A Cross-Country Multi-Model Empirical Investigation into the Firm Value of Cash

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1. The Research Problem

1.1. Introduction

What firm value do shareholders in distinctly different markets place on Changes in Cash and Cash Holdings, and to what extent do these valuation changes vary between different countries? In 2017 Apple Inc owned approximately US$ 163 billion in cash and marketable securities due to more than two decades of successful and high margin technology products. The firm's cash and marketable securities were reduced to US$ 93 billion by June 2020 (AppleInc, 2020), mostly through share buy-backs due to shareholder criticism that the firm was holding excessive levels of cash. The criticism was based on a global saturation of smartphones and lower growth levels in other business areas. In contrast, Alphabet Inc approximately US$ 121 billion in cash and marketable securities (Alphabet, 2020). Google has record-breaking firm results in June 2020 and is a more diversified technology company that dominates in the firm's key areas. Both firms are regarded as growth companies and are priced on a 35-times share price to historic earnings ratio. The combined market value of the companies is some US$3 trillion and comprise over 11% of the S&P 500 Index.

The importance of placing a firm value on these two firms' significant cash levels is that shareholders are aware of the near-term risks facing both companies. These risks include changing privacy laws, changing global demand patterns, escalating trade protectionism, and intellectual property disputes, which may prejudice supply chains.

My focus in this paper is on the shareholder firm value attributable to *changes* in firm Cash Holdings and firm Cash Holding levels. To increase the study's relevance and generalizability in a connected and global investment environment, the empirical investigation

considers firms in three distinctly different markets – the USA, the UK, and Brazil. I use a methodology to examine these constructs on firm value from the perspective of excess equity returns and Tobin's q. The study's empirical predictions suggest that shareholder value differs greatly between markets for a unit change in the variables of interest. The variables in the analysis are discussed further below and in more detail in Chapter3.

In this Chapter, I provide a short overview of the research problem in the context of existing theory and briefly summarize the seminal contributions on cash value analysis. I then introduce several problem statements that are considered in more detail further in the paper. This is followed by a description of the terms and constructs used in the empirical analysis. Finally, I discuss the significance of the study and the contribution to the existing literature.

I propose that the nucleus of the conflicting manager-shareholder relationship manifests in company Cash Holdings and the associated changes in such holdings. Agency cost theory acknowledges that managers have an incentive to deviate from decisions that may be in the shareholders' interests in circumstances where there is no explicit understanding and mutual agreement regarding management incentives to avoid such costs. Agency cost theory from a cross-country investment perspective is thus the fundamental theoretical basis of this dissertation.

In this regard, Jensen and Meckling noted the obstacles in organizational structures in the context of managerial behavior and agency costs (Jensen & Meckling, 1976). They specifically consider agency costs and the nature of the firm regarding the 'separation and control' problem as it relates to managers and shareholders. The fact that manager and shareholder interests diverge because of the agency problem is not a recent concern. Adam Smith noted that directors of firms could not be expected to behave with the same vigilance over company affairs as the

partners in a partnership and suggested that ‘negligence and profusion’ is a logical and probable consequence of such a commercial arrangement (Smith, 1776).

In environments where corporate governance or shareholder power is inadequate, company managers may decide to increase and maintain cash balances for the purposes of potential operational expenditures and capital investments that may not be in shareholders' interests. Conversely, it is also as likely that managers will under-invest despite robust opportunities if the manager believes that the personal risk-reward ratio is unattractive in executing certain investments.

In consideration of the importance of these issues and during the late 1990s, several studies were undertaken on the specific drivers of firm Cash Holdings. Specifically, three seminal studies involve a theoretical cost-benefit analysis of varying levels of Cash Holdings. They conclude that those companies with robust growth profiles, unpredictable cashflows, and fluctuating external financing access are likely to maintain higher cash balances (Kim, Mauer, & Sherman, 1998) (Harford, 1999; Opler, Pinkowitz, Stulz, & Williamson, 1999). These studies did not consider firm value and the variation in firm value of Cash Holdings.

Pinkowitz and Williamson studied the value of cash from the perspective of management investment decisions (Pinkowitz & Williamson, 2002). The authors used the Fama and French methodology and concluded that outside stakeholders investing in companies that exhibit more volatile investment opportunities (than the average company) and superior growth outlook place a higher value on cash than firms with the opposite investment and growth profile. The dependent variable used in the study is the market-to-book value of the firm (Fama & French, 1998).

Faulkender and Wang extend the value of cash literature by developing a methodology that presents estimations of the incremental value embedded in equity values that are a result of variations in cash balances (annualized). The dependent variable in the study is stock *i*'s return during fiscal year *t* less the benchmark return over the period, or 'excess return' (Faulkender & Wang, 2006). These studies are discussed further in the literature review in Chapter 3.

In evaluating the extent of the agency problem described by Jensen and others above, I adopt the shareholder perspective in assessing the firm value of Cash Holdings and the extent to which changes in cash impact firm value across markets. Two firm value-dependent variables apply in this study: excess equity returns ($r_{i,t} - R_{i,t}$) to existing shareholders and Tobin's firm market value to firm replacement value (q).

Conducting a cross-country comparison in the paper is important from the perspective of existing shareholders and potential global investors. Markets may differ on key characteristics that can determine agency costs and shareholder appetite for higher firm-level Cash Holdings. Tables 1 and 2 illustrate some of these market differences.

Table 1: Market Characteristics

Market capitalization is measured in USD trillion. The dividend yield is the dividend per share divided by the firm share price. The 5-year return is calculated as the total return on the index for five years, and a five-year annual average is calculated. The top ten firms are by market capitalization. The 5-year volatility is the average weekly standard deviation over the five years. Sector Concentration is the sum of the constituent firm capitalization representing that sector. The US market is represented by the S&P500, the UK by the FTSE 350, and Brazil by the Bovespa indices.

Market	Mkt cap	Dividend Yield	5 yr rtn p.a.	Top 10 firms	5yr volatility*	Sector Concentration		
	USD tln	*%*	*%*	*%*	*%*	*1*	*2*	*3*
US	29.3	1.7	14.4	26	15	Technology (35%)	Consumer Services (18%)	Health Care (16%)
UK	2.30	4.55	3.4	33.2	12	Consumer Goods (22%)	Industrials (18%)	Consumer Services (17%)
Brazil	0.06	3.5	8.6	49.4	38	Basic Materials (25%)	Consumer Services (25%)	Oil and Gas (19%)

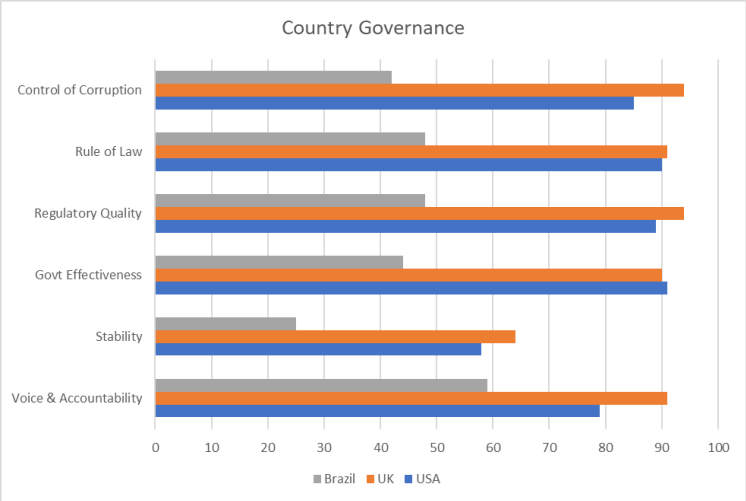
Source: FTSE Publications, September 2020; Bloomberg, 2020

It is clear from Table 1 that the two developed markets (USA and UK) are distinctly different in size, returns, dividend yield, price volatility, and sector concentration. A conclusion is that the US is a growth market, where firm cash tends to be reinvested into potential long-term capital growth opportunities, and these opportunities are usually in the rapidly developing technology sector. On the other hand, the UK market presents low returns and tends to return the cash back to investors in the form of dividends. One would argue that this is a value market given its very low price-to-book ratio. Brazil is characterized by small relative size and significantly higher price volatility in comparison. Constituent concentration is very high, with the top ten firms making up half the index weight and very high concentration (44%) in the commodity sectors. However, the Brazil market's key feature is the extent of the volatility, which is a widely used proxy for market risk in financial models. Price volatility is measured by the variance of a security price from its historical mean. Price volatility is the foundation of Modern Portfolio Theory in a mean-variance framework that illustrates the risk (variance) and expected returns of a security. In an efficient or semi-efficient market, bigger price deviations occur because of unexpected changes. Unexpected changes occur due to information asymmetry and poor governance.

Such risks are illustrated clearly in Figure 1. It is reasonable that market characteristics are expected to influence the shareholder perceptions and, thereby, the firm value of cash.

Figure 1: Market Governance

The WGI is based on multiple and diverse data sources. The results encapsulate the opinions of survey/study respondents.



Source: World Bank, World Governance Indicators, September 2020

Table 2 illustrates the difference in governance and potential shareholder power in Brazil relative to the study's developed markets. On every governance metric, Brazil significantly trails the two developed markets, and this potential for unexpected risks and the associated information asymmetry has implications for shareholder perceptions and firm value.

In summary, agency costs and diverging manager-shareholder interests in the corporate structure are exacerbated in poor governance environments and low shareholder power. This dynamic manifests in cash management.

The primary problems under investigation in this study are as follows:

- To what extent do shareholders value a Change in Cash and levels of firm cash?
- To what extent does the firm value of cash differ between markets with different market characteristics?
- To what extent do excess return and q differ as proxies for firm value?

The models and variables used in the study are described further in Chapter 3 and in Tables 2 and 3 below. A full summary table incorporating both model variables is presented in Table 44 in the Appendix. As a summary introduction, the Faulkender and Wang (2006) model dependent variable is the firm excess return ($Re = r_{i,t} - R_{i,t}$). This is determined by the firm's stock return ($r_{i,t}$) less the return of the country index ($R_{i,t}$). The equity return is the year-on-year change in the firm's share price (Faulkender & Wang, 2006). In this paper, the firm equity excess to benchmark (Index) returns are calculated as the Firm Value. The benchmark deviates from the Faulkender and Wang model, which uses the Fama and French benchmarks. These benchmarks are 25 segmented portfolios (5x5 portfolios) based on individual company book-to-market and size characteristics. The 25-portfolio benchmark is not available for the UK and Brazil and is thus inappropriate for this study. This paper includes the UK FTSE 350 Index and the Brazil BOVESPA Index. All firms in the study are constituents of the respective benchmarks used in the calculation of excess return. The Faulkender and Wang model estimation equation is specified as:

$$r_t - R_t = \beta_1(\Delta C_{i,t} / M_{i,t-1}) + \beta_2(\Delta E_{i,t} / Mi_{,t-1}) + \beta_3(\Delta NA_{i,t} / M_{i,t-1}) + \beta_4(\Delta RD_{i,t} / M_{i,t-1}) + \beta_5(I_{i,t-1} / M_{i,t-1}) + \beta_6(\Delta D_{i,t} / M_{i,t-1}) + \beta_7(C_{i,t-1} / M_{i,t-1}) + \beta_8(L_{i,t}) + \beta_9(NF_{i,t} / M_{i,t-1}) + \beta_{10}(C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1}) + \beta_{11}(L_{i,t} * \Delta C_{i,t} / M_{i,t-1}) \quad (1)$$

The Faulkender and Wang (2006) model includes the lagged value of Market Capitalization to standardize the measurement of the independent variables and to enable an interpretation of the coefficients since excess return is defined as a year-on-year change in the firm market value of equity.

The model variables of interest are as follows:

$\Delta C_{i,t}$ standardized by Market Capitalization: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior year$_{t-1.}$ This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1}$ standardized by Market Capitalization: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior period impacts firm value. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by of Market Capitalization: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by of Market Capitalization: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by of Market Capitalization: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as

the change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$\Delta RD_{i,t}$ standardized by of Market Capitalization: Change in R & D expenses which is a control on the extent to which research and development expenditure impacts firm value. Calculated as the difference in the R&D expenses between the current year $_{t-1}$ and prior year $_{t-1}$. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$\Delta I_{i,t}$ standardized by of Market Capitalization: Change in interest expense which is a control on the extent to which interest expenses' impact firm value. It is calculated as the change in the interest expenses between current year $_{t}$ and prior year $_{t-1.}$ This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$L_{i,t}$: Market leverage which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by of Market Capitalization: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

Table 2: Faulkender and Wang Model: Variables

Faulkender and Wang (2006) Model Variables

	Description	Variables		Study Notation	Specifications
Dependent Variables			where,		
	Excess equity return	$r_{it} - R_{it}$	r_{it}	RE_t	Annual equity return of firm $_i$ in year $_t$
			R_{it}		Equity benchmark return of firm $_i$ in year $_t$ (local market Index)
Variables of Interest					
	$C_{i,t-1} / M_{i,t-1}$		$C_{i,t}$	C_t	Lagged value of Cash holdings of firm $_i$ in year $_t$ (Cash = Cash + marketable Securities)
	$\Delta C_{i,t} / M_{i,t-1}$		$\Delta C_{i,t}$	ΔC_t	Change of cash holdings of firm $_i$ in year $_t$ (Cash = Cash + marketable Securities)
	$\Delta D_{i,t} / M_{i,t-1}$		$\Delta D_{i,t}$	ΔD_t	Change Common Dividends paid of firm $_i$ in year $_t$
			$M_{i,t-1}$	M_t	Lagged Market Capitalization of equity $_i$ at year $_t$ (closing equity price * number of shares)
Control Variables	$\Delta E_{i,t} / M_{i,t-1}$		$\Delta E_{i,t}$	ΔE_t	Change of EBIT of firm $_i$ in year $_t$
	$\Delta NA_{i,t} / M_{i,t-1}$		$\Delta NA_{i,t}$	ΔNA_t	Change of Non Cash Assets of firm $_i$ in year $_t$ (Total Assets - $C_{i,t}$)
	$\Delta RD_{i,t} / M_{i,t-1}$		$\Delta RD_{i,t}$	ΔRD_t	Change of Research & Development expense of firm $_i$ in year $_t$
	$\Delta I_{i,t} / M_{i,t-1}$		$\Delta I_{i,t}$	ΔI_t	Change of Interest Expense of firm $_i$ in year $_t$
	$L_{i,t} / M_{i,t-1}$		$L_{i,t}$	L_t	Leverage of firm $_i$ in year $_t$ (Total Debt / (=Total Debt + $M_{i,t}$)
	$NF_{i,t} / M_{i,t-1}$		$NF_{i,t}$	NF_t	Net Financing of firm $_i$ in year $_t$ (Total Equity - Stock Repurchaes + Debt Issuance - Debt Redeemed)
	$(C_{i,t-1} / M_{i,t-1}) * (\Delta C_{i,t} / M_{i,t-1})$			$C_{t-1} * \Delta C_t$	The effect of changes in cash for varying levels of cash holdings
	$L_{i,t} * (\Delta C_{i,t} / M_{i,t-1})$			$L_t * \Delta C_t$	The effect of Leverage on a change in cash holdings

The Modified Faulkender and Wang model adopted in this study uses the q ratio as the dependent variable. The modified model is very similar to the previous model described above, but for two differences: (a) the adoption of a change in Tobin's q to measure Firm Value, and (b) the standardization is Total Assets, rather than Market Value. The q variable is firm enterprise value to replacement cost (Total Assets). That is the sum of Market Capitalization and Net Liabilities to Total Assets. For model comparison purposes and given that this study employs a modified F&W model, the numerator of the independent variables in the q model is the same as the F&W model.

The model variables of interest are as follows:

$\Delta C_{i,t}$ standardized by of Market Capitalization: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior year$_{t-1.}$ This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1}$ standardized by of Market Capitalization: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior year impacts firm value. This is divided by the prior year value of Market Capitalization ($M_{i,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by Total Assets: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by Total Assets: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by of Total Assets: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as the

change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta I_{i,t}$ standardized by of Total Assets: Change in interest expense which is a control on the extent to which interest expenses' impact firm value. It is calculated as the change in the interest expenses between current year $_{t}$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$L_{i,t}$: Market leverage which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by Total Assets: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

Table 3: q Model: Variables

q Model Variables				
	Description	**Variables**	**Study Notation**	**Specifications**
Dependent Variables	Tobin's q	where,	q	Enterprise Value of firm i in year t divided by Total Assets (TAt)
Variables of Interest	$C_{i,t-1} / TA_{i,t-1}$	$C_{i,t}$	C_t	Lagged value of Cash holdings of firm $_i$ in year $_t$ (Cash = Cash + marketable Securities)
	$\Delta C_{i,t} / TA_{i,t-1}$	$\Delta C_{i,t}$	ΔC_t	Change of cash holdings of firm $_i$ in year $_t$ (Cash = Cash + marketable Securities)
	$\Delta D_{i,t} / TA_{i,t-1}$	$\Delta D_{i,t}$	ΔD_t	Change Common Dividends paid of firm $_i$ in year $_t$
		$TA_{i,t-1}$	TA_t	Lagged Total Assets of firm $_i$ at year $_t$
Control Variables	$\Delta E_{i,t} / TA_{i,t-1}$	$\Delta E_{i,t}$	ΔE_t	Change of EBIT of firm $_i$ in year $_t$
	$\Delta NA_{i,t} / TA_{i,t-1}$	$\Delta NA_{i,t}$	ΔNA_t	Change of Non Cash Assets of firm $_i$ in year $_t$ (Total Assets - $C_{i,t}$)
	$\Delta RD_{i,t} / TA_{i,t-1}$	$\Delta RD_{i,t}$	ΔRD_t	Change of Research & Development expense of firm $_i$ in year $_t$
	$\Delta I_{i,t} / TA_{i,t-1}$	$\Delta I_{i,t}$	ΔI_t	Change of Interest Expense of firm $_i$ in year $_t$
	$L_{i,t} / TA_{i,t-1}$	$L_{i,t}$	L_t	Leverage of firm $_i$ in year $_t$ (Total Debt / (=Total Debt + $M_{i,t}$)
	$NF_{i,t} / TA_{i,t-1}$	$NF_{i,t}$	NF_t	Net Financing of firm $_i$ in year $_t$ (Total Equity - Stock Repurchaes + Debt Issuance - Debt Redeemed)
	$(C_{i,t-1} / TA_{i,t-1}) * (\Delta C_{i,t} / TA_{i,t-1})$		$C_{t-1} * \Delta C_t$	The effect of changes in cash for varying levels of cash holdings
	$L_{i,t} * (\Delta C_{i,t} / TA_{i,t-1})$		$L_t * \Delta C_t$	The effect of Leverage on a change in cash holdings

1.2. Research Significance

The scholarly analysis of firm cash value is important for numerous reasons. Firstly, Cash and Marketable securities are usually a significant portion of a company's Total Assets. In the cases of Alphabet Inc and Apple, the ratio of cash and marketable securities to Total Assets is 44% and 29%, respectively. Thus, cash face value, and thus firm value, should not be tacitly assumed from the perspective of a shareholder. The study's significance relates to company valuation and, more specifically, the value placed on Total Assets. If cash is a significant portion of total assets, the firm value of cash is important. By analyzing the firm value of cash in listed companies, through the generalization of the results for both excess return and Tobin's q, one can gain significant insights and a more precise view on the value of cash for private firms.

Private firms do not have the benefit of a market price and wide-ranging public scrutiny and analysis. Thus, the generalization of results is essential.

Second, this study's cross-country nature provides insights into the firm value of cash in differentiated markets. In the context of globalization, such insights are important, especially considering that the vast number of global corporate actions are taking place in private firms. The generalization of results from this study would certainly add to the international business and finance literature.

The third significant feature of the analysis relates to the difference in excess return and Tobin's q from the shareholder's perspective. Excess return provides insights into what the market deems the company's performance is worth relative to the respective market. However, if the market valuations are considered to be overvalued, an outperforming firm may exhibit unsustainable valuations. This is a shortcoming of the Faulkender and Wang model, in my opinion. Excess return is not controlled for market overvaluation. Nevertheless, the model does provide a firm value of cash methodology, which is statistically robust, despite market anomalies. However, Tobin's q allows for a more realistic proxy for the company's value, given the inclusion of Liabilities and Total Assets in the calculation. This is discussed further in section 2.4.3.2.

Fourth, shareholders are generally concerned when cash levels are persistently high, and cash flow is robust and positive. The theory behind the statement is not limited to the principle of declining marginal utility on the firm cash but is also relevant considering the agency problems of Cash Holdings and potentially elevated levels of divergence of interests between firm executives and outside stakeholders when Cash Holdings are persistent or increasing. The significant risks to shareholders are not limited to inflated executive compensation and

over/under-investment in capital projects. Both Jensen et al. and Easterbrook point out the importance of paying out excess cash to shareholders, and the benefits of financial discipline imposed on management when approaching capital markets for investment growth funding should an investment opportunity arise (Easterbrook, 1984; Jensen, 1986).

A fifth important aspect of the study relates to both the capital and firm ownership structures. Cash balances have an impact on other firm structures. Increasing or elevated firm cash levels have an impact on the risk profiles of bond and equity investors. Faulkender and Wang (2006) indicate that in circumstances where management uses cash to reduce Leverage or other liabilities, bondholder value increases, but equity value may decline (Faulkender & Wang, 2006). Equity holders seek reinvestment given that such an investment is a call option on growth and will tend not to value excess cash at face value.

Furthermore, one should not understate the role of the firm's future growth and investment profile in the determination of Firm Value of cash in a global context. For example, a private technology company with significant investment opportunities and large Cash Holdings should probably not ignore the implications of completing an initial public offering (IPO) in a market with low mean forecast growth. Evidence from the literature as noted previously suggests that outside shareholders typically value Cash Holdings below the face value of the cash in determining Firm Value in such markets.

The final significance of the study pertains to shareholder activism. In addition to agency theory, one could argue that this paper finds theoretical justification in both property rights and shareholder structure theory, as suggested by Jensen et al (Jensen & Meckling, 1976). It is a breach of property rights if management allocates firm cash in a manner that prejudices shareholder interests. Both Smith (1776) and Jensen (1986), cited previously, suggest the

propensity for management to squander excess capital on negative Net Present Value (NPV) projects. By placing a Firm Value on Cash Holdings, Changes in Cash, and dividend policy, the shareholder can more actively articulate their losses and enforce their rights with greater financial precision.

1.3. Contribution

The contribution to reducing the research gap in the prevailing scholarly literature lies in the study's approach. The current research tends to be somewhat one-dimensional in process. The literature's empirical analyses use either a Fama and French-based or Faulkender and Wang approach. The research questions study the determination of cash value or the study of the determinants of cash levels, but rarely both. Studies are generally focused on single-country data. Other studies solely consider the impact of governance on cash value. Several studies that consider cross-country effects are typically governance-related and focus on governance indices.

The primary contributions of this paper are two-fold. First, the introduction of Tobin’s q to the field of study provides a different investment perspective on the Firm Value of cash. Excess return and Tobin’s q are different in their ratio composition and thus may appeal to different market participants, depending on their focus of analysis. Many participants prefer analysis involving Total Assets and balance sheet data rather than market data. Second, I introduce both excess return and Tobin’s q into a global environment comprising three very different and representative global markets. Both these contributions result in generalizable results that can be used in both further scholarly research and applied outside academia.

This study highlights the market's expected firm value on both firm cash and Cash Holdings, thereby illuminating the market's character for the prospective investor. Such information is critical for an investor in a relatively efficient sector of the economy.

2. Theoretical Framework and Literature Review

2.1. Introduction

Keynes provided early scrutiny of corporate cash's role in 1936 and proposed two primary purposes for Cash Holdings: precautionary and transactional. Management in firms typically maintains cash levels for precautionary reasons given the need to offset shocks while avoiding the expensive costs of insurance or an alternative means of hedging risk. Transactional motivations stem from the need to undertake trade and avoid liquidating non-liquid cash assets to transact (Keynes, Bullitt, & Rosenberg, 1936). Other theories relating to cash have evolved subsequently and include the theories of Pecking-Order, Agency, Shareholder Power, Free Cash Flow, and Capital Structure.

By the 1980s, the literature connected with other prior constructs. For example, Jenson's contribution to the agency field inspired a reassessment of why managers hold cash (Jensen & Meckling, 1976). Easterbrook considered agency theory concerning dividends, Myers concerning the capital structure, and Jensen regarding free cash flow and corporate structure (Easterbrook, 1984; Jensen, 1986; Myers, 1984; Myers & Majluf, 1984).

During the late 1990s, several scholars contributed both theoretical diversity and additional methodologies for empirical analysis. The most notable contributions were from Fama and French on taxes, financing decisions, firm value, and Harford on the relationship between Cash Holding and acquisitions (Fama & French, 1998; Harford, 1999). A seminal study by Opler et al. contributed to firm cash levels' determinants and consequences (Opler et al., 1999).

Shyam-Sunder et al. contributed to the pecking order theory of capital structure by concluding that a dynamic Pecking-Order model is more empirically robust than the traditional

capital structure models. The authors presented statistically robust evidence that firms gradually move to an optimized and more balanced debt structure over time. (Shyam-Sunder & C. Myers, 1999)Fama and French contributed further to this theory in the context of dividend decisions (Fama & French, 2002). Dittmar et al. analyzed cash levels from the perspective of corporate governance (Dittmar et al., 2003). Between 2000 and 2018, the diversity of approaches to analyzing firm Cash Holdings increased dramatically, and numerous scholars contributed almost a dozen determinants of cash levels. From an empirical methodology perspective and in addition to the empirical approach of Fama and French (1998), Faulkender and Wang presented the most significant contribution to modeling Cash Holdings and a different methodology (Faulkender & Wang, 2006). The authors devised a marginal value of cash model, which provided a new avenue of research away from the book-to-price methodology used extensively previously. Finally, Pinkowitz et al analyzed the Firm Value of Cash Holdings across various markets with diverse investor protection (Pinkowitz, René, & Williamson, 2006).

2.2. Theoretical Framework Summary

Other conclusions have been drawn from various studies. Tables 3 and 4 present a brief overview of the primary studies undertaken on the determinants of Cash Holdings and the Firm Value of Cash Holdings and their empirical conclusions reflected by the determinants of cash levels (Table 3) and the results of empirical studies (Table 4). Table 3 has been presented in a format reflective of the theoretical foundations from which this dissertation will draw. Firstly, agency theory is very prominent in the firm cash level literature. Agency Theory points to the conflict inherent in the relationship between shareholders and management. Agency Theory can be divided into a further five components, as extracted from the literature. Harford et al. justified large Cash Holdings as a precautionary measure for shareholders against market shocks when

such Cash Holdings are subject to governance (Harford, Mansi, & Maxwell, 2008). This was referred to as *shareholder power*. Jensen clarified agency theory in terms of management *flexibility*. Managers prefer higher cash levels for potential corporate activity rather than returning it to shareholders (Jensen, 1986). Faleye presented a contrasting view to Harford et al. and suggested that cash is deemed a defensive tool against exogenous *hostile intentions* (M&A defense), mainly when the firm exhibits poor corporate governance (Faleye, 2004). Jensen and Meckling's seminal and very early contribution concluded that overinvesting is encouraged when cash levels are elevated and proposed the *spending* hypothesis (Jensen & Meckling, 1976). A more recent contribution from Liu and Mauer proposes that indebted firms subject to debt covenants may be obliged to incur the costly elevated cash levels as part of the debt *contract* (Liu & Mauer, 2010).

Secondly, firm cash research relies on the much-published theories of capital structure. Myers and Majluf suggest that raising cash for a firm through an increase in equity issuance is financially expensive as a result of the asymmetry of available information between internal management and outside shareholders. Internal firm managers can know more about the state of the firm than shareholders. Thus, shareholders are cynical about management intentions to raise equity at potentially overvalued prices and take advantage of the information asymmetry. The result is that cash is raised in a prioritized manner with internal financing preferred in the first instance, followed by leverage, and equity issuance is the least preferred option. This is regarded as the *Pecking-Order Theory* (Myers & Majluf, 1984). The contributions from Modigliani and Miller were many, but few more important than the *trade-off theory*. Although it can be regarded as an extension of a cost-benefit analysis, its introduction to the debate surrounding the cost and benefits of holding cash was critical at the time (Modigliani & Miller, 1958).

Table 4 presents a summary of the effect of various determinants on Cash Holdings, as derived from the literature. The ticks and crosses represent the impact of a listed determinant on Cash Holding levels.

Table 4: Theory contributions

	Dividends	Capex	Size	Leverage	Profitability	Governance	Info Asymmetry	Liquidity/ Distress	Total Assets
Agency Theory									
Shareholder Power	+	-	+	+	no effect	+	-	+	+
Flexibility	-	+	-	-	-	-	+	+	-
Corporate Hostility	-	+	-	-	-	-	+	+	-
Management Spending	+	-	-	-	-	+	-	-	+
Contract Cost	+	-	-	-	+	+	-	-	+
Capital Structure Theory									
Financial Hierarchy	-	+	-	-	no effect	-	+	+	-
Trade-Off	-	+	-	-	no effect	-	+	+	-

+ = positive relationship to theory - = negative relationship to theory

In summary, the existing literature presents the following broad conclusions:

- The Firm Value of cash increases/decreases in market environments exhibiting robust/poor governance and oversight;
- The Firm Value of cash increases/decreases in firms within countries that exhibit robust/poor governance and oversight;
- The Firm Value of Cash Holdings increases/decreases in firms that exhibit robust/low dividend distributions;
- The Firm Value of Cash Holdings increases in firms that have dual class shareholder structures;
- Firms with elevated cash levels that do not have a robust dividend policy tend to have decreased Firm Value on Cash Holdings resulting from agency problems and shareholder concerns relating to compensation and over/under-investment.

2.3. Empirical Framework Summary

Given the number of studies on Cash Holdings, several empirical studies have been presented in the field. The direction of empirical research perspectives is numerous and wide-ranging. Table 5 summarizes both seminal and diverse contributions that include perspectives on competition, governance, global companies, accounting accuracy, executive compensation, and dual listing. For example, Bates et al. present empirical results that illustrate the key determinants of the significant rise in the Firm Value of Cash Holdings for almost three decades ending in 2009. The coefficients are particularly large for the profitability, size, investment, and dividend variables (Bates, Chang, & Chi, 2018). Generally, one can ascertain the following from three decades of research: Cash Holdings decline when there is an increase in dividends, leverage, investment, liquidity, and corporate size. Conversely, cash levels tend to increase when cash flow and book to market ratios are increasing. Finally, a change in profitability provides a mixed Cash Holding outcome.

Table 5: Empirical Results from existing studies

Table 2: Empirical Results from Literature on the determinants of Cash Holdings

	Dividends	Capex	Size	Leverage	Profitability	Mkt-to-Book	Liquidity	Cash Flow
Kim et al (1998)			-0.001	-0.235	-0.014	0.009		0.010
Harford (1999)					0.547	0.057		0.748
Bates et al (1999)	-0.043	-0.259	-0.009	-0.368	-0.002	0.016	-0.203	0.151
Pinkowitz/Williamson (2001)	0.116	-1.172	-0.116	-0.530	-0.508	0.085	-0.803	0.164
Dittmar et al (2003)	-0.180	-0.330	-0.650	-1.170	1.060	-0.080	-0.840	
Almeida et al (2004)		-1.096	0.002	0.259	0.045	0.004	-0.001	
Ozkan & Ozkan (2004)	-0.004		0.001	-0.063	-0.208	0.023	-0.073	0.091
Faulkender and Wang (2006)	2.504			-0.477	0.524		0.263	
Acharya et al (2007)			-0.008	-0.326	0.053	0.005		
Kalcheva & Lins (2007)	-1.222	-0.015	0.055	0.297	1.851		-1.766	
Chen & Chuang (2009)	0.040	-0.150	0.030	-0.050	0.100	0.010	-0.190	-0.010
Riddick & Whited (2009)		-0.362			-0.014	0.129		
Opler et al (2009)		0.321	-0.046	-3.037	0.310	0.152	-0.814	0.955
Denis & Sibilkov (2010)		-0.015			0.197		-0.136	
Duchin (2010)		-0.074	-0.016		-0.137	0.065	-1.080	0.063
Chen et al (2012)	0.034				0.488	0.006	-0.013	0.570
Huang et al (2013)	0.172	0.651	-0.088	4.324	-0.055	0.006	-0.779	0.116
Chen et al (2014)	0.336	-0.734	0.015		1.246	0.219	-0.589	6.120
Chen et al (2014)			-0.004	0.185	0.054	0.011	-0.227	0.175
Iskandar-Datta & Jia (2014)	-0.003	-0.216	-0.011	0.022	0.015	0.010	-0.195	0.149
Harford et al (2014)	-0.185	-1.696	0.232	0.595		0.122	-2.205	0.109
Lyandres & Palazzo (2016)		-0.299	0.000	0.021		0.003		0.053
Cooper & Jensen (2017)		-0.311	0.002	0.104		-0.008		0.066
Tong & Huang (2018)	2.266	0.858	-0.106	-0.247		0.021		-0.326
Bates et al (2018)	2.601	0.272	0.216	-0.522	0.478		-1.854	0.061
Rukh & Ur Rehman (2019)		1.370	-0.287	0.061			-0.129	-0.188

2.4. Literature Review

2.4.1. Introduction.

In a perfect market without market imperfections, management's financial decision-making would have zero impact on firm value (Stiglitz, 1974). The reason is that external finance would always be accessible and reasonably priced. Taxes and liquidity constraints would not play a role in pricing, and thus, Cash Holdings have zero cost-benefit implications. Therefore, decisions regarding cash levels would not have an impact and would not impact shareholders. Conversely, in a world of market imperfections, management must consider liquidity optimization, and which has a continuous impact on the equity value of a company.

Existing literature on firm Cash Holdings analysis is varied in both approach and perspective. Since corporate Cash Holdings are prevalent on balance sheets in vastly differing companies, countries, economic circumstances, and management composition, it is not surprising that research has focused on many different aspects of the field. For example, the vast differences in motivations with which cash is held have resulted in many studies focused on the determinants of corporate Cash Holdings. Many studies have focused on a single aspect or determinant of the motivation to hold cash, ignoring multiple other factors. The literature has provided several avenues that have been explored to varying degrees. While some have reached a broad consensus in results, many different perspectives on the subject have diverse and contradictory conclusions. This is primarily due to the multiple circumstances and motivations for holding cash. In this paper, I attempt to condense and untangle some crucial aspects of the firm cash puzzle within this scholarly environment.

In this paper, I seek to explore the Firm Value of Changes in Cash and Cash Holdings rather than the much-studied determinants of firm Cash Holding levels. Furthermore, the paper

considers the circumstance where the firms are domiciled in vastly different markets: The U.S., U.K., and Brazil. Comparatively speaking, these markets have different industry composition, management styles, and external governance. The paper also examines the value of cash from two different perspectives, the firm's value by market value (excess return) and the firm's value as determined by the ratio of market value to replacement value (q). In this manner, the paper will condense some aspects of the existing literature into a single data set analysis. A summary review of the current literature on the subject is undertaken in the context of the perspective of this paper, with a short review of the scholarly contributions on the firm drivers of Cash Holdings for completeness.

2.4.2. Theoretical Perspective

2.4.2.1. Capital Structure Theory

Early contributions regarding firm Cash Holdings can be tied to research on liquidity. Three notable theories are Trade-Off, Financing Hierarchy, and Agency. The former two theories are commonly referred to as the Capital Structure Theory. Capital Structure Theory considers the broader financing decisions faced by the firm, not only cash levels. The Trade-Off theory is often noted in the literature as the 'transactions motive' for holding cash (Baumol, 1952; Keynes et al., 1936). Similarly, the Financing Hierarchy theory has been noted as the 'precautionary motive' in earlier research. However, in recent decades, 'Pecking-Order' has been used frequently as well (Fama & French, 2002; Shyam-Sunder & C. Myers, 1999).

Regarding the Trade-Off Theory, Keynes proposed that Cash Holding optimality occurs from companies considering the incremental marginal costs of internal company liquidity against the additional cost of liquidity shortage (Keynes et al., 1936). The equilibrium demand for liquidity is where transaction costs are incurred in changing a non-cash asset to cash for

transaction purposes. The theory postulates that as a result of the principle of economies of scale in financing transactions, big corporates hold relatively less cash (Mulligan, 1997). One of the seminal contributors to the theory was Modigliani and Miller. They considered the intrinsic trade-off between debt's deductibility and bankruptcy costs (Modigliani & Miller, 1958, 1963). However, the Trade-Off Theory can also be viewed in the context of a cost-benefit analysis with respect to holding cash, rather than a more general capital structure optimization problem. For example, the level of cash is sourced from cash flow, and in this context, the raising of debt finance is irrelevant. From a cost-benefit perspective, the benefits are the avoidance of external capital raising costs and the costs of overinvestment by management. The notable costs of holding cash are the opportunity loss of debt-related tax deductions and the potential for growth-enhancing investment. The agency problems of management utilizing Cash Holdings for their benefit is an additional cost, which is discussed further below.

The Financing Hierarchy Theory proposes that firms hold cash in circumstances where acquiring external finance is difficult and costly. Part of the rationale for this is information asymmetry. For example, in an environment where a firm is relatively constrained in its capital-raising capabilities, management's intention to raise capital through equity issuance can be problematic. Management typically has more information than shareholders regarding the financial and operating state of the firm. Shareholders may cynically deem the offer to purchase additional stock in the capital raise as an attempt by management to increase cash levels when the firm may be overvalued. Issuing shares can be regarded as an indication of firm overvaluation and is a negative market indicator. However, should management raise debt for a project (rather than equity), this has a positive effect on market perception since the debt is subject to interest and capital pay-back commitments, which justifies shareholder perception of

the project viability. Thus, the theory refers to the financing order confronting management concerning the use of cash and proposes that internal cash is used in the first instance, followed by debt and equity.

Regarding the Financial Hierarchy Theory, Opler et al. conclude that corporates with uncertain future cash receipts and difficult access to external leverage facilities maintain greater Cash Holdings. However, they also suggest that firms with perceived robust long-term investment and capital growth profiles maintain elevated internal liquidity, given the firm's view of potential market shocks and the subsequent associated economic costs to the firm (Opler et al., 1999). Almeida et al. also conclude that liquidity-constrained firms tend to finance investment from continuous operational net cash receipts (Almeida, Campello, & Weisbach, 2004). The latter observation above was contradicted by Riddick and Whited on measurement grounds. The authors find a negative relationship between the sensitivity of saving and net cash changes, which is contradictory to the previous assertion. Still, Riddick et al. did find evidence that the external risk circumstance confronting a company plays a positive role in company liquidity. Moreover, there is also support for the assertion that management tends to increase liquidity rather than reducing leverage when the opportunity for income-enhancing investment is low (Riddick & Whited, 2009).

Given the above, Capital Market Theory encompasses elements of agency problems, discussed further below. However, the Trade-Off Theory also concerns issues outside of agency. Similarly, the Financial Hierarchy Theory includes issues besides problems of agency. Similar to Trade-off Theory, the Financial Hierarchy Theory differs with respect to its concern with the combination of investment decision-making and information asymmetry.

2.4.2.2. Agency Theory

Aside from capital structure considerations, the problems associated with the various firm participants are a source of another series of theories relating to corporate Cash Holding. The principle of utility maximization on the part of managers and shareholders and the resulting relationship conflict is the agency theory's foundation. Information asymmetry that exists in the relationship exacerbates the problem.

Flexibility

Jensen proposed that management prioritizes flexibility over investment. The holding of cash for future investment rather than face the restrictions of the external funding market (Jensen, 1986). While this also falls within the scope of the Capital Structure Theory as a precautionary motive, scholars supporting the flexibility hypothesis point to uncertain cash flows, changing credit ratings (Harford, Klasa, & Maxwell, 2014), and hedging (Acharya, Almeida, & Campello, 2005, 2013). Acharya et al. suggest that management prefers to hold cash rather than paying down debt, especially in a firm facing an uncertain external financing environment. The management perspective is that cash is a hedge and arguably the most efficient manner of preserving future investment outflows. The authors argue that if the growth outlook is robust and forecastable, cash flows will be robust, and thus the need to hold cash decreases. The hedging perspective supports the notion that the causal relationship between firm growth and net cash receipts determines the levels of firm liquidity and thus Firm Value. In this paper, we deem hedging as a subset of the flexibility hypothesis.

Shareholder Power

Shareholder Power can be best viewed as an understanding between minority shareholders and managers to hold excess cash. The circumstance for such an understanding is

within an environment of corporate governance where the shareholders have sufficient control over management and the parties' interests are aligned (Almeida et al., 2004; Mikkelson & Partch, 2003). Agency costs are thus significantly decreased. The alignment of interests and agreement to hold excess cash increases the potential for future opportunistic investments benefitting both parties.

Corporate Hostility

Faleye notes that the management decision to hold perceived excess cash can lead to the threat of excessive compensation, overinvestment, or extreme managerial caution (Faleye, 2004). In such a situation, the firm could be a target of a hostile takeover supported by shareholders. The authors propose that management reacts by increasing cash levels further to fight off such a takeover, thereby further exacerbating the situation and making the firm a more attractive takeover target. Harford notes the success of such a liquidity strategy given the low levels of takeovers in such an environment and suggests that such external discipline is ineffective (Harford, 1999).

Management Spending

The spending motive differs from the flexibility motive temporally. Management prefers to spend on investments in the current environment rather than hoarding cash for future opportunities. Jenson and Meckling suggest that this management behavior is particularly prevalent in an environment of poor corporate governance and results in value eroding expenditure (Jensen & Meckling, 1976). This phenomenon is not a new contribution and harks back to the 1980s when Myers noted that management could have a predisposition toward self-promotion, excessive compensation, career paranoia, and incentive geared towards short-term goals (Myers, 1984; Myers & Majluf, 1984).

Contract Cost

Liu and Mauer propose that young firms generally adopt more risk growth-orientated behavior and thus require debt covenants to insure against potential cavalier management behavior concerning creditor debt (Liu & Mauer, 2010). The contract cost theory's underlying motivations are similar to Pecking-Order theory since firms generally prefer to use internal liquidity when the costs of external leverage and funding are unattractive. The level of Cash Holdings is similar in both theories. However, the value of Cash Holdings differs given that growth firms may be more tempted to squander that cash, and thus the value is lower in this theory.

2.4.2.3. Defragmenting the theories on Firm Value of cash

Table 4 illustrates the cash-related determinants of Firm Value derived from the empirical results from the most pertinent literature reviewed in this paper.

Observing the liquidity impact on Firm Value, the Agency Theories of Shareholder Power, Management Spending, and Contract Cost are generally in contrast to the Capital Structure Theory. That is, the Firm Value of Cash Holdings increases as shareholder oversight increases through better contracts between managers and shareholders and greater shareholder participation in firm strategic direction. Similarly, leverage increases the value of cash given the oversight that debt covenants introduce to the agency dynamic, consistent with the governance determinant and increased dividends. In sum, the observations are compatible with the notion that increased control of management is directly and positively associated with the Firm Value of Cash Holdings. However, profitability and firm distress impact shareholder power, management spending, and contract cost. For example, increased management spending is assumed to be

inefficient in Agency theory and impacts profitability and, consequently, the value attributed to Cash Holdings.

Increased profitability has a positive effect on Contract Cost (lowers the cost) through improved credit rating and less restrictive covenants. The impact on the value of cash is through demand-supply dynamics, given that leverage generally results in reduced internal liquidity, and thus the value of cash held increases. As can be seen from Table 4, firm distress has the opposite effect through deteriorating credit ratings and covenant enforced increased Cash Holding levels. The increased cash level decreases the value thereof. Finally, the Flexibility Hypothesis proposes that increased firm cash levels are justified by management to avoid value destruction through underinvestment. In this context, firm Cash Holdings value is positively associated with firm distress (benefits of available cash) but negatively related to profitability (unnecessary Cash Holdings, given increased cash-flow).

Regarding the Capital Structure Theory, the various determinants' impact is similar for both the Financial Hierarchy and Trade-Off Theories. Notably, the Capital Structure Theory determinants have a similar cash impact on the Firm Value as flexibility or corporate hostility. Leveraged firms, displaying high information asymmetry levels and subject to financial distress, tend to exhibit greater Firm Value because of internal liquidity. Also, as the Firm Value of cash increases, the greater the capex on investments.

2.4.3. Empirical Perspective

In this literature review, I have considered the theoretical perspectives regarding the primary drivers of Cash Holdings and Firm Value. Also, scholarly research has contributed to several approaches and models to empirically analyze the theoretical constructs and relationships. Like the theoretical contributions, the empirical contributions based on the

theoretical research questions are diverse in their scope and consequences. In the paper, I distinguish between the models used to analyze the determinants from those studying the Firm Value as it relates to internal liquidity. Given the research question of this paper, the emphasis will be on firm value models relating to changes in cash, Cash Holdings, and dividends paid.

2.4.3.1. Cash Holding Models

The literature presents numerous examples of research papers that have based analysis of Cash Holdings on the following model formulation (Bates, Kahle, & Stulz, 2009):

$$Cash_{it} = \alpha + \beta_1 x X_{1it} + \beta_2 x X_{2it} + \varepsilon_{it} \quad (2)$$

Where,

$Cash_{it}$ is the standardized cash ratio and the dependent variable, and X_{1it} is one of an array of determinants of Cash Holdings per the theoretical perspective section above. X_{2it} represents a control variable. The coefficients of variable X_{1it} are of interest in ascertaining levels of Cash Holdings. The variables are scaled to a common factor as part of the standardization process, which is typically to Total Assets (Opler et al., 1999). $Cash_{it}$ consists of cash and short-term investments. Generally, the research has proposed the following explanatory variables for $X_{1i,t}$: Investment (R&D spending); Growth (Market-Book ratio); Leverage (total debt as a ratio of net assets); Size (log total assets); Profitability (operating cash flow); Liquidity uses the concept of net working capital; Dividends (Dummy variable); Financial Distress (variance of net cash receipts); and Investment activity (capital expenditure). An additional variable, governance, is included in many studies seeking clarification on the impact of both internal and external governance and management control on Cash Holding levels (Harford et al., 2008; Liu & Mauer, 2010). Other studies included variables considered relevant within the scope of their respective

research questions (Chen, Dou, Rhee, Truong, & Veeraraghavan, 2014; Huang, Elkinawy, & Jain, 2014; Iskandar-Datta & Jia, 2014; Mikkelson & Partch, 2003; Tong & Huang, 2018).

2.4.3.2. Value of Cash Models

Modified Fama and French Models

In contrast to the diversity of models on the determining factors of liquidity levels, the existing studies on cash-based valuation are based primarily on two primary models. From a chronological perspective, Fama and French proposed a model that Pinkowitz et al. later modified. The Fama and French model is robust to statistical testing and was widely used for cross-sectional regressions on firm value but is limited to the extent that the formulation is not sufficiently specific for the purposes of an analysis of the Firm Value of Cash, for example. The Pinkowitz et al. modified model regresses the firm equity value of the firm against $Cash_{it}$ to determine the contribution of cash levels to firm value (Fama & French, 1998; Pinkowitz et al., 2006). Other standardized control variables (usually scaled to total assets) are included in the regression equation, and these typically include Net assets (NA_{it}); Earnings (E_{it}); R&D expense (RD_{it}); Dividends (D_{it}); and Interest (I_{it}).

From an interpretation perspective, β_{16} is the Cash Holding coefficient and the locus of interest given its determination of firm value (Vi,t). Simply stated, a coefficient of 0.500 for the variable indicates that a US$ 1 increase in Cash Holdings increases firm value by US$ 0.50. This means that firm value increases by only US$0.50 for every US$1 in Cash Holdings. In this example, Cash Holdings detract from firm value for reasons that would be derived from the values of the control variables. The implication is that if a shareholder were to value the firm on the level of Total Assets, for example, the Cash component of Total Assets would be halved,

thereby reducing the adjusted value of Total Assets, and reducing the perceived Firm Value. The model equation (3) is specified as follows:

$$MV_{it} = \alpha + \beta_1 \times E_{it} + \beta_2 \times dE_{it} + \beta_3 \times dE_{it+1} + \beta_4 \times dNA_{it} + \beta_5 \times dNA_{it+1} + \beta_6 \times RD_{it} + \beta_7 \times dRD_{it} + \beta_8 \times dRD_{it+1} + \beta_9 \times I_{it} + \beta_{10} \times dI_{it} + \beta_{11} \times dI_{it+1} + \beta_{12} \times D_{it} + \beta_{13} \times dD_{it} + \beta_{14} \times dD_{it+1} + \beta_{15} \times dMV_{it+1} + \beta_{16} \times Cash_{it} + \varepsilon_{it} \quad (3)$$

Faulkender and Wang

Faulkender and Wang suggest that the Firm Value of one extra unit of cash will differ from the face value depending on how management uses the cash (Faulkender & Wang, 2006). They. They categorize the uses of cash into three categories: cash distribution, liability servicing, and raising cash. They note that a tax effect exists in cash management since the corporate tax on interest earned is generally higher than on individuals. Agency and tax issues are the basis for the author's first hypothesis: the incremental Firm Value of cash decreases as the level of the firm's Cash Holdings increases.

It is also suggested that firms with elevated leverage and the propensity to add more risky debt will likely result in shareholder-creditor conflict for the agency reasons highlighted previously. They propose that for these firms, cash generated will be allocated to creditors and debt reduction. From the shareholders' perspective, the following hypothesis is proposed: the additional Firm Value of the incremental dollar of cash decreases with the level of leverage increasing.

Finally, the authors consider financially constrained firms and conclude that the costs and information asymmetry of raising cash externally are prohibitive for many firms. In conditions of

constrained access, the authors propose the following: the additional Firm Value of an incremental dollar of cash is higher for financially constrained firms.

The authors used data from Compustat for the period between 1971 and 2001. An important aspect of their contribution was the presentation of a contrasting and competing model to study cash value compared with Fama and French. The model focuses on determining the Firm Value of liquidity, focusing on the excess to index return on the equity value of the listed firm. The authors note two primary advantages to this approach: first, the comparison of the firm return to the benchmark return generating a risk factor, and second, the model avoids the risk of historical book value numbers, which may overstate the value of assets.

The model incorporates the level of cash and leverage in determining marginal cash value and analyses the marginal cash value in the context of dividends and stock repurchases. Model control variables include dividends, earnings, interest expenses, R&D expenses, additional financing, and non-cash assets. The authors use market returns (Ret_{it}) as an indicator of firm value and are regressed against firm cash and control variables. The basic model specification is presented in equation (4) below. The models of Pinkowitz et al. (equation 3) and Faulkender and Wang (equation 1) are similar, but where they differ is in the scaling of the Cash Holdings ($Cash_{it}$) and the control variables (X_{2it}). Both are standardized by the lagged Market Value of the firm, thereby facilitating the interpretation of the cash coefficient as a US$ change of firm value for a US$1 Change in Cash Holdings.

$$Ret_{it} = \alpha + \beta_1 \left(Cash_{it} / MV_{it-1}\right) + \beta_2 \times X_{2it} + \varepsilon_{it} \qquad (4)$$

The detailed Faulkender and Wang estimate equation is shown as equation (1):

$$rt - Rt = \beta_1(\Delta Ci_{,t} / M_{i,t-1}) + \beta_2(\Delta E_{i,t} / M_{i,t-1}) + \beta_3(\Delta NA_{i,t} / M_{i,t-1}) + \beta_4(\Delta RD_{i,t} / M_{i,t-1}) + \beta_5(I_{i,t-1} / M_{i,t-1}) + \beta_6(\Delta D_{i,t} / M_{i,t-1}) + \beta_7(C_{i,t-1} / M_{i,t-1}) + \beta_8(L_{i,t}) + \beta_9(NF_{i,t} / M_{i,t-1}) + \beta_{10}(C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1}) + \beta_{11}(L_{i,t} * \Delta C_{i,t} / M_{i,t-1}) \quad (1)$$

Prior to Faulkender and Wang's seminal contributions, Harford indicated that firm Cash Holding was empirically determined as detracting from firm value (Harford, 1999). The results from Faulkender and Wang concur with this conclusion showing that a dollar increase in Cash Holdings increases Firm Value by US$0.94. They also conclude that as cash levels and leverage increase, the marginal Firm Value of cash decreases significantly. From a tax perspective, firms that rebate excess liquidity back to shareholders by equity repurchase rather than paying dividends generate a higher marginal value of cash. They attribute this result to taxation: the higher tax rate on dividends than capital gains tax on equity buy-backs. Following on from observations earlier in this paper, the above tax perspective may also explain Apple Inc's decision to reduce cash by way of significant stock repurchases rather than dividends. They also conclude that the value of cash is higher for firms that have restricted access to external financing. The variation in Firm Value is particularly significant in those firms where robust investment opportunities are prevalent, but the firm possesses low levels of internal funding (Faulkender & Wang, 2006).

Other scholars have reached the same conclusions to varying degrees and from diverse perspectives (Alimov, 2014; Chi & Su, 2016; Dittmar & Mahrt-Smith, 2007; Frésard & Salva, 2010; Kalcheva & Lins, 2007; Martínez-Sola, García-Teruel, & Martínez-Solano, 2013). More specifically, the notable rationale for the negative marginal change in firm value is a result of the following factors, many of which have been discussed above. Companies exhibiting poor corporate governance or operating in poor governance environments present significant agency problems dominate in this regard (Frésard & Salva, 2010). Poor governance emanates from poor

regulatory environments, information asymmetry, poor disclosure requirements, lack of management control, inter alia. In this sense, excess cash is deemed a risky investment by shareholders for reasons explained previously, and thus firm value does not reflect the face value of Cash Holdings.

Tobin's q

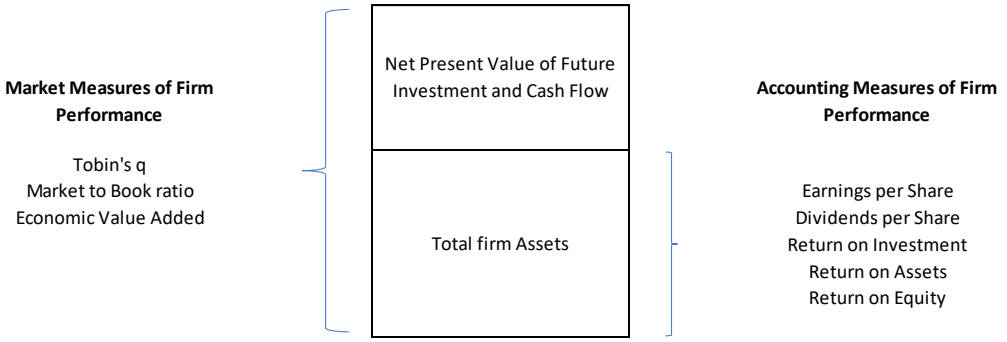
I introduce Tobin's q into the firm value of cash analysis to measure performance from another perspective. Initially, Tobin suggested that the q ratio was a predictor of future investment. The ratio is typically used in the literature to analyze q on investment and financing decisions (Bolton, Chen, & Wang, 2011). The simplest formulation of the ratio comprises market value to replacement cost of the firm and is presented in the following form:

(Market Capitalization + Current Liabilities – Current Assets + Long Term Debt) / (Total Assets) (Chung & Pruitt, 1994). However, the ratio has been subsequently adopted to measure business performance (Wernerfelt & Montgomery, 1988). Accounting measures of performance do not incorporate changes in systematic risk and market distortions. Numerous studies have found q to be a fundamentally superior metric of performance than financial statement measures. It has also been considered an alternative to Altman's Z as an alternative measure of firm viability. (Wolfe & Sauaia, 2005). Furthermore, several studies have used Tobin's q to analyze cross-sectional aspects of managerial decision-making, managerial shareholding, and firm value (Chung & Pruitt, 1994).

Wernerfelt and Montgomery note the further advantage of Tobin's q from the perspective of including a market valuation of company worth, since the ratio incorporates an appropriate discount rate, calculates returns, and reduces the financial statement distortions caused by company financial regulations (Wernerfelt & Montgomery, 1988). Moreover, the literature provides a more cynical view in noting that the calculation of Tobin's q does not depend on

accounting profit and is thus not subject to the vagaries of accounting techniques and profit determination (Bacidore, Boquist, Milbourn, & Thakor, 1997). The ratio is also more future-orientated since its determination is significantly market-based and should contain more information and a better measure of future discounted cash-flows (Ganguli & Agrawal, 2009). Figure 1 summarizes various performance measures and components of firm value in context and is an extended version of Bacidore et al (1997).

Figure 2: Firm value Components and Performance Indicators



Other Studies

However, the literature also provides evidence of positive marginal increases in firm value as Cash Holdings increase. In constrained liquidity circumstances, the value of cash increases (Chen & Chuang, 2009; Faulkender & Wang, 2006). The presence of poor governance can mitigate the incremental gains attributed to liquidity constraints.

Furthermore, Mikkelson and Partch note the marginal value increases to firm value if Cash Holdings are persistently elevated through the competitive advantages that such cash levels create (Mikkelson & Partch, 2003). This has been supported in other research contributions (Martínez-Sola et al., 2013).

Given the focus on the cash-related Firm Value in this paper, it is useful to review the notable scholars' methods cited above. Pinkowitz et al. contributed a modified specification centered on the earlier work of Fama et al. but exclusively analyzed the Firm Value and its relationship to liquidity. The authors sourced data for the period 1955 to 1999 from the Compustat database. In summary, firm value increases by an average of US$1.20 for every US Dollar of cash held, but also noted the variation between firms. By dividing the firms based on firm characteristics, they found that the value of cash ranged from US$ 0.26 to US$ 2.38. Thus, the contribution's merit lies not in determining the average value of cash but rather the value range's granularity. They concluded that with poor governance and firm distress in poor growth environments, cash value is significantly discounted. They attribute this to the classic agency problems and potential management behavior. It was also concluded that the value of cash increase in situations where a firm has growth opportunities and elevated future investment uncertainty. They found no indication that firm distress impacts the value of cash. The overall conclusion left room for subjective assessment since the authors suggested that shareholders' prevailing belief that the value of holding cash in specific environments may offset the mitigating nature of agency (Pinkowitz & Williamson, 2002).

A few years later, Pinkowitz et al. analyzed the Firm Value in jurisdictions with differing corporate governance (Pinkowitz et al., 2006). The authors sourced data from Worldscope for the period 1988 to 1998, and the dataset comprised some 75,887 firm-year observations. The basis of the empirical model was from Fama and French (1998). As noted previously, their results illustrated that the Firm Value relating to liquidity increases with robust investor protection, and conversely. Moreover, a strong relationship between healthy dividends and increased cash value in weak investor protection environments was observed. Without investor governance, agency

detracts from cash value. Nevertheless, the authors found that cash value is, on average, US$ 0.91 per US Dollar of cash in above-median investor protection markets, but only US$ 0.33 in markets with weak governance.

Dittmar et al. studied the influence on Firm Value from the perspective of corporate governance differences between firms (Dittmar & Mahrt-Smith, 2007). They sourced data from the Global Vantage database with some 13,000 observations and almost 2,000 listed companies from 1990 to 2003. Both the Fama et al. and Faulkender et al. estimations specifications were used in the study. Dittmar et al. illustrated in companies with weak governance, the Firm Value is between US$0.42 and US$ 0.88. Firms presenting good governance achieved approximately US$1.50 of value per US Dollar of cash. The authors concluded that poorly governed firms would use cash rapidly, based on agency problems, reduce cash flow, and lead to operating inefficiency. The opposite is true in an environment of robust governance.

From the perspective of weak shareholder protection, Kalcheva and Lins study the value of cash in terms of cash dividends (Kalcheva & Lins, 2007). Reviewing data from 31 markets and some 5000 stocks for the calendar year-end 1996 concluded that firm value will be lower when managers hold elevated cash levels in weak shareholder protection environments. However, if dividends are paid, the Firm Value is greater despite the weak protection. Dividends mitigate the agency problems of excess cash when weak shareholder protection is prevalent. They also found that excess cash levels and firm value have a weak relationship when investor protection is robust.

Concerning the managerial decision to pay dividends or repurchase stock, Harford et al. found that shareholders within a weak protection environment prefer stock repurchase over dividends (Harford et al., 2008). The logic being that as shareholders, stock repurchase avoids

the potential management over-promising of future dividends that may be subject to agency problems. They also concluded that firms with weak shareholder protection misuse cash and allocate toward acquisitions and capex and subsequent low profitability and inferior valuation. The authors sampled 1872 firms and studied 11,645 firm-year observations between 1993 and 2004. The data was sourced from Compustat.

Masulis et al. undertook a further study based on the Faulkender and Wang approach. They comprised an assessment of the Firm Value of dual-listed companies and the associated corporate governance (Masulis, Wang, & Xie, 2009). The sample consisted of 503 dual-listed companies based in the United States between 1995 and 2003. The dataset consisted of 2,440 firm-year observations. The study's conclusions were similar to the results contributed by Dittmar and Mahrt-Smith (2007). The study produced a negative relationship between excess management control emanating from insider voting rights and cash value. The rationale is that outside stakeholders allocate a reduced value on entities with anti-takeover provisions and low institutional (external voting rights) firm ownership. The authors also suggested that in countries exhibiting lower shareholder protection, the cash value is lower and is consistent with the results of Pinkowitz et al. (Pinkowitz et al., 2006).

The value of cash, as described previously, is also determined by the extent to which a form is financially constrained. From this perspective, Denis and Sibilkov studied listed firms in the U.S. for the period 1985 and 2005, including 74,347 observations (Denis & Sibilkov, 2010). The research questions centered on the reason for an increase in cash value for liquidity-restricted firms and the decision-making rationale of management in such situations. Specifically, the authors aimed to elaborate on why managers retained low cash levels under financial constraint conditions. Evidence points out that firm value increases under conditions

where Cash Holdings are elevated, and the firm is constrained. A 3-stage least squares methodology was used to determine how cash impacts investment and how the level of investment impacts firm value. The authors confirmed the positive association between liquidity and investment expenditure, particularly in financially constrained firms. They also found that the attribution to Firm Value from investment is greater for liquidity-restricted firms, and thus cash levels have a strong positive relationship for constrained firms. They further concluded that liquidity-restricted companies tend to maintain reduced liquidity levels, in contrast to the evidence of firm value accruing from higher cash levels. The limited cash-generating resources and challenging external financing opportunities result in lower cash levels. The authors proposed that firms with low Cash Holdings resulting from inferior operating performance have poor financial ratios relative to firms with higher Cash Holdings. These metrics included cash flow margins, interest coverage ratios, and z-scores. Simply stated, the management of companies that are operationally unable to increase Cash Holdings have little control over the Cash Holdings decision and thus have little control over cash management policy and firm value.

As elaborated in the sections above, the Financial Hierarchy Theory and the Cash Flow Theory are theories that explain both the holding level and Firm Value of cash. Drobetz et al. investigated these contrasting theories in a study undertaken with data from 1995 to 2005 and consisting of 8,500 firms from 45 markets (Drobetz, Grüninger, & Hirschvogl, 2010). The authors use the Fama and French and Pinkowitz models, inter alia. They contribute to the literature in the analysis of information symmetry and the impact on the Firm Value of cash. The proxy for the quality of information is the variance or volatility of forecasted EPS estimates. The greater the volatility of the earnings forecasts, the lower the quality of the information. The conclusion was that the Firm Value of cash without information asymmetry is US$ 0.66, and

including information asymmetry, the value is negative. The firm value of cash deteriorates as information asymmetry increases because of Poor Shareholder Power and Agency costs. Poor information increases the potential for management to misallocate Cash Holdings.

Continuing the work on governance and in a similar vein to Fresard and Salva studied the impact of inside controlling shareholder actions on cash value (Frésard & Salva, 2010). The authors used a modified Fama and French model and included a sample of 870 US-listed foreign firms for the period 1989 and 2005. The research question was based on the notion that having a cross-listing in the US and foreign markets would increase the value of cash. This is due to the increase in shareholder protection and regulatory enforcement that the US provides. The authors found that shareholders would pay a premium for cash in such circumstances, given the limited risk of agency costs.

Financial constraints and agency issues have also been considered in the context of diversification and its impact on the value of money (Tong, 2011). Tong adopts the Faulkender and Wang model using data that includes some 25,000 observations and 6,800 entities for the period 1998 to 2005. It was concluded that firm cash value was lower for diversified firms irrespective of whether the entity was financially constrained or not. The author introduced governance into the model and found that poor governance had a negative impact on diversified companies' cash value. In contrast, for higher governance firms, there was no impact from diversification on cash value. The study's contribution pertains to the proposition that agency problems can manifest in diversified companies through opaque inter-company relationships. Thus, shareholders will discount firm cash value as a result.

Martinez-Sola investigated the management optimization of balance sheet liquidity in the maximization process of Firm Value using the model based on the work of

Pinkowitz and Williamson (Martínez-Sola et al., 2013). The sample included 472 listed US firms from 2001 to 2007. The results confirm that Cash Holdings are optimized at some 14% of Total Assets. They further note that variance above that level has a detrimental effect on Firm Value, but variance below has a positive effect.

Chi and Su illustrate competing firms' impact with predatory strategies and the effect of firm cash value using the Faulkender and Wang model (Chi & Su, 2016). The authors suggest that in circumstances where a firm is financially constrained, a financially competitive rival may use predatory tactics to destabilize the weaker rival and disrupt the financially constrained firm's cash flows. Thus, constrained firms' cash is more valuable. The dataset comprised 6,657 firms and 46,000 firm-year observations. The data was sourced from Compustat for the period 1997 to 2011. They find that when products are similar or, firm price volatility is high, the value of cash is some US$ 0.36. The authors also find that product similarity and firm beta are reinforcing, and when they occur together, the value of cash increase is US$ 0.52 higher. They also find that predatory risks are higher for restricted liquidity companies.

Bates et al. note that the Firm Value of Cash Holdings has increased materially since the 1980s (Bates et al., 2018). Adopting the Faulkender approach, Bates et al. show that US$1.00 of Cash Holdings was worth US$0.61 during the 1980s, US$ 1.04 in the following decade, and US$1.12 in the first decade of the new millennium. They suggest that this increase in firm value results primarily from improved investment opportunities, lower cash flow volatility, lower bond market risk, and greater company diversification.

2.4.4. International Perspective

Reviewing firm cash literature, one can categorize the seminal studies into three distinct areas. First, research focused on firms in the United States (Bates et al., 2009; Fama & French,

1998; Faulkender & Wang, 2006; Harford et al., 2008; Opler et al., 1999). Second, cross-country studies (Dittmar, Mahrt-Smith, & Servaes, 2003; Frésard & Salva, 2010; Iskandar-Datta & Jia, 2014; Kalcheva & Lins, 2007; Pinkowitz et al., 2006). Finally, non-US country data studies (Ozkan & Ozkan, 2004; Pinkowitz & Williamson, 2001).

Much of the early research on firm Cash Holdings and cash value produced mixed results in the United States. As a result, Dittmar et al. and Kalcheva migrated their respective research focus to global companies (Dittmar et al., 2003; Kalcheva & Lins, 2007). The research orientation was primarily based on governance and shareholder protection, rather than other aspects of foreign country-firm characteristics. The authors all note the benefits of an international setting regarding the 'richness' of the data given the diversity of markets internationally and the wide deviations in values and market characteristics. Despite this exploration of international data, Chen and Mahajan note the scarcity of literature studying the macro-economic impact on firm Cash Holdings and value (Chen & Mahajan, 2010). Mulligan analyzed the impact of scale economies on firm money demand and Cash Holdings (Mulligan, 1997). The study concluded that larger companies maintain less liquidity to revenue. The author also found the scale elasticity to be less than one, thereby validating the proposition that scale economies exist in cash demand. Natke studied the role of inflation and its impact on Brazil's firm liquidity (Natke, 2001). He found that both scale economies exist consistent with Mulligan's contribution and that interest rates affect firm liquidity decisions and Cash Holdings.

Building on Harford (2008), Haw et al. analyzed the impact of liquidity and equity buy-backs to equity holders on Firm Value in the context of global markets (Haw, Ho, Hu, & Zhang, 2011). The authors used both the Fama and Faulkender papers as a basis for their respective studies. The period studied was between 1998 and 2004 and consisted of 14,495 firms and

59,011 firm-year observations. They concluded that the impact of share buy-backs has a greater impact on Firm Value in higher governance and shareholder protection markets. They also argue that in markets with weak shareholder protection, dividends increase firm value more than repurchases by some US$ 0.12. This is consistent with prior studies indicating that firms exhibiting poor investor protection will suffer agency problems (cash flow theory). Thus, a discount will be applied to firm value unless equity repurchases are undertaken by management.

Chen and Mahajan investigated the macroeconomic impact on firm cash levels in 34 countries for the period 1994 to 2005 (Chen & Mahajan, 2010). The authors determined a significant relationship between firm liquidity and notable macroeconomic variables, including inflation, real interest rates, GDP growth, corporate tax rates, government deficits, inter alia. They also note the second-round effects given that macroeconomic variable affects other determinants of firm Cash Holdings and cash values.

Chen et al. study the impact of cultural aspects on company liquidity internationally (Chen et al., 2014). The authors conclude that company liquidity is negatively related to the individual cultural inheritance (individualism) of management but positively related to the avoidance and reduction of risk. Maintaining liquidity for precautionary reasons is affected by both individual culture and uncertainty-avoidance. Finally, the authors find that individualism is positively associated with capital expenditure, equity repurchases, and corporate activity, but uncertainty avoidance is negatively related.

Tong and Huang analyzed international markets from the perspective of labor union membership's impact on corporate cash levels (Tong & Huang, 2018). The authors find that countries with higher union membership have lower cash levels. The effect is pronounced in environments exhibiting negligible employment rights, higher levels of centralized labor

bargaining power, and greater firm-level financial constraints. Firm cash value is also lower in such environments. They also find that firm liquidity is greater in environments with greater potential for strikes and lockouts. The authors conclude that international firms use Cash Holdings as a strategic bargaining position to negotiate with unions.

2.5. Hypothesis Development

The seminal article by Faulkender and Wang studied Firm Value associated with liquidity for the period 1972 to 2001. Given that the methodological foundation of this paper is derived from the approach and most variables used in their study, it is worthwhile to investigate the extent to which the results of that study remain credible and relevant for use currently. The equity market composition, investor expectations, a period of unprecedented global liquidity, globalization of the work economy, and low inflation in the US has resulted in a strong appetite for growth-orientated companies. The implications are such that attitudes toward dividends as a source of shareholder wealth may have dissipated significantly relative to firm investment growth and the potential associated capital gains. In the context of the above, I believe that shareholders in the US are significantly more understanding regarding cash change and Cash Holdings currently than in prior decades. One would anticipate the Firm Value of Cash Change and Cash Holdings to be higher than those of Faulkender and Wang (2006).

Hypothesis 1(a): The US Firm Value of Changes in Cash (ΔC_t) is greater in the current sample period using the F&W Model than the Faulkender and Wang (2006) sample period of 1972 to 2001.

Hypothesis 1(b): The US Firm Value of Cash Holdings (C_{t-1}) is greater in the current sample period using the F&W Model than the Faulkender and Wang (2006) sample period of 1972 to 2001.

Considering the Pecking Order and Trade-Off theories, it is expected that cash value is more significant for those companies with greater investment and growth opportunities (Fama & French, 2002; Shyam-Sunder & C. Myers, 1999). Agency theory proposes that firm management generally may misallocate cash resources in a manner not consistent with shareholders' interests. Management tends to justify cash explicitly and publicly for flexibility and hostile takeover defense reasons rather than allocate the resources to investments privately deemed risky from the perspective of management self-interest. If investment opportunities exist for the firm, management may be under shareholder pressure to invest excess cash. Thus, the literature indicates that firm cash value for growth companies will be valued higher for those with greater investment opportunities (Opler et al., 1999).

Hypothesis 2(a): The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US firm results in greater Firm Value relative to a UK firm.

Hypothesis 2(b): The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a UK-based firm.

Hypothesis 2(c): The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(d): The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(e): The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(f): The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(g): The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US firm results in greater Firm Value relative to a UK firm.

Hypothesis 2(h): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a UK-based firm.

Hypothesis 2(i): The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(j): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(k): The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

Hypothesis 2(l): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

The literature indicates a strong relationship between robust governance, shareholder protection, and the value of cash (Dittmar & Mahrt-Smith, 2007; Dittmar et al., 2003; Franks, Mayer, & Renneboog, 2001; Frésard & Salva, 2010; Gao, Harford, & Li, 2013; Harford et al., 2008; Haw et al., 2011; Masulis et al., 2009; Pinkowitz et al., 2006). Agency problems discussed previously have the potential effect of diverting management and shareholder interests (Jensen & Meckling, 1976). The literature suggests that management has a vested interest in utilizing the cash for their benefit rather than solely for shareholders' interest. Shareholders are thus cynical about the effective and appropriate use of firm Cash Holdings. This is worse in firm environments presenting inadequate shareholder protection. Thus, the shareholder power hypothesis is positively related to firm cash value (Kalcheva & Lins, 2007;

Pinkowitz et al., 2006). Moreover, the literature suggests that information asymmetry is negatively related to firm cash value (Drobetz et al., 2010; Shin, Kim, Shin, & Lee, 2018).

Furthermore, given the relationships proposed in hypotheses 1 and 2 above, it is consistent that an increasing trend in Cash Holdings over time will have a negative effect on firm value. Firms with larger Cash Holdings tend to undertake investment through mergers and acquisitions, which can lead to poor operating performance, especially in weak governance environments (Harford, 1999). Moreover, higher cash levels tend to result in higher management compensation regardless of firm performance (Cheng, Harford, Hutton, & Shipe, 2016). Thus, an increasing build-up of cash may be valued at a discount to the actual level of firm cash.

Hypothesis 3(a): The F&W Model empirical evidence indicates that the Firm Value for a Brazil-based firm resulting from an increase in Change in Cash (ΔC_t) is negative at firm Cash Holding (C_{t-1}) levels.

Hypothesis 3(b): The F&W Model empirical evidence indicates that the Firm Value for a US-based firm resulting from an increase in Change in Cash (ΔC_t) is valued at less than face-value at firm Cash Holding (C_{t-1}) levels.

Hypothesis 3(c): The F&W Model empirical evidence indicates that the Firm Value for a UK-based firm resulting from an increase in Change in Cash (ΔC_t) is valued at less than face-value at firm Cash Holding (C_{t-1}) levels.

3. Method

3.1. Data

The study samples are based on annual company data extracted from Compustat for the period 2006 to 2014. The firms considered in the analysis are constituents of the S&P500, FTSE 350, and BOVESPA indices. The firms' fiscal financial 2006 year-end is the base year in the investigation, given the importance of including the periods immediately before the global financial crisis, the period of the crisis between 2008 and 2009, and the extended period of expansionary monetary policy globally. This provides-through-the-cycle coefficients and conclusions rather than a smaller sample window, which can be biased to a specific economic period. Financial and utility firms are excluded from the samples since the firms in those industries hold regulatory cash and make decisions regarding Cash Holdings differently from other firms given the respective regulatory environments. Firms having more than five years of missing data from the beginning of the period are excluded. The largest sample is from the US dataset and comprises some 4750 observations and 392 companies. The data is winsorized at the 1% and 99% levels to control for outliers in the data. The data's nature suggests that kurtosis will be high, but trimming the data is avoided since the data points are valid and thus should be validly included in the study.

3.2. Dependent and Independent variables

In this paper, I consider two primary methodological approaches to the research questions- Faulkender and Wang (2006) and a modified Faulkender and Wang model incorporating Tobin’s q (the q Model). The analysis in the modified model is based on the Faulkender and Wang independent variables. The independent variables used in the two models differ. The Faulkender and Wang (2006) model incorporate excess returns to a domestic equity

index as the independent variable, whereas the modified model includes Tobin's q as the independent variable.

The Faulkender and Wang model uses the firm excess return relative to the index of the public stock price rather than book value as used in the Pinkowitz et al. model. Faulkender and Wang propose that the model improves the underlying Fama and French model because using the equity-based benchmark return, temporal factors are included in the estimation process. The Fama and French model does not include such measures to control for risk factors. Furthermore, the stock return is easier to measure, interpret and may be less biased. The market-to-book value ratio may result in model misspecification due to measurement differences resulting from varying book value disclosures across firms. Such differences may deviate significantly from replacement cost. These differences may thus result in biased estimates of the calculated Firm Value of liquidity.

The estimation equation is:

$$r_t - R_t = \beta_1(\Delta C_{i,t} / M_{i,t-1}) + \beta_2(\Delta E_{i,t} / M_{i,t-1}) + \beta_3(\Delta NA_{i,t} / M_{i,t-1}) + \beta_4(\Delta RD_{i,t} / M_{i,t-1}) + \beta_5(I_{i,t-1} / M_{i,t-1}) + \beta_6(\Delta D_{i,t} / M_{i,t-1}) + \beta_7(C_{i,t-1} / M_{i,t-1}) + \beta_8(L_{i,t}) + \beta_9(NF_{i,t} / M_{i,t-1}) + \beta_{10}(C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1}) + \beta_{11}(L_{i,t} * \Delta C_{i,t} / M_{i,t-1})$$

The independent variable of the model is the stock's excess return to benchmark ($R_e = r_{i,t} - R_{i,t}$) determined by the company price return ($r_{i,t}$) less the benchmark return ($R_{i,t}$) over the period. In this paper, the benchmark return ($R_{i,t}$) is the market return. The benchmark deviates from the Faulkender and Wang model, which used the Fama and French benchmarks (5x5 portfolios) based on book-to-market and size. The 25-portfolio benchmark is not available for the

UK and Brazil and is thus inappropriate for this study. This paper includes the UK FTSE 350 Index and the Brazil BOVESPA Index.

In addition, the Faulkender and Wang (2006) model includes the lagged value of Market Capitalization to standardize the measurement of the independent variables and to enable an interpretation of the coefficients since excess return is defined as a year-on-year change in the firm market value of equity.

The model variables of interest are:

$\Delta C_{i,t}$ standardized by Market Capitalization: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior year$_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1}$ standardized by Market Capitalization: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior year impacts firm value. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by Market Capitalization: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by Market Capitalization: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_{t}$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by Market Capitalization: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as the change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta RD_{i,t}$ standardized by Market Capitalization: Change in R & D expenses which is a control on the extent to which research and development expenditure impacts firm value. Calculated as the difference in the R&D expenses between the current year $_{t-1}$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta I_{i,t}$ standardized by Market Capitalization: Change in interest expense which is a control on the extent to which interest expenses impact firm value. It is calculated as the change in the interest expenses between current year $_{t}$ and prior year $_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$L_{i,t}$: Market leverage, which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by Market Capitalization: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued in the fiscal

year less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

The Modified Faulkender and Wang model (q Model) in this paper adopts q as the dependent variable. The q variable is broadly defined as the ratio of the enterprise value of the firm to the replacement cost (Total Assets). In this paper, we use the simplified version of q proposed by Chung and Pruitt, which is defined as:

Tobin's q = (Market Capitalization + Current Liabilities – Current Assets + Long Term Debt) / Total Assets. Chung and Pruitt refer to the formulation as an 'approximate q' (Chung & Pruitt, 1994). Similar to Tobin's original formulation of the ratio, Lindenberg and Ross proposed a far more practical ratio, but it remained more complex than other more market-related and available firm value metrics. The complex calculation is formulated as:

q = (PREFST + VCOMS + LTDEBT + STDEBT -ADJ) / (TOTASST -BKCAP +NETCAP)

where PREFST (liquidation value of the preferred stock), VCOMS (the price of common stock multiplied by the end of fiscal year shares outstanding), LTDEBT (value of the long term debt adjusted for age structure), STDEBT (book value of current liabilities), ADJ (value of current

assets), TOTASST (book value of the total assets), BKCAP (book value of the net capital stock), and NETCAP (inflation-adjusted net capital stocks). (Lindenberg & Ross, 1981)

Chung and Pruitt present evidence that the simplified version of q is a robust equivalent of the Lindenberg and Ross version with an adjusted R^2 of over 96% (Chung & Pruitt, 1994). We thus adopt the simplified formulation of Tobin's q in this study as the dependent variable.

The Modified Faulkender and Wang model is specified as:

$$\Delta q = \beta_1(\Delta Ci,t / TAi,t) + \beta_2(\Delta Ei,t / TAi,t) + \beta_3(\Delta NAi,t / TAi,t) + \beta_4(\Delta RDi,t / TAi,t) + \beta_5(Ii,t\text{-}1 / TAi,t) + \beta_6(\Delta Di,t / TAi,t) + \beta_7(Ci,t\text{-}1 / TAi,t) + \beta_8(Li,t) + \beta_9(NFi,t / TAi,t) + \beta_{10}(Ci,t1 / TAi,t * \Delta Ci,t / TAi,t) + \beta_{11}(Li,t * \Delta Ci,t / TAi,t) \quad (5)$$

The model includes the lagged value of Total Assets to standardize the measurement of the independent variables and to enable an interpretation of the coefficients since q is defined as enterprise value to Total Assets.

The variables of interest in the q Model are:

$\Delta C_{i,t}$ standardized by Total Assets: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior $year_{t-1.}$ This is divided by the prior year's value of Total Assets ($TA_{i,t-1}$).

$C_{i,t-1}$ standardized by Total Assets: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior year impacts firm value. This is divided by the prior year's value of Total Assets ($TAi_{,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by Total Assets: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_{t}$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by Total Assets: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_{t}$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by Total Assets: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as the change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta I_{i,t}$ standardized by Total Assets: Change in interest expense which is a control on the extent to which interest expenses impact firm value. It is calculated as the change in the interest expenses between current year $_{t}$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$L_{i,t}$: Market leverage, which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by Total Assets: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$C_{i,t-1} / TA_{i,t-1} * \Delta C_{i,t} / TA_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / TA_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

3.3. Regression Techniques and Models

This paper uses panel data analysis given the nature of the respective datasets, simultaneously cross-sectional and time-series. An analysis employing panel data for firm-year observations can be undertaken with three estimation methods: fixed effects, random effects, or a pooled-OLS method. We investigate the three methods using each model and variable sets and then test for appropriateness using the Hausman test. The appropriateness of variables is assessed with the Wald test.

Regarding the models employed in the paper and as noted above, it is concluded in the analysis to follow the models of Faulkender and Wang (2006) and the Modified Faulkender and Wang models as specified in equations (1) and (5) respectively, both presented below.

The Faulkender and Wang (2006) Model is:

$$r_{i,t} - R_{i,t} = \beta_1(\Delta C_{i,t} / M_{i,t-1}) + \beta_2(\Delta E_{i,t} / M_{i,t-1}) + \beta_3(\Delta NA_{i,t} / M_{i,t-1}) + \beta_4(\Delta RD_{i,t} / M_{i,t-1}) + \beta_5(I_{i,t-1} / M_{i,t-1}) + \beta_6(\Delta D_{i,t} / M_{i,t-1}) + \beta_7(C_{i,t-1} / M_{i,t-1}) + \beta_8(L_{i,t}) + \beta_9(NFi,t / M_{i,t-1}) + \beta_{10}(C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1}) + \beta_{11}(L_{i,t} * \Delta C_{i,t} / M_{i,t-1}) \quad (1)$$

Where:

The model variables of interest are:

$\Delta C_{i,t}$ standardized by Market Capitalization: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior year$_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1}$ standardized by Market Capitalization: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior year impacts firm value. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by Market Capitalization: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by Market Capitalization: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by Market Capitalization: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as

the change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta RD_{i,t}$ standardized by Market Capitalization: Change in R & D expenses which is a control on the extent to which research and development expenditure impacts firm value. Calculated as the difference in the R&D expenses between the current year $_{t-1}$ and prior year $_{t-1}$. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$\Delta I_{i,t}$ standardized by Market Capitalization: Change in interest expense which is a control on the extent to which interest expenses impact firm value. It is calculated as the change in the interest expenses between current year $_{t}$ and prior year $_{t-1.}$ This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$L_{i,t}$: Market leverage, which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by Market Capitalization: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued in the fiscal year less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year's value of Market Capitalization ($M_{i,t-1}$).

$C_{i,t-1} / M_{i,t-1} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / M_{i,t-1,}$ standardized by Market Capitalization: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

The q Model is specified as:

$$q = \beta_1(\Delta C_{i,t} / TA_{i,t}) + \beta_2(\Delta E_{i,t} / TA_{i,t}) + \beta_3(\Delta NA_{i,t} / TA_{i,t}) + \beta_4(\Delta RD_{i,t} / TA_{i,t}) + \beta_5(I_{i,t-1} / TA_{i,t}) + \beta_6(\Delta D_{i,t} / TA_{i,t}) + \beta_7(C_{i,t-1} / TA_{i,t}) + \beta_8(L_{i,t}) + \beta_9(NF_{i,t} / TA_{i,t}) + \beta_{10}(C_{i,t-1} / TA_{i,t} * \Delta C_{i,t} / TA_{i,t}) + \beta_{11}(L_{i,t} * \Delta C_{i,t} / TA_{i,t}) \quad (5)$$

where,

The model includes the lagged value of Total Assets to standardize the measurement of the independent variables and to enable an interpretation of the coefficients since q is defined as enterprise value to Total Assets.

The variables of interest in the q Model are:

$\Delta C_{i,t}$ standardized by Total Assets: Changes in firm cash level. This calculates the extent to which change in (including cash equivalents) impacts firm value. Specifically, it is calculated as the change in the cash between the current year t and prior year$_{t-1.}$ This is divided by the prior year's value of Total Assets ($TA_{i,t-1}$).

$C_{i,t-1}$ standardized by Total Assets: The lagged value of cash-holding is a control on the extent to which cash (including cash equivalents) in the prior year impacts firm value. This is divided by the prior year's value of Total Assets ($TAi_{,t-1}$).

The control variables are:

$\Delta D_{i,t}$ standardized by Total Assets: Change in the dividends paid is a control on the extent to which dividends impact firm value, calculated as the change in the ordinary dividend distributions between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

The control variables in the study are:

$\Delta E_{i,t}$ standardized by Total Assets: Change in firm earnings. This variable is a control on the extent to which a firm's profitability impacts firm value, measured as the change in EBIT between current year $_t$ and prior year $_{t-1}$. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta NA_{i,t}$ standardized by Total Assets: Change in firm non-cash assets. This variable is a control on the extent to which a firm's investment policy changes firm value. It is calculated as the change in total assets less cash assets ($C_{i,t}$) between the current year $_{t-1}$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$\Delta I_{i,t}$ standardized by Total Assets: Change in interest expense which is a control on the extent to which interest expenses impact firm value. It is calculated as the change in the interest expenses between current year $_t$ and prior year $_{t-1.}$ This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$L_{i,t}$: Market leverage, which is a control on the extent to which leverage contributes to firm value. It is measured as the total debt of the firm.

$NF_{i,t}$ standardized by Total Assets: Net financing, which is a control on the extent to which net financing contributes to firm value. It is calculated as total equity issued less net stock repurchases (net of debt issuance) less debt redemption. This is divided by the prior year value of Total Assets ($TA_{i,t-1}$).

$C_{i,t-1} / TA_{i,t-1} * \Delta C_{i,t} / TA_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Cash Holdings and change in firm cash, and will calculate the effect of changes in the value of cash for different levels of firm cash.

$L_{i,t} * \Delta C_{i,t} / TA_{i,t-1,}$ standardized by Total Assets: Interaction variable is the product of Leverage and change in firm cash and will calculate the effect of leverage on Cash Holdings' marginal value.

4. Results

I measure the impact of Changes in Cash ($\Delta C_{i,t}$) and Cash Holdings (C_{t-1}) on Firm Value (FV). Firm Value is calculated using two models, and the models measure firm equity excess return and change in q, respectively. In addition to a range of control variables, the moderating effects of a Change in Cash given Cash Holding levels and a Change in Cash at Leverage levels are measured. This section presents descriptive statistics, univariate correlations, empirical results, and model test results for both models. All independent variables, excluding Leverage, are standardized by the lagged value of Market Capitalization and Total Assets for the F&W and q models, respectively. The F&W formulation is consistent with Faulkender and Wang (2006). The F&W model dependent variable should be interpreted as follows:

$r_{i,t}$ = (Firm Capitalization $_t$ – Firm Capitalization $_{t-1}$) / Firm Market capitalization $_{t-1}$, less

$R_{i,t}$ = (Index Capitalization $_t$ – Index Capitalization $_{t-1}$) / Index capitalization $_{t-1}$

= annual change in firm excess equity returns

The dependent variable is thus the change in excess return of a firm. Market Capitalization (the denominator in the F&W Model) is the variable of standardization of the independent variables. Accordingly, the regressor coefficients can be interpreted as a unit currency change in Firm Value associated with a USD1 change in an independent variable.

The q Model dependent variable should be interpreted as follows:

q = (Market Capitalization + Current Liabilities - Current Assets + Long term Debt) / (Total Assets)

= (Market Capitalization + Current Liabilities) / (Total Assets)

= (Enterprise Value) / (Total Assets)

The dependent variable is the change in q (Δq). Total Assets (as the denominator of the q ratio) at the end of the previous fiscal period is the variable of standardization of the independent variables. The regressor coefficients can be interpreted as a unit currency change in Enterprise Value associated with a USD1 change in an independent variable. The interpretation is similar to F&W. It is important to note that in both models and all three markets, currency conversion is not undertaken. Cross-country comparisons are undertaken and based on local currency. The comparisons are interpreted in the context of each respective market discount/premium to cash value. This is discussed further in Section 4.3.

4.1. Sample Descriptive Statistics

Sample descriptive statistics for the variables are presented in Tables 6 to 11. These tables include variables for both models and the three markets. The tables include a mean, standard deviation, maximum, minimum, skewness, and kurtosis for each variable included in the respective models.

4.1.1. Faulkender and Wang (F&W) Model

4.1.1.1. United States

Table 6 presents the variable statistics for the F&W estimation model for a sample of US-listed firms. The mean annual excess return over the sample period is approximately 4.8%. However, the standard deviation of 28% is large, which is not unusual in capital markets data for long periods of time series data. For example, the standard deviation of excess return in the Faulkender and Wang (2006) study was approximately 56%. Cash Holdings (C_{t-1}) is some 9.2% of Market Capitalization at the start of the fiscal year over the sample period. Interestingly, this is half the level reported by the Faulkender and Wang (2006) study. Furthermore, the original study reports Leverage of some 28% of Market Capitalization at the start of the fiscal year, compared

to 18.8% for the sample in this paper. The table also illustrates that average profitability has increased over time, which is consistent with the results of both Faulkender and Wang (2206), and Opler, Pinkowitz, Stulz, and Williamson (1999). It is also notable that the means of R&D expense, Interest Expense, and Dividends were stable during the sample period.

Table 6: Sample Descriptive Statistics: F&W Model – USA

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
$r_{i,t} - R_{i,t}$	0.048	0.284	1.157	-0.499	1.113	5.357
ΔC_t	0.008	0.052	0.245	-0.157	1.073	9.098
ΔE_t	0.006	0.034	0.146	-0.144	-0.304	10.736
ΔNA_t	0.061	0.207	1.316	-0.481	3.259	20.047
ΔRDt	-0.001	0.008	0.035	-0.041	-0.443	16.930
ΔI_t	-0.001	0.006	0.020	-0.030	-1.484	13.813
ΔD_t	-0.001	0.008	0.040	-0.028	1.939	14.263
C_{t-1}	0.092	0.102	0.554	0.001	2.245	8.921
L_t	-0.188	0.149	0.000	-0.679	-0.985	3.782
NF_t	-0.004	0.091	0.447	-0.233	1.970	10.795

This table presents summary statitics for the variables in the study sample of firm-years from US-based publically listed traded firms between 2014 and 2019 in local curtrency. $r_{i,t} - R_{i,t}$ is the annual firm equity return of firm $_i$ at end of fiscal year $_t$. $R_{i,t}$ is the country equity index (S&P500). All independent variables, except L_t are deflated by the lagged market value of equity. C_t is cash and liquid assets. E_t is EBIT. NA_t is total assets less cash. It is interest expense. RD_t is the Research and Development expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. $\Delta X_{i,t}$ represents the one year change for $X_t - X_{t-1}$. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$. Faulkender and Wang (2006)

4.1.1.2. United Kingdom

Table 7 presents the variable statistics for the F&W Model for a sample of UK-listed firms. The mean annual excess return over the sample period is less than 1% and markedly lower than in the US. The standard deviation of 37% is also large, which is not unusual in capital markets data, as noted above. Cash Holdings (C_{t-1}) is 13% of Market Capitalization at the start of each firm fiscal year during the sample period, higher than in the US and expected, as noted previously. Leverage is about 23% of Market Capitalization at the start of the fiscal year, compared to 18.8% for the US sample. The table also illustrates that average profitability has increased over time, which is consistent with the results of the US sample in this paper, and the

studies of Faulkender and Wang (2006), and Opler, Pinkowitz, Stulz, and Williamson (1999). It is also notable that R&D expense, Interest Expense, and Dividends were stable during the sample period, similar to the US. Thus, for the two developed markets, the descriptive statistics are reasonably consistent across both markets and compared consistently with previous studies.

Table 7: Sample Descriptive Statistics: F&W Model - UK

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
$r_{i,t} - R_{i,t}$	0.007	0.366	1.555	-0.765	1.261	6.465
ΔC_t	0.007	0.092	0.405	-0.373	0.371	10.476
ΔE_t	0.005	0.064	0.274	-0.293	-0.571	11.986
ΔNA_t	0.078	0.336	1.775	-1.118	1.368	12.461
ΔRDt	0.000	0.002	0.013	-0.007	4.641	46.450
ΔI_t	0.000	0.014	0.067	-0.075	-0.399	16.835
ΔD_t	-0.003	0.011	0.054	-0.044	1.433	13.178
C_{t-1}	0.130	0.167	0.983	0.002	2.749	11.919
L_t	0.227	0.195	0.820	0.000	0.989	3.541
NF_t	0.001	0.134	0.524	-0.625	-0.579	11.364

This table presents summary statitics for the variables in the study sample of firm-years from UK-based publically listed traded firms between 2014 and 2019 in local curtrency. $r_{i,t} - R_{i,t}$ is the annual firm equity return of firm $_i$ at end of fiscal year $_t$. $R_{i,t}$ is the country equity index (FTSE350). All independent variables, except L_t are deflated by the lagged market value of equity. C_t is cash and liquid assets.E_t is EBIT. NA_t is total assets less cash. It is interest expense. RD_t is the Research and Development expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. ΔX_{it} represents the one year change for $X_t - X_{t-1}$. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$. Faulkender and Wang (2006)

4.1.1.3. Brazil

Table 8 presents the variable statistics for the F&W Model for a sample of Brazil-listed firms. To recap, Brazil is a traditionally fast-growing economy but has much fewer companies, and the market exhibits significantly lower trading liquidity. The mean annual excess return over the sample period is more than 8% and markedly higher than in the US and UK. The standard deviation of 71% is large, probably a result of a smaller sample compared to the UK and US and the lower liquidity levels in the Brazil equity market. Lower trading liquidity tends to increase price volatility over time. Cash Holdings (C_{t-1}) is 36% of Market Capitalization at the start of the

fiscal year. I elaborate on this high level of Cash Holdings further in Chapter 5. Leverage is some 36% of Market Capitalization at the beginning of the fiscal year, compared to 18.8% for the US. The table also illustrates that average profitability has increased over time, which is consistent with the results of the US and UK samples in this paper, and the studies of Faulkender and Wang (2006), and Opler, Pinkowitz, Stulz, and Williamson (1999). It is also notable that the mean values for R&D expense, Interest Expense, and Dividends were stable on average during the sample period, similar to the US.

Table 8: Sample Descriptive Statistics: F&W Model - Brazil

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
$r_{i,t} - R_{i,t}$	0.084	0.715	3.619	-0.913	2.355	10.673
ΔC_t	0.009	0.262	1.109	-1.192	-0.219	11.709
ΔE_t	0.032	0.668	3.962	-2.959	1.406	20.441
ΔNA_t	0.067	1.350	6.201	-7.272	-1.143	17.906
ΔI_t	0.006	0.375	2.161	-1.774	1.304	21.953
ΔD_t	0.000	0.034	0.159	-0.147	0.338	12.059
C_{t-1}	0.358	0.587	3.781	0.000	3.556	17.932
L_t	0.364	0.294	0.982	0.000	0.466	2.032
NF_t	0.059	0.287	1.905	-0.663	3.807	24.247

This table presents summary statitics for the variables in the study sample of firm-years from Brazil-based publically listed traded firms between 2014 and 2019 in local curtrency. $r_{i,t} - R_{i,t}$ is the annual firm equity return of firm $_i$ at end of fiscal year $_t$. $R_{i,t}$ is the country equity index (BOVESPA). All independent variables, except L_t are deflated by the lagged market value of equity. C_t is cash and liquid assets. E_t is EBIT. NA_t is total assets less cash. It is interest expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. $\Delta X_{i,t}$ represents the one year change for $X_t - X_{t-1}$. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$. Faulkender and Wang (2006)

4.1.2. q Model

4.1.2.1. United States

Table 9 presents the variable statistics for the q Model for a sample of US-listed firms. The mean change in q value over the sample period is approximately 13.9%. The standard deviation of 47% is also large, consistent with the results of the F&W Model. Cash Holdings (C_{t-1}) are some 13.2% of Total Assets at the start of the fiscal year over the sample period. Leverage

is approximately 20%. Consistent with the F&W Model results presented in Tables 6-9, average profitability has increased over time. It is also notable that the mean values for R&D expense, Interest Expense, and Dividends were stable on average during the sample period.

Table 9: Sample Descriptive Statistics: q Model - USA

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
Δq	0.139	0.471	1.593	-0.506	1.521	5.592
ΔC_t	0.013	0.053	0.148	-0.081	0.783	3.772
ΔE_t	0.011	0.028	0.076	-0.046	0.311	3.460
ΔNA_t	0.074	0.127	0.432	-0.101	1.336	4.564
ΔRDt	-0.002	0.007	0.007	-0.024	-1.990	6.741
ΔI_t	-0.001	0.004	0.006	-0.010	-0.684	4.067
ΔD_t	-0.002	0.005	0.012	-0.013	0.252	4.970
C_{t-1}	0.132	0.131	0.466	0.006	1.217	3.495
L_t	0.199	0.107	0.378	0.000	-0.226	2.236
NF_t	-0.015	0.080	0.181	-0.155	0.644	3.446

This table presents summary statitics for the variables in the study sample of firm-years from US-based publically listed traded firms between 2014 and 2019 in local curtrency. q is the firm enterprise value divided by total assets of firm $_i$ at end of fiscal year $_{t-1}$. All independent variables, except L_t are deflated by lagged total assets. C_t is cash and liquid assets. E_t is EBIT. NA_t is total assets less cash. It is interest expense. RD_t is the Research and Development expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. ΔX_{t-1} represents the one year change for X_t - X_{t-1}. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$.

4.1.2.2. United Kingdom

Table 10 presents the variable statistics for the q Model for a sample of UK-listed firms. The mean change in q value over the sample period is approximately 13.3%, which is very similar to the US. The standard deviation of some 53% is also comparable to the US market. Cash Holdings (C_{t-1}) is some 9.8% of Total Assets at the start of the fiscal year over the sample period, lower than the US by approximately 4%. Leverage is about 17% and lower than in the US. Consistent with the US, average profitability has increased over time. It is also notable that Interest Expenses and Dividends were stable on average during the sample period.

Table 10: Sample Descriptive Statistics: q Model - UK

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
Δq	0.133	0.529	1.826	-0.514	1.812	6.382
ΔC_t	0.007	0.045	0.113	-0.081	0.442	3.520
ΔE_t	0.008	0.029	0.071	-0.055	0.028	3.323
ΔNA_t	0.078	0.145	0.448	-0.138	0.990	3.579
ΔI_t	-0.001	0.004	0.007	-0.010	-0.476	3.794
ΔD_t	-0.004	0.006	0.008	-0.020	-0.874	4.082
C_{t-1}	0.098	0.092	0.351	0.006	1.442	4.275
L_t	0.173	0.106	0.354	0.000	-0.157	2.057
NF_t	0.009	0.061	0.167	-0.090	0.925	3.815

This table presents summary statitics for the variables in the study sample of firm-years from UK-based publically listed traded firms between 2014 and 2019 in local curtrency. q is the firm enterprise value divided by total assets of firm $_i$ at end of fiscal year $_{t-1}$. All independent variables, except L_t are deflated by lagged total assets. C_t is cash and liquid assets. E_t is EBIT. NA_t is total assets less cash. It is interest expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. $\Delta X_{i,t}$ represents the one year change for X_t - X_{t-1}. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$.

4.1.2.3. Brazil

Table 11 presents the variable statistics for the q Model for a sample of UK-listed firms. The mean change in q value over the sample period is approximately 9.1%, which is lower than the US and UK by some 4%. The standard deviation of 53.9% is also comparable to both the US and UK markets. Cash Holdings (C_{t-1}) was some 13% of Total Assets at the start of the fiscal year over the sample period, comparable with the US and greater than the UK by 4%. Leverage is approximately 20%, similar to the US and higher than the UK by around 3%. Consistent with the US and UK, average profitability has increased over time. It is also notable that, like the other markets, Interest expenses and Dividends were stable on average during the sample period.

Table 11: Sample Descriptive Statistics: q Model - Brazil

Variable	Mean	Std. Dev.	Maximum	Minimum	Skewness	Kurtosis
Δq	0.091	0.539	5.734	-0.892	2.701	17.625
ΔC_t	0.009	0.060	0.150	-0.107	0.452	3.368
ΔE_t	0.008	0.056	0.132	-0.109	0.089	3.202
ΔNA_t	0.090	0.185	0.600	-0.186	1.150	4.256
ΔI_t	-0.001	0.024	0.057	-0.056	0.141	4.112
ΔD_t	-0.002	0.012	0.024	-0.033	-0.516	4.289
C_{t-1}	0.132	0.124	0.429	0.001	0.963	2.931
L_t	0.201	0.126	0.424	0.000	-0.078	1.993
NF_t	0.026	0.070	0.236	-0.058	1.872	5.800

This table presents summary statitics for the variables in the study sample of firm-years from Brazil-based publically listed traded firms between 2014 and 2019 in local curtrency. q is the firm enterprise value divided by total assets of firm $_i$ at end of fiscal year $_{t-1}$. All independent variables, except L_t are deflated by lagged total assets. C_t is cash and liquid assets.E_t is EBIT. NA_t is total assets less cash. It is interest expense. D_t is ordinary dividends paid. L_t is market leverage. NF_t is total equity issuance plus net debt issuance plus net debt redemptions. ΔX_{t} represents the one year change for X_t - X_{t-1}. The subscript $_{t-1}$ is the value of the variable at the beginning of fiscal year $_t$ or at the end of fiscal year $_{t-1}$.

4.2. Pearson Correlation Statistics

Pearson correlation statistics for the variables in the two models are presented in Tables 12 to 17. Pearson correlation analysis depicts the univariate relationship between the dependent variables in the two models (excess return and Δq) and the independent variables, comprising variables of interest and control variables. A positive* correlation approximating 1 suggests a positive relationship between the variables that are statistically significant at the 95% confidence level. Conversely, a negative* correlation approximating minus 1 suggests a negative relationship between the variables that are statistically significant at the 95% confidence level. Data has been rounded to four decimals. Significance is based on one-tailed tests. For the purposes of interpretation, independent variable relationships with the dependent variable are observed, as is the presence of significant multicollinearity between the variables of interest and the control variables. Multicollinearity is also assessed using Variance Inflation Factors (VIF) in Section 4.4.1. The correlations between the dependent and independent variables are not high,

given the significant number of potential omitted variables that impact excess return and Δq. This study is not focused on capturing all, or most of, the variables for dependent variable estimation or forecasting purposes. Our focus is on the variables of interest, and thus the six model-country correlation matrices should be interpreted in that context.

4.2.1. Faulkender and Wang Model

4.2.1.1. United States

Table 12 presents the Pearson correlation statistics for the F&W Model for a sample of US-listed firms. The table shows a relatively high correlation between excess return ($r_{i,t} - R_{i,t}$), Change in Cash (ΔC_t), Change in Earnings (ΔE_t), Leverage (L_t), and Cash Holdings (C_{t-1}). The matrix also presents evidence that the correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, suggesting a low probability of multicollinearity. The correlations between the independent variables are mostly below 0.3, from which one can reasonably assume minimal model multicollinearity. Correlations between Change in Cash and the interaction variables are high as expected, given the inclusion of Change in Cash (ΔC_t) itself in the interaction variables. The highest correlation within the model is between the Non-Cash Assets (ΔNA_t) and Net Financing (NF_t) variables. This is unsurprising since firms tend to raise financing for long-term and fixed asset purchases. This statement is somewhat supported by the negative correlations between Cash Holdings (C_{t-1}) on Non-Cash Assets (ΔNA_t) and Net Financing (NF_t).

Table 12: Pearson Correlation: F&W Model – United States

	$r_{i,t} - R_{i,t}$	ΔC_t	ΔE_t	ΔNA_t	ΔRDt	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$\Delta C_t * C_{t-1}$	$\Delta C_t * L_t$
$r_{i,t} - R_{i,t}$	1											
ΔC_t	0.2006*	1										
ΔE_t	0.2554*	0.0646*	1									
ΔNA_t	0.0738*	-0.029*	0.1944*	1								
ΔRDt	-0.0464*	0.0032	-0.0316*	-0.1316*	1							
ΔI_t	-0.015	-0.0507*	-0.0925*	-0.3455*	0.0713*	1						
ΔD_t	0.0163	0.0531*	-0.0847*	-0.165*	0.0485*	0.0423*	1					
C_{t-1}	0.1244*	-0.0638*	0.0428*	-0.0032	-0.005	-0.0248	0.0506*	1				
L_t	0.2088*	0.0293*	0.0743*	-0.0946*	-0.1409*	0.1975*	-0.0519*	-0.1016*	1			
NF_t	0.0024	0.2429*	-0.0357*	0.518*	-0.0446*	-0.3519*	-0.0661*	-0.0963*	-0.2005*	1		
$\Delta C_t * C_{t-1}$	0.1591*	0.8348*	0.0521*	-0.0373*	0.0088	-0.0354*	0.0242	-0.0818*	0.066*	0.1887*	1	
$\Delta C_t * L_t$	-0.1162*	-0.8678*	-0.0251	0.0268	-0.03*	0.0771*	-0.0687*	0.0864*	0.0601*	-0.2382*	-0.7533*	1

4.2.1.2. United Kingdom

Table 13 presents the Pearson correlation statistics for the F&W Model for a sample of UK-listed firms. The table shows a relatively high correlation between excess return ($r_{i,t} - R_{i,t}$), Change in Cash (ΔC_t), Change in Earnings (ΔE_t), Leverage (L_t), and Cash Holdings (C_{t-1}). Leverage is negatively related to excess return in the UK, in contrast to the US. One can reasonably assume that shareholders in a mature growth and dividend orientated market composition would not reward firm leverage with a higher Firm Value. From the perspective of the equity investor, Leverage may result in future cash-flow being diverted to debtholders rather than equity investors via dividends. The matrix also presents evidence that the correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, which suggests a low probability of multicollinearity. More generally, the correlations between the other independent variables are

mostly below 0.3, from which one can reasonably assume minimal model multicollinearity. The correlations with the interaction variables are high as expected, given the inclusion of Cash (ΔC_t) itself in the interaction variables. Similar to the US, the highest correlation is between the variables Non-Cash Assets (ΔNA_t) and Net Financing (NF_t). Again, this is unsurprising since firms tend to raise financing for long-term and fixed asset purchases. This is supported by the negative correlations between Cash Holdings (C_{t-1}) and Non-Cash Assets (ΔNA_t) and Net Financing (NF_t).

Table 13: Pearson Correlation: F&W Model – United Kingdom

	$r_{i,t} - R_{i,t}$	ΔC_t	ΔE_t	ΔNA_t	ΔRDt	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$\Delta C_t * C_{t-1}$	$\Delta C_t * L_t$
$r_{i,t} - R_{i,t}$	1											
ΔC_t	0.1074*	1										
ΔE_t	0.2465*	0.1102*	1									
ΔNA_t	0.0422*	-0.0123	0.3009*	1								
ΔRDt	-0.015	0.0186	0.0218	0.0312	1							
ΔI_t	0.1129*	-0.0264	-0.1914*	-0.3346*	-0.0071	1						
ΔD_t	-0.0552*	-0.0561*	-0.2192*	-0.2498*	-0.0183	0.2017*	1					
C_{t-1}	0.0523*	-0.1695*	-0.0589*	-0.0024	0.017	0.0337	0.0499*	1				
L_t	-0.2917*	0.0257	-0.1268*	0.0899*	-0.0192	-0.1664*	0.0501*	0.1614*	1			
NF_t	-0.1198*	0.0833*	0.0733*	0.4566*	0.0188	-0.3182*	-0.1526*	-0.0838*	0.1068*	1		
$\Delta C_t * C_{t-1}$	0.0604*	0.7729*	0.0896*	-0.0607*	0.0161	-0.0014	-0.036	-0.3016*	-0.0173	0.076*	1	
$\Delta C_t * L_t$	0.0294	0.8261*	0.0476*	0.0043	0.0181	-0.0188	-0.0506*	-0.1649*	0.0662*	0.1162*	0.6418*	1

4.2.1.3. Brazil

Table 14 presents the Pearson correlation statistics for the F&W Model for a sample of Brazil-listed firms. The table shows a relatively high correlation between excess return ($r_{i,t} - R_{i,t}$), Change in Earnings (ΔE_t), Leverage (L_t), and Net Financing (NF_t). Similar to the UK, Leverage and Net Financing are negatively related to excess return in the UK, in contrast to the US. One

can reasonably assume that shareholders in a high real interest rate environment would not reward firm leverage. From the perspective of the equity investor, Leverage may result in future cash-flow being diverted to debtholders rather than equity investors via dividends or growth-orientated investment. From the standpoint of Net Financing (NF_t), this is deemed to be an equity dilution strategy since both net equity outstanding and net debt increase. Both reduce the future dividend flows for existing shareholders especially given the adequate mean levels of firm cash in Brazil. This may not be viewed favorably by existing shareholders. The matrix also presents evidence that the correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, which suggests a low probability of multicollinearity. Generally, the correlations between the independent variables are mostly below 0.3, from which one can reasonably assume minimal model multicollinearity. The correlations with the interaction variables are high as expected, given the inclusion of Change in Cash (ΔC_t) itself in the interaction variables. Similar to the US and UK, the highest correlation is between the variables Non-Cash Assets (ΔNA_t) and Net Financing (NF_t). This is understandable because firms tend to raise financing for long-term and fixed asset purchases. This assumption is supported by the negative correlations between Cash Holdings (C_{t-1}) and Non-Cash Assets (ΔNA_t) and Net Financing (NF_t).

Table 14: Pearson Correlation: F&W Model – Brazil

	$r_{i,t} - R_{i,t}$	ΔC_t	ΔE_t	ΔNA_t	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$\Delta C_t * C_{t-1}$	$\Delta C_t * L_t$
$r_{i,t} - R_{i,t}$	1										
ΔC_t	0.1468*	1									
ΔE_t	0.1143*	0.0916*	1								
ΔNA_t	0.1429*	0.1859*	0.1654*	1							
ΔI_t	0.0216	-0.0448*	0.108*	-0.0734*	1						
ΔD_t	-0.0603*	-0.0578*	-0.0324	-0.0472*	-0.014	1					
C_{t-1}	0.1191*	-0.2891*	0.0679*	-0.1485*	0.0254	0.0855*	1				
L_t	-0.1841*	-0.054*	0.0216	-0.1178*	0.0281	0.0814*	0.3392*	1			
NF_t	0.1869*	0.2091*	0.0036	0.2046*	0.0089	-0.043*	0.0581*	0.0554*	1		
$\Delta C_t * C_{t-1}$	0.0279	0.7957*	0.0322	0.2428*	-0.058*	-0.0853*	-0.5056*	-0.1287*	0.0628*	1	
$\Delta C_t * L_t$	0.1129*	0.8996*	0.085*	0.2201*	-0.045*	-0.0244	-0.2906*	-0.0673*	0.1837*	0.7961*	1

4.2.2. q Model:

4.2.2.1. United States

Table 15 presents the Pearson correlation statistics for the q Model for a sample of US-listed firms. The table shows a relatively high correlation between the change in q (Δq), Change in Cash (ΔC_t), Change in Earnings (ΔE_t), Change in Non-Cash Assets (ΔNA_t), and Net Financing (NF_t). Comparing the two models for the US, it is apparent that Change in Cash and Change in Earnings are both highly correlated to the dependent variables in the respective models. The models differ in the other high correlation variables. The q Model seems to have a correlation bias toward variables that impact enterprise value (Debt and Non-Cash Assets). In contrast, the F&W Model presents evidence that shareholders view Cash Holdings and Leverage as additional variables that affect excess return. The difference is relevant since the Firm Value of cash on the same dataset may be different depending on the perspective of what stakeholders believe the appropriate measure of Firm Value to be. The matrix also presents evidence that the

correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, suggesting a low probability of multicollinearity. The correlations between the independent variables are mostly below 0.3, implying minimal model multicollinearity. Furthermore, correlations between Change in Cash and the interaction variables are high as expected, given the inclusion of Change in Cash (ΔC_t) in the interaction variables. The highest correlation by some margin is between the variables Non-Cash Assets (ΔNA_t) and Net Financing (NF_t). Intuitively, this is unsurprising since firms tend to raise financing for long-term and fixed asset purchases. This is somewhat supported by the negative correlations between Cash Holdings (C_{t-1}) and Net Financing (NF_t).

Table 15: Pearson Correlation: q Model – United States

	Δq	ΔCt	ΔEt	ΔNAt	ΔRDt	ΔIt	ΔDt	Ct-1	Lt	NFt	ΔCt*Ct-1	ΔCt*Lt
Δq	1											
ΔCt	0.1113*	1*										
ΔEt	0.1542*	0.1783*	1*									
ΔNAt	0.2553*	-0.0328*	0.2342*	1*								
ΔRDt	-0.0551*	-0.1586*	-0.1398*	-0.2467*	1*							
ΔIt	-0.0653*	-0.0207	-0.0532*	-0.3443*	0.056*	1*						
ΔDt	0.0205	0.0389*	-0.0594*	-0.0948*	-0.0266	0.0372*	1*					
Ct-1	0.0726*	0.1423*	0.1797*	0.1506*	-0.4451*	-0.0286*	-0.0019	1*				
Lt	-0.038*	-0.1495*	-0.1733*	-0.0489*	0.2658*	-0.2188*	0.0192	-0.3924*	1*			
NFt	0.1203*	0.2312*	-0.0684*	0.473*	-0.0236	-0.3303*	0.0058	-0.1239*	0.2611*	1*		
ΔCt*Ct-1	0.0841*	0.889*	0.1924*	-0.0046	-0.2309*	-0.0149	0.0336*	0.3158*	-0.1948*	0.1804*	1*	
ΔCt*Lt	-0.076*	-0.8368*	-0.0757*	0.0547*	0.0477*	0.0659*	-0.0202	-0.0062	-0.026	-0.235*	-0.6548*	1*

4.2.2.2. United Kingdom

Table 16 presents the Pearson correlation statistics for the q Model for a sample of UK-listed firms. The table shows a relatively high correlation between the change in q(Δq), Change in Cash (ΔC_t), Change in Earnings (ΔE_t), Change in Non-Cash Assets (ΔNA_t), and Net

Financing (NF_t). These correlations are similar to the variable relationships presented above for the US dataset. Comparing the two models for the UK, it is apparent that Change in Cash and Change in Earnings are both highly correlated to the dependent variables in the respective models. The models differ in the other high correlation variables. The q Model seems to have a correlation bias toward variables that impact enterprise value (Debt and Non-Cash Assets). In contrast, the F&W Model presents evidence that shareholders view Cash Holdings and Leverage as additional variables that affect excess return. The difference is relevant since the Firm Value of cash on the same dataset may be different depending on the perspective of what stakeholders believe the appropriate measure of Firm Value to be. However, there is a further difference that distinguishes the q Model for the UK from other the other models. In the UK, Change in Dividends (ΔD_t) has a meaningful, statistically significant, and negative correlation with Δq. While dividends are not the focus of this study, this relationship is worthy of further analysis. The matrix also presents evidence that the correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, suggesting a low probability of multicollinearity. The correlations between the independent variables are mostly below 0.3, from which one can reasonably assume that minimal model multicollinearity exists. Furthermore, correlations between Change in Cash and the interaction variables are high as expected, given the inclusion of Change in Cash (ΔC_t) in the interaction variables. The highest correlation by some margin is between the variables Non-Cash Assets (ΔNA_t) and Net Financing (NF_t). Intuitively, this is unsurprising since firms tend to raise financing for long-term and fixed asset purchases. This is somewhat supported by the negative correlation between Cash Holdings (C_{t-1}) and Net Financing (NF_t).

Table 16: Pearson Correlation: q Model – United Kingdom

	Δq	ΔC_t	ΔE_t	ΔNA_t	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$\Delta C_t * C_{t-1}$	$\Delta C_t * L_t$
Δq	1										
ΔC_t	0.1241*	1									
ΔE_t	0.2575*	0.1702*	1								
ΔNA_t	0.2425*	-0.0079	0.3045*	1							
ΔI_t	-0.0188	-0.0327	-0.1225*	-0.3561*	1						
ΔD_t	-0.1494*	-0.1093*	-0.3723*	-0.2587*	0.0977*	1					
C_{t-1}	0.0862*	-0.1208*	0.1439*	0.1126*	0.0119	-0.2237*	1				
L_t	-0.0708*	-0.0432*	-0.1365*	0.0408*	-0.2*	0.1899*	-0.3514*	1			
NF_t	0.1178*	0.0847*	0.0254	0.5168*	-0.3861*	-0.1014*	-0.0154	0.2019*	1		
$\Delta C_t * C_{t-1}$	0.099*	0.8879*	0.1619*	-0.045*	-0.0111	-0.0973*	-0.0995*	-0.0451*	0.0231	1	
$\Delta C_t * L_t$	0.0966*	0.8073*	0.082*	0.024	-0.0549*	-0.0684*	-0.1345*	0.0773*	0.1373*	0.6241*	1

4.2.2.3. Brazil

Table 17 presents the Pearson correlation statistics for the q Model estimating on a sample of Brazil-listed firms. The table shows a relatively high correlation between the change in q (Δq), Change in Cash (ΔC_t), Change in Earnings (ΔE_t), and Change in Non-Cash Assets (ΔNA_t). These correlations are similar to the variable relationships presented above for the US dataset. Comparing the two models for Brazil, it is apparent that Change in Cash, Change in Earnings, and Non-Cash Assets are all highly correlated to the dependent variables in the respective models. The model is markedly different from the UK q Model correlation results and is more consistent with the US. The matrix also presents evidence that the correlations are mostly statistically significant. Observing Change in Cash (ΔC_t) as a variable of interest, the correlations with other independent variables are low, suggesting a low probability of multicollinearity. The exception is that Change in Cash is highly correlated to Cash Holdings. The correlations between the independent variables are mostly below 0.3, from which one can reasonably assume that

minimal model multicollinearity exists. Furthermore, correlations between Change in Cash and the interaction variables are high as expected, given the inclusion of Change in Cash (ΔC_t) in the interaction variables. The highest correlation by some margin is between the Non-Cash Assets (ΔNA_t) and Net Financing (NF_t) variables. Intuitively, this is unsurprising since firms tend to raise financing for long-term and fixed asset purchases. This is somewhat supported by the negative correlation between Cash Holdings (C_{t-1}) and Net Financing (NF_t).

Table 17: Pearson Correlation: q Model – Brazil

	Δq	ΔC_t	ΔE_t	ΔNA_t	ΔI_t	ΔD_t	C_{t-1}	L_t	NF_t	$\Delta C_t * C_{t-1}$	$\Delta C_t * L_t$
Δq	1										
ΔC_t	0.1573*	1*									
ΔE_t	0.1897*	0.1265*	1*								
ΔNA_t	0.1034*	0.0939*	0.179*	1*							
ΔI_t	0.0142	-0.0776*	0.0094	-0.1398*	1*						
ΔD_t	0.0073	-0.0181	-0.1208*	-0.0998*	-0.0231	1*					
C_{t-1}	0.0818*	0.4568*	0.0686*	0.1816*	-0.0724*	-0.0699*	1*				
L_t	-0.0357	0.0602*	-0.0142	-0.0224	-0.0843*	0.067*	-0.003	1*			
NF_t	0.0351	0.2768*	0.0702*	0.3928*	-0.118*	-0.035	0.2036*	0.1563*	1*		
$\Delta C_t * C_{t-1}$	0.1539*	0.8793*	0.1126*	0.122*	-0.0671*	-0.0448*	0.5243*	0.0688*	0.2824*	1*	
$\Delta C_t * L_t$	0.1045*	0.8328*	0.0906*	0.1205*	-0.0902*	-0.0263	0.4351*	0.1191*	0.3051*	0.7121*	1*

4.3. Empirical Results

This section presents the panel regression results for the two models and the three markets. The variables of interest are Change in Cash (ΔC_t) and Cash Holdings (C_{t-1}), and their respective impact on the dependent variables in the two model-firm excess return and change in firm q. Results from the respective markets are briefly compared in this section. As mentioned previously, the results are in local currencies but are comparable, given that one is merely observing the impact of the face value of cash changes and levels on the Firm Value within the respective markets. The perspective focuses on the extent to which Firm Value changes as a result of the cash dynamics in each market. This implies the interpretation of the Firm Value premium or discount to cash face value and comparing these premia and discounts across markets under different model specifications – with interaction variables and without interaction variables.

The premia and discounts are reflected in the coefficient values. A regressor coefficient value greater than 1 indicates a Firm Value premium to cash face value, and a value less than 1 denotes a discount to cash face value. For example, a coefficient value of USD1.20 (or any other currency) represents a Firm Value premium to cash value of 20%. Similarly, a coefficient value of USD0.80 (or any other currency) represents a Firm Value discount to a cash value of 20%. For example, a coefficient of USD1.20 and a UK sample coefficient of GBP1.20 are comparable since they both represent a premium of 20% within their respective markets and are thus no different. Shareholders of UK and US firms view cash dynamics in the same manner. Given the like-for-like currency comparison between firm value and cash face value in each market, the interpretation of the currency for the coefficients can be regarded as units (or percentages) rather

than in respective local currencies when comparing these premia or discounts across markets. Hence, currency translation is not undertaken or required in this study.

Faulkender and Wang (2006) considered the regression results with no interaction variables. This is relevant since one of the important results generated from this paper, and in contrast to the results of Faulkender and Wang (2006), is the lack of statistical significance for the Change in Cash (ΔC_t) and Cash Holdings (C_{t-1}) interaction variables in most of the models in this study. Indeed, the interaction variable is only statistically significant in Models 4 and 6, both of which are q Models. Pragmatism may indicate that Firm Value resulting from a Change in Cash levels will also depend on the Cash Holding level at the time. Indeed, the Law of Diminishing Marginal Utility supports such pragmatism. That is, the higher the levels of Cash Holdings, the lower the value (utility) of an incremental increase in cash.

However, in the absence of statistical significance for the interaction variables in some of the models, the regressor coefficients are estimated and interpreted without the inclusion of the interaction variables to facilitate statistically valid comparisons between the models. The models, without interaction, are presented in section 4.3.3 below and illustrated in Tables 24 to 30. A more comprehensive discussion relating to the model regression results (without interaction variables) in the context of the hypotheses is presented in Chapter 5. A summary table of the results is presented in Table 18 below.

Table 18: Results Summary

	Model (*including* Interaction Variables)						Model (*excluding* Interaction Variables)					
	1	2	3	4	5	6	1	2	3	4	5	6
ΔC_t	1.712*** (0.208)	0.954*** (0.264)	0.653*** (0.117)	2.474*** (0.409)	1.999*** (0.601)	0.802 (0.511)	1.259*** (0.153)	0.711*** (0.15)	0.481*** (0.093)	1.078*** (0.178)	1.697*** (0.258)	0.906*** (0.218)
ΔE_t	1.351*** (0.269)	1.12*** (0.265)	0.062** (0.025)	1.296*** (0.377)	2.542*** (0.612)	1.543*** (0.328)	1.361*** (0.267)	1.139*** (0.269)	0.063** (0.026)	1.329*** (0.372)	2.538*** (0.598)	1.545*** (0.327)
ΔNA_t	0.085*** (0.026)	0.095*** (0.036)	0.037*** (0.012)	0.917*** (0.11)	0.732*** (0.083)	0.309*** (0.099)	0.087*** (0.027)	0.094*** (0.037)	0.034*** (0.013)	0.918*** (0.11)	0.734*** (0.084)	0.309*** (0.1)
ΔRD_t	-0.711 (1.097)			5.728*** (2.032)			-0.700 (1.127)			5.573*** (2.038)		
ΔI_t	-1.61* (0.971)	0.791** (0.627)	0.002 (0.071)	6.371** (2.747)	12.527*** (3.039)	-0.632 (0.665)	-1.501 (0.954)	0.728** (0.633)	0.003 (0.071)	6.426** (2.731)	12.522*** (3.006)	-0.610 (0.661)
ΔD_t	1.805 (1.175)	-0.351 (0.662)	-0.897*** (0.33)	5.645** (2.268)	1.346 (3.16)	0.868 (0.667)	1.692 (1.163)	-0.338 (0.654)	-0.893*** (0.33)	5.7** (2.27)	1.343 (3.19)	0.848 (0.685)
C_{t-1}	1.27*** (0.104)	0.817*** (0.165)	0.432*** (0.066)	0.632*** (0.197)	0.908*** (0.177)	0.483** (0.195)	1.277*** (0.101)	0.817*** (0.145)	0.456*** (0.069)	0.573*** (0.2)	0.913*** (0.179)	0.519** (0.217)
L_t	1.129*** (0.08)	-1.028*** (0.079)	-1.34*** (0.161)	0.529*** (0.183)	-0.053 (0.189)	0.013 (0.358)	1.141*** (0.079)	-1.036*** (0.08)	-1.344*** (0.161)	0.492*** (0.183)	-0.055 (0.199)	0.010 (0.36)
NF_t	-0.029 (0.05)	-0.259* (0.139)	0.206* (0.11)	-0.030 (0.131)	0.132 (0.238)	0.051 (0.205)	-0.035 (0.049)	-0.271* (0.144)	0.219* (0.118)	-0.022 (0.131)	0.139 (0.237)	0.032 (0.192)
$C_{t-1} * \Delta C_t$	-0.108 (0.425)	0.166 (0.636)	-0.089 (0.092)	-4.523*** (0.966)	-2.163 (3.021)	1.678 (1.138)						
$L_t * \Delta C_t$	1.887*** (0.394)	-1.051** (0.419)	-0.148 (0.337)	3.628*** (1.255)	-0.240 (3.288)	-1.334 (1.006)						
Intercept	0.115 (0.016)	0.111*** (0.016)	0.396*** (0.049)	-0.118 (0.045)	-0.036 (0.047)	-0.025 (0.067)	0.118*** (0.015)	0.113*** (0.015)	0.394*** (0.05)	-0.102** (0.045)	-0.035 (0.048)	-0.026 (0.067)
F-Statistic	5.123	4.881	6.374	6.563	37.884	3.179	5.105	4.881	0.339	6.537	4.673	3.179
Adj R_2	0.250	0.297	0.339	0.311	0.283	0.186	0.248	0.295	714.558	0.308	0.283	0.186
Observations	5131	2466	2346	5126	2465	2092	5131	2466	2346	5128	2465	2092

Models: 1 = US F&W ; 2 = UK F&W ; 3 = Brazil F&W ; 4 = US q ; 5 = UK q ; 6 = Brazil q

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.1. F&W Model

The F&W model should be interpreted as follows:

$r_t - R_t$ = (Market Capitalization $_t$ – Market Capitalization $_{t-1}$) / Market capitalization $_{t-1}$

= annual change in excess equity returns $_t$

= Firm Value $_t$

It should also be noted that the market capitalization of the equity as presented in the equation above is an excess return, given that the benchmark return has been deducted. The

dependent variable is the change in excess return. Market capitalization (as the denominator of the dependent variable in the F&W model) is used to standardize the independent variables. Thus, the coefficients can be interpreted as a change in Equity Value associated with a USD1 change in an independent variable.

4.3.1.1. United States

Table 19 presents the regression results for the US sample. The results are similar to the results obtained by Faulkender and Wang (2006). The independent variables are generally statistically significant, except for the control variables R&D and Dividends.

The coefficient for Change in Cash (ΔC_t) indicates that for every USD1 Change in Cash, Firm Value increases by USD1.71. This compares to USD1.47 in the Faulkender and Wang (2006) study. The regression includes the two interaction variables. It should be noted that the Change in Cash and Cash Holding interaction variable is not statistically significant. While this suggests some caution in the interpretation of the results, the presence of a robust statistical relationship may exist. Intuitively, the firm value of a Change in Cash should be affected by the levels of Cash Holding. It may be that the model, as specified, may not be sufficiently robust to achieve statistical significance with respect to the interaction. Nevertheless, the interaction is included in the interpretation and discussion in this section, but further discussion in the paper does not include the interaction variables.

Indeed, in the absence of both interaction variables as per Table 24 below, the Firm Value impact of a USD1 Change in Cash is USD1.25. This compares to the USD0.75 in the Faulkender and Wang(2006) study. The mean Firm Value of a USD1 Change in Cash is USD2.06, which compares with USD0.94 in the Faulkender and Wang(2006) paper.

The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is USD1.27, which is approximately USD1.00 greater than the Faulkender and Wang results. The effect of Cash Holdings with no interaction and the mean Firm Value resulting from Cash Holdings are also markedly greater than the previous study, at USD1.28 and USD1.62, respectively. This is illustrated in Table 24.

Table 19: Regression Results: F&W Model – United States

Independent Variables	
ΔC_t	1.712***
	(0.208)
ΔE_t	1.351***
	(0.269)
ΔNA_t	0.085***
	(0.026)
ΔRD_t	-0.711
	(1.097)
ΔI_t	-1.61*
	(0.971)
ΔD_t	1.805
	(1.175)
C_{t-1}	1.27***
	(0.104)
L_t	1.129***
	(0.08)
NF_t	-0.029
	(0.05)
$C_{t-1} * \Delta C_t$	-0.108
	(0.425)
$L_t * \Delta C_t$	1.887***
	(0.394)
Intercept	0.115
	(0.016)
F-Statistic	5.123
Adj R_2	0.250
Observations	5131

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.1.2. United Kingdom

Table 20 presents the regression results for the UK sample. The results are a contrast to the US results. The independent variables are generally statistically significant, except for the control variables, Interest Expense, and Dividends. Similar to the US, the Change in Cash and Cash Holdings interaction variable is not statistically significant.

The coefficient for Change in Cash (ΔC_t) indicates that for every GBP1 Change in Cash, Firm Value increases by GBP0.95. This compares to USD1.71 for the US sample. In the absence of both interaction variables, the Firm Value impact of a GBP1 Change in Cash is GBP0.71, as shown in Table 25. This compares to the USD1.26 for the US. The mean Firm Value of a GBP1 Change in Cash is GBP0.98, which compares with USD2.06 in the US.

The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is GBP0.82, which is significantly lower than in the US results. Table 25 illustrates that the impact of Cash Holdings with no interaction and the mean Firm Value resulting from Cash Holdings is also markedly lower than in the US, at GBP0.82 and USD1.28, respectively.

Table 20: Regression Results: F&W Model – United Kingdom

Independent Variables	
ΔC_t	0.954***
	(0.264)
ΔE_t	1.12***
	(0.265)
ΔNA_t	0.095***
	(0.036)
ΔI_t	0.791**
	(0.627)
ΔD_t	-0.351
	(0.662)
C_{t-1}	0.817***
	(0.165)
L_t	-1.028***
	(0.079)
NF_t	-0.259*
	(0.139)
$C_{t-1} * \Delta C_t$	0.166
	(0.636)
$L_t * \Delta C_t$	-1.051**
	(0.419)
Intercept	0.111***
	(0.016)
F-Statistic	4.881
Adj R_2	0.297
Observations	2466

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.1.3. Brazil

Table 21 presents the regression results for the Brazil sample. The results are a contrast to both the US and UK results. The independent variables are statistically significant, except for the control variable, Interest Expense. Similar to the US, the Change in Cash and Cash Holdings interaction variable is not statistically significant.

The coefficient for Change in Cash (ΔC_t) indicates that for every BRL1 Change in Cash, Firm Value increases by BRL0.65. This compares to the USD1.71 and GBP0.95 for the US and UK samples. In the absence of both interaction variables, the Firm Value impact of a BRL1 Change in Cash is BRL0.48, as presented in Table 26. This compares to the USD1.26 and

GBP0.71 for the US and UK, respectively. The mean Firm Value of a BRL1 Change in Cash is BRL0.62, which compares with USD2.06 and GBP0.98 in the US and UK, respectively.

The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is BRL0.43, which is significantly lower than in the US and UK results. The impact of Cash Holdings with no interaction and the mean Firm Value resulting from Cash Holdings is also markedly lower than in the US and UK, at BRL0.46 and BRL0.43, respectively. This is shown in Table 26.

Table 21: Regression Results: F&W Model – Brazil

Independent Variables	
ΔC_t	0.653***
	(0.117)
ΔE_t	0.062**
	(0.025)
ΔNA_t	0.037***
	(0.012)
ΔI_t	0.002
	(0.071)
ΔD_t	-0.897***
	(0.33)
C_{t-1}	0.432***
	(0.066)
L_t	-1.34***
	(0.161)
NF_t	0.206*
	(0.11)
$C_{t-1} * \Delta C_t$	-0.089
	(0.092)
$L_t * \Delta C_t$	-0.148
	(0.337)
Intercept	0.396***
	(0.049)
F-Statistic	6.374
Adj R_2	0.339
Observations	2346

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - $Xi_{,t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.2. q Model

4.3.2.1. United States

Table 22 presents the regression results for a change in firm q for the US sample. The independent variables are statistically significant, except for the control variable Net Financing.

The coefficient for Change in Cash (ΔC_t) indicates that for every USD1 Change in Cash, Firm Value increases by USD2.47. This compares to the USD1.47 in the Faulkender and Wang (2006) study and the USD1.71 in the F&W Model in this paper. The regression includes the two interaction variables, and both are statistically significant. In the absence of both interaction variables, the Firm Value impact of a USD1 Change in Cash is USD1.08 as per Table 27. This compares to the USD0.75 in the Faulkender and Wang study and the USD1.26 in the F&W Model in this paper. The mean Firm Value of a USD1 Change in Cash is USD2.01, which is very similar to the USD2.06 obtained in the F&W model in this paper.

The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is USD0.63, which is a 37% discount to the face value of Cash Holdings. Table 27 illustrates that the impact of Cash Holdings with no interaction and the mean Firm Value resulting from Cash Holdings are also markedly greater than the F&W model results, at USD0.57 and USD0.17, respectively. Regarding the latter coefficient value, the mean Firm Value resulting from a USD1 increase in Cash Holdings is valued at an 83% discount to Cash Holdings face value. Refer to Chapter 5 for further discussion.

Table 22: Regression Results: q Model – United States

Independent Variables	
ΔC_t	2.474*** (0.409)
ΔE_t	1.296*** (0.377)
ΔNA_t	0.917*** (0.11)
ΔRD_t	5.728*** (2.032)
ΔI_t	6.371** (2.747)
ΔD_t	5.645** (2.268)
C_{t-1}	0.632*** (0.197)
L_t	0.529*** (0.183)
NF_t	-0.030 (0.131)
$C_{t-1} * \Delta C_t$	-4.523*** (0.966)
$L_t * \Delta C_t$	3.628*** (1.255)
Intercept	-0.118 (0.045)
F-Statistic	6.563
Adj R_2	0.311
Observations	5126

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.2.2. United Kingdom

Table 23 presents the regression results for a change in firm q for the UK sample. The independent variables are statistically significant, except for the control variable Net Financing.

The coefficient for Change in Cash (ΔC_t) indicates that for every GBP1 Change in Cash, Firm Value increases by GBP1.99. This represents more than a GBP1 increase compared to the GBP0.95 in the F&W Model in this paper. The regression includes the two interaction variables,

but neither interaction variables are statistically significant. Table 28 below shows that in the absence of both interaction variables, the Firm Value impact of a GBP1 Change in Cash is GBP1.70. This compares to the GBP0.71 in the F&W Model in this paper. The mean Firm Value of a GBP1 Change in Cash is GBP1.80, which is almost double the GBP0.98 obtained in the F&W model in this paper.

The impact on Firm Value resulting from Cash Holdings levels (C_{t-1}) is GBP0.91, which is a 9% discount to the face value of Cash Holdings. Cash Holdings' impact with no interaction and the mean Firm Value resulting from Cash Holdings are very similar to the F&W model results, at USD0.91 and USD0.89, respectively. Refer to Chapter 5 for further discussion.

Table 23: Regression Results: q Model – United Kingdom

Independent Variables	
ΔC_t	1.999*** (0.601)
ΔE_t	2.542*** (0.612)
ΔNA_t	0.732*** (0.083)
ΔI_t	12.527*** (3.039)
ΔD_t	1.346 (3.16)
C_{t-1}	0.908*** (0.177)
L_t	-0.053 (0.189)
NF_t	0.132 (0.238)
$C_{t-1} * \Delta C_t$	-2.163 (3.021)
$L_t * \Delta C_t$	-0.240 (3.288)
Intercept	-0.036 (0.047)
F-Statistic	37.884
Adj R_2	0.283
Observations	2465

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_i is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.2.3. Brazil

Table 24 presents the regression results for a change in firm q for the Brazil sample. The statistical significance of the variables is mixed. The control variables Change in Interest Expense, Change in Dividends, Leverage, Net Financing resulting are not statistically significant.

The coefficient for Change in Cash (ΔC_t) indicates that for every BRL1 Change in Cash, Firm Value increases by BRL0.80. This is approximately BRL0.15, greater than the F&W Model

in this paper. The regression includes the two interaction variables, but neither interaction variables are statistically significant. In the absence of both interaction variables, the Firm Value impact of a BRL1 Change in Cash is BRL0.91. This compares to the BRL0.48 in the F&W Model. The mean Firm Value of a BRL1 Change in Cash is BRL1.02, which is higher than the results obtained in the F&W model.

The impact on Firm Value resulting from Cash Holdings (Ct-1) levels is BRL0.48, which is a 52% discount to the face value of Cash Holdings. The impact of Cash Holdings with no interaction and the mean Firm Value resulting from Cash Holdings are similar to the F&W model results, at BRL0.52 and BRL0.65, respectively, as shown in Table 29.

Table 24: Regression Results: q Model – Brazil

Independent Variables	
ΔC_t	0.802
	(0.511)
ΔE_t	1.543***
	(0.328)
ΔNA_t	0.309***
	(0.099)
ΔI_t	-0.632
	(0.665)
ΔD_t	0.868
	(0.667)
C_{t-1}	0.483**
	(0.195)
L_t	0.013
	(0.358)
NF_t	0.051
	(0.205)
$C_{t-1} * \Delta C_t$	1.678
	(1.138)
$L_t * \Delta C_t$	-1.334
	(1.006)
Intercept	-0.025
	(0.067)
F-Statistic	3.179
Adj R_2	0.186
Observations	2092

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.3.3. Model Results - No Interaction Variables

In the context of the interpretation of the results above, Tables 25 to 30 present the model regression results described in sections 4.3.1 and 4.3.2. That is, excluding the interaction variables. The results for the variables of interest in each country and both models are summarized in Table 30. These results will form the basis of further discussion in Chapter 5.

Table 25: Regression Results: F&W Model – United States

Independent Variables	
ΔC_t	1.259*** (0.153)
ΔE_t	1.361*** (0.267)
ΔNA_t	0.087*** (0.027)
ΔRD_t	-0.700 (1.127)
ΔI_t	-1.501 (0.954)
ΔD_t	1.692 (1.163)
C_{t-1}	1.2771*** (0.101)
L_t	1.141*** (0.079)
NF_t	-0.035 (0.049)
Intercept	0.118*** (0.015)
F-Statistic	5.105
Adj R_2	0.248
Observations	5131

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity ($M_{i,t-1}$). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 26: Regression Results: F&W Model – United Kingdom

Independent Variables	
ΔC_t	0.711*** (0.15)
ΔE_t	1.139*** (0.269)
ΔNA_t	0.094*** (0.037)
ΔI_t	0.728** (0.633)
ΔD_t	-0.338 (0.654)
C_{t-1}	0.817*** (0.145)
L_t	-1.036*** (0.08)
NF_t	-0.271* (0.144)
Intercept	0.113*** (0.015)
F-Statistic	4.881
Adj R_2	0.295
Observations	2466

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity ($M_{i,t-1}$). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 27: Regression Results: F&W Model – Brazil

Independent Variables	
ΔC_t	0.481***
	(0.093)
ΔE_t	0.063**
	(0.026)
ΔNA_t	0.034***
	(0.013)
ΔI_t	0.003
	(0.071)
ΔD_t	-0.893***
	(0.33)
C_{t-1}	0.456***
	(0.069)
L_t	-1.344***
	(0.161)
NF_t	0.219*
	(0.118)
Intercept	0.394***
	(0.05)
F-Statistic	0.339
Adj R_2	714.558
Observations	2346

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 28: Regression Results: q Model – United States

Independent Variables	
ΔC_t	1.078***
	(0.178)
ΔE_t	1.329***
	(0.372)
ΔNA_t	0.918***
	(0.11)
ΔRD_t	5.573***
	(2.038)
ΔI_t	6.426**
	(2.731)
ΔD_t	5.7**
	(2.27)
C_{t-1}	0.573***
	(0.2)
L_t	0.492***
	(0.183)
NF_t	-0.022
	(0.131)
Intercept	-0.102**
	(0.045)
F-Statistic	6.537
Adj R_2	0.308
Observations	5128

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 29: Regression Results: q Model – United Kingdom

Independent Variables	
ΔC_t	1.999*** (0.601)
ΔE_t	2.542*** (0.612)
ΔNA_t	0.732*** (0.083)
ΔI_t	12.527*** (3.039)
ΔD_t	1.346 (3.16)
C_{t-1}	0.908*** (0.177)
L_t	-0.053 (0.189)
NF_t	0.132 (0.238)
Intercept	-0.036 (0.047)
F-Statistic	37.884
Adj R_2	0.283
Observations	2465

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change, $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 30: Regression Results: q Model – Brazil

Independent Variables	
ΔC_t	0.906*** (0.218)
ΔE_t	1.545*** (0.327)
ΔNA_t	0.309*** (0.1)
ΔI_t	-0.610 (0.661)
ΔD_t	0.848 (0.685)
C_{t-1}	0.519** (0.217)
L_t	0.010 (0.36)
NF_t	0.032 (0.192)
Intercept	-0.026 (0.067)
F-Statistic	3.179
Adj R_2	0.186
Observations	2092

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change, $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Table 31: Regression Coefficients Summary: Variables of Interest

		Faulkender and Wang (2006)		F&W Model		q Model	
				Model 1		Model 4	
		Mean	FV	Mean	FV	Mean	FV
US	ΔC	0.004	0.751	0.048	1.26	0.13	1.08
	C	0.176	0.337	0.092	1.28	0.13	0.57
				Model 2		Model 5	
UK	ΔC	No Analysis by authors		0.01	0.71	0.01	1.70
	C			0.13	0.82	0.10	0.91
				Model 3		Model 6	
Brazil	ΔC	No Analysis by authors		0.01	0.48	0.09	0.91
	C			0.36	0.46	0.13	0.52

4.4. Model Test Results

4.4.1. Multicollinearity Tests

Typically, multicollinearity exists when independent variables exhibit a high degree of correlation. This tends to inflate the independent variables' predictive capabilities and thus may overstate the relationship between an independent variable and the model-dependent variable. Multicollinearity can be viewed as both a ‘facet and a symptom’ of poor model specification (Haitovsky, 1969). Observing Pearson bivariate correlation coefficients is an acceptable method of detecting high collinearity between independent variables (Kraha, Turner, Nimon, Zientek, & Henson, 2012). The model correlations were presented in Section 4.2 and Tables 12 to 17.

An additional method to detect multicollinearity is by observing independent variable Variance Inflation Factors (VIF) (Tamura et al., 2019). The VIF statistic for an independent variable indicates the extent of the linear relationship between one independent variable and the other independent variables. A VIF statistic greater than ten is considered unacceptable and strong evidence of multicollinearity (Mertler & Vannatta, 2005). The model VIF’s are presented

in Table 31. This section considers both the Pearson correlation matrix and Variance Inflation Factors to detect multicollinearity.

4.4.1.1. F&W Model

United States

The correlation matrix presented in Table 12 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 32 presents the VIF statistics for the US F&W model sample represented as Model 1. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

United Kingdom

The correlation matrix presented in Table 13 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 31 presents the VIF statistics for the UK F&W model sample represented as Model 2. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

Brazil

The correlation matrix presented in Table 14 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 32 presents the VIF statistics for the Brazil F&W model sample represented as Model 3. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

4.4.1.2. q Model

United States

The correlation matrix presented in Table 15 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 32 presents the VIF statistics for the US q model sample represented as Model 4. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

United Kingdom

The correlation matrix presented in Table 16 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 32 presents the VIF statistics for the UK q model sample represented as Model 5. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

Brazil

The correlation matrix presented in Table 17 shows low correlations between the non-cash independent variables. There is thus little evidence of any strong bivariate linear relationships. Table 32 presents the VIF statistics for the Brazil q model sample represented as Model 6. All variables exhibit very low VIF's suggesting a very weak linear association between a single variable and the remaining variables.

Table 32: VIF Statistics

	Model					
VIF Test	1	2	3	4	5	6
ΔC_t	1.1	1.1	1.2	1.3	1.1	1.4
ΔE_t	1.1	1.2	1.1	1.2	1.3	1.1
ΔNA_t	1.6	1.5	1.1	1.8	1.7	1.3
ΔRD_t	1.0	-	-	1.3	-	-
ΔI_t	1.2	1.2	1.0	1.2	1.3	1.0
ΔD_t	1.0	1.1	1.0	1.0	1.3	1.0
C_{t-1}	1.0	1.1	1.3	1.4	1.2	1.3
L_t	1.1	1.1	1.1	1.4	1.3	1.0
NF_t	1.7	1.4	1.1	1.8	1.6	1.3

Model 1 = Faulkender and Wang Model - US
Model 2 = Faulkender and Wang Model - UK
Model 3 = Faulkender and Wang Model - Brazil
Model 4 = q Model - US
Model 5 = q Model - UK
Model 5 = q Model - Brazil

4.4.2. Chow Tests:

A Chow test was undertaken on the six model samples to determine whether a pooled (common effect) ordinary least squares or specific effects regression model is most appropriate for panel data regression. Thus, the tests' outcome will determine whether a pooled OLS regression model or a fixed/random effects regression model is more appropriate for the empirical analysis. The decision to pool data with an OLS regression or to use an alternative is a decision based on the extent to which the regression estimate's parameters vary for the sample. A Chow test based on the null hypothesis that the independent variable coefficients for fixed effects are zero is undertaken. It is expected that the common effects are the dominant characteristics in the data sample. If the test is significant at the 95% confidence level (p = 0.05), the null hypothesis is rejected. The interpretation is that the fixed/random effects are significant, and the data should not be pooled in an OLS regression model for common effects. In this case, a fixed/random effects regression model is appropriate (Baltagi, 2001; Cantrell, Burrows, & Vuong, 1991).

The Chow Test chi-squared statistic and p-values for the six models are presented in Table 33. All models show statistically significant values indicating the prevalence of fixed effects. Thus, a pooled OLS model is not preferred. Hausman Tests will indicate whether the data is more suitable for a fixed effect or random effect regression model.

Table 33: Chow Tests

	Model					
Chow Test	1	2	3	4	5	6
Cross-Section/Period Chi-square	894.08	436.21	348.14	404.53	292.25	168.86
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Model 1 = Faulkender and Wang Model - US
Model 2 = Faulkender and Wang Model - UK
Model 3 = Faulkender and Wang Model - Brazil
Model 4 = q Model - US
Model 5 = q Model - UK
Model 5 = q Model - Brazil

4.4.3. Hausman Tests

Hausman tests are undertaken on the six models to test for model misspecification resulting from endogeneity. Given that the Hausman test's null hypothesis is that the optimum model for regression on a panel data sample is the random-effects model, the test will also specify the appropriate model selection between the random and fixed-effect models. The test indicates the strength of the association between the independent variables and the residuals in the model. If the test fails to reject the null hypothesis, this outcome indicates no (or very little) correlation between the independent variables and the residuals (error terms). In this instance, the random-effects model for panel data regression should be chosen. If the test is significant, the null hypothesis is rejected, and therefore the appropriate model for the sample regression is the fixed effects model. The p-value for the test is interpreted at the 95% confidence level ($p < 0.05$) (Arellano, 1993).

4.4.3.1. F&W Model

United States

The chi-squared statistic and its associated p-value for the US using the F&W model are presented in Table 34 as Model 1. The test is significant at the 99% confidence level. The chi-statistic is 554.58. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the F&W model are presented in Table 34 as Model 2. The test is significant at the 99% confidence level. The chi-statistic is 213.65. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the F&W model are presented in Table 34 as Model 3. The test is significant at the 99% confidence level. The chi-statistic is 282.28. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

4.4.3.2. q Model

United States

The chi-squared statistic and its associated p-value for the US using the q model are presented in Table 34 as Model 4. The test is significant at the 99% confidence level. The chi-statistic is 81.86. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the q model are presented in Table 34 as Model 5. The test is significant at the 99% confidence level. The chi-statistic is 27.17. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the q model are presented in Table 34 as Model 6. The test is significant at the 99% confidence level. The chi-statistic is 25.42. The null hypothesis is rejected, and thus the random-effects model is the appropriate model for the panel regression.

Table 34: Hausman Tests

	Model					
Cross-Section Random	1	2	3	4	5	6
Chi-Sq. Statistic	554.58	213.65	282.28	81.86	27.17	25.42
Prob.	0.0000	0.0000	0.0000	0.0000	0.0024	0.0046

Model 1 = Faulkender and Wang Model - US
Model 2 = Faulkender and Wang Model - UK
Model 3 = Faulkender and Wang Model - Brazil
Model 4 = q Model - US
Model 5 = q Model - UK
Model 5 = q Model - Brazil

4.4.4. Redundant Fixed Effects Tests:

The redundant fixed effects test generates an F-statistic of the combined statistical significance of the panel model specification's independent variables. It indicates the justification for a fixed-effects variable inclusion in a model (Eviews, 2020). The output in Table 35 illustrates the combined significance of both the cross-section and period fixed effects of all the independent variables in the respective models. The F-test measures the combined significance

of the cross-section and period effects using a sum of squares methodology, and the chi-squared test provides a likelihood estimation. The p-values are assessed at the 95% confidence level ($p < 0.05$).

4.4.4.1. F&W Model:

United States

The chi-squared statistic and its associated p-value for the US using the F&W model are presented in Table 35 as Model 1. The tests are significant at the 99% confidence level. The two statistical values (2.49 and 990.50) and the associated p-value strongly reject the null hypothesis that the combined effects are redundant. Thus, the inclusion of the set of independent variables in the model is justified.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the F&W model are presented in Table 35 as Model 2. The tests are significant at the 99% confidence level. The two statistical values (2.61 and 657.15) and the associated p-value strongly reject the null hypothesis that the combined effects are redundant. Thus, the inclusion of the set of independent variables in the model is justified.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the F&W model are presented in Table 35 as Model 3. The tests are significant at the 99% confidence level. The two statistical values (4.14 and 818.48) and the associated p-value strongly reject the null hypothesis that the combined effects are redundant. Thus, the inclusion of the set of independent variables in the model is justified.

4.4.4.2. q Model:

United States

The chi-squared statistic and its associated p-value for the US using the q model are presented in Table 35 as Model 4. The tests are significant at the 99% confidence level. The two statistical values (5.01 and 1831.51) and the associated p-value strongly reject the null hypothesis that the combined effects are redundant. Thus, the inclusion of the set of independent variables in the model is justified.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the q model are presented in Table 35 as Model 5. The tests are significant at the 99% confidence level. The two statistical values (3.28 and 800.59) and the associated p-value strongly reject the null hypothesis that the combined effects are redundant. Thus, the inclusion of the set of independent variables in the model is justified.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the q model are presented in Table 35 as Model 6. The tests are significant at the 99% confidence level. The two statistical values (2.53 and 520.41) and the associated p-value strongly reject the null hypothesis.

Table 35: Redundant Fixed Effects Tests

	Model					
Effects Test	1	2	3	4	5	6
Cross-Section/Period F	2.49	2.61	4.14	5.01	3.28	2.53
Cross-Section/Period Chi-squa	990.50	657.15	818.48	1831.51	800.59	520.41
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Model 1 = Faulkender and Wang Model - US
Model 2 = Faulkender and Wang Model - UK
Model 3 = Faulkender and Wang Model - Brazil
Model 4 = q Model - US
Model 5 = q Model - UK
Model 5 = q Model - Brazil

4.4.5. Wald Tests:

The Wald test measures how far the estimated coefficients are from zero and measures these standard errors on all estimated coefficients in the model simultaneously. The test's value is that if an estimated coefficient is not statistically different from zero, omitting it from the model will have little impact on the model goodness-of-fit (as denoted by the value of the F-statistic). Hypothesis tests are performed on the estimated equations of the six models. The null hypothesis is that each independent variable in the respective models has a coefficient of zero. Rejecting the null hypothesis implies that the variable coefficients are simultaneously and statistically significantly different from zero.

4.4.5.1. F&W Model:

United States

The chi-squared statistic and its associated p-value for the US using the F&W model are presented in Table 36 as Model 1. The tests are significant at the 99% confidence level. The two statistical values (247.45 and 2721.91) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the F&W model are presented in Table 36 as Model 2. The tests are significant at the 99% confidence level. The two statistical values (125.13 and 1376.43) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the F&W model are presented in Table 36 as Model 3. The tests are significant at the 99% confidence level. The two statistical values (38.67 and 386.72) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

4.4.5.2. q Model

United States

The chi-squared statistic and its associated p-value for the US using the q model are presented in Table 36 as Model 4. The tests are significant at the 99% confidence level. The two statistical values (112.88 and 1241.70) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

United Kingdom

The chi-squared statistic and its associated p-value for the UK using the q model are presented in Table 36 as Model 5. The tests are significant at the 99% confidence level. The two statistical values (49.95 and 499.46) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

Brazil

The chi-squared statistic and its associated p-value for Brazil using the q model are presented in Table 36 as Model 6. The tests are significant at the 99% confidence level. The two statistical values (16.69 and 166.94) and the associated p-values strongly reject the null hypothesis that the regressors' estimated coefficients are simultaneously equal to zero. Thus, the inclusion of the set of independent variables in the model is justified and would detract from the model fit if omitted.

Table 36: Wald Tests

	Model					
Wald Test Statistic	1	2	3	4	5	6
F-statistic	247.45	125.13	38.67	112.88	49.95	16.69
Chi-square	2721.91	1376.43	386.72	1241.70	499.46	166.94
Prob.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Model 1 = Faulkender and Wang Model - US
Model 2 = Faulkender and Wang Model - UK
Model 3 = Faulkender and Wang Model - Brazil
Model 4 = q Model - US
Model 5 = q Model - UK
Model 5 = q Model - Brazil

4.4.6. Robustness Tests:

In addition to the model and independent variable tests above, I analyze the model results for the period between 2010 and 2019. This period excludes the time immediately before, during the Global Financial Crisis, and the immediate aftermath. Thus, the study sample period from 2006 to 2009 relating to the financial crisis is excluded from all six models. The three F&W Models were robust for the ten-year robustness test period. The variables of interest were significant in all three models. However, the three q Models were robust for only four years.

Interestingly, all three q Models were only robust for the four years between 2016 and 2019. During that period, the variables of interest were significant in all three models. Change in Cash (ΔC_t) was not statistically significant in any of the q models from 2010 to 2015. Also, the Cash Holdings level (C_{t-1}) was not statistically significant in the US q Model during that period. A summary table of the test results are presented in Table 37 below:

Table 37: Robustness Tests Summary Results

	Model					
	1	2	3	4	5	6
ΔC_t	1.501*** (0.205)	0.773*** (0.27)	0.714*** (0.146)	1.889*** (0.402)	1.347* (0.734)	0.808 (0.585)
ΔE_t	1.496*** (0.186)	1.547*** (0.093)	0.05* (0.027)	1.742*** (0.286)	2.773*** (0.606)	1.251*** (0.298)
ΔNA_t	0.077*** (0.023)	0.046 (0.034)	0.032** (0.014)	0.998*** (0.069)	0.687*** (0.085)	0.395*** (0.115)
ΔRD_t	-3.909 (1.045)			3.962*** (1.356)		
ΔI_t	-0.792 (1.543)	0.367 (0.847)	0.052 (0.064)	7.414** (2.582)	12.111*** (3.731)	0.159 (0.401)
ΔD_t	2.296 (1.467)	-0.775 (0.87)	-0.908** (0.423)	3.647** (1.717)	1.154 (3.393)	0.528 (0.677)
C_{t-1}	1.3755*** (0.185)	0.677*** (0.205)	0.361*** (0.048)	0.416*** (0.146)	0.643*** (0.203)	0.518** (0.25)
L_t	1.266*** (0.131)	-0.912*** (0.092)	-1.277*** (0.135)	0.252 (0.194)	-0.040 (0.244)	0.191 (0.387)
NF_t	0.004 (0.054)	-0.222** (0.107)	0.053 (0.046)	0.062 (0.137)	-0.106 (0.204)	0.116 (0.248)
$C_{t-1} * \Delta C_t$	-0.070 (0.768)	-0.040 (0.97)	0.012 (0.078)	-3.982*** (1.066)	2.066 (4.182)	1.522 (1.577)
$L_t * \Delta C_t$	1.765** (0.736)	-0.719 (0.465)	-0.561*** (0.202)	1.785 (1.159)	1.400 (2.98)	-1.577 (0.71)
Intercept	0.116 (0.021)	0.076*** (0.011)	0.333*** (0.052)	-0.08*** (0.055)	-0.037 (0.056)	-0.069 (0.069)
F-Statistic	4.274	3.802	4.340	0.000	2.999	2.449
Adj R_2	0.263	0.274	0.278	0.163	0.211	0.146
Observations	3772	1966	1914	3768	1966	1827

Models: 1 = US F&W ; 2 = UK F&W ; 3 = Brazil F&W ; 4 = US q ; 5 = UK q ; 6 = Brazil q

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - $Xi_{,t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.4.6.1. F&W Models:

United States

Table 38 presents the regression results for the US sample for the period 2010 to 2019. The results are very similar to the results obtained for the full sample period presented in Table 18. The same independent variables are statistically significant. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is USD0.21 lower than for the full sample period. The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is USD0.11 higher for the robustness test period. The adjusted R^2 is 1% higher than for the full period, and the F-statistic is 80 basis points lower at 4.274. The Durbin Watson Statistics are both between 2.0 and 2.1.

In sum, the F&W US sample's model specification is very robust and a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of market stability and volatility.

Table 38: Robustness Test Results: F&W Model – United States

Independent Variables	
ΔC_t	1.501*** (0.205)
ΔE_t	1.496*** (0.186)
ΔNA_t	0.077*** (0.023)
ΔRD_t	-3.909 (1.045)
ΔI_t	-0.792 (1.543)
ΔD_t	2.296 (1.467)
C_{t-1}	1.3755*** (0.185)
L_t	1.266*** (0.131)
NF_t	0.004 (0.054)
$C_{t-1} * \Delta C_t$	-0.070 (0.768)
$L_t * \Delta C_t$	1.765** (0.736)
Intercept	0.116 (0.021)
F-Statistic	4.274
Adj R_2	0.263
Observations	3772

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - Xi_{t-1}. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

United Kingdom

Table 39 presents the regression results for the UK sample for the period 2010 to 2019. The results are similar to the results obtained for the full sample period presented in Table 19. The same independent variables are statistically significant, except for Non-Cash Assets (ΔNA_t), which was not significant for the robustness testing period. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is GBP0.18 lower than for the full sample period. The

impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is GBP0.14 lower for the robustness test period. The adjusted R^2 is 2.3% lower than for the full period, and the F-statistic is 1% lower at 3.802. The Durbin Watson Statistics are both between 2.10 and 2.20.

In sum, the F&W UK sample's model specification is very robust and a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of stability and volatility.

Table 39: Robustness Test Results: F&W Model – United Kingdom

	F&W: UK
Independent Variables	
ΔC_t	0.773***
	(0.27)
ΔE_t	1.547***
	(0.093)
ΔNA_t	0.046
	(0.034)
ΔI_t	0.367
	(0.847)
ΔD_t	-0.775
	(0.87)
C_{t-1}	0.677***
	(0.205)
L_t	-0.912***
	(0.092)
NF_t	-0.222**
	(0.107)
$C_{t-1} * \Delta C_t$	-0.040
	(0.97)
$L_t * \Delta C_t$	-0.719
	(0.465)
Intercept	0.076***
	(0.011)
F-Statistic	3.802
Adj R_2	0.274
Observations	1966

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t}$ - $Xi_{,t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Brazil

Table 40 presents the regression results for the Brazil sample for the period 2010 to 2019. The results are similar to the results obtained for the full sample period presented in Table 20. The same independent variables are statistically significant, except for Net Financing (NF_t), which was not significant for the robustness testing period. Generally, there is evidence of a small reduction in confidence levels during the 2010 to 2019 period. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is BRL0.06 higher than for the full sample period. The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is BRL0.07 lower for the robustness test period. The adjusted R^2 is 0.6% lower than for the full period, and the F-statistic is 2% lower at 4.340. The Durbin Watson Statistics are both at the 1.9 level.

In sum, the F&W Brazil sample's model specification is robust and a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of stability and volatility.

Table 40: Robustness Test Results: F&W Model – Brazil

Independent Variables	
ΔC_t	0.714*** (0.146)
ΔE_t	0.05* (0.027)
ΔNA_t	0.032** (0.014)
ΔI_t	0.052 (0.064)
ΔD_t	-0.908** (0.423)
C_{t-1}	0.361*** (0.048)
L_t	-1.277*** (0.135)
NF_t	0.053 (0.046)
$C_{t-1} * \Delta C_t$	0.012 (0.078)
$L_t * \Delta C_t$	-0.561*** (0.202)
Intercept	0.333*** (0.052)
F-Statistic	4.340
Adj R_2	0.278
Observations	1914

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

4.4.6.2. q Models:

United States

Table 41 presents the regression results for the US sample for the period 2016 to 2019. The robustness period, presented in the F&W Models above, was not statistically significant for the period 2010 to 2015 in the US q Model. The results for the robust period (2016-2019) contrast to the results obtained for the full sample period presented in Table 24. Generally, the same independent variables are statistically significant. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is USD0.58 lower than for the full sample period. The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is USD0.22 lower for the

robustness test period. The adjusted R^2 is 14% lower than for the full period, and the F-statistic is 378 basis points lower at 2.78. The Durbin Watson Statistics are both between 1.80 and 2.10.

In sum, the model specification for the q Model US sample is not robust during periods of rapid equity price recovery and thus may not be a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of rapidly increasing equity values.

Table 41: Robustness Test Results: q Model – United States

Independent Variables	
ΔC_t	2.474***
	(0.409)
ΔE_t	1.296***
	(0.377)
ΔNA_t	0.917***
	(0.11)
ΔRD_t	5.728***
	(2.032)
ΔI_t	6.371**
	(2.747)
ΔD_t	5.645**
	(2.268)
C_{t-1}	0.632***
	(0.197)
L_t	0.529***
	(0.183)
NF_t	-0.030
	(0.131)
$C_{t-1} * \Delta C_t$	-4.523***
	(0.966)
$L_t * \Delta C_t$	3.628***
	(1.255)
Intercept	-0.118
	(0.045)
F-Statistic	6.563
Adj R_2	0.311
Observations	5126

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 1% and 99% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

United Kingdom

Table 42 presents the regression results for the US sample for the period 2016 to 2019. The robustness period, presented in the F&W Models above, was not statistically significant for the period 2010 to 2015 in the UK q Model. Like the US, the results for the robust period (2016-2019) contrast to the results obtained for the full sample period presented in Table 25. Generally, the same independent variables are statistically significant. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is GBP0.65 lower than for the full sample period. The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is GBP0.27 lower for the robustness test period. The adjusted R^2 is 7% lower than for the full period, and the F-statistic is 164 basis points lower at 2.99. The Durbin Watson Statistics are both between 1.80 and 2.10.

In sum, the model specification for the q Model UK sample is not robust during periods of rapid equity price recovery and thus may not be a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of rapidly increasing equity values.

Table 42: Robustness Test Results: q Model – United Kingdom

Independent Variables	
ΔC_t	1.347*
	(0.734)
ΔE_t	2.773***
	(0.606)
ΔNA_t	0.687***
	(0.085)
ΔI_t	12.111***
	(3.731)
ΔD_t	1.154
	(3.393)
C_{t-1}	0.643***
	(0.203)
L_t	-0.040
	(0.244)
NF_t	-0.106
	(0.204)
$C_{t-1} * \Delta C_t$	2.066
	(4.182)
$L_t * \Delta C_t$	1.400
	(2.98)
Intercept	-0.037
	(0.056)
F-Statistic	2.999
Adj R_2	0.211
Observations	1966

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

Brazil

Table 43 presents the regression results for the Brazil sample for the period 2016 to 2019. The robustness period, presented in the F&W Models above, was not statistically significant for the period 2010 to 2015 in the Brazil q Model. Similar to the other two markets, the results for the robust period (2016-2019) are a contrast to the results obtained for the full sample period presented in Table 26. Generally, the same independent variables are statistically significant. Regarding the variables of interest, the coefficient for Change in Cash (ΔC_t) is the same as the full sample period. The impact on Firm Value resulting from levels of Cash Holdings (C_{t-1}) is

marginally higher by BRL0.04 lower for the robustness test period. The adjusted R^2 is 4% lower than for the full period, and the F-statistic is four basis points lower at 2.45. The Durbin Watson Statistics are both approximately 2.20.

In sum, the model specification for the q Model Brazil sample is not robust during periods of rapid equity price recovery. It thus may not be a reliable predictor for the Firm Value of Cash and Cash Holdings during periods of rapidly increasing equity values. However, unlike the q Models in the US and UK, the values during the reduced robustness period showed much higher stability levels, unlike the deterioration evidenced in the US and UK.

Table 43: Robustness Test Results: q Model – Brazil

Independent Variables	
ΔC_t	0.808
	(0.585)
ΔE_t	1.251***
	(0.298)
ΔNA_t	0.395***
	(0.115)
ΔI_t	0.159
	(0.401)
ΔD_t	0.528
	(0.677)
C_{t-1}	0.518**
	(0.25)
L_t	0.191
	(0.387)
NF_t	0.116
	(0.248)
$C_{t-1} * \Delta C_t$	1.522
	(1.577)
$L_t * \Delta C_t$	-1.577
	(0.71)
Intercept	-0.069
	(0.069)
F-Statistic	2.449
Adj R_2	0.146
Observations	1827

*Significant at 10%, ** significant at 5% and *** significant at 1%

The above table shows the results of the regression estimation of the dependent variable, excess stock returns ($r_{i,t} - R_{i,t}$) on changes in the independent variables (firm characteristics) over the firm fiscal year. All independent variables, except Market Leverage ($L_{i,t}$), are deflated by the lagged market value of equity (M_{t-1}). $\Delta C_{i,t}$ is Cash and Marketable Securities, $\Delta E_{i,t}$ is EBIT, and $\Delta NA_{i,t}$ is Total Assets less Cash Holdings ($C_{i,t}$). Dividends Paid ($\Delta D_{i,t}$) is measured as Common Dividends Paid, I_t is Interest Expense, and $NF_{i,t}$ is the Net Total Equity Issuance plus Net Debt Issuance. R&D expenditures ($RD_{i,t}$) is zero if firm data is missing. Δ is the notation for a one-year change , $X_{i,t} - Xi_{t-1}$. The subscript $_{t-1}$ means the value of the variable is at the end of fiscal year $_{t-1}$. The data is winsorized at the 5% and 95% tails to reduce the effect of outliers. White heteroscedastic-consistent standard errors, corrected for correlation across observations of a given firm, are in parentheses (White (1980).

5. Discussion

For reference convenience, Table 30 from Section 4.3.3 is shown below.

		Faulkender and Wang (2006)		F&W Model		q Model	
				Model 1		Model 4	
		Mean	FV	Mean	FV	Mean	FV
US	ΔC	0.004	0.751	0.048	1.26	0.13	1.08
	C	0.176	0.337	0.092	1.28	0.13	0.57
				Model 2		Model 5	
UK	ΔC	No Analysis by authors		0.01	0.71	0.01	1.70
	C			0.13	0.82	0.10	0.91
				Model 3		Model 6	
Brazil	ΔC	No Analysis by authors		0.01	0.48	0.09	0.91
	C			0.36	0.46	0.13	0.52

Regarding the F&W models and the mean Change in Cash variable (ΔC), the mean values of Change in Cash are notably higher for all markets in the paper sample period compared to the Faulkender and Wang (2006) sample period. This is particularly the case in the US, where the mean annual change is 4.8% of Market Capitalization compared to 0.4% for the original sample period. The US presents a mean Change in Cash that is almost five times greater than the UK and Brazil. The UK and Brazil are equivalent at approximately 1.0%. The increase in the US may be attributed to the unprecedented increase in global liquidity and the US equity market structure relative to the other two markets. Regarding market structure, the last two decades have given rise to a significant increase in the global technology sector. The companies involved therein have benefitted from cash generation not generally experienced in firms operating in more traditional sectors such as commodities and industrials. The latter sectors dominate the UK and Brazil equity markets, as shown in Table 1. The UK market constituents are more similar to the US market during 1972-2001 compared to the current sample period, and the data is similar as presented in Table 30.

The q Models produce a similar result, with the US presenting a much greater mean Change in Cash (13% of Total Assets) compared to the 1% in the UK and 9% in Brazil. The differences between the UK and Brazil are greater than in the F&W models due to the larger differences in mean Total Assets, as the variable of standardization, compared to Market Capitalization used as a variable of standardization in the F&W model.

In contrast, the mean annual Cash Holding (C) in the F&W model is almost half the US's levels over the paper sample period compared to the original Faulkender and Wang (2006) sample period, at 9.2% and 17.6% of Market Capitalization, respectively. The mean annual cash level in Brazil is 36% for the sample period and is largely offset by mean Total Debt of approximately 27% of Market Capitalization. It is noteworthy that the Brazil firms' median cash level in the study during the sample period is 15.7%, significantly different from the mean. This has implications for a more comprehensive interpretation of the study and is a motivation for future analysis. Nevertheless, there is robust justification for both the levels of cash and debt in Brazil. Over the sample period, Brazil exhibited one of the highest real interest rates globally (Lozano & Caltabiano, 2015).

In contrast to the efficient market hypothesis, the above Cash Holding and Leverage levels in Brazil suggest that the external financing conditions were generally difficult for firms. Firms had the additional incentive to hold cash, given the real returns on Cash Holdings. Similarly, to hold and service long-term debt is deemed an advantage in such conditions, rather than face the risk of arranging distress financing in the future and in a potentially uncertain environment. This strategy may be justified despite the prevailing high real interest rates. Thus, holding cash and servicing debt is regarded as a risk mitigant against refinancing, especially

under financial duress conditions. This is consistent with the Management Flexibility Hypothesis.

Regarding Cash Holding in the q Model, the holding levels as a percentage of Total Assets are very similar. It is noteworthy that Cash Holding in Brazil is materially lower than for the F&W Model. In Brazil, listed equities tend to price at a discount to book value. In the Brazil dataset for the sample period, the ratio of Market Capitalization to Total Assets is 0.66. This results in an elevated Cash Holding variable in the F&W Model relative to Brazil's q Model. The mean values are not discussed further in the study.

The remainder of this chapter considers the empirical results in the context of the hypotheses outlined in Section 2.5.

Hypothesis 1(a): *The US Firm Value of Changes in Cash (ΔC_t) is greater in the current sample period using the F&W Model than the Faulkender and Wang (2006) study sample period of 1972 to 2001.*

I expect that the Firm Value of a Change in Cash has increased over time in the US because of increased investment opportunities in recent decades due to globalization, the significant growth in the technology sector, and abundant global liquidity. The composition of the US equity market has also changed. It is significantly more biased towards technology firms, firms in other sectors benefitting from technology, and the investment in that sector. These secular changes have resulted in shareholder tolerance for increased Cash Holdings on the expectation that a company requires the flexibility for the inevitable investment opportunities in the future, which will increase shareholder equity value through greater excess returns.

This increase in Firm Value is confirmed in Table 30. The Firm Value of a Change in Cash increased by approximately USD0.51 between the initial sample period and the analysis period of this study. Moreover, the Firm Value of a USD1 Change in Cash is USD1.26 indicating that changes in cash are valued at a 26% premium by shareholders. The Change in Cash in the original sample was valued at a 25% discount by shareholders (USD0.75).

Hypothesis 1(b): *The US Firm Value of Cash Holdings (C_{t-1}) is greater in the current sample period using the F&W Model than the Faulkender and Wang (2006) study sample period of 1972 to 2001.*

The rationale for this hypothesis is similar to Hypothesis 1(a) and is based on the perspective of the changes in the global economy in recent decades. It is expected that shareholders have a greater tolerance for persistent Cash Holdings. The results in Table 30 confirm this and indicate that shareholders place a 28% Firm Value premium on each US Dollar of Cash Holdings (USD1.28) in anticipation that the Cash Holdings will be deployed and will be value-enhancing for equity holders through increased excess equity returns. This result is a significant change compared to the original sample, where the results showed that shareholders placed a 66% discount on each US Dollar of cash (FV = USD0.34). The increase in Firm Value resulting from Cash Holdings is approximately USD0.94.

Hypothesis 2(a): *The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US firm results in greater Firm Value relative to a UK firm.*

The sector exposure between the US and UK markets differs substantially, and thus the investment opportunities, potential future earnings growth, and equity valuations differ. Moreover, the shareholders' expectations in the respective markets differ regarding investment

opportunities and the management of firm cash. It is expected that US shareholders will value an increase in a Change in Cash to a greater extent than in the UK, given the potential for value-enhancing growth, which is perceived to be of greater value to US shareholders than reducing debt or increasing the dividend. The reverse is more likely in the UK, where a dividend is preferable given the less favorable investment environment and expectations of dividends.

The data in Table 30 indicates that the Firm Value is greater in the US by some 0.55 currency units (USD1.26 vs. GBP0.71). In the UK, a GBP1 increase in Cash Holdings is valued by shareholders at GBP0.71, a discount of 29% to the cash's face value. This shareholder valuation may place pressure on management to pay out the cash in the form of dividends or share repurchases to increase the firm's equity value. The dividends reduce the perception of agency risks on the part of shareholders and may result in an improved valuation of the company equity.

Hypothesis 2(b): *The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a UK-based firm.*

Similar to Hypothesis 2(a), the difference in the firm operating environments between firms in the two markets leads to the expectation that US shareholders would have a higher tolerance for Cash Holdings than UK firms. US shareholders may be prepared to accept the agency risk of potential cash mismanagement in anticipation of increased equity value through value accretive investments. Table 30 confirms this expectation and indicates that a US firm's value resulting from USD1 in Cash Holdings is approximately 0.46 currency units greater (USD1.28 vs. GBP0.82).

Notably, the Firm Value of an increase in Cash and Cash Holdings are very similar within the two respective markets. A Change in Cash and Cash Holdings are valued in the US at USD1.26 and USD1,28, respectively, and in the UK are valued at GBP0.71 and GBP0.82, respectively. This consistency increases the validity of the conclusion that a currency unit of cash, whether a Change in Cash or Cash Holding, is valued very differently between the two markets.

Furthermore, the outcomes of hypotheses 1(a) to 2(b) suggest that the results from the Faulkender and Wang (2006) study are potentially not generalizable to other developed markets with an adequate degree of predictability, nor are the conclusions from results likely to be persistent over time, even within the US market. Thus, the key contributions of this paper are that the results in one market may not be generalizable to other developed markets. That management and shareholders should be aware of the Firm Value of cash impact on firms in different listing jurisdictions and the temporal changes on a firm within a single jurisdiction. Also, a dynamic approach to cash management may be required to optimize equity value.

Hypothesis 2(c): *The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.*

Hypotheses 1(a) to 2(b) are centered on two developed markets with similar governance levels. The introduction of a large developing market to the analysis is to provide insights into the Firm Value of cash in different governance environments. By contrasting Firm Value in Brazil against those of both the US and UK, which exhibit other differences as indicated above, I expect an outcome that results in a lower Firm Value in Brazil than the other two markets. To recap, the firm constituents of Brazil are more comparable to the UK than the US. Thus, in the absence of governance differences, one would expect the Firm Value of cash to be very similar in the UK

and Brazil. However, the perception of governance and the financing environment are deemed to be worse in Brazil. Thus, I expect the Firm Value of cash to be lower in Brazil than in the UK and significantly lower than in the US.

Concerning the comparison between the US and Brazil, the results in Table 30 suggest that both governance and the difference in the two countries' financing environments impact Firm Value. The Firm Value impact from a BRL1 Change in Cash is BRL0.48. This is a significant 52% discount to face value and approximately 0.78 currency units lower than the US (USD1.26 vs. BRL0.48). This spread is much wider than that between the US and UK in hypothesis 2(a), suggesting agency problems relating to the Change in Cash and the management thereof for a Brazilian firm. Shareholders may perceive a risk of mismanagement of cash and thus apply a discount in the equity valuation.

Following this assertion, the question of shareholder preference in Brazil arises. Table 26 presents empirical evidence that a BRL1 increase in Dividends decreases Firm Value by approximately BRL0.89 and this outcome is statistically significant at a 99% confidence level. Also, there is some historical evidence that shareholders in Brazil do not place a premium or react positively to share repurchase announcements (Micheloud, 2013). It is not clear, without further research, why shareholders would place a Firm Value discount on Changes in Cash, have a negative preference for Dividends, and are indifferent to share repurchases. An aspect warranting further research is the influence, preferences, and expectations of foreign investors in the Brazilian equity markets. Foreign investors may not invest in Brazil for dividends or share repurchases, but the potential mean reversion of valuation disparities and a global investment environment conducive to risk-taking on the part of equity investors. Foreign investors comprise a significant portion of the ownership of Brazilian listed companies relative to local shareholders,

thus influencing the determinants of Firm Value. This is also probably valid in most other developing markets.

Hypothesis 2(d): *The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.*

Like Hypothesis 2(c), the Firm Value of Cash Holdings differs by a similar 0.82 currency units in the two markets (USD 1.28 vs. BRL0.46). The rationale for the difference is the same as Hypothesis 2(c). Moreover, the Firm Value of a Change in Cash and Cash Holdings in Brazil are remarkably similar at BRL0.48 and BRL0.46, respectively, presenting strong evidence of low shareholder tolerance of cash persistence within the Brazilian firms.

Hypothesis 2(e): *The F&W Model empirical evidence indicates that a Change in Cash (ΔC_t) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.*

As noted above, it is expected that the change in Firm Value for a Change in Cash will be greater in the UK than in Brazil. Since the markets are similar in sector composition, it is likely that the primary reason for the difference in valuation is due to governance differences between the two markets. The governance differences result in increased perceived agency risks and, thus, shareholder valuation differences. Table 30 shows that the difference between the excess return per currency unit is approximately 0.23. The change in Firm Value for a Change in Cash in the UK is GBP0.71, compared to BRL0.48 in Brazil. The Firm Value discount of approximately 52% to the face value of each BRL1 of additional cash in Brazil is a significant reduction in value.

Hypothesis 2(f): *The F&W Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.*

As expected, the differential between Firm Value for a UK company and a Brazil-based firm is 0.36 currency units in favor of the UK sample. The likely reasons for this spread are explained above. The Firm Value discount on Cash Holdings (BRL0.46) for firms in Brazil is similar to that applied by shareholders on a Change in Cash (BRL0.48), as illustrated in Table 30.

The rationale for including an alternative model, the q Model, in the analysis is to test whether the hypothesis results for the F&W Model and excess returns as a proxy for Firm Value are consistent with alternative definitions of Firm Value. Hypotheses 2(g) to 2(i) address this research question.

Hypothesis 2(g): *The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US firm results in greater Firm Value relative to a UK firm.*

The data in Table 30 suggests that the change of the mean US Firm Value for a Change in Cash is a slight premium (8%) to the face value of the Change in Cash (USD1.08). This is approximately 18% less than the USD1.26 for the mean US firm in the F&W Model. Given that the excess return is a vastly different approach to Firm Value compared to Enterprise Value, and the sample consists of at least 5128 firm-year observations, the similarity is very comforting from the perspective of any interested party evaluating the mean Firm Value of a Change in Cash for a US firm. It also suggests that the q Model is robust as a tool to evaluate the impact of firm cash management on Firm Value in the US.

However, the q Model results for a Change in Cash for the mean UK firm differs significantly from that of the F&W Model. Table 30 illustrates that this difference is GBP0.99 higher in the q Model and a 70% premium to a GBP1 Change in Cash on average for a UK firm. Further research on this difference may reveal that the components of Enterprise Value may be more sensitive to changes in Cash in the UK compared to the US. It is also possible that the differences between average Market Capitalization, Total Assets, and Enterprise Value between the markets and models are worthy of further study. For example, in this study, the average Total Assets ratio to average Market Capitalization for the US and UK samples is similar and approximately 78%. Again, Total Assets and Market Capitalization are the variables of regressor standardization and the denominators of the dependent variables in the F&W and q Models, respectively. However, the ratio of Enterprise Value to Market Capitalization between the two markets differs significantly. The US ratio is 115%, but in the UK, it is similar to the Total Asset-to-Market Capitalization ratios, at approximately 69%. These differences may impact the regressor coefficients in the two models differently.

Nevertheless, the result is unexpected. Comparing the mean firm in the US to the UK, the Firm Value of a US company for a Change in Cash is some 0.62 currency units less. That is USD 1.08 and GBP1.70, respectively. This contrasts with the comparison using the F&W results in Hypothesis 2(a), which showed a 0.55 currency unit spread favoring the US firms.

Hypothesis 2(h): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a UK-based firm.

Consistent with Hypothesis 2(g), the Firm Value of a one currency unit holding cash is higher in the UK (GBP0.91) than in the US by approximately 0.34 currency units. The Firm Value for a UK firm is almost at parity with Cash Holding face value. The Firm Value for a US company

resulting from a USD1 Cash Holding is only USD0.57 in the q Model, a 43% discount to face value. This is not an expected result. The spread between the F&W and q Models for a US company Firm Value against Cash Holdings is USD0.71, a significant disparity in the models. The likely explanation potentially relates to the model equations, as suggested above.

However, the spread between the F&W and q Models for a UK company Firm Value against Cash Holdings is only GBP0.09, suggesting some parity between the models.

Hypothesis 2(i): The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Regarding Brazil, Table 30 presents data that shows an increase in mean Firm Value resulting from a Change in Cash from BRL0.48 in the F&W Model to BRL0.91 for the q Model. The q Model values a Change in Cash at a 9% discount to parity. Compared to the mean US firm, the results are expected. A US-based firm exhibits a greater Firm Value to a Change in Cash relative to Brazil's mean firm by approximately 0.17 currency units (USD1.08 vs. BRL0.91). Moreover, the mean Firm Value for Brazil is at a discount to parity, which is also expected, given Brazil's aforementioned potential agency problems between management and shareholders.

Hypothesis 2(j): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a US-based firm results in greater Firm Value relative to a Brazil-based firm.

Firm Value to Cash Holdings in Brazil is remarkably stable across the two models. Table 30 presents a mean Firm Value of BRL0.46 for the F&W Model and BRL0.52 for the q Model. Both firm values are a discount of approximately 50% to parity, consistent with the expectations explained previously. In addition, a US company exhibits a mean Firm Value of USD0.57 in the

q Model, which is higher than the BRL0.52 in Brazil. This is also consistent with the expectations of this hypothesis.

Hypothesis 2(k): The q Model empirical evidence indicates that a Change in Cash (ΔC_t) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

Similar to Hypothesis 2(e) and for reasons primarily related to governance and Agency theory, it is expected that the UK mean Firm Value will be greater than the Brazil-based firms when regressed to Cash Holdings. The Hypothesis is confirmed with the UK firm presenting a mean Firm Value of GBP1.70 in the q Model and thus a spread of some 0.79 currency units over the Brazil-based firm.

Hypothesis 2(l): The q Model empirical evidence indicates that Cash Holding levels (C_{t-1}) in a UK-based firm results in greater Firm Value relative to a Brazil-based firm.

The research question was confirmed for the F&W Model in Hypothesis 2(f). This Hypothesis for the q Model is similarly confirmed, with the UK mean Firm Value spread of approximately 0.39 currency units over the mean Brazil-based firm.

Hypothesis 3 considers the cash interaction impact of a Change in Cash moderated by the impact of Cash Holding levels. That is, whether the mean Firm Value, resulting from a Change in Cash, is impacted by the prevailing level of Cash Holdings. The empirical results were unexpected for Hypotheses 3(a) to 3(c). The cash interaction variables for all three markets were statistically insignificant at the 90% confidence level, resulting in coefficients that are statistically invalid, and therefore the hypotheses cannot be interpreted. The reasons for this result may also be a worthwhile future research study. Hence, the Hypotheses that will not be discussed further in this paper are as follows:

Hypothesis 3(a): The F&W Model empirical evidence indicates that the Firm Value for a Brazil-based firm resulting from an increase in Change in Cash (ΔC_t) is negative at firm Cash Holding (C_{t-1}) levels.

Hypothesis 3(b): The F&W Model empirical evidence indicates that the Firm Value for a US-based firm resulting from an increase in Change in Cash (ΔC_t) is valued at less than face-value at firm Cash Holding (C_{t-1}) levels.

Hypothesis 3(c): The F&W Model empirical evidence indicates that the Firm Value for a UK-based firm resulting from an increase in Change in Cash (ΔC_t) is valued at less than face-value at firm Cash Holding (C_{t-1}) levels.

6. Limitations and Future Research

As noted previously, the lack of statistical significance of the interaction variables is a limitation in this paper. It would be informative to observe the Change in Cash coefficients in terms of prevailing Cash Holdings levels.

A further limitation of this paper has included only one developing market. Developing markets differ significantly in equity market structure, foreign shareholder participation, and domestic investor participation. Similarly, factors such as real interest rate levels also differ. These differences may influence the premia and discounts that shareholders apply to Cash Change and Cash Holdings.

Thus, future research could incorporate additional large and liquid developing markets to test this study's generalizations. The model specification could also include net Cash Holdings, rather than total cash, to assist comparability for countries that maintain high levels of both cash and leverage. The negative Dividend coefficient for Brazil in Hypothesis 2(c) is counter-intuitive and thus also worthy of future analysis, as discussed previously. Furthermore, a more specific analysis of the result of the q models, which present statistical robustness for the period between 2016 and 2019 (but not for the period 2010 - 2015), could produce interesting insights into shareholder behavior regarding Change in Cash and Cash Holdings.

7. Conclusion

The results of this paper have several implications. The results from the model specification in the seminal paper by Faulkender and Wang (2006) may not be generalizable across markets. The statistical significance and the magnitude of the coefficients are vastly different from the original results for US-based firms. Shareholder perceptions of firm cash management also differ across markets, and this may mean that other variations of the model specification may be required for individual markets. Indeed, even in the US, the F&W model is not stable over time.

The results from this paper confirm governance and agency discounts to parity observed in other studies. The role of Agency Theory remains central to firm value and cash management.

A further implication of this study is that the Firm Value of cash may be best described as a range of values rather than a specific currency value. The results from this paper point to intra-market differences for Firm Value depending on the model employed. That is, excess return and enterprise value result in vastly different Firm Value outcomes and thus should be viewed in the context of shareholder expectations. Not all shareholders (or potential shareholders) view Firm Value in terms of excess annual return.

The most significant implication resulting from the study may be that firm cash management policy should consider shareholder expectations, and thus tolerance, for firm cash. Both models used in this study incorporate Market Capitalization in the specification. It follows that if some form of equity value incentivizes management, external stakeholders' expectations are key. This point is not only valid for remuneration, but also future capital increases undertaken in the equity market.

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9. Appendix

Table 44: Model Variables Summary

Faulkender and Wang (2006) Model Variables

	Description	Variables		Study Notation	Specifications
Dependent Variables			where,		
	Excess equity return	$r_{it} - R_{it}$	r_{it}	RE_t	Annual equity return of firm i in year t
			R_{it}		Equity benchmark return of firm i in year t (local market Index)
Variables of Interest					
	$C_{i,t-1} / M_{i,t-1}$		$C_{i,t}$	C_t	Lagged value of Cash holdings of firm i in year t (Cash = Cash + marketable Securities)
	$\Delta C_{i,t} / M_{i,t-1}$		$\Delta C_{i,t}$	ΔC_t	Change of cash holdings of firm i in year t (Cash = Cash + marketable Securities)
	$\Delta D_{i,t} / M_{i,t-1}$		$\Delta D_{i,t}$	ΔD_t	Change Common Dividends paid of firm i in year t
			$M_{i,t-1}$	M_t	Lagged Market Capitalization of equity i at year t (closing equity price * number of shares)
Control Variables	$\Delta E_{i,t} / M_{i,t-1}$		$\Delta E_{i,t}$	ΔE_t	Change of EBIT of firm i in year t
	$\Delta NA_{i,t} / M_{i,t-1}$		$\Delta NA_{i,t}$	ΔNA_t	Change of Non Cash Assets of firm i in year t (Total Assets - $C_{i,t}$)
	$\Delta RD_{i,t} / M_{i,t-1}$		$\Delta RD_{i,t}$	ΔRD_t	Change of Research & Development expense of firm i in year t
	$\Delta I_{i,t} / M_{i,t-1}$		$\Delta I_{i,t}$	ΔI_t	Change of Interest Expense of firm i in year t
	$L_{i,t} / M_{i,t-1}$		$L_{i,t}$	L_t	Leverage of firm i in year t (Total Debt / (=Total Debt + $M_{i,t}$)
	$NF_{i,t} / M_{i,t-1}$		$NF_{i,t}$	NF_t	Net Financing of firm i in year t (Total Equity - Stock Repurchaes + Debt Issuance - Debt Redeemed)
	$(C_{i,t-1} / M_{i,t-1}) * (\Delta C_{i,t} / M_{i,t-1})$			$C_{t-1} * \Delta C_t$	The effect of changes in cash for varying levels of cash holdings
	$L_{i,t} * (\Delta C_{i,t} / M_{i,t-1})$			$L_t * \Delta C_t$	The effect of Leverage on a change in cash holdings

q Model Variables

	Description	Variables		Study Notation	Specifications
Dependent Variables			where,		
	Tobin's q			q	Enterprise Value of firm i in year t divided by Total Assets (TAt)
Variables of Interest					
	$C_{i,t-1} / TA_{i,t-1}$		$C_{i,t}$	C_t	Lagged value of Cash holdings of firm i in year t (Cash = Cash + marketable Securities)
	$\Delta C_{i,t} / TA_{i,t-1}$		$\Delta C_{i,t}$	ΔC_t	Change of cash holdings of firm i in year t (Cash = Cash + marketable Securities)
	$\Delta D_{i,t} / TA_{i,t-1}$		$\Delta D_{i,t}$	ΔD_t	Change Common Dividends paid of firm i in year t
			$TA_{i,t-1}$	TA_t	Lagged Total Assets of firm i at year t
Control Variables	$\Delta E_{i,t} / TA_{i,t-1}$		$\Delta E_{i,t}$	ΔE_t	Change of EBIT of firm i in year t
	$\Delta NA_{i,t} / TA_{i,t-1}$		$\Delta NA_{i,t}$	ΔNA_t	Change of Non Cash Assets of firm i in year t (Total Assets - $C_{i,t}$)
	$\Delta RD_{i,t} / TA_{i,t-1}$		$\Delta RD_{i,t}$	ΔRD_t	Change of Research & Development expense of firm i in year t
	$\Delta I_{i,t} / TA_{i,t-1}$		$\Delta I_{i,t}$	ΔI_t	Change of Interest Expense of firm i in year t
	$L_{i,t} / TA_{i,t-1}$		$L_{i,t}$	L_t	Leverage of firm i in year t (Total Debt / (=Total Debt + $M_{i,t}$)
	$NF_{i,t} / TA_{i,t-1}$		$NF_{i,t}$	NF_t	Net Financing of firm i in year t (Total Equity - Stock Repurchaes + Debt Issuance - Debt Redeemed)
	$(C_{i,t-1} / TA_{i,t-1}) * (\Delta C_{i,t} / TA_{i,t-1})$			$C_{t-1} * \Delta C_t$	The effect of changes in cash for varying levels of cash holdings
	$L_{i,t} * (\Delta C_{i,t} / TA_{i,t-1})$			$L_t * \Delta C_t$	The effect of Leverage on a change in cash holdings