Valuation of Emerging Economy Investments: Applying Real Options Analysis to Brazilian Timberland Investment Valuaton

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VALUATION OF EMERGING ECONOMY INVESTMENTS

APPLYING REAL OPTIONS ANALYSIS TO BRAZILIAN TIMBERLAND INVESTMENT VALUATION

PURPOSE OF THE STUDY

The objective of the thesis was to find a way to value investment projects in emerging economy environment. The purpose of the study was to find out how the most common valuation methods lend to emerging economy investment valuation. Such an environment is characterized by incompleteness of the markets, private ownership, high transaction costs and unpredictable changes in environment that can cause sudden changes in asset prices, among other aspects that are contrary to the assumptions of many valuation methods.

METHODOLOGY

The methodology used was to find out from the literature the current methods for valuing emerging economy investments, how those methods are used and what kind of challenges are found in their application. A literature study was also used to find out additional considerations applicable in such a valuation. An alternative process for the valuation based on indifference pricing of real options was developed and finally, a valuation of an investment project is carried out using the process developed, in order to gain experience of the practical applicability of the process.

RESULTS

In the literature study it was verified that methods such as discounted cashflow analysis together with the cost of equity found though CAPM are problematic in emerging economy setting. It was also found out that using real options pricing based on the indifference prices can be used to include the specific characteristics of emerging economies in the valuation process. The method is also capable of valuing the managerial flexibilities that play important role in dynamic emerging economy environment.

KEYWORDS: Investment valuation, Real Options Analysis, Indifference pricing, CAPM, Brazil, Emerging markets, Emerging economies, BRIC, Timberland investment

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1. Introduction

The underlying research question of the thesis is:

How to value an emerging economy investment?

The research question as such is very broad and needs to be further specified. The more specific questions this research is in:

What are the specific characteristics of the emerging economies that affect investment valuations?

How the specific characteristics of emerging economies in investment valuation are taken into account currently?

How can the real option analysis method be used to capture the characteristics of the emerging economies in investment valuation?

Returns on investments in the emerging markets appear to have more variation than investments in the developed economies. This is due to higher and different kind of uncertainties compared with developed market investment. Some of the uncertainties are caused by the very nature of these markets; they are in a change. Other causes of uncertainties are caused by the political, the economic, and the financial factors of risk (Checa et al., 2003) as well as the institutional uncertainties.

Despite these uncertainties, companies traditionally having based their operations in the developed nations are implementing or considering emerging market investments. Likewise, investors are seeking opportunities to benefit from emerging market investments. It thus appears that the companies and investors are willing to accept the increased risk in their emerging market investments compared with what they accept in their other investment. Sometimes they also find that the risks in emerging markets are uncorrelated to their current risks, and because those markets are not fully integrated (by definition) to the global markets, such investments provide investment opportunity their owners otherwise would not have.

The trend of emerging economy investment can be seen to have started from the operational costs point of view: companies cited such factors as increasing short-term return on assets, minimizing fixed costs, and increasing flexibility for reasons of making such investments. After the initial manufacturing driven investments the emerging markets were seen as potential new markets by many companies, bringing new reasons for making emerging market investments.

More recently, strategic reasons have gained importance: the emerging markets have been seen as innovation drivers where new technologies, consumption patterns, and business models emerge. This changed view has given new reasons for making investments in emerging markets (Koudal, 2005).

1.1. Challenges in Valuation of Emerging Economies Investments

The emerging economy is thought of being the economies in the world that are in the process of rapid growth and industrialization. "Emerging market" is another widely used term and is used as a synonym for the emerging economy in this text. The BRIC-countries (Brazil, Russia, India and China) are used to refer to the four largest emerging economies. Similarly, the fast growing countries in Asia are tagged "Asian Tigers". Further examples of emerging economies are the new European Union countries, former socialist countries of Eastern Europe.

The term emerging economy is sometimes though to be out-dated since several of the countries originally included in the emerging economy since the inception of the term in early 80's have become fully developed economies (e.g., South Korea) (The Economist, 2008). It is also noted that many of the emerging economies, especially the BRIC, have become major players in the world economy.

However, these countries still face a rapid growth as well as a change is occurring in their policies, making them increasingly more investable, but at the same time changing the characteristics of the economy, thus complicating the valuation process among other things.

Some of the areas that have distinguishing characteristics on the emerging economies, thus differentiating them from fully developed economies, are described in (Khanna & Palepu, 2005). These include the following, examples from the BRIC countries:

Political and social system: Emerging economies can be either democratic, authoritarian, or oligarchy, and have either free press or government-controlled media, but distinguishingly they have a high level of bureaucracy and corruption.

Openness: Greenfield investments and acquisition are somewhat restricted, in many cases by government regulation, but at the minimum, requiring local expertise to cut through the red tape.

Capital markets: Emerging economies tend to have a developed banking system (with the notable exception of China) although the cost of capital is higher than in developed economies. Bond markets are underdeveloped, as well as equity markets although both are available. The venture capital market is active in some cases (most notably in Brazil). Accounting standards are considered good in Brazil, India and Russia, poor in China. Bankruptcy processes are considered fully developed in Russia, inefficient in India, and lacking in Brazil and China.

Product markets: There generally is local product design capability in emerging economies, but consumer acceptance of local and global brands varies. Problems in enforcing IPR rights are common. Local suppliers are available, but the quality leaves to be desired especially in case of India. Infrastructure can be occasionally good, but just as often underdeveloped, again, especially in India.

On the other hand, **labor markets** are subject to similar variability as developed economies; in some countries, they are more relevant than in others.

Market imperfections play a large role in emerging markets due weak institutions, underdeveloped financial sector and investment environment.

The changing environment causes challenges when applying the valuation methods commonly used in developed economies:

There are known knowns. There are things we know that we know. There are

known unknowns. That is to say, there are things that we now know we don't

know. But there are also unknown unknowns. There are things we do not

know we don't know. (Rumsfeld, 2002).

Things that are not known cause uncertainty in the expected returns of investments. In this work a distinction between unknown unknown and known unknown is made following (Knight, 1921): Uncertainty is an unknown unknown, something that is not, or cannot be quantified. Risk, on the other hand, is a known unknown, or something that is quantified, or at least the quantification can be attempted, and sensibility analysis made to found out how sensitive the results are to the correctness of the assumptions.

From the investor point of view the difference is significant: an investment with uncertainties cannot be valued while an investment with risks is readily valuable. As described above, an emerging market, from an investor point of view, is a market that is in between investable and uninvestable. It thus has attributes that are uncertain as well as those that are risky.

One possibility to model the value of an investment under uncertainty is real options analysis. These can capture such factors as rights to make or delay investment, growth options, a flexibility option, exit options and learning options (Thomas, 2001).

1.2. Study Background

This study is combining various fields of expertise, and as such the prior studies in each area are discussed in the chapters concerning with respective subject.

The perspective of this work is that of an independent investor, or a group of investors. It thus describes a model from the perspective of a single agent, and not a model of market equilibrium.

The research an analysis methods used was included literature review based on textbooks and article research. In article research the main source of information was the Scopus research article database, e.g., searching for articles with "emerging market"

OR "emerging economy" and each valuation method in order to find articles describing application of each respective valuation in the emerging economy setting.

In addition, an analytical framework was developed and it was verified using a case study.

1.3. Outline

The text structure of this work follows the circle in Figure 1. The discussion begins with a look at the current practices, and the issues practitioners face using the current practices, proceeds to highlight the challenges the emerging economy environment places on investment valuation. An alternative for the current practices is formulated and the analysis of a case using the method is done. Finally, this process feeds the understanding about emerging economy investment analysis that can be used in future works.
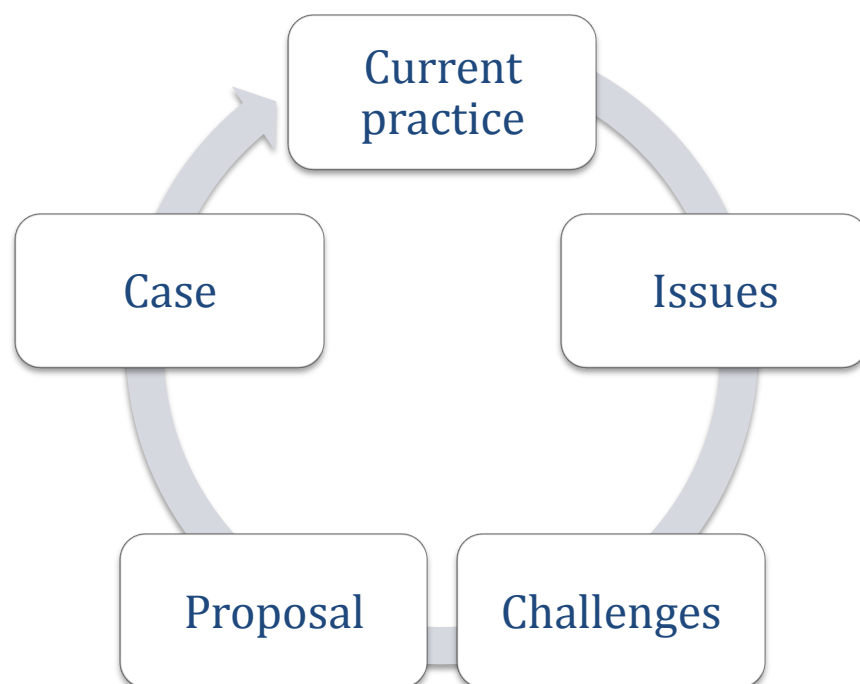
Figure 1: Organization of the thesis.

In more details next, in Chapter 2, the most common valuation methods used in the valuation of emerging economy investments in use currently are studied. Also, how the specific concerns regarding emerging economy conditions can be addressed using these

methods is examined. The chapter is based mainly on literature study, presenting examples illustrating the challenges practitioners are faced in performing their analysis.

The challenges found in Chapter 2 serve as starting point for Chapter 3 where some of the characteristics of emerging markets are studied closer. The uncertainties caused by these characteristics are explained and the process of transforming uncertainties into risks is begun.

In Chapter 4 the findings in both Chapter 2 and 3 are used to formulate an alternative for the most widely used valuation methods. The method is based on real option analysis, and more precisely based on indifference argument, i.e., a price is found such that an investor would be indifferent between making taking the option and not taking the option.

In Chapter 5 the case to be analyzed is first presented and then the investment in the case is valued using two different approaches, namely discounted free cash flows and the proposed process for real options analysis.

Finally, in Chapter 6, conclusions are made as to how the methods tried in this thesis were able to provide usable solution for the valuation of the case investment.

1.4. Terms

Emerging market: "An emerging market can be defined as a country in which its national economy grows rapidly, its industry is structurally changing, its market is promising but volatile, its regulatory framework favors economic liberalization and the adoption of a free-market system, and its government is reducing bureaucratic and administrative control over business activities. According to this definition, emerging markets are those developing economies characterized by rapidly growing and structurally changing economies. Transitional economies are those emerging economies that undergo significant economic (and/ or political and social) reforms, shifting from former centrally-planned system to market-determined system." (Luo, 2002). The classification as emerging markets is done to describe investability and regulatory issues.

Real option: A real investment project involving choice alternatives in implementation.

Certainty: "A decision is said to take place under certainty when the decision maker knows the resultant outcome if a particular alternative is chosen." (Baird, 1989)

Uncertainty: "The uncertainty case does not contain as much evidence [that it may be treated in terms of objective probability.]" (Baird, 1989)

Risk: Uncertainty quantified in a way that allows investors to price it.

Systematic or nondiversifiable risk: A risk that influences every asset and cannot be eliminated through diversification (Luenberger, 1998). "The uncertainty of future returns due to uncontrollable movements in the market as a whole. This type of risk generally arises from external, macroeconomic factors that affect all economic assets within the economy as a whole." (Hitchner, 2003)

Unsystematic or diversifiable risk: A risk that can be eliminated from a portfolio through diversification. "The uncertainty of future returns as a function of something other than movements in market rates of return, such as the characteristics of an industry, enterprise, or type of investment." (Hitchner, 2003)

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Complete markets: "A financial market is said to be complete if all claims are attainable, that is, if all the claims can be replicated by means of a self-financing strategy." (Yang, 2003)

Risky market: A market having high variance in investment returns.

Developed economy: Countries that are the most developed and the least risky.

Pre-emerging economy: A less developed economy than emerging economy, still considered investable. Frontier economy is often used synonym of pre-emerging economy.

The BRICs: Four emerging economies: Brazil, Russia, India, and China.

2. Emerging Market Investment Valuation

In this chapter, valuation methods applied for emerging economy investment valuation are introduced. The aim is to study the valuation methods used in practice to find out their respective strengths and weaknesses when applied in emerging economy environment.

The purpose of this chapter is two-fold: firstly to examine what are the valuation methodologies used and secondly, what kind of emerging economy uncertainties are generally considered in the valuation process, what kind of issues there has been in the application of the methods and how the methods are able to address the challenges caused by the uncertainties.

The second objective will provide a starting point for the development of the method that will ultimately be applied to the case discussion, and the first objective the background against which the method used to solve the case can be measured.

The sources for the study have been two studies made on application valuation methods, in developed economies on one the hand and in emerging economy on the other. On valuation methods that are not widely utilized in practice, theoretical papers have been used to find out the potential for application.

This chapter first examines what are the valuation methods most commonly used, and especially which ones are used in valuing the emerging economy investments. Then two of the most common methods are presented and their applicability for valuing emerging economy investments are studied. The challenges are highlighted and commonly used practices are presented.

Finally, a third alternative, real options analysis, is presented briefly as a basis for further examination in the following chapters.

2.1. Valuation Methods Used

Few studies have been published about the application of different valuation methods in emerging economy setting. One relatively recent study is (Pereiro L. E., 2006) which

studies the investment valuation methods used by CFOs, financial advisors and private equity funds in Argentina.

The study reveals that the most common method used is Discounted Cash Flow (DCF) method, used by the vast majority of the respondents (89%), practically always in its Net Present Value (NPV) form, but frequently also in its Internal Rate of Return (IRR) form.

Another popular valuation method in use is Capital Asset Pricing Model (CAPM), used by 68% of the respondents, with additional 8% using Arbitrage Pricing Theory (APT).

These results approximate to the results obtained from similar studies made in the US markets, e.g. (Graham & Harvey, 2001). Those studies found out that majority of the investment pricing professionals resort to the valuation methods mentioned above.

In Argentina, as secondary methods Economic Value Added (EVA) and multiples are of some importance, used by 50% and 29% of the respondents, respectively. Real options analysis is rarely used. These methods tend to be more widely used in developed markets.

While it is appears that the valuation method choices are similar in emerging economies to those of developed economies, there remain some unanswered questions: Are the methods chosen in emerging economy environment similar to those in developed economies because they are naturally suitable for the application in the emerging economy setting? Are those methods used for other reasons, such as the availability of analysts from business schools where these methods are the mainstream?

To answer these questions, the methods need to be examined in more detailed level. The methods are briefly introduced in their basic form and their applicability is considered. Some proposed variations made in order to address the emerging economy realities are also considered where appropriate.

The intention is not to be exhaustive but rather to concentrate on the most relevant methods for emerging market investment; therefore the discussion is limited to NPV, CAPM and real options analysis here. Of these, CAPM is presented in some detail and

in particular its application in the emerging market investment valuation. This is justified on the one hand because it is the prevailing practice and on the other hand because it appears to be flawed in the form it is generally applied, perhaps even fundamentally unsuitable for the task.

2.1.1. NPV

In the Net Present Value method, the initial investment outlay and the expected future cash flows are discounted back to their present value and summed. The decision criterion applied is generally either that the result is equal or higher than zero, or alternatively, if decision is to be made between multiple investment opportunities, one that has the highest value.

The formula of NPV is:

$$NPV = -I_0 + \sum_{t=1}^{n} \frac{X_t}{(1+k)^t}$$

Where

I_0 = initial cash investment,
X_t = the net cash flow in period t,
k = cost of capital of the project, and
n = investment horizon.

There are two components that can be modified to take into account the emerging economy uncertainties in the valuation: adjusting the expected cashflows (I_0 and X_t), and adjusting the discount rate (k).

Textbooks tend to recommend adjusting the expected cashflows, e.g., (Shapiro, 1999). This is justified on one the hand with arguments against adjusting the cost of capital. One such argument is that using an uniformly higher discount rate will not properly reflect the risk attitude of investor: an investor might consider expropriation five years hence far less damaging than expropriation next year.

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Another argument against adjusting the cost of capital is that the choice of risk premium seems arbitrary. Further, even if the risk premium could be selected such that it is non-arbitrary, a constant risk premium would be an inappropriate one because the country risk may vary during the investment horizon.

On the other hand, there are arguments in favor for adjusting the expected cashflows. It is seen that there is better information on the impact of the risk on cashflows than on required return.

The current practice, however, has been that the emerging economy risks are factored into the discount rate, e.g., (Shapiro, 1999), (Keck et al., 1998) . More recent study on practices used in emerging economies, (Pereiro L. E., 2006) found mixed results: corporate practitioners tend to use the cashflow adjustment, while financial advisors use discount rate adjustment.

The reason for this is probably pragmatic. (Pereiro L. E., 2006) suggests that the reason for avoiding the cashflow adjustment is the difficulty of predicting the exact effect of the risk on expected cashflow: it may be that the corporate practitioners feel more confident about their knowledge of the project they are evaluating than outside financial advisors.

Challenges of Application of NPV to Emerging Economy Investment Valuation

The NPV method applied as recommended by textbooks is suggested being able to catch such risks as expropriation, currency controls, inflation, and exchange rate changes (Shapiro, 1999).

In order to determine the cash flow effects of these risks, first the probability of each risk must be determined during the horizon of the investment (N.B., the probability may change over time), then every cashflow needs to be studied against each risk, then calculate the probability weighted value of each cash flow, and finally discount the value.

For example, consider the value of constant yearly foreign currency cashflow under the risk of a sudden exchange rate change caused by an economic shock.

Year	0	1	2	3
Cashflow in foreign currency	-1000	200	200	200
Probability of shock	0	0.15	0.10	0.05
Value in home currency, if no shock	-500	100	100	100
Value in home currency, if shock	-	60	60	60
Expected value	-500	0.85·100 + 0.15·60 = 94	0.8·100 + 0.2·60 = 92	0.95·100 + 0.05·60 = 98
Discount rate	15%	15 %	15 %	15 %
Present value	-500	81.74	69.56	64.44
Cumulative present value	*-500*	*-418.26*	*-348.70*	***-284.26***

Table 1: Example of NPV adjusting cash flows.

Adjusting a single cashflow under single risk is already somewhat tedious. As the number of the cashflows, the risks under consideration, and the investment horizon increase, the NPV calculation becomes increasingly complicated.

Analysis of a similar case using discount rate adjusting might find that the risk premium required for such an investment is 10 %-points. An NPV calculation using discount rate adjusting is presented in Table 2.

Year	0	1	2	3
Cashflow in foreign currency	-1000	200	200	200
Value in home currency	-500	100	100	100
Discount rate	25%	25 %	25 %	25 %
Present value	-500	80	64	51.2
Cumulative present value	*-500*	*-420*	*-356*	***-304.8***

Table 2: Example of NPV adjusting discount rate.

2.1.2. CAPM

The other widely used valuation method is the Capital Asset Pricing Model (CAPM). It was derived by (Sharpe, 1964), (Lintner, 1965) and (Mossin, 1966) based on results from portfolio theory (Markowitz, 1959).

CAPM aims to provide solution for determining the correct, arbitrage-free, fair equilibrium price of an asset. The assumptions are that the actors in the market are a mean-variance optimizers, everyone agrees on the probabilistic structure of assets and there exists a unique risk-free rate of borrowing and there are no transaction costs (Luenberger, 1998).

CAPM is based on the idea that risk and return are correlated in investment decisions: in making investment decisions the investors demand the higher return the higher risk the investment involves. CAPM also assumes that the risk of different assets can be derived from market information.

Specifically, in CAPM the systematic risk can be described by one single factor, ß.

The formula for the G-CAPM is

$$C = R_f + \beta(R_M - R_f)$$

where

C = cost of equity capital,

R_f = the risk-free rate,

R_M = the market return of appropriate asset class, and

β = the beta of the target company computed against the market index.

There are several challenges in applying the theory in practice, even more so when applied in international setting, and still more in the emerging economy environment. Two general areas of criticism of the CAPM theory when the model is applied in real world setting are introduced below. Specific challenges in the application of the theory for the emerging economy investments are discussed in the following subchapters.

One of the assumptions in the model is that the investors measure the value of their investment based its mean and its standard deviation and are risk averse. The mean-variance preference however has the drawback of penalizing outcomes higher than expected just as much as outcomes lower than expected, although the the higher outcomes are preferred by a rational investor.

Another area of criticism is the multiperiod fallacy of the CAPM theory. In practice the investment decisions tend to be multiperiod, e.g., stocks can be traded at any time. However, from one period to next, there will be changes in the prices of the assets in relation to each others, and thus the parameters used during the first period will not be valid during the next period.

Applying CAPM in International Setting

Applying CAPM for foreign investments is considered being among the most complex issues in financial management (Shapiro, 1999). The application is complicated by the fact that both systematic and unsystematic risks the foreign investment project faces are likely to be different from those in the home market.

(Shapiro, 1999) argues that economic and political risks are unsystematic from a global investor point of view, and can therefore be eliminated through diversification. There may have been a change in that during the recent decade.

The economic shocks that hit the emerging economies late 1990's and early 2000's in Asia, Americas and Europe serve as example that the economic risks an emerging economy investor faces can be systematic. The financial crisis of 2007 shows that the economic shocks can also cause global systematic risk.

Similarly in the case of political risks, there have been cases where a political trend starts from one country and spreads to other countries (e.g., Venezuela, Bolivia, Ecuador and Argentina), and changing the risk from unsystematic into somewhat systematic. Another example is the reaction of the financial crisis of 2007: changes in policies are appearing, which can lead into a more integrated global economy than before the crises, with similar restrictions for financial entities, and maybe even more globally coordinated supervision.

Thus the practitioners recognize that the risks involved with foreign investments are not the same as those the investor faces in its home markets. Therefore the same measures of risks are not applicable. The key issues practitioners of CAPM are devoting their attention have resolved around determining three factors (Shapiro, 1999):

Proxy companies: Because the foreign investment projects often do not have the same risk characteristics as local projects, the covariance (ß) between the investment and the market portfolio has to be decided case by case. Best proxy for determining the ß in such case would be based on betas of representative companies operating in the region of investment. Often such companies do not exist, in such cases often used approaches are to use the ß of the whole foreign market, the ß of home market industry in representative business, or combination of these two.

The relevant base portfolio: The second determination is which portfolio is used to measure the systematic risk that cannot be diversified. The choice has traditionally been home market portfolio, but as pointed out above, the capital markets are increasingly integrated and thus world capital markets would be the appropriate portfolio.

The relevant market risk premium: Thirdly, the risk premium which investors demand for investing in risky assets. (Shapiro, 1999) argues in favor of using the US market risk premium, on the basis that the market has best data available. Other alternative is the home market of the investor, if different from the US market.

Applying CAPM in Emerging Economy Setting

The general difficulties in applying CAPM for foreign investments, described above, are particularly problematic in the emerging economy setting: Firstly, the shocks, as noted in the introduction, shocks are some of the distinguishing features of the emerging economies.

Secondly, the policy changes can affect significantly on both the expected return and the expected variance in return. Consider the case of expropriation as an example: the return will become certain constant and the variance will disappear.

Third, the market data necessary to apply CAPM in the form used in the developed economies is difficult to obtain in the emerging markets. The markets are often relatively recent. They have also undergone or are undergoing changes that alter the risk characteristics and thus the historical data is less useful. Further, the markets are often thinly traded and less transparent than those in the developed economies.

There are also difficulties in applying CAPM in emerging economy investment valuation that are not often discussed in the textbooks. As mentioned earlier, the expected variance in returns is difficult to estimate. In practice, in the developed economy environment where market data is readily available and the markets are relatively efficient, the historic variances of asset return are often used. However, there are a couple of challenges in applying the historic data in emerging market setting is that the environment is changing. Firstly, because the markets are not fully developed, there are market inefficiencies: the information is not available, the companies the companies tend to be closely held as well (Pereiro L. E., 2001) and transaction costs, especially for the foreign investors, are elevated.

Secondly, even in cases where the data was available and observed from efficient enough markets, the basic premise that emerging markets are in chance, the characteristics of the markets will not remain the same, but rather change due the changes in the environment the economy "grows rapidly, its industry is structurally changing, its market is promising but volatile, its regulatory framework favors economic liberalization and the adoption of a free-market system, and its government is reducing bureaucratic and administrative control over business activities" (Luo, 2002). Thus the parameters needed in valuation can change considerable during the investment period.

The extreme example of a change that distorts the parameters and is more common in emerging economy setting than in developed economies is economic shock: during distress, the returns become disturbed and variances become extremely elevated. This is not captured using historic variances.

Research on Applying CAPM in the Emerging Economy Setting

These difficulties of applying CAPM in the emerging economy setting have raised some academic interest, in the SCOPUS article database 15 articles were found concerning the usage of CAPM in emerging economy. Based on these, it appears that it has been established that CAPM, using the volatility of the price as a factor indicating the risk and thus the expected return, does not work in emerging economy setting, e.g., (Hwang & Satchell, 1999) point out similar contributors to those described above that cause CAPM results to be misleading .

Article by Girard and Omran (Girard & Omran, 2007) on five Arab capital markets is one study confirming this: they find that in those markets beta is not good proxy to identify the risk. It should be noted though that Arab capital markets are generally considered frontier markets instead of emerging markets.

Thus the attention has been on identifying other sources of risk that can be used in the valuation process.

Estrada (Estrada, 2007) and (Estrada, 2002) compares the CAPM usage of variance as a measure for risk and an alternative measure for risk, the semivariance of returns and, based on MSCI database, finds evidence against using CAPM. He suggests using called downside beta in a model called D-CAPM instead.

Yet another variation of CAPM, Consumption CAPM, is compared with CAPM on the Taiwanese markets in Chen (Chen, 2003) and finds out that CAPM performs better.

Pereiro (Pereiro L. E., 2001) points out that because of the lesser efficiency of Latin American markets compared with those in developed economies, it is difficult to estimate the appropriate cost of capital. Also, most companies in these markets are closely-held and therefore bear unsystematic risk components, further complicating the valuation process. In the article, a fundamental based valuation model is proposed.

Bark (Bark, 1991) tests the applicability of CAPM in Korean stock markets in the 1980s, i.e., during the period when it was still in an emerging state, and finds no

evidence of a trade-off between the market risk and the variance of the return in this market during that period.

Garcia and Ghysels (Garcia & Ghysels, 1998) study the applicability of conditional CAPM in emerging economy setting. In conditional CAPM, the non-constancy of the parameters can be modeled.

Current Practice of CAPM in Emerging Economy

Regardless of these challenges, CAPM is still the most widely used valuation method also in the emerging economy setting and thus apparently has appealing properties. As a result, morphing CAPM to better suit the emerging economy environment seems to be something of an academic pastime: (Pereiro L. E., 2006) lists 11 CAPM variations.

The same study shows that the practitioners generally use the U.S. dollar denominated instruments to determine the risk-free rate, usually 10 years T-bond. The risk premium is determined based on the U.S. markets, adjusted with the yield spread between a global bond and a sovereign bond of similar maturity from the local market.

The betas used depend on the practitioners: the corporations tend to use local betas, while the financial advisors and fund tend to use the betas of U.S. companies.

Example of the Cost of Equity using CAPM of an Emerging Economy Investment

To illustrate how the CAPM is applied international setting, the cost of equity for an investment is calculated using two different approaches: Global CAPM (G-CAPM) and Lessard's model. In the following the cost of equity for the investment described in Chapter 5 is determined, followed by a discussion.

Global CAPM

G-CAPM was presented in (Stulz R. , 1999). It is straightforward application of the general CAPM framework: while traditionally SP500 or similar wide based local economy market index is used to determine the required market return and the ß of the target investment, in G-CAPM a global market index is used. The local country risk-free is used, exactly as in traditionally CAPM. As global index, Stulz suggests using the MCSI World Index.

Thus the formula for the G-CAPM is

$$C_{EG} = R_f + \beta_G(R_G - R_f)$$

where

C_{EG} = cost of equity capital,

R_f = the risk-free rate,

R_G = the global market return, and

β_G = the beta of the target company computed against the global market index.

The suggested procedure when the target company is non-quoting if to use the average beta of a group of local quoting comparables.

The investment in case of Chapter 5, timberland, is indeed non-quoting. Also, there is no quoting comparables for timberland investments, thus the next best selection for comparables is paper and pulp companies. There are two such companies listed in Brazil, Vororantim Celulose e Papel, with ß of 1.86 against MSCI World Index, and Aracruz Celulose, with ß of 2.22, giving ß of 2.04 as the average of local quoting companies. Bond yields obtained from (Bloomberg, 2009), Beta calculated from Bovespa USD returns versus S&P500 or MSCI World index returns, based on 60 monthly returns.

The investment is treated from the U.S. based investor point of view, thus the suitable risk-free rate is the yield of 10-year T-Bond, or 0.034. The mean annual rate of return of MSCI World Index between May 1992 and May 2009 was 0.033. Thus,

$$C_{EG} = 0.034 + 2.04(0.033 - 0.034) = 0.032$$

Given the low correlation between S&P500 and timberland returns, the cost of equity compromises mostly of first two components, risk free rate and country risk premium calculated from the sovereign bond yield spread.

Lessard's Model

An alternative way to determine the foreign investment cost of equity is Lessard's model (Lessard, 1996). The model determines the cost of equity from

$$C_E = R_{f,US} + R_C + BC_{L,US} \cdot B_{US}(R_{M,US} - R_{f,US})$$

where

> $R_{f,US}$= U.S. risk free rate,
>
> R_C= Country risk premium,
>
> $\beta C_{L,US}$= Country beta relative to U.S. market returns,
>
> β_{US}= Beta of a similar U.S. based project, and
>
> $R_{M,US}$= U.S. market return

The sovereign bond yield of Brazilian government 8-year bonds is 0.1276, giving yield spread over the U.S. of 0.0936. Beta of Brazilian stock market index Bovespa against SP500 is 1.53. As a ß of a similar US based project, the case information reveals -0.1, the SP500 annual return, May 1992 to May 2009, was 0.045, thus

$$C_{EL} = 0.034 + 0.094 + (1.53)(-0.1)(0.045 - 0.034) = 0.126$$

Discussion

The cost of equity obtained using the Global CAPM method, 3.2%, does not appear feasible proposition for any investor, given the risk-free interest rate of 3.4%, and the fact that the low result is due to the low market return. This is caused by the downturn of the stock markets during the financial crisis of 2008. The same method, applied during the first half of 2008, would have given 10.7% as the cost of capital.

However, there are other issues of applying the G-CAPM besides the market behavior during financial crisis. The global market return is difficult to obtain using the composite indices available today. The MSCI World Index, suggested by (Stulz R. , 1999) although containing 1500 stocks, only contains companies of the 30 most developed economies in the world and thus it does not contain any direct emerging economy weight.

There are other world indices available, but include either a very small number of companies (S&P Global 100, Global DOW, BBC Global 30) or are composed of other indices, possibly selected on the basis of convenience, rather than in order to provide statistically meaningful data. E.g., S&P Global 1200 index consists of seven subindices, one of them consisting of subindices itself.

The lack of traded comparable is another major drawback of the method, settling on indicators obtained from paper and pulp manufacturers appears an arbitrary decision. The variance in their returns in comparison with variance in timberland returns has been different in developed economies, and is probably quite different also in emerging economies.

While the G-CAPM probably works reasonably well when developed economy based investors are making decisions about investments in other developed economy, the difficulties exemplify some of the challenges there are in applying the developed markets valuation methodologies in emerging economy environment: the incomplete integration of emerging markets with the global markets, incomplete markets, lack of availability of market data and unquoted investments.

The result from Leissard's model is easier to accept. Also, the result would not have been significantly different if the method was applied during the first half of 2008 instead of the first half of 2009. On closer inspection, there are a couple of troublesome assumptions.

However, the assumptions made may not be well founded. Firstly, the country risk premium was assumed to be the yield spread of a sovereign bond of the target country over a similar bond used for measuring the risk free rate is just one alternative that is suggested. Others are using the financial insurance premium of the target country, obtained, e.g., from (OPIC, 2009), or delivering it indirectly from country risk ratings, provided by ratings companies (e.g., Moody's, S&P). The former requires an explicit definition of against what risk the insurance is taken (e.g., inconvertibility, expropriation, political violence), while the latter requires judgment based on judgment made by the rating company, i.e., it is not based on any market data.

Secondly, there is the question whether the characteristics of a Brazilian timberland investment on Brazilian markets really similar to the US timberland investment in the US markets? The answer to that question has potentially large impact on the cost of equity.

The impact of the choice of methodology on the valuation has been under some study. (Pereiro L. E., 2006) cites a couple of such studies according to which the difference can be as low as 300 basis points, or as high as 2300 basis points.

2.1.3. Real Options Analysis

A real option analysis is an alternative valuation method and it is presented in detail in the following chapter. Thus the discussion is kept short here. There are different approaches for applying real options analysis, but the general idea is that the potential business decisions that can be taken during the investment horizon, or real options, are explicitly taken into account in the investment valuation.

Using real options analysis for the valuation of investments is considered especially advantageous when the investment includes managerial decisions during the investment horizon. Traditionally real options analysis textbooks have promoted such decisions as delaying the investment, abandoning the project, shrinking or expanding it, and combinations of those.

Intuitively, it could be seen as a useful approach in the fast changing emerging economy environment. According to the study of (Pereiro L. E., 2006), real options analysis is not widely used in practice in emerging economy setting.

However, some academic effort has been made to apply real options analysis to value investments under certain risks of emerging economy investments. Vonnegut (2001) develops a theoretical real option model to take into account the uncertainty investors are faced in emerging economy investments and studies how suitable such a method would be in valuation different type of investments by investors with different preferences.

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The continuous time model developed by Vonnegut bases on assumption that there is some development in one factor that affects the value of the investment, e.g., changes in the subvention policy of the government or structural stability. These changes are assumed to affect the value of the investment although the direction is not known, neither is the timing when information about the changes is available known.

The suitability of using the model (instead of the extended NPV valuation model) is considered based on needs of companies of three different kind as found out through the survey. The fields of operation of the companies considered are pharmaceutical industry, retail petrol combined with a mini market station and financial investing.

The real option method is considered suitable when the companies have an option to wait and when there is great uncertainty. It was found out that even though the companies did not use real options as valuation method, the preconditions mentioned affected their behavior in making their investment decisions as expected.

Nordal (Nordal, 2001) develops a model to valuate oil field investments using real options approach. In his approach, country risk in general is divided into economic risk, commercial risk and political risks. Of these, he chooses one risk falling under political risk, namely the risk of expropriation and develops a model to value the investment given certain probability of such a risk to materialize.

Tong and Li (Tong & Li, 2008) consider using real options to value investments under uncertainties in Asia Pacific area, especially in China. They categorize uncertainties in four classes: Policy uncertainty (encouraging / restricting FDI), input cost uncertainty (labor, capital, raw materials, transportation), market and technological uncertainties (industry structures, consumers, standards) and partner uncertainty (opportunistic behavior, resource availability, contract enforcement, IPR). To combat the uncertainties mentioned last, they suggest due diligence in partner selection and cultivating the contact network and personal relationships.

(Vonnegut, 2000) compares the usage of real options analysis and NPV as the decision making rules of emerging market investments facing some policy changes.

2.2. Chapter Conclusions

This chapter has presented three valuation methods, two of which are commonly used in emerging economy investment valuation, and third that has the theoretical potential to address some of the challenges such valuation process faces.

Although the basic methods used to value emerging economy investments seem to be established (NPV and CAPM), there are several variations of those methods that can be chosen and there is no generally accepted best practice to choose between those methods. Further, there seem to be differences also in applying those variants.

As pointed out, the methods provide vastly different results, depending on how they are applied. Thus, to answer the question presented in the beginning of the chapter of whether the methods used in practice are chosen because those are suitable for the task at hand or for other reasons; it seems probable that the other reasons have more weight.

This view is further supported by the finding that the traditional methods for establishing an appropriate cost of capital get increasingly complicated when they are modified to fit the emerging economy setting. There appears to be a need for an alternative method. The following chapter suggests one based on the real options analysis approach.

3. Emerging Economy Uncertainties

In Chapter 2, the valuation methods used for valuing emerging economy investments were presented. It was found that the most common methods failed to take into account some of the factors that most characterize the emerging economy investment landscape. This can lead into severe errors in the valuation process.

This chapter discusses these uncertainties in more detail considering the typical sources of uncertainties affecting investments in emerging economies. In addition to the uncertainties brought up in the previous chapter, further information was search from articles and textbooks covering foreign investments and investing in emerging economies. The subjects of the articles selected included the valuation of investments in emerging economies, cultural considerations in foreign investments, and analyses of macroeconomic and policy conditions leading to economic shocks, typical for emerging economies.

Further in this chapter the first step is taken to convert these uncertainties into quantified risks. This facilitates handling the uncertainties of an investment in ways that is necessary in order to value them.

The generic sources of uncertainty in investments, i.e., those applicable under both the emerging market and the developed market conditions, are discussed only briefly. At the end of this chapter, the findings are summarized.

First, however, a brief look is taken on what methodologies are proposed for assessing the future in order to discover uncertainty.

3.1. Discovering Uncertainty

The methodology for discovering future uncertainties is not a central topic of this work. However, it has significant impact on the valuation of the investment and cannot be neglected altogether, especially because during the financial crises that begun 2007, it has become evident that the investment risks have been severely underestimated by the financial world.

The aim here is thus to find a relatively simple, yet realistic, framework for estimating the effect of uncertainties on an emerging market investment project. The framework should also be such that it avoids the most obvious pitfalls in the light of recent events, as described, e.g., in (Stulz R. M., 2009).

3.1.1.   Framework for Analyzing Uncertainties

There are several methods for discovering uncertainty in the future events that can be used in the valuation of investments. In the context of real option valuation, (Copeland & Antikarov, 2001) points out two different ways for finding the uncertainty in the investment: using historical data and using subjective estimates by experts or management.

This is a rather broad view and in general, several methodologies have been developed for estimating the future development, including: role playing, intentions, expert opinions, conjoint analysis, judgmental bootstrapping, analogous time series, extrapolation, rule-based forecasting, expert systems, and econometric models (Armstrong, 2001).

The method sufficient for the purposes of this work is the following: first, future scenarios are considered based on the development of the areas of uncertainties relevant to the investment project under valuation. Then the impact of the scenarios is estimated based on historical data. Finally, the likelihood of the event is assessed based on managerial judgment with aid of expert opinion.

For example, three different scenarios for policy development are selected based on the current political zeitgeist of the country and the continent. Then the effect of each scenario on the investment is estimated. Finally, the likelihood of each scenario is evaluated.

3.1.2.   Evaluation of the Framework

One of the areas that will probably be of interest of future study as a consequence of the financial crisis of 2007 is likely to be how misconduct in risk evaluation and management can be identified. One early attempt is that presented in (Stulz R. M., 2009) where six sources of failure according are identified. They are the lack of

appropriate data, the narrow measures of risk, the overlooked risks, the hidden risks, the poor communication and the rate of change. In the following the method proposed is evaluated against failure points in order to see how vulnerable the method pointed out is for similar errors.

Firstly, the lack of appropriate data refers to the situation where the riskiness of the investment is evaluated based on data that does not contain a sample of the time period with similar events that causes the risk. In the method proposed, on one hand, the historical data used is the effect a given event would have on the investment when such an event occurs. On the other hand, not all possible events can be incorporated in one model. Attention is needed to ensure that the aspects that have most impact on the investment are included.

Secondly, the narrow risk measure refers to situation where a significant loss event of very low probability is omitted. The model used specifically is capable of dealing with events of low probability but significant impact, unlike the traditional methods described in the previous chapter.

On the other hand, just as was case with the first source of failure, a single model will not take into account all possible future outcomes and may thus be vulnerable to this kind of error. On the other hand, also low probability events causing significant may have been omitted.

Thirdly, overlooking knowable risks relate to risks that should be known to the decision maker and are, e.g., risks at corporate level are measured using classification from one unit and thus neglecting risks from another unit, risks incurred by hedging (e.g., the default of the counterparty), risks caused by market imperfections, and risks caused by changes in trading behavior on markets (e.g., if the market becomes less complete). The method selected in this work is specifically suitable for taking these kinds of risks into account.

Fourth class of risk assessment failure, overlooking concealed risks, is caused by the people responsible for risks not reporting those risks, or worse, deliberately hide them.

This work aims to be as outspoken about the risk as possible, trying rather to find hidden risks as well as possible than not taking those into consideration.

Fifth error committed in risk assessment according to Stulz is communication failure. The analysis in this case is well documented, and communication failure can thus be avoided by ensuring that the information is distributed and understood properly.

Finally, the method proposed answers to the problem of too slow a rate of change, by having well documented analysis of the investment on one hand, and by implementing a computer program to calculate the investment value in such a way that it can be modified by changing parameters. Ideally, the investment valuation would be done in real-time, however, the current computing power does not allow that.

3.2. Sources of Uncertainty in Emerging Economies

In the real option analysis framework as presented in (Trigeorgis, 1996) and (Copeland & Antikarov, 2001), as well as Trigeorgis' later work on combining real option analysis and game theory, e.g., in (Ferreira et al, 2009), the variables considered for determining the outcome of the investment are generally the costs of the investment and production, and the price of the product, added, especially in the case of real option analysis, with the potential other revenue streams, e.g., the abandonment value of the capital goods.

As found out earlier, these do not form a sufficient basis for valuing investments in the emerging economies, because of the special characteristics of the investment environment.

Thus, in order to value emerging market investments, it necessary to analyze other factors affecting the outcome: Some uncertainties are significantly more probable in emerging markets than on developed markets. Such is the case of expropriation of production facilities of high or strategic value: (Nordal, 2001) discusses the valuation of oil fields investments using real options. Straightforward application of the cost-price framework would be unable to catch the effect of such uncertainties. An occurrence of an economic shock is far more likely in emerging economies as well.

Other purpose of considering the underlying factors affecting the outcome is to make these factors more tangible. In investments made in environment familiar to the decision makers it can be feasible to assume that many of the uncertainties are known well enough by the decision makers or information on them can be obtained from the market place so that they can be considered qualifiable, or risks. The valuation of such investments can then be carried out using a suitable valuation framework.

The emerging economy environment, on the other hand, is often times more unfamiliar to the decision makers, or the market place is not mature enough to provide accurate information, or both. In such a case there is likely to be uncertainties that are not quantified sufficiently, and therefore cannot be captured with valuation frameworks that are based on risk.

The question then becomes: What are those uncertainties that should be taken under consideration? There are several frameworks that aim to catch uncertainties in foreign investments, but none was found to provide the necessary starting point for the needs of this study, as discussed below.

In the following, the most common uncertainties are considered and the estimation of their likelihood in emerging market setting is begun, when appropriate. The uncertainties considered include the most dramatic uncertainty in emerging economies (as well as sometimes in developed economies, as proven by the recent events), an economic shock. Another uncertainty considered is that of policy selection, which in many cases has lead to economic shock, but can affect investments significantly in other ways as well.

Further, the human factor is considered. Several studies have shown that cultural distance between the country of origin and the destination country can have impact on the success of the investment.

3.2.1.   Economic Shock

The uncertainty emerging markets are famous for are the recurring shocks that hit such economies. This phenomenon has been studied often, see e.g., (Calvo, 2005). The basic cause for the reoccurrence of these shocks is caused by the nature of these economies: they are in transit from developing economies to developed economies, but because they have not reached a developed stage, they are constantly in a danger of falling off the cliff into a developing stage.

One particularly good case study of how this occurs is (Cardoza et al, 2006). They studied the factors leading to Argentinean economic crises of 2001. The background of the crises were found from the typical emerging economy setting: weaknesses in the institutional structure, political instability and indebtedness. These left the country vulnerable to the external shock that started with the Asian crises of 1998, and through the factors affecting each others in the complex ways shown the figure below, finally caused the global financial markets to loose confidence in the country and collapsing the economy. The dynamics found in that study are shown in Figure 2.

Other studies include (Bussiere et al, 2006) that notes that emerging economy private sector holds a large share of short-term debt and the share actually increases with uncertainty. Considering that this will cause reduction in the investment capability of the companies after a crisis, as noted above, this behavior seems counter intuitive.

Aguiar (2005) analyses the consequences of the Mexican crises 1994, finding that the shock caused a decline in GDP of 6% in 1995, followed by the growth of 5% and 7% in 1996 and 1997 respectively. However, while the recovery was largely driven by exporting firms, the exporters did not invest to expand capacity, due to pre-shock exposure to short-term foreign currency debt, leading into increased cost of capital and reduced willingness to invest.
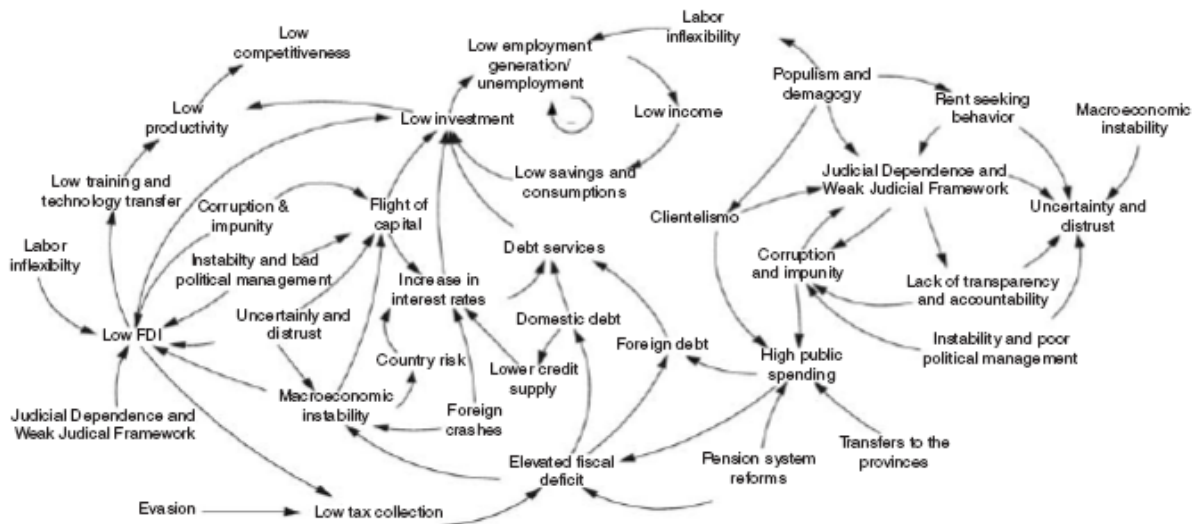
Figure 2: Dynamics of Argentinean crises of 2001.

In order to facilitate the transformation this uncertainty into the risk of emerging economy investments, I studied several most recent crises that affected the emerging economies: the Asian and crisis of 1998, the Tequila crisis 1994-1995, and the Argentinean crisis of 2001. Two measurements were studied: the effect of the crises on GDP growth and on exchange rate of the local currency against the US dollar.

GDP Growth

In case of shock, GDP will decline. The average impact of a shock on GDP in the crisis studied was -7.17%, median being -6.70%, measured from the year the shock hit the economy hardest. The standard deviation of GDP growth was 0.04

	GDP Growth		
Country	**1997**	**1998**	**1999**
Thailand	-1.3%	-8.0%	4.2%
Indonesia	4.7%	-13.7%	-0.1%
South Korea	5.0%	-5.8%	9.2%
Malaysia	7.8%	-6.7%	4.9%
Philippines	9.7%	-0.4%	3.0%
Taiwan	-1.3%	-8.0%	4.2%

Table 3: Effects Asian crises in 1997 on real GDP growth in some economies.

Source: (Pilbeam, 2001).

	GDP Growth		
Country	**1993**	**1994**	**1995**
Mexico	2%	4%	-6%

Table 4: Effect of Tequila crisis of 1994-1995 on Mexican GDP growth.

Source: World Bank, World Economic Indicators Database

	GDP Growth		
Country	**1997**	**1998**	**1999**
Russia	0.9%	-4.9%	5.3%

Table 5: Effect of Russian crisis of 1998 on GDP growth.

Source: (Pinto;Gurvich;& Ulatov, 2004).

	GDP Growth					
Country	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Argentine	4%	-3%	-1%	-4%	-11%	9%

Table 6: Effect of the Argentinian crisis of 1999 on GDP growth.

Source: World Bank, World Economic Indicators Database.

Local Currency / USD Exchange Rate

The effect of the shock on the currencies of the emerging economies that went through a shock during the 1990s was studied as well. To find out the effect, the exchange rate before the shock hit was compared with the exchange rate after the shock. The currency against which the emerging economy currency was measured was the USD. It was found out that, on average, the currencies depreciated by 48.48%, the median depreciation being at 49.63%. The standard deviation in the devaluation of local currency was 0.20.

	Exchange rate per USD			
Country	1996	1997	End crisis	Depreciation
Thailand	25.30	31.40	47.30	46.5%
Indonesia	2342	2909	4650	49.6%
South Korea	804.50	951.30	1695	52.5%
Malaysia	2.52	2.81	3.89	35.2%
Philippines	26.20	29.50	40.00	34.5%
Taiwan	27.46	28.70	32.64	15.9%

Table 7: Exchange rates before and after Asian crisis 1997.

Source: (Pilbeam, 2001).

	Exchange rate per USD			
Country	1993	1994	End crisis	Depreciation
Mexico	3.12	3.38	6.42	51.4%

Table 8: Effect of the Tequila crisis of 1994-1995 on Mexican exchange rate.

Source: World Bank, World Economic Indicators Database.

	Exchange rate per USD			
Country	1997	1998	End crisis	Depreciation
Russia	5	20	30	83.3%

Table 9: Exchange rate before, during and after Russian crisis of 1998.

Source: (Chiodo & Owyang, 2002).

	Exchange rate per USD			
Country	2000	2001	End crisis	Depreciation
Argentine	1	1	3.06	68.3%

Table 10: Effect of the Argentine crisis of 1999 on exchange rate.

Source: World Bank, World Economic Indicators Database.

Other studies exploring the linkage between macroeconomic information and economic shocks at emerging economies include (Larson & Madura, 2001) and (Andritzky et al, 2007). Larson and Madura (2001) studies the causes and strength of extreme currency exchange rate fluctuations between emerging economy currencies and the U.S. dollar. They found that the events can be divided into two categories: undefined and defined. Defined events were further divided into economic and political events.

Andritzky et al (2007) examines how emerging market bonds react to announcements. The announcements they consider are macroeconomic data (real GDP, industrial production, consumer prices, trade balance, and fiscal balance) and policy (domestic

policy interest rate) as well as rating change announcements (S&P actual ratings, rating outlooks, and watch listings). Further they consider the effects of international policy announcements (U.S. interest rate changes).

They studied financial crises periods in Asia and Russia in 1998, Turkey in 2000–2001, Argentina in 2001, and Brazil in 1998–1999 and 2002 and found that macroeconomic announcements do not tend to have significant effect on daily change in spreads, but significant effect on volatility. Rating announcements affect both spreads and volatility. International policy announcements (mostly U.S. interest rate cuts) tend to lower both spreads and volatility.

3.2.2. Policy

In addition to the recurring economic shocks, another characteristics of emerging economies is their political instability. In developed economies, despite the democratic process of changing governments, there is certain continuity in the economic policies, due to institutional stability. As an example, the independent central banks in developed economies guarantee price stability, whereas in emerging economies the central banks are closely tied to the government and having far less independency cannot guarantee price stability. Sometimes the emerging economies seek to provide price stability through fixing the local currency exchange rate to some global reserve currency, such as U.S. Dollar or Euro, but in the face of crises, maintaining the fixed rate has proven too costly for the governments.

Economic policy decisions affect both the economy in general at macro level as well as each investment project at micro level. The taxation, limits to competition, curbs for the repatriation of investment gains, the risks of expropriation, possible subsidies, loans or loan guarantees, and so on will affect the investments and depend on what type of government the country elects.

In order to convert the policy uncertainty into risk, two viewpoint are discussed next. Firstly, the connection between government change and economic crises is studied and secondly, the question of analyzing the political landscape and its effect on investments.

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Some uncertainties raised in studies concerning emerging economy investment valuation included (Perotti & van Oijen, 2001) considering how privatization can be seen as a sign improvement in perceived political risk and (Tanner & Samake, 2008) where it is pointed out that one of the uncertainties causing volatility in investments, fiscal policy, is itself under uncertainty in the emerging economies. I.e., even in the best intentions, the sustainability of the fiscal policy cannot be guaranteed and the economy can find itself under distress. They define a set of policies that increase the likelihood of sustainability of the fiscal policy in terms of what was done to guarantee the sustainability and what should be done to increase the sustainability.

A positive relationship between primary surplus and debt, and present value of government liabilities are proposed such policies.

The authors also examine how these policies were held in the case of Brazil 2000-2005. It is noted that while the primary surplus increased during that time from 0% the over 3%, at the same time the debt-GDP ratio rose from 49% to peak of 60% in 2004. This was against the intentions laid down in 2000, due to electoral uncertainties that caused the real interest rate and real depreciation to increase. After the government had changed the currency recuperated and debt ratio begun to fall.
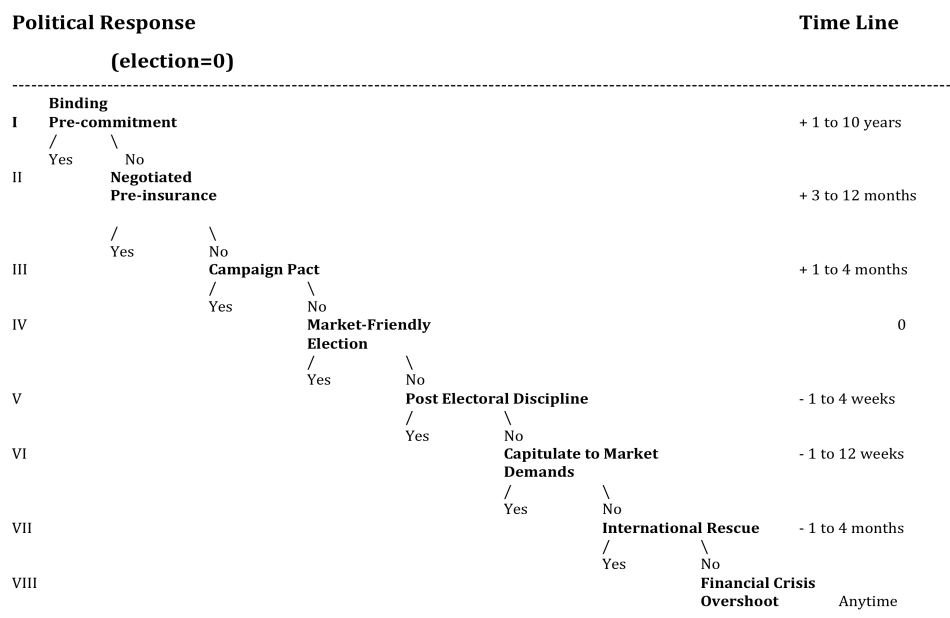
Elections and Crisis

There seems to be linkage between the government change and economic crises: a government change seems to increase the likelihood of an occurrence of an economic crisis. Emerging market crisis and the nearest election date are listed on the following table.

Country	Peak Crisis Year	Nearest Election Dates
Argentina	1989	May 1989
India	1991	May/June 1991
Mexico	1995	August 1994
Bulgaria	1996	April 1997
Thailand	1997	November 1996
South Korea	1997	November 1997
Venezuela	1998	December 1998
Russia	1998	December 1999
Brazil	1999	October 1998
South Africa	2001	June 1999
Turkey	2001	November 2002
Argentina	2001	October 1999 /April 2003
Brazil	2002	October 2002

Table 11: Emerging market crisis and nearest election month.

As can be noted from the table, the peak of the crisis and elections are close to each other in most of the crisis: most of the crisis peak shortly before the elections, sometimes shortly after.

In fact, this phenomenon has been studied more closely. It has been found that there is a process of eight steps that indicate whether the elections cause an economic shock or not. This process is shown in the following picture.


```
Political Response                                                        Time Line

        (election=0)
--------------------------------------------------------------------------------------------------------------
      Binding
I     Pre-commitment                                                     + 1 to 10 years
      /        \
   Yes        No
II           Negotiated
             Pre-insurance                                               + 3 to 12 months

        /          \
     Yes         No
III          Campaign Pact                                               + 1 to 4 months
             /          \
          Yes         No
IV              Market-Friendly                                          0
                Election
                /          \
             Yes         No
V                 Post Electoral Discipline                              - 1 to 4 weeks
                  /          \
               Yes         No
VI                   Capitulate to Market                                - 1 to 12 weeks
                     Demands
                     /          \
                  Yes         No
VII                       International Rescue    - 1 to 4 months
                          /          \
                       Yes         No
VIII                          Financial Crisis
                              Overshoot          Anytime
--------------------------------------------------------------------------------------------------------------
```

Figure 3: Political response for economic policy uncertainty leading into elections.

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The picture shows the critical steps in the political path that can lead a country into an economic crisis. At which step a country enters into a crisis depends on other than political factors. E.g., if the country has large amount of debt in compared with its ability to increase income it can fall into crisis without political contribution, as seems to be the recent case of Latvia.

On the other hand, if the country has large reserves of valuable raw material, as is the case with Venezuela, it can sustain a protracted period of uncertainty without flat out collapse, even after going through the full political path leading to crisis.

Outside these extremes, the following steps can be taken to avoid the economic crises:

I. There can be a binding pre-commitment, resembling the continuity provided by the institutions in developed economies.

II. A negotiated pre-insurance can take place before the campaign start.

III. During the campaign, the candidates can enter into a pact that guarantees a certain economic policy framework, regardless of the outcome of the elections.

IV. The elections can have market friendly outcome.

V. The government elected can follow self dictated discipline in it policy.

VI. The government can agree to the market demands and follow an economic discipline involuntarily.

VII. There is international rescue, e.g., led by IMF, containing terms for economic discipline the government must follow.

Examples of what the economic discipline required to avoid the crises can be observed from the presentation of Cardoza et al. (2006) shown earlier in Figure 1. (Johnson, 2009) tells a vivid account of the approaches of IMF in rescuing countries in crises, the measures required include commonly reduction of fiscal deficit, reduction of internal and external debt, labor flexibility, controlling corruption, increasing tax collection, etc.

As an example of how part of this process can be observed on the market place, the Brazilian presidential elections of 2002 and the yield spread between Brazilian government bonds and emerging countries government bonds.

The context was that in his platforms for the elections, the then candidate Lula called for thorough audit of the foreign debt as a condition for the payment. This was discontinuation point from the earlier policy, and caused worries in the market place that Brazil would default its debt payments if Lula was elected.

The chart below shows 10 months prior to elections, or steps II and III of the framework above. There was neither a negotiated pre-insurance nor a campaign pact. As the elections approached, the polls started to show increased support for Lula, and as a consequence the investors began to require higher returns on the Brazilian government bonds compared with bonds of other emerging economy countries.
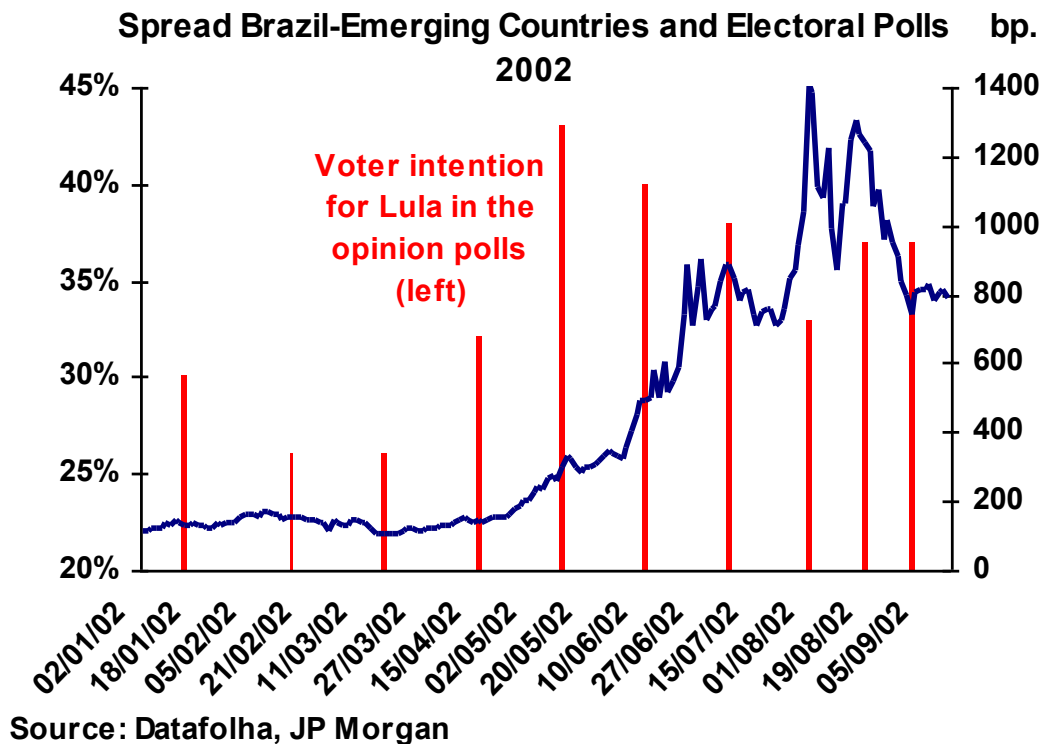
Spread Brazil-Emerging Countries and Electoral Polls bp. 2002

Source: Datafolha, JP Morgan

Figure 4: Risk premium required on Brazilian bonds over general emerging market bonds.

It appears that the markets were expecting Brazil to be heading to an economic crisis. The country continued towards the path leading to a crisis through the elections, Lula, i.e., a market-unfriendly outcome, winning. However, after the elections the president elect Lula announced that Brazil would not default its debt payments and thus the story ended with a post-electoral discipline outcome.

Assessing Political Outlook

Above some of the policy decisions and their possible effects on investments were shown. The next question that inescapably rises is how to turn this uncertainty into a risk. That question seems more difficult to answer than the effects of an economic shock.

Earlier in this work two different approaches for turning uncertainties into risks, namely using historical data and using subjective estimates. An example of using historical data is the case of assessing the impact of an economic crisis on GDP growth and currency valuation presented above.

Assessing the political outlook appears inevitably to fall into those risks that have to be evaluated subjectively. Although polls provide guidance as the elections approach, the investment period often exceeds the electoral cycle, and even within one cycle numerous events can turn the outcome unexpectedly.

Thus, historical data is of small help and the assessment must rely mostly on subjective evaluation, and must be done case by case. An example of such evaluation related to the case study in this work is presented in Appendix A.

3.2.3.   Cultural Distance

Third source of uncertainties often discussed in context of foreign investments is that caused by cultural distance between the investor and the target economy. In the domain of cultural distance belongs not only such skills as understanding national habits, beliefs, values but also knowledge of local regulations and access to government.

In the investment valuation ability to interpret the information is a key to measuring the expected rate of return and the level of risk.

Because of the difficulty of measurement, in practice, the uncertainties caused by cultural distance are not well incorporated in the valuation and the attempt to control them has been done through organizational choices instead. Such organizational choices range from choosing employees of multicultural skill or training personnel in such skill to joint ventures.

Effect of Cultural Distance

Measuring the effect of cultural distance on investments has proved to be rather challenging. One attempt is made in (Meschi & Riccio, 2008) which studies the joint ventures in Brazil. The study inspects the success factors for joint ventures between Brazilian companies and foreign companies.

They use two dimensions causing risk in that setting, namely national cultural distance and country risks. Thus, the country risks they examine are divided in two categories: uncertainties in macroeconomic situation or demand (factors being the risk of government default on payments, the level of debt, inflation and the GNP figures per capita), and uncertainties in political environment, or enforcement of regulatory restrictions on foreign direct investment (expropriation, nationalization, restrictions on repatriation of profits, discriminatory taxes, etc.) and/or government instability (weakening of the state, instability of political institutions, government corruption, coup d'e´tat, unrest, riots, strikes), factors being government and institutional stability, the socioeconomic situation, the level of corruption and the government's attitude towards foreign direct investment.

They found that cultural distance increases the likelihood of a joint venture company to be sold off, bought out or dissolved in the first 5 years 30-50% depending on the cultural distance as measured using two indices for country distance, namely Hofstede's four dimensions of national culture (Hofstede, 1980) and Globe's nine dimensions of societal cultural practices (House et al., 2004).

The study results alone are not sufficient basis to try to quantify the uncertainties related to cultural distance into risks that could be used in valuation process of an investment.

3.2.4. General Sources of Uncertainty

Finally, some considerations of the general sources of uncertainty, i.e., the cost of operation and production, the volume of sales and pricing power, in the emerging economy setting.

Cost

The cost factor in emerging markets is also affected by the characteristics of those markets. The rapid national economy growth implies that the costs are likely to rise at higher rate than those at home economy. On the other hand, economic liberalization and movement towards a free market system tends to affect in the opposite direction, reducing costs.

The infrastructure tends to be lacking in many of the emerging markets, but is improving, possibly allowing cost reductions during the investment project.

Volume and Pricing

The ability of the to set the price of the product at the emerging economies is similarly affected by the change occurring in those economies. The markets can be partially closed, which may improve the pricing power. Further, similar arguments about the market growth potential affecting negatively on costs factors can affect positively on volume and pricing.

4. Real Options Analysis Applied in Emerging Economy Environment

This chapter develops a method for applying the real option analysis for investments made in emerging economy environment. As shown in Chapter 2, the assumptions required for performing valuation based on the methods most widely used by the financial community do not hold well in the emerging economy environment. Further complication their applicability, there are practical difficulties in obtaining the required parameters in such environment.

This has led into formulation of number of alternatives that take into account the specific characteristics of emerging markets using data that is more easily available. As a result, there is no agreed best practice for conducting such analysis. Further, the choice and application of the methods will affect the resulting cost of equity radically.

In Chapter 2 it was also found that real options analysis has potential to address some of the challenges investment valuation practitioner faces in the valuation of emerging market investments. However, no real options analysis process that could be considered as best practice was found for emerging economy investment valuation, and in fact the application of real options analysis in emerging economy setting was sporadic, both in real-life application and in academic research.

Thus, in this chapter, a description of different real options analysis methods is given, their applicability for emerging economy investment valuation purpose is considered and finally, these ideas are combined to form a basis for a valuation of an investment in emerging markets that is used in the case valuation of the next chapter.

4.1. Pricing of Real Options

Several different methods can be found for valuating real options in practice from literature. Trigeorgis (Trigeorgis, 1996) suggest real options to be valued through replication, (Copeland & Antikarov, 2001) points out that risk-neutral probability approach is an equivalent alternative, and based on this they suggest using decision trees to value real options.

Third approach to be considered is through using the indifference argument to find a bid price value for the option used in, e.g., (Pratt, 1964), (Kallio, 2007) and (Musiela & Zariphopoulou, 2004).

In the first method, the valuation of real options through replication, a portfolio equivalent to the planned investment is created from securities traded in markets and the price of the option is decided based on the characteristics of that portfolio.

In the simplest scenario, such a portfolio consists of one publicly traded stock only. In more complex cases, such a portfolio would consist of stock and bond securities. These portfolios are used to observe the expected rate of return and expected volatility of the rate of return of the investment.

Once the expected rate of return, its volatility and exercise price of the option are known, the real options are valued using techniques similar to financial option valuation. E.g., the real option to scale back a project (or abandon it completely) at given future date would be valued as a European put option, and real option to postpone the start of the project at given future date as a European call option.

Advantages of the method are that it appears fairly straightforward as the valuation technique relies on well-researched area of valuing financial options. A disadvantage of this approach is that in most cases it is extremely difficult, if not practically impossible, to construct a portfolio similar to the planned investment. E.g., when valuing a gold mine one might intuitively choose gold as security on which to base the valuation. However, the rate of return and volatility of gold are not the same as the rate of return and volatility of a gold mine, and likewise, the rate of return and volatility of forest investment are not the same as the rate of return and volatility of a company manufacturing pulp or paper.

Another weakness is the limitation on using financial option valuation methods for valuing the real options. In practice, real options include features that tend to be quite complicated to value as financial options. This is not a downside as such, however, the main attraction of the method, namely simplicity, is lost in real life setting.

Third drawback in pricing the real option through replication is that it relies on the requirement that such components can be found on the markets that can be used to replicate the option, and that there is effective market for pricing those components. This is not generally the case and this assumption is particularly problematic in the emerging economy setting, as emerging economies by definition do not have efficient market mechanisms.

Fourth issue is that the valuation of financial options using the standard Black-Scholes Equation (Black & Scholes, 1973) is based on assumption that the price of the underlying asset follow a random walk, i.e., changing by small amount during small time period following certain trend and drift, will not lead into correct valuation of options having underlying assets whose price may have jumps, i.e., a large change at some point in time, as shown in (Merton, 1990). As discussed earlier, economic disturbances are one distinctive feature of emerging economies, and such disturbances will cause jumps in asset prices.

Given these deficiencies, this approach is not appropriate for the valuation of several types of emerging economy investments. (Copeland & Antikarov, 2001) suggest an alternative approach based on the marketed asset disclaimer. In this method, the rate of return is obtained from the NPV estimation of the investment. In order to estimate the volatility of the investment, a model of the investment is constructed and the volatility is estimated through simulation.

In final step, they construct a decision tree where at each step the real options available at the time are either taken or discarded. The value of the investment is then decided using decision tree processing techniques presented for example in (Baird, 1989).

This method seems tempting at first sight, however, in practical emerging economy investment, the alternatives to be considered in a decision tree will become too numerous to handle. As presented in the previous chapter, there are five factors to be considered if only the very basic ones are included. The decision tree would need to be constructed including two or more outcome of each risk, actions taken under each outcome would have to be evaluated and decided and so on. To further complicate the challenge, the risks are not independent.

Therefore, there is a need for an alternative method.

The third method for the valuation of real options found in literature is one based on indifference pricing. The indifference price is the price at which an agent maximizing her expected utility would be indifferent between making a trade and abstaining from the trade.

Indifference pricing has been used to value derivatives on assets having prices subject to imperfect market conditions (Kallio, 2007), financial options that contain non-traded assets, e.g., European put and call options in (Musiela & Zariphopoulou, 2004) and weather derivatives in (Yang, 2003). Indifference pricing has also been used to value claims including aspects that traditional valuation methods (i.e., Black & Scholes) fail to directly address, e.g., the transaction costs in (Hodges & Neuberger, 1989).

Thus the indifference pricing appears to be a suitable candidate to be used for real option valuation in emerging economy setting, which are characterized by market incompleteness and non-insignificant transaction costs.

4.2. Example Real Options Analysis Process

The real option valuation method proposed here is based on the process described in (Copeland & Antikarov, 2001). The process is aimed for the valuation of projects containing uncertainties (e.g. the unit price of a product, the production quantity, and the variable cost) and managerial options for reacting for the future events (e.g. building, shutting down, and halting production units).

The process consists of four phases shown in the figure below.

Figure 5: Overall approach for real option analysis of (Copeland & Antikarov, 2001).

According to the process, the investment is first valued using a DCF model without considering any flexibilities. This provides the base case for the valuation. In second phase, the uncertainties are evaluated. Using these, an estimation of the volatility of the project is obtained.

In third phase, the managerial flexibilities to respond to any new information are considered and a decision tree is build to reflect the real options available for the management. Finally, the project is valued using computational aid.

The process as described by (Copeland & Antikarov, 2001) does not, however, fully suite the emerging economy investment valuation. The shortcomings are described below, as well as proposing alternative process.

4.3. Real Options Analysis Process for Emerging Market Investment Valuation

The studies on valuation methods are used in financial community in practice do not address the issue of which the real option valuation method is the most commonly used, see (Graham & Harvey, 2001) and (Pereiro L. E., 2006). Similarily, given that (Trigeorgis, 1996) and (Copeland & Antikarov, 2001) fail on significant aspects encountered in the setting of interest herein, there is relatively little literature on best practices for real option valuation. Valuing real options in real life setting in emerging economies is virtually non-existent.

Therefore in this part a real option valuation process is proposed. Ideas for the process are borrowed from (Copeland & Antikarov, 2001) described above and the indifference pricing with the aim of obtaining an indifference valuation for a emerging economy investment.

The idea in indifference pricing is that optimal investment opportunities are formulated with and without the investment to be priced through maximizing the expected utility of those investments. The price of the investment is at the level the investor would be willing to invest so that he is indifferent between choosing either one. This leads into a valuation that incorporated investor's attitude towards risks that cannot be eliminated.

To value the investment a process is followed has five phases. First, the investment opportunity is considered: what is the initial outlay and the successive cash flows; optionally, a discounted cash flow analysis can be performed.

Secondly, the uncertainties of the investment are modeled. In the case of emerging economies, the uncertainties are those presented in an earlier chapter: macro economy, policy, demand, costs, cultural and investment project specific ones.

Thirdly, the managerial flexibilities are considered, these may include the ones discussed in literature, e.g., in (Trigeorgis, 1996): deferring, default during staged construction, expand, contract, shutdown and restart operations, abandon at salvage value, switch use and corporate growth. However, the flexibilities to consider are not necessarily limited in those and vary case by case.

In the fourth phase, the alternative investment is considered: what would the investor do if he chooses not to invest into the investment under consideration? This can be, e.g., a riskless bond, stock in given markets, or some combination of those.

Finally, the utility function of the investor is decided and the value of the real option is calculated using indifference pricing, and utilizing computational methods solving the optimal investment opportunities through, e.g., dynamic programming.

The process is summarized in the picture below.

Figure 6: Proposed real options analysis process.

5. Case

5.1. Description

The case under inspection is investment on timberland in Brazil by Timber Capital Group (The Forest Fund, 2008). Initially USD 50M is to be invested in 2-3 projects. Later on, additional USD 450M is to be raised and invested.

Each project consists of acquisition of land, planting eucalyptus, maintenance, cutting the timber and sale of the land at the end of the project. The average duration of a project is 6.5 years, or the time eucalyptus takes to grow before it can be cut into timber.

The cost and revenue per 1,000ha unit are estimated as follows:

Land acquisition	USD 0.61M
Maintenance	USD 0.48M/year
Plantation	USD 1.36M
Pulpwood revenue	USD 4.07M

Based on these parameters, the real IRR of a project is calculated to be 15.0% (in U.S. dollar terms). The cost and revenue estimations are based on following numbers:

- Long-term fiber supply contract USD 20/M^3
- Average annual increase 32m^3/ha/year yielding 208m^3 wood/ha
- Acquisition cost USD 610/ha
- Annual real land appreciation 15%

Another timber land investment company gives slightly different estimates in 2003 (FAO, 2004):

- Average annual increase 40-60m^3/ha/year yielding 260m-390m^3 wood/ha
- Timber prices $1,280-2,200/ha, resulting in USD 4.92-6.11/m^3

It is also noted that the timber markets in Brazil are mostly local and thus there is significant price variation of timber between different regions. In the investment presentation the IRR of timberland investments is estimated to vary between 2%-16%, depending on the location.

The variation in the rate of return in timberland investment depends on the price of the transportation, the local demand-supply situation, and local legislation and taxation.

Infrastructure is generally bad in Brazil, it is estimated that logistics costs are at 30% of GNP in Brazil, while in the developed world they are typically at 10%, or even below 10% countries such as Japan. Thus the proximity to the production facility will increase the rate of return of a timberland investment.

During the investment period, the level of cost components will change as well. Total operating costs were at USD 202/ton of bleached hardwood pulp in 3Q05.

Cost component	USD / ton	% of total
Wood	69	34%
Chemicals	37	18%
Energy	16	8%
Labor	14	7%
Freight	36	18%
Sales and Marketing	10	5%
Other mill	20	10%
Total	**202**	**100%**

Table 12: Pulp production cost components in Brazil.

The marketing claims supporting the investment of the Forest Fund are following:

- Predictable real returns over a long investment horizon
- Low correlation with other asset classes
- Wood fiber demand growth is fuelled by China and India
- A socially responsible investment

Historically, it appears that timberland has been an investment of relatively high returns with low risk. E.g., the timberland index of NCREIF has had average of about 14% returns on the beta of -0.1 between 1987-2007 (NCREIF, 2008).

The correlation of the index with other assets is shown in the table 13.

Asset	Correlation with NCREIF Timberland Index
US Government Bonds	0.12
S&P 500	0.04
Gold	0.02
Oil	-0.10
GSCI Index (Commodities)	-0.25
NRCEIF Real Estate Index	-0.3
Inflation	0.2

Table 13: Correlation of return on timberland investment and other assets.

The trend in the usage of product of the paper industry in the developed world is shown in the picture below. As a long-term trend, the usage of paper has been roughly related to the GDP of the market area. The production facilities have been built in, or outskirts of the end markets.

The following trend is visible: in the developing world, the consumption of paper is falling below the traditional proportion based on GDP, while the usage is growing in the emerging markets. However, the consumption is still relatively low in the emerging markets. Further, the leading developed world paper companies are still in the phase of establishing presence in emerging markets.
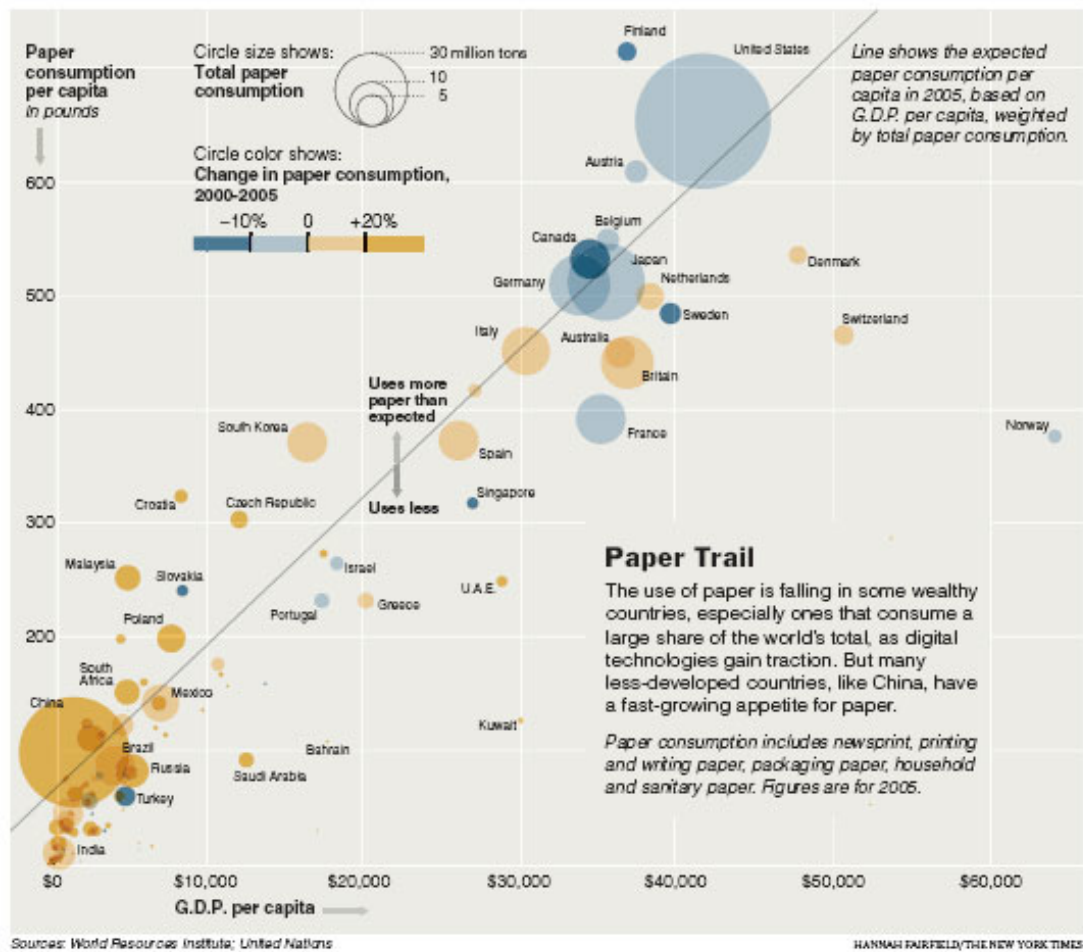
Figure 7: Paper consumption in different markets.

Source: (The New York Times , 2008).

The timber demand in Brazil is forecast to grow about 5% yearly, roughly following the historical trend.

Factor contributing to the social responsibility of the investment include:

- Reforestation, preventing global warming
- Tradable emission credits from new plantations
- The certifications of sustainable foresting

Plantations supply wood demand, reserving natural forests

5.2. Case Analysis

The point of view in the case analysis is that of an investor considering an entirely new investment opportunity in new markets. The local markets are the U.S. markets and the local currency the U.S. dollar. The investment is considered using two timberland production periods of 6 years, giving an investment horizon of 12 years.

For comparison, the case investment is first valued using discounted cash flows with the cost of equity obtained from CAPM in Chapter 2. Because there is no generally accepted best practice for applying CAPM in emerging market investment setting, the cash flow is analyzed twice, using two different versions of international CAPM.

After the discounted cash flow valuation, the investment valued using the real options analysis process described in the previous chapter.

Both the CAPM and real options analysis is done using the cash flows given in the case description. These leave out some factors that would potentially change the results significantly, e.g., taxation of the investments. The reason is that such considerations are often complicated in case of investments between different countries and merit a study of their own.

5.2.1. Discounted Cash Flows

The first phase of the valuation process described earlier is the description of the investment opportunity, identifying the initial cash outlay and the cash flows of the investment. Additionally, the investment project is valued using the discounted cash flows method.

The discounted cash flow analysis is calculated using the cost of equity obtained applying two different models: the Global CAPM and the Lessard's model (Lessard,

1996). The cost of equity using these models was calculated in Chapter 2, and was found out to be $C_{EG} = 3.2\%$ and $C_{EL} = 12.6\%$, respectively.

At the beginning of the first period (2008-2013), 20 units of 1000ha timberland is acquired and planted. At the beginning of the second period (2014-2020), an additional 10 units is acquired using the pulpwood revenue generated from the first period plantations. Then the total of 30 units are planted. At the end of each period, the timber is lumbered. Between the periods begin and end, there are only maintenance costs.

Following assumption were used in addition to the information given in the case:

- Maintenance and plantation cost annual increase of 4% (in nominal USD)
- Pulpwood price annual increase of 5% (in nominal USD)
- Some of the equity is retained at account providing risk-free interest of 2% annually for the purpose of paying the yearly maintenance
- The final year maintenance includes lumbering

Year	2008	2009-2012	2013	2014	2015-2019	2020	Σ
Land acquisition / sales	-12.20			-14.11		42.33	16.02
Plantation	-27.20			-51.63			-78.83
Maintenance	-1.20	-5.30	-1.46	-1.20	-6.71	-1.85	-17.72
Pulpwood revenue			77.52			155.83	233.35
Interest on cash		0.62	0.09		.93	0.16	1.80
Total	-40.60	-4.68	76.15		-5.78	196.48	221.57
PV at 12.6% (C_{EL})	-40.60	-3.48	42.08	-33.00	-2.11	53.26	33.17
NPV at 12.6%							16.15
PV at 3.2% (C_{EG})	-40.60	-4.32	65.96	-55.67	-4.41	132.94	86.53
NPV at 3.2%							99.00

Table 14: Discounted cash flow analysis of the timberland investment.

The NPV of the investment project is USD16.15 million using the cost of equity from Lessard's model, or USD99.00 million when the cost of equity of G-CAPM is applied.

Given the appreciation of the timberland, an alternative investment strategy for a foreign investor might be to buy only land. The discounted cash flows of such investment would be as shown in the following table.

Year	2008	2020
Land acquisition / sales	-50.00	232.60
Total	-50.00	232.60
PV at 12.6% (C_{EL})	-50.00	63.06
NPV at 12.6%	13.06	
PV at 3.2% (C_{EG})	-50.00	164.50
NPV at 3.2%	114.50	

Table 15: Discounted cash flow analysis of a simple timberland investment.

The present value of such investment would be lower using the Lessard's model, and higher using the G-CAPM, than of the base case with the plantation. On the other hand, the investor could increase the income through renting the land for local entrepreneurs and increase the revenues at low cost.

5.2.2. Real Options Analysis

After identification of the investment opportunity, the initial cash outlay required and the succeeding cash flows, the real option analysis is done following the process described in the previous chapter: the uncertainties are modeled and the managerial flexibilities are discovered. After that, the attributes of the investment the investor would make if he did not have the option under valuation are and finally the value of the real option is determined.

Modeling Uncertainties

The second phase of the analysis is to model the uncertainties. The modeling begins by designing the structure and the dynamics of the model. The model to be used is in discrete time, thus the structure design includes the division of the investment horizon in smaller time units. This division is considered during the designing of the structure.

After the basic structure is decided, the specific uncertainties that affect the investment are decided and the impact of different future outcomes are analyzed.

Basic investment opportunity → Modeling uncertainty → Identify managerial flexibilities → Investment w/o the opportunity → Valuation of Real Option

Dynamics

In the analysis, a discrete time state tree model is used. For the sake of both clarity and computing capacity limitations, the number of stages to be considered is small. However, it is also shown that a reasonably small number of stages can result in relatively accurate pricing (Luenberger, 1998). The number of stages in the model is four.

In each of the time periods considered, there can be several changes in the world that affect the investment. These changes are described using technique known as lattice model. In the lattice, there can be an infinite number of outcomes moving from specific point in time to the next, so that the possible changes in the world are each captured in one branch.

The investment is considered for a 12-year period. As pointed out in Chapter 3, the elections tend to be both one of the distinctive events in emerging economy development as well as a source of uncertainty in themselves. Therefore the elections are selected as boundaries between stages. During the 12-year from 2008, the

anticipated elections are held in 2010, 2014 and 2018. Thus the durations of stages are 2, 4, 4, and 2 years. Unanticipated elections or government change are not considered in the model.

Each source of uncertainty is described using a separate lattice, reducing the complexity of the description of the model. The separate lattices are combined in the implementation phase of the model.

Uncertainties

In the following, the effects of the following uncertainties in emerging economies will be considered: policy, demand, cost and economic shocks. The effects of uncertainties caused by cultural differences are not considered, primary because HR policy issues are outside the scope of this work, but also because such uncertainties are best handled by appropriate personnel policy (Meschi & Riccio, 2008) and by conducting appropriate due diligence on contracts.

Policy

This section analyses the Brazilian the political environment and the effects the most likely policy alternatives have on the case investment.

Political landscape

The most significant aspect of Brazilian political landscape during the last two decades has been the transition from military rule into democracy. After the military rule, the Brazilian political scene has been dominated by two supercoalitions, one formed around Partido Social Democrata Nacional (PSDN), or "Tucans" and the other around Partido dos Trabalhadores (PT). The current government is PT dominated.

The Tucans are considered more business friendly of the two. This kind of policy should result in relatively low inflation, real GDP growth close to its potential, and growth in foreign direct investments. Also, private investments are allowed to improve the infrastructure, decreasing the currently significant costs caused by lagging infrastructure.

The PT supercoalition came to power in 2002. The policy of PT was feared to be populist, but instead, the government has largely adopted policy similar to that of the Tucans. The feature that distinguishes the PT government from the Tucan rule has been policy of favoring equality over economic growth. This is exemplified by the increase in wealth transfers.

Also, the PT can be considered to be somewhat less business friendly than PSDN, e.g., they are reluctant to accept private funding to improve the infrastructure, such as building high speed railroad between Rio de Janeiro and São Paulo (Rodrigues, 2008).

Thus the consequences of PT government are lower real GDP growth, higher salaries and higher overall costs.

A third alternative that is considered is a populist government. The policy may result governments of different ideologies and while the political ideology of these governments is not the same, the consequences from the FDI point of view can be considered to be similar.

Examples of what this third alternative might consists of are the populist governments of Kirschners in neighboring Argentina, Hugo Chavez in Venezuela and the unlikely return under military or other right wing authoritarian. Such political change would result in unfavorable business environment, especially for foreign investors, characterized by high inflation, low real GDP growth, lacking demand, devaluation of property values and higher likelihood for economic instability.

There are three policy choices that are considered in the valuation model: Populist, Growth oriented and Poverty reducing. The changes are assumed to happen according to the presidential election cycle, or in 2010 and 2014. The dynamics is shown in Figure 8.
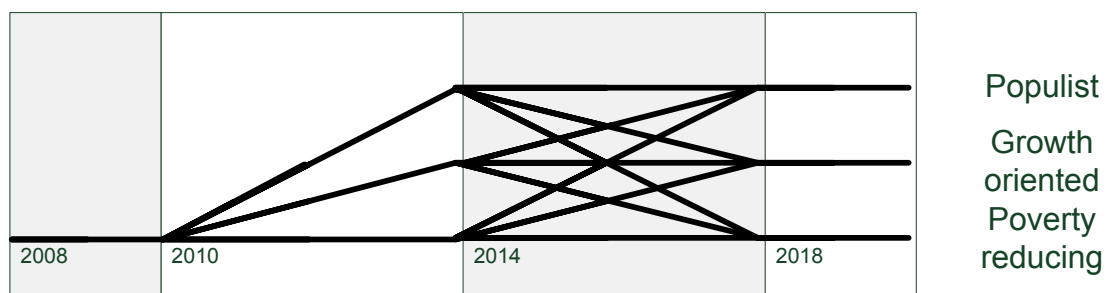
Figure 8: Policy dynamics.

Probabilities of Different Policy Alternatives

After modelling the policy dynamics, the probability of each policy outcome needs to be decided.

Due to the length of the investment period, the evaluation of the political outlook in the country is done using two different methodologies: firstly, the near term a political analysis was made (see 0). Secondly, the further reaching changes was considered taking place according to two principles of critical elections and realignment presented by Key (Key, 1954).

The idea presented by key is that firstly, there are critical elections every 30 years or so, causing realignment of political landscape. Secondly, the realignment tends to persist in the elections to come until the succeeding critical elections.

According to Mettenheim (Mettenheim, Under review), the critical elections in Brazil can be considered having taken place in 1932 and 1994. There was also a phase comparable to critical election from 1948-1964, causing the collapse of the democracy and rise of authoritarian, and later military, rule.

The 1994 election resulted in the rule of the political tendency considered economic growth oriented as described above. According to the persistence of the realignment, this economic growth minded tendency should last until around early 2020's.

Therefore, when considering the long-term political outlook, it is considered that growth oriented tendency will be more likely to win the elections than the alternatives. The probability of this is set at 0.5 in the base case, while the inequality reducing tendency is the second most likely to win election by probability of 0.4. The populist alternative is

considered to be far less likely, with probability of 0.1. The sensitivity of the value of the investment for the accuracy of these assumptions is tested in the final phase of the valuation process.

Impact on Economic Environment

To conclude the discussion about the policy uncertainty in Brazil, the consequences of each political environments on the attributes of the investment are considered. As noted in the case description, there has been a significant linkage between GDP growth and paper consumption. This will have direct impact on the price of the timber. Therefore the discussion of the policy impact on the investment is begun by considering the impact on GDP growth rate. After that, the effect of policy choice on labor costs, the price of timber and the price of timberland is considered.

GDP GROWTH

There are three basic assumptions made to determine the growth rate of GDP during the investment horizon.

Firstly, it is assumed that the GDP will grow, on average, 3.6% annually, as predicted by Goldman Sachs (Wilson & Purushothaman, 2003). Secondly, the probability for policy selection is assumed to be .5 for Tucan coalition, .4 for PT coalition and .1 for populist government, as argued above.

Thirdly, it was assumed that Tucan coalition governance would result in greater GDP growth than PT coalition, by 0.5%-point annually. Finally, it was assumed that a populist government would cause the GDP growth to halt.

Based on these assumptions, the probability neutral GDP growth rate was computed for Tucan and PT coalition policies. For 12 year, four stages model, the annual growth rate under Tucan coalition was found to be at 4.7%, under PT coalition it was the stated 0.5%-point lower, or 4.2%.

DEMAND

As noted earlier, demand for paper has historically followed the development of GDP. Thus, depending on the chosen policy, the demand will grow either 4.7%, 4.2%, or 0%.

In the model, the effect of policy on plantation and maintenance price comes from the price of the personnel. The personnel cost factor constitutes half of the original costs (i.e., $240/ha for maintenance and $680/ha for plantation). The personnel cost can be estimated based on the minimum salary – the minimum salary in Brazil indicates not only the level at which untrained personnel can be hired, but other salaries are decided based on minimum salary as well. The salary is often decided to be, e.g., three times the minimum salary.

Development of the minimum salaries in Brazil during last ten years is shown on the table below. It also shows the presidency under which the minimum salary was decided, the salaries in 1998 prices, the real growth rate and average growth, the last one calculated for each presidency.

Year	President	Minimum salary[1] in Brazilian Reals (R$)	Nominal increase in %	Consumer price inflation[2]	Minimum salary in 1998 prices	Real increase in %
1998	FHC	R$ 136		3.20%	R$ 136	
1999	FHC	R$ 151	11.03%	4.86%	R$ 144	5.88%
2000	FHC	R$ 180	19.21%	7.04%	R$ 160	11.37%
2001	FHC	R$ 200	11.11%	6.84%	R$ 167	4.00%
2002	FHC	R$ 240	20.00%	8.45%	R$ 185	10.65%
Average	*FHC*		*15.34%*	*6.08%*		*7.97%*
2003	Lula	R$ 260	8.33%	14.17%	R$ 175	-5.11%
2004	Lula	R$ 300	15.38%	6.60%	R$ 190	8.24%
2005	Lula	R$ 350	16.67%	6.87%	R$ 207	9.27%
2006	Lula	R$ 380	8.57%	4.18%	R$ 216	4.22%
2007	Lula	R$ 415	9.21%	4.46%	R$ 225	4.55%
Average	*Lula*		*12.46%*	*7.26%*		*4.21%*
Average	*Total*		*13.28%*	*6.67%*		*5.88%*

Table 16: Development of minimum salary in Brazil 1998-2007.

[1] (S A L Á R I O M Í N I M O)
[2] (World Bank)

Based on this analysis, during the poverty reducing government, the nominal annual personnel costs increase by 13.28% is projected, and during growth oriented

government, the nominal personnel costs increase by 15.34% is projected. During populist government, the personnel costs increase by 20%.

The demand for the timber correlates with the demand for the end products. In the case presentation it is assumed that timber price will increase from $10/m^3$ of 2002 to $20/m^3$ in 2014, or 6% annually. The assumption is based on the demand growth of timber increasing at the rate of GDP growth during the period (3.6%).

In the model, one percent growth in timber demand is thus assumed reflect in 1.66% growth in timber prices.

The land price can be assumed to follow the timber price. Abandon value of land acquired and planted is assumed to equal the value of unplanted land. This is justified by the intuition that if such conditions arise that the abandoning of the plantation is the optimal decision, no other investor would be willing to pay higher price than he would be willing to pay for unplanted land.
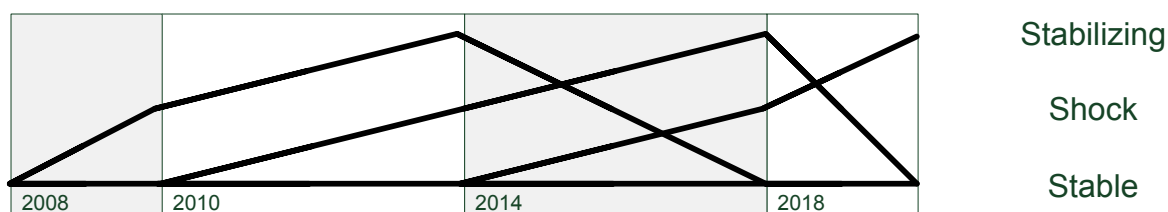
Macro economy

As pointed out in an earlier chapter, macroeconomic conditions in emerging economic are one of the main sources causing most uncertainty. It was also pointed out that, macroeconomic conditions in emerging economies are affected by both external factors and internal factors, i.e., an economic shock can spread from one emerging economy to another. Thus, both sources will need to be considered. First though the dynamics of the macroeconomics is decided.

Modeling

As described in Chapter 3 where effect of economic shock were analyzed, a shock has the following effects on emerging economy: as the first reaction to the shock, GDP will decrease by about 7% and the currency will devalue by about 49%.

The devaluation of the currency will have the effect that after the shock the economy growth rate will accelerate and the currency will appreciate. Thus, the economic

environment model is described through three possible states: stable, shock and recovering from the shock, or stabilizing.

Figure 9: Macroeconomic state tree.

Probability of a Shock

The probability of a shock depends on external factors on the one hand and on internal factors on the other. The external factors that can cause an economic shock are either a shock in an neighboring country, which may cause a shock through both real consequences, such as decreased trade between the countries, or through perceived consequences, as investors require higher risk premium from their investments in the country.

As the economic shockwave that spread through the emerging markets in the 1990's exemplifies, an economic shock can spread from one emerging market to another, even though there were no significant trade relations between them.

Thirdly, the financial crisis of 2007 shows that economic shocks at developed economies have impact on emerging markets as well. The probability of a shock is set to be .135 in the base case. This assumption is somewhat arbitrary and thus will be a subject of the sensitivity testing of the model.

Internal Factors

Brazil, such like any other emerging economy, has an intensive history of economic shocks. The causes for these have often been similar to those that were described earlier, in Section 3.2.1. The most intensive economic turbulence was reaction to the economic policies of the military rule when the theme of economic environment in Brazil initially high inflation and measurements taken in order to get the inflation under control.

Both main party coalitions have demonstrated commitment to a sound economic policy, to the degree that the country has become a source of IMF funding rather than IMF debtor. Thus the probability of internal factors causing an economic shock is considered relatively low under these two government rules (.05 under growth oriented government and .1 under poverty reducing government). However, the probability of an economic shock during a populist government is considered higher at .3.

Consequences

The consequences on the investment come from the effect of the shock on GDP growth and local currency. The effect of GDP growth is as described above under the section of consequences of chosen policy. The change of value of local currency will affect the price of the investment, which is measured in USD.

The third consequence of a shock is that under a shock, there will be no decision for building a new pulp mill and if there are one or more pulp mills under construction, the construction of one of those is halted. This will affect the demand for the timber.

Cost

The main cost components affecting the investment are labor costs (affecting planting and harvesting), infrastructure costs (affecting the price obtained when timber is sold) and land costs (affecting on the one hand the land acquisition price and on the other, the recovery price obtained when the land is sold). The labor costs and land costs were considered above.

Infrastructure Costs

In Brazil, as typical for an emerging economy, the infrastructure is lacking. It is estimated that in Brazil, the infrastructure related costs account for one third of the total costs. In the developed economies such costs are generally around 10% of total costs. Thus, improvement in infrastructure can result in both significant cost reductions in total costs and in the increased competitiveness of the supply chain as a whole, resulting in increased pricing power. An Morgan Stanley report (Garner;Wang;Gomez;& Silva) has estimated that Brazil will spend over $1 trillion on infrastructure improvement during the coming decade.

Other costs

Total non-labor costs are assumed to either stay the same over a stage (supported by the reductions in the infrastructure costs), or increase at the pace of overall inflation.

Dynamics

Costs moves either up or down each stage following expected annual drift (v) with expected annual volatility (σ). Given these parameters and the length of period ($\varDelta t$), the factor for up or down movement is $e^{\sqrt{(\sigma^2 \Delta t + (v\Delta t)^2}}$. The probability of up movement is $.5 + .5(\sqrt{\sigma^2/v^2\Delta t} + 1$. The lattice for general cost states is given in Figure 10.

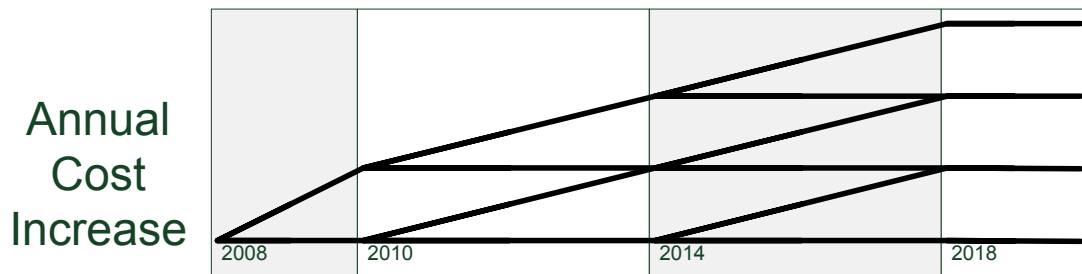**Figure 10: Price dynamics and annual change in total costs.**

Demand

The demand for the timber is dependent primarily on the demand for the end product, namely paper, in the region. Historically, the demand for paper has been strongly correlated with the real GDP growth. While during recent year this correlation has been broken in the developed economies, such correlation still exists in the emerging markets (The New York Times , 2008).

The demand for timber was about 115 million m^3 in 2001 and has been growing, as can be historically expected, at about the rate of real GDP, reaching 140M m^3 in 2007. Further, the demand is expected to outgrow the supply in Brazilian markets through 2020.

The demand growth pattern is assumed to follow the historical trend observed in several markets during a long period of time.

Year	Demand (million m³)	Price / m³ (USD)
2003	125	10
2004	129	
2005	132	
2006	136	
…		
2012 (estimate)	175	20

Table 17: Timber demand in Brazil.

In addition, an addition to local pulp mill capacity is considered as an increase to the demand. This is justified because the utilization of the timber is generally local: some expensive timber qualities are shipped abroad and made into, e.g., furniture there, but the transportation of eucalyptus rarely makes sense. Shipping intermediate material, i.e., pulp, to papermills abroad is more common.

Thus, if a new pulp mill is built in Brazil, the demand for timber will increase. A typical pulp mill uses about 5M m³ of timber annually.

Dynamics
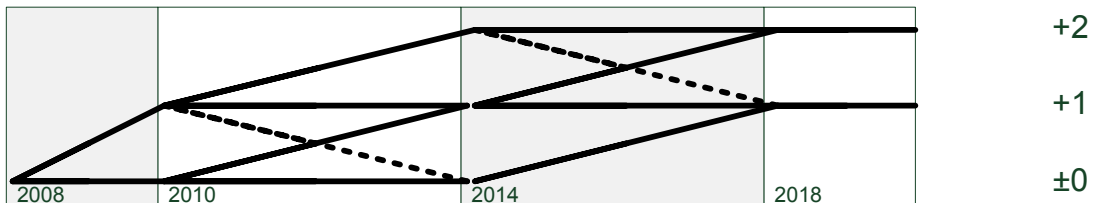
Figure 11: Dynamics of decisions to build pulp mills.

During the investment horizon, either one or two new mills are constructed. The timing of the construction is unknown, but it is known that if construction decision is made, it takes approximately the same time to plan and build the mill as it takes to grow eucalyptus ready to harvest (or six years).

Further, it is considered that there is a no change that the company constructing the mill runs into financial difficulties and is unable to complete the construction. However, if

there a macroeconomic shock occurs, the construction is halted (dotted lines in Figure 11).

The political situation affects the likelihood of building of a mill: if market oriented government is in power, the likelihood of a new mill is .5, if poverty reducing government is in place, and the likelihood is .3. No decision is made for constructing new mills under populist government.

Managerial Flexibilities

The third phase of the real option analysis process developed earlier is to determine the managerial flexibilities in the investment.
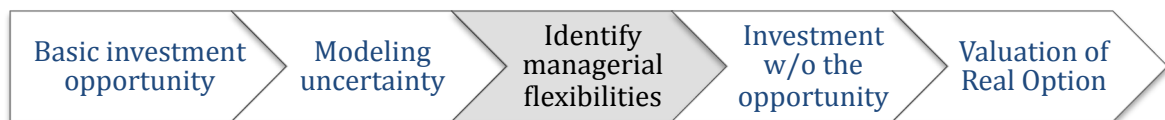

The managerial flexibilities in this project constitute of buying land, selling land, the decisions of planting bought land and harvesting planted land after six years of growth. It is also possible to sell a land that is planted, the price of such sale is considered the same as selling unplanted land. Renting land is not considered.

In addition to the options listed above, the investor is allowed to invest in the asset classes available for him or her if he or she decides not to invest in the Brazilian timberland. Those assets are described below.

Investment without the Option

Fourth phase of the real option analysis process is to decide what the investor would do if he decides against taking the investment opportunity under evaluation.
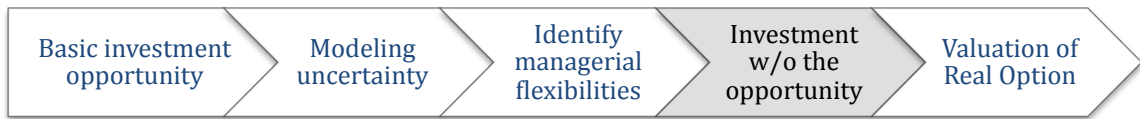
As an alternative to Brazilian timberland investment, an investment in a developed nation is considered in this case. I.e., if the investor decides not to take the option, he would invest into a stock index. In this case, the S&P500 index is chosen to represent the stock investment. The investor can also borrow and lend at market rate. The market rate is considered equal to risk free rate plus (minus) fixed margin.

The developed market stock index is considered having up and down movement and volatility that are the same as they have historically been. . Stock index moves either up or down each stage, by factor of $e^{\sqrt{(\sigma^2 \Delta t + (v \Delta t)^2}}$, where v is the expected annual drift, σ is the expected annual volatility and Δt is the length of the period. The probability of up movement is $.5 + .5(\sqrt{\sigma^2/v^2 \Delta t} + 1$. Dynamics of the stock market is shown in Figure 12 below.
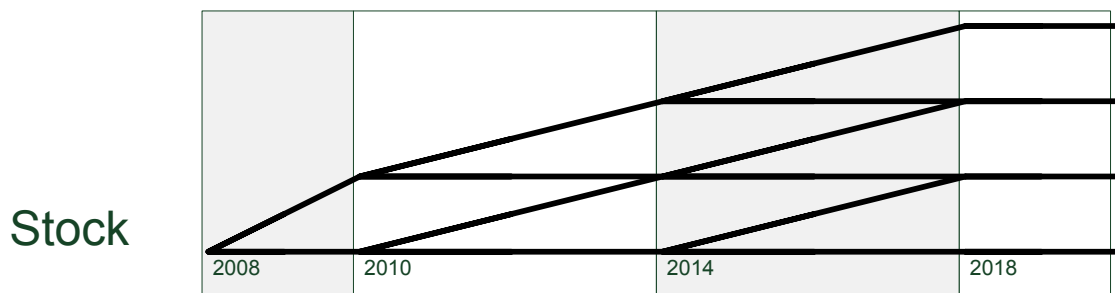

Figure 12: Stock index dynamics lattice.

Valuation of the Real Options

The final phase of the real option analysis process is to decide the value of the real option under consideration.

To find out the value of the option, indifference pricing is used as described in Chapter 4: a value of the investment project at which the investor would be indifferent between taking the investment opportunity and not taking it.

The investor is risk averse, and thus because the outcome of both the timberland investment and the investment including stock options and bonds have uncertain outcome, the preference of the investor in respect of the different outcomes need to be measured. In the model, a utility function is used to model the risk aversion nature of the investor, and specifically, an exponential utility function with risk aversion coefficient γ is selected.

The expected utility of the wealth at end of the investment horizon of each investment (one containing the real option and another one without it) is:

$$E[U] = \sum_{k \in T} -p_k e^{-\gamma c_k},$$

where:

T is the set of terminal nodes,

p_k is the probability of node k,

c_k is the amount of cash at node k, and

γ is the risk aversion coefficient.

First, the best investment strategy without the real option needs to be found so that the expected utility is maximized, such utility of such strategy is denoted as u^*. Then, an alternative investment strategy is constructed including the real option, and the value of the option, V is determined such that the investor would be indifferent between the two cases, i.e., $u(V) = u^*$. Thus the option value V tells the maximum price the investor would be willing to pay for the option. The real option value V is unique in terms of arbitrage pricing theory as implied by the valuation result of Kallio (2005).

The utility function of the investor is approximated by estimating the risk aversion coefficient of the exponential utility function. Finding the risk aversion coefficient of an investor is a task not subject of this work, instead the selected risk aversion coefficient is subjected to a sensitivity test.

The model was implemented in AMPL mathematical programming language (Fourer et al., 1993).

5.3. Results

Using risk aversion coefficient (γ) of 0.01, the value V of the investment was 152.86. At this level, the expected wealth at the was USD 628.42M. The difference from earlier discounted cashflow analysis end cash amount of USD 221.57 reflects the opportunity managerial flexibilities bring.

With initial investment of USD 50M, the discount rate for reaching the expected return is 25.67% over the rate of return of the investment without the option.

In addition to the base case analysis, the sensitivity of the result against the assumptions made during the valuation was analyzed. Three assumptions were checked: probability of economic shock, the probability of different policy choices, and the risk aversion coefficient.

5.3.1. Risk Aversion

The effect of the choice of the risk aversion coefficient γ on V was analyzed as γ ranged from 0.005 to 0.014 (base case value being 0.01). The results are shown in Figure 13.
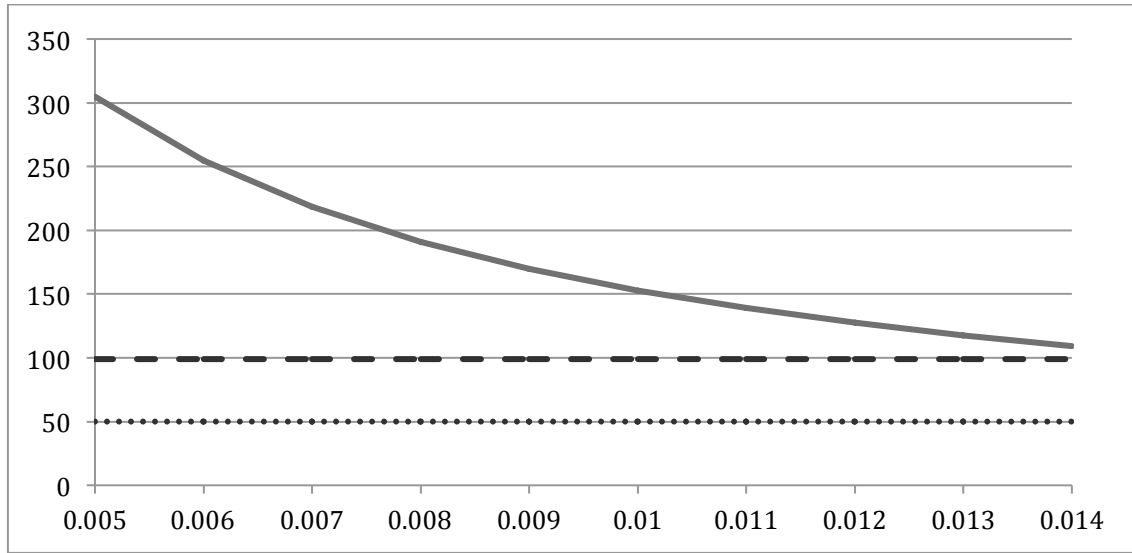

Figure 13: Effect of the risk aversion coefficient on the value of the investment.

The solid line is the value of the option as γ ranges from 0.005 to 0.014. The long dashed line is the value of the investment based on CAPM valuation, and short dashed line is the initial investment.

The selection of the γ also affects the average amount of cash at the end of the investment horizon, as shown in Figure 14.
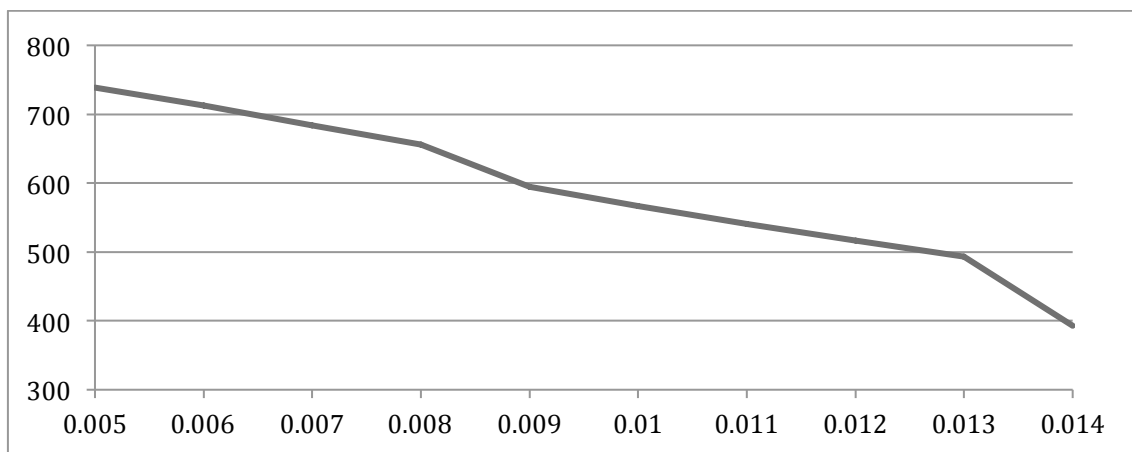

Figure 14: Expected amount of cash at the end of the investment horizon at different levels of risk aversion. Amount of cash on the vertical axis, value of the risk aversion coefficient on the vertical axis.

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5.3.2.   Shock

The probability of a shock in the base case was 0.135 at each stage. The sensitivity of the investment to is shown in Figure 15 as the probability ranges from 0.075 to 0.185. As can be expected, the value of the investment increases as the probability of an economic shock decreases although the difference between the analyzed extreme cases is only about 5%.
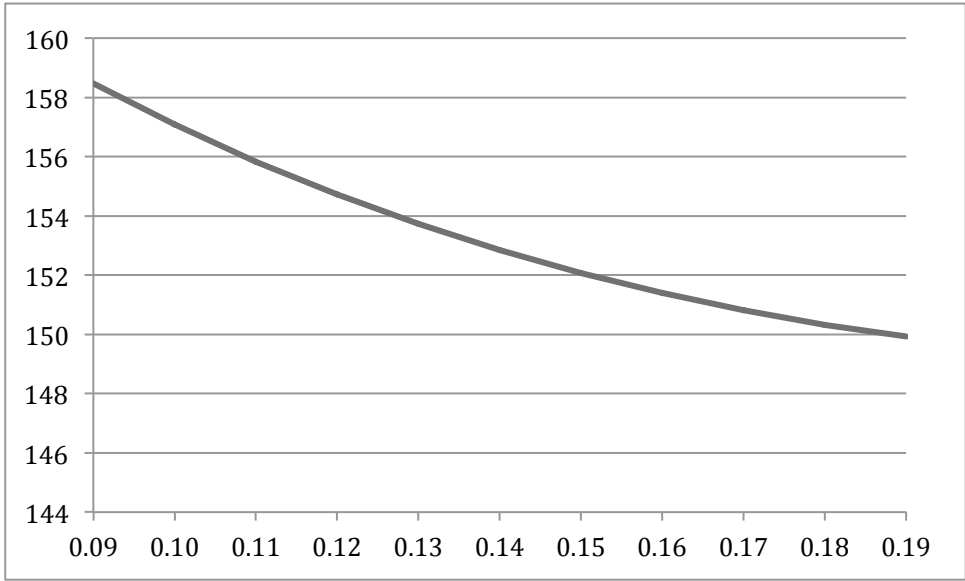

Figure 15: Sensitivity of the investment value for different probability of economic shock.

Value of the investment on vertical axis and probability of an economic shock on the horizontal axis.

5.3.3.　　Government

In Figure 16, the effect of the chosen policy can be seen. The probability of the poverty reducing oriented policy is the remaining portion. The maximum of the values is 238.0, and the minimum is 75.2, or 68% less than the best case.
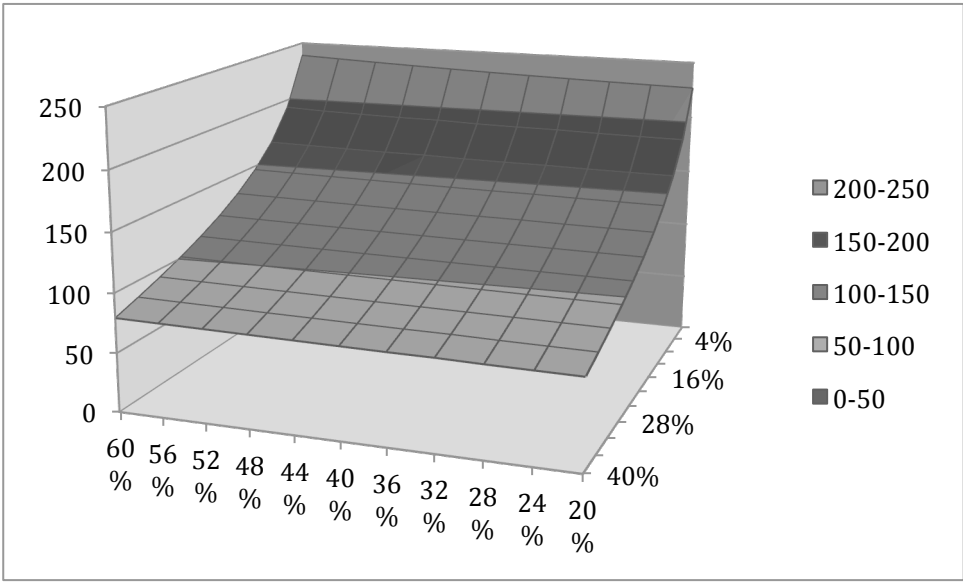
Figure 16: Effect of the government choice on the value of the investment.

On the vertical axis is the value of the option, on the horizontal axis is the probability a growth-oriented policy is followed, and on the depth axis is the probability of the populist policy. The remaining proportion is the probability of the poverty reducing policy winning elections.

As can be seen, the populist government has the largest impact on the value for the investment. The poverty reducing government decreases the value of the investment as well, but only by less than 5%.

6. Conclusions

The conclusions of the work are divided in four areas: the emerging economy uncertainties, application of international CAPM, using real options analysis in the emerging economy setting, and applying the real options analysis for analyzing the case.

The purpose of the study was to find out how to take into account the specific characteristics of emerging economies in investment valuation, and to find that out, first the specific characteristics of emerging economies in investment valuation that are currently taken into account were studied. Then the specific uncertainties of the emerging economies that affect investment valuations were explored. The question of how the real option analysis method can be used to capture the characteristics of the emerging economies in investment valuation was analyzed, a process was developed based on the analysis and finally, the process was used to value a case investment project.

In the following, conclusions that can be made based on the study of each of these areas are summarized.

6.1. Emerging Economy Uncertainties

In Chapter 3 it was found out that the emerging economy environment is characterized by aspects that complicate the investment project valuation process, especially in the form that they are used in the developed economies.

The most important features are that the emerging economies are still not fully integrated with the world markets, the information about the markets tends to be incomplete, and the markets are in largely unpredictable change that affects the expected returns.

The lack of integration with the world markets implies that measurement of both the risk and the expected rates of return are imprecise. The incompleteness of the markets contributes further to the imprecision of the analysis. Finally, because the markets are in

change, neither the risk nor the expected rate of return can be assumed to be constant over the investment horizon.

Chapter 3 concluded by considering the sources of uncertainties that cause the risks in emerging market economies. Three sources of uncertainties typical for emerging economy investment were pointed out in addition to the uncertainties typically considered in the investment project valuation process, i.e., those related to the amount of sales, the sales price and the costs. The further sources of uncertainties were those related to the policy decisions, the higher frequency of economic shock, and the cultural distance.

6.2. International CAPM

In Chapter 2 the applicability of the Capital Asset Pricing Model in the valuation of investment made in the emerging markets was analyzed. It was found that in order to apply CAPM in its basic international form (G-CAPM) requires that the home and the foreign markets are not segmented and that the purchase power parity holds between the home and the foreign markets.

This is not the case between developed home markets and emerging foreign markets investments. It was found out that numerous alternatives have been proposed for applying CAPM into valuing foreign investments. However, there is no generally agreed model for the emerging economy case. Further, the alternative method used in Chapter 2 was found to contain somewhat arbitrary assumption about both the risk premium investors require from emerging economy investments, as well as the relationship between the returns of a foreign market investment and the foreign markets being similar to the relationship of the returns of a comparable home market investment and the home markets.

6.3. Real Options Analysis

Based on the findings of Chapter 2, it was evident that alternative methods to the widely used CAPM and to the form it is most commonly used would be welcome to the toolbox of emerging economy investment analyst. Thus in Chapter 4 the focus was

turned into different real option analysis frameworks. Three such methods were studied to find out how they can be used to value emerging economy investments.

It was found out that the most common textbook real options analysis methods were not particularly suitable because they are aimed mainly to value managerial options given the market information similar that is used in the most popular CAPM applications was available. This assumption does not hold well in emerging economy setting.

Valuation of options based on indifference argument and maximization of the utility of the investor was found to be a promising basis for building an investment valuation framework also for emerging economy investments. Based on this, a process for the valuation of investments was developed.

6.4. Real Options Analysis in Practice

In Chapter 5, an investment project of Brazilian timberland was presented and analyzed using both CAPM and real option analysis valuation. In CAPM valuation, two methods were utilized to find out the cost of equity to provide an example of how choosing the CAPM method will lead into different results.

Then the same investment project was valued using the real options analysis process developed in Chapter 4. The impact of relevant areas of uncertainties identified in Chapter 3 on the investment was considered as well as the managerial flexibilities.

It was found out that the real options analysis approach, as applied in this work, allows taking into consideration both the changing environment and the managerial flexibilities, distinct from the CAPM models.

On the other hand international CAPM models proved much easier to apply than real options analysis. CAPM models can be easily created so that the models can be modified and different scenarios observed practically in real time. The real options analysis on the other hand is not applicable in real time and the analysis is more expensive to implement.

While the CAPM models were based on market data, while real options analysis was mostly based on subjective estimations, the data available for the CAPM models in emerging economies is not of good quality and thus the results are not reliable.

6.5. Further Areas of Study

While the framework developed in Chapter 4 proved capable of addressing the valuation of the case in Chapter 5, the case was quite straightforward and the framework needs to be tested against other cases in different fields of operations and different market areas.

Work is also needed to make the real options analysis framework easier to apply, because although it was found to suite the emerging economy investment valuation better than international CAPM, the latter is still the chosen method due to its relative effortlessness.

In Chapter 3 it was found out that some uncertainties have not been widely studied in context that would facilitate the treatment of these uncertainties as risks. Thus, further study on the uncertainties, e.g., what the risks caused by cultural distance are, would be helpful in the valuation process.

This work did not address methods of finding CAPM measurements from other sources than historical market data, also studies using such methodologies as consumption based CAPM are infrequent although they might be useful in emerging economy setting.

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Appendix 1: Near-term Outlook of Brazilian Politics

In the FGV BrazilForecast 2003, the most likely scenarios from 2003 onwards were given on seven areas. It is likely that those trends that were realized will have continuity into the beginning of the second term of Lula, as far as the global environment is favorable. Towards the end of the term, however, the race for winning the coming elections will play ever larger role.

Thus, to make scenarios for period 2007-2010 one might take the former trends, the information concerning the party politics and outlook for the election given in "Cenários possiveis e a incógnite de 2010" in Cenários FGV used and the changes in the world economic and politic environment.

Political environment: During the first half of the period, the local elections of 2008 are the most defining political element. Starting 2009, the elections of 2010 will continue to play increasingly large role in the political environment, as the PT does not have clear successor for Lula and the coalition partners will try to improve their changes for winning the elections.

Economic policy: For the beginning of the period, the continuation of the current economic policy seems most likely. Towards the end of the period, the economic policy will be affected by the popularity polls.

Business environment: It is most likely that the current policies will stay at place, considering that the administration won the elections last year. Most of the reforms required to improve the business environment will not be implemented during the periods. There might be state level reforms might be implemented that make setting up businesses easier (or at least faster).

Growth: There seems to be consensus for the Brazilian economic growth to continue at about 3-4% until 2010. However, the world economic situation development is likely to have large impact. Devaluation of dollar might decrease the value of exported goods and/or decrease the demand of the products.

Inflation: The most likely scenario is that the inflation will continue slowing, unless the government chooses to increase income-transfer enough to increase the budget deficit, which it might do in order to win the election the towards the end of the period.

Debt: The debt burden will continue to decrease; however, towards the end of the period, the investor confidence might be tested if the government increases the income-transfers setting the budget primary surplus at risk. This would cause the terms and cost of government bonds to worsen.

Foreign policy: The foreign policy will be challenging for the Lula government. The outcome is likely to be unproductive. The most likely partners for Brazil to ally with in the world politics are the other large emerging nations, especially India and China. Venezuela and its allies will continue to cause problems, and finding common interest with the other Mercosur nations will be difficult. The Brazilian government is not in favorable relationship with the current US government, but towards the end of the period the change in the US government will provide Brazil with an opportunity to improve the relationship, especially if the Brazilian government shows more willingness to take tougher stance against Venezuela.

The EIU expects the Brazilian economy key ratios to continue along the similar lines as they have during the first term of the Lula government. According to the expectations, the GDP continues to grow between 3%-4%, inflation keeps slowing. The foreign investment level is seen to remain at the current level while the trade surplus would decrease. More worryingly, the unemployment level will not decrease, despite the economic growth.

	2004	2005	2006a	2007e	2008e	2009e
GDP, %-change	4,9	2,3	2,9	3,4	3,5	3,6
GDP, Nominal, US$B	663,6	882	1067,4	1190,2	1252	1309,3
GDP/Person, nominal	3650	4790	5720	6290	6530	6740
GDP/Person, purchase buying power adjusted	8300	8680	9130	9580	10050	10550
Private consumption, %-change	3,8	4,8	4,4	4,7	4,1	3,8
Investments, %-change	9,1	3,6	8,8	11,1	7	5

in fixed assets						
Industrial production, %-change	8,1	3,4	2,9	3,8	4	3,8
Consumer prices, %-change	7,6	5,7	3,1	3,9	4	3,9
Unemployment, %	11,5	9,8	10	9,7	9,5	9,3
Trade balance (US$)	11,7	14	13,5	10,6	4,4	3,1
Trade balance, % of GDP	1,8	1,6	1,3	0,9	0,3	0,2
BRL / US$	2,93	2,44	2,18	2,09	2,12	2,17
Budget Deficit	-2,4	-3	-3	-2,4	-2,3	-1,8
Primary Surplus	4,2	4,4	3,9	3,7	2,9	2,9
Foreign investment inflow	18,2	15,2	18,8	19	19	19,5
Investment level	161,2	176,4	195,2	214,2	233,2	252,7
Export	96,5	118,3	137,5	155	168,2	180,1
Import	62,8	73,6	91,4	113,4	132,5	146,8

Source: EIU 2007

In comparison, other forecasts expect GDP to be slightly higher, at around 4% (PowerPoint presentation September 19th), interest rates to decrease significantly (although SELIC still at almost 9% in 2010), BRL/US$ to be slightly weaker than EIU predicts, primary surplus slightly higher (reaching 3,53% of GDP in 2010), government debt to decrease to 37,61% of GDP in 2010 and foreign investment slowing to US$21,360B in 2010.

Thus there can be seen to be consensus on the coming development of the key Brazilian economic indicators.

It seems that the reason for the stability of the forecasts is the continuation of governance of Lula and the PT coalition. After the elections, there were no changes that would have signaled a change for the inflation targeting, primary fiscal target or flexible foreign exchange regime. As Cenários FGV points out, the Central Bank president appears to be the economic strong man thus the economic policy is likely to continue.

However, it seems that the forecasts are done applying a "straight-line method". This does not take under consideration the main events during the period. I would focus on three events:

- Firstly, the ongoing development of the US economic and the possible financial crises,

- Secondly, the Brazilian local elections of 2008, and

- Thirdly, the presidential election of 2010 which will be defining since Lula cannot be a candidate

Concerning the US economic situation and possible financial crises, the most likely scenario is that the crises will be avoided, probably by the US Federal Bank cutting the interest rates aggressively, if needed. This will weaken the US dollar more rapidly than foreseen, but the global demand would not suffer. The second most likely scenario is that the US economy will face serious financial crises sending the rest of the world economics into turmoil as well. The strength of BRL might get tested in this scenario.

The elections of 2010 will cause uncertainty for the forecasts in the latter half of the period. How the elections of 2010 might change the outlook depends on how the PT plans to win the elections. This is especially true on fiscal side, the government has shown willingness to let poll ratings will affect their fiscal policies; electors of PT seem to look for low inflation, economic growth, employment consumer credit and especially income-transfer social policies.

The local elections in 2008 will be indicative on how the PT will try to approach the presidential election. An interview of the minister of internal affairs shows that she might be willing to accelerate spending on public works during the election year to gain votes.

If the unemployment level continues at its high levels, this might cause satisfaction for the government to decrease. The government might choose to compensate this with increase of income-transfers.

While PT strong support in northeast, they should try to lure São Paulo and Minas Gerais voters, who are less responsive for income-transfers when they are making their voting choices.

The most likely scenario regarding the both election is that PT will try their old tricks, increasing the income transfers but not enough to throw neither the primary surplus nor the reduction of the debt into doubt.

The next most likely scenario is that the PT will adopt more aggressive strategy. This would not only cause disappearance of primary surplus and increase of debt but also cause investors to loose confidence in the country, weakening the Real and lowering the FDIs even faster than expected.