolios and are categorized as investors who do not prefer liquidity. This sorting is independent of our investor horizon sorting. By doing so, we can further split either short-term or long-term investors into those who prefer liquidity and those who do not. To test whether customer concentration attracts institutional investors who prefer liquidity, we replace the dependent variable in Eq. (3) with the ownership of one of the following four groups of institutional investors: short-term institutional investors who prefer liquidity and who do not, and long-term institutional investors who prefer liquidity and who do not.

Table 2-10 presents the regression results. For each customer concentration measure, we have four specifications. Each of them uses the ownership of one group of institutional investors as the dependent variable. All three customer concentration measures show consis-

tent results. In models where the dependent variable is short-term institutional ownership, the coefficient on customer concentration is positive and statically significant. However, the coefficient is close to zero for short-term investors who hold the least liquid portfolios. One standard-deviation in the total sales to major customers is associated with an 7.5% increase in the ownership of short-term institutional investors who prefer liquidity relative to the sample median, but close to zero for those who do not prefer liquidity.

According to our definition, long-term institutional investors hold their position for long run. But the increased liquidity from a concentrated customer base could be also attractive, especially for those who prefer liquid stocks. In models where the dependent variable is long-term institutional ownership, the coefficient on customer concentration is negative and statistically significant only for long-term institutional investors who do not prefer liquidity. For those who prefer liquidity, the coefficient is not significant any more. This finding supports our prediction that customer concentration increases stock liquidity, so it attracts long-term investors even though they are also concerned about future risks. The insignificant coefficient could be due to the fact that the benefits from holding liquidity stocks can mitigate the concern on the risk associated with a concentrated customer base.

Taken together, this section documents that stock liquidity is a channel through which customer concentration attracts short-term institutional investors. As a result, customer concentration mainly attracts short-term investors who like holding liquid stocks. For long-term institutional investors who favor liquidity, the increased stock liquidity also makes firms with a concentrated customer base more attractive.

Table 2-10
Liquidity Preference and Customer Concentration

This table presents results from regressions of institutional ownership on customer concentration. We sort institutional investors into terciles based on their portfolio liquidity, measured as the value-weighted average stock turnover over all holdings. We further divide both short-term and long-term investors into those who hold the most liquid portfolios in the top tercile and those who hold the least liquid portfolios in the bottom tercile. We estimate the following model:

$$Inst\%_{i,t} = \beta_0 + \beta_1 Customer\ Concentration_{i,t} + \beta_2 X_{i,t} + \epsilon_{i,t}$$

where $Inst\%_{i,t}$ is the ownership of each of four types of institutional investors, $Customer\ Concentration_{i,t}$ is one of the three measures for customer base concentration: Total Customer Sales, Customer HHI, and Largest Customer, and $X_{i,t}$ includes a set of firm characteristics: Tobin's q, Size, Age, Payout, Volatility, Turnover, Price, and Returns. All variables are defined in Appendix C. In all specifications, we include industry-year fixed effects. Industry classifications are based on 2-digit SIC. Standard errors are clustered by firm and year. The sample includes all firms that have at least one major customer reported in Compustat Customer Segment Files from 1980 to 2015.

	ST %		LT %		ST %		LT %		ST %		LT %	
Portfolio Liquidity	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
Total Customer Sales	0.006***	0.000*	0.000	-0.002*								
	(3.09)	(1.79)	(0.10)	(-1.66)								
Customer HHI					0.006**	0.001**	0.000	-0.004**				
					(2.49)	(2.47)	(0.15)	(-2.09)				
Largest Customer									0.004*	0.001**	-0.000	-0.004**
									(1.79)	(2.06)	(-0.45)	(-2.24)
q	-0.002***	-0.000***	-0.001***	-0.001***	-0.002***	-0.000***	-0.001***	-0.001***	-0.002***	-0.000***	-0.001***	-0.001***
	(-7.08)	(-7.84)	(-8.69)	(-7.67)	(-7.05)	(-8.04)	(-8.70)	(-7.53)	(-6.94)	(-7.88)	(-8.62)	(-7.51)
Size	0.009***	0.000***	0.000**	0.007***	0.009***	0.000***	0.000**	0.007***	0.009***	0.000***	0.000**	0.007***
	(19.21)	(9.01)	(2.50)	(16.84)	(19.13)	(9.03)	(2.50)	(16.85)	(19.09)	(9.01)	(2.46)	(16.80)
Age	-0.009***	-0.000	0.001***	0.006***	-0.009***	-0.000	0.001***	0.006***	-0.009***	-0.000	0.001***	0.006***
	(-12.81)	(-0.51)	(3.30)	(11.11)	(-12.93)	(-0.48)	(3.30)	(11.12)	(-12.99)	(-0.53)	(3.26)	(11.13)
Payout	-0.485***	0.027***	-0.040***	0.277***	-0.486***	0.027***	-0.040***	0.278***	-0.485***	0.027***	-0.040***	0.278***
	(-16.43)	(4.73)	(-3.53)	(7.50)	(-16.47)	(4.71)	(-3.53)	(7.52)	(-16.44)	(4.71)	(-3.52)	(7.52)
Volatility	-0.014***	-0.003***	-0.001	-0.021***	-0.013***	-0.003***	-0.001	-0.021***	-0.013***	-0.003***	-0.001	-0.021***
	(-2.68)	(-4.95)	(-0.34)	(-7.42)	(-2.65)	(-5.00)	(-0.34)	(-7.41)	(-2.61)	(-4.97)	(-0.32)	(-7.41)
Turnover	0.010***	-0.000***	0.001***	-0.002***	0.010***	-0.000***	0.001***	-0.002***	0.010***	-0.000***	0.001***	-0.002***
	(25.59)	(-5.61)	(5.74)	(-9.99)	(25.65)	(-5.59)	(5.74)	(-10.03)	(25.66)	(-5.58)	(5.75)	(-10.02)
Price	0.007***	0.000	0.003***	0.003***	0.007***	0.000	0.003***	0.003***	0.007***	0.000	0.003***	0.003***
	(10.19)	(0.18)	(11.92)	(4.96)	(10.21)	(0.23)	(11.90)	(4.93)	(10.18)	(0.21)	(11.89)	(4.93)
$Return_{-3,0}$	0.008***	-0.000**	-0.002***	-0.005***	0.008***	-0.000**	-0.002***	-0.005***	0.008***	-0.000**	-0.002***	-0.005***
	(7.27)	(-2.01)	(-6.41)	(-9.73)	(7.27)	(-1.99)	(-6.41)	(-9.75)	(7.26)	(-2.00)	(-6.42)	(-9.74)
$Return_{-12,-3}$	0.010***	-0.000**	-0.002***	-0.003***	0.010***	-0.000**	-0.002***	-0.003***	0.010***	-0.000**	-0.002***	-0.003***
	(15.88)	(-2.33)	(-9.36)	(-11.68)	(15.89)	(-2.31)	(-9.37)	(-11.69)	(15.88)	(-2.32)	(-9.37)	(-11.68)
N	41,716	41,716	41,716	41,716	41,716	41,716	41,716	41,716	41,716	41,716	41,716	41,716
$\bar{R}^2$	0.30	0.07	0.13	0.32	0.30	0.07	0.13	0.32	0.30	0.07	0.13	0.32

2.6 Conclusion

Our study documents that customer profile shapes the equity ownership structure among institutional investors with heterogeneous investment horizons. We find that higher customer concentration is associated with an increase in short-term, but a decrease in long-term institutional ownership.

We find that the trade-off between benefits and costs associated with a concentrated customer base can explain our empirical findings. With a concentrated customer base, the increased risk deters long-term institutional investors from investing in these firms, but the improved stock liquidity attracts short-term institutional investors. From the perspective of institutional investors, we offer new insights on the costs and benefits of business relationships along the supply chain. We also exploit alternative possible mechanisms. We do not find support for either information transfer along the supply chain or future abnormal stock returns associated with customer concentration.

REFERENCES

Chapter One

Agca, S., Mozumdar, A., 2008. The impact of capital market imperfections on investment-cash flow sensitivity. *Journal of Banking and Finance* 32, 207-216.

Allayannis, G., Mozumdar, A., 2004. The impact of negative cash flow and influential observations on investment-cash flow sensitivity estimates. *Journal of Banking and Finance* 28, 901-930.

Almeida, H., Campello, M., Laranjeira, B., Weisbenner, S., 2009. Corporate debt maturity and the real effects of the 2007 credit crisis. Unpublished Working Paper. University of Illinois, Urbana-Champaign.

Ascioglu, A., Hegde, S.P., McDermott, J.B., 2008. Information asymmetry and investment-cash flow sensitivity. *Journal of Banking and Finance* 32, 1036-1048.

Baker, M., Stein, J.C., Wurgler, J., 2003. When does the market matter? stock prices and the investment of equity-dependent firms. *Quarterly Journal of Economics* 118, 969-1006.

Bates, T.W., Kahle, K.M., Stulz, R., 2009. Why do U.S. firms hold so much more cash than they used to? *Journal of Finance* 64(5), 1985-2021.

Bekaert, G., Harvey, C., Lundblad, C., 2001. Emerging equity markets and economic development. *Journal of Development Economics* 66, 465-504.

Bekaert, G., Harvey, C., Lundblad, C., 2005. Does financial liberalization spur growth. *Journal of Financial Economics* 77, 3-55.

Bekaert, G., Harvey, C., Kiguel, A., and Wang, X., 2016. Globalization and asset returns. *Annual Review of Financial Economics* 8, 221-288.

Brown, J., Petersen, B., 2009. Why has the investment-cash flow sensitivity declined so sharply? Rising R&D and equity market developments. *Journal of Banking and Finance* 33, 971-984.

Chen, H., Chen, S., 2012. Investment-cash flow sensitivity cannot be a good measure of financial constraints: evidence from the time series. *Journal of Financial Economics* 103, 393-410.

Demirgüc-Kunt, A., Maksimovic, V., 1998. Law, finance, and firm growth. *Journal of Finance* 53, 2107-2137.

Erickson, T., Jiang, C., Whited, T., 2014. Minimum distance estimation of the errors-in-variables model using linear cumulant equations. *Journal of Econometrics* 183, 211-221.

Erickson, T., Whited, T., 2000. Measurement error and the relationship between investment and q. *Journal of Political Economy* 108, 1027-1057.

Erickson, T., Whited, T., 2012. Treating measurement error in Tobin's q. *Review of Financial Studies* 25, 1286-1329.

Farre-Mensa, J., Michaely, R., Schmalz, M.C., 2017. Financing payouts. 2017 AFA Paper.

Fazzari, S., Hubbard, R., Petersen, B., 1988. Financing constraints and corporate investment. Brookings Papers on Economic Activity, 141-195.

Hail, L., Leuz, C., 2006. International differences in the cost of equity capital: do legal institutions and securities regulation matter? *Journal of Accounting Research* 44, 485-531.

Hoshi, T., Kashyap, A., Scharfstein, D., 1991. Corporate structure liquidity and investment: evidence from Japanese panel data. *Quarterly Journal of Economics* 106, 33-60.

Hubbard, R., 1998. Capital market imperfections and investment. *Journal of Economic Literature* 36, 193-227.

King, R.G., Levine, R., 1993. Finance and growth: Schumpeter might be right. *Quarterly Journal of Economics* 108, 717-737.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2006. What works in securities laws? *Journal of Finance* 61, 1-32.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1997. Legal determinants of external finance. *Journal of Finance* 52, 1131-1150.

Lau, S.T., Ng, L., Zhang, B., 2010. The world price of home bias. *Journal of Financial Economics* 97, 191-217.

Lau, S.T., Ng, L., Zhang, B., 2012. Information environment and equity risk premium volatility around the world. *Management Science*, 1526-5501.

Levine, R., 2005. Finance and growth: theory and evidence. In Aghion, P., Durlauf, S. (Eds.) Handbook of Economic Growth.

Levine, R., Zervos, S., 1998. Stock markets, banks, and economic growth. *American Economic Review* 88, 537-558.

Lewellen, J., Lewellen, K., 2016. Investment and cashflow: new evidence. *Journal of Financial and Quantitative Analysis* 51, 1135-1164.

Love, I., 2003. Financial development and financial constraints: International evidence from the structural investment model. *Review of Financial Studies* 16, 765-791.

McLean, D.R., Zhang, T., Zhao, M., 2012, Why does the law matter? Investor protection and its effects on investment, finance, and growth. *Journal of Finance* 68, 313-350.

Moshirian, F., Nanda, V., Vadilyev, A., Zhang, B., 2017. What drives investment-cash flow sensitivity around the world? *Journal of Banking and Finance* 77, 1-17.

Peters, R.H., Taylor, L.A., 2017. Intangible capital and the investment-q relation. *Journal of Financial Economics* 123, 251-272.

Rajan, R.G., Zingales, L., 1998. Financial dependence and growth. *American Economic Review* 88, 559-586.

Wurgler, J., 2000. Financial markets and the allocation of capital. *Journal of Financial Economics* 58, 187-214.

Chapter Two

Albuquerque, A.M., Papadakis, G., Wysocki, P.D., 2014. The impact of risk on CEO equity incentives: evidence from customer concentration. Working Paper, Available at SSRN: https://ssrn.com/abstract=1944015

Amihud, Y., 2002. Illiquidity and stock returns: Cross-section and time-series effects. Journal of Financial Markets 5, 31-56.

Ahern, K.R., Harford, J., 2014. The importance of industry links in merger waves. Journal of Finance 69, 527-576.

Balakrishnan, K., Billings, M.B., Kelly, B., Ljungqvist, A., 2014. Shaping liquidity: on the causal effects of voluntary disclosure. Journal of Finance 69, 2237-2278.

Banerjee, S., Dasgupta, S., Kim, Y., 2008. Buyer-supplier relationships and the stakeholder theory of capital structure. Journal of Finance 63, 2507-2552.

Bushee, B.J, 1998. The influence of institutional investors on myopic R&D investment behavior. The Accounting Review 73, 305-333.

Bushee, B.J, 2001. Do institutional investors prefer near-term earnings over long-run value? Contemporary Accounting Research 18, 207-246.

Bushee, B.J., Noe, C.F., 2000. Corporate disclosure practices, institutional investors, and stock return volatility. Journal of Accounting Research 38, 171-202.

Bhattacharyya, S., Nain, A., 2011. Horizontal acquisitions and buying power: a product market analysis. Journal of Financial Economics 99, 97-115.

Cen, L., Dasgupta, S., Sen, R., 2016. Discipline or disruption? stakeholder relationships and the effect of takeover threat. Management Science 62, 2820-2841.

Cen, L., Dasgupta, S., Elkamhi, R., Pungaliya, R.S., 2016. Reputation and loan contract terms: the role of principal customers. Review of Finance 14, 501-533.

Campello, M., Gao, J., 2017. Customer concentration and loan contract terms. Journal of Financial Economics 123, 108-136.

Cen, L., Maydew, E.L., Zhang, L., Zuo L., 2016. Customer-supplier relationships and corporate tax avoidance. Journal of Financial Economics 123, 377-394.

Diamond D.W., Verrecchia, R.E., 1991. Disclosure, liquidity, and the cost of capital. Journal of Finance 46, 1325-1359.

Dhaliwal, D., Judd, J.S., Serfling, M., Shaikh, S., 2016. Customer concentration risk and the cost of equity capital. Journal of Accounting and Economics 61, 23-48

Ellis, J.A., Fee, C.E., Thomas, S.E., 2012. Proprietary costs and the disclosure of information about customers. Journal of Accounting Research 50, 685-728.

Fee, C.E., Thomas, S., 2004. Sources of gains in horizontal mergers: evidence from customer, supplier, and rival firms. Journal of Financial Economics 74, 423-460.

Gaspar, J.M., Massa, M., Matos, P., 2005. Shareholder investment horizons and the market for corporate control. Journal of Financial Economics 76, 135-165.

Gompers, P.A., Metrick, A., 2001. Institutional investors and equity prices. The Quarterly Journal of Economics 116, 229-259.

Graham, J.R., Campbell R.H., Shivaram R., 2005, The economic implications of corporate financial reporting. Journal of Accounting and Economics 40, 3-73.

Huang, H.H., Lobo, G.J., Wang, C., Xie, H., 2016. Customer concentration and corporate tax avoidance. Journal of Banking and Finance 72, 184-200.

Hui, K.W., Klasa, S., Yeung, P.E., 2012. Corporate suppliers and customers and accounting conservatism. Journal of Accounting and Economics 53, 115-135.

Hertzel M.G., Li, Z., Officer, M.S., Rodgers, K.J., 2008. Inter-firm linkages and the wealth effects of financial distress along the supply chain. Journal of Financial Economics 87, 374-387.

Irvine, P.J., Park, S.S., Yildizhan, C., 2016. Customer-base concentration, profitability, and the relationship life cycle. The Accounting Review 91, 883-906.

Itzkowitz, J., 2013. Customers and cash: how relationships affect suppliers cash holdings. Journal of Corporate Finance 19, 159-180.

Johnson, W.C., Kang, J.K., Yi, S., 2010. The certification role of large customers in the new issues market. Financial Management 39, 1425-1474.

Kale, J.R., Shahrur, H., 2007. Corporate capital structure and the characteristics of suppliers and customers. Journal of Financial Economics 83, 321-365.

Kim, R., Luo, W., 2017. Customer concentration and earnings management: evidence from the Sarbanes-Oxley Act. Working Paper, Available at SSRN: https://ssrn.com/abstract=2970368

Kolay, M., Lemmon, M., Tashjian, E., 2016. Spreading the misery? sources of bankruptcy spillover in the supply chain. Journal of Financial and Quantitative Analysis 51(6), 1955-1990.

Krishnan, G., Patatoukas, P.N., Wang, A.Y., 2017. Customer-base concentration: implications for audit pricing and quality. Working Paper, Available at SSRN: https://ssrn.com/abstract=2440009

Murfin, J., Njoroge, K., 2014. The implicit costs of trade credit borrowing by large firms. Review of Financial Studies 28, 112-145.

Patatoukas, P.N., 2012. Customer-base concentration: implications for firm performance and capital markets. The Accounting Review 87(2), 363-392.

Raman, K., Shahrur, H., 2008. Relationship-specific investments and earnings management: evidence on corporate suppliers and customers. The Accounting Review 83, 1041-1081.

Shahrur, H., 2005. Industry structure and horizontal takeovers: analysis of wealth effects on rivals, suppliers, and corporate customers. Journal of Financial Economics 76, 61-98.

Titman, S., Wessels, R., 1988. The determinants of capital structure choice. Journal of Finance 43, 1-19.

Wang, J., 2012. Do firms' relationships with principal customers/suppliers affect shareholders' income? Journal of Corporate Finance 18, 860-878.

Yan, X., Zhang, Z., 2009. Institutional investors and equity returns: are short-term institutions better informed? Review of Financial Studies 22, 893-924.

Appendices

Appendix A
Country-level and Firm-level Measures

Variable	Definition	Data source
Firm-level variables		
I	Capital expenditure scaled by the beginning-of-period total assets	Worldscope
q	Total assets plus the market value of equity minus the book value of equity divided by total assets.	Worldscope
CF	Net income before extraordinary items/preferred dividends plus depreciation and amortization scaled by the beginning-of-period total assets	Worldscope
Δ Equity	The change in the sum of the book value of equity and the deferred taxes, minus the change in retained earnings, scaled by the beginning-of-period total assets	Worldscope
Δ Debt	The change in the total debt scaled by the beginning-of-period total assets	Worldscope
Measures for economic development		
GDPC	Log of gross domestic product per capita measured in constant 2005 US$	WDI
Electricity Consumption	Electric power consumption measured by the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants (kWh per capita)	WDI
Secondary Education Enrollment	Total enrollment in secondary education, regardless of age, expressed as a percentage of the population of official secondary education age	WDI
R&D	Capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications (% of GDP)	WDI
FDI	The sum of foreign direct investment net inflows and net outflows, both of which are absolute values. (% of GDP)	WDI

Appendix A - Continued
Country-level and Firm-level Measures

Variable	Definition	Data source
Measures for financial development		
Stock Market Development	Stock market capitalization (% of GDP)	WDI
Cost of Equity Financing	The average of four different implied cost of equity estimates following: (i) Gebhardt, Lee, and Swaminathan's (2001) residual income valuation model; (ii) Claus and Thomas's (2001) residual income valuation model; (iii) Ohlson and Juettner-Nauroth's (2005) abnormal earnings growth valuation model; and finally (iv) Easton's (2004) MPEG ratio (price-to-earnings ratios divided by growth rate) model	IBES&Worldscope
Private Credit	Private credit by deposit money banks and other financial institutions (% of GDP)	WDI
Portfolio equity inflows	Net inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts (American or global), and direct purchases of shares in local stock markets by foreign investors (% of GDP)	WDI
Protection	Principal component of disclosure, liability standards, and anti-director rights	La Porta et al. (2006)
Disclosure	The arithmetic mean of prospect, compensation, shareholders, inside ownership, contracts irregular, and transactions	La Porta et al. (2006)

Appendix B
Correlation Matrix

The table reports the correlation matrix of our main country-level variables, namely GDP per capita (GDPC), electricity consumption per capita, secondary school enrollment ratio, R&D expenses, FDI, stock market development, cost of equity financing, private credit, portfolio equity net inflows, protection, and disclosure. All these variables are defined in Appendix A. ICF sensitivity is estimated using firms within a country for each year. Statistical significance at the 1%, 5%, and 10% levels is denoted by ***, **, and *, respectively.

	ICF	GDPC	Electricity Consumption	Sec School Enrollment	R&D	FDI	Stock Market Development	Cost of Equity	Private Credit	Equity Portfolio Inflows	Protection	Disclosure Disclosure
ICF	1.000											
GDPC	-0.218***	1.000										
Electricity Consumption	-0.200***	0.737***	1.000									
Sec School Enrollment	-0.195***	0.748***	0.551***	1.000								
R&D	-0.249***	0.620***	0.580***	0.453***	1.000							
FDI	-0.165***	0.263***	0.186***	0.134***	0.020	1.000						
Stock Market Development	-0.146***	0.223***	0.144***	0.035	0.012	0.382***	1.000					
Cost of Equity Financing	0.191***	-0.417***	-0.281***	-0.355***	-0.338***	-0.057	-0.144***	1.000				
Private Credit	-0.274***	0.588***	0.444***	0.370***	0.419***	0.297***	0.389***	-0.383***	1.000			
Portfolio Equity Inflows	-0.072*	0.156***	0.173***	0.028	-0.011	0.476***	0.092**	-0.010	0.124***	1.000		
Protection	-0.146***	-0.164***	0.076*	-0.095**	-0.056	0.112***	0.348***	-0.051	0.190***	0.031	1.000	
Disclosure	-0.169***	0.031	0.165***	-0.127***	0.081*	0.101**	0.402***	-0.263***	0.407***	0.070*	0.643***	1.000

Appendix C
Ownership, Customer Concentration and Firm Characteristics

Variable	Definition
Customer Concentration	
Total Customer Sales	The sum of sales to all major customers divided by the supplier's total sales.
Customer HHI	The sum of squared sales percentages to major customers.
Largest Customer	The sales percentage to the customer who accounts for the largest share of the supplier's total sales.
Institutional Ownership	
ST %	The number of shares owned by short-term institutional investors divided by total number of shares outstanding. Institutional investors whose average portfolio churn rate over the last four quarters is higher than at least 2/3 of all institutions in a quarter are defined as short-term.
LT %	The number of shares owned by long-term institutional investors divided by total number of shares outstanding. Institutional investors whose average portfolio churn rate over the last four quarters is lower than at least 2/3 of all institutions in a quarter are defined as long-term.
Total %	The number of shares owned by all institutional investors divided by total number of shares outstanding.
Firm Characteristics	
Tobin's q	Total assets plus the market value of equity minus the book value of equity divided by total assets.
Size	The log of market capitalization of a firm.
Age	The log of number of years since the first year the firm appears in Compustat.
Payout	Dividends divided by market capitalization of a firm.
Volatility	The standard deviation of monthly stock returns over the past year.
Turnover	The monthly trading volume divided by total number of shares outstanding.
Price	The log of stock price.
$Return_{-3,0}$	Past 3-month cumulative stock return.
$Return_{-12,-3}$	9-month cumulative stock return ended 3 months prior to the fiscal year-end.