The Weighted Average Cost of Capital and Investment; new insights from Emerging Markets.

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Abstract

The Weighted Average Cost of Capital and Investment; new insights from Emerging Markets

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The cost of capital is one of the fundamental concepts of modern finance. The theoretical value of a firm is the sum of its future cash flows discounted back to present value by this cost of capital. In classical theory, companies should only accept projects that have returns higher than their cost of capital. There has been considerable research into the determination of the cost of capital, but less into the practical side. Is there a measurable relationship between cost of capital and investment? Do firms that generate sufficient cash flow from their investments enjoy a lower cost of capital than those that do not? This paper looks at these questions from an Emerging Markets perspective, given the increase in both available information and interest in these markets, focusing on the Information Technology sector. In addition to the cost of capital, we include other variables such as corruption perceptions, cash flows and institutional ownership which can theoretically impact both the level of investment and the cost of capital. We find evidence of a significant relationship between both cash flow and corruption to the rate of investment. However, the relationship between investment and cost of capital is less clear.

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Introduction

In classical theory, the weighted average cost of capital (WACC) for a firm is the threshold that determines the company's investments.

Most companies are expected to invest in projects that generate positive returns above their WACC and therefore generate sufficient funds to repay creditors, and to reward shareholders for taking on the risk of the investment. In theory, a company that invests in projects that offer returns below its cost of capital, will destroy value and eventually run out of capital.

Therefore, one would expect a relationship between the cost of capital and the investment decisions of companies; the lower the cost of capital, the greater the investment by the company. How well this relationship holds up in practice has been the subject of analysis, mainly focusing on the Developed Markets. To date, this research has not produced definitive results.

This paper attempts to build on the existing Developed Markets research and to study the subject from an Emerging Markets perspective but by looking at a specific industry.

Are companies "rational"? Do they limit investment to projects that will produce a positive return, or are there other factors at play? Recently, much attention has been paid to so called "Unicorns", companies that have market capitalizations over $1 billion that have yet to produce earnings. Companies are able to sustain these losses because of their ability to raise either debt or equity in the capital in the markets.

In theory, the more often a company has to go back to the capital markets for fresh injections of capital, the higher the price they will have to pay for that marginal capital and thus their WACC should rise. If we assume that the cost of capital is a reasonable proxy for the capital available to the firm to invest, as the cost of capital rises the firm will become increasingly capital constrained.

Some have argued that the key is not earnings, but cash-flow; do firms generate sufficient cash to fund operations and grow the business? Anecdotally, Amazon was generating free cash long before it posted positive net income. Tesla, on the other hand, has not been cash-flow positive for most of its expansion thus forcing the company to return to both the equity and credit markets numerous times to fund its growth. Many of Elon Musk's famous clashes with equity analysts have been over the firms' balance sheet and its ability to fund future growth. He has frequently chosen to raise equity *after* the stock has fallen as a result of one of these clashes, rather than raise funds as the stock has run up ahead of the results announcement. If we interpret this fall in the share price as an increase in the cost of equity, not only is Tesla taking on higher priced capital (equity), but the market is forcing the company to pay a premium because it does not appear to understand its capital constraint.

Emerging Markets

The name "Emerging Markets" was first coined by Antoine van Agtmael, an Economist at the International Finance Corporation (IFC) division of the World Bank, in 1981. The IFC had created a database of local market investment returns and showed that these markets offered

positive risk-adjusted returns over the long run. Taken together with their low correlations to Developed Markets, this made them attractive, diversifying investments for pension funds which is why van Agtmael was trying to launch an investment fund.

At that time there were 10 countries covered by the database - Argentina, Brazil, Chile, Greece, India, Jordan, Korea, Mexico, Thailand and Zimbabwe.

Apocryphally, J.P Morgan did not like the original name “Third World Equity Fund” as the phrase “Third World” had negative connotation associated with poverty. Van Agtmael proposed “Emerging Markets” as it held more promise of a positive outcome.

As time has gone by, it has been assumed by market practitioners that the same factors that have made developed financial markets more efficient at allocation capital, would also play out in Emerging markets; improved disclosure by corporations, a more level regulatory playing field and greater liquidity would be rewarded through reduced risk and cheaper capital. Cheaper capital would, in turn, enable higher rates of investment and growth, creating a positive feedback loop. Some of the literature supporting this view is covered in the Literature review below.

Research into the Emerging Markets has grown in recent years, but still lags the research into Developed Markets. Country analysis, primarily of China, appears to dominate. In contrast, this paper takes a sectorial approach. It focuses on the GICS Information Technology sector (GICS 2-digit code 45) because it appears to be a sector with less negative political interference, than

traditionally protected sectors like Energy (GICS 2- digit code 10). It is implicitly assumed that less political interference leads to lower costs of capital and more rational capital allocation.

Firms' investment behaviour is analysed in terms of their capital expenditure to existing assets. The cost of capital is assessed two ways, a Dividend Discount Model (DDM) model taken from Bloomberg, and a classical Capital Asset Pricing Model (CAPM) derived from Fama and French data. Measures of cash flow are also included, as are measures of institutional ownership, corruption and default risk

Literature Review

Abel and Blanchard (1986) looked at the relationship between investment and the expected present value of marginal profits. They find that more than half the variation in their study of marginal q "is accounted for by variations in the *ex-ante* cost of capital". Although the q theory of investment is not the main focus of this paper, their work establishes a clear link between the cost of capital and expected returns on investment.

Villarreal (2010) suggests that for a non-efficient EM,

$$K'_D = K_D + CR$$

Otherwise $K_D + CR = r_f + r_c + \text{intermediation spread}$

Where K_D' is the total cost of debt in a non-efficient market; CR and r_c are the country risk premium, and intermediation spread "incorporates all transaction costs involved reflecting the intermediation margin and default risk debt holders manage when financing the project". Traditionally, the assumption has been that a corporation cannot "trade through" its Sovereign; an emerging market company cannot have a lower credit spread than the country in which it is domiciled and thus Sovereign Risk is a limiting factor.

Hence their CAPM model becomes

$$K_E = K_D^{'}(1-t) + \beta_m\left(E\left[r_m - r_f\right]\right) + CR$$

Later papers focusing on both Emerging and Developed Markets discussed below show that reductions in the intermediation spread and expected returns are associated with *inter alia* greater liquidity, less private information and potentially globalization.

Amihud and Mendelsohn (1986) look at Asset Pricing and expected returns on the NYSE. They show that securities with wider bid-ask spreads are discounting a higher rate of return, and therefore, a higher cost of capital. Intermediaries protect themselves against trades based on private information by widening the spread, which is incorporated into the intermediation spread of Villareal above. For Emerging Market, this suggests that the perception of greater trading on private information should result in higher costs of capital, but as companies cross-list or even make the NYSE their primary listing, they should enjoy a lower cost of capital. It also suggests a linkage between the cost of capital and corruption, if we assume corruption is linked to more opportunities for trading on private information.

Doidge et al (2002) looking at both Emerging and Developed Market companies show that firms cross-listing their shares in the US had Tobin's q ratios 16.5% higher that non cross-listed firms from the same country. They list four principal mechanisms for the reasons why this might be so and present supporting evidence from the literature.

1. *Risk Premium reduction*. If the firm's shareholder base expands and the listing enables US investors, who might otherwise be unable to invest, to now do so.

2. *Access to more developed capital markets*. The depth and liquidity of the US markets enables foreign firms to raise funds more cheaply and can be less credit constrained.

3. *Information disclosure.* US markets require higher disclosure and therefore the opportunities for information asymmetry are less.

4. *Bonding and monitoring*. Agency costs are reduced by the greater regulation requirements of the US. Crucially, this effect is increased for firms that list on the New York Stock Exchange (NYSE), rather than merely on the Over-the-Counter Market (OTC) or rule 144a.

Although not the focus of the Doidge paper, it seems likely that companies that cross-list GDRs in Europe would see similar benefits. We would expect GDR cross-listing to have a reduced effect, just as listing on the OTC market had lower effects compared to the NYSE. This is

relevant because several companies in our sample have cross-listings in Europe, such as Samsung Electronics (005930 KS Equity) listing in Germany.

The Amihud and the Doidge papers are important, because they highlight the role of market structure on the cost of capital, posit theories as to why market structure influence the cost of capital and directly link the cost of capital to the ability of firms to invest. Similar propositions have been put forward by reformers in specific Emerging Markets as to why market structures and Securities Laws should be modernised. We can see the results of these reforms in the *Novo Mercado* of Brazil, China's 1998 Securities legislation and the re-establishment of Stock Exchanges in the former Soviet bloc.

Rajan and Zingales (1995) looked at the determinants of capital structure across Developed Markets. They found that firm leverage was similar across G7 markets, suggesting that *inter alia* firms tend to behave in similar ways even under different legal and institutional systems. We may lack evidence to prove that Emerging Market companies behave in a certain way, but without any specific evidence to the contrary, it is reasonable to assume that under similar circumstances companies in Emerging Markets will behave in a similar fashion to Developed Markets; the same imperatives to optimise the capital structure should apply in Emerging as well as Developed Markets.

Stulz (1999) focuses on the cost of equity, suggesting that it declines with Globalization. He attributed this to a fall in the required rate of return and a reduction in the agency cost of raising capital. If a country's stock market becomes more accessible to foreigners, either through the

creation of funds like van Agtmael's, or through other reforms, the domestically listed companies gain access to a larger pool of investors. However, he does warn that the empirical results are less than theory predicts.

Stulz makes the following observation "Asian investors now worry about how the U.S. markets performed while they were asleep because they believe that the fate of their markets during the day depends on what happened in New York over the previous twelve hours. Similarly, morning news shows in the U.S. routinely discuss the overnight performance of Asian markets and try to forecast the performance of U.S. markets from the overnight returns of the Nikkei and Hang Seng indices."

Stulz criticizes the traditional method of determining discount rates by averaging long-run returns on a broad-based index. This approach assumes discount rates are constant, which may not be the case in a period of Globalization. Amongst his other works, Damodaran (3rd) makes it extremely clear that Equity Risk Premia are NOT constant over time, whilst the current "Hunt for Yield" seems to confirm this, at least anecdotally.

Stulz goes on to say "When markets are imperfect, equity market liberalization could have strong effects as well. Financing constraints (see, e.g., Hubbard, 1997 and Gilchrist and Himmelberg, 1999), make external finance more costly than internal finance and cause investment to be sensitive to cashflows." For the purposes of this paper, this introduces a linkage between cost of capital, cash-flow and investment.

Rouwenhorst (1999) finds that the return factors of emerging market stocks are similar to those found in Developed Markets. The principal Fama French 3 factors, together with momentum, are all significant in driving emerging market stocks returns. He concludes by observing that "the return premiums do not simply reflect a compensation for illiquidity".

If Rouwenhorst is indeed correct, a Fama and French model should give a robust measure of a company's WACC in Emerging Markets. This is important for this paper, not only because we use Fama French data and methodology to calculate our Weighted Average Cost of Capital, but because we are also assuming overall Emerging Markets behave in a similar fashion to Developed Markets.

Henry (1999) shows that there was a direct link between stock market liberalization and private investment booms. In a sample of 11 developing countries that liberalized their stock markets, the mean growth rate of private investment in the three years immediately following stock market liberalization, exceeds the sample mean by 22 percentage points. This suggests *inter alia* that liberalization reduces the WACC and that reduction has a direct relationship to investment.

Bekaert et al. (2001) look at the relationship between financial equity market liberalization and economic growth across several emerging markets. They find that average real economic growth increases by between 1% and 2% when markets are liberalized, suggesting that liberalization reduced the cost of capital within the market. Their findings are consistent with the work of Levine and Zervos (1998) who show "that stock market liquidity and banking development both positively predict growth, capital accumulation, and productivity improvements when entered

together in regressions, even after controlling for economic and political factors". This appears to confirm the basic hypothesis that integration with global capital markets enables increased investment. Significantly, Levine and Zervos predict this effect will be seen in both the cost of equity *and* the cost of debt, which is consistent with Villareal's analysis.

Easley et al. (2002), looking at the NYSE, show that "a difference of 10 percentage points in the probability of information-based trading between 2 stocks leads to a difference in their expected returns of 2.5 percent per year".

Again, we would expect the greater scrutiny and more stringent listing requirements of the NYSE and NASDAQ to reduce the probability of information-based trading in EMs. As noted earlier, we would also assume similar effects for companies that are cross listed on other Developed Market exchanges, we would also expect this effect, even in the absence of directly listed ADRs and GDRs, such as when there were listed country funds. Mutual funds investing in these markets, even if directly trading on the domestic emerging stock market, could reasonably be expected to reduce the probability of information-based trading, assuming these mutual funds used the same standards as applied in the US or Europe, e.g., if most of the analysts had the CFA designation. Again, this brings us back full circle to van Agtmael's initial fund. Therefore, we would expect there to be a relationship between the cost of capital and institutional ownership within a market.

Bekaert and Harvey (2005) investigate certain number of Stulz's proposals. Specifically, they look at the role of Liberalization and Economic growth. They show that equity market

liberalisation leads to a 1% increase in average annual economic growth. They argue why this should be mirror those of Doidge *et al* and reiterate neoclassical theory where decreased costs of capital lead to increases in investment.

Cueto (2009) looks at the relationship between corporate governance and ownership structures in Latin America. Specifically, he looks at the effect of differences in voting rights and cash flow rights on performance. He shows that companies where a dominant shareholder has voting rights that exceed their cash flow rights trade at a discount. Significantly, that discount is greater if the dominant shareholder is an Institutional shareholder or the Government than if it is a family group.

Cakici, Fabozzi and Tan (2012) use stock level data from January 1990 to December 2011 to measure the size, value and momentum effects in 18 emerging markets. They found that there was a significant value effect in every country and a momentum effect in all but Eastern Europe. The authors went on to look at local cross-sections of value and momentum stock returns, comparing U.S. and local factors. They found that for portfolios based on value and momentum factors, the economic performance of local factors is significantly better than U.S. factors at explaining performance, suggesting a degree of emerging market segmentation. This confirms that we should be looking at Emerging Market data in its own right rather than merely as an extension of the US Market data This view is supported by DeGroot, Pang, and Swinkels (2012), who look at cross-section returns in frontier emerging markets, finding “the presence of economically and statistically significant value and momentum effect and local size effects”, and

that these effects cannot be explained by global risk factors. Both papers also confirm that the Fama and French approach to estimating the cost of capital in Emerging Markets is appropriate.

Ben-Rephael, Kadan et al (2015) find that the liquidity premium of the US market has been eroding, a trend they ascribe to the increase Index Funds and ETFs. If their analysis is correct, we should expect similar effects between developed and emerging market liquidity, given the proliferation of emerging market ETFs. This should be reflected in a generalized reduction in WACC.

Amihud, Hameed et al (2013) show that there is a commonality across countries for the illiquidity return premium and that it is greater in globally integrated markets.

S.-G. Jun et al (2002) find that liquidity within emerging markets has been rising and that the increase in liquidity is usually associated with decreasing risk premia. Therefore, we should expect that the country-spread between the emerging markets and the US market should also have narrowed, implying a convergence in WACC.

Lischewski, and Voronkova (2012) look at liquidity in the Polish stock market and paradoxically find that it was **not** a factor on price setting, but they attribute this to the introduction of a Liquidity Support Mechanism by the Warsaw Stock Exchange in 2009. This is little evidence that changes in Government regulation can have a direct effect on price discovery in Emerging Markets, supporting our analysis of a sector with lower government interference.

Fama and French extend their original work (FF 1993) with their 2014 paper "A five-factor asset Pricing model (FF 2014). The model tries to capture the effects of size, value, profitability and investment on average stock returns, for both Developed and Emerging markets. Therefore, we use the Five Factor Model in calculating the WACC of each of our companies.

Frank and Shen (2015), building on the work of Abel and Blanchard (1986), looked at the relationship between the cost of capital and investment in developed markets, using firm level data in the US from 1955 to 2011. It would be fair to say that, like Abel and Blanchard before them, Frank and Shen do not find definitive evidence to support the theory.

Akbari, Ng, & Solnick (2020) use a return decomposition approach to analyse stock returns. A stock's return can be separated into changes in cash-flows expectations driven by economic changes (Economic integration) and changes in risk pricing driven by financial markets (Financial integration). They find that there is a similar degree of economic integration between Developed and Emerging Markets, but that the levels of financial integration are significantly lower, and that it actually fell after the Global Financial Crisis (GFC) as many countries introduced protectionist measures. Critically, they suggest that the path of integration "is through the economic realities of companies rather than through the openness of local capital markets."

Extant literature on the effects of the cost of capital on investment is limited and mixed at best. We are unaware of any papers that focus on the cost of capital in Emerging Markets *per se*. Therefore, we believe this paper provides new evidence for this in Emerging Markets.

Hypothesis Development

This study uses two measures of cost of capital, one derived from a Fama French 5 factor model and one derived from a Dividend Discount Model. Although the calculations might differ, the consistency of the two methodologies should yield comparable results. Lower costs of capital should permit a larger number of profitable investment opportunities, enabling an unconstrained firm to invest more. Hence, there should be an inverse relationship between the cost of capital and investment.

Hypothesis 1: There is an inverse relationship between the Cost of Capital and Investment.

Corruption is a risk to all the capital providers of a company. At lower levels, it may reduce the expected returns from a project via rent seeking from gate keepers. *In extremis*, there may even be an existential threat to the company itself via expropriation. It should therefore be expected that companies reduce investment in countries with high corruption perceptions in favour of countries with low corruption perception. Corruption should have a direct effect on a firm's cost of capital, with investors demanding a higher premium to invest in a riskier asset, reducing the number of profitable investment opportunities, and resulting in an inverse relationship between corruption perception and investment.

Hypothesis 2: There is an inverse relationship between Investment and Corruption Perceptions.

Capital for investment can be provided by internally generated funds, externally provided debt, and externally provided equity. Ultimately, the markets may not choose, or have the capacity, to provide further capital, thereby constraining further investment for the firm. Each of the sources of capital have a different cost, whereby a company that has to return to the equity markets frequently for new capital will pay a higher price for its capital than a firm that is entirely self-financing. Therefore, a firm that is able to finance its investments from internally generated funds should have a lower cost of capital than a firm that requires more external capital. Thus, we should see a positive relationship between cash flow and investment.

Hypothesis 3: There is a positive relationship between Cash flow and Investment

As the percentage of Institutional Investors increases amongst a firm's investor base, their greater scrutiny and systematic analysis rewards well-managed companies with a lower cost of capital via a higher share price and cheaper debt. The larger pools of capital available to the institutional investors should also reduce the likelihood of capital becoming rationed, enabling a larger number of profitable investment opportunities. Thus, a larger share of institutional investors should be positively related to the level of investment

Hypothesis 4: There is a positive relationship between Investment and Institutional Ownership.

Data

A list of GIC IT sector stocks was obtained from Bloomberg. The sample included new issues as well as stocks that had stopped trading and initially numbered approximately 3000 companies.

Data for Capital Expenditure, monthly stock returns, Plant Property and Equipment, Total Assets, Tangible Assets, Weight of Debt, Cost of Debt, EBITDA, EBIT/ Interest, Debt/ Equity, Retention Ratios, Normalised ROE, Market Capitalisation, 1 year default probabilities, and Bloomberg's measure of WACC, derived from their Dividend Discount Model (DDM), were all obtained from Bloomberg. The data were converted to USD by Bloomberg.

Fama and French Emerging Market 5 Factor data in USD were obtained from Kenneth French's website at Dartmouth.

GDP, GDP/ Capita, and corruption data were obtained from the World Bank – The Worldwide Governance Indicators.

Ownership data were obtained from FactSet.

Country stock market capitalisations were from the World Federation of Exchanges.

Research Methodology

Companies with a Market Capitalization below $1 Billion were excluded. This reduced the number of companies in the sample to 635.

Building Key Variables

Monthly stock returns for each stock were regressed against the Fama French 5 factor monthly return data to derive coefficients for the individual Fama French Factors – CMA, SMB, HML, RMW, and (Rm-Rf).

The resulting coefficients were used to build annual estimates of Costs of Equity (Ke), using the annual returns from the Fama French data set.

The annual Ke was combined with the annual cost of Debt (Kd) obtained from Bloomberg, according to the usual formula, to get an estimate for the annual Weighted Average cost of capital (WACC).

$$WACC = (W_e \times K_e) + (W_d \times K_d)$$

This annual WACC was arithmetically averaged into distinct 5-year periods to create our variable *mWACC*; where the resulting value was below the equivalent 5-year average risk-free rate (mRFa), the value was replaced by mRFa on the basis that the WACC cannot be below the risk-free rate.

Although we take a Fama French 5 factor model approach to calculating the primary cost of capital, we recognise that this measure includes an implicit investment measure, namely Conservative Minus Aggressive (CMA). Since this might introduce a degree of bias when regressed against our own INV variable, we also calculate the cost of capital with the simpler Fama French 3 Factor Model (F3WACC) and a simple one stage CAPM (CWACC), neither of which includes CMA.

The other variables were less complicated.

K1 is the current year Bloomberg derived EBITDA divided by previous year Bloomberg derived Total Assets. Negative values were set to N/A. This resulted in the loss of 146 observations

K2 is the current year Bloomberg derived EBITDA divided by current year Bloomberg derived Total Assets. Negative values were set to N/A. This resulted in the loss of 146 observations

kT is the current year Bloomberg derived EBITDA divided by previous year Bloomberg derived Tangible Assets. Negative values were set to N/A. This resulted in the loss of 146 observations

INV is the current year Bloomberg derived Capital Expenditures divided by previous year Bloomberg derived Net Plant Property, and Equipment. Negative values were set to N/A.

mDDM was the 5-year arithmetic average of Bloomberg's calculated cost of capital derived from their Dividend Discount Model. Again, where this was below the mRFa, mRFa was substituted.

Corruption (*Corr*) was measured as the log of the ranking of the Country of Domicile in the World Bank corruption data base.

Own is the sum of reported Institutional holding from Factset.

Dfp is the one – year default probability derived from Bloomberg

Finally, data before 2004 was excluded to remove the effects of the bursting of the Tech bubble in the sample. However, the sample still includes the period of the Great Financial Crisis (GFC).

Insert Table 1A here.

Insert Table 1B here.

Insert Table 1C here.

When we look at Table 1 A, we can see that the sample is dominated by companies from Asia, particularly China, Taiwan and South Korea. Israel is also well represented; we should remind

ourselves that Israel was elevated to Developed Market status midway through the sample period, but the companies remained in the sample for the whole period.

Table 1 B gives us general descriptive statistics for our data set.
Although Argentina is officially a Frontier Market, its single representative company, Mercado Libre, operates though out Latin America, with most revenues coming from Brazil. It is listed in the US as MELI US.

Table 1 C gives us general descriptive data for the Emerging Markets within our sample. The list is again dominate by China, the world's second largest economy in nominal terms and the largest stock market capitalization. Size does not correlate with wealth as Israelis enjoy a *per capita* income nearly 4 X the average Chinese person and 20 X the average Indian. Chile and Taiwan are the two least corrupt countries in the sample, whilst Brazil is considered the most corrupt.

Insert Table 2 here.

Table 2 shows the Pearson correlation coefficients from our data set and confirms that there are no significant correlations between the variables and that they appear to be independent.

Models

The linear regression models were constructed from our variables as follows

1 Dependent variable – *INV*

4 Measures of cost of capital – *mWACC, F3WACC, CWACC,* and *mDDM*

3 Measures of Cashflow to Investment – *K1, K2, kT*

1 Measure of Corruption – *Corr*

1 Measure of Ownership – *Own*

Dependent	=	cost of capital	Cash flow	Corruption	Ownership
INV		mWACC	K1	Corr	Own
		F3Wacc	K2		
		CWACC	kT		
		mDDM			

This yielded the 12 basic regression models as shown below.

1. $INV = mDDM\ k1\ Corr\ Own$
2. $INV = mDDM\ k2\ Corr\ Own$
3. $INV = mDDM\ kT\ Corr\ Own$
4. $INV = mWACC\ Corr\ k1\ Own$
5. $INV = mWACC\ Corr\ k2\ Own$
6. $INV = mWACC\ Corr\ kT\ Own$
7. $INV = F3WACC\ k1\ Corr\ Own$
8. $INV = F3WACC\ k2\ Corr\ Own$
9. $INV = F3WACC\ kT\ Corr\ Own$
10. $INV = CWACC\ Corr\ k1\ Own$
11. $INV = CWACC\ Corr\ k2\ Own$
12. $INV = CWACC\ Corr\ kT\ Own$

This set of models was expanded to include a set with Country fixed effects alone and a further set with Year and Country fixed effects, yielding a total of 36 models

Endogeneity

When considering the construction of the models, there is a risk that the cost of capital might be endogenous with respect to the default probability of individual companies. Institutional investors might build their portfolios using companies with lower default probabilities as a specific factor.

We perform tests for the validity of the overidentifying instruments and endogeneity of the cost of capital (using the dividend discount measure and the various market measures) and firm investment using Generalized Method of Moments approach, treating the cost of capital as the potential exogenous variable, after Switzer et al (2018).

The instrument variables were the same right-hand side (RHS) variables as the underlying model but with mDDM lagged one year as a new RHS variable and the Bloomberg calculated Default Probability (Dfp) now included. The use of a lagged value for mDDM was specified on the basis that reductions in the costs of equity and debt for a company would generate positive returns in their existing instruments that would in turn attract further investors into those instruments in following periods.

Analysis of results.

When we look at the results from the basic models, we can see that the results are somewhat mixed.

Models with a Fama French 5 Factor calculated cost of capital (mWACC) dominated the other two calculated costs of capital (F3WACC and CWACC) in terms of F Values and R^2. Unless otherwise stated, t-values and Pr values quoted below will be for mWACC for brevity and clarity.

Models with the cash-flow measure K1 dominated models with the other two cash-flow measures (K2 and kT) again in terms of F Values and R^2.

Insert Table 3 here.

Starting with the overall models, we can see that each one was significant at 1%.

Hypothesis 1: There is an inverse relationship between the cost of Capital and Investment

Looking closely at the models, we get a contradictory picture for hypothesis 1.

When mDDM was the cost of capital, the relationship was negative as expected, but the significance was limited with Pr in the range of 0.1028 to 0.0695. Conversely, when using our Fama French derived mWACC the coefficients were positive and with high significance. Pr <0.0001 in every case and t values that ranged from 4.81 to 5.50.

Frank and Shen also found that implied costs of capital followed the expected model, whilst calculated measures did not. It is not possible to reach a definitive conclusion for hypothesis 1, as it is clearly dependent on what measure of cost of capital is used.

Hypothesis 2: There is an inverse relationship between Investment and Corruption Perceptions

The corruption variable was negatively correlated in every case, with a significance ranging between 0.0662 and 0.0298 which supports hypothesis 2.

Hypothesis 3: There is a positive relationship between Cash flow and Investment

When we look at hypothesis 3, we can see a positive correlation between Investment and Cashflow, significant at 1%, regardless of the sub-variable.

Models with K1 had an R^2 and F value at nearly 3 X a model with K2.

Models with K2 had an R^2 and F value approximately 50% higher than models with kT.

So, Hypothesis 3 can be accepted, with the variable K1 as the most appropriate sub-variable

Hypothesis 4: There is a positive relationship between Investment and Institutional Ownership

Institutional ownership proved to be negatively correlated to investment in all but one model. In the top models for mDDM and mWACC, the standard error of the variable was greater than the mean value in every case. Significance was extremely low, with Pr between 0.8556 and 0.9695.

It appears that Institutional ownership is not a significant variable, and we can probably reject the hypothesis.

Analysing complete models

Focusing just on mWACC and mDDM, the two models with the highest R^2 and F value were

$$INV = mWACC\ Corr\ K1\ Own$$

$$INV = mDDM\ Corr\ K1\ Own$$

Their R^2 were 0.1304 and 0.1223 respectively, whilst their F values were 109.21 and 101.4. As noted above, their overall significance was high, with Pr<0.0001

In the first model, the Pr value for mWACC was <0.0001, which we can interpret as a high degree of significance. However, it was positively signed which contradicts our hypothesis 1. In the second model, the Pr for mDDM was 0.0914, suggesting it was not *highly* significant, but in contrast to the previous model, it was negatively signed as theory would suggest.

In each model, corruption was significant with Pr of 0.0300 and 0.0331 and |t| values of 2.13 andn2.17 respectively.

As noted above, K1 was significant <0.0001 and |t| values of 19.96 and 19.98 respectively.

The models confirm that *Corr* and *K1* are material variables.

Endogeneity tests

Insert table 4 here.

Insert table 5 here.

As described above, the model where the cost of capital was correctly signed and that showed the highest R^2 and F value was tested for endogeneity and misspecification using a GMM approach that targeted the cost of capital as the potential exogenous variable.

The resulting j-statistics were 2.458 and 1.886 with probabilities of 17.31% and 29.25%. These low probabilities suggest we cannot reject the null hypothesis of overidentifying constraints of the instruments, which implies our model is valid.

The difference in the j-statistics is insignificant with a probability of 44.93%, so we cannot reject the null hypothesis that mDDM is exogenous.

Taken together, these two tests suggest that endogeneity is not an issue with the implied cost of capital and the least squares method is a valid approach to analyse the problem.

When we extend the analysis to calculated costs of capital, the top model for mWACC gives similar results, again suggesting no endogeneity and that the approach is valid despite the coefficient for mWACC being signed backwards.

This lack of endogeneity remains true of the remaining two calculated costs of capital.

Conclusions

In this paper, the relationship between Investment and Cost of Capital was investigated, focusing on the Information Technology Sector within Emerging Markets. Although simpler in approach, it can trace its origins to Abel & Blanchard (1986). It contributes to the literature in several ways.

Firstly, it adds further knowledge to our understanding of Emerging Markets. Secondly, it takes an industry specific view rather than the more usual country centric approach, thereby bringing in information from Emerging Market countries that might otherwise be overlooked. Finally, it looks at how non-financial variables such as institutional ownership and corruption perceptions can play a role in the financial investment decision.

Like Abel & Blanchard's seminal paper, the conclusions are equivocal.

The lack of a definitive link between investment and the cost of capital is surprising. It is possible that companies modified their investment decisions as a result of the GFC, choosing to "preserve" capital even when it was freely available. This approach would make sense if the companies believed the fall in the cost of capital was transitory, and abundance of capital might get reversed as the support measures for the GFC were unwound.

The strongest conclusion that can be made is that there is a clear positive correlation between cash-flow and investment.

As measured by both R^2 and F value, cash-flow over previous year's total assets has the strongest relationship, which is what one would intuitively expect; companies need to show that the investment they *have made* is producing the required rate of return.

The significant negative correlation with corruption is both interesting and encouraging. We would expect companies to invest more in countries with lower levels of corruption and this does appear to be confirmed. The linkage does not appear to be as strong as with cash-flow

It is surprising that the level of Institutional Ownership does not appear to be a significant factor. This might be affected by "strategic" institutions, such as the Korean State Pension Fund, or China's SASAC (State Owned Assets Supervision and Administration Commission), whose roles are often associated with protecting "National Champions" rather than purely financial returns. Because of this, further research that separates out "Strategic Ownership" from other types of institutions might be interesting.

There may also be a behavioural aspect, with institutions "following the crowd" by copying their peers' holdings rather than forming their own fundamentally based decisions.

Appendix A

Table 1 Descriptive Data

Table 1 A Descriptive data for the companies within the sample (2019) – sample averages

Country	***Companies***	MCAP ($ M)	Debt/ Equity %	EBIT/ Interest	DFP	Retention Ratio	ROE	Ownership %
China	**472**	$2,552.07	45.5	3760.1	3.01E-03	77.56	4.61	20.38
Taiwan	**101**	$8,138.40	34.64	363.07	7.66E-04	38.18	11.41	33.35
South Korea	**18**	$23,468.85	29.9	140.53	1.75E-02	79.94	12.01	34.56
India	**15**	$11,515.27	21.76	75.16	5.27E-04	68.23	19.03	33.14
Israel	**10**	$4,314.09	41.21	35.19	4.05E-04	86.59	13.98	67.76
Brazil	**6**	$3,600.08	58.9	60.48	1.07E-02	78.86	13.13	83.42
Thailand	**4**	$1,092.90	17.57	492.13	2.82E-03	44.19	10.22	13.60
Malaysia	**2**	$1,125.82	13.52	152	4.13E-05	54.25	25.64	47.62
South Africa	**2**	$218.13	318.7	5.79	2.19E-02	100.00	-35.50	42.77
Poland	**1**	$1,393.70	36.2	10.56	6.51E-04	20.96	5.78	87.95
Chile	**1**	$750.46	59.4	4.25	3.42E-03	97.11	-5.16	8.48
Argentina	**1**	$3,919.99	37.4	65.85	1.04E-04	100.00	17.05	103.77
Grand Average	**632**	$4,239.89	43.42	2813.97	3.06E-03	71.06	6.48	26.34

Table 1 B Descriptive statistics for data set

Variable	***N***	Mean	SD	25th	Median	75th
INV	**3068**	0.4876	9.3384	0.1574	0.2870	0.5079
mWACC	**3068**	5.1838	6.8148	1.238	2.2560	6.023
F3wacc	**3068**	3.5557	4.5652	1.238	1.9747	4.007
cWacc	**3068**	2.9128	4.5639	1.24	2.2560	3.3
mDDM	**3068**	9.0185	9.3384	6.93	10. 4258	12.2
K1	**2922**	2.2615	15.9355	0.3421	0.6534	1.4647
K2	**2921**	1.4925	4.0510	0.3006	0.5621	1.2199
kT	**2921**	0.1601	0.1309	0.0799	0.1329	0.2034
Corr	**3068**	3.9997	0.3749	3.8	3.8827	4.3
Own	**3061**	18.8276	15.9137	6.78	15. 4673	26.4
Dfp	**2981**	0.0014	0.0059	1.782E-05	1.926E-04	1.008E-03

Table 1 C Descriptive date for the Emerging Market countries within the sample

Country	GDP $ BN (2019)	GDP/ Capita $	Credit Rating (S&P)	Corruption Rank % (2019)	Stock Market Capitalization ($ BN)
China	14342.9	10261	A+	43.27	8515.5
India	2868.9	2099	BBB-	47.6	2179.8
Brazil	1839.8	8717	BB-	42.41	1187.4
South Korea	1646.7	31846	AA-	76.92	1484.8
Taiwan	610	26910	AA-	82.62	1217.3
Poland	595.9	15629	A-	71.15	151.6
Thailand	543.5	7806	BBB+	39.42	569.2
Argentina	445.4	9912	CCC+	53.57	39.4
Israel	394	43592	AA-	78.85	237.4
Malaysia	364.7	11412	A-	62.5	404
South Africa	351.4	6001	BB-	59.62	978
Chile	282.3	14986	A+	83.17	203.8

Table 2 Correlations between variables

Pearson Correlation Coefficients

Prob > |r| under H0: Rho=0

Number of Observations

	INV	K1	K2	KT	mWACC	f3wacc	Cwacc	mDDM	OWN	Corr	DFP
INV	1	0.3462	0.19908	0.16264	0.09613	0.09329	0.08194	-0.03064	0.01489	-0.02613	-0.03149
		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.0897	0.4102	0.1479	0.0856
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
K1	0.3462	1	0.28349	0.07981	0.01862	0.02128	0.0318	0.00047	0.03473	0.00643	-0.01585
	<.0001		<.0001	<.0001	0.3143	0.2501	0.0856	0.9797	0.0607	0.7284	0.3989
	2922	2922	2921	2921	2922	2922	2922	2922	2917	2922	2836
K2	0.19908	0.28349	1	0.19049	0.05301	0.05141	0.10624	0.00151	0.08867	0.02422	-0.03667
	<.0001	<.0001		<.0001	0.0042	0.0054	<.0001	0.9351	<.0001	0.1907	0.0509
	2921	2921	2921	2920	2921	2921	2921	2921	2916	2921	2835
KT	0.16264	0.07981	0.19049	1	0.08198	0.05116	0.03382	0.02853	0.18377	-0.00405	-0.16356
	<.0001	<.0001	<.0001		<.0001	0.0057	0.0676	0.1232	<.0001	0.8269	<.0001
	2921	2921	2920	2921	2921	2921	2921	2921	2916	2921	2835
mWACC	0.09613	0.01862	0.05301	0.08198	1	0.81611	0.54074	-0.17037	-0.03085	0.03649	-0.03956
	<.0001	0.3143	0.0042	<.0001		<.0001	<.0001	<.0001	0.0879	0.0433	0.0308
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
f3wacc	0.09329	0.02128	0.05141	0.05116	0.81611	1	0.70189	-0.15338	-0.03487	0.03246	-0.0377
	<.0001	0.2501	0.0054	0.0057	<.0001		<.0001	<.0001	0.0537	0.0722	0.0396
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
Cwacc	0.08194	0.0318	0.10624	0.03382	0.54074	0.70189	1	-0.11814	-0.01015	0.05048	-0.03328
	<.0001	0.0856	<.0001	0.0676	<.0001	<.0001		<.0001	0.5747	0.0052	0.0692
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
mDDM	-0.03064	0.00047	0.00151	0.02853	-0.17037	-0.15338	-0.11814	1	0.02083	-0.12007	-0.0533
	0.0897	0.9797	0.9351	0.1232	<.0001	<.0001	<.0001		0.2492	<.0001	0.0036
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
OWN	0.01489	0.03473	0.08867	0.18377	-0.03085	-0.03487	-0.01015	0.02083	1	0.03511	-0.11107
	0.4102	0.0607	<.0001	<.0001	0.0879	0.0537	0.5747	0.2492		0.0521	<.0001
	3061	2917	2916	2916	3061	3061	3061	3061	3061	3061	2974
Corr	-0.02613	0.00643	0.02422	-0.00405	0.03649	0.03246	0.05048	-0.12007	0.03511	1	-0.0164
	0.1479	0.7284	0.1907	0.8269	0.0433	0.0722	0.0052	<.0001	0.0521		0.3708
	3068	2922	2921	2921	3068	3068	3068	3068	3061	3068	2981
DFP	-0.03149	-0.01585	-0.03667	-0.16356	-0.03956	-0.0377	-0.03328	-0.0533	-0.11107	-0.0164	1
	0.0856	0.3989	0.0509	<.0001	0.0308	0.0396	0.0692	0.0036	<.0001	0.3708	
	2981	2836	2835	2835	2981	2981	2981	2981	2974	2981	2981

Table 3 Summary of Regression Results

This table shows the regressions on the sample from 2004 to 2019, which reports the results from OLS regressions of Investment on a set of firms' costs of capital and cash flow, together with measures of corruption and institutional ownership. Details of the variable definitions can be found in Appendix B. The t-values are reported in parentheses. Models are listed in the same order as above. C.o.C is the cost of capital measure in the respective model.

	Measure of Cost of Capital											
	mDDM			mWACC			F3WACC			CWACC		
Model	1	2	3	4	5	6	7	8	9	10	11	12
C.o.C	-0.005**	-0.00505	-0.00566*	0.00782***	0.00749***	0.00724***	0.00987***	0.00954***	0.00966***	0.01221***	0.01058***	0.01301***
	(-1.6900)	(-1.63)	(-1.82)	(5.50)	(5.03)	(4.81)	(5.10)	(4.71)	(4.73)	(4.21)	(3.47)	(4.27)
k1	0.0169 ***			0.01683***			0.01682***			0.0168***		
	(19.98)			(19.960			(19.94)			(19.88)		
K2		0.03864***			0.03766***			0.03772***			0.03732***	
		(11.06)			(10.80)			(10.82)			(10.64)	
kt			0.98964***			0.93681***			0.95265***			0.96619***
			(8.96)			(8.47)			(8.63)			(8.76)
Corr	-0.07662**	-0.08168**	-0.07048*	-0.07719**	-0.08162**	-0.06976*	-0.07591**	-0.08046**	-0.06885*	-0.07739**	-0.08106**	-0.07094*
	(-2.13)	(-2.17)	(-1.86)	(-2.17)	(-2.19)	(-1.86)	(-2.13)	(-2.16)	(-1.84)	(-2.17)	(-2.17)	(-1.89)
Own	-1.56E-04	-4.41E-04	-1.07E-03	-3.28E-05	-3.06E-04	-8.80E-04	2.00E-05	-2.55E-04	-8.45E-04	-1.01E-04	-3.72E-04	-9.78E-04
	(-0.18)	(-0.49)	(-1.16)	(-0.04)	(-0.34)	(-0.96)	(0.02)	(-0.28)	(-0.92)	(-0.12)	(-0.41)	(-1.07)
Intercept	0.80689***	0.81365***	0.6859***	0.72097***	0.72757***	0.59905***	0.71951***	0.72603***	0.59455***	0.72742***	0.73454***	0.59971***
	(5.38)	(5.19)	(4.32)	(5.04)	(4.86)	(3.95)	(5.02)	(4.85)	(3.92)	(5.07)	(4.89)	(3.95)
R^2	12.23%	4.22%	2.87%	13.04%	4.96%	3.53%	12.92%	4.85%	3.53%	12.67%	4.53%	3.36%
F Value	*101.4***	*32.05***	*21.5***	*109.21***	*37.96***	*26.6***	*107.21***	*37.13***	*26.41***	*105.21***	*34.5***	*25.33***
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country and Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
*	*Significant at 10%*											
**	*Significant @ 5%*											
***	*Significant @ 1%*											

Table 4 Test for overidentification: instrument validation

The table shows the GMM tests for the validity of the overidentifying instruments on the principal models. The t-values are reported in parentheses. C.o.C is the cost of capital measure in the respective model.

	mDDM	MWACC	F3WACC	CWACC
C.o.C	-0.0095	0.0072	0.0108	0.0057
	(-1.4068)	(2.2785)	(1.5855)	(0.7668)
k1	0.0141	0.0139	0.0139	0.0140
	(3.32)	(3.30)	(3.32)	(3.33)
Corr	-0.2964	-0.2772	-0.2811	-0.2862
	(-5.94)	(-5.49)	(-5.58)	(-5.74)
Own	5.16E-04	4.01E-04	5.07E-04	5.24E-04
	(0.45)	(0.35)	(0.44)	(0.46)
Intercept	1.6856	1.4907	1.5014	1.5393
	(7.76)	(7.20)	(7.21)	(7.51)
J-Stat	1.8866	0.73834	0.00866	2.93885
Prob	*16.97%*	*39.02%*	*35.20%*	*23.01%*

Table 5 Test for endogeneity

The table shows the J-statistics for the restricted and unrestricted versions of the GMM tests on the principal models. The difference between the restricted and unrestricted J-statistics gives the measure of likelihood for accepting the H_0; Cost of Capital is not endogenous, for each measure of cost of capital.

	mDDM	mWACC	F3WACC	CWACC
Restricted J-stats	2.4581	0.8713	2.0758	2.9388
Unrestricted J-stats	1.8866	0.7383	0.8662	1.2433
Difference in J-stats	.5725	0.1330	1.2096	1.6955
df	1	1	1	1
Probability	44.93%	71.54%	27.14%	19.29%

Appendix B

List of Variables

Variable	Definition	Source
mDDM	5 - year Arithmetic Mean of Dividend Discount Model	Bloomberg
mWACC	5 - year Arithmetic Mean of calculated FF5 Factor	K. French data, & Bloomberg
F3WACC	5 - year Arithmetic Mean of calculated FF3 Factor	K. French data, & Bloomberg
CWACC	5 - year Arithmetic Mean of calculated CAPM Factor	K. French data, & Bloomberg
INV	Current Year Capex / Prior Year PP&E	Bloomberg
K1	Current Year EBITDA / Prior Year Total Assets	Bloomberg
K2	Current Year EBITDA/ CURRENT year Total Assets	Bloomberg
kT	Current Year EBITDA / Prior Year Tangible Assets	Bloomberg
Corr	Log of Rank from Control of Corruption	World Bank
Own	Sum of reported Institutional ownership positions	FactSet
Dfp	Default Probability	Bloomberg

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