

Capital Budgeting vs. Market Timing: An Evaluation
Using Demographics
Online Appendix

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1 Appendix A - Mathematical Appendix

Proof of Proposition 1. We prove Proposition 1 (iv) for the case of time-to-build ($g(I) = 0$). The rest of the proposition is proved in the text. In this case, $I_2^* = 0$, so we only show $I_{1,\bar{\alpha}}^* > I_{1,\underline{\alpha}}^*$. If $\alpha = \underline{\alpha}$ there are no financing constraints, and hence, $I_{1,\underline{\alpha}}^* = I_{1,\underline{\alpha}}^{FB}$. If $\alpha = \bar{\alpha}$, the first-best investment is not attainable without equity issuance and the manager wishes to repurchase shares due to mispricing. Therefore, the financing constraint will be binding. Hence, the maximization problem for $\alpha = \bar{\alpha}$ is

$$\max_{n_1, I_1} \frac{1}{N} (C + V_{\hat{\alpha}}) + \frac{1}{N + n_1} (\alpha f(I_1) - I_1 - V_{\hat{\alpha}}) \quad \text{s.t.} \quad I_1 = C + \frac{n_1}{N} (C + V_{\hat{\alpha}})$$

We can solve for n_1 in terms of I_1 using the constraint to rewrite the objective function as

$$\max_{I_1} \frac{1}{N} (C + V_{\hat{\alpha}}) + \left(\frac{C + V_{\hat{\alpha}}}{N(V_{\hat{\alpha}} + I_1)} \right) (\alpha f(I_1) - I_1 - V_{\hat{\alpha}}).$$

The first order condition of this objective function with respect to I_1 is equivalent to (scaled by a constant)

$$(V_{\hat{\alpha}} + I_1^*)^{-1} (\alpha f'(I_1^*) - 1) - (V_{\hat{\alpha}} + I_1^*)^{-2} (\alpha f(I_1^*) - I_1^* - V_{\hat{\alpha}}) = 0.$$

Further rearranging this expression and substituting the definition of $V_{\hat{\alpha}}$ yields

$$f'(I_1^*) \left(\hat{\alpha} f(I_{1,\hat{\alpha}}) - I_{1,\hat{\alpha}} + I_1^* \right) - f(I_1^*) = 0. \quad (1)$$

Notice that α disappears from the first order condition. Hence, the optimal level of investment will be independent of the level of $\bar{\alpha}$ given a particular constant $\hat{\alpha}$. This property of optimal investment arises because any increase in $\bar{\alpha}$ simultaneously increases the marginal productivity of investment (leading to share issuance) and the marginal motivation to exploit mispricing (leading to share repurchases). These two forces perfectly offset each other so that the net issuance policy and the investment policy remain unchanged in response to an increase in $\bar{\alpha}$.

We show that for any level of I_1 lower than $I_{1,\underline{\alpha}}^{FB}$ the left hand side of expression (1) is positive for $\alpha = \bar{\alpha}$. Therefore, the objective function must be a monotonically increasing function of investment at least until the investment reaches $I_{1,\underline{\alpha}}^{FB}$. The corollary of such a statement is that investment must be greater for high demand than for low demand, $I_{1,\bar{\alpha}}^* > I_{1,\underline{\alpha}}^* = I_{1,\underline{\alpha}}^{FB}$. First, we note that for any level of $I_1 \leq I_{1,\underline{\alpha}}^{FB}$ there exists an $\alpha_{I_1} \leq \underline{\alpha}$ such that I_1 is the first-best level of investment for that level of demand α_{I_1} , that is, $I_1 = I_{1,\alpha_{I_1}}^{FB}$. Next, since the expression $\alpha f(I_{1,\alpha}) - I_{1,\alpha}$ is increasing in α , we know that $\hat{\alpha} f(I_{1,\hat{\alpha}}) - I_{1,\hat{\alpha}} > \alpha_{I_1} f(I_{1,\alpha_{I_1}}) - I_{1,\alpha_{I_1}}$ because $\hat{\alpha} > \underline{\alpha} \geq \alpha_{I_1}$. Hence, we obtain the following relation

$$f'(I_1) \left(\hat{\alpha} f(I_{1,\hat{\alpha}}) - I_{1,\hat{\alpha}} + I_1 \right) - f(I_1) > f(I_1) (f'(I_1) \alpha_{I_1} - 1) = 0.$$

This inequality demonstrates that the left hand side of the first order condition is always greater than zero for any $I_1 \leq I_{1,\underline{\alpha}}^{FB}$, and therefore, $I_{1,\bar{\alpha}}^* > I_{1,\underline{\alpha}}^*$.

2 Appendix B - Online Appendix Tables

Online Appendix Tables 1a, 1b, and 1c report the summary statistics for the measures of IPO (Table 1a), net equity issuance (Table 1b), and net debt issuance (Table 1c).

Online Appendix Table 2 revisit the specifications of equity issuance in Columns 7 and 8 of Table 3 in the main text 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, though somewhat less precisely estimated.

Online Appendix Table 3 presents the result of Fama-MacBeth regressions.

Online Appendix Table 1a. Summary Statistics for New Listings

Industry Category	Share of New Listings in the Industry				Share of IPOs (Ritter) in the Industry			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	Std. Dev.	# Years	# Firms	Mean	Std. Dev.	# Years	# Firms
Child Care	0.097	(0.175)	31	3.71	0.070	(0.116)	24	4.29
Children's Books	0.105	(0.241)	23	2.30	0.075	(0.154)	19	2.58
Children's Clothing	0.058	(0.127)	31	3.26	0.074	(0.141)	24	3.33
Toys	0.096	(0.105)	31	14.29	0.077	(0.076)	24	14.54
Books: college texts	0.011	(0.060)	31	2.19	0.000	0.000	24	1.58
Books: general	0.032	(0.060)	31	9.45	0.032	(0.062)	24	9.63
Books: K-12 texts	0.012	(0.064)	27	2.93	0.016	(0.073)	21	2.62
Movies	0.117	(0.077)	31	36.90	0.080	(0.052)	24	40.71
Newspapers	0.045	(0.048)	31	17.39	0.032	(0.043)	24	18.17
Magazines	0.059	(0.066)	31	9.55	0.051	(0.059)	24	9.38
Cruises	0.126	(0.253)	19	3.68	0.078	(0.143)	18	3.78
Dental Equipment	0.080	(0.152)	31	4.00	0.096	(0.168)	24	3.58
Drugs	0.095	(0.067)	31	196.39	0.080	(0.057)	24	223.08
Health Care (Services)	0.124	(0.094)	31	67.58	0.113	(0.097)	24	78.67
Health Insurance	0.081	(0.095)	31	19.32	0.067	(0.090)	24	21.17
Medical Equipment	0.108	(0.074)	31	133.90	0.087	(0.067)	24	156.42
Funeral Homes, Cemet.	0.066	(0.131)	29	3.10	0.038	(0.092)	24	3.00
Nursing Home Care	0.116	(0.089)	31	20.00	0.092	(0.093)	24	21.92
Construction Equip.	0.043	(0.065)	31	28.19	0.036	(0.060)	24	26.13
Floors	0.032	(0.091)	31	6.03	0.041	(0.102)	24	4.75
Furniture	0.037	(0.057)	31	26.58	0.034	(0.059)	24	25.92
Home Appliances Big	0.064	(0.057)	31	31.29	0.061	(0.049)	24	31.96
Home Appliances Small	0.079	(0.133)	31	6.97	0.080	(0.134)	24	6.58
Housewares	0.023	(0.071)	31	3.52	0.029	(0.079)	24	3.25
Linens	0.030	(0.068)	31	5.32	0.032	(0.070)	24	5.33
Residential Const.	0.074	(0.093)	31	17.00	0.064	(0.085)	24	17.00
Residential Develop.	0.067	(0.051)	31	63.06	0.020	(0.023)	24	59.00
Residential Mortgage	0.098	(0.107)	31	18.42	0.078	(0.097)	24	20.08
Beer (and Wine)	0.057	(0.089)	31	12.65	0.052	(0.083)	24	12.29
Cigarettes	0.017	(0.069)	31	4.13	0.000	0.000	24	3.96
Cigars, Other Tobacco	0.031	(0.104)	31	3.45	0.029	(0.108)	24	2.71
Food	0.060	(0.042)	31	273.48	0.051	(0.032)	24	269.67
Liquor	0.022	(0.060)	29	5.28	0.021	(0.061)	24	4.75
Clothing (Adults)	0.045	(0.033)	31	68.26	0.045	(0.036)	24	63.25
Cosmetics	0.063	(0.077)	31	13.06	0.057	(0.071)	24	13.38
Golf	0.077	(0.146)	31	5.61	0.082	(0.149)	24	6.50
Jewelry	0.059	(0.069)	31	13.35	0.064	(0.073)	24	13.13
Sporting Equipment	0.100	(0.103)	31	11.19	0.105	(0.097)	24	11.04
Life Insurance	0.045	(0.043)	31	43.58	0.027	(0.028)	24	38.00
Property Insurance	0.059	(0.071)	31	49.00	0.050	(0.065)	24	53.63
Airplanes	0.053	(0.044)	29	49.59	0.040	(0.040)	24	48.00
Automobiles	0.052	(0.051)	31	81.65	0.042	(0.049)	24	80.38
Bicycles	0.043	(0.119)	30	1.60	0.045	(0.128)	24	1.75
Motorcycles	0.109	(0.278)	26	1.42	0.056	(0.212)	24	1.46
Coal	0.061	(0.091)	31	10.84	0.024	(0.044)	24	10.50
Oil	0.084	(0.063)	31	304.13	0.035	(0.051)	24	329.13
Telephone	0.116	(0.098)	31	49.97	0.097	(0.069)	24	57.71
Electricity	0.027	(0.015)	31	210.74	0.017	(0.012)	24	213.38

Notes: The share of new public firms for industry k and year t is the share of public companies in industry k and year t that are new equity listings in year t. The summary statistics including the mean (Column 1) and the within-industry standard deviation (Column 2) are reported for each industry. The number of years for which the data is available (Column 3) and the average number of firms in the industry (Column 4) is also displayed. The share of IPOs in industry k and year t is the share of public companies that undertake an IPO according to Jay Ritter's data set of IPOs. This measure is available from 1980 until 2003 and the summary statistics reported in columns 5 through 8 are analogous to those reported in columns 1 through 4.

Online Appendix Table 1b. Summary Statistics: Net Equity Issuance Measures

Industry Category	Net Equity Issuance in the Industry				Net Equity Issuance in the Industry (Alternative Measure)			
	(5)	(6)	(7)	(8)	(5)	(6)	(7)	(8)
	Mean	Std. Dev.	# Years	# Firms	Mean	Std. Dev.	# Years	# Firms
Child Care	0.007	(0.116)	31	2.48	0.020	(0.111)	31	1.90
Children's Books	0.037	(0.140)	23	2.08	0.039	(0.142)	22	1.75
Children's Clothing	-0.009	(0.058)	31	2.74	0.013	(0.041)	31	2.55
Toys	0.009	(0.028)	31	11.03	0.019	(0.041)	31	9.39
Books: college texts	-0.002	(0.005)	14	2.36	0.008	(0.014)	13	2.14
Books: general	-0.001	(0.025)	31	6.81	0.006	(0.030)	31	6.16
Books: K-12 texts	-0.008	(0.026)	28	2.07	0.001	(0.025)	27	1.96
Movies	0.021	(0.038)	31	30.39	0.033	(0.074)	31	24.00
Newspapers	-0.024	(0.044)	31	12.77	0.003	(0.023)	31	11.81
Magazines	-0.008	(0.037)	31	7.10	0.002	(0.059)	31	5.87
Cruises	0.062	(0.170)	19	3.37	0.066	(0.169)	19	3.16
Dental Equipment	0.054	(0.139)	29	3.32	0.113	(0.321)	29	2.81
Drugs	-0.005	(0.018)	31	167.03	0.011	(0.016)	31	144.19
Health Care (Services)	0.007	(0.034)	31	46.74	0.030	(0.049)	31	37.03
Health Insurance	0.000	(0.007)	31	13.06	0.003	(0.010)	31	11.32
Medical Equipment	0.003	(0.024)	31	114.52	0.016	(0.026)	31	96.35
Funeral Homes, Cemet.	-0.022	(0.083)	18	1.14	0.003	(0.054)	17	1.03
Nursing Home Care	0.013	(0.018)	31	13.74	0.019	(0.027)	31	10.77
Construction Equip.	0.004	(0.015)	31	23.23	0.011	(0.016)	31	20.90
Floors	0.010	(0.050)	29	5.39	0.027	(0.102)	28	4.84
Furniture	-0.001	(0.022)	31	22.68	0.005	(0.023)	31	20.65
Home Appliances Big	0.001	(0.017)	31	27.26	0.010	(0.024)	31	24.19
Home Appliances Small	-0.001	(0.005)	31	6.00	0.009	(0.022)	31	5.55
Housewares	-0.005	(0.063)	31	2.94	0.017	(0.034)	31	2.71
Linens	0.003	(0.031)	31	4.48	0.015	(0.051)	31	4.06
Residential Const.	0.008	(0.017)	31	15.23	0.015	(0.030)	31	13.13
Residential Develop.	0.017	(0.035)	31	53.71	0.020	(0.028)	31	43.58
Residential Mortgage	0.008	(0.024)	31	15.16	0.012	(0.030)	31	12.35
Beer (and Wine)	-0.025	(0.032)	31	10.19	-0.014	(0.036)	31	9.26
Cigarettes	-0.012	(0.017)	31	3.48	-0.003	(0.018)	31	3.13
Cigars, Other Tobacco	-0.060	(0.091)	31	2.87	-0.006	(0.132)	28	2.48
Food	-0.007	(0.014)	31	228.65	0.009	(0.027)	31	204.71
Liquor	-0.017	(0.049)	29	3.83	0.004	(0.070)	29	3.48
Clothing (Adults)	-0.012	(0.033)	31	61.19	0.001	(0.059)	31	55.00
Cosmetics	-0.010	(0.033)	31	11.39	0.001	(0.026)	31	9.71
Golf	0.041	(0.106)	31	5.29	0.043	(0.113)	31	4.10
Jewelry	0.007	(0.025)	31	11.45	0.017	(0.029)	31	10.55
Sporting Equipment	0.010	(0.031)	31	9.55	0.021	(0.046)	31	8.48
Life Insurance	0.000	(0.003)	31	16.97	0.002	(0.004)	31	15.94
Property Insurance	0.000	(0.007)	31	30.52	0.003	(0.008)	31	28.84
Airplanes	0.001	(0.019)	29	43.17	0.008	(0.015)	29	36.21
Automobiles	-0.001	(0.009)	31	66.61	0.004	(0.008)	31	59.77
Bicycles	0.011	(0.047)	28	1.39	0.009	(0.038)	27	1.23
Motorcycles	-0.001	(0.038)	23	1.29	0.009	(0.048)	19	0.96
Coal	0.003	(0.013)	31	8.68	0.009	(0.023)	31	7.23
Oil	-0.001	(0.011)	31	245.52	0.009	(0.014)	31	206.81
Telephone	0.020	(0.029)	31	36.90	0.013	(0.077)	31	25.00
Electricity	0.011	(0.013)	31	179.19	0.020	(0.016)	31	170.74

Notes: The first measure of net equity issuance for industry k is the industry net stock issuance in year t scaled by industry book value of assets in year $t-1$ (Frank and Goyal, 2003). The summary statistics including the mean (Column 1) and the within-industry standard deviation (Column 2) are reported for each industry. The number of years for which the data is available (Column 3) and the average number of firms in the industry (Column 4) is also displayed. The second measure of net equity issuance is change in book equity minus the change in retained earnings (scaled by lagged assets) (Baker and Wurgler, 2002). The summary statistics reported in columns 5 through 8 are analogous to those reported in columns 1 through 4.

Internet Table 1c. Summary Statistics: Net Debt Issuance Measure

Industry Category	Net Debt Issuance in the Industry			
	(1)	(2)	(3)	(4)
	Mean	Std. Dev.	# Years	# Firms
Child Care	0.093	(0.181)	31	2.48
Children's Books	0.032	(0.093)	23	2.08
Children's Clothing	-0.005	(0.024)	31	2.74
Toys	-0.005	(0.045)	31	11.03
Books: college texts	0.001	(0.034)	14	2.36
Books: general	-0.002	(0.059)	31	6.81
Books: K-12 texts	-0.005	(0.040)	28	2.07
Movies	0.018	(0.055)	31	30.39
Newspapers	0.003	(0.059)	31	12.77
Magazines	-0.001	(0.041)	31	7.10
Cruises	0.003	(0.079)	19	3.37
Dental Equipment	0.013	(0.051)	29	3.32
Drugs	0.011	(0.017)	31	167.03
Health Care (Services)	0.016	(0.052)	31	46.74
Health Insurance	0.003	(0.005)	31	13.06
Medical Equipment	0.000	(0.017)	31	114.52
Funeral Homes, Cemet.	-0.012	(0.048)	18	1.14
Nursing Home Care	-0.001	(0.039)	31	13.74
Construction Equip.	0.026	(0.028)	31	23.23
Floors	-0.016	(0.055)	29	5.39
Furniture	0.001	(0.023)	31	22.68
Home Appliances Big	0.013	(0.026)	31	27.26
Home Appliances Small	0.006	(0.026)	31	6.00
Housewares	0.011	(0.080)	31	2.94
Linens	0.002	(0.040)	31	4.48
Residential Const.	0.010	(0.046)	31	15.23
Residential Develop.	0.021	(0.051)	31	53.71
Residential Mortgage	0.049	(0.075)	31	15.16
Beer (and Wine)	0.022	(0.027)	31	10.19
Cigarettes	0.006	(0.024)	31	3.48
Cigars, Other Tobacco	0.024	(0.087)	31	2.87
Food	0.009	(0.018)	31	228.65
Liquor	0.011	(0.066)	29	3.83
Clothing (Adults)	0.006	(0.036)	31	61.19
Cosmetics	0.010	(0.050)	31	11.39
Golf	-0.001	(0.061)	31	5.29
Jewelry	0.006	(0.041)	31	11.45
Sporting Equipment	-0.010	(0.047)	31	9.55
Life Insurance	0.003	(0.004)	31	16.97
Property Insurance	0.002	(0.002)	31	30.52
Airplanes	0.012	(0.027)	29	43.17
Automobiles	0.020	(0.026)	31	66.61
Bicycles	0.005	(0.052)	28	1.39
Motorcycles	0.018	(0.084)	23	1.29
Coal	-0.004	(0.050)	31	8.68
Oil	0.003	(0.015)	31	245.52
Telephone	0.023	(0.026)	31	36.90
Electricity	0.017	(0.018)	31	179.19

Notes: The measure of net debt issuance for industry k is the industry net debt issuance in year t scaled by industry book value of assets in year $t-1$. The summary statistics including the mean (Column 1) and the within-industry standard deviation (Column 2) are reported for each industry. The number of years for which the data is available (Column 3) and the average number of firms in the industry (Column 4) is also displayed.

Online Appendix Table 2. Net Equity Issuance Results: Robustness

Dependent variable Sample	Net equity issues (Benchmark measure)		Net equity issues (Alternative Baker- Wurgler, 2002 measure)	
	(1)	(2)	(3)	(4)
Forecasted annualized demand growth between t and $t+5$	2.529 (0.9970)**	1.782 (0.821)**	2.259 (1.168)*	1.454 (1.060)
Forecasted annualized demand growth between $t+5$ and $t+10$	-2.852 (1.034)***	-1.533 (1.048)	-2.122 (1.118)*	-0.770 (1.230)
Industry market to book ratio	0.010 (0.007)	0.012 (0.009)	0.013 (0.012)	0.018 (0.013)
Aggregate net equity issuance	2.557 (0.677)***		1.253 (0.848)	
Industry fixed effects	X	X	X	X
Year fixed effects		X		X
Mean of Dependent Variable				
R²	0.230	0.286	0.160	0.217
N	$N = 575$	$N = 575$	$N = 566$	$N = 566$

Notes: Columns 1 and 2 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. Columns 3 and 4 report similar regressions where the dependent variable is the industry change in book equity plus net of stock repurchases (scaled by industry book value of assets) for year $t+1$, along the lines of Baker and Wurgler (2002). The demand forecasts are made using information available as of year $t-1$. The coefficients on the forecasted annual demand growth are normalized by the number of years of the forecast (5 for both coefficients). 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%

Online Appendix Table 3. Fama-MacBeth Regressions

Dependent Variable	Share of New Listings		Net Equity Issuance		Net Debt Issuance	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.0510 (0.0176)***	0.0323 (0.0192)*	-0.0124 (0.0065)*	-0.0068 (0.0084)	0.0000 (0.0110)	-0.0193 (0.0148)
Forecasted annualized demand growth between t and $t+5$	3.5559 (1.6646)**	2.2619 (1.3393)*	2.1608 (0.8493)**	1.8608 (0.7587)**	0.8534 (0.8769)	1.0625 (0.8645)
Forecasted annualized demand growth between $t+5$ and $t+10$	-3.3161 (1.2880)***	-2.6260 (1.1578)**	-1.4567 (0.7297)**	-1.0677 (0.7365)	-0.4891 (0.7633)	-0.7375 (0.7444)
Industry market to book ratio		0.0225 (0.0073)***		-0.0025 (0.0039)		0.0155 (0.0053)***
N	$N = 31$	$N = 31$	$N = 31$	$N = 31$	$N = 31$	$N = 31$

Notes: Columns 1 and 2 report the time series averages of the OLS coefficients from 31 cross-sectional regressions of the industry share of new listings for year $t+1$ on the forecasted annualized demand growth due to demographics between t and $t+5$ and between $t+5$ and $t+10$ from 1974 until 2004. Columns 3 and 4 report the time series averages of the OLS coefficients from 31 cross-sectional regressions of the industry stock sales net of stock repurchases (scaled by industry lagged book value of assets) for year $t+1$ on the forecasted annualized demand growth due to demographics between t and $t+5$ and between $t+5$ and $t+10$ from 1974 until 2004. Columns 5 and 6 report the time series averages of the OLS coefficients from 31 cross-sectional regressions of the industry debt sales net of debt repurchases (scaled by industry lagged book value of assets) for year $t+1$ on the forecasted annualized demand growth due to demographics between t and $t+5$ and between $t+5$ and $t+10$ from 1974 until 2004. The demand forecasts are made using information available as of year $t-1$. All industries are included in each of the cross-sectional regressions. The coefficients on the forecasted annual demand growth are normalized by the number of years of the forecast (5 for both coefficients). Standard errors are based on the time-series variation of the regression coefficients using OLS standard errors. * significant at 10%; ** significant at 5%; *** significant at 1%