

Sensitivity analysis for the determinants of investment appraisal

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Abstract

This study empirically conducts the sensitivity analysis for the determinants of investment appraisal of Pakistani non-financial firms listed at Pakistan Stock Exchange (PSX) across sectors. We employed OLS regression along with common effect and fixed effect model on panel data pertaining to 60 non-listed firms at Pakistan Stock Exchange (PSX) over the period from 2003 to 2015. Empirical results document that leverage, growth, dynamism and inflation have strong positive associations with investment appraisal, however, munificence and GDP influence the process conversely. The study provides useful framework for potential investors to evaluate all these vital factors besides conventional mechanism, prior to making investment decision. Policy makers for non-financial sectors may get benefit by apply this diagnostic model to evaluate prospective investment projects for the most optimistic outcome. Corporate finance literature reveals that there is no formal evidence of determinants of capital expenditure at different levels of economic recessions; therefore, the study is pioneer effort to identify the significant determinants of investment appraisal of Pakistani listed non-financial firms across sectors, eventually, a useful contribution in existing literature.

Keywords: Capital expenditure, investment appraisal, sensitivity analysis, munificence, HHI

JEL Classification: M41, G31, G12

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Introduction

Capital expenditure refers to the planning process used to identify, evaluate and select the most appropriate long-term project in compliance with budget constraints; however, every firm has specific strategies to achieve the desired objectives with optimized utilization of available resources, considering the value creation metaphor for shareholders (Penman, 2010). Capital expenditure decision has long-term range impact on the strategic performance of the organization and is a key to the success or the failure of the organization. The purpose of the investment decisions includes allocation of the firm's capital funds most effectively to ensure the best possible return, because of the sensitive nature of such decisions, as well as future prediction.

Similarly, Mc Connell and Muscarelle (1985) document that capital expenditures affect business performance. At the macro level, capital spending affect aggregate demand and GDP, economic development, and business courses (Dornbusch and Fisher, 1987).

Many studies examine the factors that influence the level of capital expenditures, some researchers focusing on country-level factors and institutional differences across developed and emerging economies (Wnuk-Pel, 2014). Sensitivity analysis method is often applied to help making investment decisions regarding capital budgeting under uncertainty, it is the procedure that examines how changes in certain input values (revenue, costs and the value of investments, etc.), which occur due to inadequate forecasting or for another reason, influence certain criteria and budget total capital values.

Furthermore, according to Christy (1996), there is not any significant relationship between earning per share and share trends, especially capital expenditure for the investment decisions. by Christy (1966) Contrary, size is presumed to influence the investment decisions of the firms (Klammer, 1973; Hall and Weiss, 1967); however, the literature assumes that investment decisions have a major impact on the future well-being of the firm (Weston and Brigham, 1979).

As the normative goal of capital expenditure is to maximize the net economic gain to owners of the firm, it might seem preferable to isolate the influence of corporate capital expenditure practices on share prices (Fama, 1969; Mandelker, 1994; Alexander and Bucholz, 1978; Kudla, 1980). Further, Sundem (1980) observed that capital expenditure has a substantial short-run

negative effect on the earnings of firms. However, Lu-Andrews and Yu-Thompson (2015) emphasize upon the role of CEO in strengthening the liquidation value and tangibility of assets when he has more debt-like compensations. However, Holmes and Maghrebi (2015) argue that the results could be different due to non-linear behavior of Tobin's q with investment expenditure.

Consistently, some other researchers focused on country-level factors and institutional differences across developed and emerging economies (Pel, 2015). Sensitivity analysis method is often applied to help making investment decisions regarding capital budgeting under uncertainty, it is the procedure that examines how changes in certain input values (revenue, costs and the value of investments, etc.), which occur due to inadequate forecasting or for another reason, influence certain criteria and budget total capital values.

The study warrants the need to examine how different economic periods differently influence investment decisions. The study tends to investigate the influences of different factors in pre-and post-financial crises and inclines to investigate the significance of different sectors in Pakistan, focusing on sector level determinants for capital expenditure to the knowledge gap identified in corporate finance literature, as there is no formal evidence of capital expenditure factors at three different levels in economic recessions. The objectives of study are; 1) to identify the significant determinants of investment appraisal of Pakistani listed firms across sectors in different economic recessions and 2) to categorize whether and how investment decisions are differing in different economic recessions.

Theoretical Background

From Barclay's and Smith's (2005) theory of hierarchy, it means that there are relatively few companies that know investment opportunities, and free cash flow has low debt ratios because that money will be used to repay debt. Therefore, it is suggested that chip companies with low operational cash have high debt ratios because of their reluctance to raise new funds. It should be emphasized that when the symmetry of information is not clear, then the debt company will become bankrupt if additional funds are needed, and finally issue shares to meet the remaining capital requirements. It is clear at this stage that companies prefer domestic external financing sources expensive, not only for capital cost, but to avoid dilution of the current shareholders' control.

Therefore, the import theory of hierarchy is that companies that achieve profitability and can generate profits are expected to use less capital than those that do not generate high profits. In support of this Symeou (2008) stated that the reason companies can choose to maintain spare debt power is to maintain your credit rating because it can take several years to recover from deterioration. Maintaining local debt financing improves the company's ability to withstand a period of poor performance and allows you to run a recovery plan.

The Signals theory according to Gatsi and Akoto (2010), is a theory based on the assumption that the managers involved are superior to the information activities of the company, which managers can increase the influence element. However, in contrast to the time of the market where stock offers are trying to increase the "cheap" model the capital implies that financing decisions are primarily intended to transfer trust managers in the prospects of the company to overseas investors (Barclay and Smith, 2005). Most often, this is done to raise the value of stocks when managers think they are undervalued. Debt companies require to make a fixed set of cash payments to debt holders during a period of debt. Companies may have to go bankrupt if they fail to meet their debt obligations.

1. Literature review

Many studies examine the factors that influence the level of capital expenditures, some researchers focused on country-level factors and institutional differences across developed and emerging economies (Pel, 2015). Sensitivity analysis method is often applied to help making investment decisions regarding capital budgeting under uncertainty, it is the procedure that examines how changes in certain input values (revenue, costs and the value of investments, etc.), which occur due to inadequate forecasting or for another reason, influence certain criteria and budget total capital values

1.1. Determinants of Capital Expenditure at Firm level

According to Griner and Gordon (1995), sales is normally used to control for firm size and measured by total revenues generated by company. Haller and Murphy (2012) also find that firm size is one main determinant of Investment appraisal decision, approaching the size of the company by income, the

consumer price index published in the Swedish Statistics. In estimating equation, we imagine the associated volume to use the recommended investment appraisal (Brounen and Eichholtz, 2003; Hermes, 2007).

Profitability is measured by net profit, as well as some of the profitability ratios (return on equity, return on assets and the ratio of profit margin). It should be noted that the most profitable companies are using the net present value and in terms of other methods, they do not largely or adversely affect this variable. It is said that the investment projects are mutually exclusive if only one can be acceptable. The Firms having greater sales abroad use less the coefficient of profitability. Furthermore, overseas sales have no positive impact relation with callback technique. Therefore, this outcome does not support the conclusions Holmen and Pramborg (2009).

The firms having leverage give more concentration to the period to improve their startup outlay, as the high degree of financial risk is involved. We that the greater leverage associated with the use of the reward method is not recommended, as it looks positively correlated with economic ambiguity (Binder and Chabot 1996; Shawl and Sundem, 1980). An alternative interpretation is expected to pay a high leverage and it is used often by companies, i.e. by these firms having financial problems, and thus, they may feel they have to uncover investments that quickly recover the initial investment (Daher & Saout, 2015). On the other hand, Block (2007) inferred that financial organizations can exercise indirect pressure on the analytical methods used by companies to make investment decisions.

Growth opportunities are given by the price-to-earnings (P / E) ratio because it is believed that a high P / E means that the prices of capital market is rising and expects the company to have a greater growth in the future. According to Brailsford and Yeoh (2004), the growth opportunities are significantly important to explain the market reaction to Investment appraisal. Contrary to our expectations, and the Swedish fastest growing companies employ TIR often, but the rate of return (recommended) a lot less. Gaver, Gaver and Battistel (1992) say that in the identification of joint investment opportunities the companies rely long-term vision to achieve a balance between incentives for management and the interests of shareholders. Commonly, the past studies reveal that capital spending is influenced by policies and plans for compensation on

the basis of incentives aimed at harmonizing the interests of managers and shareholders. Wu and Wang (2005) reported on the continuation of a sturdy helpful connection among the implications of the proclamation and the IOP, but fail to discover the impact of issuers with high IOP.

Matoussi, Karaa and Maghraoui (2004) tested the relationship between Investment appraisal level and liquidity using a Tunisian data in (2001). Elliot (1973) shows that liquidity affects investment appraisal and provide further evidence that liquidity significantly strengthens the investment appraisal. In contrast with Chakrout and Matoussi (2012) they show a positive and significant effect on Investment appraisal. One explanation is that Tunisian investors have no confidence on the disclosed information in annual reports and do not use it to make their decisions.

The company size is approximated by revenue adjusted for inflation using the Swedish Consumer Price Index published by Statistics Sweden. The company size has generally been positively correlated with the use of recommended capital expenditure methods (Graham and Harvey, 2001; Brounen, 2004). The profitability of the company is measured by the amount of net profits as well as some profitability ratios (ROE, ROA, and Profit Margin Ratio). Moreover, foreign sales were not significantly positively related to the use of the pay-back method. The latter result thus fails to support the findings in Halmen and Pramborg (2009). Our research provides evidence that high leverage companies tend to use more the PB and NPV but they have insignificant or negative relationships with other techniques. We expect high leverage to be related to the use of the non-recommended pay-back method, which has been found to be positively associated with economic uncertainty (Binder and Chaput, 1996; Schall and Sundem, 1980). Growth opportunities are proxied by the price-earnings (P/E) ratio because high P/E-ratios are thought to mean that the capital market expects the company to have high future growth, and leverage is measured by the debt-to-asset ratio. According to Brailsford and Yeoh (2004), the growth opportunities are significantly important to explain the market reaction to capital expenditure announcements.

1.2. Determinants of Capital Expenditure at Country level

Public fixed investment was 12.4 percent of GDP during 1973-74 to 1983-84 compared with 9.7 percent and 9.4 percent during the two adjacent periods as argued by Arby (2001). He suggests that some positive structural changes occurred during this period. Gross domestic product (GDP) is the main indicator to measure the health of the economy in a country. The author defines GDP for a country of the market value of all goods and services produced in the final country during a certain period. Inflation is the rate at which the general level of prices of goods and services continues to increase, and, later, the decline in purchasing power. This can be defined as a change in the purchasing power of the currency of the pressure exerted on the producers of the raw material costs. This can be passed on to consumers, or can be absorbed by profits, or offset by increased productivity. Capital budgeting is the process used to evaluate the project. One of its objectives is to provide the expenses related to assets and future cash flows accurately, after considering all the factors that may affect future expenses. However, this is not true. Inflation affects two aspects: cash flow and reduce Rate9 an increase of 10.3 percent, Pakistan (2010).

1.3. Determinants of Capital Expenditure at Sector level

More recently, Smith, (2014) reported that firms operating in highly munificent environment with above-target debt, which have more abundant resources, tend to reduce leverage and rapidly adjust towards their target debt.

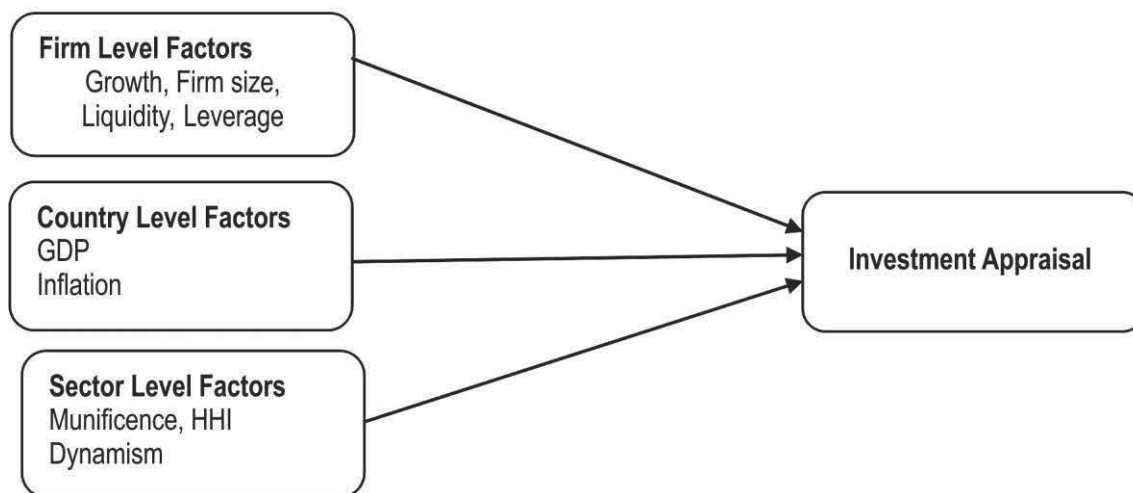
In this regard, Simerly and Li (2000) observed a positive association between leverage and firm's performance which operates under stable environment. In contrast, leverage negatively related with the firm's performance that operates under dynamic environment. According to Kayo and Kimura (2011), firms that operate within a sector or industry tend to have similar properties; hence, they expect to have similar environment.

Based on industry concentration, it can be divided as high and low concentrated industries. According to Moeinaddin, Nayebzadeh and Ghasemi (2013), the most important index of industry concentration is Herfindahl Hirschman Index, which is stronger and common in calculating the concentration level of industries. The

level of industry concentration affects the firm leverage differently. The greater the HH Index level, the more concentration and less competitiveness shall occur and vice versa (Setayesh and Kargarfard, 2011). Therefore,

from this point of view to capture the industry concentration impact on leverage, the Herfindahl-Hirschman Index (HH Index) is used to measure the firm size in relation to sector or industry.

Figure no. 1. Theoretical Framework



1.4. Techniques of Capital Expenditure

According to Shinoda (2010), the payback period method is said to be theoretically irrelevant and mistaken because the simple payback period (SPP) method ignores the time value of money and cash flows beyond the cutoff date. One of the major disadvantages of simple payback period is that it ignores the time value of money. Even if we use the discounted payback period (DPP) method, which was modified to eliminate the limitations imposed by ignoring the time value of money, we cannot resolve the difficulty of ignoring cash flows beyond the cutoff date (Shinoda, 2010). When considering the maximization of stockholders' wealth hence and after DCF techniques, the techniques under this category are Net present value NPV, Internal rate of return IRR, Profitability index PI etc.

The researchers Brealey, Myers, & Allen (2006) consider the NPV technique the superior one. Accounting rate of return (also known as simple rate of return) is the ratio of estimated accounting profit of a project to the average investment made in the project. ARR is used in investment appraisal. The advantage of

ARR is that it is easy to calculate (Blocher, 2008). Internal rate of return (IRR) is the discount rate at which the net present value of an investment becomes zero. IRR is misleading while making choice among mutually exclusive projects (Ross, 2005). Profitability index is an investment appraisal technique calculated by dividing the present value of future cash flows of a project by the initial investment required for the project.

2. Research methodology

The examination of noticeable phenomenon via geometric, numerical or computational techniques in social and natural sciences is relevant to quantitative research. Many researchers (Punch, 1998; Mertens, 2003; Newman, Ridenour, Newman and DeMarco, 2003) have suggested that to get better understanding of a research problem, this should be examined through numerical tendency from quantitative data. Furthermore, as this study uses the information for 60 firms over the period of 2003 to 2015 to test the capital budgeting techniques importance panel data estimation technique is suitable for this purpose. The data in work is resulting

from Financial Statements Analysis of Pakistan stock Exchange non financial listed firms published by State Bank of Pakistan and Business Recorder. In this study panel data is used, one faces the question whether the individual effect is taken as common, fixed or random factor. (Common effect model and fixed effect model). In the light of previous researches Booth *et al.* (2001), this model confines the complete information including omitted variables effect. The study uses the OLS regression, in line with the Shah and Khan study (2007)

on the rational use of the combined ordinary squares model and ignores the time-series and cross-section of other enterprises homogeneously affected in nature. Fixed effects model is used when the stable characteristics of the companies in the sample should be monitored for a certain period of time required. These methods are also used by Builder (2008), and Rashid and Rahman (2009) in their study. However, the variables used in the study are described in **Table no. 1** with corresponding proxy and empirical evidence.

Table no. 1. Description of Variables

Variables	Proxies/ Formula	Empirical Evidences
Investment Appraisal	TFA t - TFA t-1	Hamidi 2015
GDP	GDP per capita	Vries (2010) Mahmood T. and Arby M.F. (2012)
INFLATION	Change in CPI	Annalien (2010) Mahmood T. and Arby M.F. (2012)
Growth opportunities	Market to book ratio	Leon and Kester (2008)
Profitability	ROA = Net profit / Total Assets	Hossan and Ali (2012) Samuel and Ranti (2013)
Leverage	Total debt / Total Assets	Binder and Chaput, 1996; Schall and Sundem, 1980
Firm Size	Natural log of sales	Mehta (2012) Ali A. Hossan F. (2012) Hamidi 2015
Liquidity	Current Assets/ Current Liabilities	Handa and Schwartz (1996) Mattoussi et al. (2004)
Munificence	Regress the time against sales of sector over the period of study Taking the ratio of the regression slope coefficient to the mean value of sales	Smith (2014) Naveed, Ramakrishnan, Anuar and Mirzaei (2015)
Dynamism	Standard error of munificent slope divided by the mean value of sale over same period	Naveed et al. (2015)
HHI	By summing the square of percentage of markets share held by the firms within a given sector.	Setayesh and Kargarfard, (2011). Naveed et al. (2015)

2.1. Econometric Model

Equation 2.1 - Provide the association between capital expenditure and its determinants by using OLS regression at three different levels.

$$CE = \beta_0 + \beta_1(PRF)_{it} + \beta_2(FS)_{it} + \beta_3(LEV)_{it} + \beta_4(GO)_{it} + \beta_5(LIQ)_{it} + \beta_6(GDP)_{it} + \beta_7(INF)_{it} + \beta_8(MNF)_{it} + \beta_9(DYN)_{it} + \beta_{10}(HHI)_{it} + \varepsilon_{it} + \mu_i$$

Equation 2.2 - Provide the association between capital expenditure and its determinants by using fixed affect at three different levels.

$$CE = \beta_0 + \beta_1(PRF)_{it} + \beta_2(FS)_{it} + \beta_3(LEV)_{it} + \beta_4(GO)_{it} + \beta_5(LIQ)_{it} + \beta_6(GDP)_{it} + \beta_7(INF)_{it} + \beta_8(MNF)_{it} + \beta_9(DYN)_{it} + \beta_{10}(HHI)_{it} + \varepsilon_{it} + \mu_i$$

3. Results and discussion

Sensitivity analysis is the approved method of calculation to predict changes in the data entry on the results of the model output. Often, this procedure is used for making investment decisions with respect to the capital budget under uncertainty. Standards and the effectiveness of the sensitivity of the analysis of the balance of capital is a procedure for calculating research and management report, etc. changes in individual securities listed on the securities account of individual standards as well as evaluation of investment projects. Further, because it is likely not to be among those values in the future tens of titles and other possible factors. If we consider all the possible consequences, it is necessary to analyze in advance, possible changes in values starting in the state of facts or the results that were obtained by calculating these values, held by the sensitivity analysis procedures.

In other words, it is a procedure that examines how changes in certain input values (revenue, costs and the value of investments etc.), which occurs due to insufficient forethought or for another reason, affect certain criteria and the total capital budget values. The application of this analysis of the possible points of

maximum or minimum, you can take valuable time, however, still allows an investment project that has been justified and accepted for investigation.

The diagnosing testing includes the descriptive statistics and correlation matrix. It includes mean, median and mode. The descriptive summary of textile sector determinants at three different level firm, country and sector level is given below.

The descriptive summary of overall data set is given in Table no. 2. In accordance with the above results the mean value of capital expenditure in overall data set is -0.03%. The minimum value is -11.40 and maximum values 6.79. The median is 0.04 for overall data set. The standard deviation of capital expenditure is 1.90 which shows the low risk of dependent variable capital expenditure. Moreover, the leverage in overall data set shows mean 37.38 that is high variation. The minimum and maximum values also reported as -10.80 and 53.37 for the leverage. The standard deviation of leverage is 24.77% which shows the risk of independent variable. Further standard deviation of return on assets is 8.53 indicating that there is very low risk for the return on assets in overall data set. The mean value is 4.66 which illustrates the variation in return on assets. The maximum value is -11.4 and minimum is 6.97.

Table no. 2. Description Statistics

Variable	CA	ROA	LE	LIQ	FS	GO	MNF	DYN	HHI	INF	GDP
Mean	-0.03	4.66	37.38	71.89	20.56	1.12	65.18	20.20	0.01	87.56	4.64
Median	0.04	2.69	2.08	1.88	10.85	1.06	23.18	23.03	4.24	82.53	4.43
Min.	-11.47	-51.62	-10.80	51.56	-0.05	0.01	3.16	11.24	0.02	47.20	0.36
Max.	6.97	12.41	53.37	50.57	12.96	8.55	17.14	60.86	0.01	14.17	8.95
SD	1.90	8.53	24.77	35.31	64.18	0.56	14.59	52.73	0.03	32.11	2.13

Source: Estimation output

Moreover, standard deviation of liquidity is 71.89 indicating that there is also very high risk. The mean value is 35.31 that shows the variation in liquidity. The minimum value is reported -51.56 and maximum 50.67 for liquidity in overall data set of non-financial sectors of Pakistan. Another factor at firm level, firm size, shows mean value in overall data set is 20.56. The standard deviation of firm size is 64.18, which shows the risk of independent variable that is very low in overall data set. The mean value of growth in textile sector is 1.12. The minimum and maximum values also reported as 0.01

and 8.55. The standard deviation of capital expenditure is 0.56 which show the risk of dependent variable. Munificence, Dynamism and HHI, the determinants of capital expenditure, are reported for non-financial sector. In the light of above results mean value of munificence is 65.18 and value of standard deviation is 14.59 these values indicate normally distribution of munificence. Furthermore, mean value of dynamism is 20.20 and standard deviation is 52%, which means dynamism is highly risky. The variation in HHI is 0.01 and its standard

deviation is very low it means there is now risk in case of HHI for overall data set.

To end with GDP and inflation, two determinants of capital expenditure at country level also reported in above table; the mean values of inflation and GDP are 87.5 and 4.64% designating that inflation shows high

variation in textile sector of Pakistan. In contrast the value of GDP shows low variation. The standard deviation of inflation is 32.11 also high but the GDP shows 2.13 it means there is very low risk. Further the results of correlations Matrix to check the issue of multicollinearity are given below.

Table no. 3. Correlation Matrix Overall

	CA	ROA	LE	LIQ	FS	GR	MUN	DYN	HHI	INF	GDP
CA	1.000	-0.361	-0.0547	-0.0706	0.0050	0.1490	-0.1263	-0.1254	-0.0216	0.680	0.0836
ROA		1.0000	-0.0176	-0.0352	-0.0442	0.0175	0.0636	0.0768	-0.0286	0.604	-0.0131
LEV			1.0000	-0.0007	-0.0298	0.0898	0.0506	0.0541	-0.0140	-0.1252	0.0817
LIQ				1.0000	0.0685	-0.0603	0.0306	0.0252	-0.0503	-0.2199	0.2127
FS					1.0000	0.0075	-0.0412	-0.0470	0.1110	-0.2169	0.1994
GR						1.0000	-0.0465	-0.0459	0.0125	0.0535	0.482
MUN							1.0000	0.9986	-0.0386	-0.1672	0.1362
DYN								1.0000	-0.0404	-0.1635	0.1335
HHI									1.0000	-0.1125	0.1060
INF										1.0000	0.5532
											1.0000

Source: Estimation output

Table no. 3 above shows the results for the data set of sugar sector of Pakistani non-financial listed firms, reporting the minimum and maximum values. In accordance with above results, the maximum value of variable is firm size that shows 0.6815 in sugar sector data set. Some figures are reported with negative

correlation and other shows positive correlation within limit. This value is not greater than 0.7 or 7 percent. In this sense, we also say that there is no issue of multicollinearity in this model and no need to run VIF test.

Table no. 4. Results of Sensitivity Analysis

Variable	Pre (OLS)	Post (OLS)	Pre (Fixed)	Post (Fixed)
ROA	0.620(-0.003)	0.157(-0.005)	0.620(-0.003)	0.035(-0.015)
LEV	0.002(-0.002)	0.00001(0.001) ***	0.0020(-0.002) ***	0.0001(0.0001) ***
LIQ	0.711(-2.68)	0.537(0.001)	0.7117(-2.684)	0.537(0.001)
FS	0.237(0.001)	0.0467(-0.005)	0.237(0.001)	0.0467(-0.005)
GR	0.003(0.25) ***	0.00001(0.049) ***	0.0037(0.251) ***	0.00001(0.049) ***
MUN	0.0007(-0.05) ***	0.755(-0.004)	0.0007(-0.051) ***	0.755(-0.004)
DYN	0.0071(0.014) ***	0.773(-0.001)	0.0007(0.014) ***	0.773(-0.001)
HHI	0.271(-42.07)	0.261(33.2)	0.2715(-42.07)	0.261(33.2)
INF	0.006(0.41) ***	0.188(-0.004)	0.006(0.41) ***	0.188(-0.004)
GDP	0.020(-0.119) **	0.196(0.067)	0.0200(-0.119) **	0.196(0.067)
R-squared	0.3915	0.874251	0.19915	0.874251
P-value	0.000203	1.7e-150	0.000203	1.7e-150

Source: Estimation output

Table no. 4 represents the results of sensitivity analysis or pre and post windows created on the overall data set of sugar and textile sector. The results are reported on the basis of OLS and fixed affects model to check the influences of different factors on investment in different economic conditions. This inclusive study makes a sensitivity analysis for the determinants of investment at three different level e.g. firm level, country level and sector level. Sensitivity analysis is the approved method of calculation to predict changes in the data entry on the results of the model output. Often, this procedure is used for making investment decisions with respect to the capital budget under uncertainty. The above table findings are described by using both models, either OLS regression or fixed affects model. In the light of above, results the main findings are quite different in pre-and post-period.

According to above, results of textile and sugar sector overall data set of non-financial listed firms of Pakistan, the return on assets shows negative sign of coefficient and p- value is insignificant in pre-period by applying both models OLS regression and fixed affects model. ROA is insignificant it means no effects on dependent variable of the investment decision. Further, in post period ROA is negatively insignificant. In contrast, by using fixed affects model in post period the results are different; the sign of coefficient is negative and p-value is significant. Growth companies might also be more likely to calculate the profitability index, because they might have more potential new investment. Investment projects are said to be mutually exclusive if only one could be accepted.

Furthermore, sign of coefficient for leverage is negative its p-value is significant in pre-period by applying both models OLS regression and fixed affects. There is negative significant relationship between leverage and investment in pre-financial period. Similarly, to the post period, the sign of coefficient for leverage is positive and p-value is significant.

Another factor is liquidity, which shows negative insignificant relationship with investment because the sign of coefficient is negative and p-value is significant in pre-period by applying both models

OLS regression and fixed affects model.

Furthermore, in post period the sign of coefficient for liquidity is positive but it is insignificant; this discussion is supported by Saquido (2003) who concluded that liquidity is insignificantly related to investment; but there remains a significant relationship between investment and revenue growth and fixed capital intensity.

The firm size shows the sign of coefficient positive and p-value insignificant, indicating that there is no relationship between the firm size and investment in pre period by applying both models OLS regression and fixed affects model. In post period by applying both models OLS regression and fixed affects model the result is negative significant. Graham and Harvey found a statistically significant negative relation between size and pay-back in particular in the U.S., while Brounen D. found no statistically significant relation between size and pay-back in any of the four (Germany, France, Netherlands, and UK) countries.

In contrast, growth rates show a positive sign of coefficient and the p-value is significant, indicating that there is a positive significant relationship between growth and investment in pre and post period by applying both models OLS regression and fixed affects model. Contrary to our expectations, Swedish listed companies with higher growth opportunities (which we measured by their P/E ratio) used IRR (not recommended) more often but profitability index (recommended) less often.

Some other determinants at sectors level e.g. Munificence shows negative significant relationship with investment because the sign of coefficient is negative and p-value is significant by applying both models OLS regression and fixed affects model. It means there is positive significant relationship between munificence and investment in pre-period. In contrast the sign of coefficient in post period for munificence is negative but p-value is significant by applying both models. Dynamism shows the sign of coefficient positive and p-value is significant, indicating that there is significant positive relationship between dynamism and investment by applying both models OLS regression and fixed affects model. HHI sign of coefficient is negative and its p-value is insignificant, indicating that there is no relationship between HHI and investment by applying

both models OLS regression and fixed affects model. In post period, the sign of coefficient is positive and p-value is insignificant by using both models. Hirshleifer and Suh's studies (1992) similarly show how compensation contracts are used to induce self-serving managers to take high-value and high-risk projects.

Finally, at country level the reported determinants are inflation and GDP. The sign of coefficient for inflation is positive and p-value is significant which means there is significant affects in pre-period by applying both models OLS regression and fixed affects model. The mechanism by which inflation affects economic growth in the nonlinear environments over the long-term is represented by Investment. The inflation rate below the threshold level has a positive effect but little effect on investment, while the one above the threshold brings a negative and significant impact on the strong investment.

In post period, the result is insignificant and sign is negative by applying both models. Furthermore, the sign of coefficient for GDP is negative and p-value is significant. It indicates that GDP has effects on investment in pre-period by applying both models OLS regression and fixed affects model. However, the sign of coefficient is still positive but the p-value is insignificant in post period by applying both models. Some other researchers focused on country-level factors and institutional differences across developed and emerging economies (Wnuk-Pel, 2014).

4. Discussion of results

The research objective was to identify the significant determinants of investment appraisal of Pakistani listed firms across sectors in different economic recessions.

Table no. 5. Summary Results

Determinants	Significance
ROA	Significant (negative)
LEV	Significant (Positive) ***
GR	Significant (Positive) ***
MUNIF	Significant (negative) ***
DAYN	Significant (Positive) ***
INF	Significant (Positive) ***
GDP	Significant (negative) **

Source: Estimation output

In contrast, by using fixed affects model in post period the results are different the sign of coefficients negative and p-value is significant. It is found that profitable companies use more NPV and the relationship with other methods is either not significant or negatively related to this variable. Growth companies might also be more likely to calculate the profitability index, because they might have more potential new investment. Furthermore, the sign of coefficient for leverage is positive and p-value is significant.

In contrast, growth rates show positive sign of coefficient, the p-value is significant which indicates that there is positive significant relationship between growth and investment in pre-and post-period by applying both models OLS regression and fixed affects model. Some other determinants at sectors level e.g. Munificence shows negative significant relationship with investment because the sign of coefficient is negative and p-value is significant by applying both models OLS regression and fixed affects model. It means there is positive significant relationship between munificence and investment in pre-period. In contrast, the sign of coefficient in post period for munificence is negative but p-value is significant by applying both models. Dynamism shows the sign of coefficient positive and the p-value is significant indicating that there is significant positive relationship between dynamism and investment by applying both models OLS regression and fixed affects model.

Finally, at country level the reported determinants are inflation and GDP. The sign of coefficient for inflation is positive and p-value is significant which means there is significant affects in pre-period by applying both models OLS regression and fixed affects model. In post period, the result is insignificant and sign is negative by applying both models. The inflation rate below the threshold level has a positive effect but little effect on investment, while above the threshold at which a negative and significant impact on the strong investment.

Furthermore, the sign of coefficient for GDP is negative and p-value is significant. It indicates that GDP has effects on investment in pre-period by applying both models OLS regression and fixed affects model. However, the sign of coefficient is still positive but the p-value is insignificant in post period by

applying both models. Some other researchers focused on country-level factors and institutional differences across developed and emerging economies Whuk-Pel, (2014).

Research Objective 02 - To categorize whether and how determinants of investment decisions are differing indifferent economic recessions?

Table no. 6. Determinants in Pre-Period and Post-Period

Variables	Pre-Period	Post Period
ROA	Insignificant (negative)	Significant (negative) ***
LEV	Significant (negative)	Significant (Positive) ***
GR	Significant (Positive) ***	Significant (Positive) ***
MUNIF	Significant (negative) ***	Insignificant (negative)
DAYN	Significant (Positive) ***	Insignificant (negative)
INF	Significant (Positive) ***	Insignificant (negative)
GDP	Significant (negative) **	Insignificant (Positive)

Source: Author's compilation

In the light of above table the results for the significant determinants of investment appraisal are quite different in pre-and post-financial period. Return on assets shows insignificant relationship in pre-period but in post the results are significant at 99% level. In accordance with the level of significance, we finalized our hypothesis. In line with the relationship between return on assets and investment appraisal, this is significantly negative in post period.

Leverage shows a significantly negative relationship with investment appraisal in pre-period but in post period this relationship is significantly positive at 99% level. Finally, there is positive significant relationship between leverage and investment appraisal. Furthermore, growth shows significant positive relationship in both periods at 99% level of significance. Munificence shows significant negative relationship in pre-period at 99% level of significance but in post period this relationship is insignificant. Dynamism shows significant positive relationship in pre-period at 99% level of significance but in post period this relationship is insignificant. Inflation shows significant positive relationship in pre-period at 99% level of significance but in post period this relationship is negatively insignificant. GDP shows significant negative relationship in pre-period at 99% level of significance but in post period this relationship is positively insignificant.

In conclusion, in the light of above discussion, there are quite different results in pre-and post-windows of economic recession. The key findings or hypothesis of this study developed on the base of evidence and with the help of the signs of coefficients, significant or insignificant at 99% level. Some factors show the same results but the level of significance is different. Finally, the findings of this study are based on empirical evidence and the results are different in pre-and post-windows or make a sensitivity analysis.

5. Conclusion and implications

In conclusion, the results showed the sensitivity analysis for investment of Pakistani non-financial listing firms and the associated techniques supported the significant determinants of investment appraisal. There are other factors not related to the investment appraisal in sensitivity analysis. Investors can invest after checking the behavior in different economic conditions. However, it was not possible to get the same result when making a sensitivity analysis for the economic recession. In each economic window, different results are reported. Finally, the key findings of this study are based on diagnostic testing in which we test the health of instruments. The OLS regression and fixed affects model are also used to check the influence in different economic windows. In the future, by applying

dynamic modeling, adding some other factors at three different levels, increasing number of sectors, a sample with latest data set area of study can be investigated. The study is implacable for that investors need to analyse the use of investment factors carefully, to have a reasonable knowledge of the business before making an investment decision. Investors must evaluate all the variables in the environment rather than lookat just one

variable. Investors also need to diversify their investments in various companies through the development of sensitivity analysis for different economic recessions. The study is also implacable for the financial intuitions to set their policies. Finally, study is also applicable for students making future research for different economic recessions and sectoral analyses.

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