# Variations In the Permanent Measurement Bias

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Estimating the discrepancy in economic value and accounting value

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**Abstract**

Valuation techniques that use the accounting permanent measurement bias (PMB) do often result in robust corporate valuations. Runsten (1998) presented a table that displays median partial PMBs for important asset classes in a selected number of industries. The table did not describe how the partial PMBs varied within industries. This study aimed to create an updated table including the 25th and the 75th percentiles of the partial PMBs. Sample data was collected manually from the 2009-2013 annual reports of 213 Swedish companies listed on Nasdaq OMX Stockholm. Estimations of partial PMBs in six asset classes were presented for ten industries. In most industries, the partial PMBs turned out to have notable variations from their medians. The partial PMB in deferred taxes has decreased substantially compared to Runsten's table. However, no large differences from Runsten's table were discovered overall for the other asset classes. Investors are encouraged to consider potential industry variations and changes in deferred taxes when using the PMB in corporate valuation.

**Keywords:** permanent measurement bias, PMB, accounting bias, Mikael Runsten, residual income valuation

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# 1 INTRODUCTION

This paper deals with issues of valuation and financial analysis. In a larger picture, it attempts to aid investors in the trade-off between making robust equity valuations, and distributing their time effectively.

More specifically, the paper examines an alternative way of estimating the so-called horizon value of corporations. Most conventional valuation techniques in practice today use models that discount expected future cash flows into a net present value. While net present value was originally designed to value bonds and projects with terminal dates, corporations are instead expected to continue their operations in perpetuity. To facilitate the task of performing corporate valuation, future cash flows are usually forecasted for an explicit forecast period that stretches to a certain point in time when profitability is expected to remain constant. This point in time is usually named the "steady state" or the "forecast horizon".

After the forecast horizon, expected cash flows are commonly valued as perpetuities with the well-known Gordon Growth model. This model requires the financial investor to make specific assumptions on dividends, growth and the cost of capital. Small changes in these assumptions can create large deviations in the estimated value. In order to make these assumptions accurate, investors are required to either perform time requiring research, or to accept a larger range in the estimated corporate value. Time restricted investors might want to consider alternative methods for estimating the horizon value, giving more robust valuations in relation to the time spent.

Runsten (1998) found that the long-term market-to-book ratios for different industries can be predicted with quite satisfying reliability by identifying their median permanent measurement bias. A permanent measurement bias is a permanent difference in market value and accounting book value that arises primarily due to conservative accounting. A proper estimation of the permanent measurement bias can consequently serve as an alternative method for estimating the horizon value.

Previous research on the permanent measurement bias has presented tables showing the median bias for different asset classes between industries. These tables can aid time-restricted investors in their work by allowing them to focus on the explicit forecast period and less on estimating the horizon value. However, it could be argued that sufficient information to make confident firm-specific valuation choices in a more time effective manner is lacking. Time restricted investors might appreciate a more detailed table that could be used to estimate the horizon value. This study therefore aims to identify the variations in the permanent measurement bias within industries for the companies that are publicly traded on the Swedish Stock Exchange.

## 1.1 Background

There are an enormous number of investment possibilities in the world. Of these, only a few are publicly traded companies, available for anyone with free capital to invest. The Stockholm Stock Exchange alone has over 250 companies to choose from. It in turns dwarves in comparison to the number equity investments available on stock exchanges in the rest of the world.

Once investors have decided to invest capital into the stock market, they are left with the question of which price to pay for these securities. This issue has two mainstream solutions today. The first view is the notion of a strong-form efficient or a semi-strong-form efficient market, where at least all public information is priced into the securities. Investors can then buy these equities at the given market prices, since they are assumed to be perfectly or semi-perfectly priced. The other view is that stock markets are weak-form efficient and that securities are imperfectly priced, meaning that it is possible to find investments that are undervalued by the stock market by performing financial analysis.

Whichever view is correct is being debated by professionals and academics today. However, as argued by Penman (2012), for the market price to capture the correct value of a security, it is required that all investors conduct impeccable research when valuing stocks in the first place. Previous research combined with the fact that several value investors have systematically beaten the market over long periods of time, makes this paper take the standpoint that the market is weak-form efficient. It is then possible for investors to profit from performing exceptional financial analysis when conducting investments.

Clearly, it is not possible for any investor to thoroughly analyse all the stocks in the world and pick the best investing decision. It is an issue that has given rise to many screening frameworks, both qualitative and quantitative, and it is also an issue that has given rise to the topic of this study. In order to conduct financial analysis in a practical way, investors need valuation models that are fairly easy to use and give reliable estimations of corporate value, relatively to the time they have spent performing the valuation.

## 1.2 Previous literature and theory

Valuation models today tend to rest on the assumption that expected cash flows cannot be valued equally due to issues of timing and risk. Miller and Modigliani (1961) showed how an investor could estimate the present value of future cash flows that are generated by the company's assets. The future cash flows should be discounted to their net present values with an appropriate discount rate, as illustrated in equation [1:1]. This discount rate is supposed to capture several factors that determine the cost of capital.

$$NPV_{0,j} = -C_{0,j} + \sum_{t=1}^{T} \frac{C_{t,j}}{(1+r_j)^t} \qquad [1:1]$$

$C_{t,j}$ $= \textit{Cash flow to, or from company j at time t}$

$r_j$ $= \textit{Cost of capital}$[1]

Companies are expected to live forever and there is no specific date for interest payments, nor a repayment of the initial investment as there is with a bond. The positive cash flows that can be expected from a stock are most likely in the form of dividends. Therefore, most valuation methods stem from the present value of the future expected net dividends. These valuation techniques require investors to make assumptions on components such as the cost of invested capital and the company's future economic profitability. In order to simplify the process of making forecasts of the future, most valuation models are broken down into an explicit forecast period and a horizon value, as shown in equation [1:2]:

$$V_{0,j} = \sum_{t=1}^{T} \frac{E_0(NDIV_{t,j})}{(1+r_j)^t} + \frac{V_{T,j}}{(1+r_j)^T} \qquad [1:2]$$

$E(NDIV_{t,j})$ $= \textit{Expected net dividends during the explicit forecast period}$

$V_{T,j}$ $= \textit{Horizon value}$

[1] For better readability, all abbreviations related to the equations will only be explained the first time they are introduced.

The horizon value is set at a point in time from when dividends are expected to grow at a constant rate. Berk and DeMarzo (2011) explained how the horizon value can be estimated by viewing it as a growing perpetuity. The value can be estimated using the Gordon Growth model, illustrated in equation [1:3] below:

$$V_{T,j} = \frac{E_0(NDIV_{(T+1),j})}{r_j - g_j} \quad [1:3]$$

$g_j$ = *Growth rate*

The horizon value is often a very large proportion of the total value. It is not unusual that it accounts for over 50 per cent. Being such a representative part of total value, it is of utter importance that this factor is estimated in an appropriate manner. For example, given an expected future dividend of 100 SEK, a discount rate of ten per cent and a growth in future dividends of five per cent, the horizon value of a company's equity would be 2000 SEK. However, with an estimated growth rate of four per cent, the horizon value would only be 1667 SEK. On the other hand, if the growth rate would turn out to be six per cent, the value would be 2500 SEK. A two percentage point error in the estimation of future growth can in this case therefore create a 50 per cent error in the estimation of the horizon value. The same experiment can be done for the cost of capital, thus revealing that corporate valuation using the Gordon Growth model can create robustness issues.

Financial analysts tend to base their expectations on companies' financial statements in order to forecast dividends. Ohlson (1995) focused on earnings in the financial statements as input variables in corporate valuation. This was done without violating neither the concept of present value of expected dividends, nor the dividend irrelevance theory of Miller and Modigliani (1961). Ohlson suggested, as long as the clean surplus relationship holds, to use financial data with focus on abnormal earnings instead of net dividends, as input variable for the valuation.

Previous to Ohlson, Fama and French (1992) and Beaver and Ryan (1995) researched the relation between financial statements and corporate value. From their findings, it can be concluded that stock market returns depend significantly on the market-to-book ratio and that the ratio can be explained by the accounting bias. Accounting bias is defined as the differences in market value and book value due to factors such as conservative accounting, historical accounting, inflation and projects that have a positive expected net present value. The bias that arises from conservative accounting is of particular interest in this study, as it is thought to be permanent.

Fruhan (1979) discussed the discrepancy between the accounting value and the market value of equity. According to Fruhan, the discrepancy arises partly from the way conservative accounting requires issuers of financial statements to expense costs for marketing and research and development (R&D) as they occur. It is widely recognized that economic benefits from these types of activities are not enjoyed until some time thereafter. The book value of companies with expenses for marketing or R&D can therefore be understated in the financial statements. The understated earnings and equity will also affect the reported profitability of the company. In the long run, this measurement error will have to be adjusted for, since it affects analysts' forecasts of results, profitability and capital. According to White et al. (2003), it would be economically sound to capitalise the costs from marketing and R&D as assets in the balance sheet, rather than expensing them. This would lead to a closer alignment of the book value and the market value of equity.

Runsten (1998) continued this line of reasoning by distinguishing between three types of value: economic value, accounting value and market value. The economic value of a company's equity represents the discounted future net cash flows that will be enjoyed by the shareholders. Accounting value is the value that is displayed in the company's accounting and market value represents the value that is perceived by the stock market, i.e. the price of the company's shares. While accounting value is based on an attempt of measuring the value of the company's specific balance sheet items, market value is the collective attempt of investors to mirror the economic value of the company. Like Beaver (1995), Runsten carried on by pointing out that there is a clear difference between accounting value and market value.

Runsten aimed to explain the difference between economic value and accounting value through a two-part process. First, future abnormal earnings were predicted. Second, the difference in economic- and accounting value that may arise due to prudent accounting was determined.

Abnormal earnings should vary across industries due to Porter's (1979) five forces of competition. The competition is thought to slowly diminish abnormal returns for all industries. However, depending on where the industries are positioned in the competitive landscape, the process will vary in speed. For example, companies that are protected by high barriers to entry, low customer- and supplier pricing power and a low threat of substitutes will enjoy abnormal returns for a longer time. Companies that face the opposite scenario however, are expected to generate zero abnormal returns much earlier. Ultimately, Runsten argued that competition would lead all industries into a steady state when companies would only be left with the value difference attributable to prudent accounting, also known as the permanent measurement bias (PMB).

In the steady state, differences in economic value and accounting value should also vary across industries. This is due to the different asset classes that are required to be held by the companies depending on which industry they belong to. Some asset classes are measured closely to their true value, while other asset classes might be significantly undervalued due to prudent accounting. The PMB that arises from a certain asset class is called a partial PMB. The sum of the partial PMBs constitute the total PMB of a company. All industries have different combinations of asset classes and therefore also different partial PMBs. This means that although two different industries have no abnormal returns, their total PMB might still be different.

Runsten made estimations of median partial PMBs, as well as total PMBs for a selected number of industries. The partial PMBs that Runsten estimated are presented in table [1:A] on the following page.

Runsten found that PMB is strongly correlated with the market-to-book ratio and consequently correlated with company value. Theoretically, investors could use this table as aid when valuing their companies, enabling them to perform corporate valuation in a time efficient manner, without having to estimate the PMB.

**Table [1:A] Runsten's table (1998) - Summary of the estimated partial PMBs per industry**

| Estimated partial PMBs due to different measurement problems for different industries | MES | Buildings | Trading property | Land | Investment in shares | R&D expenses | Personnel develop. Expenses | Marketing expenses | Deferred taxes | = Total PMB |
|---|---|---|---|---|---|---|---|---|---|---|
| Pharmaceutical | 0.06 | 0.09 | | | | 1.08 | | | 0.51 | 1.74 |
| Capital-intensive service* | 0.23 | 0.15 | | ** | 0.06 | | | | 0.33 | 0.76 |
| Consumer goods | 0.15 | 0.11 | | | 0.01 | | | 0.25 | 0.20 | 0.72 |
| Investment companies | | | | | 0.53 | | | | 0.16 | 0.68 |
| Pulp and paper* | 0.23 | 0.08 | | 0.07 | 0.01 | | | | 0.27 | 0.67 |
| Shipping | 0.47 | 0.02 | | | 0.02 | | | | 0.14 | 0.65 |
| Other services | 0.03 | 0.04 | | | 0.02 | | 0.40 | | 0.14 | 0.62 |
| Consultants & computer* | 0.03 | | | | 0.01 | | 0.40 | | 0.15 | 0.59 |
| Real estate | | 0.31 | 0.12 | 0.01 | 0.01 | | | | 0.10 | 0.56 |
| Mixed build. and real est. | 0.02 | 0.02 | 0.35 | 0.01 | 0.01 | | | | 0.12 | 0.55 |
| Trading and retail | 0.03 | 0.21 | | | | | | | 0.23 | 0.47 |
| Chemical industry* | 0.10 | 0.12 | | | 0.01 | | | | 0.21 | 0.44 |
| Building and construction | 0.03 | 0.03 | 0.12 | 0.01 | 0.02 | | | | 0.16 | 0.38 |
| Engineering* | 0.07 | 0.10 | | | 0.01 | | | | 0.15 | 0.33 |
| Other production* | 0.07 | 0.10 | | | 0.01 | | | | 0.13 | 0.31 |
| Conglom & mix inv* | 0.04 | 0.08 | | | 0.08 | | | | 0.09 | 0.28 |

*Industries that contain particular companies with an estimated bias related to R&D

**Two electrical utility companies have partial PMBs amounting to approximately 0.30.

By assuming that the clean surplus relationship holds, an alternative valuation model that includes PMB is explained by Skogsvik (2002), called the Residual Income Valuation (RIV) model:

$$V_{0,j} = B_{0,j} + \sum_{t=1}^{T} \frac{B_{t,j-1} \cdot (R_{E,t,j} - r_j)}{(1 + r_j)^t} + \frac{B_{T,j} \cdot PMB_j}{(1 + r_j)^T} \qquad [1:4]$$

$B_{t,j} = Book\ value\ of\ equity\ in\ a\ specific\ year\ t$

$R_{E,t,j} = Return\ on\ equity\ in\ a\ specific\ year\ t$

$PMB_j = Permanent\ measurement\ bias$

The horizon value in the RIV model originates from the idea that there is a PMB in conservative accounting that has not been captured in the book value of the company's equity. Since the valuation is anchored in the book value of the company, less weight is put on the horizon value compared to a valuation with the Gordon Growth model. This is one of the reasons why the RIV model together with PMB often yields a more robust valuation than other models. Penman (1998) showed how all models that are derived from the dividend discount model can be rearranged into each other. This makes it possible to use PMB based valuation in several other models than only in the RIV model.

## 1.3 Problematization

Since the RIV model is thought to be relatively robust, why is it then not the most widely used model by practitioners? A possible explanation could be that the RIV model is more complex than other conventional models. The user is required to have a solid academic understanding of accounting and valuation in order to understand the intuition behind the model.

Another explanation could be that data required to make a full estimation of the PMB can be inaccessible. For example, a company whose sales depend a lot on large investments in marketing activities should logically capitalize these related costs. However, due to conservative accounting, it is required that they expense the costs immediately. To estimate the partial PMB of marketing, it is necessary to measure the size of these costs. Due to confidentiality reasons, the company might not always disclose this information, thus making it difficult, if not almost impossible to estimate the partial PMB. However, the publication of Runsten's table [1:A] should have aided investors in their effort of estimating the PMB of their investment.

Significant time has passed since Runsten's table was presented and perhaps it has become outdated. An altered corporate landscape as well as the implementation of the IFRS might have made it obsolete. Little research has been done on this topic and investors might no longer have a reliable tool for doing quick and robust estimations of PMB for the industries in which their companies are active. Bergman and Tegnér (2008) showed that no dramatic changes in PMBs have occurred since the table was originally presented. Theoretically, this should imply that Runsten's table is not outdated. However, Bergman's and Tegnér's study was only based on 30 companies spread out over five of Runsten's sixteen industry categories. Of these, it was only within the engineering industry that they had more than three companies.

Perhaps investors would use the RIV model more if they had a larger confidence in the median partial PMBs in Runsten's table. The investors could then use the more robust RIV model for valuations, knowing that the true PMB of their company does not vary much from the one in Runsten's table.

Although Runsten's table provides investors with a good overview of the partial PMBs among industries, it might be expected that the PMB of many companies will differ from that of their industry median. For example, Electrolux, a Swedish manufacturer of home electronics, can be expected to spend large amounts in R&D in relation to its total assets. In contrast, Scandi Standard, a Scandinavian producer of chicken products, can be thought to have little to no R&D expenditures. Both companies belong to the consumer goods industry and their partial PMBs for R&D expenditures can be expected to differ significantly from each other's.

Runsten's original reason for estimating the PMBs for different industries was not that the table was supposed to be used as a tool for making investment decisions. Runsten's table was a necessary step in order to perform the main aim of his study. As the matter of fact, Runsten (1998) mentioned that company specific variations in the PMB would only create noise in the results of his regressions later on in the study.

## 1.4 Purpose

This study aims to analyse how partial PMBs vary within industries. The assumption is that if provided with information on how the expected PMBs vary within industries, there might be occasions when investors will find the PMB more attractive to use in valuation models than before. The reasoning behind this assumption rests on the observation that companies, although they pertain to the same industries, differ in the nature of their business.

By performing this research, the possibility to update Runsten's table arises as well. This study will perform such an update.

**Research Question**

In order to achieve the aim of this paper, the following main research question is posed:

*How do partial permanent measurement biases vary across companies within certain industries?*

In addition, the following sub question is also of interest for this research paper:

*How have the partial permanent measurement biases changed since Runsten's table was published in 1998?*

**Contributions and Limitations**

The purpose of this study is not to convince the investing public of preferring one valuation model over another. Preferably, the goal is to make a descriptive contribution to the toolbox that investors use when making investment decisions. The paper intends to give a partial explanation of why investors do not use the PMB as an ordinary part of valuation. It provides the investing public with information about the fact that there is a time efficient technique for making robust valuations in terms of PMB and Runsten's table. The research expects to present information about variations in PMB within industries, so that the investors alone can decide when it is more or less suitable to use the PMB and the RIV model.

To illustrate this, consider a time restricted investor that is well informed on how the PMB can be used for valuation purposes. Furthermore, consider a company in an industry with only two sources of PMB: buildings & land and machinery & equipment. The investor is then presented with a table that provides information on how partial PMBs for these two asset classes are expected to vary within the industry. If the partial PMBs were to vary very little, the investor could use the industry's median PMB in the valuation model.

On the other hand, if given information that the partial PMBs were to vary a lot within the same industry, the investor would probably find it necessary to make an own estimate of the partial PMBs. This alternative would be more time consuming, and the extra robustness achieved by performing the calculations might be of marginal value for the investor. Nevertheless, knowledge about the existence of this variation would be valuable, as it could indicate that it is more time efficient to use another valuation technique.

A third alternative could be that the variation in partial PMBs might be small for some asset classes within an industry, and large for others. In this case, the investor has the possibility of "cherry picking" among those partial PMBs that seem to be more suitable for a specific investment. As the investor is expected to have basic knowledge about the company's asset structure, the presented variations from this study could be utilised. If the company is expected to have a larger weight of a certain asset class than the industry overall, the 75$^{th}$ percentile partial PMB could be used instead of the median partial PMB. Similar reasoning could be used for a particular asset class with smaller weight than the industry average. Here, the 25$^{th}$ percentile could be used. The selected partial PMBs would then sum up to a new company-specific total PMB. This exercise would require relatively short time and the marginal gain would most likely be high, as it would result in a more robust valuation.

By comparing the results from this study with Runsten's table, another interesting discussion topic could arise. If the results show that Runsten's table has not changed much since it was published, investors could confidently use the PMBs presented in it. The results of the partial PMB variations from this study could be applied to Runsten's table, in the same manner as explained in the previous examples.

The results from this study are not meant to be better than Runsten's table. However, by using a similar method as he did, investors could be aware of certain weaknesses or strengths that may come from using the table. The contribution is in other words to serve as an update of Runsten's table so that the PMB becomes more useful than before.

## 1.5 Disposition

The remaining part of the report is structure in the following way.

In *Chapter 2,* different sources of PMBs are discussed. The discussion covers where large PMBs can be expected to exist. The chapter also highlights some differences from previous studies that have occurred since the implementation of IFRS.

Next, the technical method of the study is introduced in *Chapter 3*. The main focus in this chapter is to explain how the partial PMBs have been estimated in the study.

The results are then presented in *Chapter 4*, and they are communicated in the form of tables with some descriptions of the results that may be of extra interest.

*Chapter 5* is dedicated to the results' sensitivity to different assumptions and input factors.

In *Chapter 6*, the results are discussed and connected with the problematization that gave rise to this study. Comparisons are also made with results that have been presented by previous literature.

*Chapter 7* contains a summary of the entire study, as well as a conclusion of the results and the discussion that have been presented. Finally, a couple of suggestions on what future research can contribute with are mentioned.

# 2 SOURCES OF BIAS

Different asset and liability classes are expected in the financial statement of a company. Runsten identified several items that might be sources of substantial PMB: Depreciable assets, land, investments in financial assets, inventory, intangible assets, pension obligations and untaxed reserves. The reasons for the existence of PMBs differ between assets. The asset classes that have negligible expected partial PMBs are not discussed in detail in this study. The reasoning concerning the negligible expected partial PMBs can be found in Runsten's study (1998). However, the thought processes for each potentially significant partial PMB is reviewed in this chapter.

**Table [2:A] Simplified balance sheet – bolded items are discussed in more detail below**

| Assets | Liabilities |
|---|---|
| Cash<br>Accounts receivable<br>**Inventory**<br>**Financial assets**<br>**Deferred tax assets**<br>Other accruals | Operating liabilities<br>Financial liabilities<br>**Pension obligations**<br>**Deferred tax liabilities** |
| **Buildings**<br>**Land**<br>**Machinery & Equipment**<br>Other long-term assets | Equity |
| **Research & Development**<br>**Marketing goodwill**<br>**Personnel training** | Guarantee commitments |

## 2.1 Assets

### Depreciable assets

Depreciable assets such as machinery, equipment, buildings and ships are usually measured at historical cost with linear depreciation. These assets are often depreciated too aggressively compared to the true depreciation from utilizing the assets. This creates a difference between the true economic value and the accounting book value of these assets.

Another implication of historical accounting is that increases in the remaining net book value of assets are not accounted for. Value increases can be driven by inflation, increased demand or by other circumstances. The intuition is that the remaining value of the assets after true depreciation is undervalued because it is reported at the historical cost, although the asset has increased in value over time. Subsequently, the expected partial PMB that arises due to unrecorded value increases is larger for companies with old assets than with newer assets. In other words, the remaining value after depreciation of old assets is understated in the financial statements, due to the potential increase in value from at least the rate of inflation.

Since the implementation of IFRS, some depreciable assets such as trading property, are reported at fair value. Companies within the real estate industry and the financial industry often hold large proportions of these asset types in their balance sheets. It is common that no depreciation is declared at all in these companies. Instead, yearly changes in market value are recorded in the profit and loss statement. If the companies estimate the fair value of these assets efficiently, no partial PMB can be expected for the assets. However, except for these two industries, the most common practice is that depreciable assets are valued according to historical accounting.

**Land**

Land is not depreciated in the financial statements. However, companies are required to value land at historical cost. This means that increases in value over time will not be captured and that land is a source of PMB. Therefore, an inflation adjustment must be done. In some industries however, land is recorded at fair value according to IFRS. This is often the case in industries when companies hold large biological assets. An example of this is the forestry industry and the farming industry. The expected partial PMBs within these industries are, just as for other fixed assets that are measured at fair value, thought to be zero.

**Intangible assets**

Most marketing expenses, investments in R&D and personnel expenses such as training of employees are required to be expensed immediately. However, these types of activities tend to generate revenues in the future.

Companies typically engage in projects that span over several years. Economic outflows and inflows several years in a row are often attributable to the same project. An example would be companies in the pharmaceutical industry. Products commonly follow certain cycles consisting of long periods of development and investments in patent rights etc. The patents then protect the products when they are launched to the market, allowing the company to sell them at premium prices for some time.

The time pattern for a project's first expense and its final attributable revenue stream varies a lot between companies. Both Runsten (1998) and Fruhan (1979) recommended that the investments were to be capitalized.

**Inventory**

Inventory is valued at the lowest of cost and net sales worth. This usually means that inventory is valued at cost for companies that are going concern, since it is necessary for long-term prices to be higher than acquisition costs in order to create value. Companies declare inventory in terms of raw materials, work in progress and finished goods. Intuitively, the unrecorded value of finished goods that are close to being sold is higher than that of raw materials, provided that both are valued at cost.

The company margin after costs of goods sold, selling expenses and administrative expenses should constitute the mark-up attributable to finished goods. Raw materials can be expected to be correctly valued, while work in progress can be expected to contain some unrecorded value. Work in progress can be thought of as raw materials that have entered the value adding process of the company. It should therefore have some of the characteristics of finished goods, and subsequently a similar source of unrecorded value.

Inventory is measured according to the FIFO (first in first out) or the LIFO principle (last in first out). According to the FIFO principle, the oldest inventory assets that were bought are the first to be sold. This means that the FIFO principle has a lower expected partial PMB compared to the LIFO principle, which implies that old assets remain unsold in the company's inventory. The most commonly used principle is the FIFO principle.

**Investments in financial assets**

Investments in financial assets were previously valued at historical cost. The capital gains or losses were then recognized the day the assets were sold, meaning that a potential PMB could be expected. According to Runsten's table, investment companies turned out to have a rather significant partial PMB in financial assets. The implementation of IFRS has however eliminated this partial PMB. Today, most financial instruments are recorded at fair value according to IAS 39. The few assets that are recognised at amortised cost are either loans or instruments that are held to maturity. For this reason, no partial PMB can be expected in the financial assets.

## 2.2 Liabilities

**Pension obligations**

The economic value of the pension obligations is the present value of the actual pension payments that will be imposed on the company in the future. Skogsvik (1993) stated that the partial PMB for pension obligations is more substantial when the company's employees are young. It is smaller when the employees are old or when their ages are more evenly dispersed. This is quite intuitive, as pension obligations that are due within shorter periods are more likely to be correctly measured compared to pension obligations that are due in the distant future. The PMB will be more affected the longer the time there is left until the obligation is settled, given that the discount rate used to value pension obligations differs with the true economic rate that governs the obligation.

**Deferred tax**

Deferred tax liabilities and assets stem from profits or losses that have yet not been recognized by the tax authorities. They are valued in the financial statement as the value of the accumulated unrecognized earnings times the prevailing marginal tax rate. However, due to the fact that deferred tax will not always be realized in the near future, they are usually overstated. The PMB can be obtained by adjusting for the estimated date when the actual tax payment will be made. The economic value of the tax obligation would be the present value of the expected tax payment. The difference between the true value of the deferred tax and the reported size would constitute the partial PMB.

# 3 METHOD

The following chapter will present the methods used in this study. It covers the basic methodology of a quantitative study, the sample choice and the general assumptions made in the models for estimating the PMB. The chapter also explains how each partial PMB has been estimated in this study.

## 3.1 Quantitative study

In order to estimate expected variations in partial PMBs within industries, a quantitative study is conducted. It could be argued that a qualitative study would generate more accurate results since some necessary data is not always disclosed in the public annual reports. A qualitative approach consisting of interviews with managers from the Investor Relations departments could potentially reveal these non-disclosed numbers. However, the aim is not to make perfect estimations of single companies' total PMBs. Instead, the aim is to find the variations of the partial PMBs. Therefore, a quantitative analysis of as much data as possible is preferable. A one-year time sample of all the companies traded on the Large, Mid and Small cap lists on the Nasdaq OMX Stockholm Stock Exchange has been collected. The necessary data was collected manually from the public annual reports of 2009-2013.

## 3.2 Selection of partial PMBs

This study focused on estimating the partial PMBs for the same asset classes as in Runsten's table, with a couple of alterations. Partial PMBs for trading property, land, investment in shares and personnel expenses were excluded, while the partial PMB for inventory has been added. The selected partial PMBs for this study were the following: inventory, machinery & equipment, buildings & land, R&D, marketing expenses and deferred tax. The asset classes that were excluded were so for reasons explained in detail below.

Trading properties and investment in shares are asset classes that are required to be disclosed at fair value according to IFRS. Because of this, companies do not depreciate the assets in their financial statements. The quantitative methods used in this study, in combination with the limited disclosed information, made it impossible to make any better estimation of the true value of the assets than their reported fair values.

Runsten (1998) used the taxation value of land when he estimated the partial PMB for land. However, since the implementation of IFRS, companies are no longer forced to disclose the taxation value. Under IFRS, not enough data is provided in the annual reports in order to make an individual estimation of the partial PMB of land.

Some companies have disclosed land as a separate value while others have reported one item named "buildings and land", often making it impossible to distinguish which part is land and which part are buildings. For this particular reason, the partial PMBs of buildings and land were combined into one partial PMB in this study. This decision distorted the direct comparison with Runsten's table. However, it was still assumed that the variations in the partial PMBs were to be captured.

Finally, partial PMBs for personnel expenses were not estimated due to the lack of data indicating to which degree salary expenses consist of training activities that should be capitalised. If the study had been a qualitative one, making estimations of this sort would have been a more viable option. However, it should be noted that no earlier research has made quantitative estimations on this partial PMB either.

## 3.3 Sample selection and industry classification

In order to obtain results that are comparable with Runsten's table, data from Swedish companies was exclusively used. The original sample consisted of 260 companies listed on the Nasdaq OMX Stockholm's: Large, Mid and Small cap lists. These were sorted according to Affärsvärlden's (2014) ten industry indices. The companies were then manually divided into 14 industries, whereof 13 were direct matches with Runsten's table. The few companies that Runsten sorted into the chemical industry, shipping industry and other services have been classified as either other production or capital-intensive services in this study. Details on the industry classification can be found in Appendix A. The resulting industries were included in Runsten's table, except one newly added industry: the software & electronics industry. This industry has grown substantially in size since Runsten's table was published.

Conglomerates, real estate companies, mixed building companies and investment companies have been excluded from this research. Most of the assets that are owned by these companies are required to be measured at fair value according to IFRS. Therefore, no substantial PMB is expected in these industries. After the exclusion of these four industries, the sample had been reduced to 215 companies. Two additional companies had to be dropped from the sample since their book value of equity was negative. The negative equity would have created practical issues when estimating the PMBs.

Due to data availability reasons, as well as mixed reporting styles, all data was collected manually from annual reports between the years 2009-2013. Companies with different openings or closings of their fiscal years than December 31st were also included in the study, as long as annual reports for the last five fiscal years were available. Since all data has been collected manually, there is a small risk of human error in the results.

## 3.4 Assumptions

In order to estimate the partial PMB for the different asset classes, a couple of parameters were required to be estimated. Several of the companies that are traded on the stock exchange conduct business in a worldwide scale. Therefore, some of these factors were difficult to estimate. However, all the companies are traded on the Nasdaq OMX Stockholm Stock Exchange and conduct at least some business in Sweden. The Swedish corporate tax rate of 22 per cent was therefore used in the estimations of the PMBs for all companies.

The growth rate of the companies' investments and balance sheets has been approximated to the nominal growth rate of the Swedish GDP over the last 40 years, yielding a growth of 6.8 per cent, according to SCB (2014a). The appreciation of value for old investments in buildings & land and machinery & equipment was expected to equal the average Swedish inflation for the last 40 years, which has been 4.8 per cent, according to SCB (2014b).

The capital asset pricing model (CAPM) by Sharpe (1964) was used to estimate an average return on investments in R&D and marketing expenses. A beta of one was used in the model, in order to represent the total stock market. Furthermore, the average rate of return on the ten-year Swedish government bond during 2013 was 2.1 per cent, according to the Swedish Riksbank (2014). This rate has been assumed to represent the risk free rate throughout this study. In accordance with PWC's (2014) yearly report about the expectation of the market risk premium for the Swedish stock exchange, the market risk premium has been assumed to be 5.6 per cent. The CAPM therefore yielded a cost of capital of 7.7 per cent.

The cost of debt was assumed to be 3.1 per cent, based on data from the ECB (2014). The rate was based on loans over one million EUR with five to ten years maturity to non-financial corporations in Sweden, without any dedicated security for the claim.

## 3.5 Calculations of the partial PMBs estimations

The methods that were used to estimate the partial PMBs were directly inspired by Runsten's (1998) methods. It could be argued that one should question Runsten's methods for estimating partial PMBs and try to derive, and test own methods. However, this study's goal was not to find an optimal way of estimating partial PMBs. As Runsten's regressions of PMB and market-to-book ratios proved to give significant correlations, this study has taken the position that the methods can be used to provide good estimates of the partial PMBs.

In addition to the partial PMBs that Runsten's table include, the partial PMB for inventory has been estimated in this study. The technique for doing so was inspired by Skogsvik and Skogsvik (2014).

**Depreciable assets**

Given the data sample that was collected for this research, it was not possible to deduce how large the partial PMB that arises from aggressive depreciation was. However, it was possible, given the following set of assumptions, to make an estimation of the partial PMB that stems from inflationary increases in book value:

- Companies hold balanced portfolios of assets that comprise of equal investment units.
- The yearly investments grow at a constant rate.
- The units have uniform economic lives and uniform rates of depreciation.
- The historical rate of inflation has been constant since the first of the existing units was acquired and the same rate of inflation will continue.

As Runsten (1998) mentioned, the assumptions made here cannot be expected to hold to perfection in the market environment of today. However, they make it possible to make crude estimates of the partial PMBs in depreciable assets.

The assumptions imply that the oldest investments held by the company are as old as their economic lives. It is therefore possible to picture that depreciable assets follow the pattern in the example in table [3:A], with an initial investment of 100, depreciation of ten per cent and a growth rate of ten per cent. In this example, investments are made at the beginning of each year. For the sake of convenience, decimals have been rounded to the nearest integer.

**Table [3:A] Simplified investment scheme of depreciable assets**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 7 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Investment | 100 | 110 | 121 | 133 | 146 | 161 | 177 | 195 | 214 | 236 |
| Depreciation | -10 | -21 | -33 | -46 | -61 | -77 | -95 | -114 | -136 | -159 |
| AccDepreciation | -10 | -31 | -64 | -111 | -172 | -249 | -344 | -458 | -594 | -753 |
| AccInvestment | -100 | 210 | 331 | 464 | 611 | 772 | 949 | 1144 | 1358 | 1594 |
| Book Value | 90 | 179 | 267 | 354 | 439 | 523 | 605 | 686 | 764 | 841 |

At the end of year ten, the value of the assets that were purchased in year one is zero. The oldest investment that still has value is named the *initial investment*. The economic life of the assets could be calculated with the following equation [3:1]:

$$Economic\ Life_{k,j} = \frac{AccInv_{k,j}}{Depreciation_{k,j}} \qquad [3:1]$$

$AccInv_{k,j}$ = *The accumulated investments in asset class k*

$Depreciation_{k,j}$ = *Yearly depreciation of asset class k*

Equation [3:1] is in accordance with the table [3:A], as an insertion of the numbers from the table generates an expected economic life of ten years.

Given that the assumptions stated above hold, the initial investment can be calculated by using equation [3:2]. The equation is based on the formula that renders the future value of annuities:

$$AccInv_{k,j} = I_{k,j} \cdot \frac{\left(1 + g_{k,j}\right)^{N_{k,j}} - 1}{g_{k,j}} \qquad [3:2]$$

$I_{k,j}$ = *Initial investment in asset class k*

$g_{k,j}$ = *Growth in the size of investments in asset class k*

$N_{k,j}$ = *Economic life of asset class k*

Equation [3:2] could also be verified by inserting the numbers from table [3:A]. By using the values from year ten, the equation yields the same initial investment of 100.

The data in this study needed to be adjusted, since the investments in 2012 and 2013 had been collected for the depreciable assets. Book values, accumulated investments and accumulated depreciation for 2013 were adjusted by excluding the part that sourced from the investments of the two years, as illustrated in equations [3:3].

$$
\begin{aligned}
&Acc\left(A_{k,j}^{(b)}\right)^{adjusted} = Acc\left(A_{k,j}^{(b)}\right) - Inv_{2013,k,j}\frac{N_{k,j}-1}{N_{k,j}} - Inv_{2012,k,j}\frac{N_{k,j}-1}{N_{k,j}} \\
&AccInv_{k,j}^{adjusted} = AccInv_{k,j} - Inv_{2013,k,j} - Inv_{2012,k,j} \\
&AccDepr_{k,j}^{adjusted} = AccDepr - Inv_{2013,k,j}\frac{N_{k,j}-1}{N_{k,j}} - Inv_{2012,k,j}\frac{N_{k,j}-1}{N_{k,j}}
\end{aligned}
\qquad [3:3]
$$

$AccDepr_{k,j} = The\ accumulated\ depreciation\ in\ asset\ class\ k$

$Acc\left(A_{k,j}^{(b)}\right) = Accumulated\ book\ value\ of\ asset\ class\ k$

$Inv_{n,k,j} = Investment\ beginning\ year\ n\ in\ asset\ class\ k$

This way, it became possible to estimate the initial investment, excluding the latest two years, according to equation [3:2]. By using the following equation, each year's calculated book value of the depreciable assets could be used to obtain the relative bias of a depreciable asset class:

$$Asset\ bias_{k,j} = \sum_{n=0}^{N}\left[\left(1+i_{k,j}\right)^{n}-1\right]\cdot\frac{A_{n,k,j}^{(b)}}{Acc\left(A_{k,j}^{(b)}\right)}\cdot\left(1-\tau_j\right) \qquad [3:4]$$

$A_{n,k,j}^{(b)} = Book\ value\ of\ n\ year\ old\ assets\ of\ asset\ class\ k$

$i_{k,j} = Annual\ rate\ of\ change\ in\ value\ for\ asset\ class\ k$

$n = Age\ of\ the\ asset$

$\tau_j = Corporate\ tax\ rate$

To obtain the partial PMB of the asset class, its importance in relation to the company's equity was calculated in the following manner:

$$PMB_{k,j}^{depreciable\ Asset} = \frac{Acc\left(A_{k,j}^{(b)}\right)\cdot Asset\ bias_{k,j}}{B_j} \qquad [3:5]$$

To make these estimations, it was necessary to make assumptions regarding the growth in investments in buildings & land, as well as the annual increase in their value. For this, the assumed average growth rate of 6.8 per cent was used to estimate the growth in yearly investments, while the 40-year average inflation rate of 4.8 per cent was used for estimating the increase in value.

Partial PMB for machinery & equipment was estimated using the exact same equations [3.1-3.5] as for buildings & land.

**Intangible assets**

An expense in R&D is thought to generate revenues in the future. The expense will probably be harvested in the future, yielding a larger amount than what the initial expense was. The difference in revenue arising from a previous expense and the expense of the year can be seen as a net cash flow. Given that a company held a balanced portfolio of investments, a new expense of the same size as the initial investment would be made each year. Old expenses would be harvested as revenue every year as well. The net cash flow any given year would then be represented by the following equation [3:6]:

$$Net\ Cash\ Flow_{k,j} = I_{k,j} \cdot \left(1 + i_{k,j}\right)^{n} - I_{k,j} \qquad [3{:}6]$$

$h =$ *Average investment-to-harvest period*

For the sake of illustration, consider an example of an equally sized yearly expense in R&D activities of 100. The value increase each year is ten per cent and the investment-to-harvest period is four years. During the first three years, the company would make net cash flows of -100. After four years however, the initial expense would yield 146 in revenue. The company would keep investing in R&D that year in order to keep generating future cash flows, thus resulting in a net cash flow of 46 from year four and onward. The example is illustrated in table [3:B] below:

**Table [3:B] Simplified R&D expense scheme**

| Year | 1 | 2 | 3 | 4 | 5 | 6 | … | n |
|---|---|---|---|---|---|---|---|---|
| R&D expense | -100 | -100 | -100 | -100 | -100 | -100 | … | -100 |
| Revenue | 0 | 0 | 0 | 146 | 146 | 146 | … | 146 |
| Net cash-flow | -100 | -100 | -100 | 46 | 46 | 46 | … | 46 |

*Investment-to-harvest-period (h)*

The yearly net cash flows could be valued as a perpetuity, assuming that the companies hold balanced portfolios of yearly, equally sized investments in intangible assets, all paying the same rate of return. If economic benefits were to be flowing in from previous investments, the value of an intangible asset would be represented by equation [3:7]:

$$Value_{k,j} = I_{k,j} \cdot \frac{\left(1 + i_{k,j}\right)^{n} - 1}{i_{k,j}} \cdot (1 - \tau_j) \qquad [3:7]$$

In reality, investments could be expected to grow over time. By assuming that this growth rate was constant, it would be possible to value the net cash flows using equation [3:8]:

$$Value_{k,j} = I_{k,j} \cdot \frac{1 - \left(\frac{1 + i_{k,j}}{1 + g_{k,j}}\right)^{h}}{1 - \left(\frac{1 + i_{k,j}}{1 + g_{k,j}}\right)} \cdot (1 - \tau_j) \qquad [3:8]$$

The partial PMB could then be obtained with the following equation [3:9]:

$$PMB_{k,j}^{intangible} = I_{k,j} \cdot \frac{1 - \left(\frac{1 + i_{k,j}}{1 + g_{k,j}}\right)^{h}}{1 - \left(\frac{1 + i_{k,j}}{1 + g_{k,j}}\right)} \cdot (1 - \tau_j) \Big/ B_j \qquad [3:9]$$

Runsten (1998) stressed that the time lag between investments and the returns that they yield could vary immensely between companies. Returns from investments in intangible assets may very well be harvested for several years. By assuming balanced portfolios, Runsten proposed to "*an estimate (of) an average investment to-harvest time lag and the use of the proposed metaphor may constitute a useful tool to estimate a firm's expected permanent measurement bias.*" This investment-to-harvest period could be expected to be half the period of the company's investment cycle.

To estimate the partial PMB of R&D, annual data from the years 2009 to 2013 was utilized. The R&D expenses were adjusted for the average expected growth of investments of 6.8 per cent as shown by equation [3:10]. A growth adjusted average investment in R&D expenses was obtained and used in the equation [3:9] to estimate the partial PMB. For some companies, data was only obtained for three years. In those cases, the growth-adjusted average of those three years was used to estimate the partial PMB:

$$Average\ Inv_{k,j} = \sum_{t=1}^{Obs_j} I_{t,k,j} \cdot (1 + g_{k,j})^{t} \Big/ Obs_j \qquad [3:10]$$

$Obs = Number\ of\ years\ with\ observations\ for\ company\ j$

Runsten assumed that the investment-to-harvest period is seven years for healthcare companies and three and a half years for the rest of the companies that engage in R&D activities. The same assumptions were made in this study. The return on the investment is assumed to be 7.7 per cent as explained previously.

Partial PMBs for marketing expenses were estimated in the same manner as for R&D. The calculations differed in the assumptions that were made regarding the investment-to-harvest periods. The assumed period between the first expense in a project and the first payoff was assumed to be three years. It is the same assumption that Runsten made and it implies an investment-to-harvest time of one and a half years.

**Inventory**

In this study, the general, rather conservative, assumption was that companies value their inventory according to the FIFO principle. Furthermore, work in progress is assumed to refer to raw materials that are on average half way through the value creation process. The unrecorded value of work in progress was therefore assumed to have half the mark-up margin that was added to finished goods. This method for estimating the unrecorded value of inventory was presented by Skogsvik and Skogsvik (2014) and could be summarised with the equation [3:11]:

$$UV_{t,j} = \frac{Net\ sales_{t,j} - (COGS_{t,j} + S\&A_{t,j})}{COGS_{t,j}} \cdot \left[\left(FG_{t,j} \cdot 1\right) + \left(WIP_{t,j}/2\right) + \left(RM_{t,j} \cdot 0\right)\right] \quad [3:11]$$

$UV_{t,j}$ = *Unrecorded value of inventory in year t*

$COGS_{t,j}$ = *Cost of goods sold*

$S\&A_{t,j}$ = *Selling & administrative costs*

$FG_{t,j}$ = *Finished goods*

$WIP_{t,j}$ = *Work in progress*

$RM_{t,j}$ = *Raw materials*

Finally, the partial PMB for inventory was estimated using equation [3:12]:

$$PMB_j^{inventory} = \frac{UV_{t,j} \cdot (1 - \tau_j)}{B_j} \quad [3:12]$$

**Deferred taxes**

The economic value of deferred tax liabilities and assets is the discounted present value of expected future tax payments and repayments that will be incurred due to the deferred taxes. It was assumed that loss carry forwards and allocations to tax allocation reserves would be activated within six years. The previous assumption of balanced portfolios implied that the reserves, on average, were activated within three years. Deferred taxes related to these allocations were therefore discounted three years with the assumed cost of debt of 3.1 per cent.

New deferred taxes that arose from inventory were assumed to be paid within one year and were discounted thereafter. The deferred taxes that arose from the other asset classes that generated partial PMBs were discounted with half the economic life of the underlying assets. This implied that the taxes would be paid the same year that the assets were expected to generate value that is in excess of current book value. For example, if machinery & equipment had an expected life of ten years, this meant that on average it would take five years for all deferred taxes to be activated. The taxes were therefore discounted five years back. It was assumed that the deferred taxes that were not attributable to any of the estimated partial PMBs would be activated within one year. The economic value of the deferred taxes including the taxes from the newly estimated partial PMBs was estimated accordingly:

$$EV_j^{D.T.a/l} = \sum_{n=1}^{N_{k,j}/2} \frac{\left[ D.T._{k,j}^{(B_{a/l})} - \frac{PMB_{k,j} \cdot B_j}{(1-\tau_j)} \cdot \tau_j \right]}{\frac{N_{k,j}}{2}} \Big/ (1+rd_j)^n \qquad [3:13]$$

$EV_j^{D.T.a/l}$ = *Economic value of net deferred taxes assets or (liabilities) in asset class k*

$rd_j$ = *Cost of debt*

$D.T._{k,j}^{(B_{a/l})}$ = *Reported book value of net deferred tax asset or (liability) with an economic life of N*

Finally, the partial PMB for deferred taxes was estimated using equation [3:14]:

$$PMB_j^{D.T.} = \left[ \sum D.T._{k,j}^{(B_l)} - Abs\left[EV_j^{D.T.l}\right] \right] - \left[ \sum D.T._{k,j}^{(B_a)} - Abs\left[EV_j^{D.T.a}\right] \right]^2 \qquad [3:14]$$

[2] Abs = Absolute numbers

**Total PMB**

The total PMB was then calculated as the sum of each partial PMB, as in equation [3:15]:

$$PMB_j^{Total} = PMB_j^{D.T.} + PMB_j^{inventory} + \sum_k PMB_{k,j}^{intangible} + \sum_k PMB_{k,j}^{depreciable} \quad [3:15]$$

# 4 RESULTS

In this chapter, the results that were obtained by studying partial PMBs according to the methods explained earlier are presented.

## 4.1 Variations in partial PMBs

The estimated variations in the partial PMBs have been presented in table [4:A] on the following page. The table displays the median partial PMBs for every industry in bolded characters. Intra industry variations in partial PMBs have been represented by displaying the 25$^{th}$ and the 75$^{th}$ percentile. The 75$^{th}$ percentile was elevated above the median and the 25$^{th}$ percentile was lowered below.

The companies are not evenly distributed over the industries. Therefore, each industry sample consists of different amounts of companies, shown in Appendix A. The estimations of partial PMBs that are presented for each industry in table [4:A] have all at least four observed partial PMBs. For some industries there were three observations of PMB within certain asset classes. These have been marked with three asterisks (***) in the table. If there were less than three observations for an asset class, it was left blank. More detailed information on the results for all observations can be found in Appendix B.

In table [4:A], the largest partial PMB is found within pharmaceuticals, with a median partial PMB of 1.03 for R&D. The largest variation in the partial PMBs is also found within R&D. It is in the pharmaceutical industry, with a 25$^{th}$ percentile of 0.69 and a 75$^{th}$ percentile of 3.71. The variation within R&D is very large across all industries when it comes to their specific partial PMB. The smallest variation in total PMB is found in the construction industry where the 75$^{th}$ percentile is 0.17 and the 25$^{th}$ percentile is 0.07. Deferred taxes and inventory were the asset classes with the least variations in partial PMB overall. The variation in partial PMBs within buildings & land and machinery & equipment, seems to increase with the median partial PMB.

**Table [4:A] Summary of estimated partial PMBs per industry**

| Median Partial **PMB** $^{75^{th}\ \text{percentile}}_{25^{th}\ \text{percentile}}$ | Inventory | Machinery & Equipment | Buildings & Land | R&D Expenditures | Marketing Expenses | Deferred taxes | = Total PMB |
|---|---|---|---|---|---|---|---|
| Pharmaceutical | **0.04** $^{0.07}_{0.02}$ | **0.02** $^{0.05}_{0.01}$ | **0.02** $^{0.04}_{0.01}$ | **0.03** $^{3.71}_{0.69}$ | | **0.04** $^{0.06}_{0.02}$ | **1.15** $^{3.93}_{0.75}$ |
| Software & Electronics | **0.02** $^{0.05}_{0.01}$ | **0.01** $^{0.02}_{0.00}$ | **0.02** $^{0.04}_{0.01}$ | **0.47** $^{0.73}_{0.24}$ | **0.16** $^{0.35}_{0.03}$ | **0.01** $^{0.02}_{0.01}$ | **0.70** $^{1.21}_{0.30}$ |
| Pulp & Paper | **0.03** $^{0.07}_{0.01}$ | **0.42** $^{0.53}_{0.31}$ | **0.14** $^{0.17}_{0.12}$ | | | **0.04** $^{0.06}_{0.02}$ | **0.62** $^{0.83}_{0.46}$ |
| Consumer Goods | **0.03** $^{0.03}_{0.02}$ | **0.13** $^{0.21}_{0.10}$ | **0.17** $^{0.22}_{0.08}$ | **0.20** $^{0.22}_{0.04}$ | | **0.01** $^{0.03}_{0.01}$ | **0.54** $^{0.71}_{0.25}$ |
| Capital Intensive Service | **0.02** $^{0.03}_{0.00}$ | **0.18** $^{0.35}_{0.06}$ | **0.05** $^{0.20}_{0.02}$ | **0.26** $^{1.84}_{0.08}$ | *** | **0.02** $^{0.03}_{0.00}$ | **0.50** $^{2.45}_{0.16}$ |
| Engineering | **0.03** $^{0.05}_{0.02}$ | **0.07** $^{0.16}_{0.04}$ | **0.05** $^{0.07}_{0.03}$ | **0.21** $^{0.46}_{0.13}$ | *** | **0.01** $^{0.02}_{0.01}$ | **0.37** $^{0.76}_{0.23}$ |
| Other Production | **0.02** $^{0.02}_{0.01}$ | **0.12** $^{0.23}_{0.04}$ | **0.08** $^{0.14}_{0.05}$ | **0.05** $^{0.13}_{0.03}$ | | **0.02** $^{0.04}_{0.01}$ | **0.28** $^{0.56}_{0.14}$ |
| Construction | | **0.07** $^{0.09}_{0.04}$ | **0.06** $^{0.07}_{0.03}$ | *** | | **0.01** $^{0.01}_{0.00}$ | **0.15** $^{0.17}_{0.07}$ |
| Trading & Retail | **0.04** $^{0.06}_{0.02}$ | **0.03** $^{0.09}_{0.02}$ | **0.04** $^{0.12}_{0.01}$ | *** | *** | **0.01** $^{0.02}_{0.00}$ | **0.12** $^{0.29}_{0.05}$ |
| Consultants & Computer | | **0.01** $^{0.01}_{0.00}$ | **0.00** $^{0.02}_{0.00}$ | *** | | **0.01** $^{0.02}_{0.00}$ | **0.02** $^{0.50}_{0.00}$ |

*** = Industries and asset classes that contain three companies with an estimated partial PMB related to R&D or marketing expenses. The industries have been ranked in descending order, based on their median total PMB. For each industry and asset class, the median partial PMB is presented as the main, large number. The $75^{th}$ percentile of the partial PMB is elevated while the $25^{th}$ percentile is lowered.

## 4.2 The engineering and the pharmaceutical industries

Two detailed tables over the partial PMBs are presented below. The tables display more detailed information about the partial PMBs within the pharmaceutical industry [4:B] and the engineering industry [4:C]. Similar tables for all researched industries can be found in Appendix B.

**Table [4:B] Details of estimated partial PMBs for the pharmaceutical industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 20 | 28 | 15 | 23 | 0 | 20 | 32 |
| Standard deviation | 0.42 | 0.29 | 0.18 | 3.06 | | 0.12 | 3.32 |
| $10^{th}$ percentile | 0.00 | 0.00 | 0.00 | 0.21 | | 0.00 | 0.03 |
| $25^{th}$ percentile | 0.02 | 0.01 | 0.01 | 0.69 | | 0.02 | 0.21 |
| Median | 0.04 | 0.02 | 0.02 | 1.03 | | 0.04 | 0.87 |
| $75^{th}$ percentile | 0.07 | 0.05 | 0.04 | 3.71 | | 0.06 | 1.93 |
| $90^{th}$ percentile | 0.18 | 0.17 | 0.22 | 8.36 | | 0.27 | 8.12 |

The largest partial PMB in the pharmaceutical industry is in R&D expenses. The results show that the partial PMB for R&D is around 90 per cent of the total PMB for pharmaceutical companies. No company within this industry disclosed marketing expenses and nine out of the 32 companies did not disclose any R&D expenses. Over half of the companies that did not disclose R&D expenses are listed on the Small cap list on NASDAQ OMX Stockholm. The variation of partial PMB in the other asset classes is relatively small compared to the variations found for the partial PMB in R&D.

**Table [4:C] Details of estimated partial PMBs for the engineering industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 23 | 24 | 21 | 17 | 3 | 17 | 25 |
| Standard deviation | 0.05 | 0.27 | 0.05 | 0.26 | 0.13 | 0.01 | 0.39 |
| $10^{th}$ percentile | 0.01 | 0.02 | 0.02 | 0.04 | 0.02 | 0.01 | 0.17 |
| $25^{th}$ percentile | 0.02 | 0.04 | 0.03 | 0.13 | 0.02 | 0.01 | 0.23 |
| Median | 0.03 | 0.07 | 0.05 | 0.21 | 0.21 | 0.01 | 0.36 |
| $75^{th}$ percentile | 0.05 | 0.16 | 0.07 | 0.46 | 0.26 | 0.02 | 0.64 |
| $90^{th}$ percentile | 0.15 | 0.23 | 0.14 | 0.57 | 0.26 | 0.04 | 1.04 |

Table [4:C] shows the results for the partial PMB in marketing expenses, even though only three observations have been made. The total PMB in this table is therefore larger compared to the total PMB showed for the engineering industry in table [4:A]. The partial PMB for R&D has a large variation in this industry as well. Machinery & equipment also varies relatively much compared to the other partial PMBs.

## 4.3 Comparison with Runsten's table

The results from this study are compared with Runsten's table in the combined table [4:D] on the following page. The figures from Runsten's table are presented in *italic* and the results from this study are **bolded**. The comparison has been made for each industry that was matched with Runsten's table, with the exception of the four industries that have been excluded from this study; conglomerates, real estates, mixed buildings and investment companies.

The partial PMB for inventory was not investigated in Runsten's paper. The results in this study show however, that there exists a small but consistent partial PMB in inventory for almost all industries. A major difference in machinery & equipment is only found in the pulp and paper industry. Since this report merged buildings & land into one item, the same has been done with Runsten's table in order to achieve a better comparison. Partial PMBs in buildings & land differ from those in Runsten's table in various ways, depending on the industry. A comparison with Runsten's results for partial PMB in investment in shares is not applicable since the asset class was excluded from this study. Partial PMB for R&D was identified in several more industries than in Runsten's table. Runsten did however indicate that he had found some observations of partial PMB of R&D within a couple of industries. These have been marked with one asterisk (*).

**Table [4:D] Comparison of estimated partial PMBs per industry with Runsten's table**

| This study's results (**Bolded**) and Runsten's table (*Italic*) | Inventory | | Machinery & Equipment | | Buildings & Land | | Investment in shares | R&D | | Marketing expenses | | Personnel development expenses | Deferred tax | | = Total PMB | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pharmaceutical | **0.04** | | **0.02** | *0.06* | **0.02** | *0.09* | | **1.03** | *1.08* | | | | **0.04** | *0.51* | **1.15** | *1.74* |
| Software & Electronics | **0.02** | *N/A* | **0.01** | *N/A* | **0.02** | *N/A* | *N/A* | **0.47** | *N/A* | **0.16** | *N/A* | *N/A* | **0.01** | *N/A* | **0.70** | *N/A* |
| Pulp & Paper | **0.03** | | **0.42** | *0.23* | **0.14** | *0.16* | *0.01* | | * | | | | **0.04** | *0.27* | **0.62** | *0.66* |
| Consumer Goods | **0.03** | | **0.13** | *0.15* | **0.17** | *0.11* | *0.01* | **0.20** | | | *0.25* | | **0.01** | *0.20* | **0.54** | *0.72* |
| Capital Intensive Service | **0.02** | | **0.18** | *0.23* | **0.05** | *0.15* | *0.06* | **0.26** | * | *** | | | **0.02** | *0.33* | **0.53** | *0.76* |
| Engineering | **0.03** | | **0.07** | *0.07* | **0.05** | *0.10* | *0.01* | **0.21** | * | *** | | | **0.01** | *0.15* | **0.37** | *0.33* |
| Other Production | **0.02** | | **0.12** | *0.07* | **0.08** | *0.10* | *0.01* | **0.05** | * | | | | **0.02** | *0.13* | **0.28** | *0.31* |
| Construction | | | **0.07** | *0.03* | **0.06** | *0.04* | *0.02* | *** | | | | | **0.01** | *0.16* | **0.15** | *0.38* |
| Trading & Retail | **0.04** | | **0.03** | *0.03* | **0.04** | *0.21* | | *** | | *** | | | **0.01** | *0.23* | **0.12** | *0.47* |
| Consultants & Computer | | | **0.01** | *0.03* | **0.00** | | *0.01* | *** | * | | | *0.40* | **0.01** | *0.15* | **0.02** | *0.59* |

* = "Industries that contain particular companies with an estimated bias related to R&D" - Runsten (1998)
*** = Industries and asset classes that contain three companies with an estimated partial PMB related to R&D or marketing expenses.
This study has not made any estimation of the possible partial PMBs within investment in shares and personnel development expenses.
Runsten's study had not made any estimation of the partial PMBs in inventory.

The largest and most significant difference from Runsten's table is in the partial PMB in deferred taxes. In this study, none of the industry median partial PMBs were above 0.04. In Runsten's table, the range of the partial PMBs for all industries was between 0.13 and 0.51. If deferred taxes were excluded from table [4:D], the total PMB would be as presented in table [4:E] below:

**Table [4:E] Comparison of estimated total PMB per industry, excluding deferred tax**

| | Total PMB excluding deferred tax | |
|---|---|---|
| | **This study** | *Runsten (1998)* |
| Pharmaceutical | **1.11** | *1.23* |
| Software & Electronics | **0.69** | *N/A* |
| Pulp & Paper | **0.58** | *0.39* |
| Consumer Goods | **0.53** | *0.52* |
| Capital Intensive Service | **0.51** | *0.43* |
| Engineering | **0.36** | *0.18* |
| Other Production | **0.26** | *0.18* |
| Consultants & Computer | **0.01** | *0.44* |
| Construction | **0.14** | *0.22* |
| Trading & Retail | **0.11** | *0.24* |

Table [4:E] shows that the results from this study are relatively similar to Runsten's estimated total PMBs, given that the deferred taxes are excluded.

# 5 SENSITIVITY ANALYSIS

In order to investigate the robustness of the results, a sensitivity analysis was conducted. The results that have been presented were generated from reliable data, collected manually from the annual reports of each company. However, as the method described, it is necessity to make some assumptions in order to estimate the partial PMBs. The parameters have been altered one at the time, while the others were held constant. The following variables have been changed in the sensitivity analysis; corporate tax rate, time to maturity for each asset, growth, return on investment, cost of debt, inflation and average investment.

Table [5:A] below illustrates the impact that each parameter variation had on the median partial PMB over all the asset classes. The tax rate, return on investment, general growth, cost of debt and inflation are the variables that have been varied in absolute percentage points. The percentage changes for the other parameters have instead been in relative terms.

**Table [5:A] Sensitivity analysis**

| Parameter | Partial PMB | -/+ Variation | - | Median | + |
|---|---|---|---|---|---|
| Corporate tax rate | Total PMB | [15%] | 0.678 | 0.577 | 0.476 |
| Corporate tax rate | Deferred Taxes | [15%] | 0.007 | 0.015 | 0.021 |
| Time-to-harvest R&D | R&D | 30% | 0.239 | 0.343 | 0.448 |
| Time-to-harvest marketing | Marketing | 30% | 0.073 | 0.105 | 0.137 |
| Return on investment | R&D | [2%] | 0.336 | 0.343 | 0.352 |
| Return on investment | Marketing | [2%] | 0.104 | 0.105 | 0.105 |
| Growth rate | Total PMB | [2%] | 0.569 | 0.577 | 0.586 |
| Growth rate | Buildings & Land | [2%] | 0.046 | 0.046 | 0.046 |
| Growth rate | Machinery & Equipment | [2%] | 0.044 | 0.044 | 0.044 |
| Growth rate | R&D | [2%] | 0.339 | 0.343 | 0.349 |
| Growth rate | Marketing | [2%] | 0.101 | 0.105 | 0.109 |
| Value increase buildings | Buildings & Land | [2%] | 0.024 | 0.046 | 0.076 |
| Value increase machinery | Machinery & Equipment | [2%] | 0.027 | 0.044 | 0.065 |
| Average investment R&D | R&D | 5% | 0.326 | 0.343 | 0.361 |
| Average investment marketing | Marketing | 5% | 0.100 | 0.105 | 0.110 |
| Time-to-maturity taxes | Deferred Taxes | 30% | 0.012 | 0.015 | 0.018 |
| Cost of debt | Deferred Taxes | [1%] | 0.011 | 0.015 | 0.019 |

[X%] = variation in absolute percentage points. The column to the left of the median represents the median PMB with a negative variation of the parameter. The column furthest to the right represents the median PMB with a positive parameter variation.

The corporate tax rate has a large impact since it basically changes the estimated PMB with one per cent for each percentage point that the tax rate varies with. The rather large variation in the project lengths of R&D and marketing expenses have significant impact on the partial PMBs in marketing expenses, and even more so in R&D. However, the changes in interest rates used for invested capital, cost of debt and growth seem to have very small impact on the results. The differences that arose when altering the investment size in R&D and marketing expenses, as well as the timing of the deferred taxes, seem to also have had a small impact on the results. The sensitivity analysis shows that the assumption regarding the value increase over time that has been attributed to buildings and machinery has a significant impact on their partial PMB. Overall, the results appear to be stable and robust. All the estimations have been conducted with similar logic as in previous research, or anchored in historical data.

# 6 DISCUSSION

This chapter covers a discussion of the results presented in the study. Issues of how the results can be used in corporate valuation are touched upon, and a discussion of how investors can combine the results from this study with Runsten's table is also included.

## 6.1 Robustness of PMB based valuation

The results in the sensitivity analysis indicate that valuations based on the PMB can be expected to be more robust than valuation models that use the Gordon Growth model for estimating the horizon value. As mentioned earlier in the report, a two percentage point overestimation of growth can lead to 50 per cent overvaluation of the horizon value when using the Gordon Growth model. In contrast, the sensitivity analysis in this report shows that the same overestimation of future growth can be expected to lead to a difference in total PMB of about one per cent. This example may be a bit extreme but it still illustrates the robustness of the PMB compared to other valuation models.

## 6.2 Variations in the PMB

The findings made in this study indicate that there are large variations in the partial PMBs within, as well as between industries. Investors need to take this fact into consideration when using the RIV model, or any other valuation model that requires an estimation of the PMB. It is of particular importance that special consideration is taken to the way that a specific company's assets might differ from what seems to be the industry median. By making an estimation of this, investors can decide whether to use the number given by the industry median, the 25$^{th}$ percentile or the 75$^{th}$ percentile, when deciding what the PMB is for their specific company. The 25$^{th}$ percentile that is estimated for the whole industry could be used as an estimation of the company's partial PMB, if the weight of a particular asset class is thought to be low for the company in comparison to its peers. On the other hand, if the company is thought to have a larger weight of a certain asset class, the 75$^{th}$ percentile partial PMB would be a better estimate.

In some cases, investors may be sure that the assets in a company differ so much from the results in this study that using a pre-estimated bias is not an alternative. In those cases, investors may need to make their own estimations of the partial PMB for that asset class. Another reason for investors to find themselves with the necessity of estimating the partial PMB independently, is when the company does not disclose the necessary information. This would probably be the case for consultancy firms where personnel training expenses can be expected to represent a substantial part of total PMB. Information of this sort is often not disclosed, making it more appropriate to make a qualitative estimation of the company's PMB.

However, a reliable assessment of PMB can sometimes be impossible to make. In table [4:A] for example, within the trading & retail industry, it could be argued that some partial PMB in marketing activities should be present. However, companies often prefer not to disclose such information, even if requested in private interviews or similar activities. If sufficient information is not found about the company, and the asset is deemed to be of great importance for estimating the total PMB, alternative valuation techniques might be of better use.

The results from this study will hopefully help investors make better valuation decisions, since the results highlight the ranges of the partial PMBs within industries. Perhaps, the mapping of the partial PMBs also has increased the likelihood that the RIV model will be more used in the future.

## 6.3 Comparison with Runsten's table

The total PMBs seem to have drastically changed since Runsten's research paper. However, when further examining the results, it becomes apparent that the changes are not noticeably large for the partial PMBs of most asset classes. In many cases, the partial PMBs are strikingly similar to Runsten's estimations. As the matter of fact, as shown by table [4:E], deferred taxes seem to be the main source of difference in most cases.

The difference in the partial PMB in deferred taxes can have several explanations. One could be the implementation of IFRS in 2005. IFRS has obviously affected the different partial PMBs, as this study has chosen to exclude several industries where the total PMBs are now thought to be close to zero. These industries are, as previously mentioned, thought to have substantial holdings in assets that are measured at fair value, but that were previously measured according to historical cost accounting. However, when considering the deferred taxes in industries that have been included in this study, it becomes questionable whether IFRS can explain the large differences from Runsten's table. Theoretically, IFRS should not have changed the size of the deferred taxes since corporate tax rules are most often legislated on a national level. Also, if IFRS would have had large affections on the PMBs for deferred taxes, it could be expected to have affected the partial PMBs for other asset classes as well.

As partial PMBs for asset classes do not seem to have been affected by IFRS, the differences from Runsten's table in partial PMBs for deferred taxes require another explanation. A combination of two other factors could partly explain the decrease in the partial PMB. When Runsten's (1998) study was performed, tax rates had just recently dropped from historical levels of around 50 per cent to around 30 per cent. In order to make sure that it was not just a temporary drop, Runsten used an average historical tax rate of 50.7 per cent in all of his PMB calculations. In this study, the current corporate tax rate in Sweden of 22 per cent was assumed for all companies. A difference in tax rate of such magnitude can, as seen in the sensitivity analysis, affect the size of the partial PMB for deferred tax assets. According to the sensitivity analysis, the difference in the tax rate that was assumed for this study and the rate that Runsten used, cannot solely explain the large difference in partial PMB for deferred tax assets.

The second factor that could help explain the difference in the partial PMB in deferred taxes could be found in the historical evolution of the Swedish tax system. According to Swedish tax regulations, companies are allowed to reserve a certain portion of their pre-tax earnings. Companies are allowed to hold these reserves for six years from the year that they were initially reserved. During this six-year period, the reserves are untaxed, creating a tax credit that used to be interest-free. Since Runsten's paper was published, there have been changes in the tax regulations, stating that companies need to pay a yearly fee on the untaxed reserves.

In practice, this implied that there is a cost of keeping untaxed reserves that is not too different from the cost of borrowing. Combined with the fact that the corporate tax rate is substantially lower than the period when Runsten's study was conducted, companies should theoretically be less incentivized to hold untaxed reserves today. If so, it could partly explain the difference in Runsten's results and the results in this study. This could be an interesting topic for future research.

# 7 SUMMARY AND CONCLUDING REMARKS

Many different techniques can be used to perform corporate valuation. Several of these can become problematic when dealing with the horizon value of the company. Estimations of the horizon value can often be sensitive to the assumed input variables, whereby alternative methods can sometimes be attractive. One alternative is the RIV model. It is theoretically derived from the dividend discount model and it is anchored on book value, expected abnormal returns, and the PMB. With the RIV model, investors are able to use the PMB to obtain more robust company valuations.

The PMB can be used in valuation models since previous research has shown that it correlates well with corporate value. Investors might then be interested in using pre-estimated PMBs, as estimating the PMB requires research of several input factors. Runsten (1998) presented a table containing the median PMB for different industries. The table presents the total PMB as the sum of the median partial PMBs of the industries, but it does not disclose intra industry variations. This study has therefore focused on how partial measurement biases vary across companies within certain industries.

Partial PMBs have been estimated for 213 listed companies that have been sorted into ten industries. The results indicate that partial PMBs have substantial variations within most industries. Investors can use the results from this study in order to estimate the partial PMB for asset classes that differ in comparison to their industry median. Variations in the partial PMBs have been presented in a table including the median, the 25$^{th}$ percentile and the 75$^{th}$ percentile. Table [4:A] allows investors to easily add or deduct different partial PMBs in order to estimate an accurate total PMB for their specific companies.

The results that were obtained from this study can also create an understanding of how the partial PMBs have changed since Runsten's table was published in 1998. Total PMBs are different from those in Runsten's table. However, the partial PMBs seem to be similar for most asset classes except for the deferred taxes. The table [4:A] that is presented in this study can therefore be seen as an update of Runsten's table that has been extended to include the variations in partial PMBs.

## 7.1 Future research

Since this study excluded four industries, there is a research gap to be filled and compared with previous research. It would be interesting to test this paper's assumption that IFRS has practically eliminated the largest partial PMBs for the industries conglomerates, real estate companies, mixed building companies and investment companies. This could be done with a qualitative approach, by trying to find ways of estimating the economic value of assets and comparing it with the reported book value.

It would also be interesting to conduct a study that attempts to measure the different valuation techniques used by practitioners today, with a focus on the rationale to why they use specific techniques and not others. This could aid in the explanation of why the RIV model and the PMB are not more widely used by practitioners. The data needed for this type of study could be gathered using a mix of quantitative surveys and qualitative interview sessions with valuation experts.

Finally, the large changes in partial PMB in deferred taxes that have occurred since Runsten's table was published could be further investigated. The observation that was made in this report could be explained by collecting time series data over the changes in deferred taxes and the use of untaxed reserves in Swedish companies.

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## APPENDIX A – INDUSTRY CLASSIFICATION

**Capital Intensive Service**
Alltele
Arise
Bong
BTS Group
Com Hem
DGC One
Etrion Corporation
Geveko **- (Excluded)**
Gunnebo
Intellecta
ITAB Shop Concept
Lammhults Design Group
Loomis
Millicom Int. Cellular
NSP Holding
Opcon
Rejlers
Rezidor Hotel Group
SAS
Securitas
Semcon
SkiStar
Studsvik
Tele2
TeliaSonera
Transatlantic
Transcom WorldWide S.A

**Construction**
JM
NCC
Peab
Skanska
Sweco

**Consultants & Computer**
Acando
Addnode
Avega Group
Cybercom
Enea
eWork Scandinavia

**Consultants & Computer contd.**
HiQ International
IAR Systems
Know IT
MSC Konsult
Novotek
Poolia
Prevas
Proact IT Group
Proffice
Softronic
Tieto Corporation
Uniflex
ÅF

**Consumer Goods**
Duni
Electrolux
Husqvarna
KABE
Midsona
Nobia
Oriflame Cosmetics
Scandi Standard
Swedish Match **- (Excluded)**

**Engineering**
ABB Ltd
Alfa Laval
Arcam
Atlas Copco
Autoliv
Beijer Alma
Bulten
Cavotec
Concentric
Consilium
CTT Systems
Duroc
Gränges
Haldex
Hexpol

**Engineering contd.**
Nolato
Opus Group
SAAB
Sandvik
SinterCast
SKF
Trelleborg
VBG Group
Volvo
XANO Industri

**Other Production**
Africa Oil Corp.
Assa Abloy
BlackPearl Resources
Boliden
Concordia
Endomines
EnQuest
Fagerhult
Inwido
Lindab International
Lucara Diamond Corp.
Lundin Mining
Lundin Petroleum
Nederman Holding
NGEx Resources Inc
NIBE Industrier
Nordic Mines
PA Resources
ProfilGruppen
Sanitec
SEMAFO
Shelton Petroleum
SSAB
Svedbergs
Systemair
Tethys Oil

**Software & Electronics**
Anoto Group
Aspiro
Axis
Beijer Electronics
Betsson
Doro
Elanders
Eniro
Ericsson
Fingerprint Cards
Formpipe Software
G5 Entertainment
Hexagon
HMS Networks
IFS
Image Systems
Lagercrantz Group
Micro Systemation
MTG
MultiQ
Mycronic
Net Entertainment
Net Insight
NOTE
PartnerTech
Precise Biometrics
Pricer
Seamless Distribution
Sensys Traffic
Stockwik Förvaltning
TradeDoubler
Transmode
Unibet Group SDB
Vitec Software Group

**Pharmaceutical**
Active Biotech
Aerocrine
Allenex
AstraZeneca
Bactiguard
BioGaia
BioInvent
Biotage
Boule Diagnostics
CellaVision
Dedicare
Elekta
Elos
Episurf Medical
Feelgood
Getinge
Global Health Partner
Karo Bio
Karolinska Development
Meda
Medivir
Moberg Pharma
NeuroVive Pharmaceutical
Oasmia Pharmaceutical
Orexo
Ortivus
Probi
RaySearch
Recipharm
SECTRA
Swedish Orphan Biovitrum
Vitrolife

**Trading & Retail**
AAK
Addtech
Axfood
B&B TOOLS
BE Group
Bilia
Björn Borg
Black Earth Farming
Bufab Holding
Byggmax Group
CDON Group
Clas Ohlson
Cloetta
Electra Gruppen
Fenix Outdoor Int.
Hemtex
Hennes & Mauritz
ICA Gruppen
Indutrade
KappAhl
Malmbergs Elektriska
Mekonomen
MQ Holding
New Wave Group
Odd Molly
OEM International
rnb Retail and Brands
Swedol
Trigon Agri
Venue Retail Group

**Excluded**
Atrium Ljungberg
Avanza
Balder
Besqab
Bure Equity
Castellum
Catena
Corem Property Group
Creades
Diös Fastigheter
East Capital Explorer
Fabege
FastPartner
Havsfrun
Heba
Hemfosa Fastigheter
Hufvudstaden
Industrivärden
Intrum Justitia
Investor
Kinnevik
Klövern
Kungsleden
Latour
Lundbergföretagen
Melker Schörling
Midway
NAXS Nordic Access Buyout Fund
Nordea Bank
Nordnet
Novestra
Platzer Fastigheter Hold.
Ratos
Sagax
SEB
Swedbank
Svenska Handelsbanken
Svolder
Traction
Tribona

**Excluded contd.**
Wallenstam
Victoria Park
Wihlborgs Fastigheter
Vostok Nafta Investment
Öresund

***Excluded industries***
*Real Estates*
*Conglomerates*
*Mixed Buildings*
*Investment Companies*

## APPENDIX B – DETAILS OF THE INDUSTRY PARTIAL PMBS

**Table [B:1] Details of estimated partial PMBs for the pharmaceutical industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 20 | 28 | 15 | 23 | 0 | 20 | 32 |
| Standard deviation | 0.42 | 0.29 | 0.18 | 3.06 | | 0.12 | 3.32 |
| $10^{th}$ percentile | 0.00 | 0.00 | 0.00 | 0.21 | | 0.00 | 0.03 |
| $25^{th}$ percentile | 0.02 | 0.01 | 0.01 | 0.69 | | 0.02 | 0.21 |
| Median | 0.04 | 0.02 | 0.02 | 1.03 | | 0.04 | 0.87 |
| $75^{th}$ percentile | 0.07 | 0.05 | 0.04 | 3.71 | | 0.06 | 1.93 |
| $90^{th}$ percentile | 0.18 | 0.17 | 0.22 | 8.36 | | 0.27 | 8.12 |

**Table [B:2] Details of estimated partial PMBs for the software & electronics industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 16 | 33 | 8 | 19 | 6 | 13 | 34 |
| Standard deviation | 0.08 | 0.03 | 0.02 | 0.74 | 0.18 | 0.13 | 0.71 |
| $10^{th}$ percentile | 0.00 | 0.00 | 0.00 | 0.08 | 0.02 | 0.00 | 0.02 |
| $25^{th}$ percentile | 0.01 | 0.00 | 0.01 | 0.24 | 0.03 | 0.01 | 0.10 |
| Median | 0.02 | 0.01 | 0.02 | 0.47 | 0.16 | 0.01 | 0.28 |
| $75^{th}$ percentile | 0.05 | 0.02 | 0.04 | 0.73 | 0.35 | 0.02 | 0.56 |
| $90^{th}$ percentile | 0.16 | 0.08 | 0.05 | 2.29 | 0.45 | 0.05 | 0.86 |

**Table [B:3] Details of estimated partial PMBs for the pulp & paper industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 5 | 7 | 7 | 1 | 1 | 7 | 8 |
| Standard deviation | 0.03 | 0.19 | 0.06 | | | 0.02 | 0.21 |
| $10^{th}$ percentile | 0.01 | 0.17 | 0.02 | 0.04 | 0.10 | 0.02 | 0.47 |
| $25^{th}$ percentile | 0.01 | 0.31 | 0.12 | 0.04 | 0.10 | 0.02 | 0.53 |
| Median | 0.03 | 0.42 | 0.14 | 0.04 | 0.10 | 0.04 | 0.62 |
| $75^{th}$ percentile | 0.07 | 0.53 | 0.17 | 0.04 | 0.10 | 0.06 | 0.73 |
| $90^{th}$ percentile | 0.08 | 0.76 | 0.22 | 0.04 | 0.10 | 0.07 | 1.11 |

**Table [B:4] Details of estimated partial PMBs for the consumer goods industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 8 | 8 | 7 | 5 | 1 | 8 | 8 |
| Standard deviation | 0.05 | 0.15 | 0.08 | 0.14 | | 0.01 | 0.29 |
| $10^{th}$ percentile | 0.01 | 0.01 | 0.07 | 0.03 | 0.06 | 0.01 | 0.16 |
| $25^{th}$ percentile | 0.02 | 0.10 | 0.08 | 0.04 | 0.06 | 0.01 | 0.29 |
| Median | 0.03 | 0.13 | 0.17 | 0.20 | 0.06 | 0.01 | 0.37 |
| $75^{th}$ percentile | 0.03 | 0.21 | 0.22 | 0.22 | 0.06 | 0.03 | 0.80 |
| $90^{th}$ percentile | 0.17 | 0.49 | 0.31 | 0.36 | 0.06 | 0.04 | 0.89 |

**Table [B:5] Details of estimated partial PMBs for the capital-intensive service industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 8 | 25 | 14 | 4 | 3 | 16 | 26 |
| Standard deviation | 0.03 | 0.26 | 0.21 | 1.57 | 0.02 | 0.02 | 0.70 |
| $10^{th}$ percentile | 0.00 | 0.03 | 0.02 | 0.02 | 0.08 | 0.00 | 0.05 |
| $25^{th}$ percentile | 0.00 | 0.06 | 0.02 | 0.08 | 0.08 | 0.00 | 0.19 |
| Median | 0.02 | 0.18 | 0.05 | 0.26 | 0.09 | 0.02 | 0.39 |
| $75^{th}$ percentile | 0.03 | 0.35 | 0.20 | 1.84 | 0.11 | 0.03 | 0.57 |
| $90^{th}$ percentile | 0.10 | 0.54 | 0.45 | 3.31 | 0.11 | 0.03 | 1.17 |

**Table [B:6] Details of estimated partial PMBs for the engineering industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 23 | 24 | 21 | 17 | 3 | 17 | 25 |
| Standard deviation | 0.05 | 0.27 | 0.05 | 0.26 | 0.13 | 0.01 | 0.39 |
| 10th percentile | 0.01 | 0.02 | 0.02 | 0.04 | 0.02 | 0.01 | 0.17 |
| 25th percentile | 0.02 | 0.04 | 0.03 | 0.13 | 0.02 | 0.01 | 0.23 |
| Median | 0.03 | 0.07 | 0.05 | 0.21 | 0.21 | 0.01 | 0.36 |
| 75th percentile | 0.05 | 0.16 | 0.07 | 0.46 | 0.26 | 0.02 | 0.64 |
| 90th percentile | 0.15 | 0.23 | 0.14 | 0.57 | 0.26 | 0.04 | 1.04 |

**Table [B:7] Details of estimated partial PMBs for the other production industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 13 | 20 | 17 | 7 | 1 | 17 | 26 |
| Standard deviation | 0.08 | 0.45 | 0.18 | 0.06 | | 0.07 | 0.62 |
| 10th percentile | 0.01 | 0.02 | 0.01 | 0.02 | 0.50 | 0.00 | 0.06 |
| 25th percentile | 0.01 | 0.04 | 0.05 | 0.03 | 0.50 | 0.01 | 0.09 |
| Median | 0.02 | 0.12 | 0.08 | 0.05 | 0.50 | 0.02 | 0.25 |
| 75th percentile | 0.02 | 0.23 | 0.14 | 0.13 | 0.50 | 0.04 | 0.54 |
| 90th percentile | 0.03 | 0.98 | 0.33 | 0.19 | 0.50 | 0.09 | 1.25 |

**Table [B:8] Details of estimated partial PMBs for the construction industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 0 | 4 | 4 | 0 | 0 | 4 | 5 |
| Standard deviation | | 0.04 | 0.03 | | | 0.01 | 0.07 |
| 10th percentile | | 0.01 | 0.00 | | | 0.00 | 0.02 |
| 25th percentile | | 0.04 | 0.03 | | | 0.00 | 0.08 |
| Median | | 0.07 | 0.06 | | | 0.01 | 0.15 |
| 75th percentile | | 0.09 | 0.07 | | | 0.01 | 0.16 |
| 90th percentile | | 0.10 | 0.07 | | | 0.01 | 0.18 |

**Table [B:9] Details of estimated partial PMBs for the trading & retail industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 21 | 29 | 19 | 3 | 3 | 20 | 30 |
| Standard deviation | 0.27 | 0.09 | 0.19 | 0.06 | 0.22 | 0.02 | 0.33 |
| 10th percentile | 0.01 | 0.01 | 0.00 | 0.01 | 0.06 | 0.00 | 0.01 |
| 25th percentile | 0.02 | 0.02 | 0.01 | 0.01 | 0.06 | 0.00 | 0.11 |
| Median | 0.04 | 0.03 | 0.04 | 0.09 | 0.07 | 0.01 | 0.15 |
| 75th percentile | 0.06 | 0.09 | 0.12 | 0.14 | 0.44 | 0.02 | 0.25 |
| 90th percentile | 0.12 | 0.22 | 0.20 | 0.14 | 0.44 | 0.04 | 0.53 |

**Table [B:10] Details of estimated partial PMBs for the consultant & computer industry**

| Partial PMB | Inv. | M&E | B&L | R&D | Mkt. exp | Def. tax | = Total |
|---|---|---|---|---|---|---|---|
| Number of obs. | 2 | 18 | 5 | 3 | 1 | 4 | 19 |
| Standard deviation | 0.00 | 0.01 | 0.01 | 0.42 | | 0.01 | 0.31 |
| 10th percentile | 0.00 | 0.00 | 0.00 | 0.04 | 0.41 | 0.00 | 0.00 |
| 25th percentile | 0.00 | 0.00 | 0.00 | 0.04 | 0.41 | 0.00 | 0.01 |
| Median | 0.00 | 0.01 | 0.00 | 0.27 | 0.41 | 0.01 | 0.01 |
| 75th percentile | 0.00 | 0.01 | 0.02 | 0.85 | 0.41 | 0.02 | 0.03 |
| 90th percentile | 0.00 | 0.04 | 0.03 | 0.85 | 0.41 | 0.02 | 0.32 |