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**Empirical study on the effect of the
return on investment on budgetary slacks
in investment expenditures**

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UNIVERSITY OF BURGUNDY
DIJON SCHOOL OF MANAGEMENT
MASTER'S DEGREE IN CONTROLLING

**Empirical study on the effect of the return on investment on budgetary slacks in
investment expenditures**

Master's thesis

Academic year 2015/2016

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Abstract

The purpose of this thesis is to undermine the possible effect of the return on investment on budgetary slacks. Prior literature on slacks, on the one hand, and return on investment on the other is rather extensive. Hence, we have been appraising the effect of the ROI on budgetary slacks in investment expenditures. For this purpose, we have been setting a cross-sectional study in a worldwide known company by using inferential statistics. We did not find any effect or possible association between this profitability ratio and budgetary slacks, however, we found that slacks could be highly influenced by the size of the project. Firstly, this might suggest that the ROI is not a good tool to manage budgetary slacks in investment expenditures and secondly, the fact that slacks could be influenced by size might undermine the “weaknesses” of some papers on this very subject.

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The time has come to thank all my family and, particularly, my parents for all their kind attention and support during this long period. For the past six years, your support has been both unquestioning and essential to my personal accomplishment. I love you.

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1. Introduction

2016 - we can still feel the bribe of the economic crisis that burst almost ten years ago. A mutant and worldwide crisis has affected all strata of the “real economy”. Renowned economists such as [Eggertsson](#) and [Mehrotra \(2014\)](#) even outlined a “secular stagnation” in the open economy.

8 April 2015 - Manuel Macron, the current French Prime Minister, launched an initiative to promote industrial investments. In fact, for all industrial assets eligible to the French accelerated tax depreciation and bought between the 15th of April and the 14th of April 2016, companies can depreciate over 40% on the asset’s first cost.

These major events drove both reinforcement in budgetary control inter alia in budgetary.

Slacks and more particularly budgetary slacks are old subjects that have been studied for more than fifty years. First, [Cyert and March \(1963\)](#) defined Corporate slacks as “a double constraint linked to individual’s satisfaction and aims achieved”. Slacks would actually give the necessary flexibility face to an uncertain, and rather fluctuant environment. More recent studies considered the existence of budgetary slacks in investment expenditures; indeed, slacks would promote creativity and innovation ([David 2010](#)). Slacks are also defined as “a deliberately created difference between the budgeting actor’s forecast about the future and his or her submitted budget figure” ([Lukka 1988](#)), “an inefficient use of resources or “underperformance by informationally advantaged individuals such as local business unit managers” ([Indjejikian and Matejka 2006](#)). Investments intended to create value, among other things, are linked to creativity and innovation. On the financial side, companies investing for matters more or less linked to profitability have to be as low as possible and future cash flows have to be as high as possible in order to get the highest profitability ([David 2010](#)). Hence, companies using innovation and creativity with a competitive advantage have to assess this profitability in order to highlight and improve its determinants. However, what would be the best way to assess this profitability? An answer was given more than fifty years ago through the famous “DuPont de Nemours” pyramid and its decomposition of the return of investment driven by the founding father of controlling; also well known as General Motors CFO, [Donaldson Brown](#).

The purpose of this Master thesis will be as a consequence to connect those two main controlling concepts by trying to figure out if investment budgetary slacks could be managed and reduced by the use of the ROI.

Literature highlighting the effects of budgetary slacks, investment slacks and its determinants and emphasizing the ins and outs of the use of the ROI are rather abundant but, to the best of our knowledge, no study has focused on the possible effect of an ex-ante assessment of profitability on these investment slacks. This poses the research question: “Is an ex-ante measure of a ROI a good way to manage budgetary slacks in investment expenditures?”

To show our contributions to the extensive literature, the remainder of this thesis is organized as follows: we will start with a literature study followed by a cross-sectional analysis based on inferential statistics. The data gathered comes from Operational plans and discounted investment budgets in an industrial company leader in its business worldwide.

Beginning this thesis, we hope to contribute to this extensive literature in several ways. Firstly, we wish to outline some points of the literature about budgetary slacks in investment expenditures. Secondly, we hope to show the drawbacks and issues of current and past papers on budgetary slacks.

2. Building hypothesis and literature review

The purpose of this first chapter is to define the conceptual framework tested to answer our research question. To do this, the remainder of this chapter first defines the dependent variable Y, namely investment slack (2.1), and independent one, namely used of ROI (2.2). Then we will develop our logical argument and our hypothesis (2.3).

2.1. Investment slacks: variable Y

The first part of the theoretical context aims at defining the main concepts used thereafter. For this purpose, based on the work of David (2012), we first define the concept of slack (2.1.1) then list its characteristics to develop an operational definition (2.1.2), and finally, introduce an extraneous variable (2.1.3).

2.1.1. Slack big picture

A prior definition for budgets is given by [Lukka \(1998\)](#) as a profit plan or a target, the literature undermining the negative and positive aspects of slacks in the budgeting process. Actually, if for some authors we should stop creating budgets in the classical way because it is a waste of time and it creates inflexibility ([Wijnhoven 2010](#)) for some others, objectives of budgets are “facilitating the decision-making and mitigate control problems” ([Indjejikian, Matejka 2006](#)). Participation and targets are widely considered as incentives that increase the efficiency of an organization. However, this concept may look efficient in a theoretical perspective, however, empirical research reveals that overall results occur infrequently. In fact, “important dysfunctions can be described through slacks” ([Gintrac 2012](#)). But how can we stand that slacks can stamp out the budgetary process by minoring the results? Can we even say that slacks are minoring results or, rather, could it be proof of a past performance?

Through prior literature we can highlight several ways to define slacks in what could be considered a positive or negative way. On the one hand, slacks involve organizational issues; On the other hand, slack is a concept that shows the efficiency of the company ([Prudence 2010](#)).

This complex approach is not just the result of a mechanical effect due to differences between budgets and actuals. It appears as well that personal factors are driven by agency theory and information asymmetry, organizational and contextual factors. Prior literature undermines a big amount of determinants. The following part aims to give a general overview of it.

2.1.1.1.Environmental factors: uncertainty and culture

A wide amount of research has shown that slacks are a natural answer to uncertainty and that there is a positive link between the level of uncertainty and slacks. To cope with uncertainty, organizations need to have access to complementary resources to absorb short-term variations. For [Dunk \(1993\)](#), the uncertainty is an explanatory factor defined by the complexity, the variability of the task, and the unpredictable events that could impact the process.

Beyond that, [Kren and Liao \(1988\)](#) have shown that propensity to identify slack within the IT system is as hard as uncertainty is high. In other words, the higher the uncertainty in the market (raw materials cost variation, needs for the product etc.), political environment (waiting for the announcement of a new law) or any other environmental aspect, the harder the slack will be to identify. As a consequence, there is a double effect of uncertainty that contributes to converting slacks and hiding it.

According to [Hofstede \(1984\)](#), organizations are deeply affected by cultural dimensions. [Lau and Eggleton \(2004\)](#) suggest that “national culture does not influence the subordinates’ propensity to create slack directly. Instead, a much more accurate model is needed to explain how national culture affects slacks”. If that is the case, a direct link might do not exist, but we can certainly highlight indirect links between national culture and slacks. Actually, slacks would be affected by national culture through its effect on budgetary participation inter alia over a “three-way interaction model involving budgetary participation, budget emphasis and information asymmetry” ([Prudence 2010](#)). In this way, in a high participatory culture, budgetary slack would be low because “the information asymmetry is low or the budget emphasis is high” ([Prudence 2010](#)). However, there would be a lower budgetary participation system in which power distance is lower and cultures involve “discouraging employee participation” a much lower propensity to create slack because information asymmetry is high and the budget emphasis is high.

2.1.1.2.Organizational determinants: agency theory and budget participation

There is no doubt that without this process, budgetary slacks could not exist; indeed, without the managers’ participation in the budgetary process, “the executives would constrain the budget” ([Prudence 2010](#)). However, there are two ways of thinking about participation. The first one is based on agency theory and asymmetrical information; in this case, budgetary slacks would be caused by the fact that the different members of the company do not have the

same amount of information and more especially by some individuals being in possession of insider information. The second one is based on behavioral theory. This approach argues that “the managers’ participation in the budgetary process could enhance the relation between managers and subordinates. Slacks would then be decreased” (Prudence 2010).

From an economic perspective, participation would improve the decision making by allowing a bigger amount of information to circulate (Gintrac 2012).

If for Onsi (1973), Merchant (1985), Dunk (1993) and Govindarajan (1986) participation may implies a decrease in the manager’s tendency to create slack, they have also shown that this is the existence of several variables that can lead to this tendency such as distributive fairness, procedural fairness, interactional fairness. On the contrary, Young (1985) and Lukka (1988) have shown that participation may involve an increase of budgetary slacks (Prudence 2010).

There are no exact answers to this question. On the one hand, participation seems to potentially lead to an increase of budgetary slacks but on the other hand, some state that it would decrease the propensity to create it. Finally, the answer depends on the variables taken into account. But regardless of the question whether the relation between the budgeting process and slacks is positive or negative – the most important point is to understand that there is one.

| Organizational factors | External factors |
|-------------------------------|-------------------------------------------|
| Uncertainty | Agency Theory and Informational Asymmetry |
| Culture | Participation |

Table 1 : Slacks determinants summary

This first part gives a high level overview over the concept of slacks (Table 1). However, the review is not about corporate slacks themselves, but more about a particular aspect: the investments slacks. Having developed a nominal definition of the concept of investment slacks, the following point introduces the dimension of investment which will allow to operationalize this dependent variable in the method part in order to be able to answer our research question.

2.1.2. Towards an operational definition of investment slacks

Slacks are characterized as an increase of financial needs or as underestimated incomes. First, increases of financial needs are rather usual and could be defined as an increase of cash needed by individuals in order to get more than they should have if they had communicated the right figures. Second, the underestimation of the income represents a decrease of the income in order to avoid bigger objectives. David (2012) defines investment slack as “over or unnecessary expenditures linked to annual negotiations between operational and executives”. In practical terms, the slack is the difference between investment budgets, the updated budgets and actuals which allows us to identify three types of slacks (Table 2).

| Type | Description |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------|
| “The desired slacks” | Come from the negotiation process; correspond to the difference between budget request and resources finally allocated |
| “The non-consumed budget slacks” | Come from a non-consumed resource |
| “The residual slack” | Absorbed in the expenditures |

Table 2: The three types of slacks according to David (2010)

Investment slacks are characterized by a big number of investments and/or some over-dimensioned expenditure. Hence, if slacks are too high, this could involve a waste of resources. However, if slacks are too low, potential for innovation and flexibility could be reduced.

From the listed characteristics of investment slack and its effects, we could deduce a strong logical argument explaining the possible association of an ex-ante assessment of the return on investment and the amount of investment slacks.

Before nominally defining the concept of return on investment, the independent variable in this thesis, we will identify extraneous variables Z that could be a competing theoretical explanation of our answer to the research question stated in introduction.

Project sizes could have an impact on the fact that a return on investment has been computed. Indeed, while collecting data, we found that most of the time, a ROI has been computed for

big sized projects. Size is thus an extraneous variable Z_1 that could limit the internal validity of our study without statistical control at the analysis stage of our study.

Other extraneous variables that are directly linked to slacks are their determinants $Z_2...Z_n$. According to the relevant literature, the main determinants are built around internal and external factors, respectively due to Uncertainty and Culture for the internal, and Informational Asymmetry and the manager's Participation in the budgets for the external factors.

Now that the first main concept is defined, the next part will focus on the independent variable X, the ROI measure for a given project.

2.2.Return on investment overview: the independent variable X

As this thesis does not aim at pointing out the ins and outs of the return of investment concept, this part will just focus on giving a general overview over the different ways to assess profitability. For this purpose, based on relevant literature, we will start to develop an operational definition (2.2.1.) before discussing around the method used in the company (2.2.2.).

Corporate governance and financial assessing started in middle of the 20th century with the [Sloan-Brown](#) model. Donaldson Brown is known to be the father of the “DuPont de Nemours Pyramid”, a financial process scheme which represents the ROI divided into several trivial ratios. [Donaldson Brown](#) and his homolog Alfred P. Sloan are often described as the founding fathers of the modern “Management controlling concept”. The concept of a decentralized management control came up when Brown started a new carrier in the company ran by Sloan in 1929 after being CFO in Du-Pont de Nemours ([Bausch, Kaufmann 2000](#)). The two acolytes were convinced that “financial method is so refined today that it may seem routine; yet this method – the financial model, as some call it – by organizing and presenting the significant facts about what is going on around a business, is one of the chief bases for strategic business decisions”([Crefige 2003](#)).

2.2.1. The operational approach

(Table 2) gives an accurate summary of the different methods which can be used to measure a ROI (Cham, Darido, Jackson, Laver, Schneck 2006).

| | Method | Interpretation | Equation |
|--------------------|-------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| TVM has no impacts | ARR (Accounting Rate of Return) | Part of the costs relative to the cash flows, has to be > 1 | $ARR = \frac{\sum CF}{\sum(I_0 - depreciation)}$ |
| | PB (Payback) | Give the period of time needed to reach/cover the costs | $Payback = \frac{\sum I_0}{\sum CF}$ |
| TVM has an impact | IRR (Internal Rate of Return) | Size of the discounted cash flows to cover the discounted costs of the investment | $\sum_{i=1}^n \frac{CF_t}{(1+r)^t} - \sum_{i=1}^n \frac{I_t}{(1+r)^t} = 0$ |
| | NPV (Net Present Value) | Size of the discounted cash flows compared to the discounted costs | $\sum_{i=1}^n \frac{CF}{(1+r)^t} - I_0$ |

Table 3: Return on Investment operational standard methods

The payback is a profitability indicator; however, this method is questionable: We can find plenty of examples “which are in natural facts profitable but in which payback method stands that the project related should not be funded” (Levy 1968). In fact, the PB does not take into consideration the timing of the receipts which is the main difference to the discounted rate of return.

The Accounting rate of return developed by Kay (1976) is a “periodic and ex post indicator” (Feenstra, Wang 2000). This method is quite similar to the PB but more accurate in the way it takes into account the fact that earnings decreased over the periods. ARR is usually defined as the ratio of accounting profit earned in a particular period relative to the book value of the capital employed in the period.

While the discounted rate of return and the payback do not take into account the Time value of Money, both NPV and IRR involve the use of the discounted rate.

The Net Present Value determines the residual amount of money between discounted values of initial cash flows at a constant rate “ i ” and the initial amount of interest. I.e., “the NPV of a project is the sum of the present value of all its cash flows, both inflows and outflows discounted at a rate consistent with projects risks”. This risk indeed decreases the value of the earnings (Levy 1968 and Radman-Funarić, Galić 2009) and basically, for the same ARR, the earnings will decrease for a risky investment. As a matter of fact, the NPV represents the rest of the expected discounted cash flows CF_t for the period “ t ” at the rate of return “ r ” (Joly 1988). The advantage is that this method allows to discount both streams of costs and benefits under the assumption that one euro earned today is worthier than one euro earned in the future.

The Internal Rate of return is a similar way to measure profitability, the difference is rather small in appearance but the method’s goals are different. Fisher and McGowan (1983) define the IRR as “the discount rate that equates the present value of its expected net revenue stream to its initial outlay, and state that IRR is the only correct measure of the profit rate for purposes of economic analysis”. The difference compared to the last method is that we are computing a rate and not a stream of cash flows. Basically, the IRR is the rate “ r ” for which the sum of the discounted profits equals the discounted costs of the investment. Assessing this rate is an easy way to prognosticate if a project can be realized; indeed, there is no point in thinking about a project for which this rate is too high.

2.2.2. The preferred method

When an asset is bought, it is important to distinguish an investment which is impairing over the time and which will be capitalized in the balance sheet from an expense which is not impairing and which will directly impact the profit and loss accounts. This distinction is following the French Accounting rules and is transcribed in US rules through the USGAAP 360.10 on Property, Plant and Equipment (Table 4).

| Standard | P&E (Investment) | Expense |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| French Accounting rules | - Unit expenditure > 500 euros - Lifespan > 1 year Or any replacing good, capital enhancement or building extension respecting the two last points. | - Unit expenditure < 500 euros - Lifespan < 1 year Any expenditure without value added (no lifespan or productivity improvement) Rework expenditures Dismantling expenditures Destruction expenditures of a project Relocation expenditures |
| USGAAP 360.10 | Unit expenditure > 1500\$ | Unit expenditure < 1500\$ |

Table 4: USGAAP 360.10: Property, Plant and Equipment, Revision NO. 7.0, July 2014 and internal documents.

The general scope of the ROI being set up; we will highlight the method used in the company.

The method that fits the company's way of assessing profitability is the PB (Equ. 1).

$$Payback = \frac{\sum I_0}{\sum CF} \quad (1)$$

As a conclusion, even if the relevance of the concept of ROI is not a critical point in this thesis, this might have an impact on the way companies manage investment slacks. Indeed, if the indicator is not accurate enough or unrealistic, this will just be smoke and mirror and then, an indicator that we may consider as useful could have no impact on management or, worse, negative effects.

2.3.Hypothesis Building

This part will emphasize which hypothesis has been chosen according to literature and to some critical points that have to be filled to complete this thesis.

H₁ – The measure of a ROI for a given project has an impact on the investment slacks

Relevant literature on slack on one side and return on investment on the other is rather abundant. Some authors as [David \(2010\)](#) are focusing on “investment slacks”. To the best of our knowledge, there is no literature analyzing the link that could exist between return on investment and “investments slacks”.

Control Hypothesis H₂ – Project size is associated with measure of ROI

According to [Rosenberg \(1968\)](#), to establish an “elaboration model”, we need to identify a control variable according to the theoretical model which could explain the zero “relation order”. As a consequence, H₂ supposes an association between projects size and projects with an ROI evaluation.

Auxiliary Hypotheses – The sample is following a normal repartition and large enough for the use of parametric/non-parametric tests

First of all, in an attempt to verify H₁, the normal repartition of the samples studied has to be filed in order to determine the relevance of the use of a parametric or non-parametric test. As those tests are just auxiliaries, they are presented in the methodology part.

Limitative Hypothesis – The preferred method to measure the ROI

As stated in the conclusion part of point (2.2.) on ROI, the relevance of H₁ should be questioned according to the method used to measure the ROI ratio. Indeed, if the method is not reflecting the reality, it could imply management issues. I.e., “the quality of the controlling system depends on the quality of the information contained into it, this quality will also depend on the quality of internal control” ([Luciani, Hirsch, Polossat 2013](#)). This means that if the information used is not accurate enough or biased, managing with a ratio related to it could be pointless or even dangerous. This point will be further developed in the conclusion part.

3. Methodology

Having listed the characteristics of both concepts (investment slacks and ROI) and the arising hypotheses, this part will focus on how the method has been implemented to answer our research question. Therefore, this part will start with presenting how the data has been collected and giving a nominal definition to our concepts (3.1.). The following point will then aim at presenting the research design (3.2.) before emphasizing how the data has been processed.

3.1.Data Collection

To illustrate this study, we have analyzed two types of projects in order to compare slacks. As a consequence, we have used data from investment projects both with and without ROI measure to then compare this data in terms of slacks with the help parametric test.

For projects without ROI measure, we have worked with data from a budgetary file presenting different figures from the “operational plan” from 2011 to 2015 compared to actuals after the closing period (20XX.31.12), i.e. the cumulative actuals from each month (Table 5). Concerning projects with a ROI measure, the data originates from both files used for the projects without ROI calculation as well as another file (Figure 1).

Whereas the data needed for slacks without ROI calculation has been relatively uncomplicated to compile (Table 5), data for slacks with ROI appraisal has been harder to collect. Indeed, for each one of the projects for which we felt a size influence, there is a matrix in order to assess the usefulness, the viability and, most of the time, the ROI (Figure 1). As a consequence, all that was needed to gather the respective information was to read these matrixes in order to determine which projects have effectively used a ROI calculation and, in a second step, to find them in the budgets (Table 5).

| Project | Operational Plan | Cumulative actuals after closing period | Slack |
|----------------|-------------------------|------------------------------------------------|--------------|
| XXXX | A | B | =B-A |

Table 5: Step 1 → Slacks calculation for both types of projects (with and without ROI assessment)

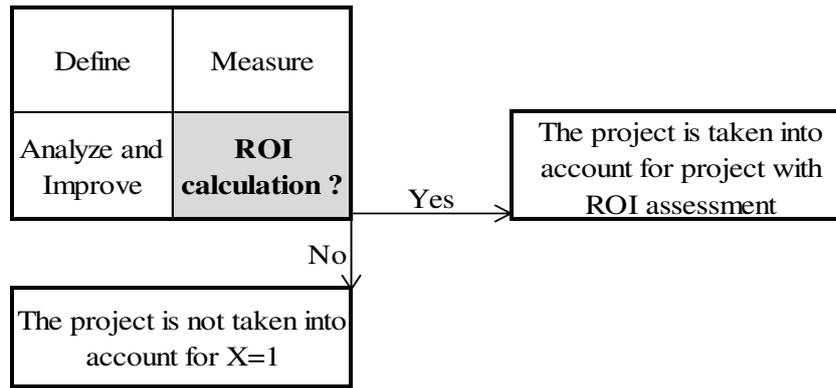


Figure 1: Step 2 → Process to find out the slacks with a ROI calculation

Table 5 and Figure 1 give an example of how the data has been collected for both types of projects. The sample contains 286 data records assessing the slack from projects both with and without ROI assessment.

3.1.1. The ROI calculation for a given project

The first variable is X, the ROI measure for a given project. X has been measured with the PB as the sum of the cash flows through the periods assessed divided by the overall cost of the project, but there is no point in exposing how the ROI is calculated here as the purpose is to find out if an ROI assessment for a given project is negatively associated with slacks. This would mean that the ROI assessment would actually decrease the amount of slacks. Given that, variable X will take two modalities: X = 0, namely the projects without ROI assessment as well as X = 1, namely projects with a ROI assessment.

3.1.2. Investment slacks

The second variable is Y, the investment slack for a given project X. The “investment slacks” are defined as an over or unnecessary amount of money resulting from annual negotiations between the direction and the managers (David 2012). On the operational side, this definition has to be relativized; in fact, if slacks can be considered as an amount exceeding budgets due to asymmetrical information between the different strata of the hierarchy, this is also a mechanical effect due to the budgetary process itself. (Table 5) and (Figure 1) give a summary on how slacks have been assessed. Basically, this variable has been measured as the difference between the operational plan and the cumulated actuals for both modalities of X.

3.1.3. Extraneous variables

The third variable is Z_1 , namely the size of a given project. This variable has been implemented because we felt a size effect. According to executives, regarding the amount of projects launched every year (about 1000), there is no point in measuring a ROI for each project; therefore, the ratio is only assessed for big projects (around 100 k€).

However, there are other determinants of slacks $Z_2...Z_n$ that are not considered and measured in this study. For some authors, slacks are just “opportunity losses” and an over-cost for the organization, some others explain it in a much more positive way; according to them, slacks are necessary for long term growing. Are slacks due to an old period of growing? Are they favored by periods of uncertainty? Do they result from risk aversion?

3.2.Design

There are different possible types of design: cross sectional, longitudinal, study case, experimental. The design we chose for this thesis is a cross sectional one; this can be described as an approach “that studies a cross section of the population at a single point in time” (Bailey 2004).

Our case is based on data coming from budgets from different periods of time and investment projects realized by the worldwide leader in the industrial sector which realizes more than 200 million euros of investments each year. This choice has been motivated by several factors. There are plenty of papers about slacks such as David (2010), who has worked on budgetary slacks in investment expenditures and as many others on the ROI. Nonetheless, there are no studies on the association between the two concepts. As a consequence, this study could be useful for any further research on this question.

This design seems to be the most adequate according to the complexity and the data required. We have basically examined the relationship between Y, namely the slacks, and both modalities of the independent variable X as well as with Z_1 , namely the project size as the control variable. Two sources of information have been crossed to gather the data needed: Budgetary data coming from operational plans and monthly follow-ups of the investment budgets have been collected and compared with big sized projects using a matrix usually used to support the purchase of an asset.

The high level overview over the design and methodology of the research being done, the next part will explain how the results have been found.

3.3.Data processing

To follow this cross sectional study, we have used the software “R” version “3.2.5”. R is open software for data treatment and analysis using the S programming language. The queries and packages used are summarized in Table 6.

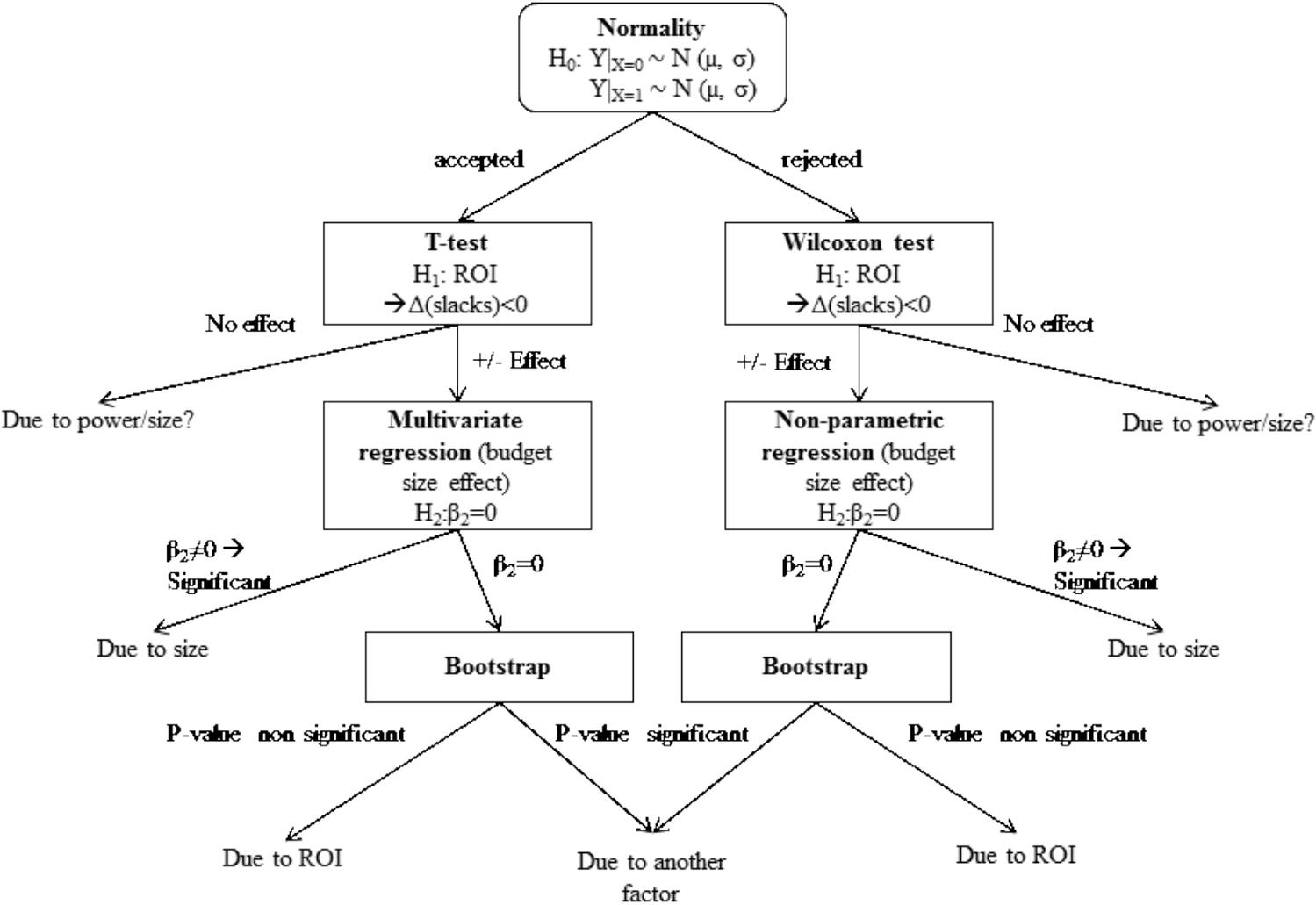
| | Test | Package | Query |
|-----------------------------|-------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Variable declaration | NA | NA | <pre> U =rnorm(A,mean=B, sd=C) Scan on X,Y,Z Bootstrap : fit=lm(Y~X+Z) library(car) Betas <- coefficients(fit) M<- length(Betas) R=10000 BtStrpRes <- matrix(rep(0,M*R), ncol=M) for(in 1:R) {BtStrpRes[i,] <- coefficients(lm(unlist(simulate(fit) ~X+Z))) </pre> |
| Auxiliaries tests | Normality | Nortest | Shapiro.test(U); lilie.test(U) ; ad.test(U) |
| | Power* | pwr | pwr.t2n.test(n1,n2,d,alternative="greater") |
| Main tests | Student | NA | t.test(Y x=0,Y x=1) |
| | Multivariate regression | NA | Summary(lm(Y ~X+Z)) |
| | Bootstrap | NA | <pre> P_valn <-mean(abs(BtStrpRes[,n] - mean(BtStrpRes[,n])) > abs(Betas[n])) (Comment : For n=1,2) </pre> |

Table 6: Queries and packages used to implement the design

* With “n1” and “n2”, respectively the size of the sample for X=0 and X=1

The adage “garbage in, garbage out” involves that assessing the ideal size of a sample is a critical point that has to be filled before proceeding any further. Hence, and according to relevant literature, we have assessed the ideal size of samples for a given power and supposed a medium effect for $Y|_{=0,1}$. Then, thanks to a normality test ([Shapiro-Wilk](#), [Kolmogorov](#), [Darling-Anderson](#)), we have made a choice between a parametric and a non-parametric test,

namely between a Student test and a Wilcoxon test to assess the equality of means with all inferential consequences involved and with a “d” of 0.8 according to Cohen (1988). We then have assessed the value of the slope of both coefficients of a multivariate regression on explanatory variables X and Z through the explained variable Y before testing the results’ strength with a bootstrap.



Model 1: Design big picture

4. Results

Table X recapitulates all descriptive statistics that have been used in order to lead this study using R v 3.2.5. .

| | Global | X=0 | X=1 |
|--------------------|--------|-------|--------|
| Frequencies | 286 | 196 | 90 |
| Mean | 172.98 | 28.85 | 486.87 |
| STDEV | 361.49 | 23.51 | 605.57 |

Table 7: Data used for the study

| Variable | Budget sizes Z | Investment slacks Y | Projects related to X=0 and X=1 |
|----------------------------------------|----------------|---------------------|---------------------------------|
| Budget sizes Z₁ | 1 | 0.05 . | -0.06 *** |
| Investment slacks Y | 0.05 . | 1 | 0.53 |
| Projects related to X=0 and X=1 | -0.06 *** | 0.53 | 1 |

Table 8: Bivariate correlation matrix

Notes: n = 286; p → 0 ***, p < 0.001 **, p < 0.01 *, p < 0.05 .

A power test using the function `pwr.t2n.t` test has been conducted. Power analysis is an ex ante condition to follow the study. Actually, power analysis is a process that allows determining the ideal size of a sample for a given medium effect and a low p-value (5%) with a power of 80%. A medium effect is commonly used in management analyses and basically answers the question: what would be the minimum amount of projects needed get a probability of 80% to reject the null hypothesis that ROI has no effect on investments slacks? Using [Cohen \(1988\)](#) $d = 0.8$ and with a medium effect (0.5), we found a power of 0.9885 which means that using data in the same condition would involve the same results with a probability of 98.85%.

| Test | Shapiro-Wilk | Kolmogorov | Darling-Anderson |
|---------------|--------------|------------|------------------|
| X=1 | 0.3023 | 0.7223 | 0.3314 |
| X=0 | 0.1465 | 0.4754 | 0.1785 |
| Global | 0.1751 | 0.3064 | 0.2372 |

Table 9: p-values resulting from Normality tests

Notes: $n = 286$; $p \rightarrow 0$ ***, $p < 0.001$ **, $p < 0.01$ *, $p < 0.05$.

Null hypothesis: $U \sim N(\mu, \sigma)$.

Table 9 presents the results used to assess the normal repartition of slacks for both modalities of X. “The outliers bring to Kolmogorov-Smirnov statistic errors of type II”, so that results from Kolmogorov (Jäntschi, Bolboacă 2009) will not be taken into consideration to assess normality. However, for both Shapiro-Wilk and Darling-Anderson, the p-value is higher than the conventional type I error cut off (5 %). Hence, we can admit that the null hypothesis, namely the normal repartition for both tests, is not rejected.

Normal repartition for both samples has therefore been showed, a student test has been used following on from Model 1. A student test or t-test is a set of parametric hypotheses tests for which the statistics calculated are following a “student law” when the null hypothesis is true. In the context of this thesis, a student test has been used in order to assess the hypothesis of equality of means between $Y|_{x=0}$ and $Y|_{x=1}$. Relevant literature admits that normality is a sufficient and necessary condition to determine the necessity of using a Wilcoxon test rather than a t-test for bivariate analyses. More recent papers have thrown a stone into the water by arguing that “the choice between t-test and WMW DRs should not be based on a test of normality”; actually, “the choice of a decision rule for an application should be based on knowledge of the application, and ideally should be done before looking at the data to avoid the appearance of choosing the DR to give the lowest p-value”. Moreover, “even if we reject the normality assumption, we may be justified in using a t-test decision rule” (Fay, Porschan, 2010). As a consequence we have conducted a t-test. The results are displayed in (Table 10).

Null Hypothesis: $\text{Mean}(Y|_{x=0}) = \text{Mean}(Y|_{x=1})$

| t | df | p-value |
|----------|-----------|----------------|
| -4.992 | 100.753 | 2.503e-06 *** |

Table 10: t-test results

Notes: $n = 286$; $p \rightarrow 0$ ***, $p < 0.001$ **, $p < 0.01$ *, $p < 0.05$.

The main issue is that the p-value is not significant enough to prove the equality of means between $Y|_{x=0}$ and $Y|_{x=1}$. Then, as it looks that the hypothesis of equality of means is rejected, computing a return on investment could be positively associated with slacks. However, any other variable could have an impact on Y.

Given the last tests results we have analyzed the question whether there is any link between the size of the project and the two modalities of X. Hence, a multivariate regression has been used (Equ. 2). Queries in Table 6.

$$Y_i = \beta_1 * X_i + \beta_2 * Z_1 * \varepsilon_i \quad (2)$$

With:

- β_1 = the sensibility of Y to X namely the sensibility of both modalities of X
- β_2 = the sensibility of Y to Z namely the sensibility of slacks to the size of the project
- ε_i = the missing information in the linear explanation of Y_i , i.e. the possible missing variables

| Variable | Estimate | Std. Error | t-value | p-value |
|----------------------|-----------------|-------------------|----------------|----------------|
| X | 436.351 | 25.171 | 0.802 | 0.205 |
| Z₁ | 0.101 | 46.44 | 9.40 | 2e-16 *** |

Table 11: Size and ROI significance

Notes:

$n = 286$; $p \rightarrow 0$ ***, $p < 0.001$ **, $p < 0.01$ *, $p < 0.05$.

$$R^2 = 0.2822$$

According to these results, the regression line slope β_1 (related to X) is not statistically significant. On the other hand, the regression line slope β_2 (related to Z_1) is statistically significant and $\beta_2 \neq 0$; thus, Z_1 could be associated to Y.

Then, the multivariate regression can be summarized as a linear regression (Equ. 3).

$$Y_i = 0.101 * Z_1 + \epsilon_i \tag{3}$$

Finally, we have used a bootstrap with a given size of 10 000 to undermine the robustness of the multivariate regression and to assess if there is any point in declaring an extraneous variable linked to slacks determinants.

| Variable | original | bootBias | bootSE | bootMed |
|----------------------|----------|----------|---------|---------|
| Intercept = Y | 20.183 | 5.311 | 18.1657 | 21.872 |
| X | 436.351 | 7.224 | 82.208 | 441.207 |
| Z₁ | 0.109 | -0.067 | 0.229 | 0.0872 |

Table 12: Bootstrap results

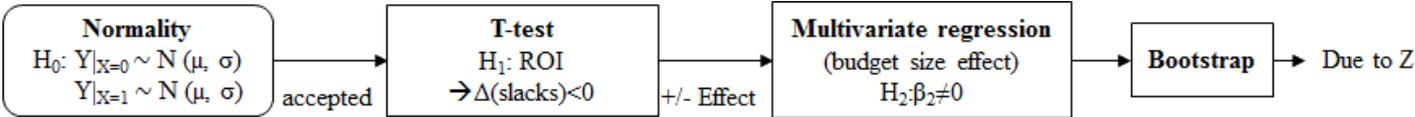
| Variable | p-value |
|----------------------|----------|
| X | 0.423 |
| Z₁ | 0.000*** |

Table 13: p-values Bootstrap

Notes: n = 286; p → 0 ***, p < 0.001 **, p < 0.01 *, p < 0.05 .

The p-value for X is not statistically significant, thus a variation of slacks Y is not due to calculating a ROI X, but to another factor and this factor seems to be the size Z₁.

Finally, Model 2 has been applied:



Model 2: Model finally applied

5. Discussion

Auxiliary tests proved the relevance of the use of parametric statistics. But this part will not be developed any further as this represents ex-ante condition.

Within this industrial company, a big amount of slacks has been found. In fact, the average slack for both modalities of X is high; i.e. for the overall amount of projects, we found an average slack of 173, but this result is skewed by extreme values involved by projects with a ROI assessment. Indeed, the average for $Y|_{x=0}$ equates to 28 while the average for $Y|_{x=1}$ equates to 486.

Hypotheses asked came from direct observation and as to our knowledge, these questions have never been exposed, we could interpret the results as an ex-ante condition to lead any study about slacks, then, this may confirm or infirm some of it.

The first variable discussed in this cross sectional study was $Y|_{x=0,1}$, namely the relation that may exist between slacks and ROI. Actually, our main hypothesis is that return on investment has a negative effect on investment slacks. In other words, calculating an ROI for a given project may reduce slacks. Results from the conducted t-test reject the equality of means for both modalities of X. This means that calculating a ROI may influence slacks. However, slacks could be influenced by any other variable which as shown by the multivariate regression on X and Z_1 , namely the measure of a ROI for a given project and the size of the project. The multivariate regression has shown that the slope of the regression line equates to zero for X and is positive and significant for Z_1 ; therefore, H_1 is rejected and we can assume that ROI is not a relevant aspect in managing slacks and this point is confirmed by the bootstrap onto the regression according to the significance of the p-value for X. Finally, the “Elaboration technique” has shown a fallacy relation between X and Y which is proven by our analysis. We can therefore assume that Z_1 is prevalent to X and Y. As a consequence, firstly, the budget size involves both modalities of X; i.e., the budget size involves the fact that we or we do not assess a return on investment, on the other side, the size is a positive function of slacks, so that, we can determine a causal relation between Z_1 and X and between Z_1 and Y, but we cannot assume a causal relation between X and Y (Rosenberg, 1968).

Moreover, results showed that investments slacks are highly influenced by projects size which confirms our hypothesis H₂ for which assessing or not a ROI depends on the project size. But this point may go a bit further: Actually, if the size of the project is so relevant for investment slacks, this may confirm the typology employed by [David \(2010\)](#) (Table 14).

| David Typology (2000) | |
|---------------------------------------|--------------------------------|
| Big sized projects | Desired slacks |
| | The non-consumed budget slacks |
| Small sized projects | The residual slacks |

Table 14: David investment slacks typology Enhancement

The last table shows our proposition to further develop David’s typology; actually, we assume that desired slacks, non-consumed budget slacks, are related to big sized projects while they may represent the biggest part of investment slacks.

But these results are also questioning the relevance of the data that has been used in some papers. [David \(2010\)](#) defines desired slack as “the result of the negotiation process”, the unconsumed slack as “the difference between budgets and actuals” and the residual slacks as “as a slack absorbed in actuals expenses”. Splitting the results between “big sized” and “small sized” could allow being more accurate on this subject.

More generally, for [Wijnhoven \(2010\)](#), slacks might be influenced by some variables such as effort or stress but bring forward a mean of 2.5, a maximum of 3.17 and quote “some slack has been found but the mean is not high”. Furthermore, [Wijnhoven \(2010\)](#) continues his thesis citing [Dunk \(1993\)](#), who has “shown a mean of 13.5 on a theoretical scale of 4 -28”. Those results look pretty close to ours for the X=0 modality which basically stands for small sized projects. But if slacks are defined by projects size, what would be the point in making a study about slacks or investment slacks for small sized projects?

As a consequence, on the basis that our results on investments slacks could be applied on slacks generally speaking, the results of the quoted papers could be skewed by slacks coming from small sized projects.

6. Conclusion

There are different ways of budgeting (Hansen 2003) and at least as many possibilities to create slacks. The two main objectives of a budget are to facilitate the decision making and mitigate control issues (Indjejikian, Matejka 2006). Slacks could be defined as a way to promote creativity and innovation (Nohria, Gulati 1996) or as a sign of past performance (Bradley 2007). On the other side, ROI as the central concern of D. Brown within General Motors is a way to assess profitability by comparing cash inflows and outflows.

Managers are creating slacks for different reasons. These slacks are hard to detect by higher management and therefore, it is difficult to reduce them within their organizations (Wijnhoven 2010). The purpose of this thesis has been to highlight that slacks could be negatively related to profitability indicators, in other words, that some factors such as the ROI could decrease budgetary slacks in investment expenditures. The question is if, within this organization, the assessment of a ROI actually reduces slacks in investment expenditures or if slack is determined by another factor. But, an indicator cannot be sufficient by itself to manage budgetary slacks, in investment expenditures as in any other matter. An indicator has to be used by managers to guide their business, projects and area of responsibility. Prior literature often tries to emphasize the downsides and advantages of budgetary slacks (Wijnhoven 2010) and its determinants (Lau, Eggleton 2004), but to the extent of our knowledge, our theme is innovative. The research question was: “Is an ex-ante appraisal of a ROI an appropriate way to manage budgetary slacks in investment expenditures?”.

A cross-sectional study using budget information coming from the Investment and Financial service within an industrial company that is a worldwide leader in its business has been used in order to lead this analysis.

We showed a fallacy relation between our two variables represented by investment slacks on one side and the fact that we do or do not calculate a ROI for a given project. Indeed, results prove that a third variable, the project size, is prevalent for slacks. In fact, the project size seems to be a positive function of slack and to determine its amount. Then, first of all, we proposed to follow and precise David’s investment Slacks typology by adding a new dimension represented by the project size. Residual slacks would be impacted by small sized projects; desired slacks and non-consumed budget slacks would be influencing big sized projects. But this study also throws a stone in the water by showing that, if the size is a necessary and sufficient condition, we could question the relevance of studies that aim at

determining slacks determinants and effects. Indeed, if size really is a prevalent condition to slacks, then an assessment of the budget size should be conducted before making any assumptions about slacks. Finally, this study shows the importance of the Pareto principle: Assessing slacks in small sized projects would look like the tree in spite of the forest.

However, we should interpret those findings in the light of some limitations. A first drawback would be directly linked to the way return on investment is implemented in the company. In fact, calculating a ROI is not the priority or at least this is not a systematic process; such assessments of the profitability are done, most of the time, for certain projects, generally speaking, the most important projects that could have an effect on the company's overall financial results. Furthermore, as this thesis undermines those effects for slacks in "investment" expenditures, a similar study should be conducted for budgets on a more general level. Moreover, the company is basically using the Payback method in order to assess profitability; this could skew the results. Indeed, there are plenty of examples which are in natural facts profitable but for which the payback method comes to the conclusion that the project in question should not be funded (Levy 1968). As a consequence, to enhance the results, an ex-post assessment of the return should be taken into consideration in order to highlight the differences in terms of profitability by first comparing ex-post and ex-ante results using the payback method. Then an ex-post assessment of the ROI should be done by comparing basics methods, for example the PB and the IRR compared with methods using a discounted rate, i.e. sensible to the "time value of money".

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