Cash-based profitability, accrual and stock return

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Abstract

Accrual represents for non-cash component of earnings. Previous research shows that cash-based profitability adjusted for working capital accrual better explains cross-sectional stock return compared with accounting profitability. This paper continues the research by showing that cash profitability adjusted for both working capital accrual and long-term accrual is a stronger signal of expected return. Meanwhile, the paper confirms the result accrual predicts no expected return after controlling cash profitability by using operating accrual, indicating that cash-based profitability is more informative than accounting profitability. Furthermore, the research also suggests the value of using free cash flow in company valuation since the adjust method of working capital and long-term capital is similar with calculation of free cash flow.

Keywords: cash profitability, accrual, stock return, free cash flow

Dedication and acknowledgements

Today is the day that I finish my dissertation. I am now standing at the end of my school days and about to have a new page of my life. Looking back, I am happy to spend a year in the University of Bristol. My professors and lecturers lead me to the world of finance and investment. My classmates and friends show me the colourful of British life. There are so many people walking in my life and made a ripple in the river.

First, I would like to thank for my ex-girlfriend, it is she who first helped me to find a way of career. I would also like to thank for my parents who are generous to offer everything they have to support my dream and goals. I am very lucky to have nice roommates who are willing to share happiness and sadness with me. Finally, I would like to thank for my supervisor who offer me a window to the asset pricing world.

AUTHOR'S DECLARATION

I declare that the work in this dissertation was carried out in accordance with the requirements of the University's Regulations and Code of Practice for Taught Programmes and that it has not been submitted for any other academic award. Except where indicated by specific reference in the text, this work is my own work. Work done in collaboration with, or with the assistance of others, is indicated as such. I have identified all material in this dissertation which is not my own work through appropriate referencing and acknowledgement. Where I have quoted or otherwise incorporated material which is the work of others, I have included the source in the references. Any views expressed in the dissertation, other than referenced material, are those of the author.

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1. Introduction

The recent research of Ball et al. (2016) show that cash-based operating profitability adjusted for working capital accrual better explains expected stock return compared with accounting-based operating profitability. At the same time, cash-based operating profitability can help to eliminate the long-lasting accrual anomaly which cannot be explained by Carhart (1997) four-factor model, Fama and French (2015) five-factor model or Hou, Xue, Zhang (2015) q-factor model. This evidence suggests strategy based on cash flow profitability should be a more favourable choice compared with accounting profitability in wealth management industry.

This paper continues research of Ball et al. (2016) by adjusting operating profitability for both working capital accrual and long-term accrual (hereafter, the combination of two is also named as operating accrual). I show three primary results. First, cash-based profitability adjusted for both working capital and long-term accrual better explains cross sectional expected return than cash profitability only adjusted for working capital accrual. Second, although the operating accrual combined both working capital accrual and long-term accrual is a stronger signal compared with working capital accrual alone, it cannot explain expected return after controlling cash profitability adjusted for operating accrual. Third, if investment managers want to maximize the utility of cash profitability adjusted for operating accrual, they need to rebalance portfolio at least every 2 years for its explanatory power higher than cash profitability adjusted for working capital accrual.

This paper combines the research on accrual with profitability. Empirical analysis begins with regression return on operating profitability and operating accrual. The research on profitability variables have evolved from net income by Ball and Brown (1968), Novy-Marx's (2013) gross profitability to Ball et al. (2015)'s operating profitability and return on equity in Hou, Xue, Zhang (2015) q-factor model. Among all accounting profitability variables, operating profitability measured defined by Ball et al. (2015) has greater explanatory power in explaining expected return, thus this is the start point of my profitability adjustments. At the same time, the definition of accrual has been extended after Sloan (1996) first publishes the famous accrual anomaly. The recent research of Larson, Sloan and Giedt (2018) provide a comprehensive research of how to decompose accrual, in which the combination of working capital accrual and long-term accrual is named as operating accrual. When I regress operating accrual and operating profitability, the result is the same as Ball et al. (2016) that their coefficients are similar in absolute value but with different sign. Ball et al. (2016) interpret this as if firms only increase earnings by increasing its working capital accrual, it predicts no higher expected return. My regression shows that their finding is also applied for change of non-current operating asset, thus their result is still robust. In addition, when operating profitability and cash-based

profitability adjusted for operating accrual is run in the same regression, operating profitability is totally subsumed by this cash profitability.

Since it has been proved that cash profitability is better than accounting profitability in predicting stock return, the question comes to which cash profitability is more closely related to stock return. The generation of cash profitability is generally completed through removing the accrual from operating profitability. Using five accruals by Larson, Sloan and Giedt (2018), a comparison of five cash profitability is run to answer this question. I show that cash profitability adjusted for operating accrual has highest explanatory power among all cash profitability including cash profitability adjusted for working capital accrual. In microcaps sample test, the former totally subsume the latter. In addition, the spanning test shows that operating accrual which cannot be priced by cash profitability adjusted for working capital can be priced by cash profitability adjusted for operating accrual.

On the other hand, my paper provides a comparison between working capital accrual and operating accrual. The robustness working capital accrual is strong in previous research, but the when I regress two accruals at the same time, operating accrual totally subsumes the working capital accrual. In 10-year rolling Fama and Macbeth (1973) regression, the result that working capital accrual loses its power around 2010 is consistent with previous paper. However, operating accrual is always significant throughout the whole sample period. In spanning test, cash profitability adjusted for working capital cannot price the operating accrual also proves this result.

What needs to be paid attention to is the horizon of cash profitability's explanatory power on stock return. I show that although cash profitability adjusted for operating accrual can predict stock return as far as 6 years. It loses relative advantage over cash profitability adjusted for working capital accrual after 2 years without rebalance portfolio. Therefore, fund managers who use this cash profitability better re-select stocks at least every 2 years.

This research is an extension of previous research on profitability study and one of the key implications of the research is that it corroborates the value of using 'free cash flow' in firm performance evaluation. The adjustment method by Ball et al. (2016) is much like adjustment of cash flow from operation. In standard textbook, cash flow operation is equal to earnings plus non-cash charge less the investment of working capital, while the definition of free cash flow to firm is to exclude fixed capital investment in addition to that. As such, the adjustment method of Ball et al. (2016) and my method are substantially similar to adjustment of working capital accrual and operating accrual developed in the paper, except that the start point is operating profitability. The rest part of paper is comprised of several sections. Section 2 is literature review which provides previous research on profitability and accrual. Section 3 describes data

statistics that is used to analyse in this paper. Section 4 is the Fama and Macbeth (1973) regression. Section 5 provides portfolio sorts on cash profitability variables and accruals. Section 6 verifies the pricing power of cash profitability of interest. Section 7 examine the horizon of cash profitability's predictive power on stock return.

2. Literature review

Accrual anomaly is distinct in asset pricing area. Before the paper of Ball et al. (2016), it is one of the most robust anomalies. The origin research shows the hedge portfolio formed by accrual generates positive return in 28 out of 30 years examined from period 1962 to 1991. According to Hirshleifer, Hou and Teoh (2011), the risk-return trade-off of accrual strategy outperforms strategy offered by other famous factor such as Fama and French's size and book-to-market ratio. Even, the recent test by Fama and French (2015), again, confirms accrual portfolio is unable to be explained by the latest five factor model.

Sloan (1996)'s definition of accrual is the same as it is in many earning management papers, which is the change of net operating assets minus depreciation and amortization, scaled by average total asset, as follows:

Accrual ≡ [change of current total asset (ΔACT)
– change of cash and cash equivalent (ΔCHE)
– change of current total liability (ΔLCT)
+ change of debt in current liability (ΔDLC)
+ change of income taxes payable (ΔDLC)
– depreciation and amortization (DP)]/Average total asset [$(AT_t+AT_{t-1})/2$]

Accrual is also defined as the difference between cash flow and reported earnings. Ball et al. (2016) state that the difference between earnings and cash flow has two main sources. The first source is due to timing difference. Accountants adjust cash receipts in the current period by recording accrued revenue and accrued expense, which corrects for the timing differences between cash flow and earnings. This treatment is familiar to most people who have learnt basic accounting rules. The purpose is to smooth the earnings and provide more information about economic performance of firms for decision makers. The second source of difference between cash flow and earnings comes from net investment. The change of inventory is a very good example to illustrate here. If company purchase inventory from its current period earnings, the amount of earning is not influenced, it only has an effect on real cash flow. This treatment is because the impact on cash flow does not result from delivering goods to customer, so accountants do not allow it to influence earnings. In fact, the change of net operating asset has

another term in finance 'working capital investment', which is more intuitive to understand. Therefore, according to Ball et al. (2016), the Sloan's anomaly (1996) can be interpreted as following: companies with higher net (working capital) investment and longer timing differences between cash flow and earnings tend to have lower expected return in the next period.

Sloan's findings quickly attract a great deal of interest and many additional researches are conducted to generate better earning quality measures and more appealing trading strategies. The original measures of Sloan (1996) focus on the change of net current operating asset, so it is named as working capital accrual by the followers. Applying the similar logic, Richardson et al. (2005) expand the measurements to three as the whole balance sheet can be decomposed into three parts: current asset, non-current asset and financial asset. Therefore, two new measures focus on change of noncurrent operating assets and the changes of net financial assets. If working capital accrual or namely net investment in working capital is a reason that leads to lower future return, the relationship between net investment in non-current net asset and stock return would also be a valuable topic. In their paper, the non-current accrual anomaly is shown to be stronger than working capital anomaly discovered by Sloan. The plausible explanation is that non-current asset requires long-term estimation of economic benefits which may eventually leads to greater bias. In the latest paper by Larson, Sloan and Giedt (2018), they further revise the definition provided by Richardson in 2005. First of all, comprehensive accrual is defined as the change of common shareholder equity minus the change in cash and cash equivalent, as

$$COMPACC = CEQ - CHE$$

This is equal to non-cash change in asset less change in liability. Then accruals are decomposed depending on whether they relate to operating part of business or financing part of business. Operating accrual is defined as:

$$OPACC = (\Delta AT - \Delta CHE - \Delta IVAEQ - \Delta IVAO) - (\Delta LT - \Delta DLC - \Delta DLTT),$$

where ΔAT is change of total asset, $\Delta IVAEQ$ and $\Delta IVAO$ are change in long-term investments, ΔDLC and $\Delta DLTT$ represents for the debt part of short-term and long-term liability. The difference of comprehensive accrual and operating accrual incorporates all investment and debt account and all equity account other than common share, as financial accrual.

$$FINACC = COMPACC - OPACC$$

Next, operating accrual is further divided into working capital accrual and long-term accrual, depending on whether the liability and asset is long-term or short term. The working capital accrual is non-cash current asset minus non-debt change of current liability, $(\Delta ACT - \Delta CHE)$ -

(ΔLCT - ΔDLC). The remainder is long-term accrual which incorporates anticipated long-term benefits and obligation (e.g. PPE and pension obligation). These extensions of accrual definition calls for the need to further adjust cash profitability from accounting profitability.

In Sloan's original paper, the accrual anomaly is attributed to the investor fail to understand the difference between cash component of earnings and accrual component of earnings. In regression,

$$\text{Earnings}_{t+1} = \gamma_0 + \gamma_1 Accruals + \gamma_2 Cash\ Flow + \varepsilon_{t+1},$$

he verifies his hypothesis that cash flow component of earning is less persistent than cash flow component of earnings because the result is $\gamma_1 < \gamma_2$ significantly. The latter research continues to explain why the accrual is less persistent than cash flow component of earnings, assuming Sloan's hypothesis is true, and the research can be classified into two streams. One stream uses the concept of discretionary accrual to explain the phenomenon, which means the estimation of accrual suffers from accounting subjectivity. (Xie 2001; Dechow and Dichev 2002;). Another stream uses growth-based to explain this phenomenon as the net investment part of accrual is associated with diminished margin return (Fairfield et al. 2003a). The recent research of Ball et al. (2016), on the other hand, question that if investors do not understand the difference accrual and cash flow, then accrual should also have incremental power to explain expected return even when cash component of earning is controlled. They simply point out that accrual predicts lower stock return because firms are less profitable in a cash basis. This explanation is in accordance with the evidence that accrual predicts return when accounting profitability is not included in asset pricing model as accrual component of earning is negatively related to cash component of earnings. In addition, the reason accrual predicts stronger stock return when accounting profitability is incorporated, see Fama and French (2015), can also be explained because the regression allows accounting profitability to extract cash earnings when accrual is controlled in regression model. Following this explanation, cash-based profitability by natural is more informative compared with accounting profitability.

3. Data

My sample covers all-but-financial firms with share code 10 or 11 that are listed on NYSE, Amex, and NASDAQ from July 1966 to December 2014. The process of data collection is similar as Novy-Marx (2013) and Ball et al. (2015). I collect monthly stock return from The Center for Research in Security Prices (CRSP) and fundamental data from Compustat/CRSP Merged, and then match CRSP data against Compustat data by lagging accounting data for 6 months to examine the impact of fundamentals on stock market reaction. For example, if a

firm's fiscal year ends on December, it is assumed that the annual report is available to the public at the next June. The six months gap ensures that fundamental is known to investors when return is measured. Sample excludes firm with missing value of market equity, total asset, revenue and cost of goods sold. Financial companies are also excluded, refering to those with one-digit standard industrial classification codes of six.

The data of return is adjusted in case stock delist from stock exchange, see Shumway (1997) Shumway and Warther (1999) and Beaver et al (2007). If return and delisting return are available, then return is calculated as $(1 + ret) \times (1 + dlert) - 1$. If return is missing but delisting return is not missing, return is set to be equal to $dlert$. If both return and delisting return are missing, then return equals to -30% for stock listed on NYSE or Amex and equals to -55% for stock listed on NASDAQ. In any other cases, return is defined as missing. To compute book value of equity, I follow Fama and French (2000), which is the sum of shareholder equity (SEQ), balance sheet deferred tax (TXDB) (if available) and investment tax credit (ITCB) (if available) minus value of preferred stock. If shareholder equity is missing, I use common shareholder equity (CEQ) or total asset minus total liability (AT-LT) instead. The value of preferred shares uses the redemption value (PSTKRV), liquidation value (PSTKL), or par value (PSTK), in that order.

The cash-based profitability measurements are adjusted from accounting profitability. Among different accounting profitability, operating profitability is generally better than gross profitability when explaining stock return. Also, the accrual is usually scaled by total asset in previous research and this is the same as Ball et al. (2016)'s measure to scale operating profitability. Considering both, I choose Ball et al's (2016) measure as my accounting profitability. The next step is to remove the influence of accrual from accounting profitability. These accruals are defined as Larson, Sloan and Giedt (2018), including comprehensive accrual, operating accrual, working capital accrual, long-term accrual and financial accrual. The compressive accrual is calculated as the change of common equity share minus the change of cash and cash equivalent (ΔCEQ - ΔCHE), or equivalently, the change of non-cash asset minus change in liability. Comprehensive accrual can be first decomposed into operating accrual and financial accrual. Operating accrual is defined as the change of non-cash and non-investment asset minus non-debt liability, assuming they all relate to operating of business (ΔAT - ΔCHE - ΔIVAEQ - ΔIVAO) - (ΔLT - ΔDLC - ΔDLTT). The difference of two is value of financial accruals. Next, operating accruals can be further divided into working capital accrual and long-term accrual. The working capital accrual is change of non-cash current asset minus non-debt change of current liability (ΔACT - ΔCHE) - (ΔLCT - ΔDLC). The difference between operating accrual and working capital accrual is the long-term accrual. Totally, there are five different accruals and I use operating profitability minus these five accruals respectively to get

five cash-based profitability. All the accrual variables and profitability variables are scaled by average total asset.

Table 1 reports descriptive statistics for profitability factors and accruals. The deflated variables have some extreme outliers, showing the need to trim the variables in the later portfolio sorts or cross-sectional regression. The average annual operating profitability is 14.3% within the sample period. Mean value of financial accrual consists of -2.5% of average total asset, although the rest mean accruals are all associated with a positive sign. Note that most mean value of accruals here have a different sign with Sloan (1996) or Ball et al. (2016) because their initial measure of accrual incorporates the depreciation of non-current asset which is not considered by measure of Larson et al. (2018). From standard deviation of comprehensive accrual and operating accrual, we can see that most of variation in comprehensive accrual is attributed to operating accrual instead of financial accrual. The average of cash-based profitability removing operating accrual exhibits the lowest value which is 8.3% of the total average asset.

Table 2 exhibits Pearson correlation between cash-based profitability, operating profitability and accruals. From the panel, several patterns can be observed. Firstly, except the financial accruals, accruals are usually positively related with each other. One good explanations of different behaviour of financial accrual is that increasing investment in working capital is often companied with increasing investment in fixed capital. While firms with growth in operating asset tend to realize the growth by using their financial asset/ or generating financial excess liability. Secondly, operating profitability is positively related to all kinds of accruals. The story may go that more profitable companies in the current period tend to have an optimistic expectation in the future market, therefore they are more likely to prepare for their growth in the next fiscal year. Thirdly, cash-based profitability is negatively correlated with accrual because high accrual component of earning lead to less profitability on a cash basis.

4. Fama and MacBeth regressions

The results of average slope of coefficient estimates (multiplied by 100) and corresponding t-value from Fama and Macbeth regression (1973) are presented in Table 3. Following Novy-Marx (2013) and Ball et al. (2016), monthly stock return is regressed on cash-based profitability, accruals and operating profitability after controlling prior month return ($r_{1,1}$), the return of past 12 months ($r_{12,2}$) which excludes the prior month, the natural logarithm of book-to-market ratio (logBE/ME) and natural logarithm of market equity (logME). Novy-Marx (2013) points out that using current value of market equity may lead to some unintentional position in momentum, therefore this number is lagged six months to avoid this problem. The sample period is from

1966 to 2014 and all independent variables are trimmed at 1 and 99 level to exclude any outlier. Panel A follows Ball et al. (2016), I show that operating accrual and cash profitability (Cpop) adjust operating accrual have several characteristics similar with working capital accrual and the corresponding cash profitability (Cpwc). Panel B and C provide comparisons between various cash profitability and accruals. For robustness, sample is also divided into All-but-microcaps and microcaps, based on 20% NYSE breakpoint to confirm the result, as shown in Panel D and E.

According to Fama (1976) and Ball et al. (2015), the coefficient of estimates in regression can be interpreted as monthly return of long-short portfolio on regressor that is orthogonal to other regressors. At the same time, t-value in the table is associated with monthly Sharpe ratio which equals to the annualized Sharpe ratio times $\sqrt{T}$, the number of years in sample. Therefore, we can use these two interpretations to find out which variables provide the most profitable strategy and which variables provide the most stable investment strategy.

Panel A begins with operating accrual and cash profitability (Cpop) adjusted based on operating accrual to verify operating accrual is similar with working accrual. They are both negatively correlated with stock return. At the same time, cash profitability 4 (Cpop) also subsumes accounting operating profitability. The result can be compared with Ball et al. (2016) and I find the similar patterns here. The result of column 2 shows the operating accrual has a t-value -10.48. As it is defined in data section, the measure not only incorporates working capital accrual, but also long-term accrual. The combination of both lead to this high significant figure. The result is in accordance with Sloan (1996) that firm with high accrual tend to have negative abnormal return. Column 3 shows that the t-value of operating profitability and accrual both increase in absolute value when put them in the same regression. This confirms Fama-French (2015)'s idea that an asset pricing model with accounting profitability factor does a worse job in explaining accrual-sorted portfolio. In column 5, the operating profitability factor is replaced with cash-based profitability adjusted from operating accruals. We can see that, although the estimated coefficient only experiences a slightly increase (1.91 versus 1.81), there is a significant increase in its t-value, from 6.19 to 14.13. When Ball et al. (2016) use cash-based profitability adjusted only for working capital accrual, they observed 40% increase of Sharpe ratio compared with operating profitability. The drastic increase here is partially attributed to use all sample without dividing them into microcaps and all-but-microcaps. Their research suggest that cash-based profitability adjusted for working capital accrual has greater explanatory power than accounting operating profitability. I take a further step showing the cash-based profitability adjusted for operating accrual is better than profitability simply adjusted for working capital accrual.

The column 5 includes both accruals and cash profitability factor in the same regression. Using cash-based profitability, the operating accruals in the regression is no longer significant ($t<1.96$). The result here is interesting to interpret because accrual itself has no relationship with stock return holding the certain amount of cash component of earnings. The reason that accrual predicts negative stock return in previous paper is that it is a subtract item for cash component of earnings. So, when cash component of earning is not included in regression, people would conclude as if it is accrual drives performance. After controlling cash profitability, if firm only increases its accrual component of earnings, it has no relation to the future stock return. In column 6, the horse race regression is run to include both operating profitability and cash profitability. T-values are 1.25 and 12.92 respectively, the operating profitability is totally subsumed by this cash-based profitability. The result is comparable when Ball et al. (2016) put operating profitability and cash profitability adjust for working capital accrual in the same regression. Both show that operating profitability is subsumed by cash profitability.

A comparison of different cash profitability. As the coefficient in Fama-MacBeth regression represents the average return of long-short variable-sorted portfolio, we can see strategy based on which cash profitability is most profitable and which is the most stable. The panel B shows that hedge portfolio of cash profitability 2 (Cpwc), adjusted from working capital, has the highest average return 2.24% per month, so it is the most profitable strategy. The return of cash profitability 3 (Cplt) is slightly lower, but it has higher t-value 11.09 compared with cash profitability 2. Consideration of both working capital and long-term accrual, the cash profitability 4 creates a mid-level average return 1.91%, but the Sharpe ratio is the highest among all kinds of profitability, therefore it generates the highest risk-return trade off. The return of cash profitability 5 (Cpfi) exhibits a different sign. Given research by Richardson et al. (2005) that it is financial liability that dominates the financial accrual, it may be true that when firm increase its financial leverage significantly, there would be negative abnormal return in the next period. I also run a horse run regression between Cpwc and Cpop and the result shows that when regressing together Cash profitability 4 subsume Ball et al. (2016)'s cash profitability (Cpwc). In robust test, I show that the result is only satisfied for microcaps when stock is grouped by market value.

Different accruals. Panel C presents the significance of accrual. We can see that the significance pattern between accruals are that Opacc> Ltacc > Wcacc >Comacc in absolute value. This trend is the same as significance of corresponding cash profitability (Cpop>Cplt>Cpwc>Cpcom) because only when cash profitability with high significance add corresponding accrual with high negative significance, we can get the same accounting profitability. On the other hand, it provides the evidence that cash-based profitability better reflects the intrinsic value of firms. The reason accrual predicts stock return is because it is negatively related to the cash component

of earnings, given total accounting earnings. The column 6 also shows that operating accruals, as sum of working capital accrual and long-term accrual, dominates working capital accruals. When both operating and working accruals are both included, t-value is only 1.25 for working capital accrual.

Robust test. It is known that small caps less than 20 percentile of market value only make up 6% of the total market, but the number of these small caps consist of almost half of the market. To avoid that the result is driven by small caps which is hard to arbitrage in practice, stocks are divided into Microcaps and All-but-microcaps, based on 20 percentile of NYSE breakpoint. The result of panel D is the same as it is when I use all sample, except that cash profitability 2 (Cpwc) is not totally subsumed by cash profitability 4 (Cpop) when using All-but-micro sample. This suggests that in sample of All-but-microcaps, cash profitability (Cpop) is only a slightly better than cash profitability (Cpwc). Viewing separately, cash profitability 4 still outperform in term of Sharpe ratio aspect. In both microcaps and All-but-microcaps t-value is higher than Cpwc (12.81 versus 8.93; 9.24 versus 8.05). On the other hand, cash profitability 2 still outperform in terms of average return (2.01 coefficient versus 1.45; 2.21 versus 2.02). Panel E again shows that working capital accrual has no explanatory power after controlling operating accrual (t=0.83).

Subsample analysis. Robust test is also conducted by splitting the whole sample period. Figure 1 represents the t-value of cash profitability Cpop, cash profitability Cpwc, operating profitability, working capital and operating accrual by 10-year rolling regression in Fama and Macbeth (1973) method. The t-value is from column 1 Panel A, column 2 and 4 in Panel B and column 2 and 4 in Panel C. The point on x-axis is the end of each 10-year regression. For example, the first point 1976 represents for t-value from Fama and Macbeth (1973) regression July 1966 to June 1976. During the sample period, we can see that t-value for cash profitability cpop is greater than t-value of cash profitability cpwc and both are greater than accounting operating profitability. In terms of accrual, operating accrual is more significant compared with working capital accrual. The explanatory power of both accruals reach peak around 2000 after which the explanatory power gradually vanished after Sloan's (1996) paper is published. Green et. al (2018) point out that working capital accrual is demise around 2009, which is consistent with my finding, but operating accrual never lose its power during the whole sample period.

5. Portfolio sorts

Although independent variables are trimmed at 1 and 99 level in Fama and Macbeth (1973) regression to exclude the impact of outliers. Distribution of these variables still suffer from

excess skewness (see Table 1), which means the parametric assumptions are not perfectly held in the regression. For robustness, portfolio sorts are provided to double confirm my result in the last section. Table 4 compares the return of portfolio sorts on profitability factor and accruals. Since the result in section 4 is that cash profitability 4 (Cpop) provides the highest Sharpe ratio and cash profitability 2 (Cpwc) provide the highest average return. These two cash profitability and related accruals are the main variables of interest in this section. For each variable, value-weighted excess return, alpha from capital asset pricing model (CAPM) and alpha from Fama-French three factor model are reported. The coefficient of market, size and value are omitted to save space. Panel A provides the result of profitability factor and Panel B provides the result of accruals. Portfolio is rebalanced at the end of June every year, sorted on the NYSE breakpoint. Sample covers period from 1966-2014.

Overall, all profitability factors are significant in explaining stock return. Hedge return of long-short portfolio sorts on cash profitability Cpwc is highest by using all three methods (0.62%, 0.87%, 1.05%) and return increases when more factors are controlled in regression model. This confirms that hedge strategy based on cash profitability adjusted working capital accrual is the most profitability one. The hedge return of portfolio sorts on cash profitability 4 Cpop (0.61%, 0.82%, 0.94%) is only a slightly lower than that sorts on 2. However, we can see that the strategy is associated with the highest t-value (t=4.48) in providing excess return. As Sharpe ratio measures the risk return trade off in the form of raw return, this t-value confirms hedge strategy based on cash profitability 4 (Cpop) provides higher Sharpe ratio than cash profitability 2 (Cpwc). High-minus-low portfolio of both cash profitability outperform portfolio sorts on accounting operating profitability.

The portfolio sorts test also has an implication for long-only investor. It can be seen that both return and alpha of Cpop decile 10 is higher than corresponding number in Cpwc decile 10 (excess return 1.07 >1.03; CAPM 0.16 > 0.11; three factor alpha 0.32 > 0.30). The higher hedge return of portfolios sort on Cpwc is mainly driven by its lowest decile 1. In case short position is prohibited or restricted the strategy based on Cpop would be a more favourable choice, although the improvement of portfolio is limited.

The result of accrual portfolio is consistent with Fama and Macbeth (1973) regression. Operating accruals perform better than working capital accruals from raw return aspect (57 basis point versus 49 basis point). The working capital accrual catches up when value and size factors are controlled in regression.

Small and big. The panel C provide results for profitability portfolio sorts in small and big stocks based on median of NYSE breakpoint. The result in big sample is the same as using all sample. Cash profitability (Cpwc) has a slightly higher hedge return and a slightly lower t-value.

However, the Cpwc is underperformed in small sample, with lower excess return (1.05 versus 1.21) and lower t-value (7.05 versus 9.58). This finding is consistent with robust test in Fama and Macbeth (1973) regression that Cpwc has no explanatory power when controlled Cpop in microcaps. The result in Panel D shows higher hedge return of operating accrual than working capital accrual in small sample as well (59 basis point versus 32 basis point).

6. Cash-based operating profitability factor

I next construct the factor of operating accrual, operating profitability, cash profitability (Cpop) adjusted for operating accrual and cash profitability (Cpwc) adjusted for working capital accrual to capture the relation between stock return and these factors. The Fama-French three-factor (1993) model is augmented by these factors to see how they price the operating accruals.

The factor is formed in the same way as Fama and French (1993) and Fama and French (2015) by 2×3 sorts. Stocks are first sorted into small and big group depending on whether market value of stock is larger than 50 percentile of NYSE breakpoint. Then an independent sort is performed on cash profitability into weak (below 30 percentile of NYSE breakpoint) and robust (above 70 percentile of NYSE breakpoint). The two independent sorts generate totally six portfolios and factor RMW_{cpop} is calculated as the difference between the average return of two robust portfolio minus the average return of two weak portfolio. Factor RMW_{cpwc} and RMW is constructed in the same way, except that the second sort is based on cash profitability 2 and operating profitability respectively. In construction of operating accruals, the weak and robust portfolio in the second sort is switched to get the positive return factor.

Table 5 summarizes the standard deviation, annualized average return and t-value for four traditional factor and four factors of interest. Among the profitability-related factor, operating profitability has the lowest annualized return (2.67%) and t-value (2.53). The average return of factor cash profitability Cpop is higher than cash profitability Cbwc (5.57% versus 4.95%), with a higher t-value as well (7.08 versus 5.33).

Pricing portfolio sorted by size and accrual (5×5). The first block of figure in Panel A, Table 6 is the excess return of 25 portfolio double sorted on operating accrual and size. At the end of June, stocks are portfolios are sorted into quintiles and held for the next year. Consistent with previous research, return is generally decreased with when firm is larger and has high operating accrual. Average monthly excess return is 1.36% for small-low portfolio and 0.71% for big-high portfolio. The rest of blocks report alpha and corresponding t-value by three-factor model and augmented three-factor model.

There is no model among 5 can eliminate alpha in all 25 portfolios, but they do produce different results. Three-factor model augmented with operating profitability factor, on average, produces a more significant alpha compared with three-factor model. The differences are particularly observable at the low accrual area. This result is similar with Fama and French (2015)'s finding as well as the result in Table 2 that including accounting profitability lead to a worse result in explaining accrual. Using cash profitability (Cpwc) improves alpha in the high accrual portfolio, but the low accrual portfolio seems to worse off. Ball et al. (2016) point out cash profitability (Cpwc) factor is a good explanatory factor for working capital accrual, but here because operating accrual incorporates both working capital accrual and long-term capital accrual, the result is not necessary to be the same. My result shows that cash profitability (Cpwc) cannot explain the long-term accrual part. The last two block of return compares the two augmented model. One is augmented with operating accrual and operating profitability factor, another is augmented with cash profitability (Cpop). In term of alpha, they produce almost identical results.

The result in Panel A gives a preliminary impression of which model performs the best, judging from magnitude of alpha and t-value. In Panel B, three test statistics are provided to further supplement this result. GRS test statistics derived from Gibbons, Ross and Shanken (1989) is to test whether alpha from 25 portfolios are jointly 0. A ($AdjR^2$) is the average of adjusted R-square in 25 regression and A($|\hat{\alpha}|$) is the mean absolute value of alpha. Overall, the result is similar with Panel A that cash profitability Cpop factor is the best to price operating accrual.

Comparison between different asset pricing model. As discussed by Fama (1998), Barillas and Shanken (2015), the relative power of asset pricing model can be evaluated by comparing the model's ability to pricing excluded factors. For example, if we want to show that CAPM is a better pricing model than Fama-French three-factor model, SMB and HML regress on CAPM must produce insignificant alphas. Table 7 runs spanning regression between Fama-French three factor model and augmented three-factor model. The left-hand variables are accounting operating profitability, cash profitability Cpop and operating accrual. When three variables are regressed on three factor model, the monthly alphas are 45 (t=6.86), 59 (t=11.03) and 41 (t=7.49) basis point with t-values all significant. This shows the augmented three-factor model all dominate Fama-French three factor model. The regressions on cash profitability factor (Cpop) generate significant in all scenarios. The alpha when regressed on cash profitability (Cpwc) is 22 basis point, with t=5.28. This shows that cash three factor model augmented with cash profitability (Cpop) is better than three factor model augmented with cash profitability which only adjusted for working capital accrual. The regressions on operating accruals show that only cash profitability (Cpop) can price operating accrual because t-value equals to 1.32<1.96. On

the other hand, cash profitability (Cpwc) cannot price operating accrual as the t-value equals to 4.99.

7. Increasing the predictive horizon

Then the test focuses on the horizon of predictive power of cash profitability variables. In Fama and Macbeth (1973) regression, I regress stock return on the lagged value of cash profitability and control variables. I act as if the current cash profitability is missing but the information of control variables is available to see how far the cash profitability can predict expected return. The lag value increases from one month to ten year, covering the period from 1966 to 2014. Panel A and B of Figure 2 shows the slope from Fama and Macbeth regression as well as their 95% confidence interval. The prediction horizon of cash profitability cpwc is similar with the result of Ball et al. (2016) – cash profitability adjusted for working capital accrual can predict return as far as 10-year horizon. However, in this test the performance of cash profitability Cpop is weaker than Cpwc. The lower bound of 95% confidence level almost reach 0 after 6 years. In panel C, we can see the t-value of cash profitability Cpop is higher than cash profitability Cpwc in the first 2 years after that predictive power of Cpop is weaker than Cpwc. This shows that investment managers need to rebalance portfolio at least every 2 years, if they want to maximize the advantage of cash profitability Cpop.

8. Conclusion

I adjusted operating profitability with both working capital accrual and long-term accrual. Overall, such cash profitability generated is associated with lower standard deviation and almost the same average return as cash profitability adjusted for working capital accrual, therefore has higher explanatory power in cross-sectional regression. In fact, fund managers who use this cash profitability will be benefit from a higher Sharpe ratio portfolio, although the relative advantage over cash profitability adjusted for working capital accrual is only 2 years without rebalancing.

My research confirms the result by Ball et al. (2016) that cash profitability is more informative compared with accounting profitability and incorporation of cash profitability in asset pricing model eliminates the long-lasting accrual anomaly. Also, my result corroborates the value of using ‘free cash flow’ in company valuation since the adjustment process is similar with calculation of free cash flow.

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Table and Appendix

Table 1 Descriptive statistics

Panel A shows the distribution of operating profitability, five types of accruals and corresponding five cash-based profitability used in my analysis. Operating profitability (OP) follows Ball et al. (2016), as revenue minus cost of goods sold, sales, general and administration expense, plus expense of research and development (REVT-COGS-XSGA+XRD), scaled by average total asset. Five accruals are the same as Larson, Sloan and Giedt (2018), all scaled by average total asset. Comprehensive accrual (Comacc) is the change of common shareholder equity less change of cash and cash equivalent (ΔCEQ - ΔCHE). Working capital accrual (Wcacc) is defined as the change of non-cash current asset minus non-debt change of current liability (ΔACT - ΔCHE) - (ΔLCT - ΔDLC). Operating accrual (Opacc) is defined as the change of non-cash and non-investment asset minus non-debt liability (ΔAT - ΔCHE - ΔIVAEQ - ΔIVAO) - (ΔLT - ΔDLC - ΔDLTT). Financial accrual (Fiacc) is the difference between comprehensive accrual and operating accrual. Long-term accrual (Ltacc) is the difference between operating accrual and working capital accrual. Cash-based profitability 1 (Cpcom) is operating profitability minus comprehensive accrual. Cash-based profitability 2 (Cpwc) is operating profitability minus working capital accrual. Cash-based profitability 3-5 are generated in the same way, using operating profitability minus corresponding accruals. The sample consists of firms listed on Amex, NYSE and Nasdaq from 1966 to 2014. Firm with missing value of market equity, total asset, revenue and cost of goods sold are excluded. Financial companies with SIC code 6000-6999 are also excluded.

Panel A: Distributions

			Percentiles				
Variable	Mean	SD	1st	25th	50th	75th	99th
Types of accural							
Comprehensive accrual (Comacc)	0.033	0.197	-0.492	-0.021	0.030	0.088	0.543
Working capital accrual (Wcacc)	0.015	0.106	-0.281	-0.023	0.009	0.052	0.324
Long-term accrual (Ltacc)	0.043	0.187	-0.374	-0.014	0.019	0.074	0.658
Operating accrual (Opacc)	0.058	0.223	-0.494	-0.026	0.038	0.125	0.751
Financial accrual (Finacc)	-0.025	0.162	-0.590	-0.061	0.000	0.028	0.378
Operating and cash-based profitability							

Table 1 (continued)

Operating profitability	0.143	0.171	-0.427	0.083	0.150	0.222	0.525
Cash profitability1 (Cpcom)	0.108	0.230	-0.604	0.051	0.120	0.193	0.571
Cash profitability2 (Cpwc)	0.126	0.183	-0.468	0.060	0.137	0.213	0.529
Cash profitability3 (Cplt)	0.101	0.244	-0.720	0.038	0.127	0.206	0.552
Cash profitability4 (Cpop)	0.083	0.260	-0.769	0.005	0.111	0.200	0.592

Table 2 Pearson Correlation

Table 2 is the Pearson correlation between the accruals, operating profitability and cash-based profitability based on firms listed on Amex, NYSE and Nasdaq from 1966 to 2014. Firm with missing value of market equity, total asset, revenue and cost of goods sold are excluded. Financial companies with SIC code 6000-6999 are also excluded.

Panel B: Pearson Correlation

	Comacc	Wcacc	Ltacc	Opacc	Finacc	OP	Cpcom	Cpwc	Cplt	Cpop	Cpfi
Comacc	1.000										
Wcacc	0.406	1.000									
Ltacc	0.621	0.083	1.000								
Opacc	0.708	0.545	0.881	1.000							
Finacc	0.236	-0.257	-0.458	-0.519	1.000						
OP	0.220	0.194	0.088	0.164	0.038	1.000					
Cpcom	-0.689	-0.202	-0.487	-0.498	-0.142	0.555	1.000				
Cpwc	-0.028	-0.399	0.029	-0.164	0.199	0.822	0.633	1.000			
Cplt	-0.348	0.065	-0.717	-0.573	0.388	0.631	0.765	0.552	1.000		
Cpop	-0.488	-0.348	-0.711	-0.762	0.485	0.513	0.797	0.682	0.913	1.000	
Cpfi	0.026	0.338	0.385	0.489	-0.666	0.720	0.513	0.479	0.206	0.047	1.000

Table 3 Profitability and accruals from Fama-MacBeth regression

This table reports average slope (multiplied by 100) and corresponding t-value from Fama-MacBeth regression (1973) that explains monthly return. Data of monthly return is from 1966 to 2014. Panel A presents the result for operating profitability, comprehensive accrual and cash profitability 1 adjusted from the accrual. Panel B compares five cash profitability and operating profitability. Panel C shows the results of accruals. All independent variables are trimmed at 1 and 99 level. Panel D and E repeat the test by using All-but-microcaps and microcaps, based on 20 percentile of NYSE breakpoint.

Panel A: Operating accrual and cash profitability Cpop						
	Regression					
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)
Operating profitability	1.81		2.22			0.39
	(6.19)		(7.59)			(1.25)
Operating accrual (Opacc)		-1.54	-1.84		0.27	
		(-10.48)	(-12.95)		(0.91)	
Cash profitabiltiy4 (Cpop)				1.91	2.09	1.79
				(14.13)	(7.57)	(12.92)
log(BE/ME)	0.41	0.32	0.38	0.37	0.37	0.37
	(7.14)	(5.59)	(6.51)	(6.49)	(6.48)	(6.49)
log(ME)	-0.11	-0.07	-0.11	-0.10	-0.10	-0.11
	(-2.88)	(-1.7)	(-2.82)	(-2.43)	(-2.74)	(-2.82)
$r_{0,1}$	-5.96	-5.91	-6.05	-5.99	-6.04	-6.04
	(-14.48)	(-14.43)	(-14.84)	(-14.6)	(-14.81)	(-14.84)
$r_{12,2}$	0.64	0.57	0.58	0.59	0.58	0.58
	(4.03)	(3.57)	(3.66)	(3.77)	(3.66)	(3.67)
Adjusted R^2	3.91%	3.85%	4.08%	3.85%	4.07%	4.08%
Panel B: Cash-based profitability						
Cash profitabiltiy 1 (Cpcom)	1.98					
	(10.65)					
Cash profitability 2 (Cpwc)		2.24				0.49
		(10.79)				(1.83)
Cash profitability 3 (Cplt)			1.89			
			(11.05)			

Cash profitability 4 (Cpop)				1.91		1.66
Table 3 (continued)						
				(14.13)		(9.40)
Cash profitability 5 (Cpfi)					0.06	
					(0.38)	
log(BE/ME)	0.39	0.40	0.39	0.37	0.38	0.49
	(6.88)	(7.06)	(6.71)	(6.49)	(6.59)	(6.61)
log(ME)	-0.10	-0.12	-0.10	-0.10	-0.07	-0.10
	(-2.49)	(-3.03)	(-2.49)	(-2.43)	(-1.81)	(-2.73)
$r_{0,1}$	-5.94	-6.01	-6.03	-5.99	-5.86	-6.05
	(-14.46)	(-14.66)	(-14.72)	(-14.6)	(-14.23)	(-14.82)
$r_{12,2}$	0.62	0.62	0.60	0.59	0.66	0.58
	(3.92)	(3.94)	(3.83)	(3.77)	(4.13)	(3.71)
Adjusted R^2	3.85%	3.86%	3.82%	3.85%	3.80%	3.99%
Panel C: Accrual						
Comprehensive accrual	-1.06					
(Comacc)	(-5.57)					
Working capital accrual		-1.61				0.38
(Wcacc)		(-6.2)				(1.25)
Long-term accrual			-1.81			
(Ltacc)			(-9.77)			
Operating accrual				-1.54		-1.64
(Opacc)				(-10.48)		(-9.35)
Financial accrual					1.46	
(Finacc)					(9.85)	
log(BE/ME)	0.34	0.35	0.33	0.32	0.34	0.32
	(5.99)	(5.99)	(5.74)	(5.59)	(5.92)	(5.62)
log(ME)	-0.07	-0.08	-0.07	-0.07	-0.08	-0.07
	(-1.8)	(-1.93)	(-1.67)	(-1.7)	(-1.91)	(-1.68)
$r_{0,1}$	-5.85	-5.91	-5.93	-5.91	-5.86	-5.95
	(-14.28)	(-14.43)	(-14.52)	(-14.43)	(-14.26)	(-14.59)
$r_{12,2}$	0.60	0.60	0.58	0.57	0.60	0.56
	(3.75)	(3.72)	(3.63)	(3.57)	(3.73)	(3.51)
Adjusted R^2	3.83%	3.81%	3.83%	3.85%	3.81%	3.94%
Panel D: Cash profitability 2 and 4						
	All-but-micocaps			Micocaps		

	(1)	(2)	(3)	(4)	(5)	(6)
Table 3 (continued)						
Cash profitability 4 (Cpop)		1.45	0.95		2.02	1.85
		(8.93)	(4.77)		(12.81)	(8.46)
Cash profitability 2 (Cpwc)	2.01		0.97	2.21		0.27
	(8.05)		(3.31)	(9.24)		(0.83)
log(BE/ME)	0.35	0.30	0.33	0.41	0.39	0.39
	(4.99)	(4.33)	(4.78)	(6.94)	(6.55)	(6.53)
log(ME)	-0.05	-0.05	-0.06	-0.33	-0.30	-0.30
	(-1.38)	(-1.31)	(-1.46)	(-4.9)	(-4.29)	(-4.49)
$r_{0,1}$	-3.35	-3.32	-3.43	-7.18	-7.17	-7.23
	(-7.44)	(-7.43)	(-7.67)	(-16.34)	(-16.26)	(-16.45)
$r_{12,2}$	0.71	0.67	0.68	0.56	0.53	0.51
	(4.15)	(3.95)	(3.99)	(3.39)	(3.24)	(3.13)
Adjusted R^2	5.81%	5.80%	6.08%	3.36%	3.33%	3.52%
Panel E: Operating accrual and working capital accrual						
Working capital accrual	-0.81		0.42	-1.61		0.63
	(-2.39)		(1.06)	(-5.55)		(1.73)
Operating accrual		-1.04	-1.00		-1.63	-1.87
		(-6.46)	(-5.15)		(-9.69)	(-8.65)
log(BE/ME)	0.21	0.19	0.20	0.40	0.39	0.39
	(3.14)	(2.89)	(2.93)	(6.54)	(6.25)	(6.23)
log(ME)	-0.04	-0.04	-0.04	-0.27	-0.25	-0.25
	(-0.98)	(-1.12)	(-1.06)	(-3.93)	(-3.58)	(-3.56)
$r_{0,1}$	-3.14	-3.13	-3.21	-7.13	-7.15	-7.17
	(-6.91)	(-6.96)	(-7.11)	(-16.39)	(-16.37)	(-16.5)
$r_{12,2}$	0.65	0.62	0.62	0.56	0.53	0.51
	(3.79)	(3.62)	(3.64)	(3.32)	(3.19)	(3.09)
Adjusted R^2	5.87%	5.87%	6.12%	3.17%	3.21%	3.32%

Figure 1 Subsample analysis of Fama and Macbeth regression

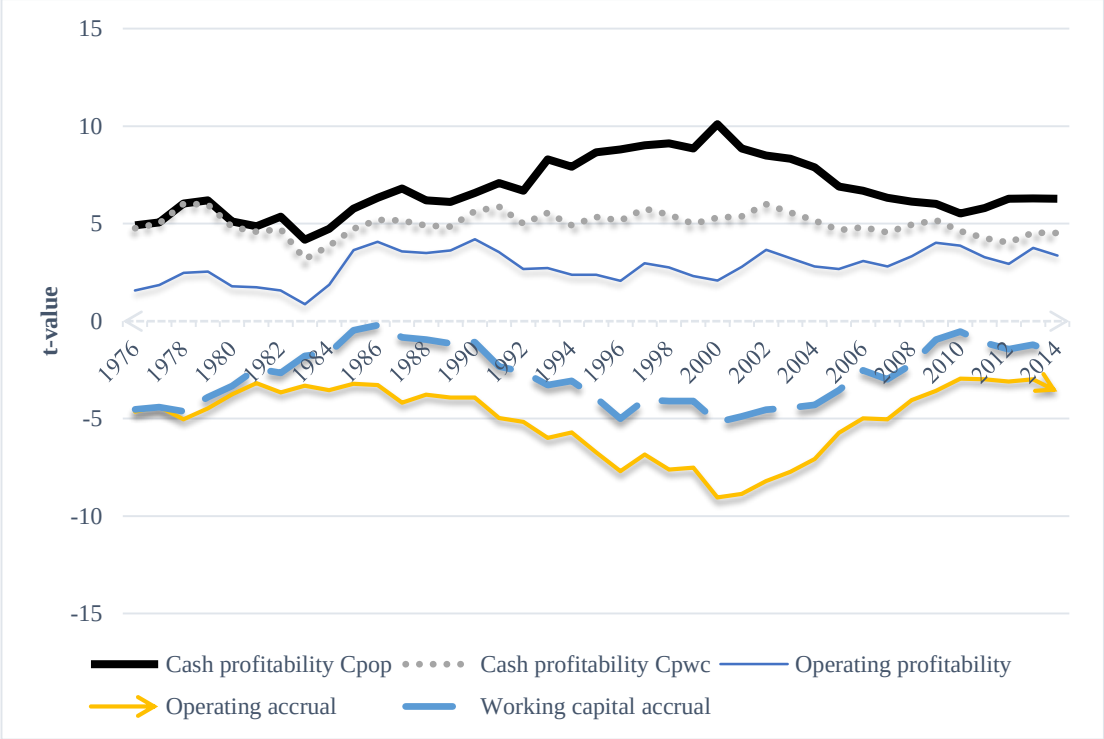


Fig.1 This figure is subsample analysis of cash profitability Cpop, cash profitability Cpwc, operating profitability, operating accrual and working capital accrual in Fama and Macbeth regression (1973). The figure shows rolling ten-year average t-value of Fama and Macbeth slope from Panel A column 1, Panel B column 2 and 4 and Panel C column 2 and 4. The x-axis is the end of each ten-year regression. For example, the first point, 1976 is the t-value of five variables by Fama and Macbeth (1973) regression from July 1966 to June 1976.

Table 4 Return sorted by operating profitability, cash profitability and accrual.

This table reports excess return, CAPM alpha and Fama-French three-factor alpha of value-weighted portfolio sorted by operating profitability, cash profitability and accrual. Stocks are sorted into deciles based on NYSE breakpoint at the end of June every year and portfolios are held for the next year. Panel A reports deciles sorted by profitability variables. Panel B reports deciles sorted by accrual variables.

Panel A: Profitability factor

	Cash profitability 4 (Cpop)			Cash profitability 2 (Cpwc)			Operating profitability (OP)		
	Excess	α		Excess	α		Excess	α	
Portfolio	Return	CAPM	FF3	Return	CAPM	FF3	Return	CAPM	FF3
				Excess returns and alphas					
1(low)	0.47%	-0.66%	-0.61%	0.43%	-0.76%	-0.76%	0.65%	-0.54%	-0.61%
2	0.87%	-0.15%	-0.20%	0.80%	-0.28%	-0.38%	0.73%	-0.35%	-0.48%
3	0.86%	-0.11%	-0.17%	0.91%	-0.12%	-0.19%	1.00%	0.01%	-0.13%
4	0.91%	-0.06%	-0.12%	0.92%	-0.07%	-0.14%	0.85%	-0.09%	-0.14%
5	0.82%	-0.12%	-0.14%	0.96%	0.02%	-0.07%	0.96%	0.02%	-0.02%
6	0.98%	0.07%	0.04%	0.84%	-0.04%	-0.05%	0.98%	0.10%	0.04%
7	1.04%	0.12%	0.09%	0.96%	0.06%	0.03%	0.94%	0.02%	-0.03%
8	0.94%	0.03%	0.07%	1.12%	0.20%	0.20%	1.09%	0.14%	0.18%
9	1.04%	0.12%	0.19%	0.95%	0.03%	0.10%	0.93%	0.03%	0.07%
10(high	1.07%	0.16%	0.32%	1.03%	0.11%	0.30%	0.94%	0.04%	0.22%
10-1	0.61%	0.82%	0.94%	0.62%	0.87%	1.05%	0.32%	0.57%	0.83%
				t-values					
1(low)	1.88	-6.70	-7.10	1.40	-5.75	-7.64	2.38	-4.05	-5.38
2	3.72	-1.75	-2.36	3.16	-2.71	-4.07	3.07	-3.45	-5.21
3	3.96	-1.45	-2.32	3.94	-1.36	-2.21	4.66	0.10	-1.57
4	4.35	-0.76	-1.47	4.28	-0.89	-1.81	4.22	-1.05	-1.54
5	4.18	-1.59	-1.94	4.75	0.24	-0.95	4.87	0.33	-0.31
6	5.21	0.98	0.50	4.50	-0.54	-0.61	5.33	1.30	0.59
7	5.38	1.63	1.22	5.12	0.92	0.47	4.90	0.26	-0.39
8	4.96	0.43	1.01	5.84	2.99	3.00	5.53	2.26	2.92
9	5.49	1.81	3.13	5.05	0.45	1.70	4.97	0.41	1.15
10(high	5.62	1.93	4.76	5.36	1.24	4.43	4.87	0.42	3.39
10-1	4.48	6.23	7.97	4.01	5.43	8.79	1.86	3.46	6.32

Table 4 (continued)

Panel B: Accruals

Portfolio	Working capital accrual (Wcacc)			Operating accrual (Opacc)		
	Excess Return	α		Excess Return	α	
		CAPM	FF3		CAPM	FF3
1(low)	1.11%	0.04%	0.14%	1.13%	0.12%	0.06%
2	1.03%	0.06%	0.14%	1.14%	0.20%	0.20%
3	0.92%	0.06%	0.08%	0.99%	0.10%	0.11%
4	1.01%	0.16%	0.13%	1.02%	0.16%	0.18%
5	1.03%	0.21%	0.18%	0.98%	0.12%	0.10%
6	0.94%	0.07%	0.05%	0.96%	0.09%	0.11%
7	0.88%	-0.02%	-0.02%	0.97%	0.07%	0.09%
8	0.87%	-0.09%	-0.04%	0.86%	-0.08%	-0.04%
9	0.90%	-0.10%	-0.03%	0.86%	-0.14%	-0.08%
10(high)	0.61%	-0.52%	-0.42%	0.56%	-0.53%	-0.44%
10-1	-0.49%	-0.56%	-0.56%	-0.57%	-0.65%	-0.50%
1(low)	4.40	0.38	1.36	4.82	1.22	0.68
2	4.73	0.78	1.73	5.47	2.71	2.71
3	5.07	0.98	1.30	5.08	1.24	1.39
4	5.60	2.27	1.86	5.57	2.45	2.86
5	6.03	3.12	2.62	5.36	1.79	1.54
6	5.10	1.11	0.75	5.16	1.37	1.65
7	4.49	-0.34	-0.29	4.98	1.03	1.36
8	4.08	-1.24	-0.56	4.15	-1.36	-0.63
9	3.96	-1.20	-0.36	3.78	-1.74	-1.04
10(high)	2.30	-4.86	-5.17	2.21	-5.90	-5.54
10-1	-3.56	-4.08	-4.18	-4.53	-5.14	-4.19

Table 4 (continued)

Panel C: Profitability sorted on small and big stocks

		Cash profitability 4 (Cpop)			Cash profitability 2 (Cpwc)			Operating profitability (OP)		
		Excess	α		Excess	α		Excess	α	
Size	Portfolio	Return	CAPM	FF3	Return	CAPM	FF3	Return	CAPM	FF3
					Monthly excess return and alpha					
Big	1	0.48	-0.60	-0.52	0.46	-0.63	-0.64	0.68	-0.41	-0.49
	10	1.02	0.10	0.30	1.01	0.07	0.28	0.91	-0.03	0.19
	10-1	0.54	0.70	0.83	0.61	0.70	0.92	0.22	0.38	0.67
Small	1	0.43	-0.87	-0.94	0.55	-0.78	-0.87	0.52	-0.82	-0.93
	10	1.48	0.32	0.27	1.41	0.26	0.24	1.28	0.10	0.09
	10-1	1.05	1.19	1.21	0.86	1.04	1.10	0.75	0.92	1.02
					t-values					
Big	1	2.01	-6.23	-5.63	1.82	-6.06	-6.26	2.66	-3.78	-4.58
	10	5.22	1.06	3.90	4.70	0.72	3.37	4.23	-0.27	2.28
	10-1	4.11	5.07	6.28	4.00	4.69	6.88	1.35	2.37	4.89
Small	1	1.35	-5.35	-10.23	1.65	-4.32	-8.90	1.53	-4.15	-7.60
	10	5.21	2.32	3.80	5.03	1.96	3.46	4.43	0.72	1.32
	10-1	9.58	11.36	11.55	7.05	8.91	9.93	5.28	6.54	7.47

Panel D: Accrual sorted on small and big stocks

		Working capital accrual (Wcacc)			Operating accrual (Opacc)		
		Excess	α		Excess	α	
Size	Portfolio	Return	CAPM	FF3	Return	CAPM	FF3
				Monthly excess return and alphas			
Big	1	1.08	0.07	0.20	1.05	0.00	0.13
	10	0.62	-0.46	-0.32	0.63	-0.38	-0.33
	10-1	-0.47	-0.53	-0.52	-0.42	-0.38	-0.46
Small	1	1.08	-0.13	-0.22	1.20	-0.02	-0.18
	10	0.76	-0.51	-0.55	0.61	-0.65	-0.73
	10-1	-0.32	-0.37	-0.33	-0.59	-0.63	-0.54
				t-values			
Big	1	4.58	0.68	2.16	4.34	0.04	1.69

	10	2.47	-4.60	-3.65	2.71	-3.88	-3.36
Table 4 (continued)							
	10-1	-3.55	-4.03	-4.02	-2.97	-2.71	-3.31
Small	1	3.59	-0.85	-2.74	3.94	-0.11	-2.06
	10	2.43	-3.21	-7.67	1.97	-4.32	-8.73
	10-1	-3.50	-4.18	-3.73	-5.18	-5.64	-4.91

Table 5 Descriptive statistics for monthly factor

This table presents the average annualized return and standard deviation of eight factors, including four traditional factors, market excess return (MKT), size (SMB) value (HML) and momentum (UMD), as well as four profitability- related factors, operating profitability (RMW), cash profitability adjusted for working capital accrual (RMW_{cbwc}), cash profitability adjusted for operating accrual (RMW_{cbop}) and operating accual (OPACC). The additional factors are constructed in the same way as Fama and French (2015) by 2×3 sorts. Stocks are independently sorted into small and big based on median of NYSE market value and weak (below 30 percentile of NYSE) and robust (above 70 percentile of NYSE) based on profitability factors. The factor is then defined as the difference between average return of two robust portfolio minus the average return of two weak portfolio (1/2) × (small-robust+ big-robust) - (1/2) × (small-weak+ big-weak). The sample period is from July 1966 to December 2014.

	Factor							
	MKT	SMB	HML	UMD	RMW	RMW_{cbwc}	RMW_{cbop}	OPACC
Average annualized return %	5.97	2.61	4.48	7.98	2.67	4.95	5.57	4.35
Annualized standard deviation	15.8	10.6	10.0	14.9	7.2	6.4	5.4	5.3
t-value	2.60	1.69	3.07	3.68	2.53	5.33	7.08	5.65

Table 6 Pricing portfolio sorted by size and operating accrual (5×5).

This table shows the excess return, alpha and its t-value of 25 portfolio sorted on operating accrual and size. Stocks are sorted into quintile at the end of June every year based on NYSE breakpoint and hold for the following year. The models used include Fama-French three-factor model (1993), three-factor model augmented with operating profitability, cash profitability (Cpwc), operating profitability plus operating accrual and cash profitability (Cpop) factor. In panel B reports test statistics that evaluate the model performance. GRS is the statistics by Gibbons, Ross and Shaken (1989). A ($AdjR^2$) is the average of adjusted R^2 from regression. A($|\hat{\alpha}|$) is the mean absolute value of alpha. Sample period is from July 1966 to December 2014.

Panel A: Monthly excess return and alphas

	Monthly alphas					t-values				
	Operating accruals					Operating accruals				
Size	Low	2	3	4	High	Low	2	3	4	High
					Excess return					
1 (Small)	1.36	1.40	1.33	1.20	0.73					
2	1.30	1.33	1.27	1.15	0.86					
3	1.30	1.26	1.24	1.13	0.76					
4	1.25	1.21	1.10	1.07	0.71					
5 (Big)	1.04	0.92	0.90	0.86	0.71					
					Three-factor model					
1 (Small)	-0.02	0.13	0.08	-0.11	-0.63	-0.17	1.73	1.16	-1.34	-6.55
2	-0.02	0.14	0.09	-0.04	-0.45	-0.30	2.08	1.56	-0.52	-6.01
3	0.07	0.18	0.14	0.01	-0.47	0.82	2.67	2.09	0.10	-5.55
4	0.15	0.16	0.07	0.02	-0.38	1.77	2.15	1.05	0.25	-4.28
5 (Big)	0.15	0.12	0.08	0.03	-0.14	1.72	1.91	1.57	0.49	-1.83
					Three-factor model + Operating profitability factor					
1 (Small)	0.20	0.22	0.12	-0.02	-0.51	2.03	2.89	1.54	-0.29	-5.21
2	0.08	0.16	0.12	-0.05	-0.43	1.07	2.30	1.81	-0.70	-5.49
3	0.20	0.21	0.12	-0.02	-0.49	2.37	3.09	1.72	-0.23	-5.61
4	0.23	0.18	0.08	0.00	-0.36	2.75	2.30	1.21	-0.01	-3.88
5 (Big)	0.22	0.16	0.04	-0.03	-0.18	2.48	2.46	0.76	-0.47	-2.38
					Three-factor model + cash profitability (Cpwc)					
1 (Small)	0.18	0.24	0.15	0.03	-0.35	1.79	2.96	1.86	0.40	-3.54

2	0.05	0.14	0.14	-0.02	-0.31	0.65	1.91	2.16	-0.21	-3.94
3	0.25	0.21	0.15	0.05	-0.35	2.91	2.95	2.13	0.74	-3.87

Table 6 (continued)

4	0.30	0.24	0.17	0.09	-0.19	3.43	3.03	2.42	1.19	-2.02
5 (Big)	0.13	0.12	0.05	-0.07	-0.11	1.41	1.65	0.80	-1.08	-1.44
Three-factor model +operating profitability + operating accrual										
1 (Small)	0.03	0.13	0.10	-0.01	-0.34	0.35	1.59	1.23	-0.16	-3.45
2	-0.06	0.08	0.07	0.05	-0.20	-0.77	1.12	1.13	0.63	-2.70
3	0.13	0.13	0.17	0.09	-0.23	1.51	1.84	2.38	1.24	-2.78
4	0.18	0.16	0.17	0.14	-0.08	2.04	1.92	2.45	1.86	-0.89
5 (Big)	-0.06	-0.06	0.03	0.07	0.08	-0.66	-0.92	0.45	1.03	1.15
Three-factor model +cash profitability (Cpop)										
1 (Small)	-0.01	0.12	0.13	-0.02	-0.32	-0.06	1.41	1.65	-0.20	-3.15
2	-0.03	0.08	0.10	0.02	-0.17	-0.41	1.10	1.50	0.24	-2.17
3	0.09	0.15	0.19	0.09	-0.22	1.02	2.08	2.62	1.29	-2.47
4	0.22	0.22	0.18	0.14	-0.06	2.48	2.73	2.49	1.79	-0.71
5 (Big)	0.04	0.02	0.03	-0.02	0.06	0.39	0.33	0.56	-0.25	0.79

Panel B: Test statistics

	GRS	A ($AdjR^2$)	A($\lvert\hat{\alpha}\rvert$)
Three factor model	6.06	90.83%	0.153
Three-factor + $RMW_{(OP)}$	5.57	91.01%	0.172
Three-factor + $RMW_{(Cbwc)}$	4.06	91.03%	0.157
Three-factor + $RMW_{(OP)}$+ OPACC	3.16	91.63%	0.109
Three-factor + $RMW_{(Cpop)}$	2.82	91.06%	0.105

Table 7 Spanning regression

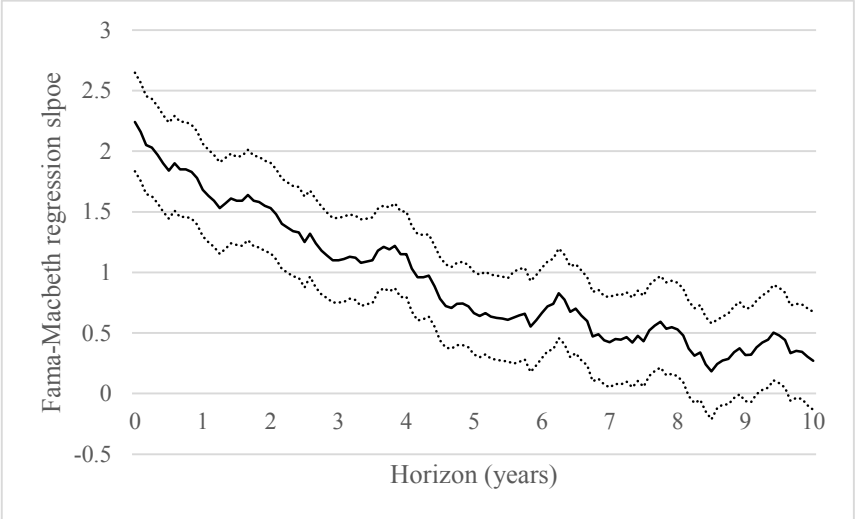
This table presents relative performance of Fama-French three-factor model and augmented three-factor model. The left-hand side variables are accounting operating profitability, cash profitability Cpop, and operating accrual. The right-hand side variables include three factors (MKT, SMB, HML) and three profitability-related variables (RMW_{OP}, RMW_{Cpwc}, RMW_{Cpop})

Spanning regression									
	Dependent variable								
	RMW_{OP}			RMW_{Cpop}			OPACC		
	Parameter estimates								
	0.45	-0.06	0.07	0.59	0.39	0.22	0.41	0.30	0.07
b(MKT)	-0.14	-0.02	-0.05	-0.13	-0.07	-0.04	-0.09	-0.06	-0.01
b(SMB)	-0.20	0.01	-0.10	-0.15	-0.06	0.00	-0.09	-0.04	0.01
b(HML)	-0.40	-0.20	-0.30	-0.16	0.01	-0.01	0.09	0.18	0.24
b(RMW_{OP})					0.43		-0.23		
b(RMW_{Cpwc})		0.87				0.63		0.02	
b(RMW_{Cpop})			0.66						0.40
	t-values								
	6.86	-1.44	1.06	11.03	8.38	5.28	7.49	4.99	1.32
b(MKT)	-9.09	-1.52	-3.85	-10.40	-6.15	-4.19	-7.12	-4.23	-0.77
b(SMB)	-8.79	0.46	-5.08	-8.07	-3.72	0.07	-4.87	-2.10	0.59
b(HML)	-17.11	-12.52	-14.14	-8.37	0.75	-0.86	3.73	8.51	12.67
b(RMW_{OP})					15.48		-7.12		
b(RMW_{Cpwc})		31.40				24.15		0.42	
b(RMW_{Cpop})			15.47						10.21
R-squared	41.2%	77.7%	57.9%	29.9%	49.8%	64.3%	27.1%	21.0%	32.6%

Figure 2 Increasing the predictive horizon

Panel A: Cash profitability Cbop

Panel B: Cash profitability Cbwc



Panel C: Comparison of t-values

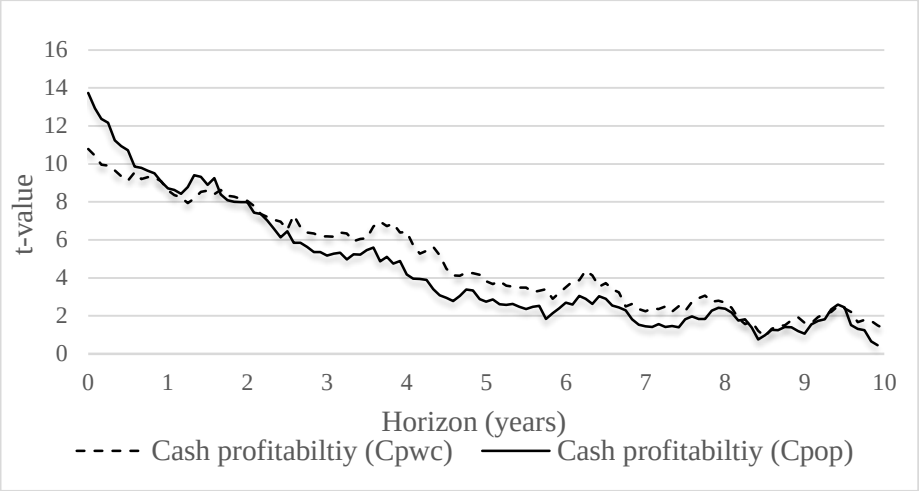


Fig. 2. This figure is the Fama and Macbeth (1973) regression of stock return on lagged of cash profitability adjusted for operating profitability (Cpop) and cash profitability adjusted for working capital (Cpwc). The control variable is the same as it is in section 4, including prior month return ($r_{1,1}$), the return of past 12 months ($r_{12,2}$) which excludes the prior month, the natural logarithm of book-to-market ratio (logBE/ME) and natural logarithm of market equity (logME). The control variables are updated on time, while the cash profitability is lagged from 1 month to 10 years. Panel A and B is the slope (multiple by 100) from Fama and Macbeth regression and corresponding 95% of the confidence interval. Panel C shows the t-value from these regressions.

Appendix: Measuring operating profitability, cash profitability and accruals

This appendix summarizes how operating profitability, cash profitability and accruals in this paper are calculated. All variables are deflated by average total asset. The name of Compusta variables is presented in parentheses.

Operating profitability

The calculation of operating profitability is same as Bakk, Gerakos, Linnainmaa and Nikolaev (2015) as:

Operating profitability ≡ Revenue (REVT)
– Cost of goods sold (COGS)
– Sales, general and administrative expense (XSGA)
+ Research and development expense (XRD)

Accruals

The calculation of accruals and decomposition follows Larson, Sloan and Giedt (2018), where Comprehensive accrual = Operating accrual +Financial accrual
= Working capital accrual +Long-term accrual +Financial accrual.

Comprehensive accrual ≡ change of common shareholder equity (ΔCEQ)
– less change of cash and cash equivalent (ΔCHE).

Operating accrual (Opacc) ≡ the change of total asset (ΔAT)
– change cash and cash equivalent (ΔCHE)
– change of investment and advances- Equity (ΔIVAEQ)
– change of investment and advances/Other (ΔIVAO)
– change of total liability (ΔLT)
+ change of debt in current liability (ΔDLC)
+ change of long-term debt (ΔDLTT).

Working capital accrual ≡ change of current total asset (ΔACT)
– change of cash and cash equivalent (ΔCHE)
– change of current total liability (ΔLCT)
+ change of debt in current liability (ΔDLC).

Financial accrual = Comprehensive accrual – Operating accrual.

Long-term accrual = Operating accrual – Working capital accrual.

Cash-based profitability

I convert operating profitability to cash-based profitability by adding or subtracting change of non-cash asset that will affect the accounting profitability.

Cash-based profitability (Cpcom) = Operating profitability – Comprehensive accrual

Cash-based profitability (Cpwc) = Operating profitability –Working capital accrual

Cash-based profitability (Cplt) = Operating profitability –Long-term accrual

Cash-based profitability (Cpop) = Operating profitability –Operating accrual

Cash-based profitability (Cpfi) = Operating profitability –Financial accrual