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Impact of Markup on Profitability Ratios: Evidence from Finland

Erkki K. Laitinen

School of Accounting and Finance, University of Vaasa, Vaasa, Finland
Email: erkki.k.laitinen@uwasa.fi

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Abstract

The objective of the study is to show how the markup affects key ratios of profitability. Markup is an important tool for pricing planning and control, but little research has been done on it from a business management perspective. In this study, a simple mathematical model is developed to demonstrate the connection between markup and profitability ratios. In addition to the markup, key factors influencing the ratios are the average lag between expenditures and revenues, which is connected to the company's expenditure structure and industry. In addition to markup and average lag, key ratios are also affected by the company's growth. The results of the study are illustrated in artificial data (100 randomized observations) and empirical data (733 Finnish companies). The results show that markup has a strong influence on profitability ratios, but other factors cause considerable fluctuations in the values of the ratios. However, profit margin is affected only by markup.

Keywords

Markup, Pricing, Profitability Ratios, Finnish Firms

1. Introduction

Pricing is one of the most important decisions made by the management. When Finnish companies were asked how strategically important they consider pricing to be on a scale of 1 - 5 (1 = no importance and 5 = extremely important), the average of the answers (n = 206) was 4.34 and the median was 5 (Laitinen, 2009; Laitinen, 2013). Despite the strategic importance of pricing for companies, there seems to be a lack of academic interest in the field of pricing (Avlonitis & Indounas, 2006). Nagle and Holden (1995) suggested that pricing is the most neglected element of the marketing mix. Several researchers have suggested that pricing is the only element of the marketing mix that generates revenue for the company, when other elements of the marketing mix are related to costs (Finch, Becherer, & Casavant, 1998; Potter, 2000; O'Connor, 2003). Pricing is also the most flexible element of the marketing mix, as pricing decisions can be implemented relatively quickly and inexpensively (Urbany, 2001). Thus, pricing is a very important element of marketing mix increasing the need for academic research on pricing. Factually, pricing is a cornerstone of economic analysis (Chavas & Pagani, 2020).

However, pricing is also a controversial issue that has raised a strong debate between economists and accountants (Laitinen, 2013; Lucas, 2003; Lucas & Rafferty, 2008). The neoclassical theory of the firm postulates that optimal pricing means to equate marginal product cost MC and marginal revenue MR conforming to the Amoroso-Robinson rule (Amoroso, 1930; Robinson, 1933). The optimal condition $MC = MR$ implies that the markup is defined as $e/(1 + e)$, where e is the price elasticity of demand. Thus, the pricing theory suggests that the profit-maximizing firms should use marginal cost as the basis of pricing and add a markup following the Amoroso-Robinson rule. Thus, in this case, the profit-maximizing price is determined as $MC \cdot e/(1 + e)$. Therefore, the ratio of the (marginal gross) profit to the price can be calculated through $(P\text{-}MC)/P = -1/e$ which is known as Lerner index. According to the index, the profitability ratio is inversely proportional to the price elasticity of demand. Lerner index is 0 for a perfectly competitive firm that has no market power (profit = 0). Since both output prices and marginal costs are unobservable, researchers have typically estimated markups using data from firm-level financial statements through the expression $M = P/MC = b \cdot$Revenue/Cost of goods sold (COGS), where b is the output elasticity of the variable inputs to production estimated using the log production function (Bilyk, Grieder, & Khan, 2023; Konzcal & Lusiani, 2022).

The controversial issue, a gap between (neoclassical) theory and practice, has arisen, since pricing practices do not follow the theoretical recommendations for profit maximization (Lucas, 2003; Lucas & Rafferty, 2008). The majority of companies do not use the theoretically recommended marginal pricing based on marginal costs MC, but calculate the price according to the full cost principle, considering all the costs of the product in the price (Fitzpatrick, 1964; Smyth, 1967; Govindarajan & Anthony, 1983; Cunningham & Hornby, 1993; Shim & Sudit, 1995; Avlonitis & Indounas, 2006; Laitinen, 2013). The results from Finnish firms also give support to the existence of the gap, since variable (marginal) costing is only used by 14.0% of the firms (Laitinen, 2013). If the full-cost users (periodic and normal capacity) are summed up, the rate of full-cost adopters is 55.3%. In addition, 16.9% of the respondents use activity-based costs that may also refer to full-cost concept (but also in special circumstances, to marginal costs). Therefore, up to 72.1% of the Finnish firms may be full-cost adopters, which is close to the percentage (69.5%) got by Shim and Sudit (1995). Thus, cost accounting systems in practice are mostly not constructed to estimate marginal costs but full-costs for the products (Drury & Tayles, 2000; Ahmed & Scapens, 2000).

The gap between theory and practice can be solved considering the production of goods as a longer-term process. In the longer perspective, the amount of fixed costs will decrease and, finally, vanish: in the long-term, there are only variable costs. However, the approaches used by researchers and managers to utilize markup information differ significantly from each other. Firstly, researchers apply advanced econometric methods to estimate markups which are used to assess the structure of the markets. If product markets are characterised by a lack of competition, firms can charge a markup over their marginal costs and achieve monopoly rents which in the longer term can lead to higher prices and lower output. Secondly, managers use their own cost accounting systems to get an estimate of the full-cost of the product and use markups in pricing to plan and control profitability.

However, more research is needed to show the relationship between markup and different profitability ratios. Markup is conceptually closely related to the profit margin that relates the difference between the price and the cost to the price whereas markup relates this difference to the cost. However, it is not clear how markup is related to such profitability measures as cash flow and return on assets. In this study, a simple longer-term model of production is developed and used to investigate the relationship between markup and different profitability ratios. The present model will be a steady approach having similarities with the approach used earlier by Laitinen (2024). Laitinen used the approach to show the impact of expenditure structure on profitability ratios. In this study, the steady framework is applied to investigate the impact of markup on these kinds of profitability ratios.

Thus, in summary, the purpose of this study is to present a longer-term process model of production and use this process model to analyse the characteristics of markup. The analysis is concentrated on analysing the relationships between markup and profitability ratios. The theoretical analysis is descriptive and normative analysis (for example, in the form of cost minimization) is not used. The relationships between markup and profitability ratios are also investigated using artificial data of 100 randomized observations and empirical data from 733 Finnish firms to support theoretical analysis. Empirical analysis is not, however, based on advanced econometric methods but utilizes only correlations between markup and profitability ratios. The contents of the paper are as follows. First, the background and the objective of the study were analyzed in this introductory section. In the second section, the process model of production is presented and the relationships between markup and profitability ratios are analyzed. The third section briefly discusses the artificial and empirical data and methods while the fourth section reviews empirical results. Finally, the last section summarizes the findings and outlines topics for further studies.

2. Framework for the Analysis

Let us describe the simplified production and sales process of the firm assuming that the firm manufactures Q products at the unit cost of C in the period 0. These products are all to be sold for the unit price P in this and following periods so that the sales volume follows an infinite geometric distribution by the parameter q. Thus, the proportional markup M for the product is equal to P/C. In this case, the following identity can be used to determine the internal rate of return r for the product to describe its profitability:

$$C \cdot Q = C \cdot Q \cdot M \cdot (1-q)\sum_{t=0}^{\infty} q^t (1+r)^{-t} \rightarrow 1 = M \cdot (1-q) \cdot \frac{1+r}{1+r-q} \tag{1}$$

where $r > 0$ and $q/(1 + r) < 1$ to make the geometric function converge.

Thus, in this framework the markup M can be expressed simply as:

$$M = \frac{1+r-q}{(1-q)(1+r)} = 1 + \frac{q \cdot r}{(1-q)(1+r)} = 1 + A \cdot \frac{r}{1+r} \tag{2}$$

where $A = q/(1 - q)$ is the average lag of the sales distribution. Thus, the markup is a simple function of the average lag A and the internal rate of return r. The longer it takes to sell the products, the higher the markup M of the product has to be raised in order to make the product profitable at r.

The result (2) also allows us to show the solution for the internal rate on return r as a function of M and A as follows:

$$r = \frac{P-C}{C \cdot A - (P-C)} = \frac{M-1}{A-(M-1)} \tag{3}$$

and for standard solutions $A > (M - 1)$ and $M > 1$ to ensure that $r > 0$. Thus, the faster the products are sold and the higher the markup (ceteris paribus), the better the profitability of the product.

Then, let us include dynamics into the model assuming that the process is growing at a steady rate g over time. Let us denote total product cost in the period t by $CQ(t)$ and assume that this cost is growing by g periodically. Every periodic total cost $CQ(t)$ is used to manufacture $Q(t)$ units of products which are all sold following the identical geometric sales distribution. For these assumptions the total periodic revenue $PQ(t)$ can be solved in the following way:

$$\begin{aligned} PQ(t) &= CQ(t) \cdot M \cdot (1-q)\sum_{t=0}^{\infty} q^t (1+g)^{-t} = CQ(t) \cdot M \cdot (1-q) \cdot \frac{1+g}{1+g-q} \\ &= CQ(t) \cdot \frac{1+r-q}{1+r} \cdot \frac{1+g}{1+g-q} \rightarrow \frac{PQ(t)}{CQ(t)} = \frac{1+r-q}{1+r} \cdot \frac{1+g}{1+g-q} \end{aligned} \tag{4}$$

This equation shows that the ratio of total revenue to total cost is symmetrically related to the internal rate of return r and the steady growth rate g. This ratio equals unity if $r = g$ and exceeds unity if $r > g$.

The expression (4) for the periodic total revenue makes it possible to calculate the cash flow margin CFM in the following way:

$$CFM = \frac{PQ(t) - CQ(t)}{PQ(t)} = 1 - \frac{CQ(t)}{PQ(t)} = 1 - \frac{1+r}{1+r-q} \cdot \frac{1+g-q}{1+g} \tag{5}$$

This equation can be simplified further by replacing *r* by (3) which leads to the following result:

$$CFM = 1 - \frac{1}{M} \cdot \frac{1+g-q}{(1-q)(1+g)} = 1 - \frac{1}{M} \cdot \left[1 + A \cdot \frac{g}{1+g}\right] \tag{6}$$

This result shows that *CFM* is simply an increasing function of the markup *M* but a decreasing function of the average lag *A* and the steady rate of growth *g*. If $g = 0$ or $A = 0$, $CFM = (M - 1)/M$.

The definition of *CFM* is based on the expenditure concept that is independent of periodization. However, the calculation of traditional profitability ratios requires that expenses and thus profits are defined in the process model. Because revenues are accumulated following the geometric sales function, it is logical to assume that expenses follow the same distribution. Thus, it is assumed that the value of the assets $SQ(t)$ is obtained by summing up the unexpired portions of the periodic expenditures as follows:

$$SQ(t) = \sum_{v=0}^{\infty} CQ(t)(1+g)^{-v} \sum_{s=v+1}^{\infty} q^s (1-q) = CQ(t) \frac{q(1+g)}{1+g-q} \tag{7}$$

This result for the assets of the firm can be used to calculate expenses according to the selected valuation method.

The accounting identity between expenses and expenditures says that periodic expenses can be calculated by deducting the change of assets from the periodic expenditure. Thus, the expenses $DQ(t)$ can be calculated through the accounting identity in the following way:

$$DQ(t) = SQ(t-1) - SQ(t) + CQ(t) = SQ(t) \cdot \frac{g}{1+g} + CQ(t) \tag{8}$$

which leads to the result:

$$DQ(t) = CQ(t) \cdot \frac{(1+g)(1-q)}{1+g-q} \tag{9}$$

Thus, the expense concept $DQ(t)$ is a simple function of *g* and *q* but independent of *r*.

The result (9) on the expense concept makes it possible to calculate the profit margin *PRM* as follows:

$$\frac{PQ(t) - DQ(t)}{PQ(t)} = PRM = \frac{r \cdot q}{1+r-q} = 1 - \frac{1}{M} = \frac{M-1}{M} \tag{10}$$

which is independent of *g*. Thus, using the expensing method where expenses are accumulated at the same rate as revenues, profit margin *PRM* is determined solely by the markup M. Note that $PRM = CFM$ when the steady growth rate *g* is equal to zero (or $A = 0$). When the growth rate is low, expenses and expenditures are generally close to each other, which is directly showed by the accounting identity (8).

The return on investment (assets) ROA is the most widely adopted profitability ratio. For the expensing method selected above it can be showed that the ratio where assets are defined at the beginning of the year basis is as follows:

$$\frac{PQ(t)-DQ(t)}{AQ(t-1)}=ROA=r\cdot\frac{1+g}{1+r}=\frac{M-1}{q}\cdot(1+g)(1-q)=\frac{M-1}{A}\cdot(1+g) \quad (11)$$

This equation shows that ROA is a decreasing function of the average lag A and an increasing function of the steady growth rate g and the markup M.

In summary, the present process model of production makes it possible to describe profitability ratios CFM, PRM, and ROA in simple terms as functions of markup M as showed in Equations (6), (10), and (11), respectively. PRM is only dependent of M being closely associated with markup through a simple monotonic (but not linear) transformation. Thus, it is obvious that statistical association to M is highest for PRM. If $g = 0$, CFM equals PRM. The deviations of CFM from PRM are thus largely due to growth g but also to average lag A. Therefore, it can be hypothesized that the statistical association of markup M is lower to CFM than to PRM. ROA is also closely related to markup M but, in addition, this relationship is affected by growth g and average lag A, which weakens statistical association. Therefore, it is expected that the association of markup M to ROA is about as strong as to CFM. In summary, it is expected that statistical association of markup M is strongest to PRM but also strong to CFM and ROA, which are comparable with respect to the strength of association. If growth g is very low, the fluctuations in CFM are small, because then CFM is close to PRM. Therefore, this low growth does not have as strong an effect on the fluctuations of ROA. However, ROA is sensitive to the variations in A, because A acts as a divisor in the ROA formula.

3. Data, Methods and Variables

The theoretical results are illustrated in two different data sets, artificial experimental data and empirical data from Finnish firms. The purpose of the artificial experiment is to illustrate the connections between markup M and the (artificial) profitability indicators calculated on the basis of derived formulas in randomized data. The values of the central variables of the model are drawn with the random number generator (randbetween) in the Excel software in such a way that they are uniformly distributed in the given relevant range. The profitability ratios are calculated based on these randomized values. The dependence between the ratios and markup M is investigated using Pearson correlation and Spearman rank correlation coefficients. The goal is to evaluate the direction (correlations) and intensity (graphical analysis) of the variation in the ratios with respect to M. The variables of the theoretical model are ranged so that markup M varies randomly between 1.00 and 1.20, average lag A between 0.25 and 2.5, and growth g between 0.00 and 0.10. These ranges are consistent with the results from the empirical data. Internal rate of interest r is calculated based on the values of variables M and A according to Equation (3). The experiment includes a total of 100 observations which are randomly drawn for analysis. The experimental data are presented in **Appendix 1**.

The experimental data allows us only to use artificial observations of markup and profitability ratios based on uniformly distributed artificial variables which are assumed independent. Therefore, the relationships between markup M and profitability ratios are also analyzed using financial statement data from Finnish firms. The mathematical analysis showed that the relationships between M and the three ratios is expected to be strong but is it an empirical question of how strong they are in reality. The present mathematical model is based on assumptions related to a steady state and steady long-term growth which usually approximately hold only for larger firms. Therefore, empirical evidence for this study is gathered from a sample of middle-sized and large companies having longer time-series of successive financial statements publicly available (see Laitinen, 2024).

The sample is extracted from the ORBIS database of van Dijk (BvD) (Bureau van Dijk, 2023). ORBIS includes financial and other information on more than 489 million companies across the globe. ORBIS captures and blends data from more than 170 different sources and makes the data standardized and comparable. In extracting the sample, a restriction that the selected company must be Finnish and employ more than 50 employees was applied. In addition, the selected company must have a longer time series of total expenditure and net sales available, to estimate the long-term growth rate. The sample was extracted from a period before the COVID-19 pandemic to avoid its potential effects on the data on M (see Bilyk, Grieder, & Khan, 2023). The sample selected in this way consisted of 957 limited companies. However, the companies which did not fulfil the convergence conditions $A > M-1$ and $M > 1$ in (3) were deleted, so that the final sample includes 733 companies. The following series shows the stages in the sampling:

Orbis data base
Finnish firms
More than 50 employees
Longer time series
Preliminary sample: 957 firms
Convergence conditions
Final sample: 733 firms

The final sample mainly consist of limited private firms (88.1%) and there are only few limited public firms (11.9%). The size distribution of the sample companies is skewed, since the average number of employees is 938 whereas the median is only 219. The average net sales of the companies are 286.388 Teur the median being only 55.010 Teur. The average total assets in the sample are 278.357 Teur while the median is 32.454 Teur. The industrial classification of the sample companies is presented in **Appendix 2**. Most companies are from manufacturing (36.4%), wholesale and retail trade (17.2%), professional, scientific and technical activities (7.8%), or information and communication (7.1%) industries. The sample is with respect to size and industrial distribution quite representative sample of Finnish middle-sized and large companies.

The variables of the analyses were calculated following the theoretical concepts. Total expenditure (expense) is defined as the sum of current and fixed expenditures (expenses) following the accounting identity (9). The total revenue concept was measured by net sales. Then, the three profitability ratios were calculated as follows:

$$CFM = (\text{Total revenue} - \text{Total expenditure})/\text{Total revenue}$$

$$PMR = (\text{Total revenue} - \text{Total expense})/\text{Total revenue} = \text{EBIT}/\text{Total revenue}$$

$$ROA = (\text{Total revenue} - \text{Total expense})/\text{Total assets} = \text{EBIT}/\text{Total assets}$$

In these definitions, total revenue (net sales) does not include other revenue and total expense does not include interest expenses or taxes. Total assets in *ROA* are defined on the beginning of the year basis.

The variables markup M, (long-term) growth g, the average lag A, and the internal rate of return r are approximated following simple procedures. First, markup M is calculated through (10) as $M = 1/(1 - PMR)$. Secondly, estimates of long-term growth rate in total revenue and total expenditures are estimated applying the regression analysis on nine-year time series. The final estimate of g is calculated as a weighted sum of these estimates using the sum of time-series as weights.

Third, the average lag A is approximated using the multiple of total assets to total expenditure. In the theoretical framework, it is showed in (7) that the ratio of total assets SQ(t) to total expenditure CQ(t) can be used to approximate first q and further A in the following way:

$$\frac{SQ(t)}{CQ(t)} =: V = \frac{q(1+g)}{1+g-q} \rightarrow q = \frac{V(1+g)}{V+1+g} \rightarrow A = \frac{q}{1-q} \tag{12}$$

where V is defined as the ratio of total assets to total expenditure.

Fourth, internal rate of return r is approximated through (3) using the estimates of M and A. The estimates of q, A, and r are only rough approximations (see Laitinen & Laitinen, 2022). For the statistical analyses, all model variables are winzorized at the 2.5/97.5 percentiles level to minimize the impact of extreme outliers on the results. The effect of M on profitability ratios is analyzed in the same way as in the artificial data using correlations and graphical analysis.

4. Empirical Results

Table 1 presents descriptive statistics for the artificial data of 100 randomized observations. Because the variables M, A, and g are drawn from the uniform distributions, skewness and kurtosis for these variables are quite low. However, internal rate of return r estimate that is calculated through (3) using these three estimates has a high kurtosis. In general, the estimates of *r* are higher than the estimates of *g* due to the range constraint set on g. The values of *ROA* are however comparable with those of *r*. The lower quartile of *CFM* is negative due to the observations where *g* exceeds *r*, which is theoretically shown by (5). The average *M* is in this experiment only 1.094 that is below the values got for markup in empirical studies. However, markup is here added to total cost, not on marginal cost which makes it smaller.

Table 1. Descriptive statistics for the artificial experiment (uniform distributions) (n = 100).

	Mean	Std. Deviation	Skewness	Kurtosis	Quartiles		
					25	50	75
M	1.094	0.059	0.176	−1.055	1.043	1.090	1.140
A	1.259	0.662	0.250	−1.210	0.665	1.130	1.858
g	0.050	0.032	−0.106	−1.236	0.020	0.050	0.080
r	0.121	0.129	2.313	7.067	0.049	0.079	0.158
CFM	0.027	0.065	−0.604	1.053	−0.005	0.029	0.065
PRM	0.083	0.049	0.029	−1.074	0.041	0.083	0.123
ROA	0.103	0.091	1.574	2.759	0.049	0.077	0.137

Table 2 and **Table 3** present the Pearson and Spearman rank correlation coefficients for the artificial data. The statistical results support expectations, since markup *M* is almost perfectly correlated with *PRM* (0.999) when the Pearson correlation is considered. The transformation (10) between *M* and *PRM* is not linear but it is monotonic making the Spearman rank correlation equal unity (1.000). The Pearson and rank correlations of *M* to *CFM* (0.643 & 0.656) and *ROA* (0.589 & 0.724) are consistent with the expectations. These correlations are high and comparable with each other. *M* is not strongly correlated with the average lag *A* or the growth rate *g*, since Pearson and rank correlations to *A* are 0.178 & 0.185 and to *g* 0.130 & 0.124. However, is closely positively correlated with internal rate of return *r* (0.531 & 0.721). This rate *r* is strongly positively correlated with all profitability ratios, especially with ROA (0.988 & 0.998). These results are also consistent with expectations, since *r* is often in financial analysis used as a surrogate of actual profitability.

Table 2. Pearson correlations for the artificial experiment (n = 100).

	M	*A*	*g*	*r*	*CFM*	*PRM*	*ROA*
M	1.000	0.178	0.130	0.531	0.643	0.999	0.589
p-value	.	0.077	0.196	<0.001	<0.001	<0.001	<0.001
A	0.178	1.000	0.166	−0.509	−0.424	0.177	−0.523
p-value	0.077	.	0.098	<0.001	<0.001	0.078	<0.001

Continued

g	0.130	0.166	1.000	0.052	−0.456	0.128	0.067
p-value	0.196	0.098	.	0.605	<0.001	0.206	0.508
r	0.531	−0.509	0.052	1.000	0.652	0.533	0.988
p-value	<0.001	<0.001	0.605	.	<0.001	<0.001	<0.001
CFM	0.643	−0.424	−0.456	0.652	1.000	0.644	0.697
p-value	<0.001	<0.001	<0.001	<0.001	.	<0.001	<0.001
PRM	0.999	0.177	0.128	0.533	0.644	1.000	0.593
p-value	<0.001	0.078	0.206	<0.001	<0.001	.	<0.001
ROA	0.589	−0.523	0.067	0.988	0.697	0.593	1.000
p-value	<0.001	<0.001	0.508	<0.001	<0.001	<0.001	.

Note: *p*-value refers to 2-tailed significance.

Table 3. Spearman rank correlations for the artificial experiment (n = 100).

	M	*A*	*g*	*r*	*CFM*	*PRM*	*ROA*
M	1.000	0.185	0.124	0.721	0.656	1.000	0.724
p-value	.	0.066	0.219	<0.001	<0.001	.	<0.001
A	0.185	1.000	0.148	−0.483	−0.380	0.185	−0.477
p-value	0.066	.	0.142	<0.001	<.001	0.066	<0.001
g	0.124	0.148	1.000	0.027	−0.446	0.124	0.063
p-value	0.219	0.142	.	0.791	<0.001	0.219	0.534
r	0.721	−0.483	0.027	1.000	0.813	0.721	0.998
p-value	<0.001	<0.001	0.791	.	<.001	<0.001	<0.001
CFM	0.656	−0.380	−0.446	0.813	1.000	0.656	0.789
p-value	<0.001	<0.001	<0.001	<0.001	.	<0.001	<0.001
PRM	1.000	0.185	0.124	0.721	0.656	1.000	0.724
p-value	.	0.066	0.219	<0.001	<0.001	.	<0.001
ROA	0.724	−0.477	0.063	0.998	0.789	0.724	1.000
p-value	<0.001	<0.001	0.534	<0.001	<0.001	<0.001	.

Note: *p*-value refers to 2-tailed significance.

Figures 1(a)-(c) show graphically the relationship of *M* to profitability ratios *CFM*, *PRM*, and *ROA* when *M* is sorted in order of size from smallest (1.00) to largest (1.20). For all ratios, the relationship is increasing as expected. For *PRM*, the relationship is depicted by almost a straight line. For the ratio *CFM*, the fluctuations are regular and occur in a limited area. The size of the fluctuations remains approximately constant as *M* increases. The fluctuations in *ROA* are however strong and their size increases as *M* increases. The differences in the fluctuations in *ROA* and *CFM* on *M* are due to the fact that *A* and *g* affect the values of these profitability ratios in different ways. For *CFM*, the effect of *A* and *g* is made low by the low values of growth.

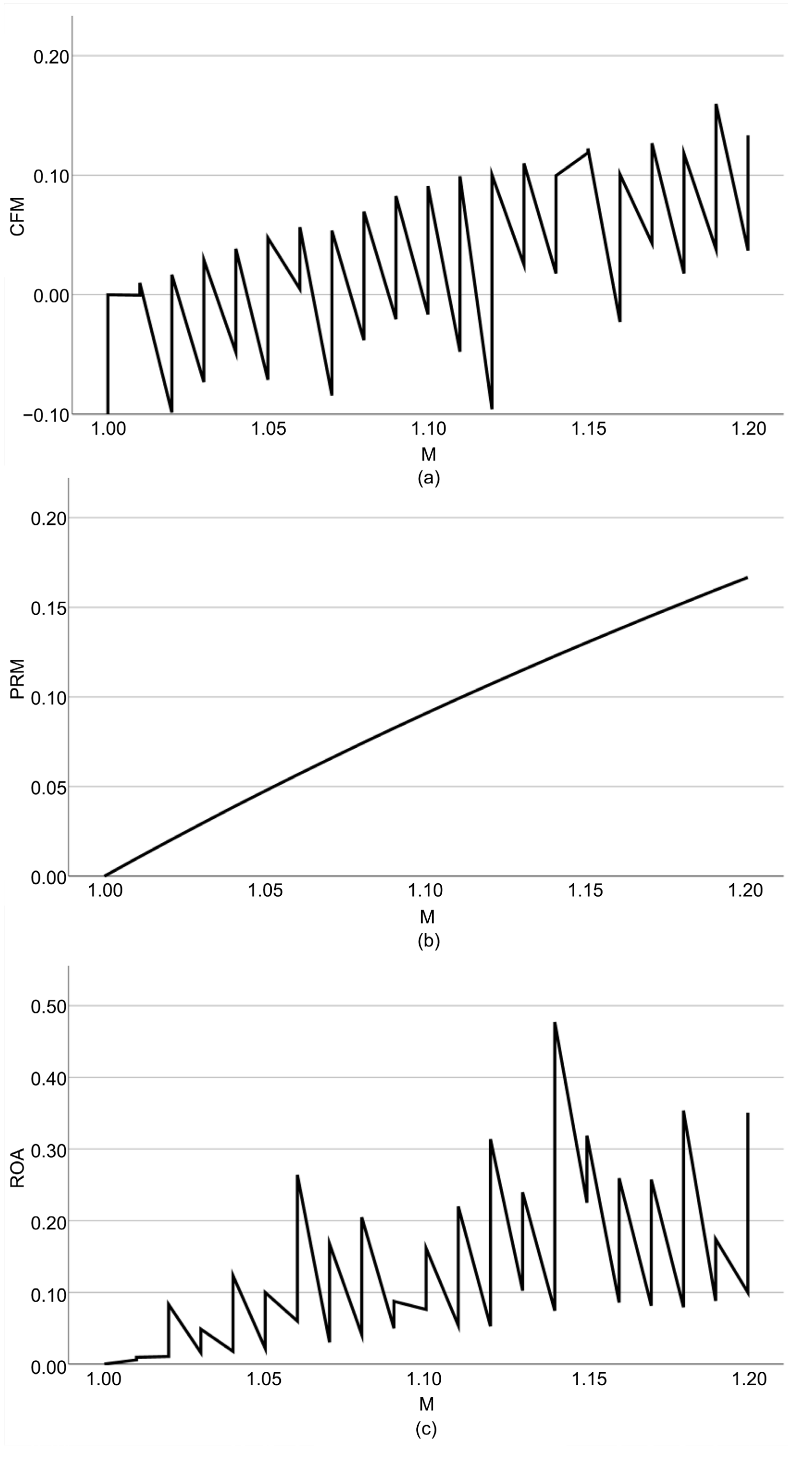

Figure 1. Profitability ratios *CFM*, *PRM*, and *ROA* when markup *M* in rank order goes from 1.00 to 1.20 (artificial experiment data).

Table 4 presents descriptive statistics for the empirical data, which is based on the financial statements of 733 Finnish companies. In this data, the average of markup *M* is even lower than in the artificial material, as the median is only 1.048. The growth of companies is exceptionally slow, often even negative, and profitability does not rise very high. Thus, the research period is characterized by low growth and low profitability in Finnish firms. The distribution of internal rate of return *r* is consistent (comparable) with the distribution of the profitability ratio *ROA*. The distributions of variables *M*, *A* and *r* show clear skewness and kurtosis. Due to the low growth of companies, the values of *CFM* are mostly positive. However, there are also plenty of negative values (10%), which shows that in several companies the growth rate *g* exceeds the internal interest rate *r* as (5) indicates.

Table 4. Descriptive statistics of the actual empirical sample (n = 733).

	Mean	Std. Deviation	Skewness	Kurtosis	Quartiles		
					25	50	75
M	1.073	0.075	1.975	3.880	1.024	1.048	1.093
A	0.867	0.767	2.749	8.235	0.435	0.637	0.979
g	0.025	0.050	0.193	0.096	−0.005	0.025	0.055
r	0.122	0.150	3.291	13.247	0.041	0.079	0.143
CFM	0.059	0.088	0.559	1.736	0.014	0.048	0.099
PRM	0.064	0.058	1.607	2.353	0.024	0.046	0.085
ROA	0.098	0.088	1.683	2.849	0.039	0.072	0.131

Table 5 and **Table 6** show Pearson and Spearman correlation coefficients for the empirical data. These correlations show the obvious result that the markup *M* is almost perfectly or perfectly (Spearman correlation) correlated with the ratio *PRM* with which it has a monotonic relationship. The Pearson correlation coefficient between these variables is 0.981 whereas the rank correlation is 1.000. Markup *M* is also strongly connected to other profitability ratios *CFM* (0.597 & 0.587) and especially *ROA* (0.641 & 0.730). The correlation of *M* with the internal rate of return *r* is also strong (0.645 & 0.734), whereas its correlation with growth rate *g* is low (0.043 & 0.081). The internal rate of return *r* also has a strong dependence on the ratios of profitability, especially on the ratios *ROA* and *PRM*. Markup *M* also has a significant correlation with average lag *A* (0.469 & 0.480).

Table 5. Pearson correlations for the actual empirical sample (n = 733).

	M	*A*	*g*	*r*	*CFM*	*PRM*	*ROA*
M	1.000	0.469	0.043	0.645	0.597	0.981	0.641
p-value	.	<0.001	0.241	<0.001	<0.001	0.000	<0.001
A	0.469	1.000	−0.061	−0.177	0.259	0.460	−0.194
p-value	<0.001	.	0.100	<0.001	<0.001	<0.001	<0.001
g	0.043	−0.061	1.000	0.098	−0.088	0.054	0.164
p-value	0.241	0.100	.	0.008	0.017	0.147	<0.001

Continued

r	0.645	−0.177	0.098	1.000	0.442	0.658	0.985
p-value	<0.001	<0.001	0.008	.	<0.001	<0.001	0.000
CFM	0.597	0.259	−0.088	0.442	1.000	0.538	0.429
p-value	<0.001	<0.001	0.017	<0.001	.	<0.001	<0.001
PRM	0.981	0.460	0.054	0.658	0.538	1.000	0.663
p-value	0.000	<0.001	0.147	<0.001	<0.001	.	<0.001
ROA	0.641	−0.194	0.164	0.985	0.429	0.663	1.000
p-value	<0.001	<0.001	<0.001	0.000	<0.001	<0.001	.

Note: *p*-value refers to 2-tailed significance.

Table 6. Spearman rank correlations for the actual empirical sample (n = 733).

	M	*A*	*g*	*r*	*CFM*	*PRM*	*ROA*
M	1.000	0.480	0.081	0.734	0.587	1.000	0.730
p-value	.	<0.001	0.029	<0.001	<0.001	.	<0.001
A	0.480	1.000	−0.042	−0.154	0.285	0.469	−0.156
p-value	<0.001	.	0.252	<0.001	<0.001	<0.001	<0.001
g	0.081	−0.042	1.000	0.141	−0.072	0.092	0.192
p-value	0.029	0.252	.	<0.001	0.053	0.013	<0.001
r	0.734	−0.154	0.141	1.000	0.442	0.738	0.998
p-value	<0.001	<0.001	<0.001	.	<0.001	<0.001	0.000
CFM	0.587	0.285	−0.072	0.442	1.000	0.561	0.433
p-value	<0.001	<0.001	0.053	<0.001	.	<0.001	<0.001
PRM	1.000	0.469	0.092	0.738	0.561	1.000	0.736
p-value	.	<0.001	0.013	<0.001	<0.001	.	<0.001
ROA	0.730	−0.156	0.192	0.998	0.433	0.736	1.000
p-value	<0.001	<0.001	<0.001	0.000	<0.001	<0.001	.

Note: *p*-value refers to 2-tailed significance.

Figures 2(a)-(c) show graphically the relationship of *M* to profitability ratios *CFM*, *PRM*, and *ROA* in the empirical data when *M* is sorted in order of size from smallest (1.00) to largest (1.35). The empirical connection between markup *M* and ratio *PRM* is, as can be expected from a theoretical relationship, almost linear, and there are no fluctuations, because *PRM* depends (monotonically) only on *M*. From the graphs of ratios *CFM* and *ROA*, it can be seen that the dependence between them and *M* is anyway positive, but there are very strong fluctuations in the values of both ratios. The oscillations in *CFM* start at full scale as soon as *M* starts increasing from unity upwards. They remain large as the values of *M* increase. In the same way, there are also strong fluctuations in the values of ratio *ROA*, but not quite at the lowest values of *M*. The fluctuations of both ratios are clearly stronger than in the artificial data.

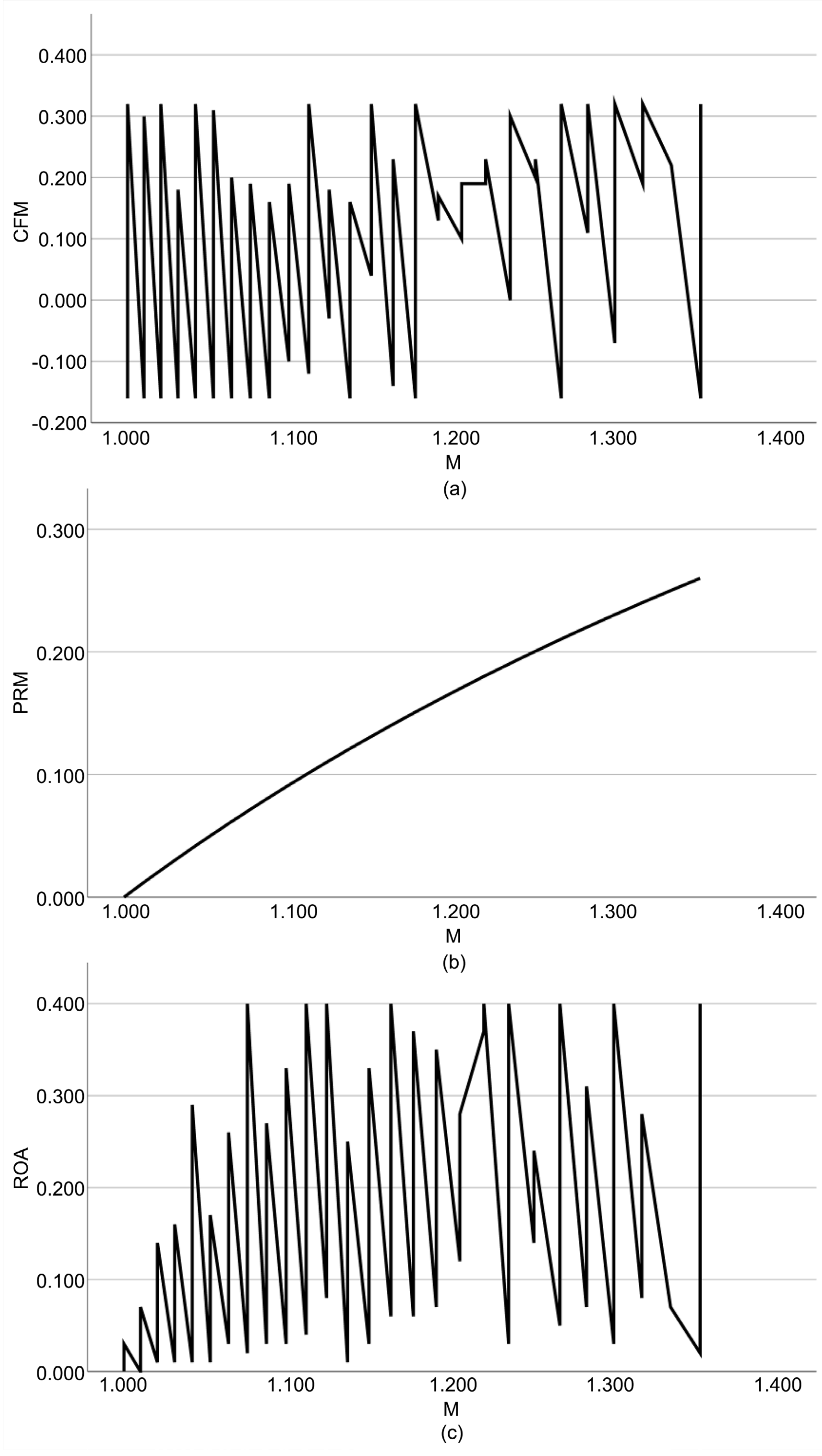

Figure 2. Profitability ratios *CFM*, *PRM*, and *ROA* when markup *M* in rank order goes from 1.00 to 1.35 (empirical data).

5. Conclusion

In this study, the focal point is markup, which in this context means the relative difference between the selling price and the unit (full) cost, the relative margin.

Markup-related research has been done from two different perspectives. First of all, econometricians have estimated the markup from the company's financial statement data and used it to evaluate the competitive situation in the market. The analysis has been based on profit maximization (or cost minimization), where the markup is evaluated using the difference between revenues and marginal costs. Secondly, company managers have used markup as a support for pricing, in which case markup is evaluated as the difference between the selling price and the unit cost of the products. The managerial perspective on the markup is very important, but it has been scientifically studied very little and almost all the research done is based on an econometric perspective.

This study concentrated on the managerial perspective of markup. The aim of the study was to evaluate the impact of markup on profitability ratios using a business managerial approach. Expressed more precisely, the goal of the study was to derive a longer-term process model that could be used to evaluate the relationship between the markup and key profitability ratios. This process model is a simple mathematical model that does not include optimization. The model is descriptive and its purpose is to describe the markup and its effect on profitability figures. Using the model, the analysis was simplified. Profitability ratios were derived based on the structure of the model and the importance of the markup on these ratios was evaluated. Mathematical results derived from the model were illustrated using artificial randomized data and empirical data. The results were evaluated using simple statistical methods.

The study discussed the effect of markup on three profitability ratios, the cash flow margin, profit margin and return on (investment) assets. For key ratios, the relationship between profit margin and markup is obvious, because profit margin is a simple and monotonous transformation of markup. Markup thus has a direct and immediate effect on the profit margin, although the relationship is not linear. The relationship of the cash flow margin to the markup is also positive, but the ratio is also affected by the lag between expenditures and revenues (negatively) and growth (negatively). In the same way, the relationship between markup and return on assets is broadly positive, but the relationship is also affected by the lag (negatively) and growth (positively). For the sake of the model, the connection between the markup and key profitability ratios is simple and easy to interpret.

The relationship between markup and profitability ratios was also investigated using artificial data (100 randomized observations) and empirical data (733 Finnish companies). The results show that there is a statistically significant correlation between the ratios and the markup. As indicated by the theoretical model, the relationship between markup and profit margin is monotonic, so there was a perfect correlation between the variables in both datasets as evaluated by the rank correlation. The ratios return on assets and cash flow margin have a strong correlation with the markup. In particular, return on assets has a high correlation with the markup and also with the internal rate of return, which reflects true profitability. Finally, graphical examinations showed that return on assets and cash flow margin have a positive dependence on the markup. However, both ratios have considerable fluctuations due to the influence of other factors. The relationship between profit margin and markup is described by an almost linear straight line.

The study produced interesting results on the relationship between profitability ratios and markup. However, several limitations have been made in the study, which weaken the generalizability of the results. The mathematical model developed in the research is simple and assumes that the company lives in a steady state situation. The model describes the lag structure between expenditures and revenues simply by means of an infinite geometric series. In the future, the model can be more complicated and made more realistic, for example by abandoning the steady state assumption and using other lag structures. Artificial data and empirical data consisting of Finnish companies were used as materials in this study. In the future, in the creation of artificial data, an advanced methodology related to experiments can be used. Moreover, the empirical data can be expanded to data from other countries than Finland. In addition to that, more advanced empirical methods can be used to analyze the data instead of the simple methods (correlations) used in this work.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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Appendices

Appendix 1. Artificial experiment data used in the study.

Case	*M*	*A*	*g*	*r*	*CFM*	*PRM*	*ROI*
1	1.130	0.590	0.010	0.283	0.110	0.115	0.223
2	1.190	1.090	0.000	0.211	0.160	0.160	0.174
3	1.110	0.500	0.000	0.282	0.099	0.099	0.220
4	1.110	0.920	0.050	0.136	0.060	0.099	0.126
5	1.060	0.780	0.010	0.083	0.049	0.057	0.078
6	1.000	1.260	0.090	0.000	−0.104	0.000	0.000
7	1.110	1.450	0.030	0.082	0.061	0.099	0.078
8	1.040	0.520	0.000	0.083	0.038	0.038	0.077
9	1.020	1.120	0.050	0.018	−0.033	0.020	0.019
10	1.150	0.680	0.020	0.283	0.119	0.130	0.225
11	1.090	1.360	0.090	0.071	−0.020	0.083	0.072
12	1.070	1.440	0.040	0.051	0.014	0.065	0.051
13	1.020	1.710	0.070	0.012	−0.090	0.020	0.013
14	1.080	1.850	0.070	0.045	−0.038	0.074	0.046
15	1.070	0.950	0.020	0.080	0.048	0.065	0.075
16	1.070	0.970	0.070	0.078	0.006	0.065	0.077
17	1.000	0.880	0.000	0.000	0.000	0.000	0.000
18	1.170	1.110	0.020	0.181	0.127	0.145	0.156
19	1.080	0.490	0.010	0.195	0.070	0.074	0.165
20	1.030	1.870	0.000	0.016	0.029	0.029	0.016
21	1.110	2.200	0.080	0.053	−0.048	0.099	0.054
22	1.140	1.920	0.020	0.079	0.090	0.123	0.074
23	1.170	2.110	0.060	0.088	0.043	0.145	0.085
24	1.170	0.740	0.090	0.298	0.093	0.145	0.250
25	1.080	0.570	0.050	0.163	0.049	0.074	0.147
26	1.200	0.900	0.070	0.286	0.118	0.167	0.238
27	1.140	0.320	0.090	0.778	0.100	0.123	0.477
28	1.050	2.300	0.010	0.022	0.026	0.048	0.022
29	1.040	0.890	0.000	0.047	0.038	0.038	0.045
30	1.120	2.360	0.050	0.054	0.007	0.107	0.053
31	1.170	0.720	0.090	0.309	0.094	0.145	0.257
32	1.200	0.610	0.070	0.488	0.133	0.167	0.351
33	1.160	0.660	0.070	0.320	0.101	0.138	0.259
34	1.120	1.960	0.060	0.065	0.008	0.107	0.065
35	1.190	2.280	0.060	0.091	0.051	0.160	0.088
36	1.080	0.480	0.020	0.200	0.065	0.074	0.170
37	1.030	0.640	0.040	0.049	0.005	0.029	0.049

Continued

38	1.090	1.110	0.080	0.088	0.007	0.083	0.088
39	1.070	1.510	0.090	0.049	−0.051	0.065	0.051
40	1.020	1.960	0.050	0.010	−0.072	0.020	0.011
41	1.080	2.040	0.050	0.041	−0.016	0.074	0.041
42	1.180	1.080	0.040	0.200	0.117	0.153	0.173
43	1.020	1.460	0.090	0.014	−0.099	0.020	0.015
44	1.050	0.780	0.000	0.068	0.048	0.048	0.064
45	1.100	0.710	0.000	0.164	0.091	0.091	0.141
46	1.120	0.390	0.020	0.444	0.100	0.107	0.314
47	1.200	2.100	0.080	0.105	0.037	0.167	0.103
48	1.100	1.360	0.060	0.079	0.021	0.091	0.078
49	1.000	0.420	0.080	0.000	−0.031	0.000	0.000
50	1.200	2.060	0.030	0.108	0.117	0.167	0.100
51	1.160	1.610	0.060	0.110	0.059	0.138	0.105
52	1.040	2.340	0.040	0.017	−0.048	0.038	0.018
53	1.020	0.290	0.100	0.074	−0.006	0.020	0.076
54	1.140	1.140	0.030	0.140	0.094	0.123	0.126
55	1.060	0.250	0.100	0.316	0.035	0.057	0.264
56	1.120	2.500	0.100	0.050	−0.096	0.107	0.053
57	1.040	0.350	0.080	0.129	0.014	0.038	0.123
58	1.110	1.580	0.030	0.075	0.058	0.099	0.072
59	1.050	1.510	0.090	0.034	−0.071	0.048	0.036
60	1.140	1.200	0.070	0.132	0.054	0.123	0.125
61	1.180	0.550	0.080	0.486	0.118	0.153	0.353
62	1.110	2.030	0.030	0.057	0.046	0.099	0.056
63	1.000	2.420	0.100	0.000	−0.220	0.000	0.000
64	1.160	1.710	0.080	0.103	0.029	0.138	0.101
65	1.130	0.570	0.050	0.295	0.091	0.115	0.239
66	1.070	2.340	0.050	0.031	−0.039	0.065	0.031
67	1.090	1.800	0.000	0.053	0.083	0.083	0.050
68	1.000	0.870	0.060	0.000	−0.049	0.000	0.000
69	1.170	2.190	0.050	0.084	0.056	0.145	0.082
70	1.130	1.370	0.080	0.105	0.025	0.115	0.102
71	1.010	1.050	0.000	0.010	0.010	0.010	0.010
72	1.060	1.000	0.000	0.064	0.057	0.057	0.060
73	1.150	0.480	0.020	0.455	0.122	0.130	0.319
74	1.090	1.220	0.100	0.080	−0.019	0.083	0.081
75	1.070	2.420	0.050	0.030	−0.042	0.065	0.030
76	1.070	0.430	0.030	0.194	0.054	0.065	0.168
77	1.010	1.660	0.000	0.006	0.010	0.010	0.006

Continued

78	1.170	0.840	0.040	0.254	0.118	0.145	0.210
79	1.030	1.860	0.060	0.016	−0.073	0.029	0.017
80	1.190	1.750	0.090	0.122	0.038	0.160	0.118
81	1.050	0.550	0.100	0.100	0.000	0.048	0.100
82	1.020	0.290	0.010	0.074	0.017	0.020	0.070
83	1.070	1.940	0.090	0.037	−0.084	0.065	0.039
84	1.020	0.440	0.040	0.048	0.003	0.020	0.047
85	1.140	1.830	0.070	0.083	0.018	0.123	0.082
86	1.190	1.930	0.020	0.109	0.128	0.160	0.100
87	1.080	1.390	0.060	0.061	0.001	0.074	0.061
88	1.100	0.650	0.050	0.182	0.063	0.091	0.162
89	1.090	1.740	0.030	0.055	0.036	0.083	0.053
90	1.070	1.340	0.040	0.055	0.017	0.065	0.054
91	1.010	1.050	0.010	0.010	0.000	0.010	0.010
92	1.060	0.840	0.070	0.077	0.005	0.057	0.076
93	1.040	0.740	0.010	0.057	0.031	0.038	0.055
94	1.160	2.050	0.100	0.085	−0.023	0.138	0.086
95	1.020	0.260	0.080	0.083	0.001	0.020	0.083
96	1.100	1.430	0.090	0.075	−0.016	0.091	0.076
97	1.120	2.340	0.090	0.054	−0.065	0.107	0.056
98	1.180	2.430	0.070	0.080	0.018	0.153	0.079
99	1.080	0.410	0.050	0.242	0.056	0.074	0.205
100	1.040	0.760	0.020	0.056	0.024	0.038	0.054

Appendix 2. Industrial distribution of the sample firms (n = 733).

Frequency	Percent	Industry
6	0.80	A Agriculture, forestry and fishing 01 - 03
3	0.40	B Mining and quarrying 05 - 09
267	36.40	C Manufacturing 10 - 33
19	2.60	D Electricity, gas, steam and air conditioning supply 35
4	0.50	E Water supply; sewerage, waste management and remediation activities 36 - 39
39	5.30	F Construction 41 - 43
126	17.20	G Wholesale and retail trade; repair of motor vehicles and motorcycles 45 - 47
41	5.60	H Transportation and storage 49 - 53
19	2.60	I Accommodation and food service activities 55 - 56
52	7.10	J Information and communication 58 - 63
39	5.30	K Financial and insurance activities 64 - 66
7	1.00	L Real estate activities 68

Continued

57	7.80	M Professional, scientific and technical activities 69 - 75
27	3.70	N Administrative and support service activities 77 - 82
6	0.80	P Education 85
10	1.40	Q Human health and social work activities 86 - 88
4	0.50	R Arts, entertainment and recreation 90 - 93
7	1.00	S Other service activities 94 - 96
733	100.00	In all