Deflating profitability

Accruals, cash flows, and operating profitability in the cross section of stock returns

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Outline

- Introduction
- Data and variable definitions
- Empirical study
  - Fama and MacBeth regressions
  - Portfolio Sorts
- Conclusion

1. Introduction-- Motivation

- **Earnings:** $\frac{\text{income before extraordinary items}}{\text{the book value of equity}}$
  - (Ball and Brown,1968; Novy-Marx, 2013)
- **Gross profitability:** $\frac{\text{gross profit (revenue minus cost of goods sold)}}{\text{the book value of total assets}}$
  - (Novy-Marx, 2013)
- **Operating profitability:** (Revenue − Cost of goods sold −Reported sales, general, and administrative expenses)/ the book value of total assets
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2015)
- **Cash-based operating profitability:** (Operating profitability- Accounts receivable –Inventory - Prepaid expenses+ Deferred revenue + Trade accounts payable)/ the book value of total assets
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2016)

1. Introduction-- Questions

- **Why gross profitability predicts future returns better than net income, Is it because of differences in deflators?**
  - Yes
- **Why net income and gross profit have the similar predictive power when they are consistently deflated?**
  - The items farther down the income statement are not pure noise.-- **Operating profitability**
- **Can cash-based operating profitability better explain the cross section of expected returns than gross profitability, operating profitability, and net income, all of which include accruals?**
  - Yes

1. Introduction-- Content

- Earnings
  - (Ball and Brown,1968; Novy-Marx, 2013)
- Gross profitability
  - (Novy-Marx, 2013)
- **Operating profitability**
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2015)
- **Cash-based operating profitability:**
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2016)

1. Introduction-- Contribution

- **Explain the puzzle** that the similar predictive power of net income and gross profit when they are consistently deflated
- **Operating profitability** better explains the cross section of expected returns than **gross profitability**, and net income
- **Cash-based operating profitability** better explains the cross section of expected returns than **operating profitability**, gross profitability, and net income

2. Data

- Data: monthly stock returns from CRSP and annual accounting data from Compustat.
- Period：1963.07~ 2013.12(2014.12)
- Exclude financial firms
- Variables: **Earnings**、 **Gross profitability**、 **Operating profitability**、 **Cash-based operating profitability measure**

3.1 Differences in deflators(Fama and MacBeth regressions)

t_value=$\frac{\mu}{\sigma/\sqrt{T}} = \sqrt{T}\,Sharpe$

	Accounting variables deflated by						
		Total assets		Book equity		Market equity	
Explanatory variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: All-but-microcaps							
Gross profit		0.834 (5.46)		0.272 (4.45)		0.350 (3.74)	
Income before extraordinary items			3.335 (5.80)		1.259 (3.78)		1.766 (3.11)
log(BE/ME)	0.291 (3.87)	0.380 (4.88)	0.376 (4.71)	0.346 (4.36)	0.336 (4.14)	0.208 (2.71)	0.244 (3.43)
log(ME)	−0.070 (−1.79)	−0.061 (−1.55)	−0.082 (−2.18)	−0.066 (−1.70)	−0.082 (−2.17)	−0.061 (−1.59)	−0.075 (−1.96)
$r_{1,1}$	−3.223 (−7.30)	−3.307 (−7.63)	−3.239 (−7.46)	−3.366 (−7.79)	−3.273 (−7.52)	−3.353 (−7.70)	−3.308 (−7.59)
$r_{12,2}$	1.019 (5.52)	1.039 (5.70)	1.061 (5.77)	1.015 (5.63)	1.037 (5.67)	1.024 (5.67)	1.032 (5.66)
Adjusted R^2	5.35%	5.89%	5.84%	5.80%	5.77%	5.74%	5.80%
Difference in Sharpe ratios			0.049 (0.37)		−0.094 (−0.51)		−0.089 (−0.42)

- Gross profit and income before extraordinary items have **similar explanatory power** when they are constructed using the same deflator.
- T-values are largest when the **book value of total assets** is the deflator.

3.1 Differences in deflators(portfolio sorts)

Panel A: Gross profit and income before extraordinary items deflated by book value of total assets

Sort by gross profit / total assets

Portfolio	Average return	Three-factor model α	b_{mkt}	b_{smb}	b_{hml}
High – low (deciles)	0.358 (2.64)	0.551 (4.18)	−0.040 (−1.30)	−0.101 (−2.28)	−0.392 (−8.27)
High – low (quintiles)	0.296 (2.45)	0.523 (4.77)	−0.051 (−1.97)	−0.051 (−1.40)	−0.503 (−12.73)

Sort by net income / total assets

Average return	Three-factor model α	b_{mkt}	b_{smb}	b_{hml}
0.082 (0.47)	0.539 (4.11)	−0.293 (−9.46)	−0.784 (−17.88)	−0.300 (−6.37)
0.038 (0.29)	0.429 (4.18)	−0.233 (−9.58)	−0.550 (−16.00)	−0.363 (−9.83)

3.2 Deflator effects

- Christie (1987)

$$r_{i,t} = \alpha + \beta \frac{\mathrm{GP}_{i,t-1}}{\mathrm{AT}_{i,t-1}} + \varepsilon_{i,t},$$

$$\frac{\Delta \mathrm{ME}_{i,t} + \mathrm{D}_{i,t}}{\mathrm{ME}_{i,t-1}} = \alpha + \beta \left(\frac{\mathrm{GP}_{i,t-1}}{\mathrm{ME}_{i,t-1}} \right) \left(\frac{\mathrm{ME}_{i,t-1}}{\mathrm{AT}_{i,t-1}} \right) + \varepsilon_{i,t}.$$

$$r_{i,t} = \alpha + \beta \left(\frac{\mathrm{GP}_{i,t-1}}{\mathrm{BE}_{i,t-1}} \right) \left(\frac{\mathrm{BE}_{i,t-1}}{\mathrm{AT}_{i,t-1}} \right) + \varepsilon_{i,t}.$$

- GP: the gross profit
- D: dividends
- ME: market value of equity
- BE: book value of equity
- AT: the book value of total assets

3.2 Deflator effects

$$\frac{\Delta ME_{i,t} + D_{i,t}}{ME_{i,t-1}} = \alpha + \beta\left(\frac{GP_{i,t-1}}{ME_{i,t-1}}\right)\left(\frac{ME_{i,t-1}}{AT_{i,t-1}}\right) + \varepsilon_{i,t}.$$

	Regression				
Explanatory variable	(1)	(2)	(3)	(4)	(5)
Panel A: All-but-microcaps					
GP/ME	0.287 (3.63)	0.066 (0.78)			0.017 (0.76)
ME/AT	−0.011 (−0.66)	−0.010 (−0.59)			
GP/BE			0.104 (4.03)	0.045 (1.65)	−0.007 (−0.08)
BE/AT			0.274 (1.60)	0.013 (0.07)	
GP/AT = (GP/ME) × (ME/AT) = (GP/BE) × (BE/AT)		0.667 (4.69)		0.612 (4.19)	0.713 (5.09)
log(BE/ME)	0.178 (2.59)	0.298 (4.13)	0.316 (4.64)	0.347 (4.99)	0.355 (4.60)
log(ME)	−0.054 (−1.47)	−0.057 (−1.55)	−0.057 (−1.55)	−0.058 (−1.58)	−0.053 (−1.45)

- Gross profitability deriving a large part of its explanatory power from the **interaction** of several components.

3.3 Components between gross profit and income before extraordinary items

- Income before extraordinary items (IB)=Revenue
  - Cost of goods sold
  - **Selling, general, and administrative expenses**
  - Depreciation and amortization
  - Interest
  - Taxes
  - Nonoperating income
  - Special items
  - Minority interest income

3.3 Components between gross profit and income

	Regression				
Explanatory variable	(1)	(2)	(3)	(4)	(5)
Panel A: All-but-microcaps					
Gross profit	0.794	2.914	2.117		
	(5.27)	(3.46)	(2.44)		
Operating profit (Compustat SG&A)				2.349	
				(6.00)	
Operating profit (reported SG&A)					3.134
					(8.92)
Depreciation and amortization		1.785	2.540		
		(1.33)	(1.89)		
Compustat SG&A expenses			−1.636		
			(−1.82)		
Reported SG&A		−2.568			
		(−2.94)			
Research and development		1.324			
		(0.88)			
Interest		1.977	−0.614		
		(0.97)	(−0.27)		
Taxes		−0.681	−0.041		
		(−0.42)	(−0.03)		
Other expenses		−1.406	−1.101		
		(−1.63)	(−1.27)		

- **Operating profitability(**reported SG&A**):** Revenue − Cost of goods sold −Reported sales, general, and administrative expenses

3.4 Operating profitability in portfolio tests

		Three-factor model			
Portfolio	Average return	α	b_{mkt}	b_{smb}	b_{hml}
High – low	0.290	0.739	−0.244	−0.564	−0.493
(deciles)	(1.95)	(6.25)	(−8.71)	(−14.24)	(−11.59)
High – low	0.209	0.543	−0.160	−0.287	−0.485
(quintiles)	(1.89)	(5.87)	(−7.30)	(−9.27)	(−14.55)

- When we compare three-factor model alphas, operating profitability significantly outperforms gross profitability

4. Cash-based operating profitability

- **Operating profitability:** (Revenue − Cost of goods sold −Reported sales, general, and administrative expenses)/ the book value of total assets
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2015)
- **Cash-based operating profitability:** (Operating profitability- Accounts receivable –Inventory - Prepaid expenses+ Deferred revenue + Trade accounts payable)/ the book value of total assets
  - (Ball, Gerakos, Linnainmaa and Nikolaev (2016)

4.1 Cash-based operating profitability(FM)

Panel A: All-but-microcaps

Explanatory variable	Regression (1)	(2)	(3)	(4)	(5)	(6)	(7)
Operating profitability	2.99	2.55		2.55			0.80
	(8.86)	(7.04)		(7.09)			(1.56)
Accruals			−1.41	−1.58		0.15	
			(−3.90)	(−4.45)		(0.34)	
Cash-based operating profitability					2.60	2.54	1.91
					(9.69)	(7.40)	(5.27)
log(BE/ME)	0.42	0.36	0.21	0.33	0.33	0.32	0.33
	(5.80)	(5.08)	(3.28)	(4.66)	(4.76)	(4.53)	(4.73)
log(ME)	−0.08	−0.09	−0.09	−0.10	−0.10	−0.10	−0.10
	(−2.07)	(−2.35)	(−2.24)	(−2.66)	(−2.59)	(−2.69)	(−2.59)
$r_{1,1}$	−3.03	−3.23	−3.34	−3.30	−3.27	−3.32	−3.28
	(−6.97)	(−7.49)	(−7.76)	(−7.72)	(−7.58)	(−7.78)	(−7.66)
$r_{12,2}$	1.03	0.95	0.86	0.91	0.92	0.91	0.92
	(5.69)	(5.30)	(4.81)	(5.12)	(5.11)	(5.08)	(5.15)
Adjusted R^2	5.6%	5.5%	5.2%	5.7%	5.4%	5.6%	5.6%

- Cash-based operating profitability has the strongest predictive power.
- Cash-based operating profitability subsumes the accrual anomaly.

4.1 Cash-based operating profitability(PS)

Panel A: All stocks

	Operating profitability			Accruals			Cash-based operating profitability		
		Excess	α		Excess	α		Excess	α
Portfolio		return	CAPM	FF3	return	CAPM	FF3	return	CAPM	FF3
					Monthly excess returns and alphas					
10 – 1		0.29	0.42	0.74	−0.35	−0.43	−0.39	0.47	0.65	0.89
					t-values					
10 – 1		1.84	2.81	5.98	−2.55	−3.15	−2.98	3.17	4.74	8.48

- Cash-based operating profitability has the strongest predictive power.

4.2 Cash-based operating profitability factor

	Factor						
	MKT	SMB	HML	UMD	ACC	RMW_{OP}	RMW_{CbOP}
Average annualized return	6.09	2.88	4.35	8.27	2.70	3.25	4.88
Annualized standard deviation	15.44	10.75	9.91	14.64	5.66	6.39	5.57
t-value	2.83	1.92	3.15	4.05	3.42	3.65	6.29

- The cash-based operating profitability factor has a **substantially higher average annualized return** and t-value than the operating profitability factor.

4.2 Cash-based operating profitability factor

Panel A: Spanning regressions

	Dependent variable						
	RMW_{OP}		RMW_{CbOP}		ACC		
	t-values						
α	7.01	−1.15	10.09	7.08	3.34	4.96	1.69
b(MKT)	−3.82	2.25	−6.86	−6.09	−1.67	−2.63	−0.62
b(SMB)	−7.47	−2.02	−7.93	−3.24	−3.33	−5.04	−2.05
b(HML)	−13.65	−6.87	−11.44	−1.24	4.78	1.37	5.97
$b(RMW_{OP})$				30.14		−6.08	
$b(RMW_{CbOP})$	30.14	30.14					3.79
Adjusted R^2	26.2%	70.2%	25.3%	69.9%	8.3%	13.4%	10.3%

Panel B: Pairwise model comparisons

Model 1	Model 2	ΔAIC	Relative likelihood of Model 1 to Model 2
FF3 + RMW_{OP}	FF3 + RMW_{CbOP}	47.25	0.000
FF3 + RMW_{OP} + ACC	FF3 + RMW_{CbOP}	24.98	0.000

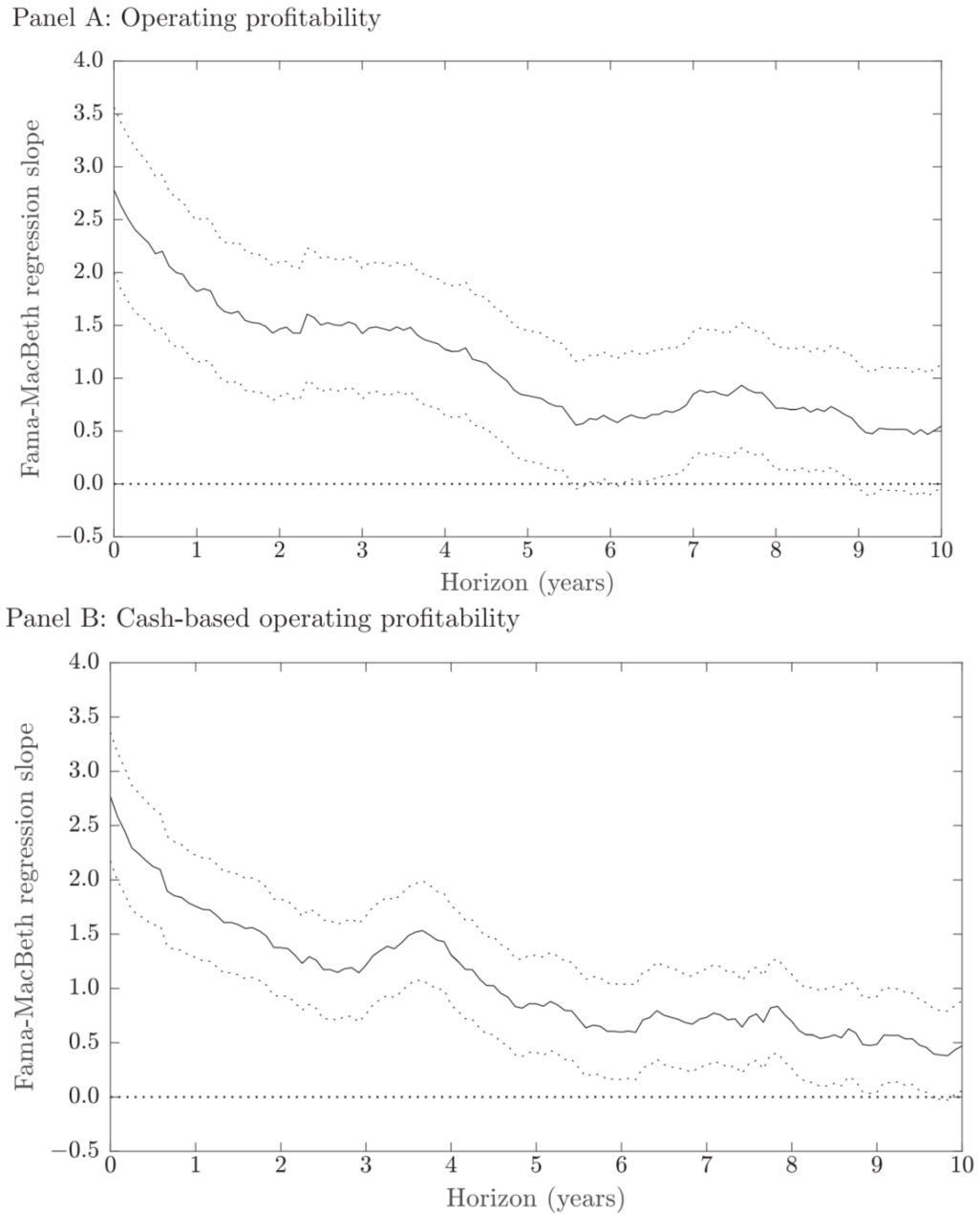
- Data overwhelmingly favor the threefactor model augmented with the cash-based operating profitability factor.

4.3 Maximum ex post Sharpe ratios

#	Optimal weights							Sharpe ratio
	MKT	SMB	HML	UMD	ACC	RMW_{OP}	RMW_{CbOP}	
1	100%							0.39
2	27%	20%	54%					0.75
3	21%	12%	41%	26%				1.06
4	17%	11%	28%	19%	26%			1.12
5	11%	11%	30%	10%		38%		1.40
6	9%	11%	21%	6%	33%	20%		1.54
7	11%	11%	24%	5%			48%	1.67
8	11%	11%	22%	5%	7%		45%	1.69

- The ex post maximum Sharpe ratio is 1.54 if the investor traded the base factors along with the cash-based operating profitability factor.

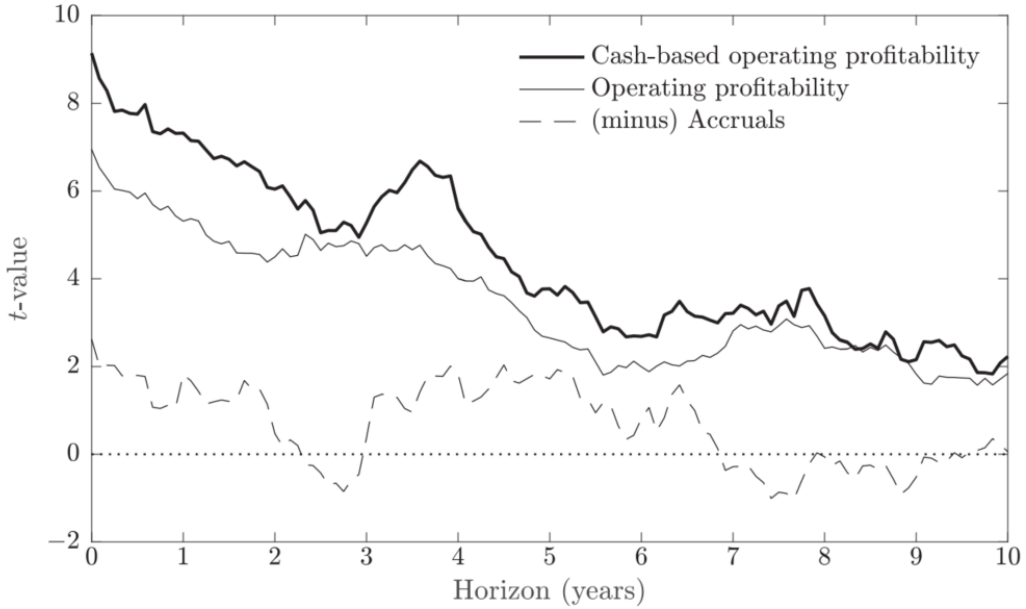
5. Increasing the predictive horizon



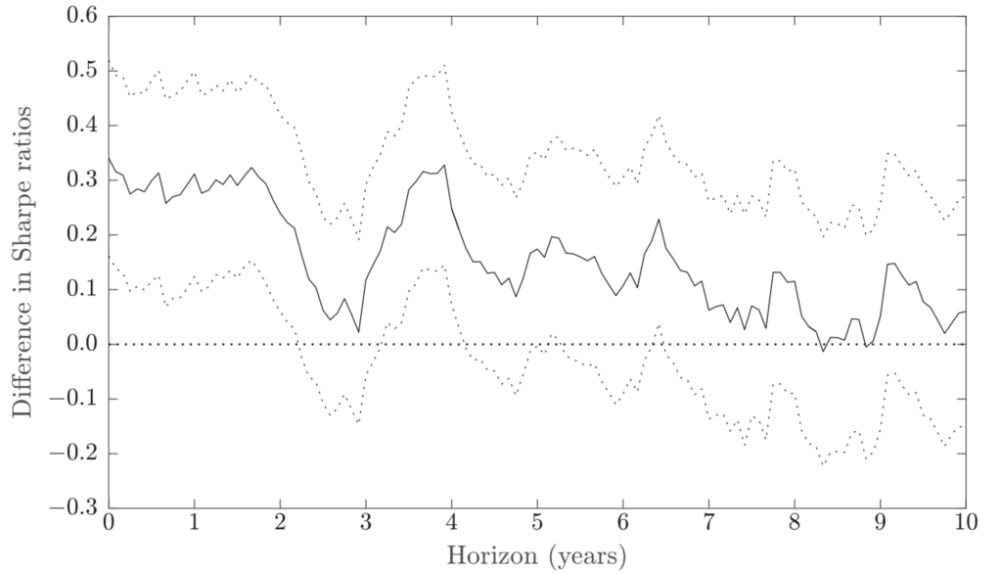
The persistent predictive power is consistent with the profitability variables and expected returns **sharing common economic determinants such as risk** that are relatively stationary over time.

5. Increasing the predictive horizon

Panel D: Comparison of t-values



Panel E: Differences in Sharpe ratios between cash-based operating profitability and operating profitability



- An investor would do significantly better with cash-based operating profitability than operating profitability over at least a four-year horizon.

6. Conclusion

- **Explain the puzzle** that the similar predictive power of net income and gross profit when they are consistently deflated
- **Operating profitability** better explains the cross section of expected returns than **gross profitability**, and net income
- **Cash-based operating** profitability better explains the cross section of expected returns than **operating profitability**, gross profitability, and net income

Reflection

- Which profit indicator is the most representative in the Chinese market? the best forecast for earnings? Is it consistent with foreign countries?