Managing Incentive Schemes in a Corporate Environment

August 28

2011

A Master Thesis supervised by Professor Peter Bogetoft, Department of Economics

Peter Christoffersen, Copenhagen Business School
Peter.Christoffersen@gmail.com

Cand.Oecon 4th semester

80 Pages/23,798 Words/141,735 Characters (incl. space)
(161,735 including tables and graphs)

Table of Contents

List of Tables

1. Executive Summary

This thesis investigates the effectiveness of various incentive schemes in terms of their ability to reduce the moral hazard problem faced between Principals with asymmetric information. By setting the standard static Budget as a benchmark: Stock Options, Dynamic target setting models, Balanced Scorecards and WACC based performance metrics are evaluated in terms of their relative ability to mitigate the weaknesses induced from: external noise, accounting manipulation, limited duration and risk adverseness costs. Stock Options were found to be the weakest performance drivers due to their strong influence from external factors. By using OLS the external noise was estimated to be significantly higher than that of the traditional static budget. Further to that Stock Options opened up for new kinds of accounting complexity which does not exist if internal account are used.

Dynamic targets were found to be more efficient than both the Budget and Stock Options since the regression equation could be used to eliminate a high degree of external noise and thus allow for a better estimation of the performance of the Agent. Overall this model was found to be optimal since the level of complexity added was considered relative low.

A model was made which allowed the balanced scorecard to be translated into a structure comparative to that of an option – or more precisely a portfolio of options. It was concluded that by the use of the Balanced Scorecard, combined with dynamic targets, the highest degree of mitigation could be achieved, although this would then come with a relatively high price in terms of added complexity and additional cost to the incentive program. Due to the same complexity argument WACC based performance metrics were in general not seen as optimal performance drivers.

2. Introduction

Incentive programs are a common feature in many companies. Contractual theory dictates that if the performance of an Agent cannot be monitored the remuneration of the Agent must be linked with the success of the company if the Agent is to provide maximum effort[1]. The tools used to solve the problem, i.e. the various types of incentive contracts, however differ greatly. Some companies use traditional budgets, other use stock options and others use complex metrics and scorecard structures to ensure the Agents are pulling in the right direction.

It can be difficult to understand why a company has chosen a specific incentive scheme, and examples of Agents being paid high amounts while the company they were supposed to manage at the same time fails, does raise reasonable doubt to whether incentive schemes are truly in place to combat the moral hazard problem. It indicates that the negotiation power of the Agent might be as much a factor for choice of incentive scheme as the need to eliminate moral hazard. This master thesis will give a practical evaluation of the some of the common types of incentive programs in order to evaluate just how different they are.

2.1. Problem definition and limitation

This thesis will answer the problem of:

What are the major flaws of the traditional static budget incentive scheme in terms of reducing moral hazard risks, and how are other incentive programs more effective in solving the problem?

The thesis will seek to solve the problem by answering the below sub questions:

- What are the main weaknesses of the basic unadjusted budget target?
- In which ways does a stock option incentive differ from the basic budget target?
- How strong are external factors on a company's result and how can performance be adjusted for it?
- Are WACC (Weighted Average Cost of Capital) based performance metrics better performance drivers?

[1] An introduction to the Economics of Information, 1.4

- How can a balanced scorecard setup be translated into the same framework as the more traditional incentive schemes?

The problem is considered a general problem but will be limited in this thesis to the A.P. Moller – Maersk Group[2]. The purpose of this limitation is to ensure the focus of the thesis is on incentive schemes in actual use today and thus to ensure the problem is also relevant today. The conclusions of this thesis are expected to be relevant for most modern companies. The problem will be limited to the main groups of traditional incentive schemes defined in the chapter "The Model", and will not explore more creative or untraditional methods of driving behavior.

Further the problem will be solved from an economical and financial point of view and will thus limit itself from considerations such as e.g. legal, tax, communication and contractual complexity, as well as more speculative factors. This thesis will specifically be limited from employee shares and similar programs where the remuneration resembles the cash flow structure of a *future*[3]. These schemes might or might not be effective in dealing with the Agent/Principal conflicts, but their cash flow structure is fundamentally different and thus they do not fit the framework of this thesis. The purpose of the thesis is to provide a relative analysis of the chosen schemes and not to make an absolute or complete analysis of all possible incentive structures.

Accounting technical considerations will be taken into consideration since this is likely going to be a very critical factor and thus indirectly influence the standard variables of the model. In that case all accounting technical analysis will be done based on IFRS[4]. For elements where the standards does not offer specific governance, as e.g. the detailed profit and loss statement, basic accounting principles will be used. Since incentive schemes are assumed to be largely used within large multinational companies and these companies are normally audited and required to report according to IFRS[5], this is seen as the most

[2] http://investor.maersk.com/

[3] See chapter 1.3 for further on comparing cash flow statements of incentive programs to that of derivatives

[4] International Financial Reporting Standards

[5] Or potentially United States Generally Accepted Accounting Principles. As per "IFRSs and US GAAP: A pocket comparison" the two principles are converging towards the same goal and differences are mostly related vry specific technical interpretations

relevant interpretation[6]. If this study is to have any practical relevance it cannot be completely ignored that the very theoretical corporate finance and game theory models will eventually in real life be introduced to the very practical and legal accounting standards. An example of an aggressive paring of corporate finance with accounting is accounting performance metrics with an element of WACC included in the construction. This thesis will not cover a thorough analysis of these metrics, but a stronger argument for why this has been done will be provided in the chapter "WACC based performance metrics".
The definition of Principal and Agent is not only limited to that between shareholders and their direct managers. Although incentive schemes relating to the highest levels of an organization are usually the ones getting the most attention in the media, the conclusions of this thesis are general and could for that matter be used at any level of an organization.

2.2. Literature, Method and theory

Although there is a lot of literature available on the topic of incentive programs there does not seem to be a standard accepted model for how the effectiveness of these programs should be quantified. It seems to be a common denominator that most articles keep a theoretical and holistic approach and does not venture deep into the practical application of the programs themselves. An example of such analysis could be the article "Bank CEO Incentives and the Credit Crisis" (Fahlenbrach/Stulz 2009). In this article it is amongst other concluded that stock options did not cause banks to fail more often than banks without stock options. Although the article does not venture to conclude more than this, there is an underlying exoneration of stock options as a failed incentive tool. The method used to reach the conclusion is mainly OLS[7] with an implied number of very strong assumptions. First of all there are the usual assumptions of effective financial markets and trust in the financial reports submitted by the Agents. Secondly there is no real explanation of to what the difference between stock options and other incentive programs are. The analysis simply compares the companies officially reporting the use of option programs against companies which do not. This means that it is difficult to apply any practical value

[6] http://www.ifrs.com/ifrs_faqs.html#q3. It is stated that 90 countries have fully conformed to IFRS
[7] Ordinary least squares method

from the conclusion which in the end boils down to that companies officially reporting the use of stock options do not cause more corporate failures than companies not officially reporting the use of stock options. Relevant other questions such as: “Are stock options more effective than other incentives schemes?” or “Should companies discontinue the use of stock options?” are left unanswered. This thesis will seek to take a more practical view to the analysis and include considerations such as the effectiveness of financial markets and the ability to manipulate financial reporting in the analysis. Further to this focus will be on establishing what the mathematical difference is between stock options and other incentive programs. Let’s first look at the IFRS definition of a derivative. According to IAS 32 a derivative is any financial instrument fulfilling the below three criteria:

1. It’s value is based on an underlying variable
2. It requires no initial investment
3. It is settled at a future date

If focus is put on these three criteria most incentive programs qualifies as derivatives. Even a simple net result target will be a derivative if the value of the future bonus is calculated based on it. So if all incentive programs are basically the same in the eyes of the accountants, did Fahlenbrach and Stulz really conclude anything else than the incentive programs of different banks resemble each other? Certainly there is not enough support to conclude that stock options, and similar programs, did not play a significant role in the financial crisis. This framework of using official accounting definitions to group and model incentive programs will be used throughout this thesis.

There are naturally many authors criticizing stock options and similar programs. Some of the articles acting as a direct inspiration for this thesis are “The trouble with Stock Options” (Brian Hall and Kevin Murphy, 2003) and “The wages of failure: Executive compensation at Bear Stearns and Lehman 2000 (Lucian Bebchuk, Alma Cohen and Holger Spamann, 2009). In these articles the limitations of stock options are summed up and specific examples are provided for how it can still be lucrative to drive a company to the ground and at the same time be remunerated through stock options. This thesis builds on the conclusions made from amongst other these articles to setup a framework for quantifying just how strong these negative factors are and at the same time analyze how other incentive programs compare on the same criteria. In the articles arguments are made for stock options being flawed but the negative aspects are not quantified and no superior alternative solutions are provided. This is what this thesis will seek to accomplish. Knowing that stock options are flawed is even more interesting if it can be demonstrated that more effective incentive programs exists. Otherwise it can always be claimed that, although stock options might be flawed, it is still the most effective tool for the job. The specific problem areas that the following model has been used to test are directly taken from the conclusions made in the before mentioned articles.

2.3. The model and main assumptions

Each incentive scheme will be analyzed based on the same model which will include the same elements according to standard moral hazard theory. Each contract will have a signing date, denoted X, where the Agent and the Principal agrees on the contract. The material element of time X is that it is at this time it is decided what sort of measurement should be used for performance evaluation and thus X is critical since it defines the rules of the game between Agent and Principal.

Assumption 1

All agreements between Agents and Principal will be of the nature of a mathematical function where audited or external data can be inserted to obtain a direct quantification of performance which cannot later be disputed by either party. The target specified in the contract is denoted x.

This assumption is seen as weak when focusing on high level Agents where it will be assumed that they have very clear contracts documenting the incentive scheme which could be taken to court if any disputes arise. For lower level Agents the assumption is most likely stronger since contracts and incentive schemes are assumed to be less well documented and a certain element of subjective negotiation takes place when performance is evaluated.

All contracts contain a point in time, denoted *Y*, where performance is evaluated based on the contract and the Agent is remunerated according to the terms of the contract.

Assumption 2

All remuneration is linear and is calculated based on how much the Agent exceeds target. The actual result of the Agent at time *Y* is denoted *y*. The Agent can never be forced to pay back salary if the target is not reached.

This is also considered a weak assumption since it is not standard that base salary is affected if an Agent does not meet a target.
In between *X* and *Y* is a period of time where the Agent acts as well as all other players such as: customers, competition and external factors. External factors include all elements outside the direct control of the Agent and it is assumed they cannot be foreseen in advance. The cash flow of any specific incentive scheme will thus always follow the below graph:

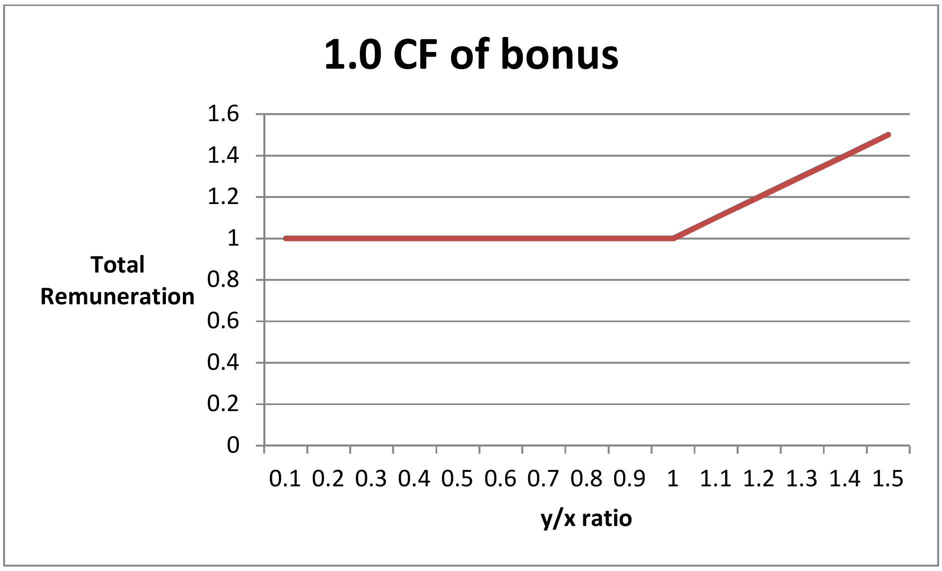


Table 1: CF Option

As long as the y/x ratio < 0 the Agent is paid 1 which is an index of base salary. As soon as y > x the Agent is paid a bonus proportional to how much the target is exceeded. In the above example the ratio between how much the target is exceeded and the increase in remuneration is the same but that does not need to be the case. The scoring formula simply needs to be linear and thus the function will be:

$$Bonus = \begin{cases} 0, & y < x \\ \dfrac{(y-x)}{x} * k, & y \geq x \end{cases}$$

In the above example the scalar *k* is equal to 1, and *k* will hereon be denoted the kicker and will directly decide how valuable the incentive program is to the Agent. A low kicker will be cheap to company but not as effective at driving Agency behavior compared to a higher kicker. The first element of the product relates directly to the performance estimation of the agent and the *k* relates to the overall size of remuneration and thus the two elements are calculated based on two completely different criteria. The variables relating to performance, *y* and *x*, are selected with the intention of maximizing the effort of the agent. The *k* is calculated based on the reservation utility of the agent and market cost of labor, and the Principal will seek to minimize his costs.

Thus all contracts will contain: *X, x, Y, y, k* variables. It should also be noted that the cash flow structure resembles that of an option. The Agent can never lose money on the incentive scheme. In the really bad years he will simply settle for the base salary which is unaffected, and then collect in the good years. Ceteris paribus it will never be relevant for the Agent to reject a bonus scheme since he will at worst be neutral. The treatment of analyzing incentive schemes based on their cash flow structure is one of the main foundations for this thesis and this is also where it differentiates the most from existing literature. Since all incentive schemes have the mathematical structure of either an option or a portfolio of options any difference must arise from either the choice of underlying variable or unique mathematical features which cannot be duplicated by another incentive scheme. Instead of focusing on perceived aspects of an incentive program, the cash flow forces the analysis around mathematical aspects and at the same time ensures that the analysis of the incentive programs are similar in construction allowing for a more standardized evaluation.

Once the contract has been established it will be analyzed with respect to how *effective* and how *efficient* is, where the base of the analysis will be the known weaknesses already pointed out by, amongst other, Cohen/Spamann and Hall/Murphy.

Assumption 3

The Principal is unable to monitor the effort of the Agent

This is the prerequisite for the moral hazard definition and what separates the problem from the simpler problem of optimization under symmetric information. Thus the problems can be presented as a maximization problem:

$$\max_{\{w(X_i)\}i=1,\ldots,n} \sum_{i=1}^{n} p_i^H [x_i - w(x_i)]$$

$$s.t. \sum_i^n p_i^H w(x_i) - v(e^H) \geq U \; (Participation\ Constraint)$$

$$\sum_i^n [p_i^H - p_i^L] w(x_i) \geq v(e^H) - v(e^L) \; (Compatibility\ Constraint)$$ [8]

The *p* represents the probability of success with high and low effort, the *x* denotes the income and *w* the wage. The *v* and the *e* represent the value of high and low effort provided. Since the Principal cannot monitor the efforts of the Agent, he must ensure that the Agent receives the highest utility when providing effort and at the same time keeping the costs of the Agent to a minimum. The two constraints are going to be critical in how the effectiveness and the efficiency of the various incentive programs can be evaluated. The participation constraint dictates that the agent must as a minimum receive the same utility in his current job compared to his other options. If that is not fulfilled the Agent will resign his contract and seek employment elsewhere. The compatibility constraint dictates that the Agent must receive higher utility from providing high effort compared to low effort or he will not provide high effort. By simulation of the results from the various analysis areas it can be evaluated their effects are in the Agent/Principal relationship.

[8] An introduction to the economics of information, risk neutral example

<u>Assumption 4</u>

The Agent will always optimize his incentive scheme

This is the cornerstone of game theory and a key assumption for this thesis. In this thesis the incentive scheme will be seen as a direct indicator of the Agent's utility. It is assumed that the Agent will treat the incentive scheme like a game and thus capitalize on any "mistake" the Principal might make in setting up the functions for the incentive program. It is further assumed that the Agent will act completely in his own interest and only if the incentive program is aligned with the values of the Principal will the Agent move in the direction the Principal wants him to move. The Agent has no direct incentive to provide value to the Principal.

2.4. Areas for Analysis

From Hall/Murphy the general weaknesses observed regarding option related budgets has been grouped into below four main categories:

The limited duration problem

Since all models will have a time *Y* where the contract expires that present a risk that the Agent will not focus on projects which creates value after the contract expires at time *Y*, since there will be no direct benefit. That creates the risk that the agent will say no to positive Net Present Value (NPV) projects with cash flows after time *Y*. In order to rank the effectiveness of the various programs ability to mitigate this problem, the standard budget construction will be analyzed and used as a benchmark to relatively evaluate other incentive schemes against.

The variance problem

Since the incentive schemes analyzed in this thesis will resemble options this means the value they have to the agent will increase as the variance in the underlying variable is increased (Pennacchi, 2008). Thus if it is possible for the Agent to influence the underlying variable the Agent might be able to create value to himself without creating additional

value for the Principal.
In order to test the variance problem Monte Carlo simulation will be used. By inserting the parameters of the different models ceteris paribus experiments can be conducted and the variance of the program can be evaluated. For more simple simulations mathematical modeling will be used.

The problem of risk adverse agents

Since the scope of this thesis is limited to incentive schemes which are structured like options, all of the chosen programs will by selection have some form of additional cost compared to paying the Agent a fixed wage. The problem will be analyzed much the same way as the limited duration problem. The standard budget will be used as benchmark and then the other incentive programs will be evaluated to investigate if they have any functional aspects which mitigate this problem.

The problem of strong external factors

If a performance metric is issued for an Agent and the function of that metric is influenced by other factors than the ability and the effort of the Agent it reduces the efficiency and effectiveness of the scorecard. This will happen due to mainly three reasons:

1. The agent might get remunerated due to the variance of external factors
2. The true performance of the Agent will not be visible, which might need Principles to promote/re-hire poor performing Agents or vice versa
3. The compatibility constraint might come under attack as the Agent will not need to supply effort to get paid “high effort” remuneration

Thus the less an incentive scheme is influenced by external factors the better this problem will be assumed to be mitigated. This will be demonstrated directly before concluding on the analysis of the standard budget.
In order to evaluate the effect of external factors panel data regression will be used.

2.5. Definitions

There exists a multitude of different types of incentive schemes which in this thesis will be grouped based on their unique differences compared to the elements of the contract defined previously. This means the names used for the groups might vary slightly compared to what is seen in other texts.

The Standard Budget

The standard budget will be defined as any sort of financial target which is negotiated once and never renegotiated. The target must be a single number and an Agent cannot have several targets for any specific period, although the calculation of any specific target can be complex and include multiple variables. If that is the case all variables must have the same unit then. Thus targets are agreed upon once for a number of **internal** financial targets and are then evaluated when the period expires which will usually be the reporting year of the company. The model does not cater for any special factors and targets are typically not adjusted during the year. If they are adjusted during the year it will most likely be done by a repeat of the original process.

This type of target setting is likely to be the most common simply because all larger companies are obliged to provide the stock market with official indications on how they expect future years to be[9], and it is thus natural to connect this with the target setting process for Agents since it is intuitive that these processes are somewhat linked. The process itself can take many different forms such as e.g. "Top down bottom up" process where the board indicates where they expect the company to be and this is then cascaded down through the tiers of the organization. The organization then reflects on the proposed targets and the provide feedback from the lower tiers and back to the top. The process could then be repeated several times.

One of the main characteristics of these types of incentive schemes are that targets are reached through some form of negotiation. It will be assumed that since all Agents within an organization does not have the same background and the target setting process will need

[9] Illustrativ IFRS-årsrapport 2010

to follow a process limited to the lowest common denominator which will often be a basic negotiation process.

Stock Options

Stock options are clearly defined in financial theory, but this section will focus on the specific characteristic of options that they focus on **external** factors and not so much the fact that they are options. The external element is what differentiate them from the basic budget target. The group has been named “Stock Options” mainly because stock options are seen as a logical driver when it comes to deriving performance based on an external variable, which is often simply the share price of the particular company.
Stock options differs from the standard budget approach because it is a group of external stakeholders who are often not in direct contact with neither the Principal nor the Agent who sets the performance of the Agent through the trading of the company’s shares. This adds a new complexity to performance management since there are a lot of assumptions connected with the pricing of shares which have not been fully documented empirically. One of the main assumptions behind using stock options is that the investors react rationally and that the market has visibility enough to price the share correctly and that no arbitrage exists in the market[10]. Such assumptions are constantly put under pressure by e.g. bank runs and other movement in prices which are not predicted by theory. This open up questions to just how rational the stock market is, and whether there might actually be causality problems in terms of what is actually the cause of variance in the price of any given share. I.e. is the share developing positively because the Agent is focusing on the best interests of the company or is it developing positively because the Agent is focusing on convincing the shareholders that the company is performing well?

Dynamic Targets

By dynamic targets are simply meant all contracts where the *y* of the contract is not a number but a function. Thus instead of negotiating a simple target for a given period a model is negotiated for how to determine performance at the end of the period. The target

[10] Theory of asset Pricing p. 66

will then typically take up the form of a traditional target adjusted for the development within certain factors. Thus the target is originally made based on certain assumptions on e.g. how the world economy, market capacity, competitor presence etc. are going to develop and at time Y the result is then evaluated together with the assumptions and adjusted accordingly.

This adds complexity compared to the traditional budget since the information needed to perform the performance evaluation is significantly increased and the scoring formula will change from being a function with only on unknown variable, y, to a function with multiple unknowns (at the time the contract is entered into).

One of the prime requisites for running effective performance management is having data of sufficiently high quality and such quality does often not come cheap. Most companies spend a sizable amount of money on external auditors to verify reported figures and including more variables into the scoring formula is most likely also going to increase the price of the corporate governance part of the scheme.

Balanced Scorecard

Balanced scorecard was a term coined by Kaplan and Norton during the late eighties and the same two authors later also published a book called "The Balanced Scorecard (1996)" which is widely considered the first generation theory of balanced scorecards. The main idea behind the balanced scorecard approach is that it lists the key financial and non-financial indicators of a company's success as per below example:

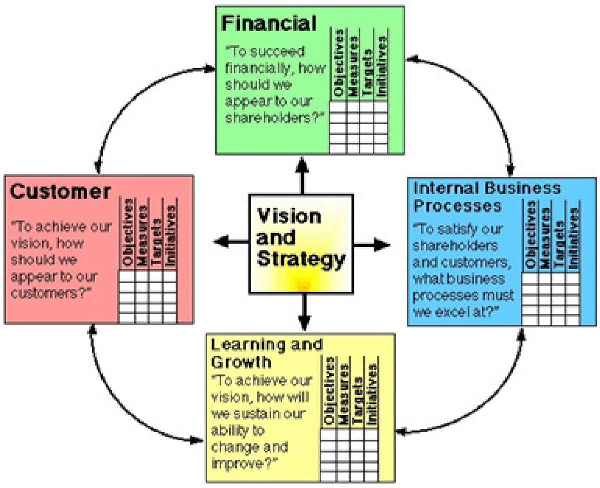


Table 2: Balanced Scorecard

The main deviation to previous thought is that any company should not simply focus on financials if it is to become successful in the long run. Instead the company should evaluate itself based on a number of factors outside finance before it can be properly determined whether the company is meeting expectations or not – so called Key Performance Indicators (KPI).

Kaplan and Norton never included any one single measurement for determining whether a company was successful or not, but their basic theory has since been developed by consultants and companies into doing just that. This is usually done by assigning certain weights to the different elements of the scorecard which then allows for quantification and the calculation of one single score determining whether a company is above or below target.

Since it has not been possible to identify one single obvious definition of a balanced scorecard this thesis will simply define a balanced scorecard to be any incentive scheme which is calculated based on both financial and non-financial measurements and where the performance is given as a score and not a currency value. In order to simplify the model all scores will be indexed so that a score of 100 is as expected and thus any score above 100 will allow for a bonus based on the general assumptions for this thesis. This will allow the balanced scorecard model to be analyzed using the same framework as for the other models.

A clear definition will be made between scorecards used for incentive purposes and scorecards used for evaluation. If the scorecard is directly used in bonus calculation it will be denoted a scorecard. If the scorecard is used for evaluation of *why* a company is performing the way it does it will be defined as being a dashboard. The two types might seem very similar but in terms of setting of the rules of a game and thus being able to calculate the Agents behavior, the differentiation is critical. A dashboard does not give any direct information on how an Agent will react since it does not provide any insight into how he will be remunerated and thus it cannot be predicted which of the elements of a dashboard the agent will focus on. Similarly once an agent has received a scorecard he will need a dashboard in order to know what the levers he will need to pull in order to maximize on his objectives.

3. Analysis

3.1. The standard budget

The standard budget will in its most simple form only have one target which could e.g. be the net result of any given year. The target is negotiated at the end of the previous year and at Y the performance is evaluated. If we then assume k equal to 1 the scoring formula for the Agent can be expressed as in the previous example as:

$$Bonus = \begin{cases} 0, & y < x \\ \dfrac{(y - x)}{x}, & y \geq x \end{cases}$$

If we assume the Agent works for a company with a targeted net result of 50 is remunerated proportionally to his ability to exceed the target then, if the Agent's base salary is indexed to 1, his remuneration function can be expressed as:

$$Total\ Remuneration = \begin{cases} 1, & y < 50 \\ \dfrac{(y - 50)}{50} + 1, & y \geq 50 \end{cases}$$

It is further assumed that the profit and loss statement consists of net revenue with a fixed contribution margin of 25 %, fixed administration costs and financial costs. The Agent is assumed unable to influence the fixed costs in the short run. These are set at 40 per year. The financial costs are long term loans which cannot be renegotiated and the interest is fixed at 10 per year, the underlying budget of x will be of the expression:

Net Revenue	400
Variable Costs	-300
Contribution Margin	**100**
Fixed cost	-40
EBIT	**60**
Interest	-10
Tax	0
Net Result	**50**

Thus in reality the Agent is actually having a Net Revenue target of 400 given the assumptions. The assumptions are considered very strong since it is obvious that if there is some correlation between fixed costs and revenue, but the ability to later model on revenue instead of net result allows for certain advantages for OLS analysis. Since the overall framework is to compare different incentive schemes relatively the strong assumptions are not considered a problem for comparison purposes.

It is observed that although the example is simple it can easily be adjusted to cater for additional factors without adding much complexity. If the capital structure changes for whatever reason the incentive scheme can be kept neutral simply by adjusting the target. Also if the company wishes to include other critical balance sheet items such as working capital this can be done easily either by modifying *y* for any changes in working capital calculated from a cost of capital principle as in below example for calculation of *y*:

Net Revenue	400
Variable Costs	-300
Contribution Margin	**100**
Fixed cost	-40
EBIT	**60**
Interest	-10
Tax	0
Net Result	**50**
Working Capital Primo	40
Working Capital Ultimo	50
Total change	-10
Cost of capital equivalent	-1
Adjusted Result	**49**

The standard budget is thus relatively effective in terms of including additional factors into the scheme without adding much additional complexity, and thus a metric can be designed to include all internal financial factors which are considered relevant from the point of view of the Principal. It should be noted that none of these adjustments changes the overall cash flow structure for the remuneration of the Agent which will still resemble that of an option as demonstrated earlier in the thesis.

The limited duration problem

One of the key elements of the incentive scheme is that it expires at time *Y*. This means that the Agent will not be incentivized to provide effort after this point in time unless a separate incentive scheme is introduced. This will limit the focus on the Agent and might lead to the Agent rejecting positive NPV projects with expected cash flows outside the incentive scheme.
It also leaves the Principal vulnerable to Agents delaying negative information until after their bonus has been paid which is especially visible during times of financial crisis.

The standard budget does not offer any other protection against this risk other than to either set *Y* at a later date and thus increase the interval between *X* and *Y* or implement a series of budgets with *Y* at different times. The approach of several overlapping incentive schemes was used for Bear Stearns and Lehman (Bebchuck, Cohen and Spamann, 2009). After their collapse it was found that even though the overlapping incentive structure was obviously not enough to prevent the collapse, the incentive program was still very lucrative for the managers in spite of remuneration being in the form of shares and options with medium to long exercise date.
Since the purpose of this thesis is not to establish whether long term targets are sufficiently adequate to prevent short term optimization, the standard budget will simply set the benchmark to test the other incentive schemes against. Based on the simple budget offering absolutely no protection against Agents holding back negative information or only focusing on project which deliver value within the incentive period, the standard budget will be classified as weak in terms of mitigating the limited duration problem.

The variance problem

As demonstrated earlier the cash flow structure of the standard budget in all manners resemble that of an option, and thus the value any Agent will get from the bonus structure

can be calculated the same way an option is valuated. This means that the higher the variance of the net result of the company, the higher the value of the incentive program for the Agent. This is given directly from the Black-Scholes[11] model where it is demonstrated that when the standard deviation goes up the value of the option goes up as well.
This can potentially create a problem since this will incentivize the Agent to maximize the variance either by taking on additional risk or by directly affecting the results of the company. The latter can be done quite easily since IFRS leaves several areas open to management interpretation which cannot be easily disputed by any outside auditor. IFRS builds on Accrual Accounting which dictates that any company must estimate costs for resources already spend before the invoice is received and money actually leave the bank[12]. Since the invoice has not yet been received this leaves a lot of possibility to influence the numbers positively or negatively since there is no final invoice to match the accrual against. Another similar opportunity exists within the reporting of provisions. IFRS states that a provision should be made against all future liabilities which are considered “more likely than not” to hit a company[13]. Such a definition is very difficult to control for efficiently and again empowers Management with amble opportunity to directly affect the figures. The effect of this bottom line manipulation can be seen by continuing the example from before.
The example is now expanded to include a company *A* and a company *B*. Both companies have the same bottom line target of 50 every year over a period of four years. Both companies make the same result of 50 every year but only company *A* reports it correctly. Company *B* reports an additional accrued expense of 5 in year 1which is then released the following year and continues this pattern. Since the cost never materialized this will in reality be a correction to previous years which will then be an upside taken in the year it is released. This provide the below bonus calculation for the two Agents:

[11] Theory of Asset Pricing, p. 182
[12] IAS 18
[13] IAS 37

	Company A			Company B		
Year	Target	Result	Score	Target	Result	Score
1	50	50	1	50	45	1
2	50	50	1	50	55	1.1
3	50	50	1	50	45	1
4	50	50	1	50	55	1.1
Total			**4**			**4.2**
St.Dev			**0**			**0.0577**
Difference in salary					**5% *k**	

Table 3: Variance and bonus

Without any significant risk of reprisal, the Agent in company *B* is able to obtain 5 % * *k* higher salary than the Agent in company *A*. This obviously has several undesired effects for the Principal. First of all he will be paying the Agent a bonus he does not deserve. Further to that the Agent will introduce noise into his accounts which will make it more difficult to analyze the true state of the company. Since the increased variance is generally seen negatively from a WACC perspective the value of his shares might also be indirectly hurt by this initiative from the Agent.

It is intuitive that when moving from this theoretical example to the real world, this type of bottom line manipulation will most likely be evident in loss giving years, where the Agent, once it becomes evident that the year will be loss giving, will have a strong incentive to make the year seems worse than it is and then release the upside the following year to better his chances for a bonus that year. Similar if there is any sort of cap for how big a bonus the Agent can get there will be an incentive to transfer profits to the following year once the cap has been reached.

In general the standard budget is considered very weak against such forms of Agent manipulation of the true figures and the scheme does not offer any obvious ways to mitigate such risk.

The problem of risk adverse Agents

The exact size of this problem is difficult to quantify. The assumption is that most Agents will have a risk adverse personality and thus the introduction of uncertainty into their remuneration package will have a direct cost for the Principal if the Agent is to have the same utility.

Since it has not been possible to obtain any documentation for the average risk averseness for corporate Agents, it will simply be assumed that there is a cost and all other incentive schemes will be benchmarked against the static budget to see if they mitigate or worsen the cost.

The problem of strong external factors

The purpose of any incentive program is do effectively drive the behavior of Agents, and in order to do so performance metrics must react when the Agent acts and to the extent possible remain immune to the noise of factors not directly related to the effort or ability of the Agent. The more noise included from such factors the more diluted will the effectiveness of the metric be. If the effect of external factors significantly overshadows the ability of the Agent to influence the metric, there will be no incentive for him to provide effort and it would simply be cheaper for the company to offer the Agent a fixed wage instead.

When evaluating the metric it is important to distinguish clearly between the model used to evaluate performance and the model used to calculate the size of the remuneration. Although these can be combined it is two completely separate types of analysis. The performance evaluation should be done based on benchmark theory and the remuneration model should be done based on reservation utility and the market for skilled labor. This thesis focuses on the first aspect only.

The model

In order to estimate the effect of external factors on basic accounting metrics linear regression will be used. The hypothesis is that the variance in the metric can be described through variance in a number of external market related factors as well as an unobserved which will amongst other include the effort and ability of the Agent. Thus the hypothesis can be constructed that:

$$Performance\ Metric = \beta_0 + \beta_1 * External\ Factor_1 \ldots + (\alpha_1 * Effort_1 + \epsilon)$$

The unobserved part of the regression will both contain an error term ε as well as the effort the Agent has supplied. Since the assumption is that the effort of the Agent cannot be monitored it will per definition be unobserved. Thus the better the error term can be minimized from omitted variable bias and the like the better the true influence of the Agent becomes visible directly in the form of percentage of variance unexplained in R^2.
As a representative of a performance metric net revenue has been used. Although net income might have been a closer fit to what would traditionally be used in an incentive program, it was estimated that net revenue will have a better linier relationship than net income. The reason for this is that any company will have a number of fixed costs, such as e.g. depreciation, which will not be directly affected by the market and which will create a non linear net income effect due to the leveraged effect operational fixed cost have on net income. Similarly other effects such as e.g. taxes will further distort the linearity assumption. Since the purpose of this analysis is to estimate an overall effect and that the effect of changes in net revenue can used to directly estimate the effect on net income through the simple model already presented, net revenue was seen as the optimal choice.

To test the effect of external factors a number of variables, such as e.g. the short and long term interest rates, GDP, the consumer price index (CPI), oil prices and the capital markets were used.

The model uses the income statement from a number of companies over a period of time. To cater for the fixed effect of these companies the regression will be made as a panel data regression which means the model will effectively be:

$$Net\ Revenue_{it} = \beta_0 + \beta_{it} * External\ Factor_1 \ldots + (\alpha_{it} * Effort_{it} + \varepsilon_{it})$$

Where the *i* denotes the net revenue of a specific company at time *t*. The effect of the external factors is measured as the total global effect and thus the effect will be the same for any company within the same time frame. Since revenues are expected to be very seasonal and that seasonality is not necessarily the same from company to company, yearend data is being used.

The purpose of the analysis is to determine the total effect of external factors and thus the problem of omitted variable bias (OVB) will not be mitigated further than the fixed effect already catered for by paneling the data. It is assumed that there is a large serial correlation between many of the factors, such as e.g. CPI and Oil prices, but since the purpose is not to estimate the exact effect of the specific variables this does not cause a problem for the model. A reverse OVB problem does however occur if a variable is omitted which is not strongly corrected with the model variables since the external effect will then be left out and the variance cased will be grouped together with the other unobserved factors. This problem is somewhat mitigated by the purpose of thesis which is to compare incentive programs and thus as long as the same variables are included it should still provide a solid base for comparison. The expectation is that indicators of how the global economy is developing such as GDP, Consumer Price Indexes (CPI) and oil price will be significant factors with positive coefficients.

<u>The data</u>

Global Insight (GI) has been used as the source for the external data. The data series only goes back to 2001 but then instead offers a large array of possible factors to include. The data is audited both by Global Insights own internal audit and ranked externally as one of the leading suppliers of data series[14], but that does not protect against the inherent quality concerns associated with the specific drivers. Especially factors such as GDP have for countries such as e.g. China strong political concerns associated with it as well as economical which questions how accurate a measurement of true economical growth it really is.

Compustat was chosen as supplier of income statement data using their *Compustat Global Fundamentals Data* database. The advantage of using Compustat is that they host a global

[14] Appendix C

database with more than 39,000 global companies which provide a large data sample for testing. Unfortunately the large data sample does come with many limitations which call for additional assumptions to be taken. The main problem is that not all companies report the same way which means limitation in visibility and reduction of data sample since only variables common to all companies can be used. This causes two distinct weaknesses for the model. First of all it is not possible to obtain a detailed revenue breakdown for a large number of companies. It is only EU GAAP[15] which requires notes to be supplied on the geographical split of revenue and these notes are not available in the database. This is the main reason why the model has been structured to include global external effects instead of company specific external effects.

The external data from GI did allow for geographical splits so any further development of this model should focus on obtaining notes on revenue which fits EU GAAP standards. This would greatly increase the number of observations and at the same time get a more accurate estimation since e.g. local GDP or CPI developments could be fitted directly to the local revenue development instead of running a global model. In order to mitigate these problems only companies with net revenue larger than 200 million unit currency has been included, although the model is still expected to overall underestimate the effect of external factors due to lack of ability to assign local development values. The CURRTR field which is the field that should allow for currency translation yielded empty fields which forced unit of currency to separate the large from small companies instead of the more meaningful approach of translating into the same currency.

The second concern comes from the difference in GAAP. When analyzing revenue IFRS has very strict guidelines on revenue recognition[16]. Companies reporting with a more loose interpretation might include pass through charges in their reporting to a certain extend. As long as this is done consistently throughout the different years this will mitigate the problems, but it will still overall create more variance in net revenue than is if all companies had adopted the IFRS principle.

[15] General accepted accounting principles required for companies reporting from a country within the European union

[16] IAS 18. The Agent/Principal principle is used to determine revenue and pass through

Due to the difference in size of the different companies the revenue had to be indexed in order to create a meaningful analysis. The indexation was done by the use of the GVKEY which is a unique key assigned to each company and the year of reporting. These are also the two variables used to panel the data. The table was sorted first by GVKEY and then by year which then allowed for the indexation to take place using the below two scripts:

$$if\ GVKEY\ of line_x = line_{x-1};\ then\ insert\ GVKEY;\ if\ not\ insert\ 0$$

$$if\ GVKEY\ of\ line_x \neq line_{x-1}; then\ lookup\ KVKEY\ and\ insert\ denominator\ if\ not\ insert\ 100$$

This transformation of data allowed for the creation of the new variable INREV which is the indexed revenue of any given company. The script detects the first time a company appears in the database and sets the revenue to 100. When the same company appears for the second time the script will lookup the non-indexed revenue from when the company appeared for the first time and divide the revenue from the second time with this amount. By using the indexed revenue the effect of the external factors can be estimated as the average effect of variance in the specific external variable has on the development of revenue per cent.

<u>The result</u>

A number of different regressions were conducted in order to test the different external factors to see which model would provide the best fit. Surprisingly GDP turned out not to be one of the strongest variables affecting company revenues. Whether that is due to data quality issues or if the there are certain political factors included in the measurement is uncertain. When testing the different variables, focus was on keeping the model as simple as possible and still describe the highest amount of variance in the dependent variable. Thus variables were removed in order of level of significance while still maximizing the R^2 value. It was assumed that if a variable could be removed without lowering R^2 that the serial correlation was then so strong that the effect was covered by an existing variable. The final model ended up including the capital marked, oil prices and CPI. The Summary statistics can be seen in appendix.

The variables included in the final model are:

gvkey: Company code. Used to panel data

fyear: Year of the observation (end year – period 12). Used to panel data

inrev: Indexed version of the REVT variable from Compustat. Measures operational revenue reported in the income statement.

sharein: Indexed version of the value of the entire capital market available at Compustat's database at period 12 within the given year

oil: Price of crude oil at the end of the year (a stronger measurement would have been the average but that was not available)

cpi: The global consumer price index at the end of the period

Due to the unit issue, the exclusion of variables meant that the data size was reduced to 5,733 observations within 880 panel groups.

```
Fixed-effects (within) regression               Number of obs      =      5733
Group variable: gvkey                           Number of groups   =       880

R-sq:  within  = 0.0471                         Obs per group: min =         1
       between = 0.0514                                        avg =       6.5
       overall = 0.0380                                        max =        10

                                                F(3,4850)          =     79.87
corr(u_i, Xb)  = -0.0047                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     sharein |   9.375948   5.029329     1.86   0.062    -.4838156    19.23571
         oil |  -.1114667   .1149217    -0.97   0.332    -.3367652    .1138319
         cpi |  -1.751517   .2015911    -8.69   0.000    -2.146727   -1.356307
       _cons |   187.7892   16.83854    11.15   0.000      154.778    220.8004
-------------+----------------------------------------------------------------
     sigma_u |  54.595845
     sigma_e |  59.909393
         rho |   .4536953   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(879, 4850) =     2.99             Prob > F = 0.0000
```

Table 4: Regression - Revenue vs. External (Global)

The result was not entirely according to expectation. First of all the share index and especially the oil price struggled with the significance level and these are factors which would definitely be expected to be significant economic drivers. Further the sign for oil and CPI is counter intuitive. Inflation will of course make it more expensive to produce and thus can theoretically slow sales but it is usually a sign of the markets heating up and increased spending which should then indicate higher sales. The significance level for oil price is however also so poor that it does not even matter to focus on the sign in this case. R^2 also falls somewhat short of what would have been expected from this analysis, where at least 10 % for the variance in revenue was expected to be explained from external factors.

It is expected that it is the lack of unity in revenue reporting which is causing some problems in the analysis and too many smaller companies from countries with low value currencies have filled the population and have taken the place of larger European and American companies reporting in millions of USD or Euro and have tougher revenue recognition requirements. Thus the analysis is repeated based on different data selection criteria. The second time the sample is limited to USD and Euro reporting companies where there is a higher likelihood they are reporting in million of EUR or USD. Also these two currencies are relatively close to each other in value which makes it easier to isolate the smaller companies which are not expected to be exposed to the global drivers as much as the larger international companies.

The result of focusing only on US and EUR companies actually led to a larger sample size[17]. The sample size is increased to 14,356 observations grouped into 2,295 panels. The increase in observations comes mainly from these companies already reporting in millions of currency unit in their reports which means that the de-selection process removes fewer observations.

The analysis was afterwards conducted exactly as previously and the results were overall the same which gave credibility to the overall process. It was still the same variables which were the most significant ones and which described the highest percentage of variance. This should off hand not have changed simply by changing the data sample. This means that once again GDP did not perform very well as a revenue driver and it was the same three variables which were needed to maximize the R^2 value. What did change though was the detailed result of the analysis.

[17] See Appendix for Summary Statistics

Fixed-effects (within) regression		Number of obs =	14356
Group variable: gvkey		Number of groups =	2295
R-sq: within	= 0.1219	Obs per group: min =	1
between	= 0.0066	avg =	6.3
overall	= 0.0530	max =	10
		F(3,12058) =	558.22
corr(u_i, Xb)	= -0.0500	Prob > F =	0.0000

lnrev	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sharein	22.91017	6.380925	3.59	0.000	10.40253	35.41781
oil	.2497254	.1452282	1.72	0.086	-.0349451	.534396
cpi	3.610936	.2573109	14.03	0.000	3.106565	4.115306
_cons	-263.8088	21.6174	-12.20	0.000	-306.1824	-221.4352
sigma_u	120.40157					
sigma_e	122.27981					
rho	.49226094	(fraction of variance due to u_i)				

F test that all u_i=0: F(2294, 12058) = 7.64 Prob > F = 0.0000

Table 5: Regression - Revenue vs. External (US and EUR)

The analysis became a lot stronger and in accordance with intuition with a higher amount of variance in revenue being described by the independent variables, more significant values and higher coefficients. The more significant results was a natural effect of more than doubling the data sample and the R^2 improvement and stronger coefficients are expected to be due to a higher increase of large EU and US companies being included in the sample and the elimination of companies in developing economies where the accounting standards are less in line with IFRS or US GAAP.

The prefix of oil and CPI is now also reversed to the expected, so that increases in oil and CPI will predict higher revenues instead of lower. Note that the share index was indexed to 1 instead of 100 thus for relative purposes the coefficient would be 0.23. As fully expected CPI is a very strong driver for revenue. Since the CPI per definition measure the inflation of prices and that revenue is the product of volume and price the entire second half of revenue developments should be captured in the CPI. Some of the variance relating to increased volumes is then captured in the somewhat weaker coefficients for oil price and the capital market.

How accurate the model predict is uncertain since there still might be an elements of omitted external factors which have been left out of the model due to lack of data availability. Adding additional factors without serial correlation with the ones already included will however increase R^2 without lowering the coefficients of the variables already included and thus overall increase the effect of external factors. The prediction of this model should then tend to underestimate the effect of external factors and thus the coefficients should be seen as conservative. Given the prefix of the first model does not follow the intuitive expectation the second model is considered the best predictor and will be used for comparison purposes.

The regression equation can then be summarized to predict revenue for a specific company at time t to be:

$$Revenue = -264 + 3.6\ x\ CPI + 0.25\ x\ Oil\ Price + 23\ x\ Capital\ Market\ Index$$

Using this equation in the example given previously we can get a better feeling for how much the noise from external factors will influence the performance metric if all measurements develop one standard deviation between two periods[18]. To make the calculation more simple revenue is adjusted to 100.

Period 1		**Period 2**	
Net Revenue	100	Net Revenue	157.5
Variable Costs	-75	Variable Costs	118.1
Contribution Margin	**25**	**Contribution Margin**	**39.4**
Fixed cost	-10	Fixed cost	-10.0
EBIT	**15**	**EBIT**	**29.4**
Interest	-2.5	Interest	-2.5
Tax	0	Tax	0.0
Net Result	**12.5**	**Net Result**	**26.9**

Table 6: Regression Equation - Calculation example

The contribution margin is assumed to be at a constant ratio and fixed costs are assumed to be unaffected by the variance in external markets. The capital structure remains the same and thus interests are unaffected and there is still no tax. Without having provided any additional effort in period 2 compared to period 1, the Agent is credited for having more than doubled the bottom line which would naturally be expected to have a dramatic effect

[18] The standard deviation is calculated directly based on the external data available in appendix assuming 2010 values for period 1

on his incentive program. In this case it seems highly likely that had the Agent provided any effort it might not have had any significant improvement to his remuneration – especially not if there are gaps for maximum remuneration build into his incentive program.

It should be noted that simply attempting to adjust the target accordingly by forecasting this development during target negotiation is not a sustainable solution. Unless of course the Principal is actually capable of forecasting the future in which case the Principal should probably quit his job and earn billions betting the market instead. If the Principal had forced a revenue target of 157 on the Agent and the market then did not go up the problem would endure, since if the market then did not go up the Agent would have an impossible target and would not be the least motivated to supply additional effort since there is no way he can get in the money. Having the Agent supply effort is as important in the bear markets as in the bull and the incentive program should thus not be designed to only pay out when the market is booming since it will then not be effective. The only possible way to have an effective scorecard with this model is if the development in external factors can be foreseen at negotiation and there is certainly no indication that companies are able to do that.

The weakness of the static budget target can be demonstrated by inserting directly into the formula for the *Compatibility Constraint*. It is assumed that a risk neutral Agent makes 1,500,000 DKK per year. She has a 40 hour workweek and believes her salary is fair. Thus the utility cost of providing low effort is 1,500,000. If she is to work more hours she charges a 50 % utility cost premium on the additional work hours since it conflicts with her family life. The company she works for matches the example from *table 6*. Period 1 has just ended and they forecast a 10 % growth in revenue which is used as target for period 2. The Agent is on a simple budget incentive scheme with a kicker of 100. It is assumed that 90 % of variance is external and 10 % is due to management effort[19].

[19] It was demonstrated earlier by this author that 96 % of variance in CM1 for the Company Maersk Line could be described through the development in global GDP. Thus this assumption is seek as weak. See Appendix.

The above assumptions are inserted directly into the formula for *Compatibility Constraint*[20].

$$\sum_i^n [p_i^H - p_i^L] w(x_i) \geq v(e^H) - v(e^L) \qquad (1)$$

$$3{,}067{,}500 - 2{,}675{,}000 \geq 2{,}250{,}000 - 1{,}500{,}000 \qquad (2)$$

$$392{,}500 \geq 750{,}000 \qquad (3)$$

This is clearly false and thus the *Compatibility Constraint* is not met and thus the Agent will not provide effort.

Sub-conclusion 1

Overall the standard budget target is a very weak incentive program. The lack of immunization to external factors means that the Principal might as well award the Agent lottery tickets instead. It might actually turn out that the standard budget incentive structure will be more harmful to a company than simply paying a fixed wage, because the lack of effectiveness is not the only drawback. The program also costs more if the Agent is risk adverse and potentially even worse, a poorly constructed incentive scheme allows the Agent to game the program by e.g. manipulating accounts within the grey area acceptance of modern accounting standards.

[20] See Appendix for the underlying calculations. The equation is modified from general stochastic formula to the ore simple example in step 2

3.2. Stock Options

Stock options seems to have been a visible incentive scheme since the introduction of derivatives to the financial markets, but in order for stock options to be treated any differently than a standard budget program it must first be established that they offer mathematical qualities that are different from the ones offered by the budget targets. It has already been established that the remuneration structure of the budget already resembles that of an option so there is little difference in the designs of the programs. The first thing that must be established is that the share price value is simply not a function of what is reported in the financial statements. If that is the case there would be no difference from an incentive point of view and the stock option could always be recreated through a portfolio of key account from the annual report.

The model

In order to test to what extend share prices can be written as a linear function of financial accounts panel data regression is again used. The purpose is to discover how significant key accounts are to the price of a share as well as to see how much of the variance in share prices can be described through the variance in key accounts. There is however a structural challenge when comparing financial reporting to share prices. Financial reporting is only reported quarterly and sometimes only annually and it is not always possible to ascertain when the information became known to the investors and thus it is not always possible to pin point the exact date the share price should be compared to.

The model developed by Darren Roulstone[21] to test insider trading was considered. In this model he compared the share prices just around when the insider trading was discovered to test the effect. This could be done because he had access to data tables on when the trading was discovered but since I could not obtain the same tables for when the financial reports were made public I could not use the same method as Roulstone.

Instead the problem will be mitigated by keeping a period of three months between the accounting data and the financial reporting period. The assumption is that all financial reports take time to construct and publish and the data will then by design only be made

[21] "The relation between insider-trading restrictions and executive compensation, 2001

available after the period reported. Three months are used because this will ensure that the next quarterly report has not yet been published and thus is not affecting the share price, but at this point all annual reports from period 12 should have been published. The model is then constructed according to below:

$$Price\ Price_{it+3} = \beta_0 + \beta_{it} * Key\ Account_1 \ldots + (\alpha_{it} * Effort_{it} + \varepsilon_{it})$$

The key accounts will, as demonstrated previously, be closely correlated with the external factors such as CPI etc. There is however no need to control for these factors as the purpose is to identify how much financial reporting is affecting the share price including all elements influencing the financial report. The main control is thus the fixed effect control offered by the panel data setup.

The expectation is that at least one account from the profit and loss statement and one account from the balance sheet will be significant. Investors are expected to focus on growth in the operations of a company but at the same time all focus on the balance sheet developments to ensure that revenues eventually materializes into cash. Growth in revenues and profit should have positive coefficients as should growth in assets and equity.

The data

Again the Compustat databases are used for the analysis. The database obtained for the analysis of external factors influence on net revenue is pulled but this time other key accounts such as: assets, equity, cash flow etc. is included in the search. The data is then paired with a data sample from the *Compustat NA security monthly database*. Both of these databases include tables on GVKEY and periods which can be used in lookup functions to merge the different data series. The data from *Compustat Global Fundamentals Data* is pulled for period 12 for any given year and the data from *Compustat NA security monthly database* period 3 the year after. To test the effect of this manipulation the below model was also tested where share prices are simply pulled for period 12 same year.

$$Price\ Price_{it} = \beta_0 + \beta_{it} * Key\ Account_1 \ldots + (\alpha_{it} * Effort_{it} + \varepsilon_{it})$$

The same methodology of indexing data was used as in the previous regressions in order to cater for difference in size of companies and currency rates, although the numbers of observations were greatly limited when the lookup was performed to merge the two databases. The database for share prices did not match very well the database for financial accounts and only 3,955 observations could be matched. This number increased to 5,245 when the same analysis was conducted without adding the three month due to gaining one extra year of observations.

The lower numbers of observations were both due the limited matching opportunity as well as the removal of all observations with obvious faults. This being observations with negative prices, missing key fields or accounting flaws such as equity being higher than total assets and negative or zero revenue. The numbers of observations eliminated due to the control algorithms were relatively small compared to the total population but it did cause concern about the overall quality of Compustat.

The Result

The Summary statistics of the first regression where the period was pushed three month can be seen in Appendix.

Several different combinations of accounts were tested but in the end the model yielding the highest R^2 value with the most significant results included:

inprice: The indexed value of PRCCM which is the price of a share at the close of the month. First year of observation is indexed at 100

inebit: EBIT, indexed

ineq: Total equity, indexed

The two last variables are the indexed values where the indexation has been done based the revenue of the first year of observation. Revenue that year =100.

This brought the below result:

```
Fixed-effects (within) regression               Number of obs      =      3955
Group variable: gvkey                           Number of groups   =       546

R-sq:  within  = 0.0007                         Obs per group: min =         1
       between = 0.0000                                        avg =       7.2
       overall = 0.0001                                        max =        10

                                                F(2,3407)          =      1.19
corr(u_i, Xb)  = -0.0547                        Prob > F           =    0.3050

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      inebit |   1.243882   .8724873     1.43   0.154    -.4667693    2.954533
        ineq |   .1103988   .1346131     0.82   0.412    -.1535319    .3743294
       _cons |   250.8623   73.74043     3.40   0.001     106.2823    395.4422
-------------+----------------------------------------------------------------
     sigma_u |  3213.6426
     sigma_e |  4146.2612
         rho |  .37528638   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(545, 3407) =     4.77           Prob > F = 0.0000
```

Table 7: Regression - Stock Price vs. Account (3 month delay)

Almost none of the variance in the dependent variable is explained by the independent variables and the accounts are not significant. This is not intuitive thus the regression was conducted again with prices from period 12 instead[22].

With one year of additional observations the model yielded a better result.

```
Fixed-effects (within) regression               Number of obs      =      5245
Group variable: gvkey                           Number of groups   =       722

R-sq:  within  = 0.0169                         Obs per group: min =         1
       between = 0.0003                                        avg =       7.3
       overall = 0.0033                                        max =        12

                                                F(2,4521)          =     38.92
corr(u_i, Xb)  = -0.2698                        Prob > F           =    0.0000

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      inebit |   2.020038   .2825795     7.15   0.000     1.466044    2.574032
        ineq |   .2792803   .1221074     2.29   0.022     .0398901    .5186704
       _cons |   83.33906   21.71039     3.84   0.000     40.77607     125.902
-------------+----------------------------------------------------------------
     sigma_u |  433.80771
     sigma_e |  759.38818
         rho |  .24604404   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(721, 4521) =     2.07           Prob > F = 0.0000
```

Table 8: Regression - Stock Price vs. Account (no delay)

Both variables became significant and the model describes a higher degree of variance in the dependent variable. It is very intuitive that it is a balance sheet and an income statement

[22] See Appendix for Summary Statistics

account that provides the best model. The income statement is obvious a direct indication on how the year has passed which will translate directly to equity and the share price. That equity is still significant given that much of the variance is already covered in EBIT is also intuitive since there are certain gains and losses which cannot be taken over the profit and loss statement or where management have an option to take the (usually) loss over equity directly. This could e.g. be gains and losses related to hedging and similar activities. That the coefficient for EBIT is much higher than for equity also makes sense since such activity will usually be relatively much smaller than the operating activity of a company, and investors will most likely not give it the same focus.

The analysis also confirms the validity of the simple example used so far in this thesis of small changes to the revenue having large impacts on the income statement due to the leverage connected with fixed operational expenses. This is seen when the model is conducted using net income instead of EBIT.

R-sq: within	= 0.0135	Obs per group: min =	1
between	= 0.0004	avg =	7.3
overall	= 0.0025	max =	12
		F(2,4519) =	31.01
corr(u_i, Xb)	= -0.2336	Prob > F =	0.0000

inprice	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inincome	1.615395	.2717087	5.95	0.000	1.082713	2.148077
ineq	.3873892	.1193942	3.24	0.001	.1533182	.6214602
_cons	92.76421	22.014	4.21	0.000	49.60601	135.9224
sigma_u	426.73668					
sigma_e	760.86219					
rho	.23929106	(fraction of variance due to u_i)				

F test that all u_i=0: F(722, 4519) = 2.05 Prob > F = 0.0000

Table 9: Regression - Stock Price vs. Account (Net Result example)

The result is overall the same but the coefficient is smaller due to the higher variance related to net income due to operational fixed costs. It is noted that more complex metrics like the turn time of assets and return on equity did not yield significant result, indicating that the market focuses more on the basic accounts and perhaps does not analyze all the way to future payment of dividends.

It would have been expected that the R^2 factor would have been much higher for an analysis such as this, and a low R^2 does indicate that there are several factors related to the share price than the financial accounts. For those factors to be relevant for incentive purposes it is however important to note that it must then be factors that can be influenced by management. Also it is difficult to estimate just how big an effect factors like insider trading, asymmetric or imperfect information flows and general market panic plays in the development in share prices. The effect of these might be very large and there is no way that management can influence them.

What is critical to observe is the coefficient of EBIT and the fact that it is larger than 1. This would indicate that the market might have a tendency to over reward good news and panic too much when phases with bad news and the variance in the share price will then be higher than the variance in the financial accounts. This is extremely important when considering incentive program. Since incentive programs in general resemble options it will be much more advantageous for an Agent to be on a stock option program than if he was on a traditional budget target. Within both programs he will get nothing when the market is down, but on the stock option program he will be rewarded much more in the good times than if he had received a budget target. Using the Black-Scholes formula the additional value of having stock options can be calculated. The average EBIT from 2005-2009 have been indexed to 100 in 2005 and the volatility has been used for the example. It is further assumed that the incentive is an “EBIT option” currently trading at 100 with the same exercise price and 5 % interest. At 1 years duration the value of such an option would be 5.7[23]. The same stock option for a share trading at 100 with exercise value 100 would be worth 7.25 when adjusting the volatility with the coefficient given in the regression equation. This is an increase in value to the Agent of 27 %.

Naturally the Principal can already adjust this in the incentive when making the change from budget targets to stock options, but if the Principal is unsure of the calculation method or not used to viewing a budget program as an option which has a present value to the Agent the second it is signed, and not only at maturity, he might end up remunerating the Agent above his reservation utility by switching to options.

[23] See appendix for the detailed calculations

Stock options are sometimes referred to as being “free” because if they get into the money it means the Agent must have provided enough value to pay for it. This is naturally false. The stock option has a direct cost, since alternatively it could otherwise be sold at the derivative market and the company would have invented free money. And if the same methods of calculation are not used to calculate the price of the incentive program at the time the contract is signed, the Agent might have an arbitrage gain simply my moving incentive schemes.

Given the low R^2 values and the lack of significance in the more complex accounting metrics, it is concluded that stock options are significantly different from the basic budget target.

The limited duration problem

Off hand it might appear as if the stock option does mitigate this better than the standard one year budget, after all many options are given with exercise dates between 3-5 years. It should however be noticed that it is not due to any specific design of the stock option that this is being enabled. Whether European of American stock options are used and whether the options are set to mature within on specific period or a portfolio of options are issued, covering a more complex time period does not change that it is ultimately just achieved through simple negotiation between the Principal and the Agent. Between the two parties any period can be agreed and what is and what is not the optimal period does not fall within the scope covered by this thesis. The same negotiations could be done when negotiating e.g. budgets. A budget could be made for the next fiscal year and then an additional budget could be made to cover a more long term perspective. The stock option does not offer anything to mitigate this problem which could not be achieved by other means just as easily.

The variance problem

The same problem exists with stock options as with budgets – the Agent will have a tendency to push income into future periods if he is out of the money on his option and push costs if he is in the money. This can be done exactly the same way as described for the traditional budget. As it was demonstrated any developments in EBIT will have a direct effect on the share price and thus the Agent can indirectly affect the price of shares through the financial accounts. The stock option does not offer any additional protection against this. An argument can be made that the investors might see through this and value the stock at the "true" value. The mathematical proof builds on the assumption that there is perfect visibility (Pennacchi, 2008) but it has not been possible to find any literature or analysis with empirical analysis supporting that this is the case. It is thus assumed more likely that investors in general trust the audited accounts, or at least do not expect that they can find irregularities which the charted accountants could not. This seems to be a sensible argument since the chartered accountant as more detailed training on this area and has access to supporting documentation and data which the external investor does not.

Besides the problem with accruals and provisions already demonstrated, stock options offers an additional complexity which is not present with more simple programs. A standard bonus program is considered standard salary in the eyes of IFRS and management would be obligated to accrue for it within a given fiscal year with a direct effect to EBIT that year. Thus the bonus calculation actually becomes a circular reference. As EBIT increases, so will the cost accrual needed for the Agent's bonus which will then lower the EBIT and the bonus. This provides a build in safety mechanism for the Principal because it will never be possible for the Agent to take out more value than he has delivered to the company. Actually the Agent's bonus will always be a guaranty that the Principal has also achieved his target.
With stock options IFRS however offers the Agent new possibilities to account for his bonus because stock options can be related directly to equity which is a balance sheet account. According to both IFRS[24] and US GAAP expensing the cost of the option can be postponed until the option is actually exercised. The accounting treatment of options is directly discussed by Salva Alves (The controversy of accounting for stock option: A literature review) during which it is concluded that even though it is now widely recognized that a stock option is an expense, it is after all simply salary, the accounting

[24] IFRS 2. The price of an option can be taken over equity if the price of the underlying asset is related to marked related conditions

treatment differs greatly. In her article she specifically points out that netting the price of the option directly against equity can lead to wrong pricing by the stock market since their focus is mainly on the income statement and not on the balance sheet. This point of view was further substantiated in this thesis where it was concluded that although equity also had a significant effect on the share price, the effect to the share price would be 14 %[25] of the effect if it was expensed directly in EBIT.

Besides the accounting complexity pointed out by Salva and others, it also means that the "safety mechanism" ensuring that Agents never get paid more than the value they deliver is removed. The value an Agent delivered for any given year is measured in the profit and loss statement for that given year and it is now possible for an Agent to receive options exceeding that value netted out against equity. This is one of the main reasons why horror stories of Agents running companies to the ground and still cashing in on huge bonuses is even possible. An Agent could technically remove a year of income simply by exercising his options. This would then trigger an immediate market response and the value of the market value of the company would plummet.

The problem of risk adverse Agents

The stock option does not mitigate this problem compared to budget targets. The additional cost comes from uncertainty relating to the future remuneration cash flows. Whether they come from budget uncertainty or from the uncertainty related to capital markets are irrelevant. It does not make any sense to make comparison on which scheme have the highest costs since this would be completely arbitrary depending on how big a share of the Agents remuneration is made uncertain.

The problem of strong external factors

Regression is once again used to estimate the effect of external factors – this time in respect to share prices. The overall model remains the same as the one used to evaluate net revenue only now used on share prices, meaning that the hypothesis is:

[25] Calculated from table 8 based on the coefficients for EBIT and Equity

$$Share\ Price_{it} = \beta_0 + \beta_{it} * External\ Factor_1 \ldots + (\alpha_{it} * Effort_{it} + \varepsilon_{it})$$

The purpose of this analysis is to obtain information that will support whether stock options are more immune to the effects of external noise than financial accounts and thus making them more effective as performance metrics. By keeping the model similar for the two programs this should allow for a like for like comparison. The overall expectation is that stock options are not better than financial accounts in terms of keeping external noise out of performance evaluations. Although it might be possible that investors do think long term and are not easily influenced by shocks in key figures there is nothing in the day to day news updates that suggests this – on the contrary. The stock markets seem very prone to panic and excess adjustments when presented with new information which would make them more volatile and thus less effective for performance purposes. It was also seen in the previous exercise that the coefficient for EBIT on share price is 2, which would suggest that stock options should twice as hard influenced by external noise.

On the other hand if stock options are more immune to external effects it would be a strong quality since this would indicate the investors compare businesses against each other and thus the variance in prices would be an indicator of whether the market believes a particular stock is beating the competitors, which would then be a very strong metric when evaluating Agents' performance. It is expected that the share price will react the same as revenue to variance in external variables.

The data

The external data is completely the same data from GI as used in the first regression exercise. In order to get data on stock prices the *Compustat NA security monthly database is* also used again. This time the database seems better suited for the purpose since it no longer needs to be merged with additional tables.

The share price is once again indexed at per previous methodology and the number of shares is included in the table so that the total value of the company can be calculated. This is done to again exclude smaller companies which are considered less receptive to changes in global trends and more to changes in local trends. A threshold of 500 million dollar market price is chosen and the period is limited to 2001-2010 to make it fit the external data. The result is 30,630 observations grouped in 5,585 groups. Again since the purpose is to estimate the total effect of external factors there is no need to control for additional variables and the control is limited to fixed effects as per the panel data setup. The GVKEY and CYEAR are again used for the panel.

The result

The methodology used is again to maximize the R^2 level with the most significant regressors. It is expected that the exercise should give overall the same results as the exercise for net revenue although with different coefficients. Meaning it should be roughly the same type of factors describing the variance and they should be ranked roughly the same in terms of importance.

The results of the regression are as expected. Unlike with the calculation done for net revenue a model cannot be made where several variables are significant at the same time. It is expected that the serial correlation is too high for when analyzing share prices because investors react to a preferred metric. When tested individually significant results can be achieved and the pattern is the same. The CPI is again the strongest and most significant factor describing the most of the variance in the regressant and being the most significant. This intuitively makes sense since it would be expected that the investors would focus on the variable with the highest influence on the income of companies.

```
Fixed-effects (within) regression               Number of obs      =     30630
Group variable: gvkey                           Number of groups   =      5585

R-sq:  within  = 0.0002                         Obs per group: min =         1
       between = 0.0016                                        avg =       5.5
       overall = 0.0004                                        max =        10

                                                F(1,25044)         =      4.29
corr(u_i, Xb)  = 0.0146                         Prob > F           =    0.0382

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         cpi |   12.10443   5.841084     2.07   0.038     .6555586    23.55329
       _cons |  -616.9265   603.5528    -1.02   0.307    -1799.925    566.0724
-------------+----------------------------------------------------------------
     sigma_u |  16306.907
     sigma_e |   7650.534
         rho |  .81959806   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5584, 25044) =    11.27         Prob > F = 0.0000
```

Table 10: Regression - Stock Price vs. External (CPI)

Interestingly enough it is possible to obtain a significant result using GDP as regressant as well, yielding almost as strong a model as for the CPI. This could indicate that although GDP, on a global scale, is not a significant driver for company income, the stock market still values it and price shares according to its development.

```
Fixed-effects (within) regression               Number of obs      =     30630
Group variable: gvkey                           Number of groups   =      5585

R-sq:  within  = 0.0002                         Obs per group: min =         1
       between = 0.0016                                        avg =       5.5
       overall = 0.0004                                        max =        10

                                                F(1,25044)         =      4.15
corr(u_i, Xb)  = 0.0154                         Prob > F           =    0.0416

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         gdp |   5.957083   2.923929     2.04   0.042     .2260093    11.68816
       _cons |   2.766451     311.21     0.01   0.993    -607.2235    612.7564
-------------+----------------------------------------------------------------
     sigma_u |  16306.927
     sigma_e |  7650.5559
         rho |  .81959757   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5584, 25044) =    11.27         Prob > F = 0.0000
```

Table 11: Regression - Stock Price vs. External (GDP)

It is a concern that the R^2 value is so low for this regression and that it is so different from the results from the revenue analysis. It is expected that it is primarily the problem identifying exactly when the financial markets are aware of new information which causes the low R^2 value. Had it been possible to identify exactly when the market was informed of the development in the different variables the price could be obtained at that time which should lead to a better estimation of the effect of that variable.

For further analysis the CPI model is used due to it being the more significant variable. Using then the same method as for net revenue the influence of external noise can be estimated by setting up an example where the CPI moves one standard deviation. The model for stock options is even simpler than for net revenue since cash payment follows directly the development in the price of a share without complexities such as company tax, operational fixed costs and the ratio of the contribution margin. The stock is assumed to be trading at price 100 at the end of period 1 and the CPI then develops one standard deviation. The stock option can be exercised at the end of period 2 at 100.

Period 1		**Period 2**	
Price	100	Price	228.9
Exercise value	100	Exercise value	100.0
Gain	0		128.9

Without having supplied any additional effort the value of the company's stock has more than doubled over the course of one year if the CPI goes up with one standard deviation. Based on the previous analysis this was also exactly what was expected to happen and is thus further confirmed by the regression. An Agent working on any incentive program resembling an option by nature will on average be much better off with stock options than with metrics based from financial reporting[26]. Obviously that is only the case because of the nature of the option. Had the program resembled a future, like e.g. employee shares, then the matter would have been different. In fact then the program might actually not be preferred because of risk averseness and the fact that the program would then threaten the fixed income.

Sub conclusion 2

There is no indication that stock options are more effective performance drivers than more traditional incentive schemes. On the contrary a number of weaknesses have been discovered which would not exist in e.g. traditional budgets. The most critical ones being the fact that stock options clouds the true performance of the Agent even more than a basic net result target. This would mean there is very little incentive for the Agent to provide effort since the external market factors are likely going to overshadow the effect of the effort provided anyway. Secondly the stock options open up an even bigger accounting complexity than before. It allows the Agent to "hide" the cost of his salary, at least until it is exercised, and open up for completely irrational scenarios where the Agents of a company can be rewarded higher bonuses for any given year than the total income of the company. This last scenario is made possible by the fact that the share market tends to react stronger on both good and bad news, and can thus bring the price of a share higher than accounted value.

[26] Assuming again the Principal does not know how to price the "Budget Option"

There are arguments for stock options being stronger incentive programs which have not been covered here - mainly because most of them remain speculation without any documented effect. The main argument seems to be that if an Agent is purely given financial targets he will sub-optimize on those and not deliver what is best for the Principal. These arguments will not be given further consideration in this thesis. First of all accounting standards have evolved considerably since the boom of stock option and secondly, although accounting sometimes fail the investors and it turns out that the true state of a company was not reported correctly, there are few examples of the stock market finding this out ahead of time and correcting the share price in advance of the news breaking. If indeed an external party exist who can value performance better than the internal board, then that person should simply be recruited to join the board.

Overall stock options are found to be a weaker alternative to the standard budget target.

3.3. Dynamic Targets

Dynamic targets basically covers all exiting incentive schemes where instead of negotiating a standard target at the beginning of the game a function is negotiated instead. The target stops being a constant factor to measure performance against and instead becomes a variable component which will develop according to parameters put into the contract. This method is already known within stock option where the exercise value gets adjusted based on an index of other shares and it is starting to move into traditional budget theory as well under more catchy slogans like "Beyond Budgeting" (Nielsen, 2010) and the like. The attack on traditional budgeting has been ongoing for some time and was launched by articles such as "Who needs budgets" (Hope and Fraser, 2003) where the traditional budget process comes under heavy scrutiny. The main conclusion from this article as well as the many consultants offering services on how to move the budget process "to the next level", is that time has simply outpaced the budget process. In the beginning of the 20^{th} century when there was no internet the one year reaction time from management might have worked, but with the speed information flows today the budget process is inadequate to keep up. The budget is described as being obsolete the moment it is setup and thus the value is diminished. Especially the lack of ability to forecast the global economic future with any accurate methodology is brought up as one of the root cause problems for why budgets cannot work. This is critical since the earlier research of this paper shows that if external factors cannot be forecasted incentive schemes such as budgets and stock options a like becomes ineffective. This not only makes budgets unsuitable for establishing targets it also makes them inappropriate to allocate resources. If resources are allocated based on assumptions that turns out not to be true, then performance of a company will be suboptimal.

The critics and consultants focuses on a series of new solutions to solve all these problems within a new budget methodology. It will however not be within the scope of this thesis to analyze "Beyond budgeting" specifically as an incentive program. The methodology focuses on solving a host of different problems within resource allocation, target setting and corporate governance. Further it has not been possible to obtain detailed solution models for how exactly the problems are to be solved. Most of the material available focuses on the more high level considerations and does not offer any concrete formula of empirical evidence. In a master thesis from 2010, Jette Nielsen concludes that beyond budgeting cannot be seen as a superior model compared to the traditional budget since although the new model solves problems which are not addressed within the traditional budget, it at the same times fail to address other purposes of a budget such as e.g. control and corporate governance.

Although much of methodology of this chapter builds on ideas on how to revitalize the budget process the definition of dynamic target setting will still simply be any incentive scheme where the standard constant is replaced by a variable target. Thus all aspects relating to resource allocation or cost control will be disregarded and instead the methodology will be open to any type of incentive program that involves targets and thus will also cover amongst other stock options and balanced scorecards. To illustrate how the dynamic target setting works consider the below example:

A global company is operating within a business segment where the total market is estimated to be 500 USD revenue. The revenue of the company after period 1is 100 and it is at this point the Agent is negotiating with the Principal the targets for period 2. After several hours of negotiation they finally agree that they expect the market to grow 5 percent the next year. They all agree that the company should increase market share with 1 percentage points from 20 % to 21 %. As per the previous examples it is assumed that fixed costs cannot be influenced and there are no taxes and a fixed ratio of contribution margin. Once nature plays it turns out to be a record year for the business with a total market growth of 20 %. The Agent however, being completely unmotivated due to his lack of ability to affect his performance program, actually manages to lose 1 % market share instead.
In a static target negotiation the outcome of the negotiations and future remuneration would then look as per the below:

Period 1 - Actual		**Period 2 - Budget**		**Period 2 - Actual**	
Net Revenue	100	Net Revenue (500*1.05*0.22)	110	Net Revenue (500*1.2*0.18)	114
Variable Costs	-75	Variable Costs	-82.5	Variable Costs	-85.5
Contribution Margin	**25**	**Contribution Margin**	**27.5**	**Contribution Margin**	**28.5**
Fixed cost	-10	Fixed cost	-10	Fixed cost	-10
EBIT	**15**	**EBIT**	**17.5**	**EBIT**	**18.5**
Interest	-10	Interest	-10	Interest	-10
Tax	0	Tax	0	Tax	0
Net Result	**5**	**Net Result**	**7.5**	**Net Result**	**8.5**

Table 12: Static Budget Performance

The Agent would be performing above budget even though he is off by 2 percentage points market share compared to budget. Had the Agent and the Principal instead setup a dynamic target setting process instead of a fixed target of 110, they would have ended up with a formula which would have read: Total Current Market * (1+X) * (0,1+Y) where X denotes total market development and Y denotes future expected development in market share. At the end of period 1, when the target is negotiated, the target will look like the budget in the above example because they only have expected values for the market development. But at the end of period 2 there will be actual values available on market development and the true adjusted budget can be calculated as per below:

Period 1 - Actual		**Period 2 - Adjusted Budget**		**Period 2 - Actual**	
Net Revenue	100	Net Revenue (500*1.2*0.21)	126	Net Revenue (500*1.2*0.18)	114
Variable Costs	-75	Variable Costs	-94.5	Variable Costs	-85.5
Contribution Margin	**25**	**Contribution Margin**	**31.5**	**Contribution Margin**	**28.5**
Fixed cost	-10	Fixed cost	-10	Fixed cost	-10
EBIT	**15**	**EBIT**	**21.5**	**EBIT**	**18.5**
Interest	-10	Interest	-10	Interest	-10
Tax	0	Tax	0	Tax	0
Net Result	**5**	**Net Result**	**11.5**	**Net Result**	**8.5**

Table 13: Dynamic Budget Performance

When actual are then compared to the adjusted budget the true performance of the Agent will be revealed and it will be completely visible that he has significantly underperformed against what was expected.

Besides arriving at different values for the period 2 target there is a fundamental difference that should be noted in terms of the negotiation process. For the dynamic model both parties are completely indifferent on what assumptions are made for the total market. The

Principal could agree to an assumption that the market will probably go into a -5 % recession and still not need to fear that the Agent will be remunerated more than his performance entitles him to. This difference is very important. In the traditional budget model the Agent and the Principal is not working together, they are adversaries. This is directly visible in the formula for the Agent/Principal problem presented in the beginning of the thesis:

$$\max_{\{w(X_i)\}i=1,\dots,n} \sum_{i=1}^{n} p_i^H [\boldsymbol{x_i} - \boldsymbol{w}(\boldsymbol{x_i})]$$

$$s.t. \sum_i^n p_i^H w(x_i) - v(e^H) \geq U$$

$$\sum_i^n [p_i^H - p_i^L] w(x_i) \geq v(e^H) - v(e^L)$$

The whole purpose in this game for the Principal is to pay as little for the Agent providing effort as possible and in the optimal example he should never pay more than the reservation utility. On the other hand the purpose of the Agent is to get paid as much as possible while at the same time doing as little as possible. They are not remotely working toward the same goal. It should be further noted that shifting to stock options does not change this. Then the Agent and the Principal would then be in a completely similar game, only now they would be negotiating number of options and exercise price, i.e. the value of the option, and not a currency target.

The very design of the static target setting process pitches the Agent and the Principal against each other and it is obvious that the negative consequences is not limited to payment of bonus. If the Agent walks into every single negotiation sand backing the targets, then other aspects of the planning process will suffer. The capacity and future investments might not be planned based on the best estimate available which will further destroy share holder value. Even for an irrational Agent actually proposing his true future estimate, this might not be accepted by the Principal since the Principal would expect the Agent to come in low and thus challenge his first estimate no matter what it is.

With the dynamic target setting process the Agent has no incentive not to give his best offer at the time and thus the benefit of the Principal is twofold. If, in the above example, it was possible to construct a formula for increase in market share there would be no need to negotiate anything. This could e.g. be a formula that predicts high increases for market share if current market share is low and then diminishes as market share increases until a point where the Agent is simply expected only to maintain his current share. At this point the entire target negotiation can be discontinued. They would naturally still need a planning process to plan investments and recruitment, but there would not be any need to discuss targets, and the Agent and the Principal would work together towards optimizing shareholder value providing their true expectations.

The limited duration problem

The dynamic target setting model does not solve the problem of limited duration. Since the incentive model per design is an amendment so the target setting process of an already existing incentive scheme, nothing additional is offered in terms of estimating the optimal duration of the program.

The variance problem

The variance problem is not solved by the dynamic model since the overall structure of the incentive program will still resemble that of an option, meaning that once the program is sufficiently out of the money the Agent will stop caring about creating value within the given period and try and push as much as possible to future periods. Likewise if any cap is set for how much money the Agent can get paid this can cause the same effect. To get an understanding how dynamic targets will affect the variance problem a Monte Carlo experiment is conducted on a fictive European call option. The underlying asset is trading at 100 at period 0 and the drift is estimated to be 8 %. The standard deviation is 20 % where 15 percent is expected to be due to external factors and five percent is expected to be due to management efforts compared to competition. The manager is capped so that his value from the option cannot exceed 130. Although stock options are not usually capped in any way the example is still meaningful since budget programs and balanced scorecards often are. Since these programs also resemble options the conclusions of the experiment are still meaningful.

For the dynamic program the same assumptions are used but with the following exceptions. The drift of 8 % is reduced to zero since the program is adjusting for the developments in the global market. Instead of a 20 % standard deviation 5 % is used since again the program will adjust for all developments in the global market. A failure of the scorecard will be defined as every time the share price reaches a value below 0 or above 130. In these two scenarios the Agent will either stop supplying effort or start manipulating the accounts.

5,000 simulations are conducted for both programs[27].

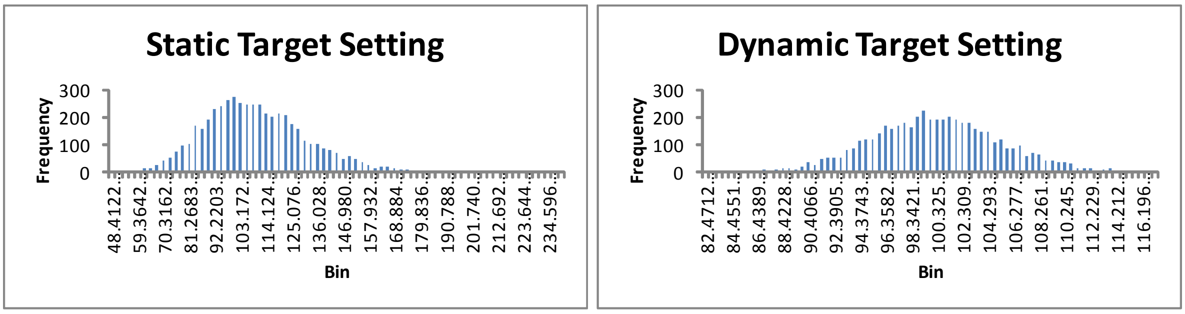


Table 14: MC Simul. - Dynamic Targets

The result of the simulation has been illustrated in the above two histograms. In the first simulation the incentive program fails 2,712 times and in the second simulation the program fails 2,521 times. So the dynamic is slightly better than the static model in this experiment. The reason why the dynamic model is not more successful is that although the 130 gap is not exceeded due to the lower variance, the model more often runs below 100 due to the drift of the market in general not being included.

It should be noted that if the incentive structure did not reflect an option. If there e.g. was some sort of consequence by hitting very low performances in the form of firing or loss of face, then the effectiveness of the dynamic model increases dramatically. If this type of consequence created a lower gap of 80 instead of 100 that would actually mean that the dynamic model would never fail and the static model would still be failing in 1,185 scenarios.

[27] See Appendix for how the model was constructed in Excel

The problem of risk adverse Agents

The dynamic model does nothing to address the problem that Agents will prefer a fixed salary over an uncertain one. It will however, as just demonstrated, reduce the overall variance of the bonus which might mitigate the problem to some extent. It is however not possible to make direct calculation of the effect since these tests only focus on the effectiveness and efficiency of the driver and not the actual remuneration itself, which will be set by the market. If dynamic target setting was used as in the above example this would mean that the option would not get in the money so often. However the reservation utility of the Agent remains the same which mean that the Principal would need to compensate for this by rewarding the Agent more options than if a static model had been used.

The problem of strong external factors

Obviously the dynamic model greatly lowers the noise of external factors and thus increases the effectiveness of the incentive program. The exact amount of external noise which can be filtered will depend on the amount of external data available to the company, which must come from a supplier which can be trusted by both the Agent and the Principal. Neither party should accept the other party calculating the effect since this would create an arm's length conflict. The party might not be capable of performing the task objectively since there is a conflict of interests. Further to that the data needs to be of a form that allows it to be referenced directly in a contract since some countries requires all bonus contracts to be legal documents fulfilling certain criteria.

When calculating the external effect for any specific company the opportunities for getting stronger regressions should, all else being equal, increase. An individual company will often have access to industry specific data which will allow for very accurate estimation of the external effect and thus perhaps completely eliminate the need for regression analysis. If a company could e.g. obtain data on both development in price and volume from an external source they would have the exact figure and thus no need to estimate it through OLS.

The same example as with the static budget is continued but is now modified to fit dynamic targets.

$$\sum_i^n [p_i^H - p_i^L] w(x_i) \geq v(e^H) - v(e^L) \qquad (1)$$

$$1{,}892{,}500 - 1{,}500{,}000 \geq 2{,}250{,}000 - 1{,}500{,}000 \qquad (2)$$

$$392{,}500 \geq 750{,}000 \qquad (3)$$

Without increasing the kicker the Agent still will not apply effort. The company will however need to increase the kicker to satisfy the *Participation Constraint* if it is assumed that the company was paying reservation utility before moving to dynamic targets. This will mean a downside to the company which will however be mitigated and possibly exceeded with the upside of only paying bonus to the agents that actually beats the market as well as the upside from having Agents who supply high effort. In the above example the *Compatibility Constraint* is met with a kicker of 191.

Sub conclusion 3

The dynamic target setting method allows for strong mitigation of the problems experienced with static budgets and stock options, and the model is always superior to the these versions. It greatly enhances the ability to block out noise from external factors and if the incentive scheme can be converted into a structure resembling more a future than an option the model can completely eliminate the incentive an Agent might have to manipulate financial accounts.
Overall it was found that dynamic targets are stronger incentive drivers than static targets.

3.4. WACC based performance metrics

WACC based performance metrics will be defined as all metrics which are a hybrid of corporate accounting and WACC. These metrics are usually created in an attempt to translate accounting language into a format which is compatible with corporate finance theory. If a simple accounting measurement is used it will often be so flawed that it becomes unsuited for use in the theoretical model. An example of such could be return on equity:

$$ROE = \frac{Net\ Result}{Equity}$$

This metric offhand seems like a meaningful way to analyze an investment made in a particular share. The problem is that the numerator is simply the end calculation of the profit and loss statement without taking into consideration the balance sheet. This means that two companies could have exactly the same ROE although clearly not having performed equally well. One company might have chosen to expense cost associated with development of a new IT system while another company capitalized the cost instead. One company might not have issued any credit and have already received the entire turnover in cash while the other has them outstanding on the balance sheet with long credit terms. Clearly the movements on the balance sheet somehow need to be incorporated into the equation so that the result can be analyzed in some meaningful way.

WACC based performance metrics attempts just that. The accounts are put into formula and the output is measured directly against the estimated WACC of the company. This will allow the investors to immediately decide whether management have destroyed or created value to the shareholders within any given period. Two of the most famous methods of doing this are EVA® and CFROI®[28]. Both are trademarked calculation methods and it can be difficult to distinguish between the two methods without detailed analysis. In the book "Value-Based Metrics: Foundations and Practice" (Fabozzi and Grant, 2000) a detailed overview is provided of the differences between the two metrics[29]. Much of the difference

[28] EVA is owned by Stern Steward and CO. CFROI is owned by Holt Value Associates. The terms cannot be used in communication with investors without the owner's consent

[29] Pages 157-178

comes from how much complexity will be allowed into the model, in terms of whether the model should take into consideration the future replacement of assets. The focus for this chapter will be before the two metrics starts to significantly deviate and thus for this purpose the EVA model will be used as base for the analysis. No conclusions will be formed in terms of whether enough visibility and quality can be obtained in the accounts to actually succefully implement the models. It will simply be assumed that is the case. The focus of this chapter is the target setting aspect – not the accounting complexity.

The simple model for EVA can be setup as[30]:

$$EVA = (r - c) * K = NOPAT - c * K$$
$$where$$
$$r = \frac{NOPAT}{K} = ROIC^{31}$$

NOPAT is the Net Operating Profit After Tax, *K* is the economic capital employed and *c* is the WACC. NOPAT is used because the cost of debt financing is already included in WACC and thus should not be included twice since *r* must be directly comparable to *c*.

CFROI comes very close to ROIC in method of calculation and the biggest difference of the two metrics is that CFROI is and IRR[32] metric and EVA is a valuation. CFROI in itself does not provide any indication of whether a company has performed good or bad, but it is basically the *r* calculation of EVA. EVA moves one step further and directly includes the target setting in the formula, where if CFROI was to be used the CFROI value would then need to be subtracted a WACC and multiplied on the invested capital in order to be used as a performance metric. Which order this is done in is irrelevant for this analysis. The key element is that a WACC will be needed in order for the metric to work. This means that for performance purposes we are not any further that with any of the other models. Since WACC is not something which can be obtained from audited accounts this must become a

[30] This is the simple EVA calculation directly from Wiki (http://en.wikipedia.org/wiki/Economic_value_added) and thus not the more complex company valuation model

[31] Return On Invested Capital

[32] Internal Rate of Return

negotiation. If they agree on a fixed WACC for the entire period they are no further than in the case of the simple budget or stock option. Since the parties still cannot forecast the future, the movement in the external factors will be so large that the Agent's efforts will be overshadowed. Thus a dynamic WACC model must be constructed. The problem with constructing a dynamic WACC model is that the complexity is increased several times. In the dynamic budget model OLS could be used to relatively accurately estimate the factors, or it might even be possible to obtain industry specific data which could create a very high level of trust in the adjusted budget. This cannot be done for the WACC. In this case the Agent and the Principal would either need to agree on a model to calculate the future WACC or obtain the WACC from a third party. The third party option is not really considered a solution since it would simply transfer the complexity and not solve it. A third party would still need to explain how he arrived at his result.

In order to understand why WACC is so much more complex than other targets each element of the model is analyzed. If a solution could be made for each element then a dynamic WACC could be constructed and the performance metric could work. At first sight the formula for WACC is very simple (PCF, 2008):

$$WACC = \frac{E}{V} r^E + \frac{D}{V} r^D (1 - T)$$

As long as r^E, r^D and T can be determined accurately by the end of period, metrics such as CFROI and EVA can be used to effectively counter many of the moral hazard problems presented so far. The issue is however that since there is no single solution to how this should be calculated the problem on settling on a WACC estimate by the end of the period becomes complex, since the WACC cannot simply be agreed at the beginning of the period due to the future being unknown.

Each of the three elements, r^E, r^D and T will be briefly analyzed in this thesis. The purpose is not to solve the problem but to illustrate the additional complexity involved with the practical implementation of WACC based performance metrics.

Return on Equity

calculating an “adjusted return on equity” at the end of a period mirrors the problem already discussed earlier of addressing how reality turned out compared to budget assumptions and adjusting a budget target accordingly. This means that analyzing how certain external variables developed can help solve the problem, in this case most often the average return on shares from companies with similar risk profiles. When analyzing return on equity the complexity is however increased compared to only analyzing a specific account, like e.g. net revenue. The complexity comes from having to take into consideration leverage, since the Modigliani-Miller (PCF, 2008) propositions established that the value of any company cannot be increased by changing financing except for the tax shield effect. Thus if the amount of debt financing is increased the return on equity must increase due to additional risk taken on by the shareholders.

There are a number of different economical methods which could be used to estimate how much the equity would need to increase or decrease if the capital structure changes, but the real problem is not in this case to come up with a theoretical model on how this could be done. The problem is to come up with a model which could be included directly in a contract between a CEO as Agent and the board as Principal, and which is accepted by both parties. The dynamic target setting model already increased complexity from the static stock option and budget target setting approaches. With the introduction of a WACC element this complexity would be increased even further. As pointed out already, trying to mitigate the problem by simplification will not help. Thus if e.g. a similar linier formula is agreed upon which is not aligned with reality this will create an arbitrage opportunity for the Agent to “game” the performance metric. Using more advanced and complex metrics only adds additional value if the discipline is then also carried out in real life.

Return on debt

Debt is easier to estimate since the figures can be obtained directly in the financial report. The complexity related to debt comes from the cost of debt already being included in the WACC calculation. Excluding interest is naturally not difficult by itself but it creates a dangerous reporting problem since effectively all cost which can be transferred into interests becomes “free” for the Agent. In the below example a company pays warehousing related to production as an operational lease taking it as an operational cost. After moving to EVA the Agent changes the contract into a financial lease instead. He only changes the contractual setup so the total cost is the same but he now instead reports it as depreciation and interest[33].

Before EVA

Profit and Loss		Balance Sheet		
Net Revenue	250	**Assets**	**200**	Balance Sheet
Variable Costs	-200			
Contribution Margin	**50**	Equity	100	Balance Sheet
Warehousing	-40	Debt	100	Balance Sheet
Other Fixed costs	-10	**Total Liability**	**200**	Balance Sheet
EBITDA	**0**			
Amortization	0	ROE	20%	Peer Group
EBIT	**0**	ROD	5%	Interest Rate
Interest	-5	**WACC**	**13%**	0.5*ROE+0.5*ROD
Tax	0			
Net Result	**-5**	**ROIC**	**0%**	NOPAT/Equity
NOPAT (Net Result - Interest)	**0**	**EP**	**-13**	(ROIC-WACC)*Equity

After EVA

Profit and Loss		Balance Sheet		
Net Revenue	250	**Assets**	**200**	
Variable Costs	-200			
Contribution Margin	**50**	Equity	100	
Warehousing	0	Debt	100	
Other Fixed costs	-10	**Total Liability**	**200**	
EBITDA	**40**			
Amortization	-20	ROE	23%	"Before" adjusted for additional gearing
EBIT	**20**	ROD	5%	Interest Rate
Interest	-25	**WACC**	**13.0%**	0.45*ROE+0.55*ROD
Tax	0			
Net Result	**-5**	**ROIC**	**20.0%**	NOPAT/Equity
NOPAT (Net Result - Interest)	**20**	**EP**	**6.99**	(ROIC-WACC)*Equity

Table 15: EP calculation

In the “Profit and Loss” column the Agent can move cost groups by changing the contractual setup as long as NOPAT and Net Result remains the same. The balance sheet is affected by his decision depending on whether he takes a financial lease, and the

[33] IAS 17. The warehouse will be reported on the balance sheet and then the cost will be reported as the depreciation of that asset plus the interest. In the above example a 50/50 split has been assumed between the two expense types

warehouse is reported as an asset, or whether he takes an operational lease. The numbers in blue represents the peer group analysis the Principal has retrieved in order to establish the WACC. Since there is no tax no additional value can be obtained by re-arranging the capital structure and thus ROE must adjust to keep WACC at 13 % when an additional asset is taken.

Without changing anything the Agent has created immediate value on this performance metric even though the shareholders have not become richer. The same effect could naturally be accomplished by changing a vast array of other contractual obligations. It should be noted that a new r^D cannot simply be calculated by dividing the new interest with the total debt obligation.

The tax shield

Much the same type of problem exists when tax is analyzed. Since the tax shield is already included in the WACC calculation the company cannot benefit from it twice in NOPAT. Thus it will need to be added back. As easy as this might be in a theoretical corporate finance problem, as equally complex is it in real accounting. The problem comes from not all tax being reported benefits from a tax shield. There will be income taxes which will, and then there will be a large amount of other taxes such as: withholding tax on dividends, other withholding taxes, tax fines and corrections to previous years, which will not. This is because the tax will be paid whether the company is profitable or not and is completely separated from EBT. Since the problem is much the same another calculation example will not be made because it will follow the same line of thought.

Sub Conclusion 4

It has been demonstrated that switching to WACC based performance metrics does not directly solve the real problems presented in this thesis. The dynamic target setting model was superior to the static stock option and budget models because it addressed an element which is not covered in these models – the role of nature. It did so however with a price and that price was increased complexity. Where the Agent before had a simple number to measure his performance against he would now need to use a function as well as external data sources. The WACC based models simply takes this complexity further by not only including an element of micro econometrics but also corporate finance. Whether or not it will be more optimal for a company to apply this model will depend on a lot of factors such as: level of corporate finance understandings of the Agents, level of visibility in the financial accounts, level of corporate governance and level of data quality. For a company being able to meet these additional strict requirements, the WACC based metrics will be superior since they address problems none of the other models come close to addressing such as e.g. alternative investments. As it was demonstrated these requirements are not minor though. The level of visibility far exceeds that of what is included in standard reporting and thus what is audited by external auditors and it is thus assumed that very few companies would be able to meet these criteria.

3.5. Balanced Scorecard

The balanced scorecard will for the purpose of this thesis simply defined as any incentive program which contains non-financial elements, KPI, indicative of future year's profits. This is not completely in line with certain text book definitions where the KPI can also be included as an indication on whether a company is really performing better or whether it is simply being carried by the market. The latter part will in this thesis not constitute a separate incentive program since it has already been shown in the previous chapters that there are other efficient methods of mitigating the effect external noise to see the Agent's true performance. The effectiveness of the balanced scorecard then depends solely on the ability to locate variables which are truly indicative of future profits and thus effective metrics in terms of preventing short term optimization. Sake completion it should be said that even if a balanced scorecard is not able to document that a KPI is an indication of future profits the scorecard in itself might still add value in terms of providing visibility on *why* a company is performing as it is. The balanced scorecard then becomes a dashboard and the KPI are often simply denoted PI (performance indicators). This however makes the scorecard completely uninteresting for the purpose of this thesis since the focus is here directly on performance drivers and then all the KPIs are then already included in the financial performance for the year. If the scorecard is in reality a dashboard it should not be included in an Agent's bonus contract.

It should be noted that the original material from Kaplan-Norton resembles more a dashboard than a scorecard. The implications of this will be revisited later in this thesis.

In order to analyze the scorecard a sample scorecard is first created. The sample scorecard will be build based on the example from the introduction and will thus include three other dimensions besides financial performance namely:

1. Customers
2. Processes
3. Employees

To make the scorecard as simple as possible one single KPI will be included for each additional dimension.

For the customer dimension the KPI will be the global average result of a customer satisfaction survey. These types of surveys can be conducted in many different ways, but for this example the so-called Net Promoter Score[34] (NPS) will be used meaning that the KPI score will be an integer between -100 and 100.

As a KPI for processes service delivery will be used. It will be assumed that the company has a defined measurement for their service and the KPI will measure how often their product fulfills these criteria. This could e.g. be how often a shipment of goods is delivered on time in percent. The KPI score will then be an integer between 0-100.

As a KPI for the development and retention of employees an employee engagement survey (EES) will be used. The employees will once a year rank the company of a series of criteria on a scale from 1-5, 1 being very bad and 5 being outstanding, and an average will then be calculated. The KPI score will then be a number form 1-5.

It will be defined that hitting target will always equal getting score of 100 and any score different from target will then yield a higher or lower score dependent on the kicker for the particular scoring formula. To simplify the example it is assumed target is status quo at the end of the year and thus y equals x at the beginning of the year. To simplify further a full year estimate for net result is inserted to make the scoring easier. A *k* of 100 is used for all KPI meaning the score becomes a ratio to target. The kicker has simply been scaled by a factor of 100 to cater for the scorecard using 100 as on target.
The bonus contract with the Agent will then look according to below. Arbitrary targets have been inserted for each KPI:

KPI #	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score
1	Net Result	50	50	100+((y-x)/x)*100	100
2	NPS	10	10	100+((y-x)/x)*100	100
3	Service Delivery	80	80	100+((y-x)/x)*100	100
4	EES	3	3	100+((y-x)/x)*100	100

Table 16: BSC - Base Structure

[34] http://www.netpromoter.com/np/calculate.jsp

At this point the scorecard does not have any meaning since it is not known how the Agent will be remunerated based on his performance. In order to do that a specific remuneration agreement needs to exist for each KPI. This can be simplified by adding weights so that a weighted score can be calculated for each KPI. It will at first be assumed that each KPI carries an equal weight:

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score
1	0,25	Net Result	50	50	100+((y-x)/x)*100	100	25
2	0,25	NPS	10	10	100+((y-x)/x)*100	100	25
3	0,25	Service Delivery	80	80	100+((y-x)/x)*100	100	25
4	0,25	EES	3	3	100+((y-x)/x)*100	100	25
						Total	**100**

Table 17: BSC - Weighted

By adding the weights and allowing for the calculation of a weighted score this also allows for all KPI to be compared relatively since they now have a common unity which are points on the scorecard. This means that it can now be calculated exactly how much effort much be put into an additional KPI in order to outweigh underperformance in another. Since the overall purpose of the Agent is to maximize his scorecard he will naturally do it in whatever way is the easiest for him in terms of effort. Thus if he e.g. misses out on his Net Result target by 10 %, but by doing so is able to increase the other KPI by 10 % he should be better off as this would increase his total score as in below example:

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score
1	0,25	Net Result	50	45	100+((y-x)/x)*100	90	22,5
2	0,25	NPS	10	11	100+((y-x)/x)*100	110	27,5
3	0,25	Service Delivery	80	88	100+((y-x)/x)*100	110	27,5
4	0,25	EES	3	3,3	100+((y-x)/x)*100	110	27,5
						Total	**105**

Table 18: BSC - Calculation example

The Agent will thus naturally start speculating in the total score and focus his attention on the KPI requiring the least effort to influence and not pay as much attention to the KPI which he finds the most difficult to influence. In order to do so it will be natural to calculate backwards which amount of the original units' equal out? This will be done by calculating the amount of a particular scorecard unit is needed to move the score 10 points.

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score	Δ 10
1	0,25	Net Result	50	45	100+((y-x)/x)*100	90	22,5	5
2	0,25	NPS	10	11	100+((y-x)/x)*100	110	27,5	1
3	0,25	Service Delivery	80	88	100+((y-x)/x)*100	110	27,5	8
4	0,25	EES	3	3,3	100+((y-x)/x)*100	110	27,5	0,3
						Total	**105**	

Table 19: BSC - Delta 10

With the introduction of Δ10 the balances of the scorecard becomes evident. An Agent can now underperform with 5 units of Net Result and still be on target if he over performs with 1 NPS point. Assuming now that Net result is measured in 100 MUSD and empirical study has indicated that 1 score of NPS has the future value of 100 MUSD, 8 % of service delivery has the future value of 250 MUSD and 0,3 increase in EES has the future value of 50 MUSD. This would then allow calculating the equivalent Δ10 USD values.

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score	Δ 10	Δ 10 (100 MUSD)
1	0,25	Net Result	50	45	100+((y-x)/x)*100	90	22,5	5	5
2	0,25	NPS	10	11	100+((y-x)/x)*100	110	27,5	1	1
3	0,25	Service Delivery	80	88	100+((y-x)/x)*100	110	27,5	8	2,5
4	0,25	EES	3	3,3	100+((y-x)/x)*100	110	27,5	0,3	0,5
						Total	**105**		

Table 20: BSC - Delta 10 USD

Obviously the scorecard cannot possibly be properly calibrated with its current construction since it will allow the Agent to perform a form of "arbitrage" where he could e.g. destroy 500 MUSD worth of value by not meeting his Net Result and then still obtain a score of 105 and obtain a bonus by only delivering 400 MUSD worth of future value. In order to calibrate the scorecard so that such form of arbitrage or gaming is not possible either the weights or the kickers would need to be adjusted. This would naturally change the composition of the scorecard dramatically and might very well make certain KPI insignificant compared to other focus areas. Below is the above example calibrated by adjusting the weights and using linear programming.

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score	Δ 10	Δ 10 (100 MUSD)
1	**0.56**	Net Result	50	45	100+((y-x)/x)*100	90	50.00	5	5.00
2	**0.11**	NPS	10	11	100+((y-x)/x)*100	110	12.22	1	5.00
3	**0.28**	Service Delivery	80	88	100+((y-x)/x)*100	110	30.56	8	5.00
4	**0.06**	EES	3	3.3	100+((y-x)/x)*100	110	6.11	0.3	5.00

Total	**98.89**

Table 21: BSC - Calibration (weight)

The same calibration could be done by adjusting the kickers of each KPI and thus changing the scoring formula and influencing the Δ10. This has been done below also through linear programming:

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score	Δ 10	Δ 10 (100 MUSD)
1	0.25	Net Result	50	45	100+((y-x)/x)*100	90	22.50	5	5.00
2	0.25	NPS	10	**11**	100+((y-x)/x)***20**	102	25.50	**5**	5.00
3	0.25	Service Delivery	80	**88**	100+((y-x)/x)***50**	105	26.25	**16**	5.00
4	0.25	EES	3	**3.3**	100+((y-x)/x)***10**	101	25.25	**3**	5.00

Total	**99.50**

Table 22: BSC - Calibration (kicker)

A small deviation exist compared to the first calibration method due to rounding errors but otherwise the two calibration methods will give almost the same result except for when an agent is exactly on target. In that case the kicker is naturally not effective and only by adjusting the weight will the weighted score be changed.

Using kicker calibration the *Actual* is adjusted to again put the Agent's performance at 105.

KPI #	Weight (w)	KPI Name	Target (x)	Actual (y)	Scoring Formula	Score	Weighted Score	Δ 10	Δ 10 (100 MUSD)
1	0.25	Net Result	50	45	100+((y-x)/x)*100	90	22.50	5	5.00
2	0.25	NPS	10	**15**	100+((y-x)/x)***20**	110	27.50	**5**	5.00
3	0.25	Service Delivery	80	**96**	100+((y-x)/x)***50**	110	27.50	**16**	5.00
4	0.25	EES	3	**6**	100+((y-x)/x)***10**	110	27.50	**3**	5.00

Total	**105.00**

Table 23: BSC - Calibration (impossible performance)

It is seen that when adjusting the kicker it is actually not possible for the EES KPI to obtain a score equal to increasing Net Result by 10 %, and when adjusting the weights it receives a very low weight which would be an indication maybe that the KPI ought to be left out.

Also it is quite evident that if the scorecard had not been calibrated it would have been possible for the Agent to game the scorecard and optimizing his own score/bonus while at the same time destroying value for the company.

Theoretical correctness vs. practical application

The calibration demonstrates that it is possible to setup a balanced scorecard in a model that will resemble the standard budget structure and thus suitable for a contract. The balanced scorecard model however also adds a level of complexity which is not seen in the other models. The scheme brings into play non-monetary elements which can only be used effectively if the Principal is able to both:

- Quantify the value of the KPI into USD
- Calculate the future value of an improvement in the KPI

Naturally this is impossible to do exactly which means some level of estimation will always take place, which then again opens up the question of just how much certainty must exist before a KPI can be included with success? Or perhaps just how much certainty is it possible to get in the calculation? These questions will not be resolved within this thesis where instead only a general evaluation will be offered. Obviously companies with high level of visibility and high levels of data quality will be better suited to implement a balanced scorecard setup. The amount of data available will facilitate the necessary analysis needed in order to do the monetary quantification and calibration. Also companies with high levels of economic and mathematical expertise would be better off than companies with an overall lower statistical level. The nature of the KPI might also impact the decision to include it in a balanced scorecard. EES would e.g. most likely be almost impossible to quantify since there might be many subjective factors influencing such a decision, and the score might only be a proxy at best for how engaged the employees are. On the other hand would a service delivery KPI, which is widely known within the industry and reported by external stakeholders, might be easier to regress.
These considerations should be taken into consideration before the remaining part of the analysis is carried out, since it will be the requirement of whether the incentive scheme can

even be used and thus capitalization of below advantages compared to a standard budget can even take place.

The limited duration problem

The balanced scorecard does to some extend mitigate the limited duration problem since the differentiating point is that variables are included which are indicative of future value. This limits the options of any Agent trying to sub-optimize in the short run in order to move on before the true state of the company is discovered. The stronger indicators of future value any company has, the stronger will the protection be against short term optimizing Agents be.

The incentive scheme will however not drive behavior towards long term planning better than the alternatives, it will simply protect against Agents acting in bad faith. The additional KPI on the scorecard will have a final exercise date Y just as the standard budget and the Agent will be encouraged to only undertake projects which will create value before that date. It is of course possible to imagine that the balanced scorecard could be further extended to include key project data from long term projects such as e.g. milestones, money spend compared to budget etc. and then extend it to include perhaps 8 or 10 KPI. In that case then standard conclusion for the balanced scorecard will still hold and the complexity of the scorecard will increase for each additional KPI added. The cost of running the scorecard will similarly increase further since additional auditors are required to ensure data reflects the true state of the company and many projects can most likely not be truly evaluated until after they have been implemented.

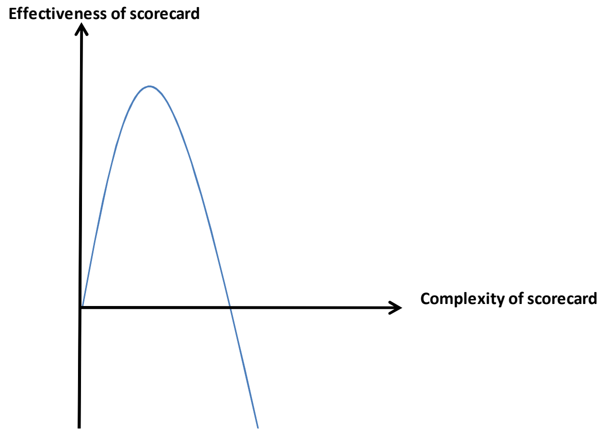


Table 24: Effectiveness vs. Complexity

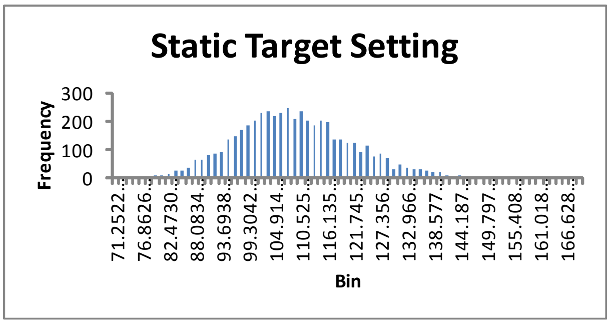
It is assumed that adding additional functionality to an incentive program will add value only until a certain point after which the administration, additional costs, and complexity will start defeating the purpose. For each individual company designing a scorecard the object of the exercise must be to design the scorecard so it reaches the maximum, and it would be expected that for some companies maximum might be reached by simply introducing one single KPI.

The variance problem

The problem of Agents manipulating the correct periods of reported numbers will to some extend also be mitigated by the balanced scorecard. First of all, where it was demonstrated that IFRS offers certain grey areas for management to influence figures this will be much more difficult when operational data is included, since this can be audited directly against whether the action has actually taken place or not. Thus the higher weight of operational KPI's compared to the financial KPI will diminish the threat proportionally.

Secondly it was demonstrated in the chapter on dynamic targets that once the scoring formula resembles a future and not an option the risk of the incentive program failing greatly diminishes. To estimate the effectiveness of the balanced scorecards ability to mitigate this problem the Monte Carlo simulation used before is repeated with the following modifications.
It is assumed that each KPI in the scorecard are capped at a minimum of 50 and a

maximum of 150 respectively. The scorecard contains three KPI which are uncorrelated and the total score is the simple average of the three KPIs. The Agent only cares about the total score which means that the scorecard fails when the total score goes below 100, or any individual KPI score is not between 50 and 150.



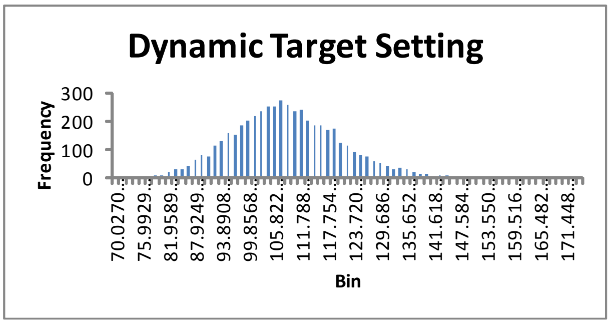


Table 25: MC Simul. - BSC

Interesting enough the static target setting model is now slightly better than the dynamic model. The static model fails 1,846 times compared to 1,877 failures in the dynamic model. The reason is again the drift which is included in the static target setting. The drift lowers the risk of the average going below 100 where there is no such protection in the dynamic model. Again it should be noted that if the overall incentive structure resembled a future the dynamic incentive scheme would never fail.

The problem of strong external factors and positive trends

First it should be noted that the same options exist for the target setting of a balanced scorecard as for the dynamic model, meaning that for the financial KPI the same options of mitigation exists. Since the other KPI are internal KPI and mostly operational by nature, it is assumed that there should not be any or at least only very limited interference from external factors. Compared to the other incentive structure the balanced scorecard mitigates this problem the most effectively when combined with the dynamic target setting model.

The problem of risk adverse Agents

It should be noted that even though the balanced scorecard allows for scores below 100 it does not change the overall cash flow structure for the Agent. The Agent will still not be

asked to pay back some of his base salary if the score drops below 100 and thus the cash flow model will still resemble that of an option.
The risk adverse Agent should however value the balanced scorecard higher than the other programs due to the laws of statistics. Since the KPI's are not 100 % correlated the addition of additional KPI will lower the variance and thus also the uncertainty related to the incentive program. A lower level of uncertainty will add value to the Agent depending on what type of utility function he resembles and thus the overall price of the balanced scorecard scheme should be lower than for the other options.

Sub Conclusion 5

The balanced scorecard is the first scorecard to directly address the problem of limited duration targets. It should be stressed that the balanced scorecard does not offer any advantages over the more traditional incentive structures in the short run since the overall inclusion of additional metrics is still to improve the financial results. Thus since the other structures were already doing this there is nothing additional gained from the balanced scorecard.
On the long run the balanced scorecard has additional protection from short term optimization in the form of operational and other internal KPI. If management seeks to improve the financial performance in the short run by sacrificing greater long term benefits by e.g. setting a tougher attitude towards customers and employees which is not beneficial in the long run the scorecard will punish them. The model however requires that is it possible to identify and quantify these factors which might not always be possible. If the additional KPIs are not quantified prober calibration cannot take place and whether the scorecard actually protects against short term optimization or whether it actually enables it becomes completely arbitrary.
Overall it is found that the balanced scorecard allows for the highest mitigation of the weaknesses identified if combined with dynamic target setting. It is however not found to be the optimal solution due to the additional complexity added since this complexity will reduce the number of companies where is can actually be successfully implanted.

3.6. Assumption 3 revisited

This entire thesis has been constructed based on the assumption that the Principal is unable to monitor the effort of the Agent. This created the classical moral hazard problem and from the theory relating to that problem it is known that this will have an additional cost if the Agent is risk adverse. It has further been demonstrated that this might have an additional price in the form of ineffective incentive programs due to the option like structure of these programs. This loss of effectiveness might then be mitigated at a cost by e.g. issuing stock options which are already in the money, which will again drive up the cost of the entire moral hazard problem.

It is perhaps important to reflect on whether this assumption truly holds. In this thesis, micro econometrics has been used to control for factors which are not related to the effort or ability of the effort. If it is possible to isolate these factors it might also be possible to get visibility on the true performance of the Agent which would bring us back to the Agent/Principal problem with symmetric information. If the Agent cannot blame external factors or the market for his lack of ability to meet targets this means that the Principal can more effectively use the stick instead of having to put carrots in front of the Agent all the time. The stick could take a number of different forms like: warnings, lack of pay increase, demotion or perhaps ultimately dismissal, but if the Principal was able to obtain credible threat he would be able to save on his cost on Agents and develop more effective performance management tools.

3.7. Adverse selection

The scope of this thesis has been limited to the moral hazard problem and has not at all covered the problem of adverse selection. It might however also be interesting to at a later stage do further studies into how these incentive programs would affect e.g. recruitment. If we imagine that the list of, on paper, suitable candidates for any given position can be grouped into two groups:

1. Agents, who do not intend to supply effort if they get hired,
2. And Agent who intend to supply effort if they get hired

The static stock option and budget would do little to deter the first group of applying since they are aware that there is a high likelihood they will be able to meet their targets simply due to the play of nature. They also know that even if they do not meet their targets they can always blame some factor outside their control and avoid any consequences.
Imagine then that two companies are completely alike, except for the choice of incentive program. Company A uses standard options and Company B uses options corrected for the development in the overall market index. The salary bands of both companies meet the same level of reservation utility. This is accomplished by Company B issuing a much higher amount of options to the employees. Further to that company B has spend a lot of marketing hours signaling this to the job market and have branded themselves as a company where successful performance is only awarded staff who beat the competition. Obviously all the candidates from group 1 will apply to company A and be hesitant to apply to company B. It will be difficult to quantify this value, but it might be that the gain from having Agents willing to supply effort greatly exceeds the cost of running the incentive program.
In all of this type of scenarios the incentive programs which are able to best quantify the true performance of the Agent will add higher value than programs which allow a higher level of external noise.

4. Conclusion

Based on the literature already available on the weaknesses of incentive programs a standard model of benchmarking was constructed around the traditional static budget scheme. The static budget was seen as the least complex program and all the most significant shortcomings applied to this scheme which was then classified as weak in terms of driving Agency behavior effectively. Standard stock options were tested as the most obvious alternative against the same criteria. It was found that stock options were significantly different from the standard budget. Not due to the aspect of the option, all the incentive programs followed the option structure, but because the performance is being reported by external parties. It was however found that this aspect in itself did not make stock options a more effective driver and actually stock options were estimated to be twice as volatile to external shocks which cloud the true performance of the agent. Also it was concluded that global accounting rules create even further opportunity for Agents to influence performance through the use of opportunistic accounting behavior. Overall stock options were found to be weaker than the standard budget target.

Dynamic target setting models were the first model to actively mitigate the weaknesses found in the static stock options and budget targets. The very nature of the model enabled external noise to be filtered away leaving a better estimation of the true performance of the Agent. It was also found that if consequence for poor performance could be build into the performance scheme, then the dynamic target could reduce the failures of an incentive scheme and thus at the same time mitigate Agents incentive to conduct account manipulation.

The balanced scorecard model was the first model to effectively address the limited duration problem through the inclusion of long term value drivers. It was found to be the most effective incentive program if at the same time it was paired with the dynamic target setting model. It was however also made clear that both the dynamic target setting model and the especially the balanced scorecard model would add a significantly higher level of complexity and cost to the incentive program. For the balanced scorecard model the additional complexity was found to be so high that it was estimated that it could not easily be implemented in many companies due to the level of visibility and quality needed within accounts not normally audited by e.g. chartered accountants. Overall it has then been concluded that dynamic target setting it the more optimal model since significant mitigation of weaknesses can be accomplished with a relatively low level of added complexity.

For this same reason WACC based performance metrics were completely disregarded from the analysis. It was found that these metrics would add an even higher level of complexity which would make them very difficult to successfully implement.

None of the incentive programs analyzed effectively mitigated the problem of additional cost due to Agents being risk adverse. It was found that in order to reduce this problem the structure of the incentive scheme needed to be changed from that of an option to that of a future.

5. References

"An introduction to the economics of information 2nd edition, Inés Macho-Stadler and J. David Pérez-Castrillo

"Value-Based Metrics: Foundation and Practice", Frank J. Fabozzi and James L. Grant, 2000

"Principles of Corporate Finance", Richard A. Brealey, Stewart C. Myers and Franklin Allen, 9th edition 2008 (PCF)

"Theory of Asset Pricing", George Pennacchi, 2008

"Beyond Budgeting vs. den traditionelle budgetteringsmodel", Master Thesis by Jette Nielsen, 2010

International Accounting Standards (IAS) 1-41 and International Financial Reporting Standards (IFRS) 1-13

"Who needs budgets?" Jeremy Hope and Robin Fraser, Harvard Business Review RO302J

"The wages of failure: Executive Compensation at Bear Stearns and Lehman 2000-2008", Lucian A Bebchuck, Alma Cohen and Holger Spamann, 2009

"Option Implied Risk Aversion and Elasticity of Intertemporal Substitution", Douglas W. Blackburn, 2006

"Are risk averse Agents more optimistic? A Bayesian estimation approach", Selima Ben Mansour, Elyés Jouini and others, 2007

"The Controversy over Accounting for Stock Options: A literature Review", Sandra Alves, 2010

"Bank CEO Incentives and the Credit Crisis", Rüdiger Fahlenbrasch and René Stultz, 2009

"The trouble with Stock Options", Brian Hall and Kevin Murphy, 2003

"The wages of failure: Executive compensation at Bear Stearns and Lehman 2000-2008", Lucian Bebchuk, Alma Cohen and Holger Spamann, 2009

"The relation between insider-trading restrictions and executive compensation", Darren T. Roulstone, 2001

"IFRSs and US GAAP: A pocket comparison", Deloitte 2008

"Illustrativ IFRS-årsrapport 2010", KPMG 2010

http://www.ifrs.com/ifrs_faqs.html#q3: AICPA IFRS resources

6. Appendix

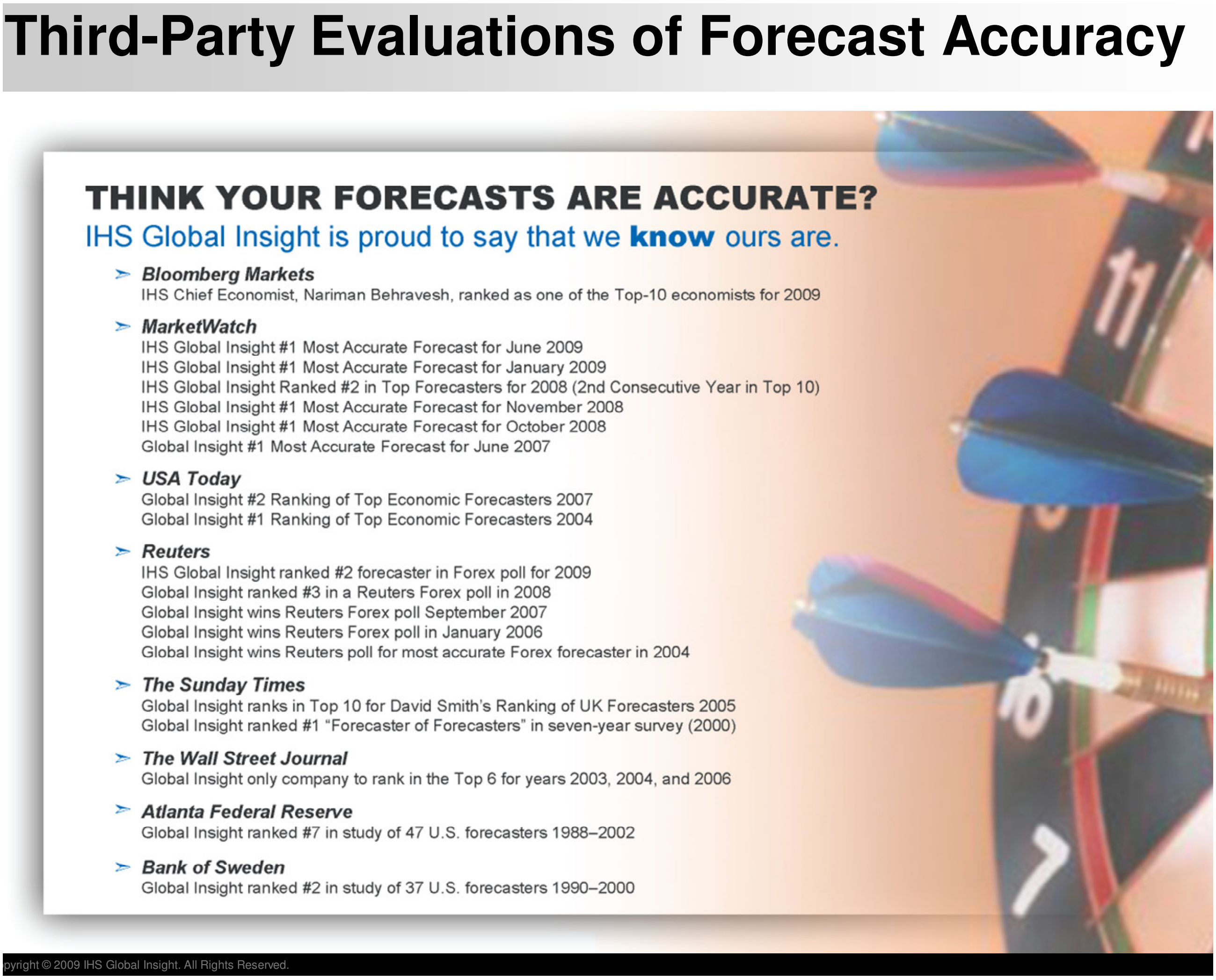
A. External Variables

GLOBAL INSIGHT

Created on Mon 15 Aug 2011, 11:00 AM EDT (16:00 GMT)

Geography	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	STDEV
Consumer Price Index												
World	89.89	92.10	94.60	97.14	100.00	103.11	106.52	111.91	113.69	116.94	121.67	10.65
Interest Rate: Long Term												
World	5.37	5.12	4.37	4.41	4.21	4.72	4.99	4.79	4.42	4.14	4.59	0.39
Interest Rate: Short Term												
World	5.34	4.20	3.35	3.25	4.04	4.92	5.43	5.04	3.27	2.81	3.21	0.97
Nominal Gross Domestic Product												
World	78.55	82.16	86.73	93.29	100.00	107.87	116.53	124.05	122.62	131.56	141.25	21.15
Price of Crude Oil, WTI												
World	25.96	26.11	31.12	41.47	56.56	66.12	72.18	99.76	61.77	79.45	100.59	27.00
Capital Marked Index	0.83	0.92	0.83	1.23	1.36	1.75	2.21	2.29	1.85	1.87	1.88	0.54

B. Global insight – Third party evaluation



C. Summary Statistics

Revenue vs. external factors

Global

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	5733	187958.9	51987.88	2410	241491
fyear	5733	2005.513	2.871957	2001	2010
lookup	5733	23871.48	65427.6	0	241491
revt	5733	3.83e+11	4.49e+12	1.00e+09	1.55e+14
div	5733	2.73e+11	3.25e+12	1.03e+08	8.21e+13
inrev	5733	15.97583	69.76089	.0455851	3513.936
ebit	5730	2.61e+10	4.32e+11	-4.18e+12	2.19e+13
ebitda	5733	4.41e+10	5.71e+11	-1.85e+12	2.44e+13
ib	5733	1.21e+10	2.24e+11	-3.08e+12	8.23e+12
cpi	5733	102.6357	8.964398	89.886	116.9386
intlong	5733	4.654716	.3903663	4.137835	5.367366
intshort	5733	4.176708	.9228402	2.808904	5.42514
gdp	5733	104.4539	17.99328	78.54737	131.563
oil	5733	56.34164	23.56108	25.96456	99.76334
sharein	5733	1.518251	.5279814	.82546	2.286043
sharenom	5733	4.57e+09	1.59e+09	2.49e+09	6.88e+09

EUR and US only

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	14356	190527.2	73762.84	1166	297239
curcd	0				
fyear	14356	2005.647	2.830007	2001	2010
index	14356	31771.14	78400.67	0	297239
revt	14356	3753.555	14575.92	100.009	458361
index2	14356	2938.14	10669.01	100.009	174218
inrev	14356	158.0098	180.3751	3.841223	4970.502
ebitda	14352	586.4141	2335.143	-2451	56416
ebit	14347	371.4975	1623.24	-14436	43645
oancf	13640	457.1862	1801.514	-3010	43918
cpi	14356	103.0368	8.867311	89.886	116.9386
intlong	14356	4.648036	.3815013	4.137835	5.367366
intshort	14356	4.177484	.9249658	2.808904	5.42514
gdp	14356	105.302	17.7778	78.54737	131.563
oil	14356	57.4153	23.40505	25.96456	99.76334
sharein	14356	1.546086	.5252264	.82546	2.286043
sharenom	14356	4.66e+09	1.58e+09	2.49e+09	6.88e+09

Summary Statistics – Share price vs. financial accounts – period 03 and 12

03

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	4782	99580.93	78193.97	1166	287882
dummy1	4782	16766.36	51542.63	0	287882
price	4780	29.0299	118.7616	.0001	7430.887
dummy2	3955	35.71437	43.4991	.002	303
inprice	3955	285.6819	5111.176	.0177778	227219.6
numbershares	4782	7.23e+09	4.56e+10	0	1.53e+12
value	4782	1.54e+11	1.12e+12	0	4.97e+13
invalue	4782	5.14e+11	9.06e+12	0	5.71e+14
cmth	4782	3	0	3	3
cyear	4782	2004.43	2.774668	2000	2009
dummy	4782	2003.43	2.774668	1999	2008
lookup	4782	9.96e+08	7.82e+08	1.17e+07	2.88e+09
cpi	0				
intlong	0				
intshort	0				
gdp	0				
oil	0				
dummy3	4782	6.97e+09	3.70e+10	10170	5.25e+11
rev	4782	8.19e+09	4.86e+10	10170	1.21e+12
ebit	4782	1.09e+09	9.44e+09	-2.80e+10	2.65e+11
income	4782	6.14e+08	5.44e+09	-2.96e+10	1.29e+11
eq	4782	4.79e+09	3.09e+10	-1.08e+10	5.80e+11
assets	4782	6.20e+09	3.61e+10	.073	7.74e+11
inrev	4782	285.0761	5069.49	.0439404	328464.2
inebit	4782	-4.92912	1541.368	-96042.02	41702.05
inincome	4782	-13.33548	1191.772	-77407.21	15225.2
ineq	4782	392.8152	5720.259	-8600.808	263677.4
inassets	4782	371.8972	6788.807	.0000307	352955.2

12

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	5635	100536.9	79620.63	1166	287882
dummy1	5635	15450.47	50481.8	0	287882
price	5635	38.94815	627.0462	1.1	46212.62
dummy2	5635	35.58149	37.14365	1.1	205.236
inprice	5635	169.2218	787.78	1.165629	54367.79
numbershares	5635	7.07e+09	4.38e+10	0	1.53e+12
valuemill	5635	154366.7	1078791	0	4.97e+07
cmth	5635	3	0	3	3
cyear	5635	2004.473	3.323857	1999	2010
lookup	5635	1.01e+09	7.96e+08	1.17e+07	2.88e+09
rev	5635	6.50e+09	3.76e+10	.108	7.74e+11
ebit	5635	1.12e+09	9.99e+09	-2.80e+10	2.65e+11
income	5635	6.29e+08	5.86e+09	-2.96e+10	1.58e+11
cf	5635	1.60e+09	1.28e+10	-2.78e+10	2.97e+11
eq	5635	5.20e+09	3.47e+10	-4.12e+09	8.55e+11
dummy3	5635	6.70e+09	4.07e+10	.435	6.48e+11
inrev	5479	166.1817	144.3733	.04	993.29
inebit	5593	24.44841	101.3415	-988.71	923.6
inincome	5592	11.74113	94.7516	-992.3	926.74
incf	5595	34.94542	99.62116	-873.66	836.68
ineq	5247	165.847	189.9326	-258.96	999.31
roe	5555	-15.30421	8724.862	-582719.7	250480

Summary Statistics – Share price vs. external factors

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	30630	67782.78	68836.14	1004	294524
dummy1	30630	9749.273	37264.12	0	294524
price	30630	75.3099	1865.8	.129	141600
dummy2	30630	55.35403	1367.477	.002	75600
inprice	30630	630.5257	12969.02	.96	780823
numbershares	30630	1.60e+09	2.05e+10	131000	1.53e+12
value	30630	3.88e+10	5.21e+11	5.00e+08	5.30e+13
valuemill	30630	38746.64	520646.5	500.0067	5.30e+07
cmth	30630	12	0	12	12
cyear	30630	2005.68	2.792146	2001	2010
lookup	30630	6.78e+08	6.88e+08	1.00e+07	2.95e+09
cpi	30630	103.0575	8.742131	89.886	116.9386
intlong	30630	4.623039	.3803742	4.137835	5.367366
intshort	30630	4.138192	.9318696	2.808904	5.42514
gdp	30630	105.3803	17.47216	78.54737	131.563
oil	30630	57.10454	22.19187	25.96456	99.76334

D. Stata Output – Revenue vs. external factors

Global

```
 Notes:
       1.  (/m# option or -set memory-) 1.00 MB allocated to data

1 . set memory 1000000
  (1000000k)

2 . (16 vars, 5733 obs pasted into editor)
  - preserve
  xtset gvkey fyear
         panel variable:  gvkey (unbalanced)
          time variable:  fyear, 2001 to 2010, but with gaps
                  delta:  1 unit

3 . sum

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       gvkey |      5733    187958.9    51987.88       2410     241491
       fyear |      5733    2005.513    2.871957       2001       2010
      lookup |      5733    23871.48     65427.6          0     241491
        revt |      5733    3.83e+11    4.49e+12   1.00e+09   1.55e+14
         div |      5733    2.73e+11    3.25e+12   1.03e+08   8.21e+13
-------------+--------------------------------------------------------
       inrev |      5733    15.97583    69.76089   .0455851   3513.936
        ebit |      5730    2.61e+10    4.32e+11  -4.18e+12   2.19e+13
      ebitda |      5733    4.41e+10    5.71e+11  -1.85e+12   2.44e+13
          ib |      5733    1.21e+10    2.24e+11  -3.08e+12   8.23e+12
         cpi |      5733    102.6357    8.964398     89.886   116.9386
-------------+--------------------------------------------------------
     intlong |      5733    4.654716    .3903663   4.137835   5.367366
    intshort |      5733    4.176708    .9228402   2.808904    5.42514
         gdp |      5733    104.4539    17.99328   78.54737    131.563
         oil |      5733    56.34164    23.56108   25.96456   99.76334
     sharein |      5733    1.518251    .5279814     .82546   2.286043
-------------+--------------------------------------------------------
    sharenom |      5733    4.57e+09    1.59e+09   2.49e+09   6.88e+09

4 . xtreg inrev sharein oil cpi , fe

 Fixed-effects (within) regression               Number of obs      =      5733
 Group variable: gvkey                           Number of groups   =       880

 R-sq:  within  = 0.0471                         Obs per group: min =         1
        between = 0.0514                                        avg =       6.5
        overall = 0.0380                                        max =        10

                                                 F(3,4850)          =     79.87
 corr(u_i, Xb)  = -0.0047                        Prob > F           =    0.0000


Indexed Revenue   Wednesday August 17 15:54:01 2011   Page 2

------------------------------------------------------------------------------
       inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     sharein |   9.375948   5.029329     1.86   0.062    -.4838156    19.23571
         oil |  -.1114667   .1149217    -0.97   0.332    -.3367652    .1138319
         cpi |  -1.751517   .2015911    -8.69   0.000    -2.146727   -1.356307
       _cons |   187.7892   16.83854    11.15   0.000      154.778    220.8004
-------------+----------------------------------------------------------------
     sigma_u |  54.595845
     sigma_e |  59.909393
         rho |   .4536953   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(879, 4850) =     2.99             Prob > F = 0.0000

5 .
```

EUR and US only

```
Notes:
      1.  (/m# option or -set memory-) 1.00 MB allocated to data

1 . set memoryt 1000000
-set memoryt- not allowed; 'memoryt' not recognized
r(199);

2 . set memory 1000000
(1000000k)

3 . (17 vars, 14356 obs pasted into editor)
- preserve
xtset gvkey fyear
       panel variable:  gvkey (unbalanced)
        time variable:  fyear, 2001 to 2010, but with gaps
                delta:  1 unit

4 . xtreg inrev sharein oil cpi ,fe

Fixed-effects (within) regression               Number of obs      =     14356
Group variable: gvkey                           Number of groups   =      2295

R-sq:  within  = 0.1219                         Obs per group: min =         1
       between = 0.0066                                        avg =       6.3
       overall = 0.0530                                        max =        10

                                                F(3,12058)         =    558.22
corr(u_i, Xb)  = -0.0500                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     sharein |   22.91017   6.380925     3.59   0.000     10.40253    35.41781
         oil |   .2497254   .1452282     1.72   0.086    -.0349451     .534396
         cpi |   3.610936   .2573109    14.03   0.000     3.106565    4.115306
       _cons |  -263.8088    21.6174   -12.20   0.000    -306.1824   -221.4352
-------------+----------------------------------------------------------------
     sigma_u |  120.40157
     sigma_e |  122.27981
         rho |  .49226094   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(2294, 12058) =     7.64         Prob > F = 0.0000
```

```
  Indexed Revenue  Wednesday August 17 17:56:28 2011   Page 2

5 . xtreg  inrev cpi intlong intshort gdp oil sharein ,fe

  Fixed-effects (within) regression               Number of obs      =     14356
  Group variable: gvkey                           Number of groups   =      2295

  R-sq:  within  = 0.1240                         Obs per group: min =         1
         between = 0.0049                                        avg =       6.3
         overall = 0.0531                                        max =        10

                                                  F(6,12055)         =    284.50
  corr(u_i, Xb)  = -0.0510                        Prob > F           =    0.0000

  ------------------------------------------------------------------------------
         inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
           cpi |  -1.167252    1.97926    -0.59   0.555    -5.046921    2.712417
       intlong |   26.22322   7.608034     3.45   0.001     11.31025    41.13619
      intshort |  -2.101702   4.130222    -0.51   0.611     -10.1976    5.994197
           gdp |   3.700973   1.179041     3.14   0.002     1.389863    6.012083
           oil |   .3735984   .1779106     2.10   0.036     .0248651    .7223318
       sharein |   -24.2746   11.89323    -2.04   0.041    -47.58725   -.9619479
         _cons |  -208.4663   87.71166    -2.38   0.017    -380.3953   -36.53737
  -------------+----------------------------------------------------------------
       sigma_u |  120.62211
       sigma_e |  122.14942
           rho |  .49370909   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0:     F(2294, 12055) =     7.66         Prob > F = 0.0000

6 . xtreg  inrev gdp oil sharein ,fe

  Fixed-effects (within) regression               Number of obs      =     14356
  Group variable: gvkey                           Number of groups   =      2295

  R-sq:  within  = 0.1220                         Obs per group: min =         1
         between = 0.0067                                        avg =       6.3
         overall = 0.0532                                        max =        10

                                                  F(3,12058)         =    558.49
  corr(u_i, Xb)  = -0.0498                        Prob > F           =    0.0000

  ------------------------------------------------------------------------------
         inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
           gdp |   2.272305   .1616304    14.06   0.000     1.955484    2.589127
           oil |   .1543374   .1474914     1.05   0.295    -.1347695    .4434444
       sharein |   9.412546   6.693591     1.41   0.160    -3.707968    22.53306
         _cons |  -104.6824   10.60718    -9.87   0.000    -125.4742   -83.89063
  -------------+----------------------------------------------------------------
       sigma_u |  120.41468
       sigma_e |  122.27626
           rho |  .49232987   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0:     F(2294, 12058) =     7.64         Prob > F = 0.0000
```

```
7 . xtreg inrev sharein oil cpi ,fe

Fixed-effects (within) regression               Number of obs      =     14356
Group variable: gvkey                           Number of groups   =      2295

R-sq:  within  = 0.1219                         Obs per group: min =         1
       between = 0.0066                                        avg =       6.3
       overall = 0.0530                                        max =        10

                                                F(3,12058)         =    558.22
corr(u_i, Xb)  = -0.0500                        Prob > F           =    0.0000

------------------------------------------------------------------------------
       inrev |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     sharein |   22.91017   6.380925     3.59   0.000     10.40253    35.41781
         oil |   .2497254   .1452282     1.72   0.086    -.0349451     .534396
         cpi |   3.610936   .2573109    14.03   0.000     3.106565    4.115306
       _cons |  -263.8088    21.6174   -12.20   0.000    -306.1824   -221.4352
-------------+----------------------------------------------------------------
     sigma_u |  120.40157
     sigma_e |  122.27981
         rho |  .49226094   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(2294, 12058) =     7.64         Prob > F = 0.0000

8 . sum

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
       gvkey |     14356    190527.2    73762.84       1166     297239
       curcd |         0
       fyear |     14356    2005.647    2.830007       2001       2010
       index |     14356    31771.14    78400.67          0     297239
        revt |     14356    3753.555    14575.92    100.009     458361
-------------+--------------------------------------------------------
      index2 |     14356     2938.14    10669.01    100.009     174218
       inrev |     14356    158.0098    180.3751   3.841223   4970.502
      ebitda |     14352    586.4141    2335.143      -2451      56416
        ebit |     14347    371.4975     1623.24     -14436      43645
       oancf |     13640    457.1862    1801.514      -3010      43918
-------------+--------------------------------------------------------
         cpi |     14356    103.0368    8.867311     89.886   116.9386
     intlong |     14356    4.648036    .3815013   4.137835   5.367366
    intshort |     14356    4.177484    .9249658   2.808904    5.42514
         gdp |     14356     105.302     17.7778   78.54737    131.563
         oil |     14356     57.4153    23.40505   25.96456   99.76334
-------------+--------------------------------------------------------
     sharein |     14356    1.546086    .5252264     .82546   2.286043
    sharenom |     14356    4.66e+09    1.58e+09   2.49e+09   6.88e+09

9 .
```

E. CM1 dependant on GDP

Regressionsstatistik	
Multipel R	0,982816367
R-kvadreret	0,965928012
Justeret R-kvadreret	0,961060585
Standardfejl	693048,1891
Observationer	9

ANAVA

	fg	*SK*	*MK*	*F*	*Signifikans F*
Regression	1	9,53174E+13	9,53174E+13	198,4473614	2,15358E-06
Residual	7	3,36221E+12	4,80316E+11		
I alt	8	9,86796E+13			

	Koefficienter	*Standardfejl*	*t-stat*	*P-værdi*	*Nedre 95%*	*Øvre 95%*	*Nedre 95,0%*	*Øvre 95,0%*
Skæring	-32714409,92	2821302,801	-11,59549762	8,00095E-06	-39385730,95	-26043088,9	-39385730,95	-26043088,9
GDP	892,8676385	63,38177802	14,08713461	2,15358E-06	742,9935492	1042,741728	742,9935492	1042,741728

F. Calculations used for the Compatibility Constraint examples

Salary	1,500,000	DKK
Work hours low effort	40	hours
Work hours high effort	50	hours
Hours per year	2,080	hours
Utility cost, low effort	721	DKK/hour
Utility cost, high effort	1,082	DKK/hour
Price of high effort	2,250,000	DKK
Price of low effort	1,500,000	DKK

Target		**Low Effort**		**High Effort**	
Net Revenue (100*1.1)	110	Net Revenue (100*1.57)	157	Net Revenue (100*1.72)	172.7
Variable Costs	-82.5	Variable Costs	-117.75	Variable Costs	-129.525
Contribution Margin	**27.5**	**Contribution Margin**	**39.25**	**Contribution Margin**	**43.175**
Fixed cost	-10	Fixed cost	-10	Fixed cost	-10
EBIT	**17.5**	**EBIT**	**29.25**	**EBIT**	**33.175**
Interest	-2.5	Interest	-2.5	Interest	-2.5
Tax	0	Tax	0	Tax	0
Net Result	**15**	**Net Result**	**26.75**	**Net Result**	**30.675**
Bonus	**0**		**1,175,000**		**1,567,500**
Total Remuneration			**2,675,000**		**3,067,500**

Dynamic

Target			**Low Effort**		**High Effort**	
Net Revenue (100*1.1)	110		Net Revenue (100*1.57-47)	110	Net Revenue (100*1.72-47)	125.7
Variable Costs	-82.5		Variable Costs	-82.5	Variable Costs	-94.275
Contribution Margin	**27.5**		**Contribution Margin**	**27.5**	**Contribution Margin**	**31.425**
Fixed cost	-10		Fixed cost	-10	Fixed cost	-10
EBIT	**17.5**		**EBIT**	**17.5**	**EBIT**	**21.425**
Interest	-2.5		Interest	-2.5	Interest	-2.5
Tax	0		Tax	0	Tax	0
Net Result	**15**		**Net Result**	**15**	**Net Result**	**18.925**
Bonus	**0**			**0**		**392,500**
Total Remuneration				**1,500,000**		**1,892,500**

G. Stata Output – Share price vs. financial accounts – period 03 and 12

03

```
Notes:
      1.  (/m# option or -set memory-) 1.00 MB allocated to data

1 . set memory 1000000
  (1000000k)

2 . (28 vars, 4782 obs pasted into editor)
  - preserve
  xtset gvkey cyear
         panel variable:  gvkey (unbalanced)
          time variable:  cyear, 2000 to 2009, but with gaps
                  delta:  1 unit

3 . sum
```

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	4782	99580.93	78193.97	1166	287882
dummy1	4782	16766.36	51542.63	0	287882
price	4780	29.0299	118.7616	.0001	7430.887
dummy2	3955	35.71437	43.4991	.002	303
inprice	3955	285.6819	5111.176	.0177778	227219.6
numbershares	4782	7.23e+09	4.56e+10	0	1.53e+12
value	4782	1.54e+11	1.12e+12	0	4.97e+13
invalue	4782	5.14e+11	9.06e+12	0	5.71e+14
cmth	4782	3	0	3	3
cyear	4782	2004.43	2.774668	2000	2009
dummy	4782	2003.43	2.774668	1999	2008
lookup	4782	9.96e+08	7.82e+08	1.17e+07	2.88e+09
cpi	0				
intlong	0				
intshort	0				
gdp	0				
oil	0				
dummy3	4782	6.97e+09	3.70e+10	10170	5.25e+11
rev	4782	8.19e+09	4.86e+10	10170	1.21e+12
ebit	4782	1.09e+09	9.44e+09	-2.80e+10	2.65e+11
income	4782	6.14e+08	5.44e+09	-2.96e+10	1.29e+11
eq	4782	4.79e+09	3.09e+10	-1.08e+10	5.80e+11
assets	4782	6.20e+09	3.61e+10	.073	7.74e+11
inrev	4782	285.0761	5069.49	.0439404	328464.2
inebit	4782	-4.92912	1541.368	-96042.02	41702.05
inincome	4782	-13.33548	1191.772	-77407.21	15225.2
ineq	4782	392.8152	5720.259	-8600.808	263677.4
inassets	4782	371.8972	6788.807	.0000307	352955.2

```
Real Account vs Share  Thursday August 18 16:54:58 2011   Page 2

4 . xtreg inprice inrev inebit inincome ineq inassets ,fe

Fixed-effects (within) regression               Number of obs      =      3955
Group variable: gvkey                           Number of groups   =       546

R-sq:  within  = 0.0022                         Obs per group: min =         1
       between = 0.0003                                        avg =       7.2
       overall = 0.0012                                        max =        10

                                                F(5,3404)          =      1.52
corr(u_i, Xb)  = -0.0324                        Prob > F           =    0.1809

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       inrev |   1.053494   .4833341     2.18   0.029     .1058393    2.001148
      inebit |  -.0126335   1.093014    -0.01   0.991    -2.155663    2.130397
    inincome |   .1889043   .7350027     0.26   0.797    -1.252187    1.629996
        ineq |   .1022537    .187407     0.55   0.585     -.265188    .4696953
    inassets |  -.2423904   .3181892    -0.76   0.446    -.8662517    .3814708
       _cons |    115.243   102.3724     1.13   0.260    -85.47458    315.9605
-------------+----------------------------------------------------------------
     sigma_u |  3208.0078
     sigma_e |  4144.9182
         rho |  .37461566   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(545, 3404) =     4.77            Prob > F = 0.0000

5 . xtreg inprice inrev ,fe

Fixed-effects (within) regression               Number of obs      =      3955
Group variable: gvkey                           Number of groups   =       546

R-sq:  within  = 0.0020                         Obs per group: min =         1
       between = 0.0010                                        avg =       7.2
       overall = 0.0014                                        max =        10

                                                F(1,3408)          =      6.87
corr(u_i, Xb)  = -0.0178                        Prob > F           =    0.0088

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       inrev |   .9727407   .3710444     2.62   0.009     .2452487    1.700233
       _cons |   105.8851   95.09615     1.11   0.266    -80.56617    292.3363
-------------+----------------------------------------------------------------
     sigma_u |  3201.2396
     sigma_e |  4142.9225
         rho |  .37385202   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(545, 3408) =     4.77            Prob > F = 0.0000

6 . xtreg inprice  inebit,fe

Fixed-effects (within) regression               Number of obs      =      3955
Group variable: gvkey                           Number of groups   =       546

R-sq:  within  = 0.0005                         Obs per group: min =         1
       between = 0.0000                                        avg =       7.2
       overall = 0.0001                                        max =        10

                                                F(1,3408)          =      1.70
corr(u_i, Xb)  = -0.0283                        Prob > F           =    0.1920
```

```
Real Account vs Share  Thursday August 18 16:54:58 2011   Page 3

------------------------------------------------------------------------------
      inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
       inebit |   1.121917   .8596782     1.31   0.192    -.5636197    2.807454
        _cons |   277.4511   66.22788     4.19   0.000     147.6007    407.3014
--------------+----------------------------------------------------------------
      sigma_u |  3204.9855
      sigma_e |   4146.062
          rho |   .3740449   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(545, 3408) =     4.77           Prob > F = 0.0000

7 . xtreg inprice  inebit ineq, fe

Fixed-effects (within) regression               Number of obs      =      3955
Group variable: gvkey                           Number of groups   =       546

R-sq:  within  = 0.0007                         Obs per group: min =         1
       between = 0.0000                                        avg =       7.2
       overall = 0.0001                                        max =        10

                                                F(2,3407)          =      1.19
corr(u_i, Xb)  = -0.0547                        Prob > F           =    0.3050

------------------------------------------------------------------------------
      inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
--------------+----------------------------------------------------------------
       inebit |   1.243882   .8724873     1.43   0.154    -.4667693    2.954533
         ineq |   .1103988   .1346131     0.82   0.412    -.1535319    .3743294
        _cons |   250.8623   73.74043     3.40   0.001     106.2823    395.4422
--------------+----------------------------------------------------------------
      sigma_u |  3213.6426
      sigma_e |  4146.2612
          rho |  .37528638   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(545, 3407) =     4.77           Prob > F = 0.0000

8 .
```

12

```
Notes:
      1.  (/m# option or -set memory-) 1.00 MB allocated to data

1 . set memory 1000000
  (1000000k)

2 . (22 vars, 5635 obs pasted into editor)
  - preserve
  xtset gvkey cyear
         panel variable:  gvkey (unbalanced)
          time variable:  cyear, 1999 to 2010, but with gaps
                  delta:  1 unit

3 . xtreg inprice inrev inebit inincome incf ineq roe ,fe

  Fixed-effects (within) regression               Number of obs      =      5128
  Group variable: gvkey                           Number of groups   =       721

  R-sq:  within  = 0.0217                         Obs per group: min =         1
         between = 0.0005                                        avg =       7.1
         overall = 0.0033                                        max =        12

                                                  F(6,4401)          =     16.30
  corr(u_i, Xb)  = -0.3350                        Prob > F           =    0.0000

  ------------------------------------------------------------------------------
       inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
         inrev |  -.1926779    .148986    -1.29   0.196    -.4847653    .0994095
        inebit |   2.618064   .5462318     4.79   0.000     1.547175    3.688953
      inincome |   .2622669   .4667528     0.56   0.574    -.6528034    1.177337
          incf |  -.1507826   .4941589    -0.31   0.760    -1.119583    .8180174
          ineq |    .368991   .1526859     2.42   0.016     .0696499    .6683321
           roe |   .0072979   .0131392     0.56   0.579    -.0184616    .0330574
         _cons |   91.18945    25.1194     3.63   0.000     41.94279    140.4361
  -------------+----------------------------------------------------------------
       sigma_u |  457.73088
       sigma_e |  767.60054
           rho |  .26231398   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0:     F(720, 4401) =     2.06             Prob > F = 0.0000
```

```
4 . xtreg inprice incf roe ,fe

  Fixed-effects (within) regression               Number of obs      =      5516
  Group variable: gvkey                           Number of groups   =       745

  R-sq:  within  = 0.0048                         Obs per group: min =         1
         between = 0.0001                                        avg =       7.4
         overall = 0.0014                                        max =        12

                                                  F(2,4769)          =     11.49
  corr(u_i, Xb)  = -0.1451                        Prob > F           =    0.0000

  ------------------------------------------------------------------------------
       inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
          incf |   .8729546    .182082     4.79   0.000     .5159899    1.229919
           roe |  -.0001015   .0015938    -0.06   0.949    -.0032262    .0030231
         _cons |   138.7549   11.94073    11.62   0.000     115.3455    162.1642
  -------------+----------------------------------------------------------------
       sigma_u |  399.51129
       sigma_e |  744.88481
           rho |  .22339764   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0:     F(744, 4769) =     2.04           Prob > F = 0.0000

5 . xtreg inprice inrev ,fe

  Fixed-effects (within) regression               Number of obs      =      5479
  Group variable: gvkey                           Number of groups   =       752

  R-sq:  within  = 0.0012                         Obs per group: min =         1
         between = 0.0013                                        avg =       7.3
         overall = 0.0012                                        max =        12

                                                  F(1,4726)          =      5.58
  corr(u_i, Xb)  = -0.0176                        Prob > F           =    0.0182

  ------------------------------------------------------------------------------
       inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
  -------------+----------------------------------------------------------------
         inrev |   .2368008   .1002614     2.36   0.018     .0402417    .4333599
         _cons |   128.0718   19.49448     6.57   0.000     89.85356    166.2901
  -------------+----------------------------------------------------------------
       sigma_u |  390.06429
       sigma_e |  749.12577
           rho |  .21329274   (fraction of variance due to u_i)
  ------------------------------------------------------------------------------
  F test that all u_i=0:     F(751, 4726) =     1.97           Prob > F = 0.0000

6 . xtreg inprice  ,fe roe
  option roe not allowed
  r(198);

7 . xtreg inprice roe  ,fe

  Fixed-effects (within) regression               Number of obs      =      5555
  Group variable: gvkey                           Number of groups   =       752

  R-sq:  within  = 0.0000                         Obs per group: min =         1
         between = 0.0001                                        avg =       7.4
         overall = 0.0000                                        max =        12

                                                  F(1,4802)          =      0.01
  corr(u_i, Xb)  = -0.0058                        Prob > F           =    0.9254
```

```
------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         roe |  -.0001303   .0013929    -0.09   0.925    -.0028611    .0026004
       _cons |    170.054    9.98539    17.03   0.000     150.4781      189.63
-------------+----------------------------------------------------------------
     sigma_u |  390.78507
     sigma_e |   744.2281
         rho |  .21612718   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(751, 4802) =     2.01           Prob > F = 0.0000

8 . xtreg inprice inrev inebit ,fe

Fixed-effects (within) regression               Number of obs      =      5460
Group variable: gvkey                           Number of groups   =       746

R-sq:  within  = 0.0132                         Obs per group: min =         1
       between = 0.0000                                        avg =       7.3
       overall = 0.0021                                        max =        12

                                                F(2,4712)          =     31.49
corr(u_i, Xb)  = -0.2924                        Prob > F           =    0.0000

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       inrev |  -.0363975   .1063908    -0.34   0.732    -.2449733    .1721782
      inebit |   1.760095    .232575     7.57   0.000     1.304139    2.216051
       _cons |    137.241    19.4831     7.04   0.000     99.04501     175.437
-------------+----------------------------------------------------------------
     sigma_u |  435.34714
     sigma_e |  745.70111
         rho |  .25419504   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(745, 4712) =     2.07           Prob > F = 0.0000

9 . xtreg inprice inebit ,fe

Fixed-effects (within) regression               Number of obs      =      5593
Group variable: gvkey                           Number of groups   =       746

R-sq:  within  = 0.0100                         Obs per group: min =         1
       between = 0.0000                                        avg =       7.5
       overall = 0.0023                                        max =        12

                                                F(1,4846)          =     49.11
corr(u_i, Xb)  = -0.2159                        Prob > F           =    0.0000

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      inebit |   1.226011   .1749531     7.01   0.000     .8830233    1.568998
       _cons |   139.1205   10.74385    12.95   0.000     118.0577    160.1834
-------------+----------------------------------------------------------------
     sigma_u |  414.47805
     sigma_e |  737.07199
         rho |  .24024604   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(745, 4846) =     2.11           Prob > F = 0.0000
```

10 . sum

Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	5635	100536.9	79620.63	1166	287882
dummy1	5635	15450.47	50481.8	0	287882
price	5635	38.94815	627.0462	1.1	46212.62
dummy2	5635	35.58149	37.14365	1.1	205.236
inprice	5635	169.2218	787.78	1.165629	54367.79
numbershares	5635	7.07e+09	4.38e+10	0	1.53e+12
valuemill	5635	154366.7	1078791	0	4.97e+07
cmth	5635	3	0	3	3
cyear	5635	2004.473	3.323857	1999	2010
lookup	5635	1.01e+09	7.96e+08	1.17e+07	2.88e+09
rev	5635	6.50e+09	3.76e+10	.108	7.74e+11
ebit	5635	1.12e+09	9.99e+09	-2.80e+10	2.65e+11
income	5635	6.29e+08	5.86e+09	-2.96e+10	1.58e+11
cf	5635	1.60e+09	1.28e+10	-2.78e+10	2.97e+11
eq	5635	5.20e+09	3.47e+10	-4.12e+09	8.55e+11
dummy3	5635	6.70e+09	4.07e+10	.435	6.48e+11
inrev	5479	166.1817	144.3733	.04	993.29
inebit	5593	24.44841	101.3415	-988.71	923.6
inincome	5592	11.74113	94.7516	-992.3	926.74
incf	5595	34.94542	99.62116	-873.66	836.68
ineq	5247	165.847	189.9326	-258.96	999.31
roe	5555	-15.30421	8724.862	-582719.7	250480

11 . xtreg inprice inebit ineq,fe

```
Fixed-effects (within) regression               Number of obs      =      5245
Group variable: gvkey                           Number of groups   =       722

R-sq:  within  = 0.0169                         Obs per group: min =         1
       between = 0.0003                                        avg =       7.3
       overall = 0.0033                                        max =        12

                                                F(2,4521)          =     38.92
corr(u_i, Xb)  = -0.2698                        Prob > F           =    0.0000
```

inprice	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
inebit	2.020038	.2825795	7.15	0.000	1.466044	2.574032
ineq	.2792803	.1221074	2.29	0.022	.0398901	.5186704
_cons	83.33906	21.71039	3.84	0.000	40.77607	125.902
sigma_u	433.80771					
sigma_e	759.38818					
rho	.24604404	(fraction of variance due to u_i)				

F test that all u_i=0: F(721, 4521) = 2.07 Prob > F = 0.0000

```
12 . xtreg inprice inincome ineq,fe

   Fixed-effects (within) regression               Number of obs      =      5244
   Group variable: gvkey                           Number of groups   =       723

   R-sq:  within  = 0.0135                         Obs per group: min =         1
          between = 0.0004                                        avg =       7.3
          overall = 0.0025                                        max =        12

                                                   F(2,4519)          =     31.01
   corr(u_i, Xb)  = -0.2336                        Prob > F           =    0.0000

   ------------------------------------------------------------------------------
        inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
       inincome |   1.615395   .2717087     5.95   0.000     1.082713    2.148077
           ineq |   .3873892   .1193942     3.24   0.001     .1533182    .6214602
          _cons |   92.76421     22.014     4.21   0.000     49.60601    135.9224
   -------------+----------------------------------------------------------------
        sigma_u |  426.73668
        sigma_e |  760.86219
            rho |  .23929106   (fraction of variance due to u_i)
   ------------------------------------------------------------------------------
   F test that all u_i=0:     F(722, 4519) =     2.05           Prob > F = 0.0000

13 . xtreg inprice inincome ineq roe,fe

   Fixed-effects (within) regression               Number of obs      =      5175
   Group variable: gvkey                           Number of groups   =       722

   R-sq:  within  = 0.0137                         Obs per group: min =         1
          between = 0.0004                                        avg =       7.2
          overall = 0.0026                                        max =        12

                                                   F(3,4450)          =     20.66
   corr(u_i, Xb)  = -0.2362                        Prob > F           =    0.0000

   ------------------------------------------------------------------------------
        inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
       inincome |   1.649381    .277384     5.95   0.000      1.10557    2.193191
           ineq |   .3825484   .1212882     3.15   0.002     .1447633    .6203335
            roe |    .007399   .0130981     0.56   0.572    -.0182798    .0330779
          _cons |   93.80154   22.33756     4.20   0.000     50.00882    137.5943
   -------------+----------------------------------------------------------------
        sigma_u |  427.87445
        sigma_e |  766.61382
            rho |  .23752321   (fraction of variance due to u_i)
   ------------------------------------------------------------------------------
   F test that all u_i=0:     F(721, 4450) =     2.02           Prob > F = 0.0000

14 . xtreg inprice incf ineq roe,fe

   Fixed-effects (within) regression               Number of obs      =      5176
   Group variable: gvkey                           Number of groups   =       722

   R-sq:  within  = 0.0098                         Obs per group: min =         1
          between = 0.0000                                        avg =       7.2
          overall = 0.0023                                        max =        12

                                                   F(3,4451)          =     14.67
   corr(u_i, Xb)  = -0.2137                        Prob > F           =    0.0000
```

```
Real Account vs Share  Thursday August 18 11:04:49 2011   Page 6

------------------------------------------------------------------------------
      lnprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        incf |   1.455566   .3476207     4.19   0.000     .7740569    2.137076
        ineq |   .3249035   .1326385     2.45   0.014     .0648662    .5849409
         roe |   .0091293   .0131392     0.69   0.487    -.0166301    .0348887
       _cons |   74.13713   22.03245     3.36   0.001     30.94257    117.3317
-------------+----------------------------------------------------------------
     sigma_u |  417.26157
     sigma_e |  768.05989
         rho |  .22788211   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(721, 4451) =     1.99           Prob > F = 0.0000

15 .
```

H. Black-Scholes Calculation

Row Labels	**Average of EBIT**				
2000	969577654.6				
2001	1186374485				
2002	454019119.1				
2003	619194585.5				
2004	943716344.7	**EBIT**		**Share**	
2005	1164636859	100		100	
2006	1208060042	103.7285	0.036606	107.4569	0.07192
2007	1384932127	118.9154	0.136635	137.8307	0.248936
2008	1591699806	136.6692	0.139151	173.3384	0.229219
2009	1614599067	138.6354	0.014284	177.2708	0.022433
		STDEV	**0.065566**	**STDEV**	**0.112908**

Exercise	100	100
RiskF	0.05	0.05
Time	1	1
Current Price	100	100
Sigma	0.065566	0.112908
d1	0.795369	0.795369
d2	0.729802	0.729802
N(d1)	0.7868	0.7868
N(d2)	0.767244	0.767244
Price	5.697495	7.253953

I. Stata Output – Share price vs. external factors

```
Notes:
      1.  (/m# option or -set memory-) 1.00 MB allocated to data

1 . set memory 1000000
(1000000k)

2 . (16 vars, 30630 obs pasted into editor)
- preserve
xtset gvkey cyear
       panel variable:  gvkey (unbalanced)
        time variable:  cyear, 2001 to 2010, but with gaps
                delta:  1 unit

3 . sum
```

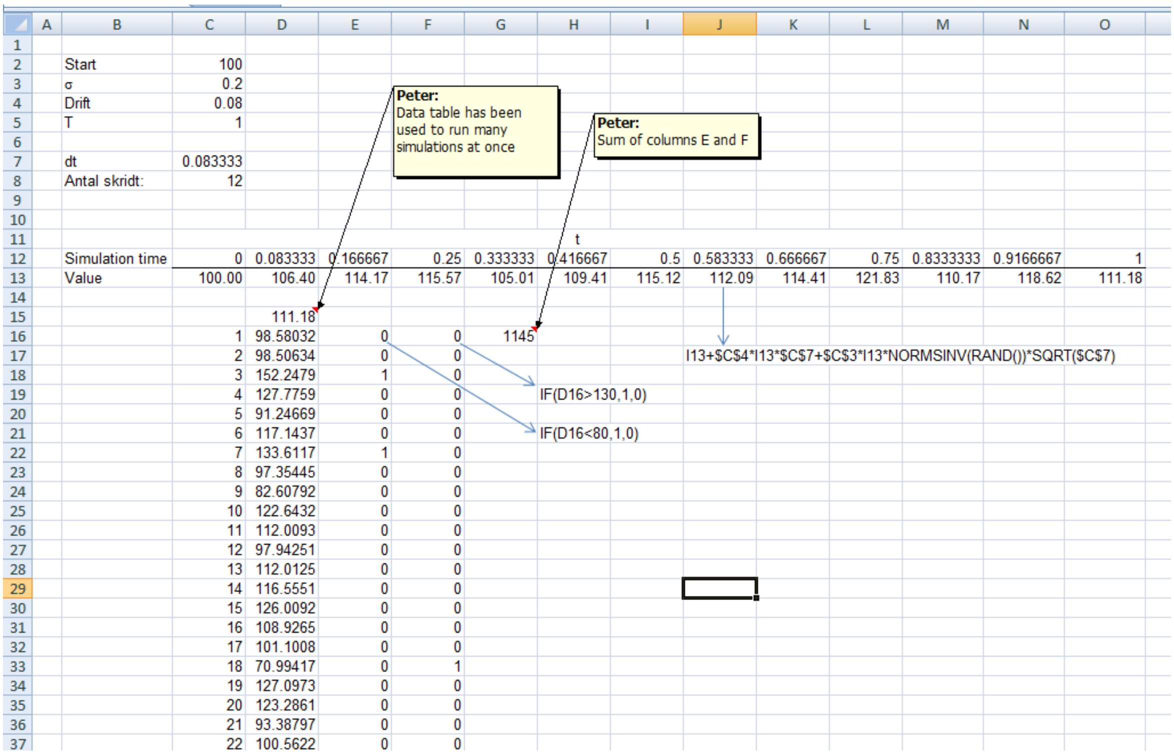
Variable	Obs	Mean	Std. Dev.	Min	Max
gvkey	30630	67782.78	68836.14	1004	294524
dummy1	30630	9749.273	37264.12	0	294524
price	30630	75.3099	1865.8	.129	141600
dummy2	30630	55.35403	1367.477	.002	75600
inprice	30630	630.5257	12969.02	.96	780823
numbershares	30630	1.60e+09	2.05e+10	131000	1.53e+12
value	30630	3.88e+10	5.21e+11	5.00e+08	5.30e+13
valuemill	30630	38746.64	520646.5	500.0067	5.30e+07
cmth	30630	12	0	12	12
cyear	30630	2005.68	2.792146	2001	2010
lookup	30630	6.78e+08	6.88e+08	1.00e+07	2.95e+09
cpi	30630	103.0575	8.742131	89.886	116.9386
intlong	30630	4.623039	.3803742	4.137835	5.367366
intshort	30630	4.138192	.9318696	2.808904	5.42514
gdp	30630	105.3803	17.47216	78.54737	131.563
oil	30630	57.10454	22.19187	25.96456	99.76334

```
4 . xtreg inprice cpi gdp oil ,fe

Fixed-effects (within) regression               Number of obs      =     30630
Group variable: gvkey                           Number of groups   =      5585

R-sq:  within  = 0.0002                         Obs per group: min =         1
       between = 0.0016                                        avg =       5.5
       overall = 0.0004                                        max =        10

                                                F(3,25042)         =      1.48
corr(u_i, Xb)  = 0.0134                         Prob > F           =    0.2188
```

```
------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         cpi |   28.90688   54.81515     0.53   0.598    -78.53403    136.3478
         gdp |  -11.23411   33.25149    -0.34   0.735    -76.40899    53.94077
         oil |   2.431532     6.8598     0.35   0.723    -11.01408    15.87714
       _cons |  -1303.544    2521.66    -0.52   0.605    -6246.146    3639.059
-------------+----------------------------------------------------------------
     sigma_u |  16306.962
     sigma_e |  7650.8189
         rho |  .81958804   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5584, 25042) =    11.27         Prob > F = 0.0000

5 . xtreg inprice cpi ,fe

Fixed-effects (within) regression               Number of obs      =     30630
Group variable: gvkey                           Number of groups   =      5585

R-sq:  within  = 0.0002                         Obs per group: min =         1
       between = 0.0016                                        avg =       5.5
       overall = 0.0004                                        max =        10

                                                F(1,25044)         =      4.29
corr(u_i, Xb)  = 0.0146                         Prob > F           =    0.0382

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         cpi |   12.10443   5.841084     2.07   0.038     .6555586    23.55329
       _cons |  -616.9265   603.5528    -1.02   0.307    -1799.925    566.0724
-------------+----------------------------------------------------------------
     sigma_u |  16306.907
     sigma_e |   7650.534
         rho |  .81959806   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5584, 25044) =    11.27         Prob > F = 0.0000

6 . xtreg inprice gdp ,fe

Fixed-effects (within) regression               Number of obs      =     30630
Group variable: gvkey                           Number of groups   =      5585

R-sq:  within  = 0.0002                         Obs per group: min =         1
       between = 0.0016                                        avg =       5.5
       overall = 0.0004                                        max =        10

                                                F(1,25044)         =      4.15
corr(u_i, Xb)  = 0.0154                         Prob > F           =    0.0416

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         gdp |   5.957083   2.923929     2.04   0.042     .2260093    11.68816
       _cons |   2.766451     311.21     0.01   0.993    -607.2235    612.7564
-------------+----------------------------------------------------------------
     sigma_u |  16306.927
     sigma_e |  7650.5559
         rho |  .81959757   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5584, 25044) =    11.27         Prob > F = 0.0000
```

```
7 . xtreg inprice oil ,fe

  Fixed-effects (within) regression               Number of obs      =     30630
  Group variable: gvkey                           Number of groups   =      5585

  R-sq:  within  = 0.0001                         Obs per group: min =         1
         between = 0.0017                                        avg =       5.5
         overall = 0.0004                                        max =        10

                                                  F(1,25044)         =      3.36
  corr(u_i, Xb)  = 0.0143                         Prob > F           =    0.0667

------------------------------------------------------------------------------
     inprice |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         oil |    4.08578   2.228101     1.83   0.067    -.2814297    8.452989
       _cons |   397.2091   134.5349     2.95   0.003     133.5129    660.9054
-------------+----------------------------------------------------------------
     sigma_u |  16307.546
     sigma_e |  7650.6763
         rho |  .81960415   (fraction of variance due to u_i)
------------------------------------------------------------------------------
  F test that all u_i=0:     F(5584, 25044) =    11.27          Prob > F = 0.0000

8 .
```

J. Monte Carlo Simulation



	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	Start	100												
3	σ	0.2												
4	Drift	0.08												
5	T	1												
7	dt	0.083333												
8	Antal skridt:	12												
11							t							
12	Simulation time	0	0.083333	0.166667	0.25	0.333333	0.416667	0.5	0.583333	0.666667	0.75	0.8333333	0.9166667	1
13	Value	100.00	106.40	114.17	115.57	105.01	109.41	115.12	112.09	114.41	121.83	110.17	118.62	111.18

	C	D	E	F	G
15		111.18			
16	1	98.58032	0	0	1145
17	2	98.50634	0	0	
18	3	152.2479	1	0	
19	4	127.7759	0	0	
20	5	91.24669	0	0	
21	6	117.1437	0	0	
22	7	133.6117	1	0	
23	8	97.35445	0	0	
24	9	82.60792	0	0	
25	10	122.6432	0	0	
26	11	112.0093	0	0	
27	12	97.94251	0	0	
28	13	112.0125	0	0	
29	14	116.5551	0	0	
30	15	126.0092	0	0	
31	16	108.9265	0	0	
32	17	101.1008	0	0	
33	18	70.99417	0	1	
34	19	127.0973	0	0	
35	20	123.2861	0	0	
36	21	93.38797	0	0	
37	22	100.5622	0	0	