Capital Budgeting vs. Market Timing: An Evaluation Using Demographics

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ABSTRACT

Using demand shifts induced by demographics, we evaluate capital budgeting and market timing. Capital budgeting implies that industries anticipating positive demand shifts in the near future should issue more equity to finance greater capacity. To the extent that demographic shifts in the distant future are not incorporated into equity prices, market timing implies that industries anticipating positive demand shifts in the distant future should issue less equity due to undervaluation. The evidence supports both theories: new listings and equity issuance respond positively to demand shifts during the next five years and negatively to demand shifts further in the future.

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The determinants of equity issuance are the subject of an ongoing debate in corporate finance. Are initial public offerings (IPOs) and seasoned offerings best explained by the demands for external finance, or are they driven by market timing in response to company misvaluation?

Capital budgeting holds that firms issue equity (and debt) to invest the proceeds in positive net present value (NPV) projects, for example, to expand production when demand is high (Modigliani and Miller (1958)). Market timing instead holds that firms issue equity to take advantage of mispricing by investors (Baker, Ruback, and Wurgler (2007), Stein (1996)).

One crucial difficulty in evaluating these theories is the lack of exogenous proxies for investment opportunities, on the one hand, and for misvaluation, on the other hand. For instance, the relationship between the market-to-book ratio and corporate decisions could reflect investment opportunities (Campello and Graham (forthcoming)), mispricing related to accruals or dispersion of opinion (Gilchrist, Himmelberg, and Huberman (2005), Polk and Sapienza (2009)), or both (Hertzel and Li (2010)). These issues are also linked to whether market-to-book is a proxy for risk (Fama and French (1992)) or a measure of mispricing relative to accounting fundamentals (Lakonishok, Shleifer, and Vishny (1994)).

We use demographic variables as proxies for both in a novel evaluation of these two theories. We consider industries that are affected by predictable shifts in cohort sizes, such as breweries and long-term care facilities. These industries have distinctive age profiles of consumption. Therefore, forecastable changes in the age distribution produce forecastable shifts in demand for various goods. Even though these demand shifts only capture a small component of the variation in investment opportunities and mispricing, they are exogenous from the perspective of the manager. As such, they allow us to address the endogeneity problem and identify separately the managerial response to variation in investment opportunities and mispricing.

We distinguish between shifts that will affect an industry in the near future, up to five years ahead, and shifts that will occur in the more distant future, five to ten years ahead. As the model in Section I demonstrates, traditional capital budgeting indicates that industries affected by positive demand shifts in the near future should raise capital to increase production. Positive demand shifts increase marginal productivity and the optimal level of investment; in turn, the desire for more investment induces demand for additional capital. Therefore, demand shifts due to demographics in the near future should be positively related to equity issuance.

Another prediction relies on the assumption that investors are short-sighted and hence partially neglect forecastable demographic shifts further in the future (five to ten years ahead). Indeed, demand shifts due to demographics five to ten years ahead significantly predict industry-level abnormal returns (DellaVigna and Pollet (2007)). In our model, we assume that managers in a particular industry have longer foresight horizons than investors—perhaps because managers usually develop in-depth knowledge essential to long-term planning. Under this assumption, demand shifts in the distant future serve as proxies for mispricing and managers react to this mispricing by modifying their equity issuance decisions. Companies in industries with positive demand shifts five to ten years ahead will tend to be undervalued and managers respond by reducing equity issuance (or repurchasing equity). Conversely, companies in industries with negative demand shifts five to ten years ahead will tend to be overvalued, and managers react by issuing additional equity. This analysis assumes that the announcement of issuing or repurchasing equity does not cause investors to fully eliminate the mispricing.

We also consider a case in which time-to-build considerations create a trade-off between raising equity to finance investment and repurchasing equity to exploit mispricing. A company facing high demand growth due to demographics five to ten years ahead would like to repurchase shares (market timing) but also invest (capital budgeting). Unlike in the standard case, time-to-build induces a trade-off between the two because the company cannot postpone investment to the later period. Hence, the above predictions are attenuated in high time-to-build industries compared to low time-to-build industries.

Although the model does not include debt, capital budgeting suggests that firms affected by positive demand shifts in the near term can raise capital by borrowing through loans or by issuing bonds (debt issuance) in addition to issuing equity. Market timing does not provide a clear prediction about the relation between long-term demand shifts and debt issuance.[1]

To summarize, capital budgeting predicts that demand shifts due to demographics in the near future should be positively related to debt and equity issuance, while market timing suggests that demand shifts further in the future should be negatively related to equity issuance. We note that the two predictions are not mutually exclusive. In Section II we describe the construction of demand shifts due to demographics (obtained combining cohort size forecasts and estimates of age profiles of consumption) and introduce the measures of external financing.

In Section III we analyze the impact of demographics on the likelihood of initial public offerings (IPOs) and on additional equity issuance by listed firms in an industry. We find that demand shifts due to demographics up to five years ahead are positively related to the ratio of new listings to existing listings, consistent with capital budgeting. Demand shifts due to demographics five to ten years ahead are significantly negatively related with this IPO

[1] The extent to which debt is mispriced when equity is mispriced is unclear. Debt issuance may be a substitute for equity issuance if debt is less mispriced than equity.

measure, consistent with market timing. We find similar results for the ratio of listing with large additional equity issuance to existing listings, our measure of secondary equity issuance. As predicted, these results are stronger for less competitive industries and for industries with lower time-to-build.

We also consider the impact of demand shifts on debt issues and repurchases. The evidence regarding debt is imprecisely estimated. For most of the specifications, the sign of the coefficient estimates for demand shifts in the near future is consistent with capital budgeting but the estimates are not statistically significant. There is also little statistical evidence that demand shifts in the distant future are related to debt policy.[2]

Finally, we provide evidence on the channels underlying these results. The model in Section II links equity and debt decisions to demographic shifts through investment. Indeed, we show that positive demand shifts up to five years ahead increase investment as well as research and development (R&D). These results provide evidence that investment, broadly defined, is a determinant of the demand for external capital.

In Section IV we discuss five alternative explanations: signalling, agency problems, large fixed costs of equity issuance, globalization, and unobserved time patterns. We find that these potential alternatives are not likely to generate our findings.

This paper is related to the substantial empirical literature about market timing.[3] Rel-

[2] However, in a few specifications long-term demand shifts are negatively related to debt repurchases. This result could support market timing if debt is used as a substitute for equity, that is, if undervalued firms repurchase equity but do not repurchase debt due to financing constraints.

[3] See Baker, Ruback, and Wurgler (2007), Campello and Graham (2007), Carlson, Fisher, and Giammarino (2006), Gilchrist, Himmelberg, and Huberman (2005), Graham and Harvey (2001), Hertzel and Li (2010), Jenter, Lewellen, and Warner (2009), Li, Livdan, and Zhang (2009), and Polk and Sapienza (2009).

ative to this literature, we consider a novel exogenous proxy for mispricing. The paper is also related to the literature on corporate response to anticipated demand shifts (Acemoglu and Linn (2004), Ellison and Ellison (2011), Goolsbee and Syverson (2008)). Unlike these papers, we focus on equity and debt financing decisions. This paper is also associated with the evidence on the effect of demographics on corporate outcomes and aggregate stock returns (Acemoglu and Linn (2004), Poterba (2001)). Finally, we extend the discussion regarding the role of attention allocation in economics and finance.[4] Our evidence suggests that the inattention of investors with respect to long-term information (DellaVigna and Pollet (2007)) affects corporate financing decisions.

I. A Model

We consider a simple two-period model of investment and equity issuance. The investment opportunity is a long-term project that can be financed in either period 1 or period 2; the cash flow from this project is realized at the end of period 2. In the second period the manager and investors have the same (correct) expectations about the expected value of the investment opportunity. However, in the first period investors do not correctly foresee the expected value of the investment opportunity in period 2, since the level of demand is beyond their foresight horizon.[5] Only the manager correctly foresees the expected value of the investment opportunity since he has a longer foresight horizon. Therefore, limited attention induces time-varying

[4]See Barber and Odean (2008), Cohen and Frazzini (2008), Daniel, Hirshleifer, and Subrahmanyam (1998), DellaVigna and Pollet (2009), Hirshleifer, Lim, and Teoh (2009), Hong and Stein (1999), Huberman and Regev (2001), and Peng and Xiong (2006).

[5]This mistake in expectations is an error in the perception of the average return for the project. It is not related to any misperception of the risk properties associated with the project.

asymmetric information between investors and the manager. We also consider the rational expectations case in which investors have correct expectations throughout.

To match the empirical evidence, it helps to think of the two periods as approximately five years apart. We assume that investors are naive about their limited foresight, and hence, do not use the equity issuance policy to make inferences about the information known by the manager. Also, since our goal is to focus on the impact of investor foresight, we do not consider other forms of asymmetric information. We assume that the manager maximizes the price per share for existing shareholders that hold their shares until the end of period 2.

We capture time-to-build aspects associated with production by considering two polar cases: (i) investment in period 1 or period 2 is equally productive (no time-to-build), and (ii) investment in period 2 is completely unproductive (severe time-to-build). The second case describes industries in which cost-effective investment in new plants must begin many years before production, that is, in period 1 and not in period 2. For example, it is much less costly to build a new aircraft assembly plant over a multi-year period than building it in one year.

The firm chooses the level of investments, I_1 and $I_2 \in [0, \infty)$, with a gross product $\alpha f(I_1 + g(I_2))$ in period 2, where $g(.)$ captures the (potential) time-to-build considerations. The marginal productivity of investment in the project is determined by $\alpha = \{\overline{\alpha}, \underline{\alpha}\}$. When demand due to demographics is high, α is high: $\alpha = \overline{\alpha}$; when demand due to demographics is low, α is low: $\alpha = \underline{\alpha} < \overline{\alpha}$. We assume that the production function is increasing and concave: $f'(I) > 0$ and $f''(I) < 0$ for all $I \geq 0$. To guarantee positive and finite investment for each project, we assume standard limiting conditions: $\lim_{I \to 0} f'(I) = \infty$ and $\lim_{I \to \infty} f'(I) = 0$. For convenience, we consider two limiting cases for $g(I)$. In the absence of time-to-build,

$g(I) = I$, that is, there does not exist a cost of delaying the investment until period 2. In the presence of substantial time-to-build, $g(I) = 0$, that is, there exists a prohibitive cost of delaying investment to period 2.

The manager uses internal funds or raises external finance (equity) in period 1 or 2 to undertake investments I_1 and I_2. Equity is the only financial instrument that is affected by the limited foresight horizon of the investor. (We discuss an extension with riskless debt at the end of this section.) In period 1, the firm has cash C available and N shares outstanding. We assume that the financing constraints are only binding when demand is high. The firm always has enough cash to undertake the first-best investment with low demand $\underline{\alpha}$, but not enough cash to undertake the first-best investment with high demand $\overline{\alpha}$ without some equity issuance.

The firm can issue n_1 shares in period 1 (at price P_1) and n_2 shares in period 2 (at price P_2). Equity issuance in either period can be negative, that is, we allow the firm to repurchase equity. We assume that there is a maximum amount of total equity issuance or repurchases: $0 < \underline{N} \leq N + n_1 + n_2 \leq \overline{N}$ and $\underline{N} \leq N + n_1 \leq \overline{N}$, with $\underline{N} < \overline{N}$. These technical assumptions rule out infinite share issuance and complete share repurchase. We let $\overline{N}$ be large enough that it is always possible to issue sufficient equity to finance the first-best levels of investment, but it may not be optimal for the manager to do so. Finally, to break ties when the firm is indifferent with respect to equity issuance, we assume that the manager incurs an extremely small fixed cost K each time equity is issued or repurchased.

The manager maximizes the price per share for the long-term shareholders, that is, total firm value scaled by the number of shares outstanding at the end of period 2. The firm's value is the sum of the initial cash holdings C, the total equity raised, $n_1P_1 + n_2P_2$, plus the value of the investment, $\alpha f(I_1 + g(I_2))$, net of the investment expense, $I_1 + I_2$. The interest rate between the two periods is normalized to zero. The manager's maximization problem is

$$\max_{n_1,n_2,I_1,I_2} \frac{1}{N+n_1+n_2}\left(C + n_1P_1 + n_2P_2 + \alpha f(I_1 + g(I_2)) - I_1 - I_2\right), \tag{1}$$

subject to

$$\begin{aligned} I_1 &\leq C + n_1P_1, \\ I_1 + I_2 &\leq C + n_1P_1 + n_2P_2, \\ \underline{N} &\leq N + n_1 + n_2 \leq \overline{N}, \\ \underline{N} &\leq N + n_1 \leq \overline{N}. \end{aligned}$$

While the manager knows the realization of the demand parameter α, investors in period 1 neglect demographic factors and make a forecast $\widehat{\alpha}$, with $\underline{\alpha} \leq \widehat{\alpha} \leq \overline{\alpha}$. This assumption captures the (potential) short-sightedness of investors. In period 2, investors and managers instead agree about the level of demand, since investors observe α directly.

We assume that the manager extracts all the surplus from outside investors. Hence, we compute the highest prices P_1 and P_2 at which outside investors are willing to buy shares of the company. Investors in period 1 are willing to purchase shares if

$$P_1 = \frac{1}{N+n_1}\left(C + n_1P_1 + \widehat{\alpha} f\left(I_{1,\widehat{\alpha}} + g\left(I_{2,\widehat{\alpha}}\right)\right) - I_{1,\widehat{\alpha}} - I_{2,\widehat{\alpha}}\right), \tag{2}$$

where $I_{1,\widehat{\alpha}}$ and $I_{2,\widehat{\alpha}}$ are the levels of investment consistent with the (potentially incorrect) demand forecast $\widehat{\alpha}$ in period 2. In the absence of time-to-build ($g(I) = I$), we assume that the predicted levels of investment in the long-term project, $I_{1,\widehat{\alpha}}$ and $I_{2,\widehat{\alpha}}$, satisfy the equation $\widehat{\alpha} f'\left(I_{1,\widehat{\alpha}}+I_{2,\widehat{\alpha}}\right)-1=0$. In the presence of time-to-build ($g(I)=0$), we assume that the predicted levels of investment in the long-term project, $I_{1,\widehat{\alpha}}$ and $I_{2,\widehat{\alpha}}$, satisfy the equations $\widehat{\alpha} f'\left(I_{1,\widehat{\alpha}}\right)-1=0$ and $I_{2,\widehat{\alpha}}=0$. These conditions define the first-best levels of investment for the project in each of the relevant cases if the true demand level is $\widehat{\alpha}$.

In period 2, investors are willing to purchase shares if

$$P_2=\frac{1}{N+n_1+n_2}\left(C+n_1 P_1+n_2 P_2+\alpha f\left(I_{1,\alpha}+g\left(I_{2,\alpha}\right)\right)-I_{1,\alpha}-I_{2,\alpha}\right), \tag{3}$$

where $I_{1,\alpha}$ is the level of investment observed at the end of period 1 and $I_{2,\alpha}$ is the forecast of investment in the second period that is consistent with the correct demand α. Defining $V_\alpha=\alpha f\left(I_{1,\alpha}+g\left(I_{2,\alpha}\right)\right)-I_{1,\alpha}-I_{2,\alpha}$ and $V_{\widehat{\alpha}}=\left(\widehat{\alpha} f\left(I_{1,\widehat{\alpha}}+g\left(I_{2,\widehat{\alpha}}\right)\right)-I_{1,\widehat{\alpha}}-I_{2,\widehat{\alpha}}\right)$, we solve for P_1 and P_2: $P_1=N^{-1}\left(C+V_{\widehat{\alpha}}\right)$ and $P_2=\left(N+n_1\right)^{-1}\left(C+n_1 P_1+V_\alpha\right)$. We now analyze investment and equity issuance in period 2 (no mispricing) and then in period 1 (mispricing).

Period 2. After substituting in P_2, the maximization problem in period 2 is

$$\max_{n_2, I_2} \frac{1}{N+n_1}\left(C+n_1 P_1\right)+\frac{1}{N+n_1+n_2}\left(\frac{n_2}{N+n_1} V_\alpha+\alpha f\left(I_{1,\alpha}+g\left(I_2\right)\right)-I_{1,\alpha}-I_2\right). \tag{4}$$

The first-order condition with respect to I_2 is equivalent to $\alpha f'\left(I_{1,\alpha}+g\left(I_2^*\right)\right) g'\left(I_2^*\right)-1=0$. Given our assumptions about $f(.)$ and $g(.)$, there is a unique solution for I_2^*. If $g(I)=I$, the solution is the first-best level of investment given by $\alpha f'\left(I_{1,\alpha}^*+I_2^*\right)-1=0$. Alternatively, if $g(I)=0$, the solution is still the first-best level of investment, where $I_2^*=0$ (a corner solution).

In either case the solution for I_2^* does not depend on the issuance decision n_2^*. To solve for

n_2^* we substitute $I_2 = I_2^*$ and $I_{2,\alpha} = I_2^*$ in expression (4). The manager's problem simplifies to

$$\max_{n_2} \frac{1}{N+n_1}\left(C + n_1 P_1 + \alpha f\left(I_{1,\alpha} + g\left(I_2^*\right)\right) - I_{1,\alpha} - I_2^*\right), \tag{5}$$

which is independent of the equity issuance n_2. Hence, optimal equity issuance in period 2 is determined only by the need to raise sufficient funds to finance the optimal level of investment in period 2. This result is not surprising because there is no divergence in expectations in the last period and there are no other capital market distortions. Given the small fixed cost of share issuance (repurchase) K, the firm does not raise equity in the second period ($n_2^* = 0$) if it already has enough funds to finance the investment, that is, if $I_2^* + I_{1,\alpha} - C - n_1 P_1 < 0$ or $I_2^* = 0$. Otherwise, the firm issues new shares to ensure that $n_2^* P_2 \geq I_2^* + I_{1,\alpha} - C - n_1 P_1$.

Period 1. Using the solution for I_2^*, we solve for the optimal equity issuance (repurchase) decision in period 1. After substituting in the values for P_1 and P_2 and rearranging, the maximization problem is

$$\max_{n_1, I_1} \frac{1}{N}\left(C + V_{\widehat{\alpha}}\right) + \frac{1}{N+n_1}\left(\alpha f\left(I_1 + g\left(I_2^*\right)\right) - I_1 - I_2^* - V_{\widehat{\alpha}}\right). \tag{6}$$

The first term in expression (6) is the value of the company according to outside investors (based on the incorrect expectation that the demand shift will be $\widehat{\alpha}$). The second term captures the value to the manager of exploiting the biased beliefs of investors by issuing or repurchasing equity via n_1. Note that the issuance (repurchase) decision in period 2 is irrelevant for the maximization problem in period 1.We consider the standard case first and then proceed to the case with time-to-build.

If $g(I) = I$ (no time-to-build), the optimal level of investment in period 1 for the long-term project satisfies $\alpha f'(I_1^* + I_2^*) - 1 = 0$. This first-best level of investment, $I_1^* + I_2^*$, is always attained because the manager can raise sufficient equity in the second period to finance the optimal investment. Hence, in the absence of time-to-build, the expected value of the investment opportunity is independent of the decision to issue or repurchase equity in the first period. Given the assumptions about $f(.)$, the optimal investment policy, $I_1^* + I_2^*$, in the project is an increasing function of α.

Next, we determine the optimal level of equity issuance/repurchase. Since the first term of (6) is not a function of n_1, the solution only depends on the numerator of the second term, $\alpha f(I_1^* + I_2^*) - I_1^* - I_2^* - V_{\widehat{\alpha}}$ (substituting I_1^* for I_1). If future demand is high, given shortsighted investors ($\alpha = \overline{\alpha} > \widehat{\alpha}$), this term is positive: since the company is undervalued, the manager repurchases as many shares as possible in period 1, $n_1^* = \underline{N} - N$, and then issues equity in the second period to finance the optimal level of investment. If there is low future demand, the term is negative: because the company is overvalued, the manager issues as much equity as possible in period 1, $n_1^* = \overline{N} - N$, and does not need to issue shares in the second period to finance the investment. If $g(I) = I$, the optimal level of investment in period 1 for the long-term project satisfies $\alpha f'(I_1^* + I_2^*) - 1 = 0$ and given the functional form of $f(.)$, the optimal investment policy, $I_1^* + I_2^*$, in the project is an increasing function of α.

If $g(I) = 0$ (time-to-build), then $I_2^* = 0$ and the manager maximizes

$$\max_{n_1, I_1} \frac{1}{N}(C + V_{\widehat{\alpha}}) + \frac{1}{N + n_1}(\alpha f(I_1) - I_1 - V_{\widehat{\alpha}}), \tag{7}$$

where the first-best level of investment is characterized by $\alpha f'\left(I_1^{FB}\right) - 1 = 0$. When demand is low ($\alpha = \underline{\alpha}$), the term $\alpha f(I_1) - I_1 - V_{\widehat{\alpha}}$ is negative. The manager issues as much equity as possible ($n_1^* = \overline{N} - N$) and selects the first-best investment level I_1^{FB}. When demand is high, ($\alpha = \overline{\alpha}$), the manager would like to repurchase shares up to $n_1^* = \underline{N} - N$. However, this action would make it impossible to undertake the first-best investment I_1^{FB} because the firm does not have sufficient cash on hand to finance the first-best level of investment when demand is high. In this case, there is a trade-off between exploiting mispricing by repurchasing equity and financing the investment opportunity by issuing (or not repurchasing) equity in the first period. Hence, the motivation to repurchase shares due to market timing will generally be attenuated by the need to finance investment in the presence of time-to-build. This trade-off implies that it is not obvious if investment is greater when demand is high than when demand is low. However, the investment opportunity and any potential mispricing are both quantitatively related to the magnitude of the demand shift and we are able to show that investment is greater if demand is high (see Internet Appendix for the proof).[6]

Proposition 1 summarizes these results. We denote the standard case ($g(I) = I$) with ST and the time-to-build case ($g(I) = 0$) with TB.

PROPOSITION 1 (Inattentive investors): *(i) In the case with high demand ($\alpha = \overline{\alpha} > \widehat{\alpha}$) and no time-to-build ($g(I) = I$), the manager repurchases shares in period 1 and issues shares in period 2: $n_{1,ST}^* = \underline{N} - N < 0$ and $n_{2,ST}^* > 0$. (ii) In the case with high demand ($\alpha = \overline{\alpha} > \widehat{\alpha}$) and time-to-build ($g(I) = 0$), the manager repurchases (weakly) fewer shares of the company*

[6] The Internet Appendix is available on The Journal of Finance website at http://www.afajof.org/supplements.asp.

compared to case (i) and does not issue shares in period 2: $n_{1,TB}^* \geq n_{1,ST}^*$ *and* $n_{2,TB}^* = 0$. *(iii) In either case with low demand ($\alpha = \underline{\alpha} < \widehat{\alpha}$), the manager issues shares in period 1 and does not issue in period 2:* $n_{1,ST}^* = n_{1,TB}^* = \overline{N} - N > 0$ *and* $n_{2,ST}^* = n_{2,TB}^* = 0$.*(iv) Total investment ($I_1^* + I_2^*$) is greater with high demand ($\alpha = \overline{\alpha}$) than with low demand ($\alpha = \underline{\alpha}$).*

Restating this discussion brings us to our empirical tests. Demand shifts in the near future should be positively related to net equity issuance, but demand shifts in the more distant future should be negatively related to net equity issuance. The second relationship should be attenuated by time-to-build considerations. Finally, investment should increase with the demand shift in the absence of time-to-build considerations.

Attentive Investors. In addition to the case of short-sighted investors, for which $\underline{\alpha} < \widehat{\alpha} < \overline{\alpha}$, we also consider the case in which investors are fully aware of the demand shift α. The solutions for investment I_2^* and equity issuance n_2^* in period 2 do not change. The maximization problem in period 1 becomes

$$\max_{n_1, I_1} \frac{1}{N} \left(C + \alpha f \left(I_1 + g \left(I_2^* \right) \right) - I_1 - I_2^* \right) \tag{8}$$

Investors have correct expectations for demand, and therefore, for investment. Hence, the firm has no incentive to issue (or repurchase) equity in period 1, except to finance the investment. If demand is high and $g(I) = I$, the manager raises equity in either period 1 or period 2 (but not in both). If demand is high and $g(I) = 0$, the manager raises equity in period 1. If demand is low, investment is financed internally in either case. Because investment is first-best, expression (7) and the assumptions about $f(.)$ imply that total investment, $I_1^* + I_2^*$, is increasing in α.

PROPOSITION 2 (Fully attentive investors): *(i) In the case of high demand ($\alpha = \overline{\alpha} = \widehat{\alpha}$),* *there is positive issuance in one of the two periods ($n_1^* > 0$ or $n_2^* > 0$); in the presence of time-to-build, there is issuance in the first period only. (ii) In the case of low demand ($\alpha = \underline{\alpha} = \widehat{\alpha}$), there is no equity issuance ($n_1^* = n_2^* = 0$). (iii) Total investment ($I_1^* + I_2^*$) is greater with high demand ($\alpha = \overline{\alpha}$) than with low demand ($\alpha = \underline{\alpha}$).*

For attentive investors, the only motive to issue equity is capital budgeting. Both equity issuance and investment respond positively to the demand shift α. Equity issuance can increase well in advance of the demand shift (period 1) or immediately before the demand shift (period 2) if time-to-build is not an important consideration.

Extensions. It is straightforward to generalize the model to include issuance and repurchases of (correctly priced) riskless debt in either period. Since riskless debt is issued for capital budgeting rather than for market timing reasons, the main differential prediction occurs for high demand due to demographics ($\alpha = \overline{\alpha}$). Instead of raising equity to finance investment, the firm could raise debt in either period. Hence, in Section III we also test the prediction that debt responds positively to demand shifts due to demographics.

We assume that the demand for equity is not downward sloping. Agency problems or more sophisticated versions of asymmetric information would generate downward sloping demand curves. These factors would distort investment, complicating the model substantially. Optimal issuance and repurchase levels in the presence of mispricing would be determined by the demand curve rather than the technical assumption of a minimum and maximum number of shares. Nevertheless, we doubt that these features would change the key insights.

II. Data

In this section, we summarize the construction of the measures of demand growth due to demographics.[7] We also briefly summarize the results about abnormal return predictability using demographic information to motivate our test of market timing. Next, we provide summary statistics on the measures of equity issuance.

A. Demand Shifts Due to Demographics

To obtain demographic-based forecasts of demand growth by industry, we generate demographic forecasts and combine them with estimated age patterns in consumption by industry.

Demographic Forecasts. We combine data from the U.S. Census Bureau on cohort size, mortality, and fertility rates to form forecasts of cohort sizes. We use demographic information available in year t to forecast the age distribution by gender and one-year age groups for years $u > t$. We assume that fertility rates for the years $u > t$ equal the fertility rates for year t. We also assume that future mortality rates equal mortality rates in year t except for a backward-looking percentage adjustment. Using cohort size in year t and the forecasts of future mortality and fertility rates, we form preliminary forecasts of cohort size for each year $u > t$, which we adjust for net migration. We compute an adjustment for net migration by regressing the percentage difference between the actual cohort size and the preliminary forecasted cohort size formed the year before on a constant. We produce these adjustment coefficients separately for each 10-year age group using data from the most recent five-year period prior to year t.

[7] See DellaVigna and Pollet (2007) for additional details regarding this procedure.

We define $\hat{A}_{g,u|t} = \left[\hat{A}_{g,0,u|t},\ \hat{A}_{g,1,u|t},\ \hat{A}_{g,2,u|t},...\right]$ as the forecasted age distribution, where $\hat{A}_{g,j,u|t}$ is the number of people of gender g alive at u with age j forecasted using information available at t, and $A_{g,j,u}$ is the actual cohort size of gender g alive at u with age j. We use these estimates to forecast the actual population growth rate during the next five years, $\log A_{g,j,t+5} - \log A_{g,j,t}$, with an R^2 of 0.83. The forecasts five to ten years in the future are only slightly less precise. Our forecasts also closely parallel publicly available demographic forecasts, in particular, the Census Bureau population forecasts created using data from the 2000 Census.[8]

Age Patterns in Consumption. We use data from the *Survey of Consumer Expenditures, 1972-1973* and the 1983 to 1984 cohorts of the ongoing *Consumer Expenditure Survey* to estimate the age patterns in consumption. We cover all major expenditures on final goods included in the survey data. The selected level of aggregation attempts to distinguish goods with different age-consumption profiles. For example, within the category of alcoholic beverages, we separate beer and wine from hard liquor expenditures. Similarly, within insurance we distinguish among health, property, and life insurance expenditures.

In Figure 1, we present the age profile for two goods using kernel regressions of household annual consumption on the age of the head of household.[9] Figure 1 plots the normalized expenditure on bicycles and drugs for the 1972 to 1973 and 1983 to 1984 surveys.[10] Across the two surveys, the consumption of bicycles peaks between the ages of 35 and 45. At these ages,

[8] We do not use the Census population forecasts because they are unavailable for many of the years in the sample.

[9] We use an Epanechnikov kernel with a bandwidth of five years of age for each consumption good and survey year.

[10] For each survey-good pair we divide age-specific consumption for good k by the average consumption across all ages for good k.

the heads of household are most likely to have children between the ages of five and ten. The demand for drugs, in contrast, is increasing with age, particularly in the later survey. Older individuals demand more pharmaceutical products.

Approximate location for Figure 1

This evidence on age patterns in consumption supports three general statements. First, the amount of consumption for each good depends significantly on the age of the head of household. Patterns of consumption for most goods are not flat with respect to age. Second, these age patterns vary substantially across goods. Some goods are consumed mainly by younger household heads (child care and toys), some by heads in middle age (life insurance and cigars), and others by older household heads (cruises and nursing homes). Third, the age profile of consumption for a given good is quite stable across time. For example, the expenditure on furniture peaks at ages 25 to 35, regardless of whether we consider the 1972 to 1973 or the 1983 to 1984 cohort. Taken as a whole, the evidence suggests that changes in age structure of the population have the power to influence consumption demand in a substantial and consistent manner.

Demand Forecasts. We combine the estimated age profiles of consumption with the demographic forecasts in order to forecast demand for different goods. For example, consider a forecast of toys consumption in 1985 made as of 1975. For each age group, we multiply the forecasted cohort sizes for 1985 by the age-specific consumption of toys estimated on the most recent consumption data as of 1975, that is, the 1972 to 1973 survey. Next, we aggregate across all the age groups to obtain the forecasted total demand for toys for 1985.

In Table I, we present summary statistics on the consumption forecasts. Column 2 and Column 4 present the five-year predicted growth rate due to demographics, $\Delta\hat{c}_{k,t+5,t,t-1} = \ln\hat{C}_{k,t+5|t-1} - \ln\hat{C}_{k,t|t-1}$, for years $t = 1975$ and $t = 2000$, respectively. The bottom two rows present the mean and standard deviation across goods for this measure. In each case, information from the most recent consumer expenditure survey is used. In 1975, the demand for child care and toys is low due to the small size of the "Baby Bust" generation. The demand for most adult-age commodities is predicted to grow at a high rate (1.5% to 2% percent per year) due to the entry of the "Baby Boom" generation into prime consumption age. In 2000, the demand for child-related commodities is relatively low. The aging of the Baby Boom generation implies that the highest forecasted demand growth is for goods consumed later in life, such as cigars, cosmetics, and life insurance.

Approximate location for Table I

Demographic Industries. We also categorize goods by their sensitivity to demographic shifts. For example, the demand for oil and utilities is unlikely to be affected by shifts in the relative cohort sizes, while the demand for bicycles and motorcycles depends substantially on the relative size of the cohorts aged 15 to 20 and 20 to 30, respectively. We construct a measure of Demographic Industries using information available at time $t-1$ to identify the goods for which demographic shifts are likely to have the most impact. For each year t and industry k, we compute the standard deviation of the one-year demand growth forecasts for the next 15 years given by $\Delta\hat{c}_{k,t+s+1,t+s,t-1} = \ln\hat{C}_{k,t+s+1|t-1} - \ln\hat{C}_{k,t+s|t-1}$ for $s = 0, 1, ..., 15$. We define the set of Demographic Industries[11] in each year t as the 20 industries with the highest standard

[11] Ideally, we would like to select industries in which demographics is a better predictor of contem-

deviation of demand growth. In these industries, the forecasted aging of the population induces different demand shifts at different times in the future, enabling the estimation of investor horizon. Table I lists all industries and indicates which industries belong to the subset of demographics industries in 1975 (Column 3) and 2000 (Column 5). Column 6 summarizes the percentage of years in which an industry belongs to the Demographic Industries subsample. The Demographic Industries are associated with high demand by children (child care, toys) and young adults (housing).

Return Predictability. The evidence supporting return predictability (from DellaVigna and Pollet (2007)) is summarized in Figure 2. This figure plots the coefficient of univariate regressions of abnormal annual industry stock returns in year t on forecasted demand growth due to demographics in year $t+h$. The panel regression includes up to 48 industries during the years 1974 to 2004. As Figure 2 shows, while contemporaneous demand shifts (h equals 1 or 2) do not significantly forecast stock returns, demand shifts five to ten years ahead (h equals 5 to 10) significantly predict returns.[12] We interpret this result as evidence that investors neglect forecastable determinants of fundamentals that are more than five years in the future. The abnormal return for an industry increases when inattentive investors incorporate the upcoming demand shift five years in the future.

Approximate location for Figure 2

poraneous profitability or revenue growth. Unfortunately, this avenue is not feasible for two reasons. First, demographics is a small predictor of revenue and profit, so one would need a long time series to identify the industries with the highest predictive power. Second, it would be impossible to conduct such a test during the first part of the sample period without violating the requirement to only use backward-looking information.

[12] The standard errors in Figure 2 are estimated using the methodology described in Section III.

B. Equity and Debt Issuance

IPOs. The first measure of equity issuance captures the decision of firms in an industry to go public and is the share of traded companies in industry k and year t that are new equity listings in year t. This measure is available for the full sample (1974 to 2004) for the large majority of industries and ranges from 0.011 (Books: College Texts) to 0.126 (Cruises). As an alternative measure, we also use the share of companies in industry k and year t that undertake an IPO according to data from Jay Ritter, though this information is available only from 1980 until 2003. During the sample in which both measures exist, the correlation is 0.8228.

Net Equity Issuance. The measures of equity issuance for public companies in year t and industry k are based on net equity issuance in year t scaled by industry book value of assets in year $t-1$ (Frank and Goyal (2003)). The measures are available for the entire sample period for most industries, even though the number of companies in an industry is smaller than for the IPO measure, given the additional requirement that the company be in Compustat as well as CRSP. The measure of substantial equity issuance is the fraction of companies in industry k for year t that have net equity issuance greater than 3% of the book value of assets. This threshold, albeit arbitrary, allows us to eliminate equity issues that are part of ordinary transactions, such as executive compensation. The mean of this variable is 0.108, with a standard deviation of 0.190. Similarly, the measure of substantial equity repurchases is the fraction of companies in industry k for year t that have net equity repurchases greater than 3% of the book value of assets. The mean of this variable is 0.067, with a standard deviation of 0.164.

Net Debt Issuance. The measures of debt issuance for public companies in year t and industry k are based on the net long-term debt issuance in year t scaled by industry book value of assets in year $t-1$. The measures of substantial debt issuance and substantial debt repurchases follow the same approach described for equity issuance.

III. Empirical Analysis

A. Baseline Specification

In the baseline specification we regress equity issuance on the forecasted demand growth due to demographics from t to $t+5$ (the near future) and $t+5$ to $t+10$ (the further future):

$$e_{k,t+1} = \gamma + \delta_0 \left(\frac{\Delta \hat{c}_{k,t+5,t,t-1}}{5} \right) + \delta_1 \left(\frac{\Delta \hat{c}_{k,t+10,t+5,t-1}}{5} \right) + \beta_m e_{m,t+1} + \beta_b mb_{k,t+1} + \varepsilon_{k,t+1} \quad (9)$$

Since the consumption growth variables are scaled by five, the coefficients δ_0 and δ_1 represent the average increase in issuance for one percentage point of additional annualized growth in demographics at the two different horizons. The fourth subscript indicates that the forecasts of demand growth from t to $t+5$ and from $t+5$ to $t+10$ only use information available in period $t-1$. The specification controls for market-wide patterns in equity issuance, $e_{m,t+1}$, and the industry market-to-book ratio, $mb_{k,t+1}$.[13]

In this panel setting, the errors from the regression are likely to be correlated across industries and over time because of persistent shocks that affect multiple industries. We allow for heteroskedasticity and arbitrary contemporaneous correlation across industries by clustering the standard errors by year. In addition, we correct these standard errors to account for

[13] Including lagged profitability and lagged investment does not affect the results (see Table IV below).

autocorrelation in the error structure.[14]

Let X be the matrix of regressors, θ be the vector of parameters, and ε be the vector of errors. The panel has T periods and K industries. Under the appropriate regularity conditions, $\sqrt{\frac{1}{T}}(\hat{\theta} - \theta)$ is asymptotically distributed $N(0, (X'X)^{-1} S(X'X)^{-1})$, where $S = \Gamma_0 + \sum_{q=1}^{\infty}(\Gamma_q + \Gamma_q')$ and $\Gamma_q = E[(\sum_{k=1}^{K} X_{k,t}\varepsilon_{k,t})'(\sum_{k=1}^{K} X_{k,t-q}\varepsilon_{k,t-q})]$. The matrix Γ_0 captures the contemporaneous covariance, while the matrix Γ_q captures the covariance structure between observations that are q periods apart. While we do not make any assumptions about contemporaneous covariation, we assume that $X_{k,t}'\varepsilon_{k,t}$ follows an autoregressive process given by $X_{k,t}'\varepsilon_{k,t} = \rho X_{k,t-1}'\varepsilon_{k,t-1} + \eta_{k,t}'$, where $\rho < 1$ is a scalar and $E[(\sum_{k=1}^{K} X_{k,t-q}\varepsilon_{k,t-q})'(\sum_{k=1}^{K} \eta_{k,t})] = 0$ for any $q > 0$.

These assumptions imply $\Gamma_q = \rho^q \Gamma_0$, and therefore, $S = [(1+\rho) / (1-\rho)]\Gamma_0$. The full derivation and details are in DellaVigna and Pollet (2007). The higher the autocorrelation coefficient ρ, the larger the terms in the matrix S. Since Γ_0 and ρ are unknown, we estimate Γ_0 with $\frac{1}{T}\sum_{t=1}^{T} X_t'\hat{\varepsilon}_t\hat{\varepsilon}_t' X_t$ where X_t is the matrix of regressors and $\hat{\varepsilon}_t$ is the vector of estimated residuals for each cross-section. We estimate ρ from the pooled regression for each element of $X_{k,t}'\hat{\varepsilon}_{k,t}$ on the respective element of $X_{k,t-1}'\hat{\varepsilon}_{k,t-1}$.

We use the set of Demographic Industries for the years 1974 to 2004 as the baseline sample. As discussed above, these industries are more likely to be affected by demographic shifts.

[14] This method is more conservative than clustering by either industry or year. In the empirical specifications that follow, the standard errors computed with either of these methodologies are almost uniformly lower than our standard errors.

B. IPO Results

In Table II, we estimate the regression specification given by equation (9) for the share of new equity listings. In the specification without industry or year fixed effects (Column 1), the impact of demographics on new equity listings is identified by both between- and within-industry variation in demand growth. The coefficient on short-term demographics, $\hat{\delta}_0 = 3.35$, is marginally significantly different from zero, while the coefficient on long-term demographics, $\hat{\delta}_1 = -4.84$, is significantly different from zero. When we introduce controls for the industry market-to-book ratio $mb_{k,t}$ and for the aggregate share of new listings $e_{m,t}$ (Column 2) the impact of long-term demographics attenuates to a marginally significant $\hat{\delta}_1 = -2.49$ and the effect of short-term demographics becomes insignificant.[15] If we include industry fixed effects (Column 3), demand growth in the near future has a marginally significant positive effect on the share of new listings ($\hat{\delta}_0 = 2.45$), while demand growth in the further future has a significant negative effect ($\hat{\delta}_1 = -3.07$). We obtain similar results if we include year fixed effects (Column 4). In this specification, the identification depends on within-industry variation in demand growth after controlling for common time-series patterns.[16]

Approximate location for Table II

For the specifications in Columns 2 through 4, a 1% annualized increase in demand from year t to $t+5$ increases the share of net equity issues by about 2.5 percentage points from an average of 6.33 percentage points. A one percentage point increase in demand growth

[15]In this and the subsequent specifications in Table II, the estimate of ρ is approximately 0.17, resulting in a proportional correction for the standard errors of $\sqrt{(1+\hat{\rho})\,/\,(1-\hat{\rho})} = 1.19$.

[16]We find quantitatively similar results using the Fama-MacBeth regression methodology (see the Internet Appendix).

corresponds approximately to 1.7 standard deviations.[17] A one percentage point annualized increase in demand from year $t+5$ to $t+10$ decreases the share of net equity issues by about three percentage points, a significant and economically large effect. While this effect is large, we note that a decrease of half a percentage point is inside the confidence interval for the coefficient estimate.

In Columns 5 and 6 we use the alternative measure based on the share of IPOs according to data from Jay Ritter. We again find that long-term demand growth due to demographics is negatively related to the share of IPOs. While the coefficient estimate is positive for short-term demand growth due to demographics, this effect is not significant.

Finally, in Columns 7 and 8 we present the results for the benchmark measure of IPOs, but for the sample of Nondemographic Industries. The coefficient estimates are similar but the standard errors are about twice as large, despite the higher number of observations. For this set of industries, the demographic shifts are not important enough determinants of demand, and hence the estimates are noisy. Notice that the limited variation in the independent variable does not per se lead to biases in the estimated coefficient. If we group the two samples together and consider all industries, the results are slightly stronger than those for the Demographic Industries sample.

To summarize, the impact of demand shifts on the share of new equity listings depends on the horizon of the demand shifts. Demand shifts occurring in the near future increase the share of IPOs, consistent with capital budgeting, although this effect is not always significant. In contrast, demand shifts occurring further in the future significantly decrease the share of

[17] For this sample, the mean forecasted annualized demand growth from t to $t+5$ ($t+5$ to $t+10$) is 0.0139 (0.0118), with standard deviation 0.0059 (0.0059).

IPOs, consistent with market timing. In both cases, the effect is economically large.

C. Net Equity Issuance Results

In Table III, we estimate the effect of demand shifts on net equity issuance by existing firms in the sample of Demographic Industries.[18] In Columns 1 through 3 we use the share of companies in an industry with net issuance above 3% of assets as the measure of large equity issues. In the specification without industry or year fixed effects (Column 1), the coefficient on short-term demographics is positive but insignificant ($\hat{\delta}_0 = 4.05$), while the coefficient on long-term demographics is significantly negative ($\hat{\delta}_1 = -7.24$). When we introduce the controls for the industry market-to-book ratio $mb_{k,t+1}$ and aggregate net equity issuance $e_{m,t+1}$ as well as industry fixed effects (Column 2), the coefficient estimates for both the short-term demographics and the long-term demographics are statistically significant.[19] Introducing year fixed effects (Column 3) lowers the coefficient on short-term demographics considerably, rendering it insignificant.

Approximate location for Table III

In Columns 4 through 6 we present the results for large equity repurchases, that is, the share of companies in an industry with net repurchases above 3% of assets. As predicted, the qualitative results are of the opposite sign compared to the estimates for large equity

[18] The results are qualitatively similar but highly imprecisely estimated for the sample of Nondemographic Industries.

[19] In this and the subsequent specifications in Table VI below, the estimate of ρ varies between zero and 0.30, for an average of 0.15, resulting in a proportional correction for the standard errors of $\sqrt{(1+\hat{\rho})/(1-\hat{\rho})} = 1.16$.

issuance. However, the estimates are less precisely estimated. Near-term demographic shifts are not significantly related to repurchases. Long-term demographic shifts increase repurchases in Columns 4 and 5 but not in Column 6.

In Columns 7 and 8 we analyze the continuous measure of net equity issuance. We find that near-term demographic shifts increase net equity issuance and long-term demographic shifts decrease net equity issuance. In Internet Appendix, we revisit the specifications in Columns 7 and 8 using an alternative measure of net equity issuance in the spirit of Baker and Wurgler (2002), defined as the change in book equity minus the change in retained earnings (scaled by lagged assets), and the results are qualitatively similar.

To summarize, the evidence matches the predictions of the model and is consistent with the findings for new listings, providing support for both capital budgeting and market timing.

D. Combined Issuance Results

Since the model does not distinguish between the two forms of equity issuance (and the results are consistent across the two), we introduce a combined measure of equity issuance. This measure provides additional power and reduces the number of specifications in the subsequent analysis. The combined measure is the average of the IPO measure (Columns 1 through 4 of Table II) and the large equity issuance measure (Columns 1 through 3 of Table III). The results for the combined measure of equity issuance are presented in Table IV and match the findings for each of the constituent measures (Columns 1 through 3 of Table IV).

Approximate location for Table IV

The improved statistical power associated with the combined measure leads to a more consistent rejection of the null hypothesis for both short-term and long-term demographic shifts. In Columns 4 through 6, we provide evidence regarding the appropriateness of the standard errors employed in the paper. In particular, we replicate the regressions in the first three columns using the double-clustering procedure described by Thompson (2011). In most regressions the standard errors for the coefficient on long-term demand growth are more conservative using our approach than those using the double-clustering procedure.

In the last two columns of Table IV we introduce additional controls for lagged accounting return on equity and lagged investment. Neither of these control variables has an appreciable impact on the point estimates or standard errors of the coefficients for short-term or long-term demand growth. We do not use these controls in the benchmark specifications because they are themselves affected by demographic shifts: investment should be endogenously related to investment opportunities (and perhaps mispricing), and profitability is related to demand shifts as documented in DellaVigna and Pollet (2007).

E. Graphical Evidence

Using the combined issuance measure, we present graphical evidence on how equity issuance responds to demographic shifts at different time horizons. For each horizon $h \in \{0, 13\}$, measured in years, we estimate

$$e_{k,t+1} = \lambda + \delta_H[\hat{c}_{k,t+h+1|t-1} - \hat{c}_{k,t+h|t-1}] + \beta_m e_{m,t+1} + \beta_b mb_{k,t+1} + \eta_k + \varepsilon_{k,t} \qquad (10)$$

for the sample of Demographic Industries. The coefficient δ_H measures the extent to which demand growth h years ahead forecasts stock returns in year $t+1$. The specification controls for market-wide patterns in issuance, as captured by $e_{m,t+1}$, for industry market-to-book, as captured by $mb_{k,t+1}$, and for industry fixed effects. This specification differs from the main specification in the paper in that: (i) we do not require the short-term effect to occur within five years or the long-term effect to occur between five and ten years ahead, and (ii) the specification is a univariate regression of equity issuance on demographic shifts h years ahead. Since demand shifts at different horizons h are positively related, the estimates capture the weighted impact at different horizons.

Figure 3 presents the results of the estimation of (10) Demand growth due to demographics from zero to one year ahead is associated with a small (insignificant) increase in IPOs according to the benchmark measure. Demand growth due to demographics two or more years ahead, in constrast, has a negative impact on IPO issuance. The impact is most negative (and statistically significant) for demand shifts seven to nine years ahead. Demographic shifts more than ten years in the future have a smaller (though still negative) impact on IPO decisions.

Approximate location for Figure 3

The pattern in this figure is remarkably consistent with the pattern for abnormal returns in Figure 2: the horizons for which returns display significant positive predictability (four to eight years ahead) are approximately the same horizons for which we observe the significant negative impact on equity issuance, consistent with market timing. This figure does not provide any statistical support for capital budgeting. However, this lack of evidence should not be surprising because demand growth at different horizons in the future are positively correlated with each other. If market timing is a stronger motivation than capital budgeting (as suggested by the coefficient magnitudes in Table IV), the negative impact of market timing will swamp the capital budgeting effect in a univariate setting.

F. Time-To-Build

The model indicates that the impact of both long-term and short-term demographics should be attenuated by time-to-build. The investment required to expand production in response to future demographic demand could take several years, possibly in excess of the five years that the proxy for short-term demand allows. In this case, the lengthy time-to-build will attenuate the negative relationship between long-term demand due to demographics and security issuance. Essentially, long-term demand captures not only the market timing (which induces a negative relation), but also capital budgeting (which induces a positive relation). In addition, in the presence of substantial time-to-build, short-term demand is unrelated to equity issuance because it is difficult to build additional capacity quickly enough to take advantage of a positive demand shift.

To provide evidence on the importance of time-to-build, we use as a proxy of time-to-build the amount of work in progress (Compustat data item 77) divided by the book value of the firm. Firms that have a higher share of work in progress are more likely to have a lengthy production process and greater difficulty adjusting capacity rapidly.[20] We split observations in

[20] We thank Kenneth French for suggesting work in progress as a measure of time-to-build. The literature considers two alternative measure of time-to-build. Koeva (2000) proposes a measure of time-to-build for new plants. However, this measure is not available for 22 of our industries and is constructed at a high level of aggregation. For example, small appliances and medical equipment would be in the same category, as would liquor, beer, and wine. Tsyplakov (2008) builds a firm-level measure of time-to-build based on depreciation of large investments. Unfortunately, this measure requires a long time series to identify the parameter of interest. To construct a measure that does not use information from subsequent years, we would have to exclude approximately half of our sample from the analysis.

two groups, above and below the median value of .005.

We present the results in Columns 1 through 4 of Table V. We find that for the high time-to-build industries (Columns 1 and 2), both coefficient estimates are closer to zero and not statistically significant. For the low time-to-build industries (Columns 3 and 4), the coefficient estimates are larger (in absolute value) than those for the benchmark sample, and long-term demand is statistically significant. Therefore, time-to-build appears to affect the response to demand shifts in a manner consistent with the predictions of the model.

Approximate location for Table V

G. Industry Concentration

The impact of a demand shift on equity issuance could depend on the market structure. In a perfectly competitive industry there is no impact on abnormal profitability, and hence, no possibility of mispricing associated with long-term demand shifts. At the other extreme, a monopolist generates abnormal profits from a positive demand shift, and therefore, demand in the distant future generates mispricing in the presence of limited attention. Thus, evidence of market timing should be more substantial for industries with high market power. Similarly, the evidence of capital budgeting may also be more considerable for industries with high market power because the potential to earn abnormal profits motivates the expansion of capacity.

To provide evidence on this prediction, we use the concentration ratio C-4 from the Census of Manufacturers to measure market power. This ratio is the fraction of revenue within an industry produced by the four largest companies (including privately held firms) and is available for firms with four-digit SIC codes between 2000 and 3999. For each industry, we construct a weighted average of the C-4 ratio for the SIC codes in the industry, using the 1972 measure (or 1970 if 1972 information is missing). Among the 31 industries with concentration data, the median C-4 ratio is 0.35.

We report the results in Columns 5 through 8 of Table V. The industries with above-median concentration (Columns 5 and 6) have statistically significant and economically large evidence of both market timing and capital budgeting. For the industries with below-median concentration (Columns 7 and 8), the impact of demographic shifts, while directionally consistent, is smaller and not statistically significant.

H. Net Debt Issuance Results

In Table VI, we estimate the same regression specification for measures of debt issuance in the sample of Demographic Industries. We present the findings for large debt issuance (Columns 1 through 3), for large debt repurchases (Columns 4 through 6), and for the continuous measure of net issuance (Columns 7 and 8). The impact of macroeconomic conditions on debt issuance, such as the yield spread and the credit spread, are captured by the control for market-wide activity or by time fixed effects.

Approximate location for Table VI

The sign of the coefficient estimates for demand shifts in the near future is usually consistent with capital budgeting but the estimates are not statistically significant. The evidence regarding demand shifts in the distant future is more mixed. Long-term demographics are not statistically related to large debt issuance (Columns 1 through 3) or the continuous measure of net debt issuance (Columns 7 and 8), but are negatively related to debt repurchases (Columns 4 through 6). An interpretation of this result is that firms with low long-term demand growth are overvalued, and hence, issue equity to reinvest the proceeds in debt repurchases. This is a similar result to the findings in Hertzel and Li (2010).

I. Investment and R&D

The model in Section II links equity and debt issuance to demand shifts due to demographics through investment. We document this link using expenditures on investment and R&D.

The measure of investment for public companies in year t and industry k is the share of companies with capital expenditures in year t (scaled by property, plant, and equipment in year $t-1$) greater than 0.8.[21] Columns 1 through 3 of Table VII display the results of the estimation of equation (9) for this measure. Demand shifts in the near future due to demographics are associated with higher investment. The estimate is significantly different from zero in the specifications in Columns 1 and 2 and marginally significant in Column 3. The effect of these demand shifts is economically large: in the specification of Column 2, a 1% annualized increase in demand from year t to $t+5$ increases the share of companies conducting substantial investment by 3.2 percentage points (compared to the average share of 6.8 percentage points). In contrast, there is no significant effect of demand shifts from $t+5$ to $t+10$. If investment opportunities are the only motivation for equity issuance, there is no

[21] The cutoff for investment of 0.8 and the cutoff for R&D of 0.1 correspond approximately to the 90th percentile of the respective distributions.

reason for the issuance/repurchase decision to be linked to demand shifts in the distant future.

Approximate location for Table VII

Next, in Columns 4 through 6 we consider an alternative measure of broadly defined investment, namely R&D, which is the share of companies with R&D expenditures in year t (scaled by assets in year $t-1$) larger than 0.1. While the evidence is somewhat mixed, demand shifts in the near future are associated with higher R&D. There is no evidence of a relation between R&D and demand shifts in the more distant future.

To summarize, we find evidence that positive demand shifts in the near term increase both investment and R&D. These results suggest that investment and R&D are likely to be drivers of the capital budgeting response.

IV. Alternative explanations

We analyze several alternatives that could potentially explain the above results.

Signalling. Consider a variant of the dividend-signalling model of Miller and Rock (1985), where equity issuance replaces the dividend as the signal and long-term demographic patterns are characterized as (quasi-)private information observed only by managers. If managers are unable to credibly signal to investors, then the firm's equity is mispriced with respect to this information. Investors are rational and understand that they are not fully informed. The manager of an undervalued firm will attempt to convey this information to the public through a costly signal, in this case a net decrease in equity issuance. The signal is costly because less issuance leads to underinvestment.

In principle, this signalling equilibrium could rationalize the observed response to long-term demand shifts due to demographics. However, firm misvaluation is eliminated at the cost of an investment distortion, which we do not observe: there is no evidence that firms with high demand in the distant future invest less than firms with low demand in the distant future (Table VII). In addition, there is a less costly strategy to publicize the information. The manager of the undervalued firm could disclose verifiable cohort size data and age profiles of consumption to investors. It is also not clear that the single-crossing condition necessary for a separating equilibrium would be satisfied. The undervalued firm (which forgoes equity issuance) plausibly faces a greater (marginal) cost of underinvestment. Finally, the signalling model would not easily explain the decision to remain private by an undervalued private firm because there is no benefit from price correction for private firms.

Agency Problems. Firms that intend to expand capacity may delay equity issuance until funds are needed to avoid the agency problems associated with excess cash. Hence, agency problems could link investment opportunities in the distant future to equity issuance. However, as the subsequent analysis indicates, agency problems do not provide a plausible explanation for the findings. Consider two firms with identical short-term investment opportunities and agency problems that make it extremely costly to raise funds many years in advance of an investment opportunity. One firm also has a favorable investment opportunity in the distant future while the other firm does not. If the only motivation for equity issuance is to finance expansion, then both firms raise the same amount of equity in the first period to finance the short-term investment opportunity, regardless of the long-term investment opportunity. In the next period, the firm with the favorable long-term opportunity in the previous period (transformed into a short-term opportunity by the passage of time) pays the small fixed cost to issue more equity while the other firm does not. In this example, equity issuance is related to short-term investment opportunities but unrelated to long-term opportunities. Hence, agency problems alone do not generate a negative relation between long-term investment opportunities and equity issuance.

Large Fixed Costs of Equity Adjustments. A large fixed cost of equity issuance has the potential to generate an intertemporal linkage between issuance and investment opportunities in the distant future. However, this linkage is likely to be of the opposite sign compared to the findings. Consider again two firms with identical favorable investment opportunities in the near future and different investment opportunities in the distant future. If the fixed cost of issuance is sufficiently large, then the firm with favorable investment opportunities in the near future and the distant future might prefer to raise sufficient funds for both projects all at once rather than issue equity each period. Incurring the fixed cost twice is worse than incurring the fixed cost once and enduring any agency problems generated by plentiful cash for the next several years. In this case equity issuance is positively (not negatively) related to investment opportunities in the distant future. If both firms have unfavorable investment opportunities in the near future, then neither firm issues equity in the first period and the first firm issues equity in the second period just in time to finance investment. Neither situation leads to a negative relation between equity issuance and investment opportunities in the distant future. We acknowledge that it may be possible to produce this negative relation using fixed costs in conjunction with particular specifications for agency problems and intertemporal investment opportunities. However, as the discussion implies, a negative relation does not arise generically.

Globalization. Demographic patterns in the U.S. do not fully capture demand shifts induced by demographics because the goods and services produced by these industries are not exclusively consumed by U.S. residents. This complication creates measurement error and biases the results against the stated findings. Indeed, there may exist many factors that predict demand shifts but not be related to demographics at all. The severity of this problem is mitigated by two issues: 1) age-specific growth rates in the U.S. are positively correlated with the analogous growth rates for other OECD countries, and 2) the trade sector is still a relatively small fraction of U.S. GDP. In terms of explaining the findings, any aggregate patterns linking globalization to equity issuance would be captured by the control for market-wide issuance. It is possible that industry-specific globalization patterns could be an omitted variable, but such changes in demand would have to be strongly negatively related to demographic patterns in the distant future.

Unobserved Time Patterns. The results could be driven by (unobserved) time patterns that are correlated with demographic shifts. These time patterns may confound the estimation to the extent that they are correlated with, for example, unobserved investment opportunities. While we cannot reject this possibility, the findings in this paper still hold after controlling for market-wide issuance patterns and, in most specifications, year fixed effects. An omitted variable could explain the results only if it has a differential impact across industries over time.

V. Conclusion

Are equity and debt financing decisions explained by capital budgeting, by market timing, or both? In this paper, we attempt to answer this question by using distinct and exogenous proxies for investment opportunities and equity mispricing.

We construct predictable short-term and long-term demand shifts across industries generated by size changes in different cohorts and by the age profile of demand. We use short-term shifts in demand due to demographics to examine capital budgeting. Positive short-term demand shifts should increase the demand for capital and lead to more equity and debt issuance.

We use long-term shifts in demand due to demographics to analyze market timing. We assume that the information about profitability in the distant future predicted by demographics is not fully incorporated into asset prices; hence, long-term demand shifts proxy for mispricing. To the extent that corporate managers have longer horizons than investors, they should respond to this mispricing via their equity issuance decisions. Companies in industries with positive (negative) demand shifts five to ten years ahead will tend to be undervalued (overvalued) and managers should reduce (increase) equity issuance.

Our empirical analysis suggests that both market timing and capital budgeting play substantial roles in the decision to issue new or seasoned equity. Demand shifts due to demographics in the short term are positively related with the occurrence of IPOs in an industry and with additional equity issuance by public firms. Demand shifts due to demographics in the long term are significantly negatively related to the share of IPOs and to the net issuance of firms. The evidence for both market timing and capital budgeting is stronger in low time-to-build and high-concentration industries, as predicted by the model. Finally, investment and R&D expenditures are related to short-term demand shifts as predicted by capital budgeting. While our estimates do not allow us to establish whether one channel is more important than the other, we find evidence that both channels have economically large impacts.

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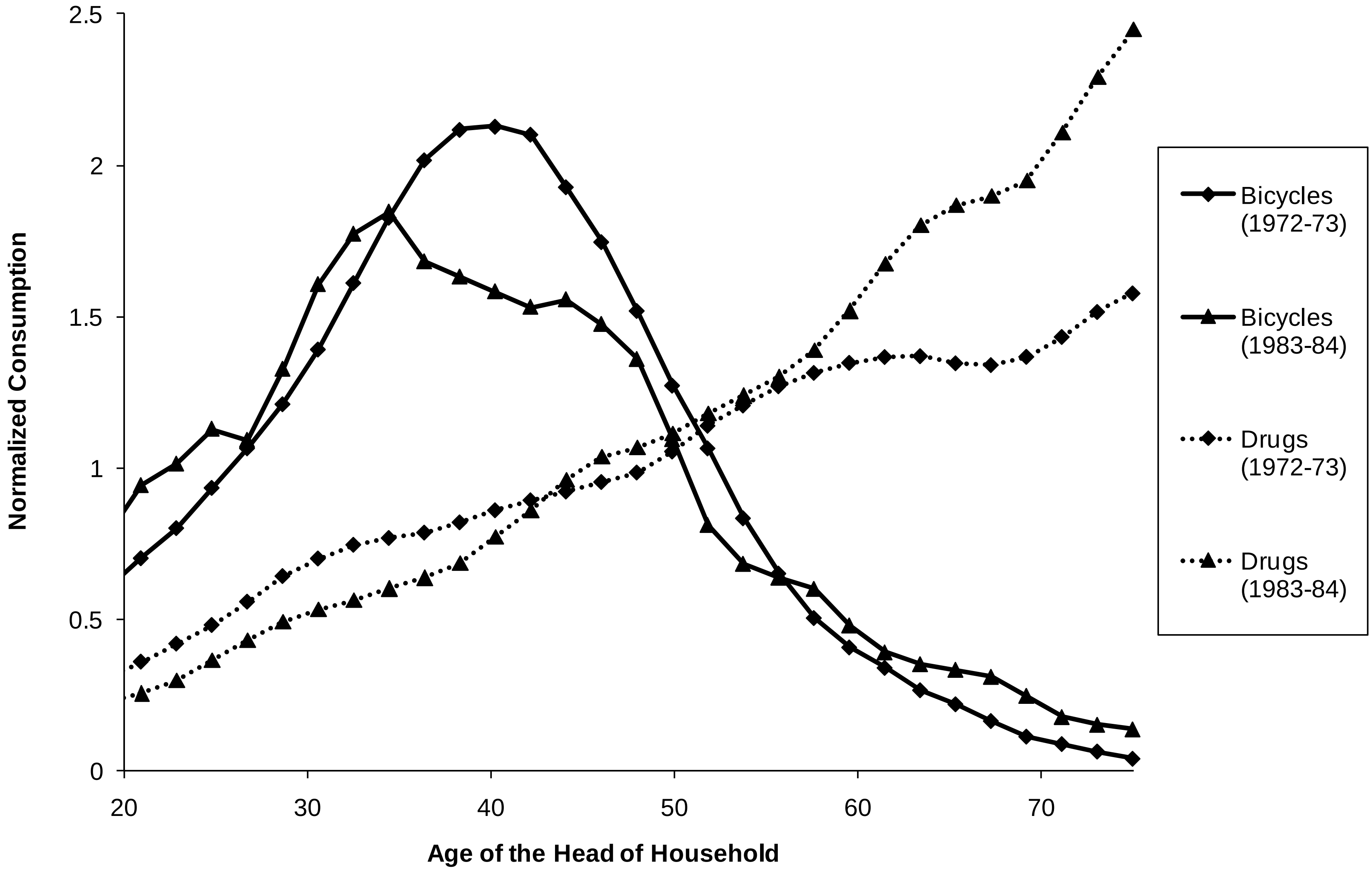

Figure 1. Age profile for the consumption of bicycles and drugs. This figure displays a kernel regression of normalized household consumption for each good as a function of the age of the head of household. The regression uses an Epanechnikov kernel and a bandwidth of five years. Each line for a specific good uses an age-consumption profile from a different consumption survey. Expenditures are normalized so that the average consumption for all ages is equal to one for each survey-good pair.

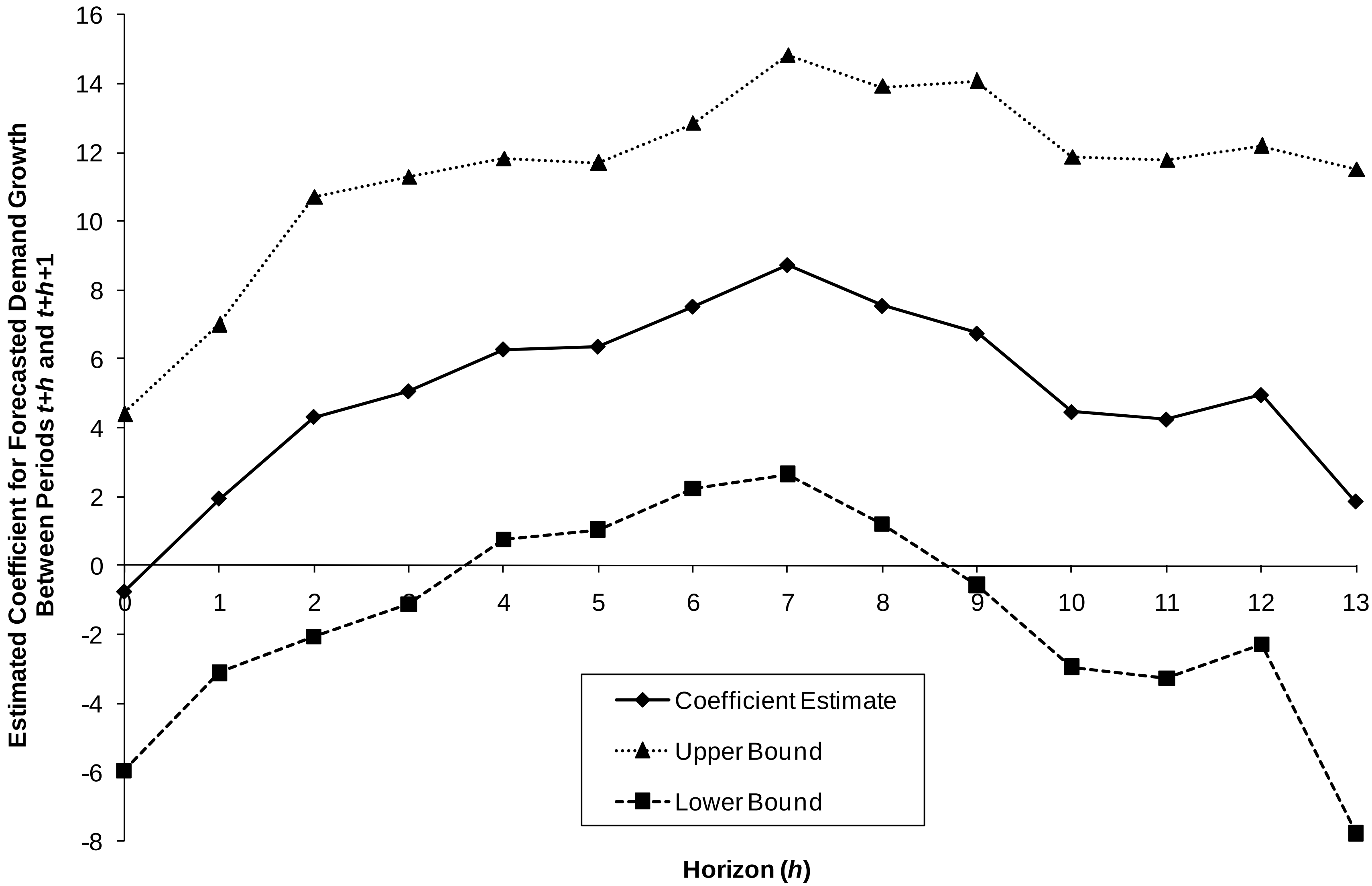

Figure 2. Return predictability coefficient from demand forecasts at different horizons. This figure displays the estimated coefficient for each horizon from a univariate OLS regression of abnormal returns at t+1 on forecasted demand growth between t+h and t+h+1 for the subsample of Demographic Industries during the period 1974 to 2004. The confidence intervals are constructed using standard errors clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions.

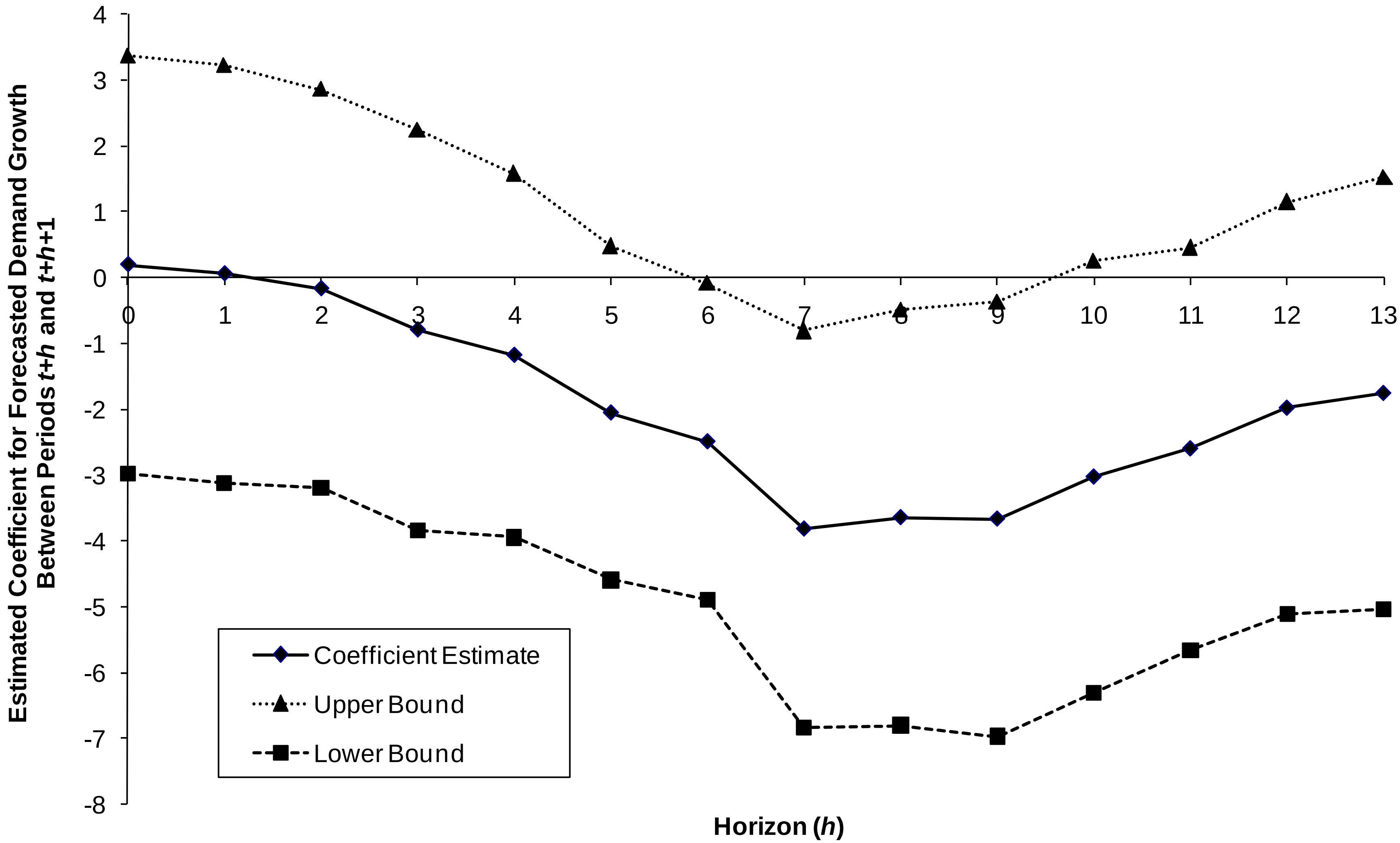

Figure 3. Combined equity issuance predictability coefficient from demand forcasts at different horizons. This figure displays the estimated coefficient for each horizon from a univariate OLS regression of the share of companies in an industry that issued equity either through a new listing in CRSP or through a seasoned issuance for year *t*+1 on forecasted demand growth between *t*+*h* and *t*+*h*+1 for the subsample of Demographic Industries during the period 1974 to 2004. Each regression includes controls for market-wide patterns in new listings, industry-level book-to-market, and industry fixed effects. The confidence intervals are constructed using standard errors clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions.

Table I

Summary Statistics for Predicted Demand Growth Rates Due to Demographics

The table provides a complete list of expenditure categories, w ith number of years of data availability (Column 1), the average predicted five-year demand grow th rate due to demographic changes in 1975 (Column 2), and the analogous average demand grow th rate in 2000 (Column 4). The last tw o row s present the mean and standard deviation of the five-year predicted consumption grow th across all the goods in the relevant year. This table also indicates w hether the industry belongs to the subsample of Demographic Industries in 1975 (Column 3) and in 2000 (Column 5). Each year the subset of Demographic Industries includes the 20 industries w ith the highest standard deviation of forecasted annual consumption grow th over the next 15 years. The percentage of the years 1974 to 2004 in w hich the expenditure category belongs to the subsample of Demographic Industries is reported in the last column (Column 6).

Expenditure Category	No. Years	1975 Forecasted 0-5 Growth	1975 Demographic Industry	2000 Forecasted 0-5 Growth	2000 Demographic Industry	% Demographic Industry
	(1)	(2)	(3)	(4)	(5)	(6)
Child Care	30	0.0001	Yes	0.0024	Yes	100%
Children's Books	28	.	.	0.0077	Yes	93%
Children's Clothing	30	0.0226	Yes	0.0138	Yes	100%
Toys	30	0.0044	Yes	0.0084	No	77%
Books -- college text books	30	0.0270	Yes	0.0156	Yes	100%
Books -- general	30	0.0205	Yes	0.0103	No	84%
Books -- K-12 school books	30	-0.0087	Yes	0.0092	Yes	100%
Movies	30	0.0232	Yes	0.0118	No	26%
Newspapers	30	0.0174	No	0.0140	No	0%
Magazines	30	0.0206	Yes	0.0122	No	29%
Cruises	28	.	.	0.0143	No	28%
Dental Equipment	30	0.0138	No	0.0133	No	35%
Drugs	30	0.0167	No	0.0153	Yes	10%
Health Care (Services)**	30	0.0173	No	0.0135	No	0%
Health Insurance	30	0.0168	No	0.0142	Yes	16%
Medical Equipment**	30	0.0173	No	0.0135	No	0%
Funeral Homes and Cemet.	28	.	No	0.0166	Yes	59%
Nursing Home Care	30	0.0198	Yes	0.0113	Yes	87%
Construction Equipment*	30	0.0200	Yes	0.0121	Yes	100%
Floors	30	0.0177	No	0.0140	Yes	81%
Furniture	30	0.0201	Yes	0.0105	No	58%
Home Appliances Big	30	0.0169	No	0.0117	No	0%
Home Appliances Small	30	0.0153	No	0.0132	No	0%
Housewares	30	0.0192	Yes	0.0138	Yes	58%
Linens	30	0.0170	No	0.0130	No	52%
Residential Construction*	30	0.0200	Yes	0.0121	Yes	100%
Residential Development*	30	0.0168	No	0.0130	No	13%
Residential Mortgage	30	0.0164	Yes	0.0070	No	77%
Beer (and Wine)	30	0.0209	No	0.0110	No	48%
Cigarettes	30	0.0178	No	0.0133	No	10%
Cigars and Other Tobacco	30	0.0141	No	0.0159	No	6%
Food	30	0.0145	No	0.0127	No	0%
Liquor	28	.	No	0.0144	No	14%
Clothing (Adults)	30	0.0197	Yes	0.0130	Yes	29%
Cosmetics	30	0.0222	Yes	0.0149	No	6%
Golf	30	0.0217	Yes	0.0146	Yes	68%
Jewelry	30	0.0189	Yes	0.0134	Yes	68%
Sporting Equipment	30	0.0183	No	0.0096	No	42%
Life Insurance	30	0.0140	No	0.0150	Yes	48%
Property Insurance	30	0.0177	No	0.0133	No	10%
Airplanes	28	.	.	0.0139	Yes	14%
Automobiles	30	0.0199	Yes	0.0112	No	26%
Bicycles	30	0.0027	Yes	0.0040	Yes	71%
Motorcycles	28	.	.	0.0115	Yes	76%
Coal	30	0.0149	No	0.0135	No	0%
Oil	30	0.0161	No	0.0129	No	0%
Telephone	30	0.0185	No	0.0129	No	0%
Utilities	30	0.0149	No	0.0136	No	0%
Mean 0-5 Cons. Growth		0.0165		0.0123		
Std. Dev. 0-5 Cons. Growth		0.0064		0.0028		

Table II
Predictability of New Equity Listings Using Demographics

Columns 1 through 4 report the coefficients of OLS regressions of the share of firms in an industry that are new listings in CRSP for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10 for the subset of Demographic Industries. Columns 5 and 6 report regression results for the subset of Demographic Industries where the dependent variable is defined using new listings recorded in Jay Ritter's IPO sample (from 1980 until 2003). Columns 7 and 8 report the regression coefficients for the subset of Nondemographic Industries. The forecasts are made using information available as of year *t* 1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). Each year the subset of Demographic Industries includes the 20 industries with the highest standard deviation of forecasted annual consumption growth over the next 15 years. Standard errors are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of the standard errors is available in the text (* significant at 10%; ** significant at 5%; *** significant at 1%).

Dependent variable	Share of Firms That Are New Equity Listings							
Industry Sample	Demographic						Nondemographic	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecasted annualized demand growth between *t* and *t*+5	3.349 (1.847)*	2.237 (1.474)	2.446 (1.270)*	2.785 (1.304)**	1.994 (1.877)	2.831 (2.273)	1.687 (2.866)	-0.525 (4.502)
Forecasted annualized demand growth between *t*+5 and *t*+10	-4.843 (1.453)***	-2.486 (1.384)*	-3.071 (1.403)**	-3.153 (1.360)**	-4.793 (1.949)**	-3.572 (1.913)*	-4.955 (3.289)	-6.930 (4.270)
Industry market-to-book ratio		0.000 (0.0065)	0.003 (0.007)	0.004 (0.010)	0.006 (0.009)	0.002 (0.012)	0.004 (0.009)	0.011 (0.009)
Aggregate share of new listings		0.890 (0.143)***	0.841 (0.151)***		1.229 (0.1507)***		0.716 (0.072)***	
Industry fixed effects			X	X	X	X	X	X
Year fixed effects				X		X		X
Jay Ritter's IPO sample					X	X		
R^2	0.040	0.133	0.245	0.306	0.260	0.315	0.264	0.297
N	*N* = 580	*N* = 580	*N* = 580	*N* = 580	*N* = 451	*N* = 451	*N* = 848	*N* = 848

Table III

Predictability of Net Equity Issuance and Net Equity Repurchases Using Demographics

Columns 1 through 3 report the coefficients of OLS regressions of the share of firms in an industry with stock issues minus stock repurchases divided by the lagged book value of assets that is greater than 3% for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10. Columns 4 through 6 report regression coefficients of the share of firms in an industry with stock repurchases minus stock issues divided by the lagged book value of assets that is greater than 3% for year *t*+1 on the forecasted annualized demand growth. Columns 7 and 8 report regression coefficients of industry stock issues net of stock repurchases scaled by industry book value of assets (a continuous measure) for year *t*+1 on the forecasted annualized demand growth. The demand forecasts are made using information available as of year *t*-1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). All specifications only include observations from the subset of Demographic Industries, which are the 20 industries with the highest standard deviation of forecasted annual consumption growth over the next 15 years. Standard errors are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of the standard errors is available in the text (* significant at 10%; ** significant at 5%; *** significant at 1%).

Dependent variable	Large Net Equity Issues			Large Net Equity Repurchases			Net Equity Issuance	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecasted annualized demand growth between *t* and *t*+5	4.046 (2.539)	4.564 (1.955)**	2.304 (1.637)	-4.209 (1.839)**	-1.688 (1.357)	-0.939 (1.619)	2.529 (0.9970)**	1.782 (0.821)**
Forecasted annualized demand growth between *t*+5 and *t*+10	-7.241 (2.588)***	-5.267 (2.170)**	-4.294 (2.013)**	3.080 (1.760)*	3.699 (1.859)**	3.222 (2.070)	-2.852 (1.034)***	-1.533 (1.048)
Industry market-to-book ratio		0.016 (0.021)	0.037 (0.023)		0.056 (0.016)***	0.046 (0.019)**	0.010 (0.007)	0.012 (0.009)
Aggregate share of large net equity issues		0.892 (0.125)***						
Aggregate share of large net equity repurchases					1.047 (0.353)***			
Aggregate net equity issuance							2.557 (0.677)***	
Industry fixed effects		X	X		X	X	X	X
Year fixed effects			X			X		X
R^2	0.030	0.284	0.349	0.013	0.169	0.213	0.230	0.286
N	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575

Table IV
Predictability of Combined Equity Issuance Using Demographics

Columns 1 through 8 report the coefficients of OLS regressions of the share of companies in an industry that issued equity either through a new listing in CRSP or through a seasoned issuance for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10. The forecasts are made using information available as of year *t*-1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). All specifications only include observations from the subset of Demographic Industries, which are the 20 industries with the highest standard deviation of forecasted annual consumption growth over the next 15 years. Columns 1 through 3 report standard errors that are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of these standard errors is available in the text. Columns 4 through 6 report standard errors based on the double-clustering approach recommended by Thompson (2011). Levels of statistical significance are as follows: * significant at 10%; ** significant at 5%; *** significant at 1%.

Dependent variable	Share of Firms That Are New Listings or Conducted a Large Net Equity Issuance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecasted annualized demand growth between *t* and *t*+5	3.717 (2.250)*	3.509 (1.506)**	2.564 (1.247)**	3.717 (1.741)**	3.509 (1.691)**	2.564 (1.802)	3.194 (1.363)**	2.436 (1.168)**
Forecasted annualized demand growth between *t*+5 and *t*+10	-6.103 (2.052)***	-3.907 (1.571)**	-3.749 (1.517)**	-6.103 (1.863)***	-3.907 (1.476)**	-3.749 (1.345)***	-3.674 (1.477)**	-3.519 (1.412)**
Industry market-to-book ratio		0.009 (0.011)	0.021 (0.012)*		0.009 (0.011)	0.021 (0.014)*	0.006 (0.011)	0.014 (0.012)
Industry investment							-0.032 (0.034)	-0.023 (0.032)
Industry accounting return on equity							0.117 (0.047)**	0.141 (0.050)***
Aggregate combined equity issues		0.947 (0.134)***			0.947 (0.148)***		0.974 (0.135)***	
Industry fixed effects		X	X		X	X	X	X
Year fixed effects			X			X		X
Double Clustering				X	X	X		
R^2	0.046	0.349	0.413	0.046	0.349	0.413	0.359	0.426
N	*N* = 572	*N* = 572	*N* = 572	*N* = 572	*N* = 572	*N* = 572	*N* = 572	*N* = 572

Table V

The Impact of Industry Concentration and Time-To-Build on Combined Equity Issuance

Columns 1 through 8 report the coefficients of OLS regressions of the industry share of companies that issued equity either through a new listing in CRSP or through a large equity issuance for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10. The forecasts are made using information available as of year *t*-1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). The sample in Columns 1 through 4 is split using a measure of industry time-to-build (work in progress divided by the book value of assets; industries for which this share is higher than 0.005 are categorized as high time-to-build industries). The sample in Columns 5 through 8 is split using a measure of industry concentration (C-4 in 1972). The analysis of each split sample is not limited to the subset of Demographic Industries. Standard errors are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of the standard errors is available in the text (* significant at 10%; ** significant at 5%; *** significant at 1%).

Dependent variable	Share of Firms That Are New Listings or Conducted a Large Net Equity Issuance							
Sample	High Time-To-Build		Low Time-To-Build		High Concentration		Low Concentration	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecasted annualized demand growth between *t* and *t*+5	1.101	1.617	5.225	2.078	5.478	6.746	1.057	0.866
	(1.855)	(1.725)	(3.239)	(3.477)	(2.262)**	(3.425)**	(2.337)	(1.980)
Forecasted annualized demand growth between *t*+5 and *t*+10	-1.600	-2.951	-6.640	-6.283	-7.358	-8.934	-1.551	-2.302
	(2.413)	(2.762)	(2.874)**	(2.469)***	(3.745)**	(4.017)**	(2.917)	(2.790)
Industry market-to-book ratio	0.018	0.020	0.022	0.033	0.000	0.000	0.029	0.038
	(0.008)**	(0.012)	(0.013)*	(0.013)***	(0.008)	(0.009)	(0.008)***	(0.007)***
Aggregate net equity issues	0.897		0.751		0.754		0.958	
	(0.102)***		(0.136)***		(0.115)***		(0.132)***	
Industry fixed effects	X	X	X	X	X	X	X	X
Year fixed effects		X		X		X		X
R^2	0.428	0.471	0.313	0.357	0.279	0.317	0.420	0.499
N	*N* = 661	*N* = 661	*N* = 746	*N* = 746	*N* = 447	*N* = 447	*N* = 451	*N* = 451

Table VI

Predictability of Net Debt Issuance and Net Debt Repurchases Using Demographic Changes

Columns 1 through 3 report the coefficients of OLS regressions of the share of firms in an industry with debt issues minus debt repurchases divided by the lagged book value of assets that is greater than 3% for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10. Columns 4 through 6 report regression coefficients of the share of firms in an industry with debt repurchases minus debt issues divided by the lagged book value of assets that is greater than 3% for year *t*+1 on the forecasted annualized demand growth. Columns 7 and 8 report regression coefficients of industry debt issues net of debt repurchases scaled by industry book value of assets for year *t*+1 on the forecasted annualized demand growth. The demand forecasts are made using information available as of year *t*-1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). All specifications only include observations from the subset of Demographic Industries, which are the 20 industries with the highest standard deviation of forecasted annual consumption growth over the next 15 years. Standard errors are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of the standard errors is available in the text (* significant at 10%; ** significant at 5%; *** significant at 1%).

Dependent variable	Large Net Debt Issues			Large Net Debt Repurchases			Net Debt Issuance	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Forecasted annualized demand growth between *t* and *t*+5	3.515	3.665	2.510	-1.537	-1.281	1.601	1.408	0.569
	(5.240)	(4.397)	(4.630)	(2.425)	(1.807)	(1.576)	(0.795)*	(0.723)
Forecasted annualized demand growth between *t*+5 and *t*+10	0.712	2.060	2.004	-2.709	-4.026	-3.416	0.886	0.825
	(4.388)	(3.941)	(4.213)	(1.860)	(1.464)***	(1.483)**	(0.793)	(0.785)
Industry market-to-book ratio		0.101	0.116		-0.028	-0.056	0.011	0.018
		(0.030)***	(0.036)***		(0.018)*	(0.020)***	(0.005)**	(0.006)***
Aggregate share of large net debt issues		1.319						
		(0.433)***						
Aggregate share of large net debt repurchases					0.509			
					(0.261)*			
Aggregate net debt issuance							0.168	
							(0.641)	
Industry fixed effects		X	X		X	X	X	X
Year fixed effects			X			X		X
R^2	0.012	0.315	0.338	0.016	0.144	0.202	0.187	0.224
N	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575	*N* = 575

Table VII

Predictability of Investment and R&D Using Demographic Changes

Columns 1 through 3 report the coefficients of OLS regressions of the industry share of companies undertaking significant investments (capital expenditures scaled by lagged property, plant, and equipment) for year *t*+1 on the forecasted annualized demand growth due to demographics between *t* and *t*+5 and between *t*+5 and *t*+10. Columns 4 through 6 report similar regressions for the industry share of companies doing significant R&D spending (research and development scaled by lagged assets). The forecasts are made using information available as of year *t*-1. The forecasts of demand growth are annualized using the number of years in the forecast (five for each forecast). All specifications only include observations from the subset of Demographic Industries, which are the 20 industries with the highest standard deviation of forecasted annual consumption growth over the next 15 years. Standard errors are clustered by year and then scaled by a function of the autocorrelation coefficient estimated from the sample orthogonality conditions. A thorough description of the standard errors is available in the text (* significant at 10%; ** significant at 5%; *** significant at 1%).

Dependent variable	Share of Firms With Large Investment			Share of Firms With Large R&D		
	(1)	(2)	(3)	(4)	(5)	(6)
Forecasted annualized demand growth between *t* and *t*+5	2.746	2.990	2.113	0.833	3.849	3.728
	(1.285)**	(1.383)**	(1.287)*	(3.453)	(1.891)**	(2.147)*
Forecasted annualized demand growth between *t*+5 and *t*+10	-0.530	-0.174	0.727	0.381	-0.721	0.161
	(1.325)	(1.685)	(1.709)	(2.667)	(1.348)	(1.616)
Industry market to book ratio	0.008	0.004	0.012	0.025	-0.005	-0.004
	(0.010)	(0.014)	(0.015)	(0.031)	(0.006)	(0.007)
Aggregate investment	0.934	0.870				
	(0.305)***	(0.289)***				
Aggregate R&D				0.089	0.310	
				(0.237)	(0.136)**	
Industry fixed effects		X	X		X	X
Year fixed effects			X			X
R^2	0.066	0.231	0.282	0.055	0.506	0.537
N	*N* = 582	*N* = 582	*N* = 582	*N* = 582	*N* = 582	*N* = 582