THE UNIVERSITY OF CHICAGO

# ACCRUALS QUALITY AND FIRM VALUE

A DISSERTATION SUBMITTED TO
THE FACULTY OF THE UNIVERSITY OF CHICAGO
BOOTH SCHOOL OF BUSINESS
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

BY
OLEG KIRIUKHIN

CHICAGO, ILLINOIS
JUNE 2018

Dedicated to my beloved parents and all my family:

Larisa Leonidovna Kiriukhina,

Maksim Yuryevich Kiriukhin,

Mikhail Yuryevich Kiriukhin,

Olga Alexandrovna Kiryukhina,

Aleksandr Sergeevich Yashchenko,

Iza Konstantinovna Yashchenko,

Yulia Aleksandrovna Yashchenko.

"Is there any knowledge in the world which is so certain that no reasonable man could doubt it?"

"All acquisition of knowledge is an enlargement of the Self, but this enlargement is best attained when it is not directly sought. It is obtained when the desire for knowledge is alone operative, by a study which does not wish in advance that its objects should have this or that character, but adapts the Self to the characters which it finds in its objects."

— Bertrand Russell, *Problems of Philosophy*

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# ACKNOWLEDGMENTS

I would like to thank Klakow Akepanidtaworn, Ray Ball, John Barrios, Philip Berger, Jonathan Bonham, Matthias Breuer, Jung Ho Choi, Hans Christensen, John Cochrane, John Gallemore, Pingyang Gao, Rachel Geoffroy, João Granja, Anya Kleymenova, Christian Leuz, Lisa Yao Liu, Miao Liu, Mark Maffett, Michael Minnis, Anya Nakhmurina, Valeri Nikolaev, Haresh Sapra, Leonard Soffer, Douglas Skinner, Chad Syverson, Rimmy Tomy, Anastasia Zakolyukina, Frank Zhou, and workshop participants at Baruch College, IESE Business School, McGill University, University of Chicago, University of Illinois at Chicago, University of Oxford for valuable comments and suggestions. I gratefully acknowledge financial support from the University of Chicago Booth School of Business and the Accounting Research Center at Chicago Booth.

# ABSTRACT

I examine the importance of the properties of accounting information to equity investors by estimating the implicit prices of accruals quality and operating volatility revealed from observed stock prices. I measure accruals quality parameters based on the model in Nikolaev [2016], which separates the volatility of accounting error from the volatility of the performance component of accruals. I use the hedonic regression approach, which relies on rational expectations (Bajari *et al.* [2012]) to identify the effect of accruals quality on firm value. This approach isolates time-varying unobservable factors correlated with accruals quality. My findings indicate that investors have preferences for higher accruals quality. At the margin, a 1% increase in the volatility of accounting error results in a 0.50% decrease in the firm value. At the same time, my findings indicate that investors have preferences for lower operating risk, which statistically and economically dominates preferences for accruals quality. At the margin, a 1% increase in the operating volatility results in a 1.43% decrease in the firm value. Overall, my findings suggest that the effect of accruals quality on firm value is largely driven by the operating risk. This result is robust to the choice of the model of time-varying unobservable firm characteristics and to different sets of control variables.

# CHAPTER 1

# INTRODUCTION

The link between the quality of accounting information and firm value is one of the most fundamental questions in accounting (Watts and Zimmerman [1986], Leuz and Wysocki [2016]). This paper studies whether stock prices reflect properties of accounting information quality. Specifically, I focus on accruals quality, which is one of the key dimensions of accounting information quality.[1] I offer an identification strategy to estimate the implicit prices of accruals quality that are revealed from observed stock prices and firms' characteristics. To achieve such identification, I use a revealed preference approach that relies on investors' rational expectations and efficient capital markets.

Accounting quality can affect firm value through multiple channels. The quality of accounting information can improve liquidity (Diamond and Verrecchia [1991]) and lower the cost of capital (Lambert *et al.* [2007]). It can improve monitoring and mitigate agency and information problems (Watts and Zimmerman [1986]). And finally, it can improve real decisions (Choi [2016]). At the same time, there are costs of high accounting information quality, which include proprietary costs (Berger [2011]), political costs (Watts and Zimmerman [1978]), and the costs of maintaining internal-control systems (Beyer *et al.* [2010]). The overall direct effect of accounting quality on firm value is unknown and has not been established previously.

The lack of evidence regarding this effect is likely explained by the lack of empirical strategy to identify it. Two main challenges arise with respect to identifying the aggregate effect of accruals quality on firm value. First, the conventional measures of accruals quality are not able to separate financial reporting from the operations that reports portray, and, as a result, accounting error and operating volatility are inherently intertwined (Kaplan [1985], McNichols and Wilson [1988], Dechow and Skinner [2000], McNichols [2002], Hribar and Nichols [2007], Dechow, Ge, and Schrand [2010], Ball [2013]). Conventional measures

1. Following the literature, I focus on the quality of working capital accruals.

of accruals quality capture not only the accounting error but also the underlying economic performance and firms' risk (e.g., Dechow, Sloan, and Sweeney [1995], Nikolaev [2016]). As a result, the effect of these measures is confounded and is subject to differing interpretations. At the same time, proxies for operating volatility are likely to be capturing accruals quality and therefore cannot be used as appropriate control variables. Therefore, it is necessary to properly separate the volatility of accruals into an accounting error component and a performance component. Second, accounting information quality is a choice that is endogenous to the choices of organization, contracting, and financial structures (Watts and Zimmerman [1990]). Accruals quality is therefore endogenous to a number of unobservable characteristics of the firm. For example, more complex or volatile firms have lower accruals quality. Finding a source of exogenous or quasi-random variation to address these problems is difficult, because the shocks to accruals quality are also likely to be correlated with shocks to firms' economic fundamentals.

To address these challenges, I exploit two recent methodological advances. First, I use the model of accruals quality developed in Nikolaev [2016] to separate accounting error from the portion of accruals that captures economic performance. The intuition is that the accounting error is present in earnings, while the performance component of accruals should be reflected in cash flows.[2] The volatility of accruals contains both an accounting noise component and a performance component, which differ in their economic nature. Following this intuition, this model allows discrimination between accounting noise, operating volatility, and economic performance. I estimate the volatility of accounting error to measure cross-sectional variation in accruals quality. The economic construct behind this measure is that accounting noise reduces relative signal in earnings about the underlying economic performance and thus results in lower information quality. Additionally, this approach allows measuring operating volatility, i.e., the volatility of the performance component of accruals, and the volatility of economic performance. These components are interesting in their own right, and the

2. The discussion of the nature of these components is given in Nikolaev [2016].

link between operating volatility and firm value is not well understood. Moreover, these parameters can be used as proper controls for underlying economic performance and firm operating risk because they do not capture accounting noise.

Second, I use the hedonic price regression approach developed in Bajari *et al.* [2012] (among others) to address the endogeneity problem.[3] This approach allows me to control for firm characteristics unobservable to the researcher that affect the stock price, that is, the firm value (Matvos [2013]). The premise of this approach is to exploit the assumption of rational expectations to identify the effect of priced firm characteristics.[4] In efficient capital markets, market prices reflect all observable firm attributes, including characteristics unobservable to a researcher. When making pricing decisions, investors with rational expectations use forecasts of the time-varying future firm characteristics, based on the information available to them.[5] Under the assumption of rational expectations, I formulate the moment conditions to identify the effect of accruals quality on firm value.[6] Further, I extend the model in Bajari *et al.* [2012] to account for the possibility of a more general process for time-varying unobservables. This extension helps me to examine the robustness of my results to the identifying assumptions.

The literature has used the factor model approach to test the pricing implications of accruals quality (e.g., Francis *et al.* [2004, 2005], Core *et al.* [2008], Ogneva [2012]) and tries to establish whether accruals quality is a systematic risk factor. The main difference between the traditional asset pricing approach and my approach is that the hedonic model explains the total value of the firm, rather than changes in the expected cost of capital. Otherwise, the two approaches can be reconciled, given that there is sufficient evidence that different firm characteristics explain the cross-sectional pattern of stock returns (Daniel and Titman

3. "Hedonic regression approach" and "rational expectations-based approach" are used interchangeably in this paper.

4. In this paper, I refer to a firm characteristic being "priced" when investors assign value to it based on their revealed preferences, though this characteristic does not have to be related to a systematic risk factor.

5. I assume that prices reflect all observable information. If there are firm characteristics unobservable to the market and that cannot be revealed to the market, then they will not be reflected in the stock price and therefore can be ignored in the hedonic model.

6. The term "effect" should be interpreted in the revealed preference framework.

[1997]) and firm characteristics are important to the investors (Fama and French [2007]). Moreover, I show that the rational expectations assumptions in my paper are consistent with rational expectations tests from Abel and Mishkin [1983].

My findings are as follows. I start my analysis by showing a negative and statistically significant association between the conventional measure of accruals quality from Dechow and Dichev [2002] and firm value using ordinary least squares regressions. Once I control for the volatility of total accruals, which is used as a proxy for operating volatility, and firm characteristics, the association between the Dechow-Dichev measure of accruals quality and firm value becomes small and insignificant. In contrast, the association between the volatility of total accruals and firm value remains highly significant. This demonstrates that the volatility of total accruals subsumes the effect of accruals quality. Therefore, following this strategy does not allow the identification of the effect of accruals quality on firm value, because the volatility of total accruals contains both accounting error and a performance component, which must be separated and included in the regression model.

I continue my analysis with using the new measure of accruals quality based on the model from Nikolaev [2016], which separates volatility of accruals into accounting error and a performance component. In a standard OLS regression, accruals quality, measured as the volatility of accounting error, exhibits a significant negative association with firm value.[7] At the same time, operating volatility has a much stronger and more robust negative association with firm value. The findings are consistent with those of Hribar and Nichols [2007], who demonstrate the importance of controlling for operating volatility, which changes the inferences with the measures of discretionary accruals. The effect of accruals quality is considerably attenuated when I control for the operating volatility. This illustrates the endogeneity problem with the standard approach, that is, omitted operating volatility correlated with accruals quality causes biases in estimates of the effect.

When I switch to the rational expectations-based approach to control for operating

7. Larger values of the volatility of accounting error indicate lower accruals quality.

volatility and time-varying unobservables, I find that accruals quality has a relatively small and marginally significant effect on the firm value.[8] Controlling for the operating volatility reduces the magnitude of the effect from −1.12 to −0.50. Further, I find that the economic magnitude of the effect of accruals quality approaches −0.89 as I add the control variables to the model. In all models with rational expectations, the effect of operating volatility dominates the effect of accruals quality. This suggests that the accruals quality has a small effect on firm value relative to the effect of the operating volatility, significantly lower than previously thought.

In contrast, I find that the effect of the operating volatility on firm value is negative and highly significant. A 1% increase in the operating volatility results in a 2.05% decrease in firm value. This result is robust to a range of control variables. Because operating volatility is an endogenous part of a firm's underlying economics and relates to other characteristics of the firm, this result should be interpreted as the implicit price, which describes the simultaneous economic behavior of agents and firms in the economy. In theory, this parameter represents an agent's preferences or marginal willingness to pay for this characteristic.[9] One intuitive interpretation of this effect is that the operating volatility captures a dimension of firms' operational risk.

Despite relatively weak results for a broad sample of firms, it is plausible that accruals quality is significantly more important for a specific subset of firms. If accruals play an important role in measuring the economic performance, their quality should be more valuable to the investors. The mechanism behind this is based on the relative information in accruals. Specifically, all else being equal, the larger portion of earnings based on the accruals, the more information they provide. I find that the effect of the volatility of accounting error on firm value is stronger (both economically and statistically) for a subsample of firms with

8. When presenting the results based on the rational expectations estimator, the term "effect" should be interpreted as an implicit price in the hedonic model framework, which represents an agent's revealed preferences for a firm's characteristic.

9. The estimated implicit prices are the structural parameters from the hedonic model.

higher average absolute accruals, that is, where accrual accounting plays a more important role. Although I cannot formally reject statistical difference, the evidence is consistent with cross-sectional predictions.

Following the prior argument, accruals quality can be more important for industries with more complex operations and thus accruals, because the information in accruals allows investors to better understand the underlying economic performance. I use industry average operating cycle as a proxy for the complexity of operations and the complexity of accrual accounting. I find that the effect of the operating volatility on firm value is stronger for a subsample of firms with longer industry average operating cycles. At the same time, once I control for the operating volatility and the volatility of economic performance, the effect of the volatility of accounting error does not depend on industry operating cycle. This result is consistent with industry operating risk being differentially important for industries with more complex operations, while the effect of accruals quality remains the same, all else equal.

Overall, the evidence suggests that the quality of accounting information in working capital accruals does not have a highly significant direct effect on firm value, as reflected in the implicit price of accruals quality, and the effect is lower than previously thought. This result contrasts with the estimates based on the linear least squares model, which generates a highly significant effect of the accruals quality on firm value, comparable to the effect of the operating volatility. However, this result should be interpreted with caution. Accruals quality can be significantly important for a specific subset of firms (e.g., firms where accrual accounting plays an important role), as indicated by my tests. Furthermore, this finding does not eliminate the possibility of the accruals quality having an indirect effect on firm value through other channels, including operations (Kanodia and Sapra [2016]). For example, it can influence the choice of operating volatility, which is included separately in my model. Further, accruals quality can affect decisions to provide more or less voluntary disclosure (Francis *et al.* [2008]). Specifically, firms might compensate for poor accruals quality with better disclosure. My model controls for such time-varying decision, since it is observable to investors. This potentially results in the underestimation of the aggregate effect of accruals quality on firm value.

One possible issue with my results is that they are influenced by the choice of the rational expectations structure, that is, the model of time-varying unobservables. To address this issue, I generalize the model of time-varying unobservables in Bajari *et al.* [2013] and use a more general process behind the rational expectations assumption. The new set of results indicates that the effect of the operating volatility on the firm value remains highly significant and robust to the choice of the model of time-varying unobservables. At the same time, the effect of the accruals quality on the firm value becomes more significant. The estimated magnitudes of the effects are similar to the ones in the first set of results. Overall, I find that my results are robust to the choice of the model of time-varying unobservables.

Another potential issue with my analysis is that the assumptions in the accruals quality model could be violated. I relax these assumptions and estimate the model based on the generalized set of moment conditions. I find that the results are robust to the violation of the accruals quality model assumptions, while the magnitudes of the estimated effects are slightly attenuated.

I contribute to the literature in several ways. First, this study is the first to separate volatility of accruals into an accounting error component (accruals quality) and a performance component (operating volatility) and to directly estimate the effect of accruals quality on firm value, while controlling for operating volatility. It is also the first to exploit the assumption of rational expectations to identify the effect of accounting properties on firm value. This approach allows me to address the endogeneity problem caused by the lack of the quasi-random variation in accruals quality, and to explicitly isolate operating volatility in accruals when testing the effect. Second, I document that accruals quality has a marginally significant effect on firm value. This effect is much smaller than that of the operating volatility, both in economic magnitude and statistical significance. My findings indicate that the effect of accounting quality is significantly smaller than what follows from prior evidence based on the models that do not isolate the operating volatility. This result is consistent with the discussion in Watts and Zimmerman [1990] and Zimmerman [2013], that the evidence from accounting, economics, and finance suggests a relatively small documented impact of accounting quality on capital markets. Third, I identify a significant effect of operating volatility on firm value. This effect suggests that operating risk is an important characteristic that could affect firm value. This result has important implications for accounting research. Studies that do not separate and control for the effect of operating volatility when studying accruals quality are likely to be subject to alternative interpretations. At the same time, using conventional proxies for operating volatility is also problematic because they could be capturing the accounting error component. Controlling for them would lead to a bias in estimates of the effect of accruals quality. Finally, I contribute to the literature by providing evidence on cross-sectional variation of the effect of accruals quality. It is likely that accruals quality is more valuable to investors in firms where accruals play a more important role, while operating risk may be relatively more important for firms in industries with long operating cycle and thus complex operations.

My paper also adds to the literature on the capital-market effects of accounting information quality. I contribute to this literature by introducing a research design that relies on rational expectations to study capital market effects of accruals quality. Overall, I provide a framework that can be applied more widely to answer a number of interesting accounting questions. In particular, it can be used to quantitatively study how accounting choices affect firm value.

My study follows a stream of work on the estimation of models with unobserved characteristics. The prior literature introduced the hedonic regression approach to differentiated product markets and developed its identification.[10] My approach is similar to that in Bajari *et al.* [2012] and Matvos [2013] and, more broadly, is related to the class of estimators

10. Court [1941], Tinbergen [1951], Tinbergen [1956], Rosen [1974], Brown and Rosen [1982], Brown [1983], Bartik [1987], Epple [1987], Kahn and Lang [1988], Ekeland *et al.* [2002], Ekeland *et al.* [2004], Heckman *et al.* [2004], Bajari and Benkard [2005], Heckman *et al.* [2010], Bishop and Timmins [2011], Bajari *et al.* [2012], Matvos [2013].

developed for panel data in Nickell [1981], Holtz-Eakin *et al.* [1988], Arellano and Bond [1991], Blundell and Bond [1998], and Blundell and Bond [2000].[11] I add to this literature by applying the hedonic regression approach to financial markets and by proposing a way to generalize the model.

My study has several limitations. First, I do not specify and explore the channels through which accruals quality could have an effect on firm value. This limits my ability to interpret the results. Second, because the accruals quality parameters are fixed over time, the main source of variation that drives my estimates is the variation across firms. I am not able to explore changes in accruals quality. Third, the measure of accruals quality captures the volatility of accounting error and not other possible dimensions of accounting quality (Dechow and Schrand [2010]). Finally, my model may be subject to misspecification, although my results are robust to different models of time-varying unobservables and are not driven by the choice of control variables. The results are also robust to a relaxed set of assumptions in accruals quality model.

The paper is organized as follows. I present the review of the literature in section 2. Section 3 introduces the hedonic model and describes the structural model of accruals quality. Section 4 describes the data and the sample. I provide the descriptive evidence and the estimation results in section 5.1. Sections 5.3 and 5.4 present and discuss the empirical test using an OLS estimator and rational expectations model. I study the effect for subsets of firms and industries in sections 5.5 and 5.6. Robustness tests are presented in section 5.7. Section 6 concludes the paper.

11. Another related stream of studies focuses on the identification of production functions, where some determinants of production are unobservable to the econometrician but observable to the firm (Berry *et al.* [1995], Olley and Pakes [1996], Berry *et al.* [2004], Ackerberg *et al.* [2015]).

# CHAPTER 2
# RELATION TO PAST LITERATURE

## 2.1 Information quality and firm value

From a theoretical perspective, it is not clear whether there is a significant link between accounting information quality and firm value and how strong that link may be. The most actively researched channel through which accounting information quality can affect firm value is the cost of capital. Diamond and Verrecchia [1991] provide a model where the supply of risky assets is endogenous. In this model, large risk-neutral traders may be informed or face liquidity shock, while small risk-averse traders are uninformed. At the same time, large traders are unwilling to take large positions because they face liquidity shocks and price protection upon liquidating their positions, and therefore small traders have to hold some of risky assets. As the result, this model demonstrates that there is positive cost of capital which depends on the information. Lambert *et al.* [2007] model information as a noisy measure of future cash flow and show that information quality may have direct and indirect effects on the cost of capital even if the information and the quality of information are idiosyncratic. In the direct effect, accounting information affects investors' assessed covariates between a firm's cash flow and other firms' cash flows, and leads to cross-sectional differences in firms' cost of capital. This effect is not diversifiable. In this model, if information quality affects real investment decisions, it can also have an indirect effect on cost of capital, e.g., better information could lead to more risky investments. Hughes *et al.* [2007] use a competitive noisy rational expectations framework to show that in the large economy limit, information symmetry has no influence on the cost of capital in cross-section. Lambert *et al.* [2011] make a distinction between information asymmetry and information precision effects on the cost of capital.[12] They show that under perfect competition, the cost of capital is

12. In this paper, the measure of accruals quality can be though as a proxy for investors' information precision.

affected only by the average precision of investors' information. In contrast, under imperfect competition, information asymmetry affects the cost of capital even after controlling for investors' average precision. However, existing models do not predict whether there exists a systematic information quality risk factor.

Empirical work has examined a relationship between information quality and the cost of capital, but the findings are mixed. Francis *et al.* [2004] find a significant association between earnings quality attributes and a proxy for the cost of capital. Francis *et al.* [2005] show that lower-quality accruals are associated with higher cost of debt and higher cost of equity. However, Core *et al.* [2008] find no evidence that accruals quality is a priced risk factor. Ogneva [2012] develops a return decomposition methodology and in asset-pricing tests demonstrates the existence of a priced accrual quality risk factor. Barth *et al.* [2013] provide evidence that firms with more transparent earnings, that is, whose earnings better reflect changes in the economic value of the firm, have a lower cost of capital measured using Fama-French 3-factors and momentum. Armstrong *et al.* [2011] find that information asymmetry has no separate effect on the cost of capital, when equity markets are perfectly competitive.

There are several potential reasons for such mixed findings. First, measures of earnings quality are endogenously related to other firm characteristics, and simple regressions provide biased estimates of their effect on the cost of capital. The conventional approach to solve this problem is to use quasi-random variation or an instrument. However, the potential quasi-random shock to the earnings quality would also likely affect other economic fundamentals and thus the cost of capital to the firm, which does not resolve the endogeneity problem. Second, prior empirical literature does not separate the effect of accounting noise from the effect of operating volatility, and hence most of the results may be attributable to operations as opposed to reporting. A third challenge in this stream of literature is that the cost of capital is difficult to estimate. The combination of the cost of capital being measured poorly and the use of fixed effects, that is, time series variation, makes the effect very difficult to detect.

My paper differs significantly from the prior literature on the information quality. First, I study the aggregate effect of accruals quality on firm value and do not focus on the specific channel, such as the cost of capital. This allows me to estimate the effect that is attributable to multiple channels, which are difficult to study separately and independently from each other. Therefore, the research question in my paper is broader than the summary of the findings in the prior literature. Second, I focus on levels of accruals quality rather than changes. My model is more robust to economic shocks, which directly affect both accruals quality and firm value, because they are modeled and isolated with rational expectations structure. The identification in my paper does not rely on quasi-random variation. Third, I do not distinguish between discretionary and innate accrual quality (Francis *et al.* [2004]) but separate the accruals quality from the volatility of economic performance and operating volatility. This approach allows me to directly isolate the accruals quality from the operations being reported via accruals. Another important difference is that I do not rely on the conventional asset pricing methodology (as in Francis *et al.* [2005] and Core *et al.* [2008]), because finding information quality risk factor is not the goal of my paper. Instead, I use the revealed preference framework to study investors' preferences for information quality. However, the two approaches can be reconciled. Specifically, asset pricing focuses on expected returns whereas my approach focuses on prices. Second, under both asset pricing approach and revealed preference approach, firm value can be expressed as a function of firm characteristics. Specifically, characteristics are predictive of future cash flows and discount rates, hence prices. Investors have preferences for characteristics because they are informative about future cash flows and risks associated with these cash flows. Additionally, they can get direct utility from holding specific assets. Examples of those preferences include "socially responsible investing" and "home bias". Therefore, stock prices can be represented as a function of firm characteristics, which could reflect both nondiversifiable risk or investors' tastes for assets as consumption goods. Finally, I show (in the appendix) that the assumptions in rational expectations-based framework can be reconciled with rational expectations tests in Abel and Mishkin [1983].

## 2.2 Price theory and hedonic regression approach

The hedonic theory models market prices as functions of product characteristics (Court [1941], Tinbergen [1951], and Tinbergen [1956]). Hedonic prices are the implicit prices of characteristics that are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them.[13] The hedonic approach to modeling differentiated product prices under pure competition is introduced in Rosen [1974] and is further developed in Brown and Rosen [1982]. Hedonic regressions estimate the effect of product characteristics on prices, with estimated coefficients representing the implicit prices. These prices are determined by the equilibrium in which all individuals solve the utility maximization problem (see the appendix for reference). Thus, implicit prices of product characteristics are directly related to consumers' preferences and their marginal willingness to pay for the specific product attribute.[14]

Hedonic price theory can be applied to financial markets (e.g., Matvos [2013]) and can be used to model firm stock price as a function of firm characteristics. Because consumers have preferences for specific product characteristics, the same analogy can be made for investors, who have different preferences with respect to firm characteristics (Fama and French [2007]). For example, some investors prefer growth stocks while others prefer more stable cash flows. This is consistent with both investors value the distribution of payoffs and investment assets are consumption goods. Investors have preferences with respect to future cash flows in terms of their levels, timing and volatility, and with respect to future discount rates, which in turn

13. For example, the hedonic approach is often used to model house prices, where the observed product characteristics are houses' square footage, lot size, the average education level in the neighborhood, etc. (Bajari *et al.* [2012]).

14. Hedonic models assume that product characteristics are observable to the consumer. In my paper, I assume that firm characteristics are observable to the investors.

are reflected in stock prices. As long as firm characteristics are informative about future cash flows, one should expect that in equilibrium, stock prices will reflect firm characteristics in the same way that product prices reflect product characteristics.[15] Following this logic, prices can be written as functions of firm characteristics. Empirical asset pricing literature has documented many examples of firm characteristics that are able to explain expected stock returns and predict future cash flows (e.g., Daniel and Titman [1997], Kogan and Papanikolaou [2013], Light *et al.* [2017]).[16] In this paper, I apply a theory argument that firm characteristics and accruals quality have an impact on firm value. In this context, the equilibrium hedonic price will reflect the investors' preference for accruals quality.

The traditional hedonic regression approach has an important limitation (Bartik [1987], Epple [1987], Ekeland *et al.* [2002], Heckman *et al.* [2004], Bishop and Timmins [2011]). Many of the product characteristics are not directly observable to the researcher. For example, in the context of firm value, the researcher cannot directly observe different dimensions of firm risk or competition. In the case in which unobserved characteristics are correlated with observed ones, the estimated coefficients are biased. The prior empirical research uses the instrumental variables approach, fixed effects, and regression discontinuity design to overcome this problem. However, their implementation is limited by the availability of the quasi-random variation or valid instruments.

Recently, Bajari *et al.* [2012] introduced a new approach to identify hedonic price regression. They take advantage of rational expectations and the efficient markets assumption, which allows estimating implicit prices based on the simple set of assumptions. I apply this approach to model the firm value and make the following assumptions. First, the price of the firm can be expressed as a linear function of observed and unobserved to the researcher firm characteristics. Second, the unobserved time-varying characteristics can be summarized in the

15. I assume an additive effect of firm characteristics on firm value, which is a standard assumption in the hedonic models.

16. Examples of firm characteristics associated with expected stock returns and stock prices include size, book-to-market ratio, market beta, asset growth, leverage and other (Light *et al.* [2017]).

form of a dynamic stochastic process. Third, the markets do not make systematic errors in predicting the evolution of unobserved characteristics, and prices reflect rational expectations based on all of the publicly available information. This set of assumptions allows isolating time-varying unobservable factors correlated with accruals quality to address the endogeneity problem.

# CHAPTER 3

# THE MODEL

## 3.1 Hedonic regression model with rational expectations

My approach is similar to Bajari *et al.* [2012] and Matvos [2013]. First, I assume that at any point in time, firm market price can be written in the form of the hedonic price equation:

$$\ln(p_{j,t}) = \alpha + \beta x_{j,t} + \gamma z_j + \xi_{j,t}, \tag{3.1}$$

where $p_{j,t}$ is the market price of firm $j$, $z_j$ is the accruals quality of firm $j$, $x_{j,t}$ is the vector of firm characteristics at time $t$ observed by the researcher, and $\xi_{j,t}$ is a scalar that describes unobserved (to researcher) firm characteristics at time $t$.

Second, I assume that unobserved time-varying firm characteristics can be described in the form of the dynamic stochastic process. In the benchmark model, the evolution of unobserved characteristics $\xi_{j,t}$ is described by the AR(1) process (I relax this assumption further):[17]

$$\xi_{j,t+1} = \phi \xi_{j,t} + \eta_{j,t+1}. \tag{3.2}$$

Third, I assume that the market has a rational expectation, that is, the expectation of stochastic innovation in the future period conditional on the current information set is zero:

$$\mathbb{E}\left[\eta_{j,t+1} | I_t\right] = 0, \tag{3.3}$$

where $I_t$ is all information available to the market participants at time $t$, irrespective of being observable to the researcher. This condition can be rewritten as:

$$\mathbb{E}\left[\xi_{j,t+1} | I_t\right] = \phi \xi_{j,t}. \tag{3.4}$$

17. The assumption of the AR(1) process is standard in the macroeconomic models and structural corporate finance literature (Strebulaev and Whited [2011]).

Therefore, the market does not make systematic errors in predicting $\xi_{j,t+1}$, consistent with efficient capital markets in which stock prices reflect rational expectations based on all of the publicly available information (semi-strong form of efficiency, Fama [1970]).

Following Bajari *et al.* [2012], the unobserved firm characteristic at time $t$ can be expressed through the observed price:

$$\xi_{j,t} = \ln(p_{j,t}) - \alpha - \beta x_{j,t} - \gamma z_j. \tag{3.5}$$

The hedonic price equation at time $t+1$ becomes:

$$\begin{aligned} \ln(p_{j,t+1}) &= \alpha + \beta x_{j,t+1} + \gamma z_j + \xi_{j,t+1} = \\ &= \alpha(1-\phi) + \phi \ln(p_{j,t}) + \beta x_{j,t+1} - \phi\beta x_{j,t} + \gamma(1-\phi) z_j + \eta_{j,t+1}. \end{aligned} \tag{3.6}$$

Based on the rational expectations assumption (with respect to all public information available at time $t$), the following moment condition holds in the efficient capital market:

$$\mathbb{E}\left[\ln(p_{j,t+1}) - \alpha(1-\phi) - \phi \ln(p_{j,t}) - \beta x_{j,t+1} + \phi\beta x_{j,t} - \gamma(1-\phi) z_j | I_t\right] = 0. \tag{3.7}$$

Any variable in the model lagged one or more periods is included in $I_t$ and, thus, can be used as an instrument (McCallum [1976], Cumby [1983], Hansen [1982], Hansen and Singleton [1982]). These generalized instrumental variables are required to have finite second moments, be in agents' information set and observable by the econometrician (Hansen and Singleton [1982]). However, values from the distant past would provide poorer instruments (McCallum [1976]). Therefore, I will use the firm price $p_j$ and observable characteristics $\mathbf{x}_j$ at time $t$ as my instruments:

$$\mathbb{E}\left[\ln(p_{j,t+1}) - \tilde{\alpha} - \phi \ln(p_{j,t}) - \beta x_{j,t+1} + \phi\beta x_{j,t} - \gamma(1-\phi) z_j | \ln(p_{j,t}), \mathbf{x}_{j,t}\right] = 0, \tag{3.8}$$

where $\tilde{\alpha} = \alpha(1-\phi)$. This moment condition is consistent with the assumption of weak or semi-strong market efficiency (Fama [1970]).

The corresponding sample moments would be defined as:

$$M = \sum_{j,t} \left\{ \left[ \ln(p_{j,t+1}) - \tilde{\alpha} - \phi \ln(p_{j,t}) - \beta x_{j,t+1} + \phi\beta x_{j,t} - \gamma(1-\phi) z_j \right] f(\ln(p_{j,t}), \mathbf{x}_{j,t}) \right\}, \tag{3.9}$$

for every $t$. Here, $f$ is an arbitrary smooth monotone function. The model can be estimated using the generalized method of moments approach (Hansen [1982]).

I further develop the generalized version of the model in which the unobserved firm characteristic follows the ARMA(p,q) process (Appendix). The parameters of this model can be estimated using the following moment condition:

$$\mathbb{E}\left[ \ln(p_{j,t+1}) - \tilde{\alpha} - \sum_{k=1}^{p} \phi_k \ln(p_{j,t-k+1}) - \beta x_{j,t+1} + \beta \sum_{k=1}^{p} \phi_k x_{j,t-k+1} - \right. \\ \left. - \gamma(1 - \sum_{k=1}^{p} \phi_k) z_j \,\middle|\, \ln(p_{j,t-q}), \mathbf{x}_{j,t-q} \right] = 0, \tag{3.10}$$

where $\tilde{\alpha} = \alpha(1 - \sum_{k=1}^{p} \phi_k)$.

## 3.2 Accruals quality

The model of accruals quality follows the approach developed in Nikolaev [2016]. The model's key idea is that both earnings and cash flows can be viewed as measures of the same underlying economic performance, denoted as $\pi$. Both measures contain measurement errors that reverse over time. Economic performance is defined as the expected value of cash from transactions and events over a period of time. Cash flow contains noise that arises from timing error inherent to cash flows (Dechow [1994]). This can be modelled as:

$$C_t = \pi_t + w_t - w_{t-1}. \tag{3.11}$$

Accruals aim to remove this error, such that $A_t^p = -w_t + w_{t-1}$ is the accrual that does so perfectly. This is the operating component of accruals. However, accruals introduce a different type of error into earnings, namely, accounting error:

$$E_t = \pi_t + v_t - v_{t-1}, \tag{3.12}$$

where $E_t$ is the earnings. The accounting error term, $V_t = v_t - v_{t-1}$, can arise for several reasons, including GAAP constraints and restrictions placed on managerial reporting choices, estimation errors, and perhaps intentional manipulation. In this paper, I do not distinguish between these sources of accounting error. The reported accruals $A_t$ will include both perfect accrual and accounting error:

$$A_t = A_t^p + V_t = -w_t + w_{t-1} + v_t - v_{t-1}. \tag{3.13}$$

The role of the accounting system is to minimize the adverse impact of accounting error on the information about the economic performance. If the accounting error has high variability relative to the economic performance, earnings have low informativeness about the economic performance. Therefore, we can define the variances of the following variables:

$$\text{var}(\pi_t) = \sigma_\pi^2, \quad \text{var}(v_t) = \sigma_v^2, \quad \text{var}(w_t) = \sigma_w^2, \tag{3.14}$$

where $\sigma_\pi$ is the volatility of the economic performance, $\sigma_w$ is the operating volatility, and $\sigma_v$ is the volatility of the accounting error.

The higher $\sigma_v^2$ is, the less information about the economic performance can be extracted from the reported earnings. Similarly, the lower $\sigma_w^2$ is, the less information is present in operating accruals relative to the signal. Therefore, accruals quality can be characterized in the cross-section in terms of the parameters: $\sigma_v$, $\sigma_w$, and $\sigma_\pi$.

Nikolaev [2016] makes the following additional assumptions about the unobservable variables, which is a natural starting point. First, he assumes that the economic performance, $\pi_t$, is uncorrelated with accounting error $v_t$ and performance accrual $w_t$. Second, he assumes that the accounting error $v_t$ and performance accrual $w_t$ are uncorrelated. These assumptions follow from unbiased estimation. Third, he assumes that the accounting error $v_t$ and performance accrual $w_t$ are white noise processes. Justification and a more detailed discussion of these assumptions are provided in Nikolaev [2016].[18]

I formulate the model in the first differences of $\pi_t$ to eliminate time-trends (growth) and persistent components in economic performance and accruals. The first-order autocorrelation is defined through the parameter $\rho_{\Delta\pi}$:

$$\mathrm{E}\left[\Delta\pi_t \Delta\pi_{t-1}\right] = \rho_{\Delta\pi}\sigma^2_{\Delta\pi}. \tag{3.15}$$

Using (3.11), (3.12), and (3.15), the moment conditions can be written as:

$$\mathrm{m}(1): \quad \mathrm{E}\left[\left(E_t - E_{t-1}\right)\left(E_t - E_{t-1}\right)\right] = \sigma^2_{\Delta\pi} + 6\sigma^2_v, \tag{3.16}$$

$$\mathrm{m}(2): \quad \mathrm{E}\left[\left(C_t - C_{t-1}\right)\left(C_t - C_{t-1}\right)\right] = \sigma^2_{\Delta\pi} + 6\sigma^2_w, \tag{3.17}$$

$$\mathrm{m}(3): \quad \mathrm{E}\left[\left(A_t - A_{t-1}\right)\left(A_t - A_{t-1}\right)\right] = 6\sigma^2_v + 6\sigma^2_w, \tag{3.18}$$

$$\mathrm{m}(4): \quad \mathrm{E}\left[\left(E_t - E_{t-1}\right)\left(E_{t-1} - E_{t-2}\right)\right] = \rho_{\Delta\pi}\sigma^2_{\Delta\pi} - 4\sigma^2_v, \tag{3.19}$$

$$\mathrm{m}(5): \quad \mathrm{E}\left[\left(C_t - C_{t-1}\right)\left(C_{t-1} - C_{t-2}\right)\right] = \rho_{\Delta\pi}\sigma^2_{\Delta\pi} - 4\sigma^2_w, \tag{3.20}$$

$$\mathrm{m}(6): \quad \mathrm{E}\left[\left(A_t - A_{t-1}\right)\left(A_{t-1} - A_{t-2}\right)\right] = -4\sigma^2_v - 4\sigma^2_w. \tag{3.21}$$

These moment conditions are used in the generalized method of moments approach to obtain estimates of the parameters $\sigma_{\Delta\pi}$, $\sigma_v$, $\sigma_w$, and $\rho_{\Delta\pi}$ for every firm.[19]

18. The assumption of a zero correlation between $\pi_t$ and $v_t$ or $w_t$ and $v_t$ can be justified by the assumption of unbiased estimation. The presence of systematic manipulations correlated with performance would naturally undermine such an assumption, but I assume that their effect would be relatively small. Even if such manipulations exist, they are unlikely to be present among all firms or through all years (Ball [2013]).

19. I use simulated annealing algorithm for approximating the global optimum, MATLAB code for which was generously provided by Toni Whited.

In addition to accruals quality parameters $\sigma_v$ and $\sigma_w$, I define accruals quality ratios:

$$\text{Accruals quality ratio} = \frac{\sigma_v^2}{\sigma_v^2 + \sigma_{\Delta\pi}^2}, \tag{3.22}$$

$$\text{Operating volatility ratio} = \frac{\sigma_w^2}{\sigma_w^2 + \sigma_{\Delta\pi}^2}. \tag{3.23}$$

Based on the industry and business environment, firms have different $\sigma_{\Delta\pi}$. The role of the accruals quality ratios is to scale accruals quality parameters by $\sigma_{\Delta\pi}$ and make firms with different $\sigma_{\Delta\pi}$ more comparable in their accruals quality. Economically, these ratios represent the fraction of noise in earnings and cash flows. To ensure that the ratios are bounded by one, $\sigma_v^2$ and $\sigma_w^2$ are added to the denominator, allowing us to avoid extreme observations.

# CHAPTER 4

# DESCRIPTION OF THE DATA AND SAMPLE SELECTION

I rely on the data from the Annual Compustat Industrial File and CRSP daily stock market data. I require nonmissing firm-year observations for total assets (*AT*), fiscal year closing price (*PRCC_F*), common shares outstanding (*CSHO*), Standard and Poor's Identifier (*gvkey*), and fiscal year (*fyear*).

The firm price variable $P$ is measured as the market value of equity at the end of the fiscal period. For observed firm characteristics, which determine the hedonic price equation, I use firm *Age*, *Size*, *Liabilities*, *Beta*, *Book-to-market*, *Asset growth*, and *Receivables Turnover*.[20] All variables are defined in the appendix and are used to control for economic fundamentals that determine the firm value (Penman [2013]). However, overcontrolling can be a problem (Wooldridge [2005]), and therefore I limit the control variables to the most important. I use CRSP daily stock market data merged with Fama-French factors data to estimate equity market betas. I drop observations with missing daily returns.

I winsorize $\log P$, *Size*, *Beta*, *Book-to-market*, *Asset growth*, *Receivables Turnover*, *Current Ratio*, *Asset Turnover*, *Inventory Turnover*, *ROE*, *Profit Margin*, *Sales Growth*, *Tangible*, *Investment*, *R&D*, *SG&A*, *Cash*, and *Intangible* at the 1% level. I replace missing research and development expense (*R&D*), selling, general and administrative expense (*SG&A*), and goodwill (*GDWL*) with zero values. Additionally, I require nonmissing control variables and instrumental variables up to three lags to estimate the hedonic regression model using the generalized method of moments. I exclude all observations with total assets of less than $5 million. I also exclude financial firms (*SIC* 6000–6999) and utilities (*SIC* 4900–4999) due to their regulated nature. I restrict my initial sample to the period from 1980 to 2016, whereas my final sample is limited to the period from 1984 to 2016 due to the need to create lagged

20. This choice of variables is motivated by literature on corporate valuation. I need to control for fundamental determinants of firm value: size and the life cycle of the firm, its capital structure, systematic risk, growth opportunities, and efficiency of the operations.

variables. The final sample contains 33,286 observations. The descriptive statistics for this sample are reported in Table 1.[21]

The accruals quality parameters are estimated using moment conditions described in section 3.2. Cash flow (variable $Cash$) is defined as Cash Flow from Operations $OANCF$ scaled by lagged total assets $AT$. Earnings (variable $Earnings$) are defined as the sum of cash flow and accruals: $Earnings = Cash + Accruals$. I use a cash flow statement-based approach to measuring accruals because the balance sheet approach is potentially contaminated by measurement error in accruals estimates (Hribar and Collins [2002]). Accruals (variable $Accruals$) are defined as $-RECCH - INVCH - APALCH - AOLOCH - TXACH$ scaled by lagged total assets $AT$, where $RECCH$ is an increase or decrease in accounts receivable, $INVCH$ is an increase or decrease in inventories, $APALCH$ is an increase or decrease in accounts payable and accrued liabilities, $AOLOCH$ is the net change in other assets and liabilities, and $TXACH$ is an increase or decrease in accrued income taxes. I require nonmissing $Accruals$. I take the first differences of cash flow, earnings, and accruals to construct $FD\_Cash$, $FD\_Ear$, and $FD\_Acc$. I truncate these variables at the 1% level. Finally, I demean them at the firm level to construct $\Delta C$, $\Delta E$, and $\Delta A$, which I use in the estimation of the accruals quality model. The descriptive statistics for this sample are similar to the one in Nikolaev [2016].

Mergers and acquisitions can introduce errors in measuring accruals (Hribar and Collins [2002]). Therefore, I mitigate this problem by using the method introduced by Owens *et al.* [2017]. In particular, I drop all observations with large discontinued operations, large special items, and large restructuring costs, where large is defined as greater than 5% of sales in the current year.

21. Firms in my sample are larger than firms that do not meet my sample selection requirements.

# CHAPTER 5

# EMPIRICAL RESULTS AND DISCUSSION

## 5.1 Estimation results

I use the generalized method of moments to recover the parameters of my model (Hansen [1982]). The moment conditions are described in sections 3.1 and 6. I estimate the model (3.10) with AR(1), AR(2), and AR(3) processes for unobservables with autoregressive parameters $\phi_1$, $\phi_2$, and $\phi_3$. The set of instrumental variables contains all value-relevant information available at time $t$. Specifically, I use all lagged control variables, *Current Ratio*, *Asset Turnover*, *Inventory Turnover*, *ROE*, *Profit Margin*, *Sales Growth*, *Tangible*, *Investment*, *R&D*, *SG&A*, *Cash*, *Intangible*, and their squared values, market value of equity $\log P$, $\log \sigma_{\Delta\pi}$, $\log \sigma_v$, $\log \sigma_w$ as instruments.[22] These variables are orthogonal to subsequent stochastic innovation and therefore can be used as valid instruments. I require only that these instruments are predetermined, while they do not need to be econometrically exogenous, consistent with Hansen and Singleton [1982]. This choice is in part motivated by Penman [2013], Nissim and Penman [2001], and Revsine *et al.* [2011].

I begin my analysis by estimating the accruals quality model for every firm in my sample. Table 2 provides summary statistics (Panel A) and Pearson correlations (Panel B) of the estimated parameters. The cross-sectional mean (median) volatility of the accounting error is 0.01 (0.01), the mean (median) operating volatility is 0.03 (0.02), and the mean (median) volatility of the economic performance is 0.06 (0.05).[23] As expected, both the mean and the median volatility of accounting error and operating volatility are lower than the volatility of economic performance. However, the cross-sectional standard deviations of the estimated

22. Generally, information available to investors is a broad concept which includes immense number of variables. Therefore, it is important to find key variables that characterize the available information. One of such variables would be the stock price because it aggregates a vast amount of information available to the market.

23. Given the model specification in first differences, here I estimate the volatility of changes in economic performance $\sigma_{\Delta\pi}$, which I further refer to as the volatility of the economic performance.

volatilities (0.01 for accounting error, 0.02 for operating volatility, and 0.04 for volatility of the economic performance) suggest a high cross-sectional heterogeneity of accruals quality parameters among firms. As expected, the volatility of the accounting error is smaller than that of the operating volatility. This finding suggests that the variance of the noise that accruals remove from cash flows is greater than that of the accounting error. Accruals thus generate a better measure of economic performance.

Further, I look at the accruals quality ratios, which measure the fraction of noise in earnings and cash flow processes. The cross-sectional mean (median) accruals quality ratio is 0.14 (0.06) and the mean (median) operating volatility ratio is 0.27 (0.18). As expected, the accruals quality ratio is smaller than the operating volatility ratio.

All parameters of the accruals quality model are correlated with each other in the cross-section. The accruals quality parameters can be considered as firm fixed attributes, which are endogenously determined by the firm. As we will see, different firm characteristics affect a firm's choice of the accruals quality and the operating volatility.

I continue my analysis by exploring the determinants of the volatility of accounting error and operating volatility. The results of the multivariate tests are presented in Table 3, Panels A and B. I find that the volatility of accounting error has a positive and significant association with firm *Beta*, *Age*, *Book-to-market*, and *Asset growth*. Additionally, it has a positive and marginally significant association with *Size* that becomes insignificant when I add industry fixed effects. Therefore, firms with higher systematic risk and higher growth have a higher volatility of accounting error. A higher level of *Liabilities* and *Receivables Turnover* is related to lower $\log \sigma_v$. The results are consistent with Nikolaev [2016].

The operating volatility has a positive and significant association with *Age*, *Book-to-market*, and *Asset growth*, similar to the volatility of accounting error. Therefore, value and growth are the main common factors that determine the accruals quality parameters. Although the operating volatility has a number of common determinants with the volatility of accounting error, there are also significant differences. Unlike the volatility of accounting error, it does not have an association with *Receivables Turnover*.

The associations of both the volatility of accounting error, $\log \sigma_v$, and the operating volatility, $\log \sigma_w$, with the volatility of economic performance, $\log \sigma_{\Delta\pi}$, are positive and significant. Controlling for $\log \sigma_{\Delta\pi}$ does not change the set of determinants of $\log \sigma_v$, while for $\log \sigma_w$ it makes the association with *Beta* insignificant.

I further explore the determinants of accruals quality ratios. Both the accruals quality ratio and operating volatility ratio have positive significant associations with *Age*, *Size*, and *Book-to-market*, and negative significant association with *Liabilities*.

## 5.2 Tests based on the Dechow-Dichev accruals quality measure

Following the literature, I start my analysis by using the conventional measure of accruals quality from Dechow and Dichev [2002]. It is defined through a firm-level regression of total accruals on lagged, current, and future cash flows from operations:

$$\frac{TCA_{it}}{\overline{Assets}_{it}} = \phi_{i,1} + \phi_{i,1}\frac{CFO_{i,t-1}}{\overline{Assets}_{it}} + \phi_{i,2}\frac{CFO_{i,t}}{\overline{Assets}_{it}} + \phi_{i,3}\frac{CFO_{i,t+1}}{\overline{Assets}_{it}} + \nu_{it}, \tag{5.1}$$

where $TCA_{it}$ is firm's total accruals in year $t$, $\overline{Assets}_{it}$ is firm's average total assets from year $t-1$ to year $t$, $CFO_{i,t}$ is the cash flows from operations in year $t$. The Dechow-Dichev measure of accruals quality is defined as the standard deviation of estimated residuals from the regression:

$$\text{DD} = \sqrt{\text{var}(\hat{\nu}_{it})}. \tag{5.2}$$

I examine the relationship between the Dechow-Dichev measure of accruals quality and firm value using ordinary least squares regressions with industry fixed effects. As was emphasized in previous literature (e.g., Hribar and Nichols [2007]), it is important to control for the firm's underlying operating volatility. I use the volatility of total accruals as a proxy for the operating volatility. Therefore, I estimate the following specification:

$$\log \mathrm{P}_{i,t} = \alpha + b_1 \log \mathrm{DD}_{\pi,i} + b_2 \log \sigma_{\mathrm{Acc}} + \mathit{Controls}_{i,t} + \mathit{Industry\ FE} + \epsilon_{i,t}. \tag{5.3}$$

The results are presented in Table 4, Panel A. The Dechow-Dichev measure of accruals quality has a negative and statistically significant association with the firm value (t-statistic equal to -14.57). Once I control for the volatility of total accruals, the magnitude of this association decreases from $-1.76$ to $-0.36$, and statistical significance becomes much smaller (t-statistic equal to -2.50). As I add firm control variables, this association becomes small and insignificant. In contrast, the association between the volatility of total accruals and firm value remains highly significant (t-statistic equal to -5.84). This demonstrates that $\sigma_{\mathrm{Acc}}$, which proxies for operating volatility, subsumes the accruals quality.

Overall, I have shown that the conventional measure of accruals quality has a strong association with firm value. However, this association is confounded by the fact that this measure does not separate accounting noise from the operating volatility. Further, controlling for the volatility of total accruals reduces the association between the conventional measure of accruals quality and firm value to a small and insignificant level. Therefore, following this strategy does not allow one to identify the effect of accruals quality on firm value. This motivates the use of accruals quality measure, which allows separating the volatility of total accruals into accounting noise and a performance component (operating volatility).

## 5.3 Implicit price of accounting quality: OLS estimates

I use the model from section 3.2 to measure accruals quality. My first test examines the relationship between the accruals quality parameters and firm value using ordinary least squares regressions with industry fixed effects. I estimate the following specification:

$$\log \mathrm{P}_{i,t} = \alpha + \gamma_1 \log \sigma_{\pi,i} + \gamma_2 \log \sigma_{v,i} + \gamma_3 \log \sigma_{w,i} + \mathit{Controls}_{i,t} + \mathit{Industry\ FE} + \epsilon_{i,t}. \tag{5.4}$$

Because this specification is written in log terms, the coefficients can be interpreted as price elasticities of accruals quality parameters.

The results are presented in Table 5, Panel A. The volatility of accounting error exhibits a negative and statistically significant association with firm value. As I add controls for the volatility of economic performance and the operating volatility, the coefficient on the $\log \sigma_v$ decreases in magnitude from $-1.11$ to $-0.69$ (t-statistic changes from -17.28 to -13.27). When I further add controls for firm characteristics, the magnitude and statistical significance of the coefficient $\gamma_2$ decreases from $-0.69$ to $-0.10$ (t-statistic changes from -13.27 to -5.13). However, one cannot reject the statistical significance of the volatility of accounting error ($\gamma_2$ is significant at the 1% level). At the same time, I find that the coefficient $\gamma_2$ in column (6) can be interpreted as a 1% increase in $\sigma_v$ is associated with a 0.10% decrease in market value P, all else equal. The coefficient on the operating volatility is greater in magnitude and exhibits greater statistical significance. The coefficient $\gamma_3$ in column (6) suggests that a 1% increase in $\sigma_w$ is associated with a 0.20% decrease in market value P, all else equal.

My second empirical test focuses on the relationship between the accruals quality ratios and firm value using OLS regressions with industry fixed effects:

$$\log \mathrm{P}_{i,t} = \alpha + \gamma_1 \log \sigma_{\pi,i} + \gamma_2 \log\left(\frac{\sigma_v^2}{\sigma_v^2 + \sigma_{\Delta\pi}^2}\right) + \gamma_3 \log\left(\frac{\sigma_w^2}{\sigma_w^2 + \sigma_{\Delta\pi}^2}\right) + \mathit{Controls}_{i,t} + \\ + \mathit{Industry\ FE} + \epsilon_{i,t}. \quad (5.5)$$

The results are presented in Table 5, Panel B. The accruals quality ratio exhibits a negative and statistically significant association with firm value. This association is smaller and weaker than one with $\sigma_v$. When I control for the volatility of economic performance, firm characteristics, and the operating volatility ratio, the magnitude of the coefficient on $\log\left(\sigma_v^2/(\sigma_v^2 + \sigma_{\Delta\pi}^2)\right)$ decreases in the same way it did for the unscaled parameter. The coefficient $\gamma_2$ in column (6) suggests that a 1% increase in the $\sigma_v^2/(\sigma_v^2 + \sigma_{\Delta\pi}^2)$ ratio is associated with a 0.06% decrease in market value P (t-statistic equal to -5.91). As previously, the coefficient on the operating volatility ratio is greater in magnitude and exhibits greater statistical significance. The coefficient $\gamma_3$ in column (6) suggests that a 1% increase in the $\sigma_w^2/(\sigma_w^2 + \sigma_{\Delta\pi}^2)$ ratio is associated with a 0.13% decrease in market value P (t-statistic equal to -9.94). Therefore, similar to the results in Panel A, I establish that the magnitude of $\gamma_3$ is higher than that of $\gamma_2$, whereas the statistical significance is approximately at the same level.

The association of $\sigma_{\Delta\pi}$ and firm value is also significant, but the sign of coefficient $\gamma_1$ is changing for different specifications. This is explained by a different cross-sectional correlations with the explanatory variables. Table 2, Panel B, shows that the volatility of economic performance has a positive correlation with the accruals quality parameters $\sigma_v$ and $\sigma_w$, and a negative correlation with the accruals quality ratios. Thus, the inclusion of a different set of explanatory variables would change the coefficient on $\sigma_{\Delta\pi}$. The test without additional control variables in Panel A column (1) indicates a negative association between the economic volatility and firm value. This result is consistent with higher $\sigma_{\Delta\pi}$ being a firm characteristic related to risk.

In sum, I find that the accruals quality has a significant association with firm value. However, the effect is dominated by the operating volatility.

Next, I use the identification approach based on rational expectations, which was described in sections 3.1 and 6.

## 5.4 Implicit price of accruals quality: rational expectations model

### *5.4.1 Tests with accruals quality parameters*

The goal of the tests in this section is to control for time-varying unobservables and compare the effects of the volatility of accounting error and the operating volatility on firm value. First, I include $\sigma_v$ and $\sigma_w$ independently in the model (Panels A and B) to set a benchmark and compare the economic magnitudes of their effects. Note that the prior studies did not discriminate between $\sigma_v$ and $\sigma_w$. Next, I include $\sigma_v$ and $\sigma_w$ simultaneously in the model (Panel C) to address the concern in the prior literature that the accruals quality is correlated with the operating volatility. Additionally, I will compare the results of these tests with the ones from the OLS regression.

My main empirical test relies on the rational expectations assumption to control for time-varying unobservables. I start the analysis with the AR(1) model of time-varying unobservables, $\xi_{j,t+1} = \phi\xi_{j,t} + \eta_{j,t+1}$, and use the moment conditions from section 3.1 to estimate the parameters of the model.

The results for the model with the volatility of accounting error are presented in Table 6, Panel A. The effect of the volatility of accounting error on the firm value is negative and statistically significant (the magnitude is $-1.19$, t-statistic equal to -5.36). Economically, a 1% increase in $\sigma_v$ results in a 1.19% decrease in market value P. Further, I control for the volatility of economic performance in the second column. In contrast to OLS, the coefficient $\gamma_2$ increases in magnitude from $-1.19$ to $-1.24$ and remains significant (t-statistic equal to -5.42). As I add additional control variables, the coefficient $\gamma_2$ remains statistically significant (at the 1% level) and economically sizable. This result could be driven by either investors assigning value to accruals quality, or there is other important firm fixed characteristic correlated with accruals quality.

In Table 6, Panel B, I consider the other important parameter of the accruals quality model, the operating volatility, or the volatility of the performance component of accruals. The effect of this parameter is interesting because it is the key characteristic of the accrual process. Panel B indicates that the effect of the operating volatility on market value of equity is negative and highly significant (at the 1% level). This is true for models with different control variables. In the baseline model, a 1% increase in the operating volatility results in a 1.61% decrease in the firm value (t-statistic equal to -9.46).

If we compare the results in Table 6, Panel A and Panel B, which are based on the same data sample, both the accruals quality and the operating volatility have a significant effect on firm value. However, the effect of the operating volatility is stronger both in magnitude and in statistical significance. This finding suggests that many prior studies, which find a significant effect of accruals quality, could be picking up the effect of $\sigma_w$. This motivates me for the test with both variables included.

Next, I include both the volatility of accounting error and the operating volatility in the models and compare their effects. The results are reported in Table 6, Panel C. In the benchmark model (column (1)), the effect of the volatility of accounting error on the firm value remains significant (at 5% level, t-statistic changes from -5.36 to -2.31), whereas the effect of the operating volatility remains highly significant (at 1% level, t-statistic changes from -9.46 to -7.28). Additionally, the economic magnitude of $\gamma_3$ is higher than that of $\gamma_2$. A 1% increase in the operating volatility results in a 1.38% decrease in firm value, compared to 0.50% for the effect of the volatility of accounting error. Compared to Panal A and B, the economic magnitude of the effect of $\sigma_v$ drops, while the magnitude of the effect of $\sigma_w$ remains at the same levels. Further, when I add control variables (columns (2), (3), and (4)), the effect of operating volatility $\gamma_3$ remains significant at the 1% level, while its magnitude does not change much. At the same time, the effect of the volatility of accounting error $\gamma_2$ becomes marginally significant. If we compare the results from column (2) with the similar test based on the OLS regression (Table 5, Panel A, column (4)), the economic magnitude of $\gamma_2$ is smaller in the rational expectations model test, whereas $\gamma_3$ is higher. The coefficient $\gamma_2$ becomes insignificant (t-statistic equal to -1.50), while $\gamma_3$ remains highly significant (t-statistic equal to -3.85). This finding suggests that controlling for time-varying unobservables and $\sigma_w$ subsumes the effect of $\sigma_v$. However, this result could be driven by lack of statistical power. Therefore, I will perform additional tests with different rational expectations structures and with accruals quality ratios, which could result in better identification accuracy.

The analysis above suggests that the volatility of accounting error has a marginally significant and relatively small effect on the firm value relative to the effect of the operating volatility, which is significantly lower than previously thought. Panel C indicates that this result is not driven by the set of control variables, which could capture different dimensions of accruals quality.

### *5.4.2 Tests with accruals quality ratios*

I also approach the identification of the effect of accruals quality on firm value from a different angle. The pricing effect could come out more cleanly using the accruals quality ratio ($\sigma_v^2/(\sigma_v^2 + \sigma_{\Delta\pi}^2)$), rather than the volatility of accounting error. This is because this measure represents the fraction of the variance in the earnings process that is due to the accounting error, and it is perhaps a better measure of the quality of accounting information in earnings. I perform this test in a way analogous to the previous analysis. First, I include $\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$ and $\sigma_w^2/(\sigma_w^2 + \sigma_{\Delta\pi}^2)$ independently in the model (Panels A and B), and subsequently study their simultaneous effect (Panel C).

The results of this test are presented in Table 7. In the baseline model, Panel A, I observe a negative significant effect of $\sigma_v^2/(\sigma_v^2 + \sigma_{\Delta\pi}^2)$. Economically, a 1% increase in the accruals quality ratio results in a 0.39% decrease in firm value (t-statistic equal to -3.56). The magnitude changes from $-0.39$ to $-1.09$ when I add control variables, and the coefficient remains significant (t-statistic equal to -2.86). Therefore, whereas the accruals quality ratio has smaller magnitude pricing implications compared to the volatility of accounting error, it changes in the same way when I add a set of control variables.

In parallel with Table 6, I also consider the model with the operating volatility ratio ($\sigma_w^2/(\sigma_w^2 + \sigma_{\Delta\pi}^2)$). The results of this test are presented in Table 7, Panel B. The effect of the operating volatility ratio is highly significant (at the 1% level, t-statistic equal to -6.85). According to the results in column (1), a 1% increase in the operating volatility ratio results in a 0.76% decrease in firm value. The coefficient is robust to the inclusion of the set of control variables. Therefore, the operating volatility ratio has a significant negative effect in the model.

In line with Table 6, if we compare the results of Panels A and B, the effect of $\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$

is significant and robust to the set of control variables, whereas the effect of $\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$ becomes marginally significant (t-statistic changes from -2.86 in Panel A, column (4), to -1.83 in Panel C, column (4)), and the economic magnitude of $\gamma_2$ is higher than of $\gamma_3$. This finding suggests that the effect of the operating volatility ratio potentially dominates the effect of the accruals quality ratio.

Next, I compare the simultaneous effects of $\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$ and $\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$ on the market value of equity. I perform the analysis with the accruals quality ratio and the operating volatility ratio. The results of this test are presented in Table 7, Panel C. For different models, the effect of the operating volatility ratio on the firm value is highly significant, whereas the effect of the accruals quality ratio is marginally significant and sensitive to the model specification. Furthermore, the effect of operating volatility ratio $\gamma_3$ remains significant at the 1% level when I add a set of control variables to the model (columns (2), (3), and (4)). In particular, a 1% increase in the operating volatility ratio results in a 0.68% decrease in the firm value. Although the effect of the accruals quality ratio is insignificant in columns (1) and (3), it is significant (marginally significant) in columns (2) and (4). If we compare the results from column (4) with the similar test based on the OLS regression (Table 5, Panel B, column (5)), the economic magnitude of the effect of accruals quality ratio $\gamma_2$ is higher in the rational expectations model test. The coefficient $\gamma_2$ becomes marginally significant (t-statistic equal to -1.81 in column (4)), whereas $\gamma_3$ remains highly significant (t-statistic equal to -4.31 in column (4)).

Overall, this analysis confirms the previous results and suggests that accruals quality ratio has a relatively small effect on firm value, which is dominated by the effect of the operating volatility ratio.

#### *5.4.3 Tests based on generalized hedonic regression model*

One potential issue with the prior analysis is that the model relies on the AR(1) choice of time-varying unobservables. The concern is that the results are sensitive to this choice and a different model will affect the main conclusion. To address this issue, I extend the model of time-varying unobservables to AR(2) ($\xi_{j,t+1} = \phi_1 \xi_{j,t} + \phi_2 \xi_{j,t-1} + \eta_{j,t+1}$) and AR(3) ($\xi_{j,t+1} = \phi_1 \xi_{j,t} + \phi_2 \xi_{j,t-1} + \phi_3 \xi_{j,t-2} + \eta_{j,t+1}$) and use moment conditions from section 6 to estimate the model. The results are presented in Table 8, with the AR(2) model in columns (1) and (2), and the AR(3) model in columns (3) and (4). Table 8, Panel A, indicates that the effect of the operating volatility on the market value of equity is highly significant and robust to the choice of the model of time-varying unobservables. Moreover, the different choices of the model of time-varying unobservables have little effect on the economic magnitude. At the same time, the effect of the volatility of accounting error on the market value of equity is negative and marginally significant. The statistical significance of $\gamma_2$ is higher in Table 8, Panel A, columns (2) and (4), compared to the results in Table 6, Panel C, column (4). Therefore, the results for the effect of accruals quality on the market value of equity are robust to the choice of the model and become more accurate in the generalized version of the model. Further, I repeat similar robustness tests for the accruals quality ratios and report them in Table 8, Panel B. The effect of the operating volatility ratio on the market value of equity is significant for different specifications, whereas the effect of the accruals quality ratio is marginally significant.[24] Therefore, the results for the effect of accruals quality ratios are also robust to the choice of the models of time-varying unobservables.

Overall, these findings suggest that investors have preferences for higher accruals quality.[25] The implicit price of the volatility of accounting error ranges from $-0.50$ to $-0.78$ based on the model specification, and the implicit price of the accounting quality ratio ranges from $-0.15$ to $-0.51$.[26] At the same time, my findings indicate that investors have preferences for lower operating risk, which statistically and economically dominates the preferences for accruals quality. The implicit price of the operating volatility ranges from $-1.43$ to $-1.78$,

24. The effect of accruals quality on firm market value is insignificant in columns (1) and (3), and significant in columns (2) and (4), similar to the corresponding results in Table 7 Panel C.

25. Investors have preferences for lower volatility of accounting error.

26. Economically, implicit price is equivalent to elasticity.

and the implicit price of the operating volatility ratio ranges from $-0.69$ to $-1.23$.

### 5.5 Cross-sectional analysis of the effect accruals quality

In the previous analysis I have examined the effect of accruals quality on firm value for a broad sample of firms. Despite relatively weak results for the broad sample, it is plausible that accruals quality is significantly more important for a specific subset of firms. If accruals play an important role in measuring the economic performance, their quality should be more valuable to the investors. The mechanism behind this is based on the relative information in accruals. Specifically, the larger portion of earnings based on the accruals, the more information they provide, all else equal. Therefore, I predict that the effect of accruals quality on firm value is stronger (both economically and statistically) for firms where accrual accounting plays a more important role, that is, where accruals represent a relatively larger portion of earnings.

I measure the importance of accrual accounting by average absolute accruals scaled by total assets (log Average |Accruals|). My first test examines the interaction effect of accruals quality and average absolute accruals using ordinary least squares regressions with industry fixed effects. I estimate the following specification:

$$\log \mathrm{P}_{i,t} = \alpha + b_1 \log \mathrm{Average}|\mathrm{Accruals}| + b_2 \log \sigma_{v,i} + \\ + b_3 \log \mathrm{Average}|\mathrm{Accruals}| * \log \sigma_{v,i} + \mathit{Controls}_{i,t} + \mathit{Industry\ FE} + \epsilon_{i,t}. \quad (5.6)$$

The results are presented in Table 9, Panel A. The interaction of the volatility of accounting error and the average absolute accruals has a negative and statistically significant association with firm value. The economic magnitude if this interaction is $-0.29$, which is comparable to the coefficient on $\log \sigma_v$.

In my next test I control for time-varying unobservables in the cross-sectional analysis using the rational expectations model. I split the sample into two subsets based on the level of average absolute accruals, and estimate the hedonic regression model on each subsample. The results of this test are presented in Table 9, Panel B. The estimates from columns (1) and (3) are based on the subsample with the lowest 50% of average absolute accruals, while the estimates from columns (2) and (4) are based on the subsample with the highest 50% of average absolute accruals. The effect of the volatility of accounting error ($\gamma_2$) on firm value is more significant and economically larger for firms with higher average absolute accruals. The coefficient $\gamma_2$ in column (4) is greater than in column (3) with simulated probability 78%. Although I cannot formally reject that they are from the same distribution, the evidence is consistent with cross-sectional predictions.

Overall, these findings are consistent with stronger effect of accruals quality on firm value for firms with higher importance of accrual accounting.

### 5.6 Industry analysis of the effect of accruals quality

Similar to the argument in the previous section, accruals quality can be more important for specific industries. In particular, industries with more complex operations (and thus accruals) are industries where accounting quality should matter more because the information in accruals allows investors to better understand the underlying economic performance. I focus on the industry average operating cycle which is used as a proxy for complexity of operations and complexity of accrual accounting. It is a fundamental industry characteristic which should make the information in accruals more important to the investors. Therefore, I predict that the effect of accruals quality on firm value is higher (both economically and statistically) for firms in industries where their operating cycle is longer.

I split the sample into two subsets based on the industry average operating cycle. The results of these tests based on the ordinary least squares regressions are presented in Table 10, Panel A. The estimates from columns (1) and (3) are based on the subsample with the lowest operating cycle, while the estimates from columns (2) and (4) are based on the subsample with the highest operating cycle. The association between the volatility of accounting error and firm value is higher for sample with longer industry average operating cycle. The coefficient on $\log \sigma_v$ in column (2) is greater than in column (1) with simulated probability 97%, and it is greater in column (4) than in column (3) with simulated probability 85%.

In the next test I estimate the hedonic regression model with rational expectations structure. The results are presented in Table 10, Panel B. I find that the effect of the volatility of accounting error $\gamma_2$ is greater in magnitude for the subsample with longer operating cycle (column (2)) with simulated probability 77%. Once I control for the operating volatility and the volatility of economic performance, the effects for different subsamples become indistinguishable. However, the effect of the operating volatility $\gamma_3$ is much higher and stronger for a subsample with a longer operating cycle. Coefficient $\gamma_3$ in column (4) is higher than in column (3) with simulated probability 99%.

Overall, these findings suggest that the effect of the operating volatility is different for industries based on their average operating cycle. Industries with longer operating cycle exhibit much stronger effect of $\sigma_w$ on firm value. This is consistent with operating risk in these industries becoming more important for investors. In contrast, the effect of accruals quality does not change much based on industry average operating cycle.

## 5.7 Robustness tests

A potential issue with the prior analysis is that the model of accruals quality relies on a set of assumptions. The concern is that the results are sensitive to these assumptions and their violation will affect the main findings of this paper. To address this issue, I assume that these assumptions are violated and repeat the main tests of my paper.

I assume that the change in economic performance $\Delta\pi_t$ is correlated with accounting error $v_t$ and with performance accrual $w_t$.

$$\text{cov}\left(\Delta\pi_t, v_t\right) = r_{\Delta\pi,v}\sigma_{\Delta\pi}\sigma_v \neq 0, \tag{5.7}$$

$$\text{cov}\left(\Delta\pi_t, w_t\right) = r_{\Delta\pi,w}\sigma_{\Delta\pi}\sigma_w \neq 0. \tag{5.8}$$

The modified moment conditions would be the following:

$$\text{m}(1): \quad \text{E}\left[\left(E_t - E_{t-1}\right)\left(E_t - E_{t-1}\right)\right] = \sigma^2_{\Delta\pi} + 6\sigma^2_v + 2\text{cov}\left(\Delta\pi, v\right), \tag{5.9}$$

$$\text{m}(2): \quad \text{E}\left[\left(C_t - C_{t-1}\right)\left(C_t - C_{t-1}\right)\right] = \sigma^2_{\Delta\pi} + 6\sigma^2_w + 2\text{cov}\left(\Delta\pi, w\right), \tag{5.10}$$

$$\text{m}(3): \quad \text{E}\left[\left(A_t - A_{t-1}\right)\left(A_t - A_{t-1}\right)\right] = 6\sigma^2_v + 6\sigma^2_w - 12\text{cov}\left(v, w\right), \tag{5.11}$$

$$\text{m}(4): \quad \text{E}\left[\left(E_t - E_{t-1}\right)\left(E_{t-1} - E_{t-2}\right)\right] = \rho_{\Delta\pi}\sigma^2_{\Delta\pi} - 4\sigma^2_v - 2\text{cov}\left(\Delta\pi, v\right), \tag{5.12}$$

$$\text{m}(5): \quad \text{E}\left[\left(C_t - C_{t-1}\right)\left(C_{t-1} - C_{t-2}\right)\right] = \rho_{\Delta\pi}\sigma^2_{\Delta\pi} - 4\sigma^2_w - 2\text{cov}\left(\Delta\pi, v\right), \tag{5.13}$$

$$\text{m}(6): \quad \text{E}\left[\left(A_t - A_{t-1}\right)\left(A_{t-1} - A_{t-2}\right)\right] = -4\sigma^2_v - 4\sigma^2_w + 8\text{cov}\left(v, w\right). \tag{5.14}$$

For robustness tests I assume 20% correlation ($r = 0.2$). The results of tests based on the ordinary least squares regressions are presented in Table 11, Panel A. I find that the volatility of accounting error has a negative and statistically significant association with the firm value. When I add control variables, the magnitude of this association decreases while it remains significant. I also find that operating volatility has negative and significant association with firm value. Overall, these results are similar to findings in Table 5, Panel A.

Further, I repeat tests based on the rational expectations estimator. The results of these tests are presented in Table 11, Panel B. The effect of the volatility of accounting error on the firm value is negative and statistically significant. When I control for the operating volatility and other firm characteristics, the effect becomes marginally significant. In contrast, the effect of the operating volatility is strong and robust. This suggests that the effect of the operating volatility dominates the effects of accruals quality, similar to the finding in Table 6, Panel C.

Overall, I find that the results are robust to violation of the baseline assumptions in the accruals quality model. The magnitudes of the identified effects might be attenuated, while the conclusion based on the results does not change.

# CHAPTER 6

# CONCLUSION

In this paper, I offer an empirical strategy to identify the relation between accruals quality and firm value by using the approach based on the investors' revealed preferences. I use the model of accruals quality developed in Nikolaev [2016] to discriminate between the accruals quality and the operating volatility, that is, the volatility of the performance component in accruals. I use the hedonic price regression approach developed in Bajari *et al.* [2012] based on the rational expectations assumption to address the endogeneity problem and control for time-varying unobservables.

I find that investors have preferences for higher accruals quality. The implicit price of the volatility of accounting error is economically significant. A 1% increase in the volatility of accounting error results in 0.50% decrease in firm value at the margin. This effect is marginally significant, which contrasts with the OLS estimation, where I find a highly significant negative association between the volatility of accounting error and firm value.

I also find that investors have preferences for lower operating risk, which statistically and economically dominates their preferences for accruals quality. The implicit price of the operating volatility is $-1.43$. That is, a 1% increase in the volatility of accounting error results in 1.43% decrease in firm value at the margin. This result is robust to the choice of the model of time-varying unobservable firm characteristics and to different sets of control variables. Overall, my findings suggest that the effect of accruals quality on firm value is largely driven by the operating risk. This effect becomes much weaker when one separates the operating volatility from the volatility of accounting error and further controls for it.

Generally, accruals quality appears to be significantly more important for specific firms. I find that the effect of accruals quality on firm value is stronger (both economically and statistically) for firms where accrual accounting plays a more important role. Accruals quality can also be more important for specific industries. I focus on the industry average operating cycle, which is a fundamental industry characteristic related to more complex operations and thus more complex accrual accounting. I find that the operating volatility has much stronger effect on firm value in industries with longer operating cycle. In contrast, I do not find significant evidence of different effect of accruals quality. Overall, this suggest that the industry operating cycle is likely to be impacting investors' preferences for operating risk but not necessarily their preferences for accruals quality.

One possible issue with my analysis is that it is influenced by the choice of the rational expectations structure. To address this concern, I generalize the model of time-varying unobservables in Bajari *et al.* [2012] and use a more general process behind the rational expectations assumption. I find that my results are robust to this modeling choice. Another potential issue with my analysis is that the assumptions in the accruals quality model could be violated. I relax these assumptions and estimate the model based on the generalized set of moment conditions. I find that the results are robust to the violation of the modeling assumptions, while the magnitudes of the estimated effects are slightly attenuated.

My study is subject to the following limitations. First, I do not specify and explore the channels through which accruals quality could have an effect on the firm value. My findings do not eliminate the possibility of the accruals quality having an indirect effect on the firm value through other channels, including operations. Second, because the accruals quality parameters are fixed over time, the main source of variation that drives my estimates is the variation across firms. I am not able to explore changes in accounting quality. Third, the measure of accruals quality captures the volatility of accounting error, and not other possible dimensions of accounting quality. Finally, accruals quality can be significantly important for specific firms (e.g., firms where accrual accounting plays an important role), as my tests indicated.

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## APPENDIX A: VARIABLE DEFINITIONS

| Firm-year variables (based on Compustat Fundamentals Annual) | |
|---|---|
| *AT* | Assets – Total (Balance Sheet) |
| *REVT* | Revenue – Total (Income Statement) |
| *RECT* | Receivables Total (Balance Sheet) |
| *SPI* | Special Items (Income Statement) |
| *DO* | Discontinued Operations (Income Statement) |
| *RCP* | Restructuring Costs Pretax (Income Statement) |
| *LT* | Liabilities – Total (Balance Sheet) |
| *PRCC_F* | Price Close – Annual – Fiscal |
| *CSHO* | Common Shares Outstanding (Balance Sheet) |
| *Market Value* | $PRCC\_F_{i,t} * CSHO_{i,t}$ |
| *LargeDiscOps* | An indicator that equals 1 if firm i has discontinued operations (*DO*) greater than 5% of sales in year t, and 0 otherwise. |
| *LargeRestruc* | An indicator that equals 1 if firm i has restructuring charges (*RCP*) greater than 5% of sales in year t, and 0 otherwise. |
| *LargeSpecItem* | An indicator that equals 1 if firm i has special items (*SPI*) greater than 5% of sales in year t, and 0 otherwise. |
| *ACT* | Current Assets – Total (Balance Sheet) |
| *CAPX* | Capital Expenditures (Statement of Cash Flow) |
| *CEQ* | Common/Ordinary Equity – Total (Balance Sheet) |
| *CHE* | Cash and Short-Term Investments (Balance Sheet) |
| *COGS* | Cost of Goods Sold (Income Statement) |
| *EBIT* | Earnings Before Interest and Taxes (Income Statement) |
| *GDWL* | Goodwill (Balance Sheet) |
| *INVT* | Inventories – Total (Balance Sheet) |
| *LCT* | Current Liabilities – Total (Balance Sheet) |

Firm-year variables (based on Compustat Fundamentals Annual), *continued*

| | |
|---|---|
| *NI* | Net Income (Loss) (Income Statement) |
| *PPENT* | Property, Plant and Equipment – Total (Net) (Balance Sheet) |
| *XINT* | Interest and Related Expense – Total (Income Statement) |
| *XRD* | Research and Development Expense (Income Statement) |
| *XSGA* | Selling, General and Administrative Expense (Income Statement) |

Firm-year variables used to estimate the accruals quality parameters
(based on Compustat Fundamentals Annual, Statement of Cash Flows)

| | |
|---|---|
| *RECCH* | Accounts Receivable – Decrease (Increase) |
| *INVCH* | Inventory – Decrease (Increase) |
| *APALCH* | Accounts Payable and Accrued Liabilities – Increase (Decrease) |
| *AOLOCH* | Assets and Liabilities – Other – Net Change |
| *TXACH* | Income Taxes – Accrued – Increase (Decrease) |
| *OANCF* | Operating Activities - Net Cash Flow |
| *Cash* | Cash Flow: $OANCF_t/AT_{t-1}$ |
| *Accruals* | Accruals: |
| | $(-RECCH_t - INVCH_t - APALCH_t - AOLOCH_t - TXACH_t)/AT_{t-1}$ |
| *Earnings* | Earnings: $Cash + Accruals$ |
| $\Delta C_t$ | $FD\_Cash_t - \text{mean}(FD\_Cash_t)$, where $FD\_Cash_t = Cash_t - Cash_{t-1}$ |
| $\Delta A_t$ | $FD\_Acc_t - \text{mean}(FD\_Acc_t)$, |
| | where $FD\_Acc_t = Accruals_t - Accruals_{t-1}$ |
| $\Delta E_t$ | $FD\_Ear_t - \text{mean}(FD\_Ear_t)$, |
| | where $FD\_Ear_t = Earnings_t - Earnings_{t-1}$ |

| Identifiers | |
|---|---|
| *lpermno* | Historical CRSP PERMNO Link to COMPUSTAT Record |
| *gvkey* | Standard and Poor's Identifier |
| *fyear* | Data Year – Fiscal |
| *SIC* | Standard Industry Classification Code |
| *ticker* | Ticker Symbol (CRSP) |
| *date* | Trading Date (CRSP) |

| Stock market data (CRSP and Fama-French Factors) | |
|---|---|
| *RET* | Daily Return (CRSP) |
| *RF* | One Month Treasury Bill Rate (Fama-French Factors) |
| *MKTRF* | Excess return on the market (Fama-French Factors) |

| Parameters of the accruals quality model | |
|---|---|
| $\sigma_{\Delta\pi}$ | Volatility of economic performance, $\sqrt{\text{var}(\pi_t)}$ |
| $\sigma_v$ | Volatility of accounting error, $\sqrt{\text{var}(v_{R,t})}$ |
| $\sigma_w$ | Volatility of performance accruals, $\sqrt{\text{var}(w_{R,t})}$ |
| $\rho_{\Delta\pi}$ | Autocorrelation parameter, $\rho_{\Delta\pi} = \text{E}\left[\Delta\pi_t \Delta\pi_{t-1}\right]/\sigma^2_{\Delta\pi}$ |

| Accruals quality ratios | |
|---|---|
| *AQR* | Accruals Quality Ratio: $\sigma^2_v/(\sigma^2_v + \sigma^2_{\Delta\pi})$ |
| *OVR* | Operating Volatility Ratio: $\sigma^2_w/(\sigma^2_w + \sigma^2_{\Delta\pi})$ |

Firm level control variables

| | |
|---|---|
| *Age* | Length of the period for which the firm is present in the file. |
| *Size* | Natural logarithm of the total revenue: $\log(REVT_t)$ |
| *Liabilities* | Natural logarithm of the total liabilities: $\log(LT_t)$ |
| *Beta* | Stock market beta estimated for every year based on the daily stock returns: $RET_{i,t} - RF_t = \alpha_i + \beta_i MKTRF_{i,t}$, |
| *Book-to-market* | Book-to-market ratio: $\left(AT_{i,t} - LT_{i,t}\right) / (PRCC\_F * CSHO)$ |
| *Asset growth* | Yearly Asset Growth Rate: $(AT_{i,t} - AT_{i,t-1})/AT_{i,t-1}$ |
| *Receivables Turnover* | Receivables Turnover Ratio: $REVT_{i,t}/(0.5 * (RECT_{i,t} + RECT_{i,t-1}))$ |

Firm level variables used as instruments for $I_t$ (in addition to price and control variables)

| | |
|---|---|
| *Current Ratio* | Current Ratio: $ACT_{i,t}/LCT_{i,t}$ |
| *Asset Turnover* | Asset Turnover Ratio: $REVT_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *Inventory Turnover* | Inventory Turnover Ratio: $COGS_{i,t}/(0.5 * (INVT_{i,t} + INVT_{i,t-1}))$ |
| *ROE* | Return on Equity: $NI_{i,t}/CEQ_{i,t-1}$ |
| *Profit Margin* | Profit Margin Ratio: $NI_{i,t}/REVT_{i,t}$ |
| *Sales Growth* | Sales Growth Ratio: $(REVT_{i,t} - REVT_{i,t-1})/REVT_{i,t-1}$ |
| *Tangible* | Tangible Asset Ratio: $PPENT_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *Investment* | Investment Ratio: $CAPX_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *R&D* | Research and Development Ratio: $XRD_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *SG&A* | Selling, General and Administrative Expense Ratio: $XSGA_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *Cash* | Cash Ratio: $CHE_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |
| *Intangible* | Intangible Asset Ratio: $GDWL_{i,t}/(0.5 * (AT_{i,t} + AT_{i,t-1}))$ |

| Conventional measures of accruals quality | |
|---|---|
| $\log \mathrm{DD}$ | the Dechow-Dichev measure of accruals quality, $\mathrm{DD} = \sqrt{\mathrm{var}(\hat{\nu}_{it})}$: $Accruals_{it} = \phi_{i,1} + \phi_{i,1} Cash_{i,t-1} + \phi_{i,2} Cash_{i,t} + \phi_{i,3} Cash_{i,t+1} + \nu_{it}$.[27] |
| $\log \sigma_{\mathrm{Acc}}$ | Volatility of accruals, $\sqrt{\mathrm{var}(Accruals)}$ |

27. All variables here are scaled by average total assets in year $t$ and $t-1$.

# APPENDIX B: MODEL EXTENSIONS

Consider the generalization of the model, where unobserved time-varying firm characteristic $\xi_{j,t}$ is described by the ARMA(1,1) process:

$$\xi_{j,t+1} = \phi\xi_{j,t} + \theta\eta_{j,t} + \eta_{j,t+1}. \tag{B.1}$$

The rational expectation assumption requires conditioning on information at $t-1$:

$$\mathbb{E}\left[\theta\eta_{j,t} + \eta_{j,t+1}\middle| I_{t-1}\right] = 0. \tag{B.2}$$

To write the moment condition based on rational expectations for the ARMA(1,q) model, we would have to condition on the information at time $t-q$:

$$\mathbb{E}\left[\sum_{k=1}^{q}\theta_k\eta_{j,t-k+1} + \eta_{j,t+1}\middle| I_{t-q}\right] = 0. \tag{B.3}$$

Further, I allow unobserved firm characteristic $\xi_{j,t}$ to follow the AR(2) process:

$$\xi_{j,t+1} = \phi_1\xi_{j,t} + \phi_2\xi_{j,t-1} + \eta_{j,t+1}. \tag{B.4}$$

The unobserved firm characteristic $\xi_{j,t-1}$ at time $t-1$ can be expressed through the observed price $p_{j,t-1}$ at time $t-1$:

$$\xi_{j,t-1} = \ln(p_{j,t-1}) - \alpha - \beta x_{j,t-1} - \gamma z_j. \tag{B.5}$$

Thus, the hedonic equation for price $p_{j,t+1}$ at time $t+1$ can be expressed through observed prices $p_{j,t-1}$ and $p_{j,t}$ at time $t$ and $t-1$:

$$
\begin{aligned}
&\ln(p_{j,t+1}) = \\
&= \alpha + \beta x_{j,t+1} + \gamma z_j + \xi_{j,t+1} \\
&= \alpha + \beta x_{j,t+1} + \gamma z_j + \phi_1 \xi_{j,t} + \phi_2 \xi_{j,t-1} + \eta_{j,t+1} \\
&= \alpha + \beta x_{j,t+1} + \gamma z_j + \phi_1 \left(\ln(p_{j,t}) - \alpha - \beta x_{j,t} - \gamma z_j\right) + \phi_2 \left(\ln(p_{j,t-1}) - \alpha - \beta x_{j,t-1} - \gamma z_j\right) + \eta_{j,t+1} \\
&= \alpha(1 - \phi_1 - \phi_2) + \phi_1 \ln(p_{j,t}) + \phi_2 \ln(p_{j,t-1}) + \\
&\qquad + \beta x_{j,t+1} - \phi_1 \beta x_{j,t} - \phi_2 \beta x_{j,t-1} + \gamma(1 - \phi_1 - \phi_2) z_j + \eta_{j,t+1}. \qquad \text{(B.6)}
\end{aligned}
$$

For the general ARMA(p,q) model, the hedonic equation for price $p_{j,t+1}$ at time $t+1$ will be represented through observed prices $p_{j,t}, \dots, p_{j,t-p+1}$:

$$
\begin{aligned}
&\ln(p_{j,t+1}) = \\
&\quad = \alpha \left(1 - \sum_{k=1}^{p} \phi_k\right) + \sum_{k=1}^{p} \phi_k \ln(p_{j,t-k+1}) + \beta x_{j,t+1} - \beta \sum_{k=1}^{p} \phi_k x_{j,t-k+1} + \\
&\qquad + \gamma \left(1 - \sum_{k=1}^{p} \phi_k\right) z_j + \eta_{j,t+1} + \sum_{k=1}^{q} \theta_k \eta_{j,t-k+1}. \qquad \text{(B.7)}
\end{aligned}
$$

Therefore, for the ARMA(p,q) model, the following moment condition can be used for the estimation of the parameters:

$$
\begin{aligned}
\mathbb{E} \Bigg[ &\ln(p_{j,t+1}) - \tilde{\alpha} - \sum_{k=1}^{p} \phi_k \ln(p_{j,t-k+1}) - \beta x_{j,t+1} + \beta \sum_{k=1}^{p} \phi_k x_{j,t-k+1} - \\
&- \gamma(1 - \sum_{k=1}^{p} \phi_k) z_j \Bigg| \ln(p_{j,t-q}), \mathbf{x}_{j,t-q} \Bigg] = 0, \qquad \text{(B.8)}
\end{aligned}
$$

where $\tilde{\alpha} = \alpha \left(1 - \sum_{k=1}^{p} \phi_k\right)$.

# APPENDIX C: HEDONIC PRICE THEORY

In my model, a firm $j \in \mathcal{J}$ is defined as a finite-dimensional vector of characteristics, $(\mathbf{x}_j, \xi_j)$, where $\mathbf{x}_j$ is a vector of characteristics observed by the investors and the researcher, and $\xi_j$ is a scalar that represents a characteristic of the firm that is observed only by the investors.[28] Let $p_j$ denote the price of firm $j$. Investors are utility maximizers who select a firm $j$ to purchase and the composite alternative asset $c$. Each investor $i$ has income $y_i$ to spend each period. The key aspect of the hedonic model is that the utility functions are defined over characteristics $u_i(\mathbf{x}_j, \xi_j, c)$. The price of asset $c$ is normalized to 1. The maximization problem:

$$\max_{j,c} u_i(\mathbf{x}_j, \xi_j, c) \quad \text{subject to} \quad p_j + c < y_i. \tag{C.1}$$

Further, I specify the investor's utility function to be log-linear:

$$u_i(\mathbf{x}_j, \xi_j, c) = \sum_k \beta_{i,k} \log(x_{j,k}) + \beta_{i,\xi} \log(\xi_{j,k}) + c. \tag{C.2}$$

The first-order conditions for the utility maximization:

$$\frac{\beta_{i,k}}{x_{j,k}} = \frac{\partial p}{\partial x_{j,k}}, \tag{C.3}$$

$$\frac{\beta_{i,\xi}}{\xi_j} = \frac{\partial p}{\partial \xi_j}. \tag{C.4}$$

The first-order conditions can be solved for the utility parameters:

$$\beta_{i,k} = \frac{\partial p}{\partial x_{j,k}} x_{j,k}, \tag{C.5}$$

$$\beta_{i,\xi} = \frac{\partial p}{\partial \xi_j} \xi_j. \tag{C.6}$$

These parameters represent the investor's preference for a specific characteristic of the firm.

28. I follow the framework developed in Bajari *et al.* [2005].

# APPENDIX D: RATIONALITY AND MARKET EFFICIENCY

Formal description of the rationality of expectations for stock returns was given in Abel and Mishkin [1983]:

$$E_m\left(R_{t+1}|I_t\right) = E\left(R_{t+1}|I_t\right), \tag{D.1}$$

where $E_m\left(R_{t+1}|I_t\right)$ is the subjective expectation of $R_{t+1}$ assessed by the market conditional on available information $I_t$, $E\left(R_{t+1}|I_t\right)$ is the objective expectation of $R_{t+1}$ conditional on available information $I_t$.

The total stock return $R_{t+1}$ is defined as

$$R_{t+1} = \frac{P_{t+1} - P_t + D_{t+1}}{P_t}, \tag{D.2}$$

where $P_{t+1}$ is the stock price at time $t+1$, $P_t$ is the stock price at time $t$, and $D_{t+1}$ is the dividend at time $t+1$. Note that

$$E_m\left(P_t|I_t\right) = E\left(P_t|I_t\right) = P_t, \tag{D.3}$$

that is the stock price $P_t$ is known to the investors at time $t$. In other words, given the available information $I_t$ at time $t$

For simplicity, assume that the dividend payments are equal to zero or perfectly predictable. In this case, the condition of rationality of expectations for stock returns (D.1) is equivalent to the following condition for stock prices:

$$E_m\left(P_{t+1}|I_t\right) = E\left(P_{t+1}|I_t\right). \tag{D.4}$$

Further, applying this condition to the hedonic price equation for firm market value results in the two conditions

$$E_m\left(x_{j,t+1}|I_t\right) = E\left(x_{j,t+1}|I_t\right), \tag{D.5}$$

$$E_m\left(\xi_{j,t+1}|I_t\right) = E\left(\xi_{j,t+1}|I_t\right). \tag{D.6}$$

Condition (D.5) implies that market has rational expectations for firm characteristics observable to the researcher. Condition (D.6) implies that market has rational expectations for firm characteristics unobservable to the researcher.

Given the assumption that unobserved time-varying firm characteristics can be described in the form of the dynamic stochastic process, the condition (D.6) can be rewritten as

$$E_m\left(\eta_{j,t+1}|I_t\right) = E\left(\eta_{j,t+1}|I_t\right) = 0. \tag{D.7}$$

The last equality comes from the definition of AR(1) process, where the unconditional expectation of stochastic innovation is equal to zero.

Therefore, starting with the definition of the rationality of expectations for stock returns from Abel and Mishkin [1983], I have derived the rational expectations assumption which I use in my paper. This demonstrates the equivalence of the two approaches.

## Table 1: Descriptive statistics

This table presents the descriptive statistics of the firm characteristics (Panel A), control variables (Panel B), instrumental variables (Panel C), and Pearson correlations (Panel D). The variables *LT*, *ACT*, *LCT*, *CHE*, *INVT*, *PPENT*, *GDWL*, *CEQ*, *NI*, *REVT*, *COGS*, *CAPX*, *XRD*, and *XSGA* are taken from the Compustat Annual Industrial File and scaled by total assets *AT*. Control variables and instrumental variables are defined in the appendix. Total Assets, Total Receivables, Total Liabilities, Number of Common Shares Outstanding, Common Equity, Total Current Assets, Total Current Liabilities, Cash and Short-Term Investments, Inventories, Goodwill, and PP&E are the Balance Sheet items. Total Revenue, Special Items, Discontinued Operations, Restructuring Costs, Cost of Goods Sold, R&D Expense, SG&A Expense, Interest Expense, Dividends, EBIT, and Net Income are the Income Statement items. Capital Expenditures is the Cash Flow Statement item. All observations where *AT*, *CSHO*, and *PRCC_F* are missing are removed from the sample. The period runs from 1984 to 2016. The sample requires Total Assets to be at least $5 million. Observations with large discontinued operations, large restructuring costs, and large special items are removed. Firms are required to have at least 10 observations. The sample excludes financial firms and utilities.

Panel A: Summary statistics of firm-year variables

| Variables | N | Mean | Std. Dev. | Q 1% | Q 25% | Median | Q 75% | Q 99% |
|---|---|---|---|---|---|---|---|---|
| LT | 33,286 | 0.48 | 0.19 | 0.09 | 0.34 | 0.49 | 0.62 | 0.92 |
| ACT | 33,286 | 0.50 | 0.21 | 0.07 | 0.34 | 0.50 | 0.65 | 0.92 |
| LCT | 33,286 | 0.24 | 0.12 | 0.05 | 0.15 | 0.22 | 0.30 | 0.62 |
| CHE | 33,286 | 0.12 | 0.14 | 0.00 | 0.02 | 0.07 | 0.18 | 0.63 |
| INVT | 33,286 | 0.17 | 0.13 | 0.00 | 0.07 | 0.15 | 0.24 | 0.57 |
| PPENT | 33,286 | 0.32 | 0.21 | 0.02 | 0.15 | 0.27 | 0.44 | 0.88 |
| GDWL | 33,286 | 0.08 | 0.12 | 0.00 | 0.00 | 0.01 | 0.12 | 0.49 |
| RECT | 33,286 | 0.17 | 0.10 | 0.01 | 0.10 | 0.16 | 0.23 | 0.49 |
| CEQ | 33283 | 0.51 | 0.20 | 0.06 | 0.37 | 0.50 | 0.65 | 0.91 |
| NI | 33,286 | 0.05 | 0.07 | -0.19 | 0.02 | 0.05 | 0.09 | 0.22 |
| REVT | 33,286 | 1.45 | 0.96 | 0.28 | 0.88 | 1.26 | 1.77 | 4.68 |
| COGS | 33,286 | 0.92 | 0.77 | 0.08 | 0.46 | 0.75 | 1.16 | 3.61 |
| CAPX | 33,286 | 0.06 | 0.05 | 0.00 | 0.03 | 0.05 | 0.08 | 0.24 |
| XRD | 33,286 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.03 | 0.20 |
| XSGA | 33,286 | 0.26 | 0.21 | 0.00 | 0.11 | 0.22 | 0.36 | 0.98 |

**Table 1, continued**

Panel B: Summary statistics of control variables

| Variables | N | Mean | Std. Dev. | Q 1% | Q 25% | Median | Q 75% | Q 99% |
|---|---|---|---|---|---|---|---|---|
| Size | 33,286 | 6.70 | 1.96 | 2.70 | 5.27 | 6.64 | 8.06 | 11.10 |
| Beta | 33,286 | 0.85 | 0.54 | -0.23 | 0.45 | 0.83 | 1.20 | 2.35 |
| Age | 33,286 | 16.02 | 8.30 | 4.00 | 9.00 | 15.00 | 22.00 | 35.00 |
| Liabilities | 33,286 | 5.76 | 2.29 | 1.06 | 4.07 | 5.68 | 7.40 | 10.98 |
| Book-to-market | 33,286 | 0.66 | 0.51 | 0.07 | 0.34 | 0.53 | 0.82 | 2.87 |
| Asset growth | 33,286 | 0.11 | 0.21 | -0.24 | -0.00 | 0.06 | 0.16 | 1.12 |
| Receivables Turnover | 33,286 | 15.65 | 29.57 | 2.51 | 5.45 | 7.11 | 10.46 | 195.56 |

Panel C: Summary statistics of the instrumental variables

| Variables | N | Mean | Std. Dev. | Q 1% | Q 25% | Median | Q 75% | Q 99% |
|---|---|---|---|---|---|---|---|---|
| Current Ratio | 33,286 | 2.50 | 1.73 | 0.47 | 1.41 | 2.02 | 2.96 | 10.34 |
| Asset Turnover | 33,286 | 1.36 | 0.76 | 0.28 | 0.84 | 1.20 | 1.68 | 4.31 |
| Inventory Turnover | 33,286 | 13.16 | 25.59 | 1.18 | 3.41 | 5.37 | 10.06 | 157.97 |
| ROE | 33,286 | 0.13 | 0.20 | -0.51 | 0.06 | 0.13 | 0.20 | 0.90 |
| Profit Margin | 33,286 | 0.05 | 0.08 | -0.23 | 0.02 | 0.05 | 0.08 | 0.28 |
| Sales Growth | 33,286 | 0.10 | 0.20 | -0.34 | -0.00 | 0.07 | 0.17 | 0.87 |
| Tangible | 33,286 | 0.33 | 0.22 | 0.02 | 0.16 | 0.28 | 0.45 | 0.92 |
| Investment | 33,286 | 0.06 | 0.05 | 0.00 | 0.03 | 0.05 | 0.08 | 0.27 |
| R&D | 33,286 | 0.03 | 0.05 | 0.00 | 0.00 | 0.00 | 0.03 | 0.21 |
| SG&A | 33,286 | 0.27 | 0.21 | 0.00 | 0.12 | 0.23 | 0.37 | 0.99 |
| Cash | 33,286 | 0.13 | 0.15 | 0.00 | 0.02 | 0.07 | 0.18 | 0.68 |
| Intangible | 33,286 | 0.08 | 0.12 | 0.00 | 0.00 | 0.01 | 0.12 | 0.52 |

# Table 1, continued

Panel D: Pearson correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Size | 1.00 | | | | | | | | | | | | | | | | | | |
| (2) Beta | 0.30 | 1.00 | | | | | | | | | | | | | | | | | |
| (3) Age | 0.29 | 0.15 | 1.00 | | | | | | | | | | | | | | | | |
| (4) Liabilities | 0.96 | 0.28 | 0.29 | 1.00 | | | | | | | | | | | | | | | |
| (5) Book-to-market | -0.24 | -0.23 | -0.07 | -0.21 | 1.00 | | | | | | | | | | | | | | |
| (6) Asset growth | -0.00 | 0.12 | -0.13 | 0.02 | -0.21 | 1.00 | | | | | | | | | | | | | |
| (7) Receivables Turnover | 0.05 | -0.02 | -0.02 | -0.01 | -0.02 | 0.01 | 1.00 | | | | | | | | | | | | |
| (8) Current Ratio | -0.43 | 0.02 | -0.04 | -0.49 | 0.05 | 0.03 | -0.13 | 1.00 | | | | | | | | | | | |
| (9) Asset Turnover | 0.04 | -0.11 | -0.10 | -0.15 | 0.00 | 0.04 | 0.31 | -0.17 | 1.00 | | | | | | | | | | |
| (10) Inventory Turnover | 0.05 | -0.02 | 0.02 | 0.06 | -0.02 | 0.02 | 0.12 | -0.21 | 0.07 | 1.00 | | | | | | | | | |
| (11) ROE | 0.21 | 0.07 | 0.03 | 0.17 | -0.35 | 0.24 | 0.04 | -0.06 | 0.10 | 0.02 | 1.00 | | | | | | | | |
| (12) Profit Margin | 0.19 | 0.08 | 0.04 | 0.17 | -0.32 | 0.22 | -0.03 | 0.08 | -0.16 | 0.00 | 0.57 | 1.00 | | | | | | | |
| (13) Sales Growth | -0.02 | 0.12 | -0.16 | -0.02 | -0.20 | 0.57 | 0.01 | 0.01 | 0.08 | 0.03 | 0.22 | 0.19 | 1.00 | | | | | | |
| (14) Tangible | 0.12 | -0.07 | -0.12 | 0.19 | 0.04 | 0.06 | 0.26 | -0.33 | -0.12 | 0.28 | 0.01 | 0.06 | 0.04 | 1.00 | | | | | |
| (15) Investment | 0.05 | 0.02 | -0.19 | 0.06 | -0.11 | 0.21 | 0.21 | -0.20 | 0.03 | 0.22 | 0.11 | 0.12 | 0.16 | 0.65 | 1.00 | | | | |
| (16) R\ &D | -0.16 | 0.18 | -0.04 | -0.16 | -0.14 | 0.04 | -0.18 | 0.23 | -0.20 | -0.15 | -0.05 | -0.04 | 0.07 | -0.31 | -0.10 | 1.00 | | | |
| (17) SG\ &A | -0.19 | -0.07 | -0.11 | -0.30 | -0.07 | -0.01 | 0.23 | 0.05 | 0.46 | -0.22 | 0.00 | -0.13 | 0.00 | -0.32 | -0.10 | 0.24 | 1.00 | | |
| (18) Cash | -0.22 | 0.18 | -0.01 | -0.25 | -0.14 | 0.14 | -0.03 | 0.58 | -0.17 | -0.04 | 0.03 | 0.13 | 0.08 | -0.34 | -0.15 | 0.43 | 0.10 | 1.00 | |
| (19) Intangible | 0.22 | 0.11 | 0.27 | 0.25 | -0.13 | 0.11 | -0.11 | -0.15 | -0.16 | 0.02 | 0.05 | 0.07 | 0.04 | -0.30 | -0.27 | -0.03 | -0.09 | -0.15 | 1.00 |

**Table 2: Estimated parameters of the accruals quality model**

This table presents summary statistics (Panel A) and Pearson correlations (Panel B) of the estimated parameters. $\sigma_{\Delta\pi}$, $\sigma_v$, $\sigma_w$, and $\rho_{\Delta\pi}$ are described by the structural model and estimated through GMM by using moments m(1)–m(6) at the firm level. The structural model is based on the equations for reported earnings and cash flows, which are represented through economic performance ($\pi_t$), performance accruals ($w_t$), and accounting error ($v_t$): $E_t = \pi_t + v_t - v_{t-1}$ and $C_t = \pi_t + w_t - w_{t-1}$ (Nikolaev [2016]).

Panel A: Summary statistics of estimated parameters at the firm level

| Variables | N | Mean | Std. Dev. | Q 1% | Q 25% | Median | Q 75% | Q 99% |
|---|---|---|---|---|---|---|---|---|
| $\sigma_{\Delta\pi}$ | 1,698 | 0.06 | 0.04 | 0.01 | 0.03 | 0.05 | 0.07 | 0.22 |
| $\sigma_w$ | 1,698 | 0.03 | 0.02 | 0.00 | 0.01 | 0.02 | 0.04 | 0.08 |
| $\sigma_v$ | 1,698 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.02 | 0.05 |
| $\rho_{\Delta\pi}$ | 1,698 | 0.58 | 2.01 | -0.70 | -0.17 | 0.07 | 0.44 | 9.74 |
| $AQR\ \left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$ | 1,698 | 0.14 | 0.19 | 0.00 | 0.02 | 0.06 | 0.17 | 0.81 |
| $OVR\ \left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$ | 1,698 | 0.27 | 0.26 | 0.00 | 0.07 | 0.18 | 0.40 | 0.96 |
| DD | 1,698 | 0.03 | 0.01 | 0.01 | 0.02 | 0.02 | 0.04 | 0.07 |
| $\sigma_{\text{Acc}}$ | 1,698 | 0.04 | 0.02 | 0.01 | 0.03 | 0.04 | 0.06 | 0.10 |
| Average \|Accruals\| | 1,698 | 0.04 | 0.02 | 0.01 | 0.02 | 0.03 | 0.05 | 0.10 |

Panel B: Pearson correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| (1) $\sigma_{\Delta\pi}$ | 1.00 | | | | | | | | |
| (2) $\sigma_w$ | 0.33 | 1.00 | | | | | | | |
| (3) $\sigma_v$ | 0.39 | 0.32 | 1.00 | | | | | | |
| (4) $\rho_{\Delta\pi}$ | -0.30 | 0.08 | 0.07 | 1.00 | | | | | |
| (5) $AQR\ \left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$ | -0.44 | 0.10 | 0.30 | 0.76 | 1.00 | | | | |
| (6) $OVR\ \left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$ | -0.49 | 0.44 | 0.02 | 0.62 | 0.75 | 1.00 | | | |
| (7) DD | 0.47 | 0.46 | 0.68 | -0.05 | 0.06 | -0.03 | 1.00 | | |
| (8) $\sigma_{\text{Acc}}$ | 0.27 | 0.72 | 0.58 | 0.14 | 0.24 | 0.36 | 0.78 | 1.00 | |
| (9) Average Accruals | 0.26 | 0.66 | 0.55 | 0.13 | 0.22 | 0.32 | 0.69 | 0.90 | 1.00 |

**Table 3: Determinants of accruals quality**

This table presents the results for explaining the determinants of the accruals quality. The dependent variables are the accruals quality parameters ($\log \sigma_v$, $\log \sigma_w$) and the ratios ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$, $\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$). The explanatory variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, *Receivables Turnover*, and the volatility of economic performance ($\log \sigma_{\Delta\pi}$). The variables are defined in the appendix. Columns (2) and (4) include industry fixed effects. For the fixed effects specifications constant term is the average value of the fixed effects. The standard errors are clustered at the 2-digit SIC level and $t$ statistics are reported in parentheses. Significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, respectively.

Panel A: The volatility of accounting error ($\sigma_v$) and firm characteristics

| | (1)<br>$\log \sigma_v$ | (2)<br>$\log \sigma_v$ | (3)<br>$\log \sigma_v$ | (4)<br>$\log \sigma_v$ |
|---|---|---|---|---|
| Size | 0.0753* | 0.0079 | 0.1094** | 0.0261 |
| | (1.69) | (0.21) | (2.55) | (0.79) |
| Beta | 0.1666*** | 0.1037*** | 0.1216*** | 0.0693*** |
| | (8.03) | (5.56) | (6.39) | (4.53) |
| Age | 0.0067*** | 0.0061*** | 0.0066*** | 0.0059*** |
| | (8.53) | (8.42) | (8.68) | (7.98) |
| Liabilities | -0.1985*** | -0.1238*** | -0.2086*** | -0.1217*** |
| | (-5.09) | (-4.01) | (-5.44) | (-4.40) |
| Book-to-market | 0.0616*** | 0.0541*** | 0.0599*** | 0.0491*** |
| | (4.37) | (4.03) | (4.33) | (3.97) |
| Asset growth | 0.1283*** | 0.0938*** | 0.1075*** | 0.0752*** |
| | (4.23) | (3.60) | (3.92) | (3.40) |
| Receivables Turnover | -0.0035*** | -0.0016*** | -0.0035*** | -0.0017*** |
| | (-2.76) | (-2.73) | (-3.06) | (-3.34) |
| $\log \sigma_{\Delta\pi}$ | | | 0.1835*** | 0.1739*** |
| | | | (10.15) | (9.54) |
| Constant | -4.0992*** | -4.0354*** | -3.6413*** | -3.5774*** |
| | (-37.80) | (-54.90) | (-31.42) | (-41.60) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | No | Yes | No | Yes |

**Table 3, continued**

Panel B: The operating volatility ($\sigma_w$) and firm characteristics

| | (1) $\log \sigma_w$ | (2) $\log \sigma_w$ | (3) $\log \sigma_w$ | (4) $\log \sigma_w$ |
|---|---|---|---|---|
| Size | 0.2383*** | 0.1006*** | 0.2682*** | 0.1189*** |
| | (4.72) | (2.97) | (5.45) | (4.00) |
| Beta | 0.0661*** | 0.0333* | 0.0266 | -0.0012 |
| | (2.90) | (1.89) | (1.06) | (-0.07) |
| Age | 0.0102*** | 0.0104*** | 0.0101*** | 0.0102*** |
| | (11.05) | (11.13) | (10.57) | (10.36) |
| Liabilities | -0.3485*** | -0.2288*** | -0.3574*** | -0.2266*** |
| | (-8.67) | (-8.67) | (-8.86) | (-9.56) |
| Book-to-market | 0.1272*** | 0.0826*** | 0.1257*** | 0.0776*** |
| | (7.10) | (4.95) | (6.75) | (4.77) |
| Asset growth | 0.2147*** | 0.1629*** | 0.1965*** | 0.1443*** |
| | (6.79) | (5.72) | (6.09) | (5.25) |
| Receivables Turnover | -0.0014 | 0.0002 | -0.0013 | 0.0001 |
| | (-0.96) | (0.24) | (-1.01) | (0.10) |
| $\log \sigma_{\Delta\pi}$ | | | 0.1609*** | 0.1740*** |
| | | | (5.52) | (7.54) |
| Constant | -3.7557*** | -3.4863*** | -3.3540*** | -3.0278*** |
| | (-32.81) | (-41.69) | (-22.72) | (-30.57) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | No | Yes | No | Yes |

## Table 3, continued

Panel C: The accruals quality ratio ($\sigma_v^2/(\sigma_v^2 + \sigma_{\Delta\pi}^2)$) and firm characteristics

| | (1) log(AQR) | (2) log(AQR) | (3) log(AQR) | (4) log(AQR) |
|---|---|---|---|---|
| Size | 0.4490*** | 0.1927*** | 0.2046** | 0.0536 |
| | (4.24) | (3.59) | (2.66) | (0.92) |
| Beta | -0.1275** | -0.1600*** | 0.1956*** | 0.1022*** |
| | (-2.37) | (-3.78) | (5.57) | (3.64) |
| Age | 0.0105*** | 0.0092*** | 0.0118*** | 0.0105*** |
| | (4.89) | (4.20) | (8.66) | (7.94) |
| Liabilities | -0.4387*** | -0.1896*** | -0.3661*** | -0.2060*** |
| | (-4.48) | (-3.88) | (-5.26) | (-4.23) |
| Book-to-market | 0.0859** | 0.0449 | 0.0977*** | 0.0830*** |
| | (2.16) | (1.36) | (4.07) | (3.68) |
| Asset growth | 0.0275 | -0.0188 | 0.1766*** | 0.1227*** |
| | (0.43) | (-0.36) | (3.84) | (3.42) |
| Receivables Turnover | -0.0057*** | -0.0039*** | -0.0061*** | -0.0031*** |
| | (-3.75) | (-3.18) | (-3.09) | (-3.80) |
| $\log \sigma_{\Delta\pi}$ | | | -1.3154*** | -1.3242*** |
| | | | (-41.54) | (-38.81) |
| Constant | -3.3183*** | -2.9814*** | -6.6016*** | -6.4703*** |
| | (-15.40) | (-23.44) | (-31.53) | (-41.33) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | No | Yes | No | Yes |

## Table 3, continued

Panel D: The operating volatility ratio ($\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$) and firm characteristics

| | (1) log(OVR) | (2) log(OVR) | (3) log(OVR) | (4) log(OVR) |
|---|---|---|---|---|
| Size | 0.5855*** | 0.2894*** | 0.3905*** | 0.1823*** |
| | (6.67) | (7.17) | (6.06) | (4.18) |
| Beta | -0.2550*** | -0.2417*** | 0.0027 | -0.0399 |
| | (-3.71) | (-4.33) | (0.06) | (-1.18) |
| Age | 0.0149*** | 0.0146*** | 0.0159*** | 0.0156*** |
| | (7.27) | (6.96) | (11.27) | (10.10) |
| Liabilities | -0.5719*** | -0.3131*** | -0.5140*** | -0.3257*** |
| | (-7.07) | (-7.83) | (-9.51) | (-9.41) |
| Book-to-market | 0.1606*** | 0.0858** | 0.1700*** | 0.1151*** |
| | (4.03) | (2.31) | (6.27) | (4.07) |
| Asset growth | 0.1426** | 0.0918 | 0.2616*** | 0.2006*** |
| | (2.04) | (1.45) | (5.56) | (4.45) |
| Receivables Turnover | -0.0010 | -0.0004 | -0.0013 | 0.0002 |
| | (-0.74) | (-0.44) | (-0.73) | (0.26) |
| $\log \sigma_{\Delta\pi}$ | | | -1.0494*** | -1.0189*** |
| | | | (-26.84) | (-26.08) |
| Constant | -2.5817*** | -2.0487*** | -5.2011*** | -4.7334*** |
| | (-14.24) | (-19.88) | (-29.97) | (-35.38) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | No | Yes | No | Yes |

### Table 4: Tests based on the Dechow-Dichev accruals quality measure

This table presents the tests based on the Dechow-Dichev measure of accruals quality. Panel A presents the estimates of the linear least squares model with industry fixed effects. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the Dechow-Dichev measure of accruals quality ($\log \mathrm{DD}$) and the volatility of accruals ($\log \sigma_{\mathrm{Acc}}$). The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, *Receivables Turnover*, and industry fixed effects. The control variables are defined in the appendix. The standard errors are clustered at the 2-digit SIC level in Panel A and at firm level in Panel B. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Specification with the Dechow-Dichev accruals quality measure ($\log \mathrm{DD}$) and the volatility of accruals ($\log \sigma_{\mathrm{Acc}}$) (Linear least squares model with Industry FE)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) | (5)<br>log(P) |
|---|---|---|---|---|---|
| $\log \mathrm{DD}$ | -1.7628*** | | -0.3668** | 0.1024* | 0.0493 |
| | (-14.57) | | (-2.50) | (1.79) | (0.88) |
| $\log \sigma_{\mathrm{Acc}}$ | | -2.0771*** | -1.7757*** | -0.4915*** | -0.3646*** |
| | | (-16.82) | (-10.94) | (-7.03) | (-5.84) |
| Size | | | | 0.9779*** | 0.8483*** |
| | | | | (15.02) | (13.02) |
| Beta | | | | 0.4435*** | 0.2344*** |
| | | | | (8.11) | (6.05) |
| Age | | | | 0.0064*** | 0.0084*** |
| | | | | (3.78) | (5.47) |
| Liabilities | | | | -0.0263 | 0.0416 |
| | | | | (-0.50) | (0.76) |
| Book-to-market | | | | | -1.0929*** |
| | | | | | (-31.66) |
| Asset growth | | | | | 0.3941*** |
| | | | | | (8.53) |
| Receivables Turnover | | | | | -0.0015** |
| | | | | | (-2.45) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | Yes | Yes | Yes | Yes | Yes |

**Table 5: The accruals quality and the market price of equity**

This table presents the estimates of the linear least squares model with fixed effects. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$), which is defined as *PRCC_F∗CSHO*. The independent variables in Panel A are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The independent variables in Panel B are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the accruals quality ratio ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$), and the operating volatility ratio ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$). The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, *Receivables Turnover*, and industry fixed effects. The control variables are defined in the appendix. The standard errors are clustered at the 2-digit SIC level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Specification with the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$) (Linear least squares model with Industry FE)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) | (5)<br>log(P) | (6)<br>log(P) |
|---|---|---|---|---|---|---|
| $\log \sigma_v$ | -1.1108*** | | | -0.6895*** | -0.1187*** | -0.0968*** |
| | (-17.28) | | | (-13.27) | (-5.67) | (-5.13) |
| $\log \sigma_w$ | | -1.3910*** | | -1.1181*** | -0.2471*** | -0.2045*** |
| | | (-16.68) | | (-12.31) | (-9.30) | (-10.20) |
| $\log \sigma_{\Delta\pi}$ | | | -0.6495*** | -0.1867*** | 0.0656* | 0.0617* |
| | | | (-11.44) | (-2.68) | (1.73) | (1.93) |
| Size | | | | | 0.9746*** | 0.8467*** |
| | | | | | (14.81) | (12.87) |
| Beta | | | | | 0.4331*** | 0.2222*** |
| | | | | | (8.68) | (6.39) |
| Age | | | | | 0.0069*** | 0.0089*** |
| | | | | | (4.14) | (5.88) |
| Liabilities | | | | | -0.0194 | 0.0463 |
| | | | | | (-0.36) | (0.85) |
| Book-to-market | | | | | | -1.0989*** |
| | | | | | | (-31.65) |
| Asset growth | | | | | | 0.3870*** |
| | | | | | | (8.69) |
| Receivables Turnover | | | | | | -0.0013** |
| | | | | | | (-2.03) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |

## Table 5, continued

Panel B: Specification with the accruals quality ratio ($\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$) and the operating volatility ratio ($\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$) (Linear least squares model with Industry FE)

| | (1) log(P) | (2) log(P) | (3) log(P) | (4) log(P) | (5) log(P) |
|---|---|---|---|---|---|
| $\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$ | -0.1013*** | | -0.4175*** | -0.0780*** | -0.0642*** |
| | (-3.72) | | (-13.10) | (-6.24) | (-5.91) |
| $\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$ | | -0.2992*** | -0.6847*** | -0.1587*** | -0.1316*** |
| | | (-5.71) | (-11.57) | (-8.70) | (-9.94) |
| $\log \sigma_{\Delta\pi}$ | | | -1.7716*** | -0.2630*** | -0.2099*** |
| | | | (-19.29) | (-7.89) | (-9.08) |
| Size | | | | 0.9753*** | 0.8473*** |
| | | | | (15.03) | (13.01) |
| Beta | | | | 0.4267*** | 0.2170*** |
| | | | | (8.70) | (6.33) |
| Age | | | | 0.0070*** | 0.0089*** |
| | | | | (4.07) | (5.76) |
| Liabilities | | | | -0.0168 | 0.0483 |
| | | | | (-0.32) | (0.89) |
| Book-to-market | | | | | -1.0990*** |
| | | | | | (-32.08) |
| Asset growth | | | | | 0.3845*** |
| | | | | | (8.54) |
| Receivables Turnover | | | | | -0.0013** |
| | | | | | (-2.06) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | Yes | Yes | Yes | Yes | Yes |

**Table 6: Implicit prices of the accruals quality and the operating volatility**

This table presents the estimates of the hedonic regression model using the assumption of rational expectations, described in section 3.1. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The model of time-varying unobservable characteristics is an AR(1) process: $\xi_{j,t+1} = \phi \xi_{j,t} + \eta_{j,t+1}$. The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, and *Receivables Turnover*. The control variables are defined in the appendix. The instrumental variables are described in section 4 and defined in the appendix. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels (*p*-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Implicit price of the volatility of accounting error ($\sigma_v$)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -1.1949*** | -1.2448*** | -1.8395** | -1.9429*** |
| | (-5.36) | (-5.42) | (-1.97) | (-2.91) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | 0.2143 | 0.9188 | 1.0122 |
| | | (1.04) | (1.04) | (1.54) |
| $\beta_1$ (Size) | | | -0.3125*** | -0.1058** |
| | | | (-6.51) | (-2.00) |
| $\beta_2$ (Beta) | | | -0.0618*** | -0.0407*** |
| | | | (-3.83) | (-3.25) |
| $\beta_3$ (Age) | | | -0.7398*** | -0.5429*** |
| | | | (-4.35) | (-4.34) |
| $\beta_4$ (Liabilities) | | | -0.4530*** | -0.2514*** |
| | | | (-10.24) | (-6.55) |
| $\beta_5$ (Book-to-market) | | | | -0.4179*** |
| | | | | (-18.31) |
| $\beta_6$ (Asset growth) | | | | -0.0212 |
| | | | | (-1.26) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0055*** |
| | | | | (-3.73) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

**Table 6, continued**

Panel B: Implicit price of the operating volatility ($\sigma_w$)

| | (1) log(P) | (2) log(P) | (3) log(P) | (4) log(P) |
|---|---|---|---|---|
| $\gamma_3$ ($\log \sigma_w$) | -1.6074*** | -1.6587*** | -2.9140*** | -2.4259*** |
| | (-9.46) | (-9.57) | (-4.32) | (-4.87) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | 0.2548 | 0.8566 | 0.8101 |
| | | (1.43) | (1.19) | (1.51) |
| $\beta_1$ (Size) | | | -0.3034*** | -0.1062** |
| | | | (-6.31) | (-1.99) |
| $\beta_2$ (Beta) | | | -0.0602*** | -0.0408*** |
| | | | (-3.73) | (-3.24) |
| $\beta_3$ (Age) | | | -0.5842*** | -0.4367*** |
| | | | (-4.51) | (-4.49) |
| $\beta_4$ (Liabilities) | | | -0.4546*** | -0.2498*** |
| | | | (-10.19) | (-6.42) |
| $\beta_5$ (Book-to-market) | | | | -0.4146*** |
| | | | | (-18.04) |
| $\beta_6$ (Asset growth) | | | | -0.0230 |
| | | | | (-1.37) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0055*** |
| | | | | (-3.70) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

**Table 6, continued**

Panel C: Implicit prices of the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$)

| | (1) log(P) | (2) log(P) | (3) log(P) | (4) log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -0.5000** | -0.5506** | -0.6274 | -0.8919 |
| | (-2.31) | (-2.50) | (-0.75) | (-1.50) |
| $\gamma_3$ ($\log \sigma_w$) | -1.3844*** | -1.4243*** | -2.6469*** | -2.0451*** |
| | (-7.28) | (-7.46) | (-3.61) | (-3.85) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | 0.2999* | 0.8853 | 0.8793* |
| | | (1.71) | (1.25) | (1.70) |
| $\beta_1$ (Size) | | | -0.3014*** | -0.1021* |
| | | | (-6.26) | (-1.91) |
| $\beta_2$ (Beta) | | | -0.0608*** | -0.0411*** |
| | | | (-3.76) | (-3.25) |
| $\beta_3$ (Age) | | | -0.5640*** | -0.4077*** |
| | | | (-4.49) | (-4.50) |
| $\beta_4$ (Liabilities) | | | -0.4549*** | -0.2504*** |
| | | | (-10.18) | (-6.43) |
| $\beta_5$ (Book-to-market) | | | | -0.4155*** |
| | | | | (-18.06) |
| $\beta_6$ (Asset growth) | | | | -0.0227 |
| | | | | (-1.35) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0057*** |
| | | | | (-3.78) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

**Table 7: Implicit prices of the accruals quality ratio and the operating volatility ratio**

This table presents the estimates of the hedonic regression model using the assumption of rational expectations, described in section 3.1. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the accruals quality ratio ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$), and the operating volatility ratio ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$). The model of time-varying unobservable characteristics is an AR(1) process: $\xi_{j,t+1} = \phi\xi_{j,t} + \eta_{j,t+1}$. The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, and *Receivables Turnover*. The control variables are defined in the appendix. The instrumental variables are described in section 4 and defined in the appendix. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Implicit price of the accruals quality ratio ($\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$) | -0.3890*** | -0.6748*** | -0.9942* | -1.0935*** |
| | (-3.56) | (-5.10) | (-1.85) | (-2.86) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | -0.9512*** | -0.8372 | -0.9196 |
| | | (-3.67) | (-0.77) | (-1.18) |
| $\beta_1$ (Size) | | | -0.3095*** | -0.1007* |
| | | | (-6.47) | (-1.91) |
| $\beta_2$ (Beta) | | | -0.0614*** | -0.0406*** |
| | | | (-3.81) | (-3.23) |
| $\beta_3$ (Age) | | | -0.7452*** | -0.5425*** |
| | | | (-4.38) | (-4.39) |
| $\beta_4$ (Liabilities) | | | -0.4579*** | -0.2578*** |
| | | | (-10.41) | (-6.77) |
| $\beta_5$ (Book-to-market) | | | | -0.4184*** |
| | | | | (-18.35) |
| $\beta_6$ (Asset growth) | | | | -0.0201 |
| | | | | (-1.20) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0056*** |
| | | | | (-3.79) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

## Table 7, continued

Panel B: Implicit price of the operating volatility ratio ($\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| $\gamma_3$ ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$) | -0.7562*** | -1.1017*** | -2.0176*** | -1.6920*** |
| | (-6.85) | (-9.35) | (-4.43) | (-5.01) |
| $\gamma_1$ ($\log\sigma_{\Delta\pi}$) | | -1.1974*** | -1.7709** | -1.4076** |
| | | (-5.78) | (-2.17) | (-2.34) |
| $\beta_1$ (Size) | | | -0.3031*** | -0.1059** |
| | | | (-6.33) | (-1.99) |
| $\beta_2$ (Beta) | | | -0.0592*** | -0.0400*** |
| | | | (-3.66) | (-3.17) |
| $\beta_3$ (Age) | | | -0.5842*** | -0.4365*** |
| | | | (-4.57) | (-4.57) |
| $\beta_4$ (Liabilities) | | | -0.4576*** | -0.2527*** |
| | | | (-10.31) | (-6.54) |
| $\beta_5$ (Book-to-market) | | | | -0.4149*** |
| | | | | (-18.07) |
| $\beta_6$ (Asset growth) | | | | -0.0230 |
| | | | | (-1.37) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0055*** |
| | | | | (-3.71) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

## Table 7, continued

Panel C: Implicit prices of the accruals quality ratio ($\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$) and the operating volatility ratio ($\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$)

| | (1) log(P) | (2) log(P) | (3) log(P) | (4) log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$) | -0.1289 | -0.3496*** | -0.4293 | -0.5803* |
| | (-1.06) | (-2.94) | (-0.95) | (-1.83) |
| $\gamma_3$ ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$) | -0.6834*** | -0.9585*** | -1.8398*** | -1.4485*** |
| | (-5.15) | (-7.87) | (-3.93) | (-4.31) |
| $\gamma_1$ ($\log\sigma_{\Delta\pi}$) | | -1.5255*** | -2.1990** | -1.9614*** |
| | | (-6.81) | (-2.48) | (-3.15) |
| $\beta_1$ (Size) | | | -0.3004*** | -0.1010* |
| | | | (-6.26) | (-1.90) |
| $\beta_2$ (Beta) | | | -0.0598*** | -0.0403*** |
| | | | (-3.70) | (-3.19) |
| $\beta_3$ (Age) | | | -0.5571*** | -0.3980*** |
| | | | (-4.54) | (-4.57) |
| $\beta_4$ (Liabilities) | | | -0.4580*** | -0.2531*** |
| | | | (-10.30) | (-6.54) |
| $\beta_5$ (Book-to-market) | | | | -0.4162*** |
| | | | | (-18.10) |
| $\beta_6$ (Asset growth) | | | | -0.0227 |
| | | | | (-1.35) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0057*** |
| | | | | (-3.83) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |

## Table 8: Generalized hedonic regression model

This table presents the estimates of the generalized hedonic regression model using the assumption of rational expectations, described in sections 3.1 and 6. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables in Panel A are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The independent variables in Panel B are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the accruals quality ratio ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$), and the operating volatility ratio ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$). The models of time-varying unobservable characteristics is an AR(2) process: $\xi_{j,t+1} = \phi_1\xi_{j,t} + \phi_2\xi_{j,t-1} + \eta_{j,t+1}$ (columns 1 and 2) and AR(3) process: $\xi_{j,t+1} = \phi_1\xi_{j,t} + \phi_2\xi_{j,t-1} + \phi_3\xi_{j,t-2} + \eta_{j,t+1}$ (columns 3 and 4). The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, and *Receivables Turnover*. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Implicit prices of the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -0.5000* | -0.7836** | -0.5112* | -0.7808* |
| | (-1.65) | (-2.03) | (-1.66) | (-1.78) |
| $\gamma_3$ ($\log \sigma_w$) | -1.4322*** | -1.6182*** | -1.4393*** | -1.7790*** |
| | (-5.41) | (-4.62) | (-5.35) | (-4.48) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | 0.4784 | | 0.5870 |
| | | (1.47) | | (1.55) |
| $\beta_1$ (Size) | | 0.3721*** | | 0.2794*** |
| | | (7.05) | | (4.67) |
| $\beta_2$ (Beta) | | -0.0428*** | | -0.0382*** |
| | | (-3.02) | | (-2.71) |
| $\beta_3$ (Age) | | -0.1768*** | | -0.2353*** |
| | | (-3.51) | | (-3.78) |
| $\beta_4$ (Liabilities) | | -0.2570*** | | -0.2829*** |
| | | (-6.75) | | (-7.12) |
| $\beta_5$ (Book-to-market) | | -0.4247*** | | -0.4236*** |
| | | (-16.43) | | (-16.71) |
| $\beta_6$ (Asset growth) | | -0.0005 | | -0.0110 |
| | | (-0.03) | | (-0.63) |
| $\beta_7$ (Receivables Turnover) | | -0.0071*** | | -0.0059*** |
| | | (-3.89) | | (-3.52) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Unobservable | AR(2) | AR(2) | AR(3) | AR(3) |

## Table 8, continued

Panel B: Implicit prices of the accruals quality ratio ($\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)$) and the operating volatility ratio ($\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)$)

| | (1) log(P) | (2) log(P) | (3) log(P) | (4) log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log\left(\sigma_v^2/(\sigma_v^2+\sigma_{\Delta\pi}^2)\right)$) | -0.1503 | -0.5065** | -0.1450 | -0.5062** |
| | (-1.11) | (-2.41) | (-0.94) | (-2.13) |
| $\gamma_3$ ($\log\left(\sigma_w^2/(\sigma_w^2+\sigma_{\Delta\pi}^2)\right)$) | -0.6982*** | -1.1103*** | -0.7142*** | -1.2304*** |
| | (-4.74) | (-4.92) | (-4.26) | (-4.80) |
| $\gamma_1$ ($\log\sigma_{\Delta\pi}$) | | -1.7890*** | | -1.8362*** |
| | | (-4.34) | | (-3.95) |
| $\beta_1$ (Size) | | 0.3641*** | | 0.2696*** |
| | | (6.87) | | (4.50) |
| $\beta_2$ (Beta) | | -0.0416*** | | -0.0370*** |
| | | (-2.95) | | (-2.64) |
| $\beta_3$ (Age) | | -0.1780*** | | -0.2365*** |
| | | (-3.56) | | (-3.86) |
| $\beta_4$ (Liabilities) | | -0.2571*** | | -0.2844*** |
| | | (-6.81) | | (-7.20) |
| $\beta_5$ (Book-to-market) | | -0.4261*** | | -0.4249*** |
| | | (-16.57) | | (-16.85) |
| $\beta_6$ (Asset growth) | | -0.0015 | | -0.0118 |
| | | (-0.09) | | (-0.68) |
| $\beta_7$ (Receivables Turnover) | | -0.0072*** | | -0.0060*** |
| | | (-3.94) | | (-3.56) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Unobservable | AR(2) | AR(2) | AR(3) | AR(3) |

**Table 9: Cross-sectional analysis of the effect accruals quality**

Panel A presents the estimates of the interaction effect of the volatility of accounting error and the average absolute accruals using the linear least squares model with fixed effects. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), the operating volatility ($\log \sigma_w$), and the natural logarithm of the average absolute accruals (log Average |Accruals|). The variables are defined in the appendix. The standard errors are clustered at the 2-digit SIC level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Interaction of the volatility of accounting error ($\sigma_v$) and the average absolute accruals (Linear least squares model with Industry FE)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| log Average \|Accruals\| | -1.9742*** | -1.7585*** | -3.1216*** | -2.3727*** |
| | (-15.61) | (-12.43) | (-7.66) | (-5.74) |
| $\log \sigma_v$ | | -0.2884*** | -1.3097*** | -1.3592*** |
| | | (-5.24) | (-3.90) | (-4.40) |
| log Average \|Accruals\| $* \log \sigma_v$ | | | -0.2959*** | -0.2906*** |
| | | | (-3.12) | (-3.28) |
| $\log \sigma_{\Delta\pi}$ | | | | -0.1595** |
| | | | | (-2.40) |
| $\log \sigma_w$ | | | | -0.6820*** |
| | | | | (-6.16) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | Yes | Yes | Yes | Yes |

**Table 9, continued**

Panel B presents the estimates of the hedonic regression model using the assumption of rational expectations for subsamples based on the average absolute accruals. The estimates from columns (1) and (3) are based on the subsample with the lowest 50% of average absolute accruals, while the estimates from columns (2) and (4) are based on the subsample with the highest 50% of average absolute accruals. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The model of time-varying unobservable characteristics is an AR(1) process: $\xi_{j,t+1} = \phi\xi_{j,t} + \eta_{j,t+1}$. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel B: Implicit prices of the volatility of accounting error ($\sigma_v$) for subsamples based on the average absolute accruals

| | (1)<br>Low<br>log(P) | (2)<br>High<br>log(P) | (3)<br>Low<br>log(P) | (4)<br>High<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -0.4509 | -0.6258$^{*}$ | -0.2110 | -0.5577$^{*}$ |
| | (-1.49) | (-1.77) | (-0.75) | (-1.65) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | | 0.4360$^{*}$ | 0.1692 |
| | | | (1.79) | (0.72) |
| $\gamma_3$ ($\log \sigma_w$) | | | -1.2491$^{***}$ | -1.1426$^{***}$ |
| | | | (-4.42) | (-3.50) |
| Observations | 16,646 | 16,640 | 16,646 | 16,640 |

**Table 10: Industry analysis of the effect of accruals quality**

Panel A presents the estimates of the linear least squares model with fixed effects for subsamples based on the industry average operating cycle. The estimates from columns (1) and (3) are based on the half-sample with the lowest operating cycle, while the estimates from columns (2) and (4) are based on the half-sample with the highest operating cycle. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables in Panel A are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The standard errors are clustered at the 2-digit SIC level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Specification with the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$) (Linear least squares model with Industry FE)

| | (1) Low log(P) | (2) High log(P) | (3) Low log(P) | (4) High log(P) |
|---|---|---|---|---|
| $\log \sigma_v$ | -0.9965*** | -1.2134*** | -0.6368*** | -0.7375*** |
| | (-11.08) | (-18.00) | (-8.90) | (-11.66) |
| $\log \sigma_w$ | | | -0.9794*** | -1.2571*** |
| | | | (-9.52) | (-12.18) |
| $\log \sigma_{\Delta\pi}$ | | | -0.2976*** | -0.0670 |
| | | | (-3.71) | (-0.68) |
| Observations | 17,421 | 16,857 | 17,421 | 16,857 |

## Table 10, continued

Panel B presents the estimates of the hedonic regression model using the assumption of rational expectations for subsamples based on the industry average operating cycle. The estimates from columns (1) and (3) are based on the half-sample with the lowest operating cycle, while the estimates from columns (2) and (4) are based on the half-sample with the highest operating cycle. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The model of time-varying unobservable characteristics is an AR(1) process: $\xi_{j,t+1} = \phi\xi_{j,t} + \eta_{j,t+1}$. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel B: Implicit prices of the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$)

| | (1)<br>Low<br>log(P) | (2)<br>High<br>log(P) | (3)<br>Low<br>log(P) | (4)<br>High<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -1.1715*** | -1.4677*** | -0.6739** | -0.7149*** |
| | (-4.42) | (-4.92) | (-2.38) | (-2.65) |
| $\gamma_3$ ($\log \sigma_w$) | | | -0.9108*** | -1.8727*** |
| | | | (-3.70) | (-8.28) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | | -0.0429 | 0.5644*** |
| | | | (-0.20) | (2.59) |
| Observations | 17,421 | 16,857 | 17,421 | 16,857 |

**Table 11: Robustness analysis of the effect of accruals quality**

This table presents a robustness analysis of the effect of accruals quality on the market price of equity assuming 20% correlation between accounting error $v_t$ and economic performance $\pi_t$, and 20% correlation between the operating component of accruals $w_t$ and economic performance $\pi_t$.

Panel A presents the estimates of the linear least squares model with fixed effects. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, *Receivables Turnover*, and industry fixed effects. The variables are defined in the appendix. The standard errors are clustered at the 2-digit SIC level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel A: Specification with the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$) (Linear least squares model with Industry FE)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) | (5)<br>log(P) | (6)<br>log(P) |
|---|---|---|---|---|---|---|
| $\log \sigma_v$ | -1.1048*** | | | -0.6675*** | -0.1145*** | -0.0929*** |
| | (-18.35) | | | (-13.16) | (-5.25) | (-4.73) |
| $\log \sigma_w$ | | -1.3929*** | | -1.1195*** | -0.2460*** | -0.2030*** |
| | | (-16.67) | | (-12.39) | (-9.15) | (-9.92) |
| $\log \sigma_{\Delta\pi}$ | | | -0.6500*** | -0.1926*** | 0.0658* | 0.0613* |
| | | | (-11.57) | (-2.73) | (1.73) | (1.90) |
| Size | | | | | 0.9739*** | 0.8463*** |
| | | | | | (14.87) | (12.91) |
| Beta | | | | | 0.4342*** | 0.2231*** |
| | | | | | (8.68) | (6.39) |
| Age | | | | | 0.0069*** | 0.0088*** |
| | | | | | (4.16) | (5.85) |
| Liabilities | | | | | -0.0180 | 0.0474 |
| | | | | | (-0.34) | (0.88) |
| Book-to-market | | | | | | -1.0989*** |
| | | | | | | (-31.44) |
| Asset growth | | | | | | 0.3875*** |
| | | | | | | (8.68) |
| Receivables Turnover | | | | | | -0.0013** |
| | | | | | | (-2.13) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 | 33,286 |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |

**Table 11, continued**

Panel B presents the estimates of the hedonic regression model using the assumption of rational expectations. The dependent variable is the natural logarithm of the market value of equity ($\log(P_t)$). The independent variables are the volatility of economic performance ($\log \sigma_{\Delta\pi}$), the volatility of accounting error ($\log \sigma_v$), and the operating volatility ($\log \sigma_w$). The model of time-varying unobservable characteristics is an AR(1) process: $\xi_{j,t+1} = \phi\xi_{j,t} + \eta_{j,t+1}$. The control variables are *Size*, *Beta*, *Age*, *Liabilities*, *Book-to-market*, *Asset growth*, and *Receivables Turnover*. The control variables are defined in the appendix. The instrumental variables are described in section 4 and defined in the appendix. The standard errors are based on the two-step efficient GMM estimator with weight matrix clustered at firm level. The significance levels ($p$-values) below 10%, 5%, and 1% are denoted by *, **, and ***, correspondingly.

Panel B: Implicit prices of the volatility of accounting error ($\sigma_v$) and the operating volatility ($\sigma_w$)

| | (1)<br>log(P) | (2)<br>log(P) | (3)<br>log(P) | (4)<br>log(P) |
|---|---|---|---|---|
| $\gamma_2$ ($\log \sigma_v$) | -1.1446*** | -0.4338** | -0.4975** | -0.7186 |
| | (-5.11) | (-1.97) | (-2.21) | (-1.17) |
| $\gamma_3$ ($\log \sigma_w$) | | -1.3764*** | -1.4161*** | -2.1004*** |
| | | (-7.08) | (-7.26) | (-3.83) |
| $\gamma_1$ ($\log \sigma_{\Delta\pi}$) | | | 0.3455* | 0.9565* |
| | | | (1.91) | (1.78) |
| $\beta_1$ (Size) | | | | -0.1034* |
| | | | | (-1.93) |
| $\beta_2$ (Beta) | | | | -0.0409*** |
| | | | | (-3.24) |
| $\beta_3$ (Age) | | | | -0.4201*** |
| | | | | (-4.50) |
| $\beta_4$ (Liabilities) | | | | -0.2514*** |
| | | | | (-6.45) |
| $\beta_5$ (Book-to-market) | | | | -0.4148*** |
| | | | | (-18.03) |
| $\beta_6$ (Asset growth) | | | | -0.0232 |
| | | | | (-1.37) |
| $\beta_7$ (Receivables Turnover) | | | | -0.0056*** |
| | | | | (-3.77) |
| Observations | 33,286 | 33,286 | 33,286 | 33,286 |