“What is a good investment measure?”

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What is a good investment measure?

Abstract

Capital investment should be correlated with investment opportunity sets, and investment outcomes, thus capital investment proxies could be validated against these benchmarks. The authors find that the choice of deflator is important to the performance of capital-expenditure-based proxies that are commonly applied in the literature. In addition, capital-expenditure-based proxies often underperform investment proxies constructed on some simple accounting information. The paper explores some sources of the difference in performance across various investment proxies.

Keywords: capital investment, investment opportunities, capital expenditure.
JEL Classification: G31, M41.

Introduction

It has long been recognized by financial economists and practitioners that capital investment affects future firm growth, risk, and size, and thus can have a significant impact on firm value (Sunder, 1980; Berk et al., 1999). A number of recent studies in accounting and finance, including Smith and Watts (1992), Gaver and Gaver (1993), Baber et al. (1996), Tang and Li (2008), and Fricke and Fung (2009), examine the association between proxies for capital investment, and risk, returns, and firm policies on financing, compensation, and accounting. Relying mainly on intuitive arguments these studies use different proxies for capital investment. The wide differences among these investment proxies raise a concern that findings in one study with one investment proxy may not be generalized, especially if the researchers' choice is not a valid measure of investment intensity. To date, no research has been done to validate these investment proxies. Capital investment reacts to investment opportunities, leads to firm growth, and is accompanied by firm structural change such as employee turnover. We thus evaluate various proxies for capital investment on the basis of their association with these factors.

We find that most investment variables applied in previous studies, except capital expenditure over firm value, are valid proxies. Nonetheless, significant differences exist in the performance of these proxies. Investment variables constructed on simple accounting statistics such as growth of property, plant, and equipment (PPE) or growth of long-term assets often perform as well as or even better than more commonly applied investment proxies, i.e., capital expenditure scaled by various deflators. These accounting statistics may capture capital investment more comprehensively as they incorporate effect from firm divestment, investment by acquisition, and non-cash investment. Among variables that are based on capital expenditure, we find that the choice of deflators can significantly affect the performance of these proxies. For example, capital expenditure deflated by PPE generally performs best while capital expenditure deflated by market value of firm assets appears problematic. R&D responds well to investment opportunities in some industries but appears to be a poor indicator of firm growth in most industries. We investigate possible sources for the differences in the performance of these variables and obtain preliminary evidence supporting our explanations. Over all, all better performing proxies are consistent with the spirit of the Hayashi (1982) model.

We believe our research is the first study that validates different investment measures commonly applied in the corporate finance literature. What is a good measure of capital investment is a question of great practical value. More accurate measures may enhance the significance of researchers' findings. In addition, measurement error in investment proxies may bias estimated coefficients when those variables are used as independent variables in a regression (Kang et al., 2006; Aivazian et al., 2005). Our results should aid researchers in constructing appropriate investment proxies. Second, our results may help to interpret some findings in previous studies that are not robust to the choice of the capital investment proxy. For example, we find that capital expenditure deflated by market value may not be a valid measure of investment. Hence, findings in studies that applied such measures may need to be interpreted with caution (e.g., Smith and Watts, 1992; Vogt, 1997). For another example, Titman, Wei and Xie (2004) find that abnormal investment is negatively correlated with abnormal future stock returns whereas Lev and Thiagarajan (1993) find that R&D is positively correlated with abnormal future stock returns. We find that the two investment variables applied in the two studies differ dramatically in their correlation with profitability-driven investment opportunities. Thus the contradictory findings in the two studies could be attributable to the choice of investment variables. Lastly, we analyze the performance of various investment proxies within each industry. The results may aid researchers in constructing powerful investment measures for firms in certain industries.

The paper is organized as follows. In the next section we discuss the ground of our validation approaches and introduce several widely-applied investment measures. Section 2 describes our sample. Section 3 reports empirical results, and the final section concludes.

1. The investment measures and their association with other factors

We first provide the link that relates investment with investment opportunities. An investment proxy that best reflects investment opportunities may be considered more accurate. In a seminal study, Hayashi (1982) shows that under some conditions, the following equation holds[1]:

$$\frac{I}{K} = a + \frac{1}{\alpha}[Q-1] + \lambda, \tag{1}$$

where I is the firm investment, K is the beginning-of-period capital stock, α is a parameter linearly increasing in the cost of adjustment function, Q is the present value of profits from new capital investment and represents investment opportunity, and λ is some technology shock[2].

Based on the Hayashi model, two conclusions could be drawn. First, capital investment should be linearly associated with investment opportunity. We thus validate investment measures by their association with proxies of investment opportunity. Second, a good measure of investment should be deflated by the beginning-of-period capital stock K, either PPE (property, plant and equipment) or long-term assets. Such deflators may work better than other arbitrary variables such as sales or expenditure in previous years. This prediction is confirmed by our empirical results.

We apply the following variables to proxy for investment opportunities: Tobin's Q, profitability (Blanchard, Rhee and Summers, 1993), past sales growth (Shin and Stulz, 1996) and value of growth opportunity (VGO) (Richardson, 2002)[3].

Second, we choose a benchmark for ex post realization of investment. Investment leads to future growth in sales, earnings and book value. Following a similar approach in Kallpur and Trombley (1999) and Richardson (2002), we focus on ex post realized sales growth, and examine its correlation with various investment proxies[4].

Third, we link a firm's capital investment with investment in human capital. In general, a firm would respond to investment opportunities with contemporaneous increase in both physical and human capital. Capital investment is often accompanied by firm structural change such as employee turnover. We thus validate investment measures by examining concurrent employee changes.

Lastly, a firm's investment depends not only on firm specific factors but also on industry-specific factors. Therefore, we also examine how various investment proxies perform after industry adjustment.

We first identify candidate investment proxies to be included in our empirical tests from a list of representative studies in the finance and accounting literature:

1. Capital expenditure/PPE (e.g., Aggarwal et al., 2006, Hennessy and Levy, 2002).
2. Capital expenditure/Total assets (e.g., Blanchard et al., 1994).
3. Capital expenditure/Sales (e.g., Anderson and Garcia-Feijoo, 2006; Titman et al., 2004).
4. Capital expenditure/Value (e.g., Smith and Watts, 1992; Vogt, 1997).
5. R&D/Total assets (e.g., Gaver and Gaver, 1993).
6. Growth in inventory (e.g., Kashyap, Lamont and Stein, 1994).
7. Growth in capital expenditure (e.g., Lev and Thiagarajan, 1993; Callen et al., 1996).
8. Sum of capital expenditure on PPE, acquisitions, and research and development deflated by depreciation expense (e.g., Baber et al., 1996).

In addition, we construct several proxies that are not as widely applied in the literature but may nonetheless capture Hayashi's idea of investment.

9. Growth in PPE, either net PPE or gross PPE[5].
10. Change in long-term assets deflated by average total assets[6].

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[1] Specifically, adjustment costs in investment are linearly homogeneous in investment and capital, so that marginal and average q will be equal.

[2] Although we only validate capital investment, not necessarily optimal investment, it can be shown that under some conditions, a measure that better matches for investment opportunities is more accurate. Assume there are two measures of investment, I_1 and I_2, both measuring the underlying investment intensity with errors: $I_1 = I^* + D + \varepsilon_1$ and $I_2 = I^* + D + \varepsilon_2$, where I^* is optimal investment proportional to investment opportunities Q, D is the distorted investment resulting from information cost or agency problem, and ε is the measurement error. Assume ε_1 has a smaller variance than ε_2 does and both measurement errors are independent of D and Q, then it is obvious that I_1 should be more closely correlated with Q than I_2.

[3] Value of growth opportunity (VGO) is defined as the difference between firm value and asset-in-place. For details, see Richardson (2002).

[4] We choose not to use growth in book value or earnings as the benchmark. Growth in book value firms may bias in favor of some candidate investment proxies, e.g., growth in PPE.

[5] The growth measure works better when potential fixed effect is present in other measurements. Thomas and Zhang (2002) apply a similar measure to proxy for investment: change in net PPE scaled by total assets.

[6] Harrison and Horngren (2003) define investing activities as "Activities that increase or decrease the long-term assets available to the business." "(Investments) increase and decrease long-term assets, such as computers and software, land, buildings, equipment, and investments in other companies. The purchases and sales of these assets are investing activities" (2003, p. 548).

11. Growth in long-term assets.
12. Cash flows in investing activities, deflated by average total assets[1].

Ex ante, we may predict the relative performance among some of the investment measures. For example, capital expenditure/sales probably would be a noisier measure than capital expenditure/PPE. This is because the former measure could be discomposed as the product of the latter measure and the ratio of sales/PPE. It is well-known that the sales turnover ratio (sales/PPE) varies significantly across industries and thus introduces some noise into the investment proxy. Another issue concerns capital expenditure. Note that it is always non-negative and omits retirement of any PPE. Focusing on only capital expenditure ignores divestment from sale of PPE and investment through acquisition, e.g., where firms liquidate one investment item to finance another investment project. Such transactions represent potential omitted variables and create potentially an errors-in-variables problem in prior research. Also, using growth of capital expenditure may be problematic if there is little expenditure in a prior year. An intuitive measure might be simply constructed as the change in PPE divided by lagged PPE. After all, this is what the Hayashi model is supposed to capture.

2. Sample selection and variables

Now we compare the performance of the selected measures of capital investment. A more accurate measure of investment should be more closely related to investment opportunities, firm growth, and employee turnover. Our sample consists of all firms for which market value and financial statement information are available on Compustat's annual industrial, full coverage, and research files. Financial institutions (SIC codes 6000-6999) are excluded because their investing, operating, and financing activities are not clearly demarcated. The sample period is from 1971 to 2006. Our data begin in year 1971 because before that year some variables do not have adequate number of observations. The resulting sample covers 161,682 firm years, with a minimum annual sample of 2,893 firms and a maximum annual sample of 7,050 firms.

We generally follow previous studies in constructing capital investment proxies and other variables. The variables are defined in Table 1 (see Appendix). The ex ante investment opportunities are proxied by: (1) *Q*; (2) value of growth opportunities (VGO) constructed in Richardson (2002); (3) profitability (ROA); and (4) past sales growth ($SGRO_{-3}$), all measured in the year before investment. We consider several measures of investment opportunity due to the concern that *Q* is a noisy measure. It is well known that the *Q* measure suffers from serious measurement error problem. Researchers have contended that investment chases profitability and higher profitability (ROA) can signal greater project quality or investment opportunities (Biddle et al., 2001; Fazzari et al., 1988; Cleary, 1999 and Alti, 2003). We also follow earlier studies (Kaplan and Zingales, 1997) and include growth in sales in the past three years ($SGRO_{-3}$). Finally, replacing *Q* with Richardson 2002's measure of VGO may provide another sensitivity test. Following previous studies and also based on empirical findings, we include these proxies for investment opportunities at the beginning of the year. The ex post measure is growth in sales over the three year period from year *t*-1 to *t*+2 ($SGRO_{+3}$). Finally, investment is often accompanied with employee turnover, measured as the growth in number of employees during the period of investment (EMPGRO).

Table 2 (see Appendix) reports descriptive statistics on a pooled basis for investment measures and various measures of investment opportunity, future realization, and contemporaneous employee growth. In A, the median firm has a *Q* ratio of 1.30, *VGO* of 0.30, *ROA* of 0.07, *PPEGRO* of 0.05, future sales growth of 30.9%, and employee growth of 1.9%. There is considerable variation among all measures of investment. In addition, the lower quartiles of some investment measures (*CAPXGRO*, *DLA/A*, *INVTGRO*, *LAGRO*, *PPEGRO*, and *EMPGRO*) are negative, suggesting that some companies reduce investment or divest in some years. In addition, the lower quartile of *Q* is below 1; the lower quartiles of *VGO* and *ROA* are negative. All indicate negative investment opportunities for some firm-years. Note that the capital expenditure-based proxies (except *CAPXGRO*) are by construction non-negative, so they may not be able to capture reduction in investment associated with negative investment opportunities.

Panel B reports correlations among different measures of investment. Given that they all purport to measure the same underlying activities, it is not surprising to see strong positive correlations. However, *R&D* (*R&D/A*) is negatively correlated with capital expenditure deflated by firm value (*CAPX/V*) and insignificantly correlated with investment cash flows (*CFI/A*). Its low association with other proxies suggests that it may not purport to gauge the same concept of investment as other variables. One explanation is that outcomes from R&D expenditure are inherently uncertain, thus accounting standards typically mandate recording R&D as an expense and not as an asset.

[1] The advantage of this measure is that it is most accurate in reflecting the cash spent in investing activities. A weakness of this measure is that it omits non-cash investing activities. Companies make investments that do not require cash. Non-cash investing activities can be reported in a separate schedule that accompanies the statement of cash flows. Hence, we anticipate this measure to be less powerful than growth in long-term assets or PPE.

It is also interesting to note that growth in PPE (*PPEGRO*, *PPEGGRO*), growth in long-term assets (*LAGRO*), and capital expenditure/PPE (*CAPX/PPE*) are closely correlated among themselves. For example, the Spearman correlation between *CAPX/PPE* and *PPEGRO* is 0.75. This is important as later it can be shown that these variables are relatively more powerful proxies among all measures.

Panel C of Table 2 (see Appendix) reports the correlations between four measures of investment opportunities, future sales growth, and employee turnover. These variables are generally significantly positively correlated because they relate to a similar construct. However, except for the correlation between *VGO* and *Q*, no correlation exceeds 0.5. Therefore, these variables may validate our investment proxies from different dimensions. *VGO* is negatively correlated with ROA because of the way *VGO* is constructed[1]. The high correlation between *VGO* and *Q* (0.954) suggests that validation results by these two benchmarks should not be interpreted as independent findings.

3. Empirical results

We test the correlation between investment proxies and benchmark variables that measure investment opportunities, future sales growth, or employee turnover. This approach faces the problem of using ex post data to measure ex ante constructs. To help mitigate this problem, we use a portfolio approach following Richardson (2002) and Kallapur and Trombley (1999). The assumption is that ex post shocks affecting future realization, employee turnover, or investment opportunities and shocks affected by past capital investment within each portfolio will be uncorrelated. Each year, we sort firms into 50 portfolios on a validation benchmark variable. For the example of future sales growth ($SGRO_{+3}$), for each year, firms are ranked based on realized sales growth over the three succeeding years ($SGRO_{+3}$); 2% of firms with the highest sales growth are placed in portfolio 1, the next highest 2% firms in portfolio 2, and so on. We then compute the Spearman rank correlations between portfolio medians of the benchmark variable and portfolio medians of investment proxies. This procedure is repeated for each year. The reported correlations in panel A of Table 3 (see Appendix) are means of rank correlations over the sample period. Significance for the mean correlation is assessed using t-statistics. Newey-West (1987) correction with three lags is applied to t-statistics for correlations related to past and future sales growth.

As expected, most reported correlations are positive and significant. One noticeable exception is from capital expenditure deflated by end-of-year firm market value (*CAPX*/*V*1). It is negatively correlated with both *Q* and *VGO* and insignificantly correlated with future sales growth and employee turnover. The negative correlations could be attributable to the use of market value of firm in the denominator, causing the ratio of *CAPX*/*V*1 to behave more like a book-to-market measure (or inverse of *Q*). Overall, end-of-year firm market value may not be a good deflator because it may reflect valuation implications of capital investment, nullifying any information contained in the numerator (capital expenditure). With a beginning-of-year defalcator (*CAPX*/*V*), the performance is slightly better though its correlations with *Q* and *VGO* are still negative[2]. In contrast, capital expenditure with other deflators always has significant positive correlations with various benchmark variables.

Consistent with our prediction, *PPE* (or long-term assets) generally performs better than total assets or sales as a deflator. *CAPX*/*PPE* has a correlation of 0.934, 0.864, 0.662, 0.922, 0.927, and 0.959 with *Q*, *VGO*, *ROA*, past sales growth, future sales growth, and employee turnover whereas *CAPX*/*S* (*CAPX*/*A*) has a correlation of 0.880 (0.796), 0.867 (0.701), 0.358 (0.854), 0.757 (0.722), 0.913 (0.889), and 0.893 (0.914)[3].

Among the investment proxies, *CAPX*/*PPE*, *PPEGGRO* (*PPEGRO*) and *LAGRO* generally perform better than other proxies. For example, *PPEGGRO* has a very high correlation of 0.934(0.981) with *Q* (*EMPGRO*). Baber's construct has high correlations with *Q* and *VGO*, but its correlation with other benchmark variables are not as high. Interestingly, some investment proxies widely used in the literature do not appear to be the most powerful. Capital expenditure based proxies that are not deflated by *PPE* generally underperform *PPEGGRO*, *PPEGRO*, or *DLA*/*A*. The inferior performance of these proxies relative to proxies constructed from growth of long-term assets or PPE may stem from the difference between change in long-term assets (or *PPE*) and capital expenditure. For example, *CAPX*/*A* underperforms *DLA*/*A*; *CAPX*/*PPE* underperforms *PPEGRO*. One explanation for the under-performance of capital expenditure is that it excludes information from

[1] *VGO* is defined as the difference between equity value (*Compustat* data25*data199) and asset-in-place ($(1 - \alpha r)BV + \alpha(1 + r)X - \alpha rd$, where *BV* is the book value of common equity (data60), *X* is operating income after depreciation (data178), *d* is the annual dividend (data 21), *r* is the cost of capital 12%, and α takes the value of 1.24). By this construction, higher *X* (ROA) may result in a lower VGO.

[2] In general, we find that a beginning-of-year deflator works better than an end-of-year deflator. For disposition purpose, we do not present results for other variables with end-of-year deflators.

[3] CAPX/A by construction may have a high correlation with ROA because ROA also has total assets in the denominator.

divestment, investment by acquisition, and non-cash investment. To investigate this possibility, we construct a new variable that captures the difference between change in long-term assets and capital expenditure, (*DLA-CAPX*)/*A*. The performance of this variable is reported in the last column in Table 3. The correlations of this variable with all benchmark variables are significantly positive, consistent with our intuition.

R&D spending appears to be positively correlated with benchmark variables but the correlations are generally lower than those of other valid investment proxies. In fact, the correlation between *R&D*/*A* and *ROA* are insignificant. The insignificant relationship may arise when some firms have less incentive to invest in *R&D* when they are already quite profitable. In addition, *R&D* may result in cost savings rather than new products in some industries, leading to a relatively weak relationship between *R&D* investment and future sales growth. The relatively low correlation of *R&D* with future sales growth is also consistent with the notion underlying the generally accepted accounting principles (GAAP) that mandate accountants to expense *R&D* expenditures rather than capitalize them. Titman et al. (2004) find that abnormal investment is negatively correlated with abnormal future stock returns whereas Lev and Thiagarajan (1993) find that *R&D* is positively correlated with abnormal future stock returns. We find that these two investment variables differ dramatically in their correlation with firm profitability. The inherent uncertainty in the outcomes of *R&D* might potentially account for the higher stock returns subsequent to investment. For instance, if the uncertainty associated with *R&D* investment is a priced risk in the market, then higher *R&D* naturally should lead to higher stock returns.

A firm's investment depends not only on firm specific factors but also on industry-specific factors. We thus validate various investment proxies after adjusting for their industry medians each year. We follow the approach on Professor Kenneth French's website and classify firms into 48 industries (financial intuitions and utility firms are excluded as firms in these industries are heavily regulated)[1]. Portfolio correlation results for industry-adjusted variables are reported in panel B of Table 3.

In general, the correlations are similar or become slightly stronger after the industry adjustment. In section 1 we predict that the performance of *CAPX*/*S* should improve after industry adjustment. Results in panel B of Table 3 generally confirm our prediction. Interestingly, one investment proxy that appears to become weaker after industry adjustment is *R&D*/*A*. This is consistent with our earlier notion that *R&D* is different from other capital investment proxies.

Table 3 panel C summarizes the results about the robustness check of our empirical finding when we divide our sample period into four sub-periods: 1971 to 1979, 1980 to 1988, 1989 to 1997, and 1998 to 2006. For simplicity of exposition, we only report relevant correlations and omit t-statistics. As shown there, in all four sub-periods, the empirical results are very close to the ones discussed in panel A and panel B of Table 3.

As a further robustness check of our findings we repeat our analysis of the associations between investment proxies and sales growth using alternative sales growth measures calculated over five-year periods. The untabulated results remain qualitatively similar. We also examine the performance of depreciation expense as a deflator. This is the deflator in Baber's construct. Depreciation expense potentially could be a good deflator as depreciation is related to the balance of *PPE*. In addition, depreciation expense may reflect more recently purchased *PPE* (which is related to the replacement cost of *PPE*) if firms follow accelerated depreciation schedules. Nonetheless, different accounting treatments and the fact that some firms may have very small or even zero depreciation expense in some years can introduce significant noise in this variable. Untabulated results show that its performance generally does not surpass *PPE*.

Because a firm's investment may be affected by industry-specific factors, it is possible that some investment proxies may perform well in some industries but not as well in other industries. Next we attempt to identify relatively powerful investment proxies within each industry. For exposition convenience, we code all investment proxies as 1 to 13 (see Table 1). *CAPX*/*V*1 is not coded as it does not seem to be a valid investment measure at all. In Table 4 (see Appendix), we report the three most powerful investment proxies in Panel A, B, and C and three least powerful proxies in Panel D, E, and F based on their correlations with various benchmark variables. Consistent with results in Table 3, growth in *PPE* (*PPEGGRO* and *PPEGRO*, coded 12 and 11 respectively) seems to be powerful in most industries whereas capital expenditure deflated by firm value (*CAPX*/*V*, coded 6) and growth in capital expenditure (*CAPXGRO*, coded 2) underperform in most industries. For example, in consumer nondurable industry (NoDur) and wholesale and retail industry (Shops), measures of growth in *PPE* (code 12 or 11) are the most or the second most powerful by all benchmark standards. Interes-

[1] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.

tingly, while *R&D/A* may be a powerful investment proxy based on its sensitivity to *Q* or *VGO* in some industries (e.g., hi-tech and health care industries in Panel A), it is a very disappointing proxy in other industries (e.g., retail, wholesale, and consumer nondurable industries in Panel D). One explanation is that *R&D* expenditure may be a more important production force in the former industries but has a less important role in the latter. The above results may help researchers when they choose investment proxies for firms in different industries. It should also be noted that even in industries (hi-tech & healthcare) where *R&D* responds well to investment opportunities, *R&D* still appears to be a poor indicator of firm growth based on sales realization. This is consistent with the notion that *R&D* investment outcome is inherently uncertain, the same notion underlying the generally accepted accounting principles that mandate recording *R&D* as an expense.

Conclusion

In this study we validate capital investment proxies based on their correlations with benchmark variables such as investment opportunities, sales growth, and employee turnover. Results show that many of the capital investment variables constructed based on capital expenditure and widely applied in the literature underperform those constructed on some simple accounting information. We investigate some sources for the differences in the performance of various investment proxies. *R&D* spending may be a poor investment proxy in some industries but a good proxy in other industries. The results may aid researchers in constructing investment proxies in the future.

References

1. Aggarwal, R., and Andrew Samwick (2006). Empire-builders and shirkers: investment, firm performance, and managerial incentives, *Journal of Corporate Finance*, 3, pp. 489-515.
2. Aivazian, V., Y. Ge, and J. Qiu (2005). Debt maturity structure and firm investment, *Financial Management*, pp. 107-119.
3. Alti, A. (2003). How sensitivity is investment to cash flow when financing is frictionless? *Journal of Finance*, April, pp. 707-722.
4. Anderson, C., and L. Garcia-Feijoo (2006). Empirical evidence on capital investment, growth options, and security returns, *Journal of Finance*, 61, pp. 171-194.
5. Baber, W., S. Janakiraman and S. Kang (1996). Investment opportunities and the structure of executive compensation, *Journal of Accounting and Economics*, 21, pp. 297-318.
6. Berk, J., R. Green, and V. Naik (1999). Optimal investment, growth options and security returns, *Journal of Finance*, 54, pp. 1153-1607.
7. Biddle, G., P. Chen and G. Zhang (2001). When capital follows profitability: non-linear residual income dynamics, *Review of Accounting Studies*, 6, pp. 229-265.
8. Blanchard, O., C. Rhee, and L. Summers (1993). The stock market, profit, and investment, *Quarterly Journal of Economics*, 108, pp. 77-114.
9. Blanchard, O., F. Lopez-de-Silanes and A. Shleife (1994). What do firms do with cash windfalls? *Journal of Financial Economics*, 36, pp. 337-360.
10. Callen, J., J. Livnat, and S. Ryan (1996). Capital expenditures: value relevance and fourth-quarter effects, *Journal of Financial Statement Analysis*, Spring, pp. 13-24.
11. Cleary, S. (1999). The relationship between firm investment and financial status, *Journal of Finance*, 54, pp. 673-692.
12. Fazzari, S., G. Hubbard, and B. Petersen (1988). Finance constraints and corporate investment, *Brookings papers on Economic Activity*, pp. 141-195.
13. Fricke, E., and S. Fung (2009). Capital Investment Growth and Economic Risk Factors, Working paper.
14. Harrison, W., and C. Horngren (2003). *Financial Accounting* (5th Ed.), Prentice Hall Publishing.
15. Hayashi, F. (1982). Tobin's Marginal q and Average q: A Neoclassical Interpretation, *Econometrica* 50 (1), pp. 213-224.
16. Hennessy, C.A., and A. Levy (2002). A unified model of distorted investment: Theory and evidence, Working Paper, University of California at Berkeley.
17. Kallapur, S. and M. Trombley (1999). The association between investment opportunity set proxies and realized growth, *Journal of Business, Finance & Accounting*, 26, pp. 505-519.
18. Kang, S., P. Kumar and H. Lee (2006). Agency and corporate investment: The role of executive compensation and corporate governance, *Journal of Business*, 79 (3), pp. 1127-1148.
19. Kaplan, S., and L. Zingales (1997). Do investment-cashflow sensitivities provide useful measures of financial constraints? *Quarterly Journal of Economics*, 112, pp. 169-215.
20. Kashyap, A., O. Lamont, and J. Stein (1994). Credit conditions and the cyclical behavior of inventories, *Quarterly Journal of Economics*, 109, pp. 565-592.
21. Lang, L., E. Ofek, and R. Stulz (1996). Leverage, investment, and firm growth, *Journal of Financial Economics*, 40, pp. 3-29.
22. Lev, B., and R. Thiagarajan (1993). Fundamental information analysis, *Journal of Accounting Research*, 31, pp. 191-215.

23. Minton, B., and C. Schrand (1999). The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing, *Journal of Financial Economics*, December, pp. 423-460.
24. Newey, W. and K. West (1987). A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica*, 55 (3), pp. 703-708.
25. Richardson, S. (2002). Corporate governance and the over-investment of surplus cash, Working paper, University of Pennsylvania.
26. Shin, H., and R. Stulz (1996). An analysis of divisional investment policies, NBER Working Paper No. 5639.
27. Smith, C. and R. Watts (1992). The investment opportunity set and corporate financing, dividend, and compensation policies, *Journal of Financial Economics*, 32, pp. 263-292.
28. Sunder, S. (1980). Corporate capital investment, accounting methods and earnings: a test of the control hypothesis, *Journal of Finance*, Vol. 35, No. 2, pp. 335-565.
29. Tang, Vicki Wei, and Kevin Li (2008). Earnings Quality and Future Capital Investment: Evidence from Discretionary Accruals, Working paper.
30. Thomas, J. and H. Zhang (2002). Inventory changes and future returns, *Review of Accounting Studies*, 7, pp. 163-187.
31. Titman, S., K. Wei and F. Xie (2004). Capital investments and stock returns, *Journal of Financial and Quantitative Analysis*, 39, pp. 677-700.
32. Vogt, S. (1997). Cash flow and capital spending: Evidence from capital expenditure announcement, *Financial management*, 26, pp. 44-57.

Appendix

Table 1. Variable definitions

Variable name	Coding in Table 4	Description
Panel A: Investment measures		
BABER	1	As defined in Baber et al. (1994), defined as the sum of capital expenditure on *PPE* (data30), acquisition (data129), research and development (data46), deflated by depreciation expense (data14)
CAPX/A	2	Capital expenditure (data128) / beginning-of-year total assets (data6).
CAPX/PPE	3	Capital expenditure (data128) / beginning-of-year net PPE (data8) .
CAPX/S	4	Capital expenditure (data128) / sales (data12) in the previous year.
CAPX/V	5	Capital expenditure (data128) / beginning-of-year firm value (data25*data199+data181).
CAPX/V1		Capital expenditure (data128) / end-of-year firm value (data25*data199+data181).
CAPXGRO	6	Growth in capital expenditure, defined as data128 in year *t* / data128 in year *t*-1 -1.
CFI/A	7	Cash flow used in investing activities, defined as -(-data113+data109-data128+data107-data129) or -(-Increase in investment + Sale of investment-capital expenditure + Sale of PPE-acquisition), divided by beginning-of-year total assets (data6).
DLA/A	8	Change in long-term asset (data6-data4) deflated by beginning-of-year total assets (data6).
INVTGRO	9	Growth in inventory, defined as data3 at the end of fiscal year *t* over its beginning balance -1.
LAGRO	10	Growth in long-term asset, defined as (data6-data4) at the end of fiscal year *t* over its beginning balance -1.
PPEGRO	11	Growth in net *PPE*, defined as data8 at the end of fiscal year *t* over its beginning balance -1.
PPEGGRO	12	Growth in gross *PPE*, defined as data7 at the end of fiscal year *t* over its beginning balance -1.
R&D/A	13	R&D expenditure (data46) over beginning-of-year total assets (data6).
Panel B: Investment opportunity measures		
Q		Tobin's *Q*, measured as market value of the firm (data6-data60+data25*data199)/ total assets (data6), at the beginning of year *t*.
ROA		Return on total assets. Operating income (data178)/ total assets (data6) in year *t*-1.
$SGRO_{-3}$		Sale (data12) in year *t* -1/ sale in year *t*-4 -1.
VGO		Value of growth measure as defined in Richardson (2002). (data25*data199-((1-1.24*0.12)*data60+1.24*1.12*data178-1.24*0.12*data21))/average of total asset (data6) in year *t*-1.
Panel C: Investment realization measures		
$SGRO_{+3}$		Sale (data12) in year *t*+2 / sale in year *t*-1 -1.
Panel D: Contemporaneous measures		
EMPGRO		Growth in number of employees, defined as data29 at the end of fiscal year *t* over its beginning balance -1.

Table 2. Descriptive statistics of capital investment and validation benchmark variables

Panel A: Summary statistics						
Variable	N	Mean	Std. dev.	25 percentile	Median	75 percentile
BABER	134.678	4.142	6.338	1.190	2.281	4.353
CAPXGRO	155.063	0.548	2.008	-0.332	0.067	0.622
CAPX/A	161.682	0.083	0.106	0.022	0.050	0.100
CAPX/PPE	160.486	0.368	0.528	0.111	0.216	0.402
CAPX/S	160.589	0.174	0.540	0.018	0.043	0.102
CAPX/V	161.682	0.056	0.069	0.013	0.034	0.071
*CAPX/V*1	159.895	0.051	0.058	0.013	0.032	0.067
CFI/A	109.191	0.057	0.240	0.010	0.044	0.107
DLA/A	157.215	0.076	0.278	-0.021	0.021	0.096
INVTGRO	133.875	0.163	0.632	-0.095	0.067	0.263
LAGRO	156.553	0.267	0.956	-0.058	0.057	0.253
PPEGRO	159.705	0.199	0.722	-0.066	0.050	0.236
PPEGGRO	158.754	0.193	0.509	0.015	0.089	0.225
R&D/A	101.821	0.078	0.149	0.000	0.023	0.089
Q	161.195	2.273	3.223	0.989	1.333	2.146
VGO	160.901	1.439	3.573	-0.024	0.342	1.262
ROA	161.682	-0.009	0.337	-0.022	0.073	0.139
$SGRO_{-3}$	134.313	1.057	3.365	0.026	0.338	0.825
$SGRO_{+3}$	124.982	0.755	2.201	-0.020	0.296	0.731
EMPGRO	149.817	0.091	0.408	-0.065	0.023	0.152

Panel B: Spearman correlations across measures of investments												
	BABER	*CAPXGRO*	*CAPX/A*	*CAPX/PPE*	*CAPX/S*	*CAPX/V*	*CFI/A*	*DLA/A*	*INVTGRO*	*LAGRO*	*PPEGRO*	*PPEGGRO*
CAPXGRO	0.386											
CAPX/A	0.420	0.489										
CAPX/PPE	0.591	0.611	0.657									
CAPX/S	0.423	0.385	0.812	0.515								
CAPX/V	0.196	0.381	0.847	0.422	0.629							
CFI/A	0.437	0.424	0.766	0.544	0.589	0.637						
DLA/A	0.532	0.465	0.592	0.584	0.479	0.413	0.603					
INVTGRO	0.306	0.303	0.308	0.356	0.256	0.200	0.334	0.422				
LAGRO	0.546	0.489	0.548	0.630	0.433	0.358	0.565	0.961	0.432			
PPEGRO	0.566	0.597	0.620	0.750	0.506	0.437	0.606	0.780	0.464	0.806		
PPEGGRO	0.540	0.506	0.559	0.731	0.478	0.342	0.569	0.719	0.466	0.741	0.893	
R&D/A	0.623	0.061	0.021	0.268	0.196	-0.276	*0.001*	0.057	0.066	0.100	0.078	0.168

Table 2 (cont.). Descriptive statistics of capital investment and validation benchmark variables

Panel C: Correlations across measures of investment opportunities, sales growth, and employee turnover						
	Q	*VGO*	*ROA*	*$SGRO_{-3}$*	*$SGRO_{+3}$*	*EMPGRO*
VGO	0.954					
ROA	0.045	-0.140				
$SGRO_{-3}$	0.222	0.163	0.318			
$SGRO_{+3}$	0.195	0.180	0.086	0.168		
EMPGRO	0.237	0.203	0.185	0.187	0.487	1.000

Notes: Except for the correlation between R&D/A and CFI/A, all other correlations are significant at 0.0001 levels.

Table 3. Mean annual portfolio Spearman correlations between investment measures and benchmark variables

	BABER	*CAPXGRO*	*CAPX/A*	*CAPX/PPE*	*CAPX/S*	*CAPX/V*	*CAPX/V1*	*CFI/A*	*DLA/A*	*INVTGRO*	*LAGRO*	*PPEGRO*	*PPEGGRO*	*R&D/A*	*(DLA-CAPX)/A*
Panel A: Original investment measures															
Investment opportunity proxy variables															
Q	**0.946** **(163.81)**	0.614 (11.77)	0.796 (19.14)	**0.934** **(70.91)**	0.880 (42.76)	-0.578 (-7.31)	-0.551 (-6.25)	0.639 (9.27)	0.896 (57.81)	0.825 (30.30)	0.914 (41.40)	0.892 (29.47)	**0.934** **(57.14)**	0.807 (17.01)	0.543 (5.14)
VGO	**0.906** **(36.29)**	0.428 (5.80)	0.701 (11.67)	0.864 (21.51)	**0.867** **(43.47)**	-0.772 (-17.17)	-0.723 (-12.08)	0.491 (7.01)	0.836 (30.04)	0.721 (14.41)	0.835 (20.42)	0.798 (17.06)	**0.871** **(27.89)**	0.836 (15.19)	0.398 (3.14)
ROA	0.444 (3.23)	0.750 (15.05)	0.854 (29.12)	0.662 (6.83)	0.358 (3.41)	0.492 (7.34)	0.410 (6.88)	**0.869** **(52.11)**	**0.867** **(23.53)**	0.844 (61.74)	0.856 (17.03)	**0.871** **(18.06)**	0.760 (10.19)	0.027 (0.17)	0.735 (25.34)
$SGRO_{-3}$	0.796 (18.10)	0.317 (6.63)	0.722 (13.60)	**0.922** **(121.35)**	0.757 (17.48)	0.311 (3.75)	0.279 (3.54)	0.699 (21.52)	0.849 (30.96)	0.782 (22.48)	0.876 (32.52)	**0.892** **(37.19)**	**0.952** **(166.20)**	0.396 (4.40)	0.423 (6.52)
Other variables															
$SGRO_{+3}$	0.868 (35.27)	0.904 (47.41)	0.889 (64.70)	0.927 (85.82)	0.913 (70.96)	0.402 (4.51)	-0.045 (-0.48)	0.867 (42.67)	0.961 (159.02)	**0.972** **(190.97)**	**0.967** **(162.26)**	**0.967** **(143.66)**	**0.972** **(188.95)**	0.500 (8.98)	0.723 (8.66)
EMPGRO	0.918 (75.42)	0.948 (89.92)	0.914 (107.75)	0.959 (194.21)	0.893 (52.76)	0.598 (10.44)	0.132 (1.67)	0.922 (66.32)	0.969 (159.65)	**0.984** **(480.77)**	0.980 (283.63)	**0.982** **(263.89)**	**0.981** **(409.26)**	0.445 (9.21)	0.855 (21.33)
Panel B: Industry adjusted investment measures															
Investment opportunity proxy variables															
Q	**0.927** **(106.90)**	0.617 (11.63)	0.866 (52.96)	**0.923** **(65.10)**	0.888 (48.46)	-0.716 (-14.27)	-0.672 (-10.92)	0.738 (29.40)	0.897 (74.16)	0.813 (28.41)	0.912 (53.14)	0.894 (39.49)	**0.928** **(61.63)**	0.750 (21.76)	0.556 (7.79)
VGO	**0.876** **(30.01)**	0.463 (5.43)	0.779 (26.72)	0.859 (21.90)	**0.862** **(40.94)**	-0.847 (-46.63)	-0.787 (-24.13)	0.598 (17.09)	0.825 (27.30)	0.715 (14.21)	0.838 (22.26)	0.821 (20.26)	**0.867** **(24.29)**	0.764 (21.21)	0.403 (3.91)
ROA	0.554 (4.73)	0.751 (16.12)	0.855 (21.56)	0.784 (12.47)	0.475 (4.43)	0.574 (9.17)	0.485 (8.60)	0.857 (33.90)	**0.877** **(25.06)**	0.868 (70.69)	**0.881** **(22.31)**	**0.891** **(21.12)**	0.826 (14.93)	-0.106 (-0.62)	0.761 (37.50)
$SGRO_{-3}$	0.798 (22.99)	0.302 (6.51)	0.751 (19.69)	**0.910** **(105.15)**	0.785 (37.74)	0.342 (6.89)	0.337 (8.89)	0.729 (28.25)	0.841 (30.54)	0.770 (26.90)	0.868 (31.25)	**0.887** **(37.02)**	**0.953** **(132.42)**	0.329 (5.89)	0.490 (13.35)

Table 3 (cont.). Mean annual portfolio Spearman correlations between investment measures and benchmark variables

Other variables															
	BABER	*CAPXGRO*	*CAPX/A*	*CAPX/PPE*	*CAPX/S*	*CAPX/V*	*CAPX/V1*	*CFI/A*	*DLA/A*	*INVTGRO*	*LAGRO*	*PPEGRO*	*PPEGGRO*	*R&D/A*	*(DLA-CAPX)/A*
$SGRO_{+3}$	0.903 (79.06)	0.907 (60.31)	0.911 (92.37)	0.956 (119.33)	0.945 (154.48)	0.522 (11.02)	-0.014 (-0.19)	0.878 (55.50)	0.962 (164.58)	**0.974** **(308.38)**	0.969 (161.52)	**0.971** **(186.34)**	**0.978** **(268.91)**	0.509 (12.72)	0.794 (14.51)
EMPGRO	0.940 (148.60)	0.946 (81.16)	0.940 (113.67)	0.965 (144.32)	0.932 (91.96)	0.737 (29.24)	0.243 (4.02)	0.930 (68.41)	0.973 (185.99)	**0.980** **(327.36)**	0.978 (221.64)	**0.982** **(273.42)**	**0.981** **(303.71)**	0.472 (10.95)	0.855 (22.69)
Panel C Sub-period results															
								1971-1979							
Q	**0.932**	0.457	0.910	0.924	0.887	-0.329	-0.227	0.832	0.924	0.805	**0.927**	0.922	**0.940**	0.604	0.244
VGO	**0.813**	0.261	**0.802**	0.719	**0.831**	-0.625	-0.503	0.592	0.788	0.631	0.744	0.743	0.797	0.587	0.072
ROA	0.902	0.708	0.881	0.950	0.620	0.184	0.115	0.832	0.922	0.864	**0.957**	**0.954**	**0.959**	0.544	0.710
$SGRO_{-3}$	0.869	0.136	0.867	**0.907**	0.815	0.544	0.527	0.762	0.905	0.731	**0.909**	0.903	**0.943**	0.187	0.240
$SGRO_{+3}$	0.875	0.772	0.898	0.854	0.914	0.703	0.351	0.818	0.924	**0.941**	0.927	**0.933**	**0.949**	0.544	0.322
EMPGRO	0.893	0.875	0.873	0.928	0.799	0.690	0.358	0.840	0.932	**0.968**	**0.956**	**0.956**	**0.968**	0.477	0.653
								1980-1988							
Q	**0.955**	0.606	0.848	**0.955**	0.916	-0.560	-0.598	0.743	0.913	0.885	0.938	0.928	**0.959**	0.908	0.505
VGO	**0.924**	0.361	0.788	0.902	0.907	-0.777	-0.736	0.607	0.868	0.797	0.889	0.848	**0.916**	**0.919**	0.299
ROA	0.688	0.888	0.911	0.837	0.376	0.548	0.404	0.914	**0.948**	0.874	**0.953**	**0.966**	0.896	0.115	0.847
$SGRO_{-3}$	0.866	0.330	0.813	**0.932**	0.812	0.370	0.320	0.747	0.879	0.807	**0.907**	0.906	**0.956**	0.659	0.425
$SGRO_{+3}$	0.908	0.880	0.874	0.927	0.813	0.481	-0.052	0.882	0.962	**0.975**	0.961	**0.965**	**0.970**	0.618	0.791
EMPGRO	0.943	0.955	0.925	0.960	0.896	0.722	0.271	0.930	0.975	**0.986**	0.981	**0.982**	**0.983**	0.488	0.866
								1989-1997							
Q	**0.947**	0.755	0.786	**0.954**	0.901	-0.671	-0.672	0.597	0.906	0.875	0.941	0.931	**0.961**	0.857	0.740
VGO	**0.940**	0.641	0.737	**0.948**	0.896	-0.807	-0.802	0.532	0.885	0.840	0.925	0.901	**0.940**	0.911	0.649
ROA	0.314	0.785	**0.925**	0.683	0.367	0.549	0.474	0.912	**0.925**	0.866	0.923	**0.937**	0.777	-0.212	0.780
$SGRO_{-3}$	0.766	0.427	0.655	0.914	0.696	0.114	0.036	0.662	0.849	0.845	**0.873**	**0.908**	**0.959**	0.485	0.586
$SGRO_{+3}$	0.870	0.929	0.820	0.943	0.915	0.199	-0.236	0.830	0.966	**0.978**	0.975	**0.977**	**0.981**	0.462	0.884
EMPGRO	0.935	0.968	0.912	0.970	0.927	0.478	-0.040	0.931	0.981	**0.988**	0.986	**0.988**	**0.988**	0.470	0.924

Table 3 (cont.). Mean annual portfolio Spearman correlations between investment measures and benchmark variables

1998-2006															
	BABER	*CAPXGRO*	*CAPX/A*	*CAPX/PPE*	*CAPX/S*	*CAPX/V*	*CAPX/V1*	*CFI/A*	*DLA/A*	*INVTGRO*	*LAGRO*	*PPEGRO*	*PPEGGRO*	*R&D/A*	(*DLA-CAPX*)/*A*
Q	**0.954**	0.680	0.613	**0.924**	0.827	-0.761	-0.735	0.402	0.824	0.749	0.875	0.828	**0.891**	0.879	0.746
VGO	**0.953**	0.558	0.504	**0.928**	0.847	-0.877	-0.861	0.269	0.814	0.689	0.857	0.795	0.887	**0.941**	0.645
ROA	0.092	0.741	**0.924**	0.568	0.287	0.597	0.534	**0.916**	0.895	0.881	0.891	**0.923**	0.771	-0.420	0.739
$SGRO_{-3}$	0.617	0.378	0.615	**0.892**	0.703	0.116	0.079	0.631	0.800	0.756	0.829	**0.876**	**0.946**	0.310	0.552
$SGRO_{+3}$	0.810	0.924	0.810	0.925	0.930	0.251	-0.148	0.802	0.965	**0.973**	**0.972**	0.970	**0.975**	0.318	0.884
EMPGRO	0.894	0.962	0.897	0.964	0.930	0.444	-0.012	0.930	0.981	**0.986**	0.985	**0.988**	**0.987**	0.355	0.939

Notes: For each investment measure, we rank each year into 50 portfolios based on its annual distribution. Firms ranked in the top 2% of firms are placed in portfolio 1, the next highest 2% firms in portfolio 2, and so on. We then compute the Spearman rank correlations between portfolio medians of the benchmark variables and portfolio medians of investment measures. This procedure is repeated for each year. The reported correlations are means of rank correlations in 36 annual portfolios. In Panel B, investment measures are adjusted by industry median values. Significance for the mean correlation over the sample period is assessed using t-statistics. Newey-West (1987) correction with three lags is applied to t-statistics for correlations related to past and future sales growth.

Table 4. Investment measures that have the highest or the lowest correlations with various benchmark variables in each industry

Industry	No. of firms	*Q*	*VGO*	*ROA*	$SGRO_{-3}$	$SGRO_{+3}$	*EMPGRO*	*Q*	*VGO*	*ROA*	$SGRO_{-3}$	$SGRO_{+3}$	*EMPGRO*
		Panel A : highest correlated investment measures						Panel D: lowest correlated investment measures					
HiTec	4314	13	13	11	12	12	12	6	6	13	2	6	6
Other	3493	12	12	10	12	12	12	6	6	13	2	13	13
Manuf	3179	1	13	7	12	9	9	6	6	13	2	6	13
Shops	2630	12	12	11	12	9	12	6	6	13	2	13	13
Hlth	2001	13	13	7	12	12	12	6	6	13	13	6	6
NoDur	1518	12	12	10	12	12	12	6	6	13	13	13	13
Enrgy	1226	4	5	7	12	12	12	6	6	5	2	13	13
Telcm	933	4	4	7	12	12	12	6	6	13	2	6	6
Durbl	650	1	13	11	12	9	9	6	6	13	2	13	6
		Panel B: 2nd highest correlated investment measures						Panel E: 2nd lowest correlated investment measures					
HiTec	4314	12	12	10	4	11	11	2	2	5	6	13	13
Other	3493	4	4	11	4	11	11	5	2	5	13	6	6
Manuf	3179	13	1	11	4	12	12	2	2	6	6	13	6
Shops	2630	8	8	12	4	12	9	13	13	6	13	6	6
Hlth	2001	1	1	11	11	9	11	7	7	1	2	13	13
NoDur	1518	8	8	11	11	9	11	2	2	6	2	6	6
Enrgy	1226	3	4	13	3	8	8	13	13	2	13	2	6
Telcm	933	12	12	9	4	11	11	5	5	5	6	13	13
Durbl	650	12	1	12	11	12	12	2	2	6	6	6	13
		Panel C: 3rd highest correlated investment measures						Panel F: 3rd lowest correlated investment measures					
HiTec	4314	4	4	8	11	10	9	7	7	6	1	2	1
Other	3493	10	10	12	11	10	10	2	5	6	6	2	5
Manuf	3179	4	4	10	11	11	11	7	7	5	13	2	5
Shops	2630	10	4	10	11	11	11	2	2	2	6	2	2
Hlth	2001	4	4	8	4	11	10	2	2	5	6	2	1
NoDur	1518	10	5	7	4	11	10	13	13	2	6	2	2
Enrgy	1226	5	3	11	7	11	10	2	2	1	9	9	5
Telcm	933	10	13	3	11	8	8	9	9	4	9	9	5
Durbl	650	4	4	10	10	8	11	7	7	5	13	7	2

Note: This table reports the three most powerful and the three least powerful investment proxies (see codes in Table 1) in each industry based on their correlations with various benchmark variables. We classify all non-financial non-utility firms into the following 9 industries (1) NoDur consumer nondurables – food, tobacco, textiles, apparel, leather, toys (0100-0999, 2000-2399, 2700-2749, 2770-2799, 3100-3199, 3940-3989); (2) Durbl consumer durables – cars, TV's, furniture, household appliances (2500-2519, 2590-2599, 3630-3659, 3710-3711, 3714-3714, 3716-3716, 3750-3751, 3792-3792, 3900-3939, 3990-3999); (3) Manuf manufacturing – machinery, trucks, planes, chemicals, off furniture, paper, computer printing (2520-2589, 2600-2699, 2750-2769, 2800-2829, 2840-2899, 3000-3099, 3200-3569, 3580-3621, 3623-3629, 3700-3709, 3712-3713, 3715-3715, 3717-3749, 3752-3791, 3793-3799, 3860-3899); (4) Energy – oil, gas, and coal extraction and products (1200-1399, 2900-2999); (5) HiTec business equipment – computers, software, and electronic equipment (3570-3579, 3622-3622, 3660-3692, 3694-3699, 3810-3839, 7370-7372, 7373-7373, 7374-7374, 7375-7375, 7376-7376, 7377-7377, 7378-7378, 7379-7379, 7391-7391, 8730-8734); (6) Telcm – telephone and television transmission (4800-4899); (7) Shops – wholesale, retail, and some services (laundries, repair shops) (5000-5999, 7200-7299, 7600-7699); (8) Hlth – healthcare, medical equipment, and drugs (2830-2839, 3693-3693, 3840-3859, 8000-8099); (9) Other – mines, construction, BldMt (building materials), Trans (transport), hotels, Bus Serv (business services), entertainment.