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Profit Persistence and Stock Returns

Adelina Gschwandtner and Michael Hauser

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Adelina Gschwandtner* Michael Hauser†

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Abstract

This paper attempts to assemble evidence for the relationship between the product and the financial market. Drawing back on work in industrial organization, we analyze the relationship between profit persistence and expected stock returns. We show that long-run profit persistence together with other additional economic firm fundamentals have a significant impact on stock returns and on their volatility even after adjusting for risk. At the same time we bring evidence for a 'low volatility anomaly'.

Keywords: Profit Persistence; Competition; Stock Return; Heteroscedasticity; Low-Volatility Anomaly; Dividend Discount Model

JEL classification: L10, G11, L25

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*a.gschwandtner@kent.ac.uk

†michael.hauser@wu.ac.at

1 Introduction

One of the basic ideas in mainstream economic theory is the 'Competitive Environment Hypothesis'. It states that the competitive process eliminates all economic profits and losses in the long-run. The intuition behind it is straight forward: if a firm has excess profits, competitors enter the market and offer similar products at lower prices, reducing the profit margin of the incumbent. This continues until profitability in that market equals the competitive rate. If firms have profits below average, investors move to markets with higher profits and therefore, unless corrective measures are introduced, restoring at least normal profits, firms with lower than average profitability are eliminated.

In the present study we investigate if persistent profits have a significant impact on the stock returns and to what extent also other real economy variables contribute to their volatility. To our knowledge this is the first analysis that links stock returns to profitability persistence. While the Dividend Discount Model (DDM) - dating back to Gordon and Shapiro (1965) - relates the stock returns to discounted future cash flows which include profitability and dividends, there is no other study that relates them to profit *persistence*. Therefore, the present study aims at closing the gap between financial economics and industrial organization, by establishing a further link between stock returns and the industry product market. The starting point was the use of profit persistence as a measure of competitiveness of the industry environment, as opposed (or additionally) to using the concentration ratio as most of the previous studies have done. Especially in the light of the recent financial crisis the importance of fundamental industrial economic variables in determining the dynamics of financial variables seems to become crucial.

Because of its basic importance as a building block of economic theory, much research has been undertaken in order to shed light on the empirical relevance of the competitive environment hypothesis. Starting with the seminal contributions by Mueller (1977, 1986), some examples of this branch of research are given by Geroski and Jacquemin (1988), Mueller (1990), Kambahampati (1995), Goddard and Wilson (1999), McGahan and Porter (1999), Cable *et al.* (2001) and Glen *et al.* (2001), to mention just a few. The main conclusion of this fruitful and growing literature is that deviations of profit rates from the norm are very persistent even in markets considered as very competitive. One contribution by Maruyama and Odagiri (2002) follows 376 Japanese firms which were previously analyzed for the period 1964-82 and finds that by extending the original sample by 15 additional years of data the conclusion stays the same: profits persist. Using structural time series analysis, Cable and Jackson (2008) point out the importance of cycles in profits, but still find "around 60% of the companies exhibiting non-eroding long-run persistence" in the UK. Fama and French (2000), looking at more than 2000 US firms over 32 years find evidence that the mean reversion rate of profitability is about 38% per year which implies a 'persistence' rate of 62% per year which is very much in accordance with the findings of Cable and Jackson (2008) and the profit persistence literature in general.

The 'Efficient Market Hypothesis' (EMH) constitutes another building block of economic theory. In his PhD thesis, Eugene Fama made the argument that in an active market that includes many well-informed and intelligent investors, securities will be appropriately priced and reflect all available information. If a market is efficient, no information or analysis can be expected to result in outperformance of an appropriate benchmark. The debate about efficient markets has resulted in a large number of empirical studies attempting to determine whether specific markets are in fact 'efficient', and if so to what degree. There is a tremendous amount of evidence in support of the efficient market hypothesis for financial markets. However, researchers have also uncovered stock market 'anomalies' that seem to contradict the efficient market hypothesis. The search for anomalies is effectively the search for systems or patterns that can be used to outperform the market.

In reality, markets are neither completely efficient nor inefficient. All markets are efficient to a certain extent, some more than others. The aim of this project is to compare the efficiency of the stock market with the efficiency of the product market and investigate if it is possible to draw conclusions from the latter on the former. Since the stock market is said to be one of the most efficient existing markets we expect that the degree of persistence of abnormal securities gains should be much closer to zero. At the same time we aim to analyze the main driving forces behind stock returns and possible interactions between the product and the stock market. Despite of the relevance of this analysis for potential investors, managers and policy decision units, the existing literature at the border line between product and financial markets seems to be quite sparse.[1] The evidence brought by this paper shows that the product market may be an important 'missing link' in explaining important relationships in the financial market.

2 Methodology

Since the seminal contribution by Mueller (1986), the dynamics of company profits tend to be specified as an autoregressive process, usually of first order. Geroski (1990) provides a theoretical justification for such an empirical specification, based on the assumption that profits depend on the threat of entry in the market, which in turn depends on past profits. This implies that firm i's profit rate at time t ($prof_{i,t}$), defined as income divided by total assets, can be thought of as being the realization of the data generating process given by

$$prof_{i,t} = \alpha_i + \lambda_i \, prof_{i,t-1} + \zeta_{i,t}, \tag{1}$$

where $\lambda_i \in (-1, 1)$ and $\zeta_{i,t}$ is white noise with constant variance σ_i^2.
The unconditional expectation of $prof_{i,t}$ in (1) is given by $LrProf_i = \alpha_i/(1-\lambda_i)$. The empirical literature on profit persistence usually compares the estimates of the unconditional expectations from (1) (or from stationary AR(p) generalizations) and tests the equality of unconditional expectations – long-run projections of the series – across companies.

[1] Three recent exceptions are: Navissi, Mirza and Yao (2006) analyze earnings persistence in China and find a high level of earnings persistence that is attributed more to cash flow than accruals. They find that investors fail to anticipate the information in earnings persistence and underprice both cash flow and accrual components of earnings. Glen et. al (2008) analyze the relationship between profit persistence and shareholder protection and find a positive relationship in civil law countries and a negative relationship in the common law countries. Zechner (2010) uses firms fundamentals like abnormal profit returns together with other important corporate governance and financial variables in the IQAM share-selection-model in order to create an alternative alpha-generator.

The first measure for profit persistence used in the persistence studies is the so called 'long-run average profit rate' $LrProf_i$. This is a measure of permanent rents, which are not eroded by competitive forces. The second measure of profit persistence, the short-run persistence, is the coefficient λ_i of the lagged variable in the autoregressive model. A short-run persistence parameter significantly different from zero and positive indicates that past year profits have an influence on today's profits and that competitive forces are not strong enough to bid away profits within one year. Short-run persistence is used in the literature as a measure for the competitiveness of the economy. However, as pointed out by Mueller (1986), it is crucial to look at both measures, the short-run and the long-run measure, simultaneously. [2]

The main scope of the present analysis is to try to explain stock returns by these two established persistence measures. For that we set up the following model:

$$r_{i,t} = E(r_{i,t}|I_{m,t}, I_{i,t-1}) + \varepsilon_{i,t} \tag{2}$$

where $r_{i,t}$ is the stock return of firm i at time t depending on the market related information available at time t, namely $I_{m,t}$, as well as firm specific information available at time $t-1$ namely $I_{i,t-1}$. In a first step we will correct for market effects using the Carhart measure as in Kent, Grinblatt, Titman and Wermers (1997) (KGTW) considering typical portfolios. Then we analyze the effect of the two industrial organization fundamentals, the firm specific short-run persistence and the firm specific long-run average, among others on the level and volatility of the stock return.

The asset pricing model predicts a positive relationship between risk and expected stock returns. Investors are willing to invest in high risk assets only if they expect a high return. The idiosyncratic risk is modeled also by our firm specific factors using a stochastic volatility specification.

$$\varepsilon_{i,t} = \sigma_{i,t}\, \eta_{i,t}, \qquad \sigma_{i,t} = \exp(h_{i,t}/2) \tag{3}$$

So $\log(\varepsilon_{i,t}^2) = h_{i,t} + \log(\eta_{i,t}^2)$. $\eta_{i,t}$ is a serially uncorrelated noise with $E(\eta_{i,t}) = 0$, $V(\eta_{i,t}) = 1$. $\eta_{i,t}$ and $\sigma_{i,t}$ are uncorrelated. $h_{i,t}$ is a function of our persistence

[2] The relationship between concentration and profit persistence (competition) is not unambiguous. See the discussion on page 5.

measures and the other firm specific characteristics as above, and so we try to capture possible heteroscedasticity in the residuals of the return equation.

The two firm specific fundamentals short-run persistence and long-run average influence the level of the returns (corrected for overall market effects) in the following way:

The higher the **short-run persistence** (λ_i), the higher the **concentration** of the industry and the lower the idiosyncratic risk of the firm. Therefore, a negative relationship between λ_i and the companies stock return is hypothesized. However, it has to be stated that the literature on profit persistence has often identified a negative relationship between short-run persistence and concentration (see e.g. Gschwandtner (2012) Table 6). Firms in concentrated industries might want to keep prices low in order deter entry. On the other hand, firms in concentrated industries might not maintain oligopolistic discipline and engage in price and/or non-price competition (like advertising) leading also to a *negative relation* between concentration and profit persistence and therefore a positive relationship between λ_i and the companies stock return is possible.

If a positive relationship between these measures and concentration is hypothesized (according to the classical 'Structure-Conduct-Performance Model' for example) then negative coefficients are expected due to the negative relationship between concentration and stock return. Hou and Robinson (2006) gave two possible explanations for this negative relationship. First, barriers to entry in highly concentrated industries insulate firms from undiversifiable distress risk. They protect firms from aggregated demand shocks and lower their risk. Second, firms in concentrated industries might engage in less innovation because they are under lower competitive pressure. Since innovation is risky these firms are associated with lower risk. On the other hand it is well known that only when firms enjoy a certain degree of protection from competition they can engage in high-scale innovations.[3]

[3]It has to be mentioned here that the analysis of Hou and Robinson (2006) has been criticized because it analyzes only firms listed at the stock exchange while the concentration ratio might be significantly influenced by firms not listed at the stock exchange. We are using listed firms as well but since we are not dealing with industry concentration this bias

A recent paper by Liu and Wilson (2012) looks at the relationship between competition and risk but in a different context. They analyze this relationship in Japanese banking and show how contrary to normal intuition competition can actually *reduce* the risk of banks with higher initial level of risk. The idea being that low lending rates arising from increased competition reduce the cost of borrowing, which leads to an increase in entrepreneurial activity and investment. The resultant reduction in loan default rates reduces the overall risk of banks. This 'financial stability' argument was first brought by Boyd and De Nicolo (2005). Martinez-Miera and Repullo (2010) find evidence of an U-shaped relationship between competition and bank risk. The U-shape relationship between competition and risk is supported also by Liu, Molineux and Wilson (2012) for the European Banking System. Other recent papers that link the financial and the industrial organization literature even if in a different manner than the present paper are: Goddard, Tavakoli and Wilson (2005), Goddard and Onali (2011), Goddard, Molyneux and Wilson (2009), Goddard, McKillop and Wilson (2008), Goddard and Wilson (2009), Asharf, Altunbas and Goddard (2007), McMillan (2009a, 2009b), Blake and Wohar (2008), McMillan and Wohar (2011), Gounopoulus, Molyneux, Staikouras, Wilson and Gang (forthcoming). Therefore, this evidence seems to suggest that the relationship between risk and competition is not linear.

The relationship between **long-run average** $LrProf_{i,t}$[4] and stock returns is as well not unambiguous. The following three potential explanations exist:

a) competition premium (−): On the one hand if the average profit level is hypothesized to be an **indicator for competition** then according to the 'competition premium' firms with lower profits should have higher stock returns due to higher risk induced by competition (see Hou and Robinson, 2006) - hypothesizing a *negative relationship* between long-run profits and stock re-

might be less important in the present case.

[4]Please note that we have included now time variation because *LrProf* includes also the current profit at t $LrProf_{i,t} = f(prof_{i,\tau}, \tau = t-9, \ldots, t)$. This comes from the fact that we are using a moving windows methodology. For each firm we have for each year a moving window of the past ten years. This is going to be explained also later on.

turns.

b) productivity premium (+):
On the other hand if the company is projected to have positive profits in the future this will raise the stock return of this company. Therefore, the coefficient of the long-run profit level $LrProf_{-1}$[5] is positive and significant as the 'productivity premium theory' suggests. Firms with a higher projected long-run profit level enjoy increasing stock prices and higher stock returns because the more productive the company is, the more investors want to invest in this company and this drives the stock price and the return of the company up. This is based on a systematic bubble created by the investors (see for ex. Brown and Rowe, 2007).[6] At the same time Fama and French (2006) show that 'more profitable firms have higher expected returns' after controlling for other variables.[7] We assume that $LrProf_{i,t}$ is used as a projection of future profit rates.

c) return is p.v. of future profits (+): The current stock price may be seen as determined by the **discounted value of future expected earnings**. Using the future profit rates as indicators for the future earnings relative to the invested capital the current stock return may be approximated by a weighted average of future profit rates. Due to rather short time series for each firm and emphasizing the dependence on past information we do not include this component explicitly in our model. However, we interpret the past average of profits rates as a projection of future earnings, and so expect a *positive relation* between long-run profits and current returns.[8]

The variables $\lambda_{i,t}$ and $LrProf_{i,t}$ are obtained estimating equation (1) for a 10 year moving window in a first step.[9]

[5] This refers to the long-run persistence over the previous time window.

[6] Of course that bubbles tend to burst, however, the assumption is that the mechanism repeats itself systematically.

[7] The two variables considered in Fama and French (2006) are the book-to market equity ratio and expected investment.

[8] This argument is embedded in the DDM.

[9] This is where the time index t comes from. The index -1 refers to the window of the previous period.

The following equation, where $r_{i,t}$ denotes the returns adjusted for common market characteristics, summarizes:

$$r_{i,t} = c + \beta_1 prof_{i,t-1} + \beta_2 \lambda_{i,t-1} + \beta_3 LrProf_{i,t-1} + \varepsilon_{i,t} \tag{4}$$

the signs of $\beta_1, \beta_2, \beta_3$ depend on the relationships of profit persistence, average profit and past profits.[10]

Finally, we extend our model in order to consider two other explanatory economic variables at firm level, namely firm's size and the firm's growth, that have been identified within the financial literature to be correlated to stock returns and therefore might provide useful information about the dynamics of the stock returns.

One of the strongest effects found in the finance literature is the so called **'Size Effect'**. This effect describes the tendency for smaller firms to generate larger returns than those of large firms. Keim (1983) shows that since 1926 small-firm stocks in the U.S. have produced rates of return over one percentage point larger than the returns from large-firm stocks. Fama and French (1992) show a clear tendency for the smaller firms to generate higher average monthly returns than larger firms. However, it is possible that some studies of the small-firm effect have been affected by the survivorship bias. If taken into account, the firms that have failed might have lowered the average return of small firms. Taking into consideration this drawback we also analyze the

[10] Two econometric issues arise here: firstly since $LrProf$ is constructed with the help of λ the two of them might be highly correlated with each other and might lead to the problem of multicollinearity. Indeed, the reason why the results for λ are often insignificant might appear to be this one. However, one has to remember that we are constructing both values based on moving windows of 10 years. Because of this reason both λ and $LrProf$ will change only slowly, therefore they will be highly autocorrelated. There is no reason why they should be contemporary highly correlated as well. Indeed, the correlation between λ and $LrProf$ is only 0.21 and the Variance Inflation Factor (VIF) is only 0.38. Therefore, there is no issue of multicollinearity here. Secondly, because both λ and $LrProf$ are estimated parameters we may have a bias in the residuals of equation 4. If λ and $LrProf$ are measured with an error then they might be correlated with the residual. However, as long as the error is small, this problem is insignificant.

impact of firms size on the adjusted stock return.

Another effect that we analyze is the **'Growth Effect'**. In the present study we measure growth - as is typically done in the persistence of profits literature - by the growth rate of company sales. This is different from the concept typically used in the finance literature for the so called 'growth stocks', where growth refers to expected earnings relative to the market average. Several studies, e.g. Nicholson (1960), Basu (1977), Ball(1978), Fama and French (1992, 1997), Lakonishok, Shleifer and Vishny (1994), show that 'value stocks' tend to have higher returns than 'growth stocks'. However, to the extent that increasing sales of the companies also reflect sturdy quality, increasing earnings and a high probability of substantial capital gains we would expect a positive impact of firm growth on the stock return. Moreover, the 4-factor model for adjusting returns does not include growth characteristics.

Augmenting equation (4) by size and growth gives

$$r_{i,t} = \beta_0 + \beta_1 prof_{i,t-1} + \beta_2 \lambda_{i,t-1} + \beta_3 LrProf_{i,t-1} + \beta_4 size_{i,t-1} + \beta_5 growth_{i,t} + \epsilon_{i,t} \tag{5}$$

All explanatory variables in the model apart from growth are expected to impact on the stock return with a delay of one period or more.

3 Data

The dataset for profitability comes from Standard and Poor's Compustat. It contains information about around 2000 surviving US companies from 1950-2006. Not all companies have such a long time series but we assure that we have at least 20 years per company. This is crucial for the notion of profit persistence and the possibility of adjustment to the norm. As stated in Cable and Gschwandtner (2008), 'persistence is essentially a long-run issue'. The share price database corresponding to Compustat is CRSP stock return database. The Center for Research in Security Prices (CRSP) is a financial research center at the University of Chicago Graduate School of Business. CRSP creates and maintains premier historical US databases for stock (NASDAQ, AMEX, NYSE), indices, bond, and mutual fund securities. The CRSP US Stock and

Indices Database includes daily data back to 1925 for the NYSE. Even though Compustat and CRSP supply a merged database the construction of a joint database for profit and stock prices for the US companies was confronted with several difficulties. Especially the industry affiliation of the specific companies was difficult to follow up. Many companies change their industry during their existence and it would have been fallacious to consider them to belong to just one industry during the whole time span. We took into consideration this aspect by exactly following the industry affiliation of the companies over the time span. Another problem was the question of the 'delisting bias'. Beaver, McNichols and Price (2007) show that the tests of market efficiency are sensitive to the inclusion of delisting firm-years. When included, trading strategy returns based on anomaly variables can increase or decrease due to the disproportionate number of delisting firm-years in the lowest decile of the considered variables. Delisting firm-years are often excluded because delisting return data are missing. After reading how CRSP handles the delisting return, we were able to adjust the code in computing the returns in the delisting month. Therefore our data is adjusted for delisted returns.

Variables description

We use two different measures for profitability: net income after taxes divided by total assets, as most of the profit persistence literature does and operating profits divided by total assets. For both measures the results are similar, so we present only the results for *Net Income/Total Assets* the measure most commonly used in the literature in order to save space.
Stock returns include dividend yield and are calculated as geometric mean of monthly stock returns.
We use adjusted returns according to the calculations of KGTW. [11]

They refer to a 4-factor model proposed by Carhart(1997) for returns in excess of the one-month T-bill return. The factors are an excess return measure of an aggregate market proxy, and returns on value-weighted, zero-investment, factor-mimicking portfolios for size, book-to-market equity, and one-year mo-

[11] Data can be downloaded from: http://www.rhsmith.umd.edu/Faculty/rwermers/ftpsite/Dgtw/coverpage.htm

mentum in stock returns. However, no growth component is included.

$$R_{i,t} - R_{F,t} = \alpha_i + \beta_i RMRF_t + s_i SMB_t + h_i HML_t + p_i PR1YR_t + e_{i,t} \quad (6)$$

where:
$R_{i,t}$ ... observed fund return
$R_{F,t}$ ... observed risk free return, the 1-month T-bill rate
RMRF ... CRSP value-weighted index less T-bills
SMB ... Small minus big size
HML ... High book-to-market minus low book-to-market
PR1YR ... High prior-year return less low prior return

According to this model the return for a fund i, $R_{i,t}$ is the sum of the risk free return $R_{F,t}$ and four other market and firm type factors. The adjusted returns, r, are then $r_{i,t} = e_{i,t} + \alpha_i$.
The model in equation (6) corrects for systematic effects in the stock market. Our scope is to explain adjusted returns by characteristics that seem relevant in the field of industrial organization. Some of the variables we use in our model seem similar to the factors of the Carhart measure. However, our measures are firm specific and not market specific. We hypothesize that past profits, past firms size and growth are relevant explanatory variables. Size is measured as the logarithm of firm's total assets. At firm level there is no correspondence in the Carhart approach. Firm's growth is calculated as the growth rate of the company's sales. Size and growth are both adjusted for inflation using the CPI on 1982-84 basis from the Bureau of Labor Statistics of the U.S. Department of Labor.
The two profit persistence measures, $\lambda_{i,t}$ and $LrProf_{i,t}$, are calculated using a moving window with the length of ten years. The last 10 years are viewed as covering the information potential investors base their decisions on. We have discarded observations (firm-years) according to their untypical behavior with respect to the relevant variables in the following way: 5 observations with respect to adjusted returns, 200 observations with respect to growth, and 100 firms with respect to the profit variable mostly because of irregularly reported values. Some descriptive statistics for the two persistence measures are provided in the Table 4.

4 Results

First, the issue of persistence in profits and the persistence in stock returns is addressed. For this we estimate the short and long-run persistence using the ten year data windows as described in equation (1) by OLS for both profitability and adjusted stock returns and compare them.
Table 4 presents the outlier corrected persistence results for both profitability and stock returns in order to enable a better first step comparability.

Table 4 should be included about here.

A first observation is that the percentage of long-run persistence values significantly different from zero is 80.2% for profitability. For returns measured as stock growth plus dividend payments the percentage is 29.3%, while for adjusted returns, measured as firm stock growth corrected for market factors it is 8.9%.

An observation worth commenting is that although the percentage of significantly positive long-run projected profit rates dominates, still 8.4 % of the companies have a significantly negative long-run projected profit rate.[12]

The percentage of λ_i's significantly different from zero is 36.5% for profits and only 11.6% for adjusted stock returns. Clearly, profit persistence dominates also with respect to short-run persistence.
Also the mean short-run persistence parameter is much higher for profitability, 0.3544, than for stock returns, -0.0792. The latter (small) negative value is in line with Baur et al. (2012) where positive/negative autocorrelation is found within firms with low/high return quantiles. Our data exclude companies with valid observations less than 20 years in sequence, so some low return companies are likely to be excluded.

A negative value for the short-run persistence parameter can be obtained if returns fluctuate more than randomly. A year with high return is followed by

[12]They might be for example firms with high sunk costs, big assets or protected by the government.

a year of low return and again followed by a year with high return. However, negative short-run projected profit rates are not an exception within the profit persistence literature (see e.g. Gschwandtner 2012).

In general the results in Table 4 bring evidence for the higher competition in the stock market than in the product market as expected.

Descriptive statistics for size and growth and for other variables used in the models are presented in Table 3 in the Appendix.

Table 5 presents the regression results for equation (5). **Panel A** refers to the whole sample and panel B to disjunct sets, which contain the firms belonging to the first, second, etc. quintiles of the explanatory variables size, growth and long-run profit.
First we observe that firm specific information contributes to the explanation of the structured portfolio adjusted returns. The impact of **lagged profits**, $prof_{-1}$, on the stock return is negative ceteris paribus as an increase of past profits has already increased stock prices in accordance with the efficient market hypothesis. If the information about high profits has been already incorporated in the stock price then there is little room for a further stock price increase and hence for an increase in the stock return. Therefore, companies with a higher profit rate in the past year tend to have a lower stock return.

The coefficient for the **persistence parameter** have to be interpreted with care. According to the 'competition premium theory' firms in more competitive environments, $\lambda, Lrprof_{-1} \approx 0$, should enjoy a higher stock return (see Hou and Robinson 2006) which would suggest a negative relationship between the persistence parameters and stock return. However, the 'productivity premium theory' would indicate an opposite, positive relationship.
The short-run persistence coefficient of λ_{-1} is negative when significant, so higher short-run persistence reduces returns. An increasing λ indicates less competition and so less risk together with a lower return which seems to be evidence for the 'competition premium theory'. However, the coefficient is barely significant.
The effect of the level of the **long-run profit rate** $LrProf_{-1}$ is significant and

positive indicating the dominance of the 'productivity' over the 'competition premium theory'.

The coefficient of the lagged firm **size** ($size_{-1}$) is negative and highly significant in accordance with the discussion about the 'Size Effect'. Smaller firms seem to have higher stock returns if they survive.

This result is obtained despite of the removal of contemporaneous size characteristics by the Carhart 4-factor model which is used to obtain the adjusted return data. This indicates that not only current but also lagged size seems to play a role.[13]

The coefficient of **current growth** is positive and highly significant. The growth rate of the firms sales turns out to be reflected quickly in the stock price as information about the business volume is more often available through quarterly reports, advertising and other media. Current growth firm characteristics are not incorporated in the Carhart measure, but prove to be highly significant in our regressions.[14]

Table 5 should be included about here.

Turning to **Panel B** we can analyze these effects in more depth by looking at the regressions results for the quintile subsets with respect to the explanatory variables size, growth and long-run profits. The distinction between low/high lagged profits and low/high short-run persistence are not included as they do not provide additional insights.

Analogous to Fama and French (1996) and Cochrane (2001 p. 437) we distinguish according to different size, growth and profit portfolios (pf). Specific portfolio betas may be more stable over time, and hence easier to measure accurately. Moreover, by grouping stocks into portfolios based on some characteristic related to average returns, one reduces the portfolio variance and

[13]Estimation of equation 5 with current size yields an insignificant coefficient.
[14]Lagged growth turned out to be insignificant.

thus make it possible to see average return differences (see Cochrane 2001 p. 436).

The estimated coefficients for the whole sample are approximately the average of the 5 quintile coefficients, if the correlations of the explanatory variables within quintiles do not differ between the quintiles. We test for the equality of the coefficients of the first and 5th quintile to find out whether effects differ and, moreover, whether some effects tend to cancel out when aggregating over quintiles. The significant results at the 1% level are indicated by $^{\Delta}$ or $^{\nabla}$ pointing to the direction of increase, at the 5% level by $^{(\Delta)}$ and $^{(\nabla)}$. However, the latter are not discussed further in order to save space.

The effect of a change in **past profits** ($prof_{-1}$) on the current stock return is significantly negative and robust over all quintiles as discussed above. If profits are high in the past year this information is already incorporated in the stock price today and there is no room for a strong increase in the stock return anymore. Firms with low profits on the other hand have high risk and therefore also higher returns (as long as they survive). A one percent increase in profits in the previous period leads to a decrease in the current stock return of 0.02 on average. In general the profits of the previous period seem to be a good information only for firms with low growth (*growth1*) and low projected profit rate ($LrProf1$). When the firm is growing strongly (*growth5*) or has a high projected profit rate (*LrProf5*) the return may not decrease as strongly with the profits of the past period because the high growth and projected profits are a positive signal for investors.

The effect of **short-run persistence** (λ_{-1}) on the stock return is only weakly significant, with a negative effect for small and low growth firms and no effect for other firms.

The effect of past **projected profit rate** ($LrProf_{-1}$) is very interesting. As mentioned above the productivity premium dominates the competition premium in the overall equation but also for all size quintiles, and for low growth and long-run profit quintiles and the relationship between projected profits and stock return is positive. However, for high growth or high long-run profit quintiles both effects cancel, so that the coefficient of the projected profit rate is zero.

It has to be pointed out here that the past **projected profit rate** does not behave according to the risk theory which would predict a negative relationship since firms with high projected profit rates should have lower risk and therefore also lower returns. However, on average, an increase in the projected profit rate by 1 percent increases the stock returns by 0.03 suggesting a weak but significant positive relationship. And this relationship is especially strong for low growth firms ($growth1$) which also have an average negative stock return and for low profit firms ($LrProf1$). Maybe these are high risk firms for which investors do not trust that they will have high returns in future. Probably, if the firms have a strong growth and a high projected profit their returns are predicted more correctly and therefore this 'anomaly' appears to exist mainly for 'weaker' firms.

Regarding the effect of **size** smaller firms that managed to survive seem to have also higher returns. As can be seen from Table 5 we can identify an overall negative and significant 'Size Effect', which is mainly due to a strong effect in the quintile of the smallest firms (size1). However, the negative size return relationship does not seem to hold for large firms (size5) where the coefficient is positive and hardly significantly different from zero. At the same time the negative relationship between size and return does not hold for firms with slow growth (growth1). For them the relationship is again significantly positive. These results show that some effects are not linear and therefore, it is important to decompose the analysis per quintile and to interpret the negative estimated coefficient for the whole sample with care. Again it has to be emphasized that these results are obtained despite of the removal of contemporaneous size characteristics by the 4-factor model which is used to obtain the adjusted return data. Therefore, not only current size which is considered in the Carhart measure, but also the lagged firm size seems to play a significant role and cannot be ignored.[15]

[15] Estimation of equation 5 with current size yields an insignificant coefficient.

Higher **growth** leads to higher adjusted returns for firms of different size/long-run profit classification, however, it does so to a larger extent for smaller firms compared to larger firms, and for higher long-run profit firms compared to lower long-run profits.

Finally, the **mean adjusted returns** (the one to last column) are calculated for the subsets showing that a significantly positive mean is obtained mainly for small size, high growth and high profit firms. The mean for larger firms is obviously corrected for adequately by the Carhart construction since it is not significantly different from zero. The quintiles wrt to growth are heterogeneous: slow growing firms exhibit a negative mean adjusted return, while high growth firms a positive one. Again the results are nonlinear and emphasize the importance of the analysis per quintile. Even if the average stock return is positive but close to zero there are firm groups characterized by significantly negative returns on average like for example low growth firms ($growth1$ and $growth2$) and there are firms for which the return is significantly positive on average like the small size, high growth and high projected profit rate firms ($size1$, $growth5$ and $LrProf5$).

In Table 6 we present the results for heteroscedasticity both for the whole sample and per quintile. Heteroscedasticity is modeled in the same way as returns were modeled in equation (5):

$$h_{i,t} = d_0 + d_1 prof_{i,t-1} + d_2 \lambda_{i,t-1} + d_3 LrProf_{i,t-1} + d_4 size_{i,t-1} + d_5 growth_{i,t} \quad (7)$$

Panel A presents the results for the log-volatility of the residuals for all companies. All the coefficients but one have the expected sign and all are highly significant. The higher the profits in the previous year, the lower the volatility of the stock return. High profits have a smoothing effect on volatility which goes in line with Bowman's risk return paradox (Bowman 1980). The higher the profit of the firms the better the managers of the firms are able to avoid risk which will lead to a lower fluctuation of profits. The short-run persistence parameter has no significant impact as it was the case for the stock return level. Contrary to the level equation an increase in the long-run level of profitability decreases the volatility of the residuals while it had a positive effect on the level of stock return. Higher profits, both past and projected future profits seem to make the stock return more stable. This again contradicts the 'risk theory' which states that higher profits shall be associated with higher volatility (risk). Size and growth of the company drives volatility in the same direction - negative and positive - as in the level equation. The larger the firm the lower the volatility of the stock return and the higher its growth the more volatile the stock returns are.

Table 6 should be included about here.

Panel B presents the results per quintile for the three different portfolio groups $size$, $growth$ and $LrProf$ and shows that even if the results are more consistent than the level results there is still value in a more detailed insight. Again we look at the effect of an 1 percent change in each variable on the volatility of the stock return.

For example an increase in **lagged profits** ($prof_{-1}$) reduces volatility more for large than - if at all - for small firms. If the firm is strongly growing ($growth5$) then additional profits do not have a very strong impact on the reduction of the volatility anymore. The effect of past profits on the volatility of the stock return is in general relatively weak when looking at the growth of the firms. A similar argument can be brought for $LrProf$. If the firm has already very high projected profits ($LrProf5$ for example) then a further increase in past profits will not further reduce the volatility of the stock returns anymore.

The impact of the **short-run persistence parameter** (λ_{-1}) is hardly significant as it was the case for the level equations. Therefore, we will look next at the impact of past **long-run projected profit rates** ($LrProf_{-1}$) on the volatility of the stock return. This is a very interesting result since the relationship between volatility and past projected profitability is not positive as the 'risk theory' might suggest, but negative. Firms with high stock return volatility have low projected profitability and firms with low volatility have high projected profits. And this relationship is strongly significant and robust throughout all quintiles specifications. It is stronger for small firms than large ones but not significantly so. And it is significantly stronger for low growing firms than for fast growing firms. The same is true for the current profitability level ($LrProf$). The negative relationship between volatility and past projected returns is stronger for firms with low profits ($LrProf1$). For firms with high profits ($LrProf5$) this effect is not significantly different from zero.

Past **firm size** ($size_{-1}$) as measured by the assets of the firm reduces the volatility of the stock return as might be expected. Large firms have a lower volatility of the stock return and the return of small firms is more volatile. Again this relationship is strongly significant throughout all quintile specifications and sizes. In this case it is especially strong for large and fast growing firms ($size5$ and $growth5$). The differences between quintiles for the profit specification ($LrProf1$ to $LrProf5$) are not significant. The impact of past size on the volatility of the stock return is negative and significant but it does not increase with the level of profits.

This is slightly different for the variable **growth** which is measured by the growth rate of the current sales of the firm. In general the impact of growth is positive meaning that growing firms have a higher stock return volatility as might be expected. A one percent increase in the current sales of the firm increases the volatility of stock return by 0.4. However, this is not the case for low growing firms ($growth1$). For low growing firms an increase in sales *reduces* the volatility of profits by 0.6. The coefficient changes signs afterwards and for high growing firms it is positive and high significant. Also between size and profit quintiles there are significant differences. While for small firms an increase in the sales of the firm increases the volatility of profits, for large firms this effect becomes insignificant. For profit the effect is the other way round. While for firms with low profits increasing sales has no significant effect on the stock return for firms with high profit ($LrProf5$) a further increase in current sales increases the volatility significantly. Therefore, the effect is not always linear and it is worth looking at the analysis per quintiles. The same is true for mean volatility (the one but last column). The average volatility is significantly larger for small firms ($size1$) than for larger firms ($size5$) and for low profit firms ($LrProf1$) compared to high profit firms ($LrProf5$). The fact that firms characterized by high long run profits ($LrProf5$) have higher average stock returns and these returns are more stable is something that might not have been expected. The return of small and relatively unprofitable firms fluctuates stronger. Interestingly, the average volatility of the stock return does not vary significantly with firm's growth.

However, in general, the regression results support the theoretical predictions, bring some additional evidence of some more multivariate relationships and show clearly that economic fundamentals play an important role in explaining both the level and the volatility of the stock returns.

The empirical **level-results** from equation (5), Table 5 can be summarized as follows:
The impact of past profits $prof_{-1}$ on the level of the stock return: $c_1 < 0$ is overall negative as expected, but not significant for high growth firms, and medium to high long-run profit levels.
The impact of the short-run persistence parameter λ_{-1} on the level of the stock return: $c_2 < 0$ is only significant for low growth and very low long-run profit firms as discussed above. In general it is not significant.
The impact of the long-run projected profit rate parameter $LrProf_{-1}$: $c_3 > 0$ is positive meaning that firms that have higher projected profits also have higher stock returns. This unexpected since firms with higher long-run projected level should be characterized by lower risk and therefore, lower returns. There is an increasing impact with size, but only in effect for low growth and low long-run profit firms.
Firm's past size $size_{-1}$: $c_4 < 0$ has on the average a negative sign as the 'Size Effect' would predict: small surviving firms have on average larger stock returns while large firms have on average lower stock returns. Remarkably, the effect is positive for low growth firms, and negative for high growth firms.
Firm's growth *growth*: $c_5 > 0$ has a positive impact on stock return as expected. Growing firms tend to also have larger stock returns. As lagged growth is not significant and therefore not included, growth should not enter 'long-run' expectations as recent sales information seems to be quickly incorporated into asset prices. The growth effect is decreasing with size and increasing with the long-run profit level.
Regarding the average stock return per quintile $Mean(r)$: small firms have a significantly higher return, than large firms, while for growth firms the relation

is inverse. High growth firms have a significantly higher mean return than low growth firms.

As a first conclusion we can say that adjusted returns may be in addition explained to a small degree (up to 7% of the variance) by fundamental factors characterizing each firm. Some are long-run factors like the past profit level, firm's size and some are short-run factors like the growth of firm's sales. Remarkably, despite of adjusting stock returns for various standard portfolios, some effects with respect to firm size and firm growth seem to remain.

The empirical heteroscedasticity-results from equation (7), Table 6 can be summarized as follows:
The impact of past profit on the volatility of the stock returns is negative $d_1 < 0$. The higher the profits in the previous year the less will the stock return fluctuate.
The impact of the short-run persistence parameter lambda on the volatility of the stock returns d_2 is in general non-significant and only in few cases negative.
The impact of the long-run projected level d_3 is significantly negative meaning that the stock returns of firms projected to have higher profits fluctuate less. This is a rather unexpected result which is not in accordance with the finance literature. Companies characterized by higher volatility of the stock return (often interpreted as a higher risk) should have also higher profits.
The impact of the firm size on the volatility of the stock return is on average negative: $d_4 < 0$ suggesting that the stock return of larger firms fluctuates less.
The impact of contemporary growth of the firm on the stock return is on average positive: $d_5 > 0$. The higher the growth rate of the firm the higher the volatility of the stock return.

We hypothesize that increasing returns correspond to a higher risk for systematic effects. Coefficients c_1 together with d_1, c_4 together with d_4 and c_5 together with d_5 are going in line with this hypothesis.[16] However, $c_3 > 0$ and $d_3 < 0$

[16]The reason for the essential insignificance of the short-run persistence measure λ might origin in the high sample variation due to the small number of data points available for estimation.

are unexpected. If higher profit persistence is associated with lower risk then these coefficients imply a negative relationship between 'risk' and expected returns and their volatility. For the long-run profit level $LrProf_{-1}$ the positive relation between risk and returns (and therefore the negative relation between $LrProf_{-1}$ and the stock return) does not seem to hold since $c_3 > 0$, indicating some (small) 'market anomaly' related to the persistence in the profit level.

Within the strategic management literature 'Bowman's Risk Return Paradox' seems to be an established fact (Bowman 1980). The management of highly profitable companies seem to be more successful in avoiding risk (measured by the volatility of the profit rate) and therefore a negative relationship between risk and (profit) return emerges. Concepts like 'income smoothing' and 'corporate strategy' are utilized to explain this apparent paradox. Within the finance literature the evidence for the so called 'Low-Volatility Anomaly' - also known under the title 'Betting against Beta' - is growing. Recent evidence is provided for example by Ang et al. (2009), Frazzini and Pedersen (2010), Baker et al. (2011) and Bali et al. (forthcoming). Our results add to this body of evidence.

5 Conclusion

The present paper analyzes the relationship between profit persistence and expected stock returns using data about 2000 surviving US companies from 1950-2006. We present some evidence for significant impacts of economic fundamentals at the firm level like firm's profit and profit persistence, firm's size and firm's growth on the level and volatility of the stock return.

The next tables (Table 4 and 5) try to summarize the main results for more clarity. Even if the Carhart four factor model (Carhart 1997) manages to eliminate contemporary size effects, lagged effects seem to be still prevalent. Lagged firm size seems to impact negatively on both the level and the volatility of stock return. The Carhart 4 factor measure does not consider the growth rate of the company. However, we find that the current growth has in general a positive and highly significant impact on both the level and the volatility of the stock return. The main conclusion seems to be that while our results align with the Carhart measure regarding the contemporary firm size effects - the four factor Carhart measure could be improved with respect to contemporary growth and lagged variables effects.

The most surprising findings of our paper are however, the positive relationship between the long-run profitability and the stock return and the negative relationship between long-run profitability and the volatility of the stock return. While the risk theory would suggest that more risky firms would be more profitable, we find that firms with higher long-run projected profit rates have on average both a higher stock return average and a lower volatility of the stock returns. These results bring additional evidence for the so called 'Risk-Return Paradox' which is an established fact within the management literature and for the so called 'Low-Volatility Anomaly' which seems to gain increased interest also within the finance literature.

Table 1: *Summary: Q5 : Q1 of Regressions Explaining Stock Returns.*

Panel B: Quintile Regressions							
	$const$	$prof_{-1}$	λ_{-1}	$LrProf_{-1}$	$size_{-1}$	$growth$	$Mean(r)$
size1	·	·	−	·	−	++	+
size5	·	·	(0)	·	0	+	0
growth1	−	−	·	+	+	·	−
growth5	0	0	·	0	−	·	+
LrProf1	·	−	−	+	·	+	·
LrProf5	·	0	(0)	0	·	++	·

Table 2: *Summary: Q5 : Q1 of Regressions Explaining the Volatility the Stock Returns.*

Panel B: Quintile Regressions							
	$const$	$prof_{-1}$	λ_{-1}	$LrProf_{-1}$	$size_{-1}$	$growth$	$Mean(\log(\epsilon^2))$
size1	·	0	·	·	·	$+$	$-$
size5	·	$-$	·	·	·	(0)	$--$
growth1	·	·	·	$--$	$-$	$-$	·
growth5	·	·	·	$-$	$--$	$+$	·
LrProf1	$-$	·	·	$-$	·	0	$-$
LrProf5	$--$	·	·	(0)	·	$+$	$--$

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Appendix

Descriptive Statistics

Table 3 presents the descriptive statistics of the variables used in the model. From Table 3 we can observe that while the average stock return, the profit

Table 3: *Descriptive Statistics*

	Mean	**Median**	**StDev**
Adj. Stock Return ($r_{i,t}$)	0.00126	0.00007	0.03067
Profit Rate ($\pi_{i,t}$)	0.04221	0.04547	0.07332
Short-Run Persistence ($\lambda_{i,t}$)	0.35442	0.39127	0.34822
Long-Run Profit ($LrProf_{i,t}$)	0.04639	0.04466	0.04139
Firm Size ($size_{i,t}$)	1.2628	1.15951	2.06055
Firm Growth ($growth_{i,t}$)	0.05105	0.03447	0.22798

number of observations (firm years) is 37965
5% of the top/bottom observations are trimmed.

rate and the long run profit are close to zero as they should be, the adjusted stock return is much closer to it than the other two. The average short run persistence parameter λ is around 0.4 which is in line with the literature (see for example Gschwandtner (2012) for a comparison). The average firm growth is 0.051 which indicates that the sales of the company rise on average by 5.1%. The firm size depends on the scaling of this variable and in this case the absolute level of the average/median is even more difficult to interpret since we take the logs of the sales of the company. But the relative values are useful. The average long run profit rate (LrProf) is similar to the average profit rate ($\pi_{i,t}$) and indicates that on average the net income is around 0.04 times higher than the total assets of the company and is projected to stay like this also in the future (or slightly increase). Even though this is not visible from this table the distribution of the profit rate is negative/left and the one of the growth rate is positive/right skewed.

Causality

It has to be noted that in principle the causality between stock return and the various explanatory variables can go in both directions. A high long-run profit level can lead to a higher stock return (through the productivity premium and /) but higher stock returns can also lead in future to a higher long-run profit level. Firms with a good performance on the stock market could get easier credits from banks and could therefore invest their capital relatively cheaper than other firms. They could also buy assets or other firms relatively cheaper and grow. At the same time the good performance at the stock exchange might act as a advertisement for the company and consumers might buy increasingly new products and herewith increase their profits. A company with a good performance on the stock market might attract customers which might increase its sales. Therefore the positive correlation between growth and stock return might also be due to a reversed causality going from stock returns to the size, the growth of sales and profitability of the firm. For the reasons mentioned above the indirect effect of stock returns on firm's size would be expected to be positive because a better performance on the stock market could lead to higher sales and to a larger size of the firm. The fact that in our regressions the coefficient ($c4$) is negative and highly significant suggests that the assumed direction of causality in the model is correct. Moreover, it is important to notice that we do not have contemporary relations but for the firm's growth. We use lagged profitability, profit persistence and lagged firm's size in order to explain stock returns. The lagged structure of our model implies a (Granger type) causality from the explanatory variables to the stock return and not the other way round. For the two profit persistence measures we even use an average of the last ten years and not only the previous period. This means that the reversed relation namely, returns determine the average profitability of the past ten years cannot hold. We explained above why we use the contemporary growth rate. However, we tested and the past lags of the return variable are not correlated with the growth variable suggesting that also in the case of growth the direction of causality assumed by the model is correct.[17]

[17]Results can be obtained by the authors upon request.

Table 4: *Persistence measures for profitability, adjusted returns and returns using model (1)*

	long-run			**short-run persistence**, λ		
	profit	**adj returns**	**returns**	**profit**	**adj returns**	**returns**
$\% \neq 0^{a)}$	80.2	8.9	29.3	36.5	11.6	8.3
pos : *neg*	91.6 : 8.4	55.2 : 44.8	94.7 : 5.3	83.1 : 16.9	36.5 : 63.5	38.8 : 61.2
Mean	0.0464	0.0016	0.1994	0.3544	-0.1072	-0.0792
Median	0.0447	0.0008	0.1702	0.3913	-0.1169	-0.0814
StDev	0.0414	0.0087	0.5427	0.3482	0.3185	0.2962

Remark: moving data window of 10 years, $^{a)}$ empirical rejection rate based on a nominal significance level of 10%

Table 5: *Regressions Explaining Stock Returns.*

	const.	$prof_{-1}$	λ_{-1}	$LrProf_{-1}$	$size_{-1}$	*growth*	N	$Mean(r_{it})$	R^2
Panel A: Whole Sample									
r_{it}	0.00087	−0.02439	−0.00190	0.02989	−0.00048	0.02294	31562	0.00126	0.033
Panel B: Quintile Regressions									
size1	–	−0.03305	(−0.00364)$^{(\triangledown)}$	0.02991	−0.00369$^{\triangledown}$	0.02721$^{\vartriangle}$	6313	0.00312$^{\vartriangle}$	0.054
size2	–	–	(−0.00271)	0.03552	(−0.00268)	0.02913	6312	–	0.042
size3	(−0.00400)	(−0.01758)	–	0.03129	(0.00209)	0.01789	6312	–	0.019
size4	–	(−0.01610)	−0.00247	0.05800	–	0.01500	6312	–	0.019
size5	(−0.00317)	−0.04799	–$^{(\triangledown)}$	0.05210	(0.00060)$^{\triangledown}$	0.01402$^{\vartriangle}$	6313	–$^{\vartriangle}$	0.019
growth1	−0.00787$^{\triangledown}$	−0.03438$^{\triangledown}$	−0.00453	0.05615$^{\vartriangle}$	0.00128$^{\vartriangle}$	–	6313	−0.00737$^{\triangledown}$	0.013
growth2	−0.00393	−0.04614	−0.00264	0.05901	0.00048	–	6312	−0.00300	0.011
growth3	–	−0.03502	–	–	−0.00054	0.06542	6312	0.00084	0.007
growth4	–	−0.03143	–	–	−0.00101	0.05600	6312	0.00362	0.012
growth5	0.01245$^{\triangledown}$	–$^{\triangledown}$	–	–$^{\vartriangle}$	−0.00272$^{\vartriangle}$	0.00543	6313	0.01007$^{\triangledown}$	0.033
LrProf1	–	−0.03923$^{\triangledown}$	−0.00438$^{(\triangledown)}$	0.05114$^{\vartriangle}$	−0.00063	0.02742$^{(\triangledown)}$	6313	–	0.037
LrProf2	–	(−0.02171)	–	–	−0.00060	0.02168	6312	–	0.033
LrProf3	–	–	–	–	−0.00057	0.02278	6312	0.00069	0.031
LrProf4	–	–	–	–	–	0.01461	6312	0.00147	0.022
LrProf5	–	(0.01718)$^{\triangledown}$	–$^{(\triangledown)}$	–$^{\vartriangle}$	–	0.03252$^{(\triangledown)}$	6313	0.00125	0.059

size1,. . ., size5 are the quintile sets of $size_{-1}$, LrProf1,. . ., LrProf5 of $LrProf_{-1}$

estimated coefficient significantly different from zero at 1% level (t-test)

'(...)' significant between 1 and 5%, '–' estimated but not significantly different from zero at the 5% level

$^{\triangledown}$, $^{\vartriangle}$ indicate the significance of the test of equality of the coefficient of 1st and 5th quintile

Table 6: *Regressions Explaining the Volatility of the Stock Returns.*

	const.	$prof_{-1}$	λ_{-1}	$LrProf_{-1}$	$size_{-1}$	*growth*	N	$Mean(\log(\hat{\epsilon}^2))$	R^2
Panel A: Whole Sample									
$\log(\hat{\epsilon}^2)$	−8.1586	−1.2515	–	−6.4934	−0.2351	0.3875	31562	−8.841	0.063
Panel B: Quintile Regressions									
size1	−8.1037	$-^{\Delta}$	–	−7.5384	−0.1616	$0.5207^{(\Delta)}$	6313	-8.138^{Δ}	0.039
size2	−8.0990	−2.2611	–	−6.1915	−0.2149	0.5202	6312	−8.528	0.032
size3	−8.0328	−1.8106	–	−6.4187	−0.2650	(0.2908)	6312	−8.795	0.022
size4	−8.6800	−3.6213	–	(−3.0079)	–	–	6312	−9.250	0.012
size5	−8.2230	-2.9879^{Δ}	–	−5.7185	−0.2096	$-^{(\Delta)}$	6313	-9.484^{Δ}	0.018
growth1	−8.1297	–	–	-7.7352^{∇}	-0.1720^{∇}	-0.5964^{∇}	6313	−8.511	0.057
growth2	−8.4136	−1.8324	–	−6.6440	−0.2035	–	6312	−9.041	0.050
growth3	−8.3273	(−1.7169)	–	−6.3817	−0.2448	–	6312	−9.114	0.059
growth4	−8.4506	–	–	−7.0906	−0.2521	–	6312	−8.999	0.058
growth5	−8.2309	(−1.1114)	(−0.1732)	-2.9501^{∇}	-0.2493^{∇}	0.7810^{∇}	6313	−8.540	0.072
LrProf1	-8.0005^{Δ}	−1.2156	–	$-6.1829^{(\nabla)}$	−0.2164	$-^{\nabla}$	6313	-8.175^{Δ}	0.076
LrProf2	−7.8898	(−1.7685)	–	−17.2938	−0.2071	0.4278	6312	−8.721	0.038
LrProf3	−9.4848	(−1.8203)	–	(17.9045)	−0.2539	0.7014	6312	−9.151	0.045
LrProf4	−8.6259	–	–	–	−0.2428	0.5905	6312	−9.018	0.042
LrProf5	-8.6160^{Δ}	–	–	$-^{(\nabla)}$	−0.2160	0.6594^{∇}	6313	-9.140^{Δ}	0.030

size1,…, size5 are the quintile sets of $size_{-1}$, LrProf1, …, LrProf5 of $LrProf_{-1}$
estimated coefficient significantly different from zero at 1% level (t-test)
'(...)' significant between 1 and 5%, '–' estimated but not significantly different from zero at the 5% level
$^{\nabla}$, $^{\Delta}$ indicate the significance of the test of equality of the coefficient of 1st and 5th quintile