The Magic Formula: Value, Profitability, and the Cross Section of Global Stock Returns

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Abstract

Buying profitable, undervalued stocks and shorting unprofitable, overvalued stocks yields significant return differentials in North America, Europe, Japan, and Asia. Using data from 1991-2016, we test Greenblatt's (2006) "Magic Formula" (MF) and find that a modified MF which uses gross profits as a measure of profitability yields significant abnormal returns for all size groups and in all regions. Results from double sorts and Fama-MacBeth regressions show that MF explains the cross-section of returns in addition to size, book-to-market and momentum.

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Buying profitable, undervalued stocks and shorting unprofitable, overvalued stocks yields significant return differentials in North America, Europe, Japan, and Asia. Using data from 1991-2016, we test Greenblatt's (2006) "Magic Formula" (MF) and find that a modified MF which uses gross profits as a measure of profitability yields significant abnormal returns for all size groups and in all regions. Results from double sorts and Fama-MacBeth regressions show that MF explains the cross-section of returns in addition to size, book-to-market and momentum.

JEL: F21, F30, G10, G11, G12, G15

Keywords: Return predictability, profitability, value, magic formula, cross-section of returns

"What would happen if we decided to only buy shares in good businesses (ones with high returns on capital) but only when they were available at bargain prices (priced to give us high earnings yield)? What would happen? Well, I'll tell you what would happen: We would make a lot of money!"

Joel Greenblatt

The Little Book that Still Beats the Market

1 Introduction

Profitability and value characteristics describe fundamentally different but complimentary dimensions of a firm and therefore explain different aspects of the cross-section of returns. Both valuation metrics, such as book-to-market equity or earnings-to-price, and profitability metrics, such as net income excluding extraordinary items and gross profits-to-assets, have been shown to be significant determinants of the cross-section of returns with value stocks outperforming growth stocks and the stocks of profitable firms outperforming the stocks of unprofitable firms (Ball and Brown (1968), Basu (1983), Fama and French (1992, 1993, 2012), and Asness, Moskowitz, and Pederson (2013), Novy-Marx (2013) among many others). The set of value stocks, however, includes both profitable and unprofitable firms, and the set of profitable firms includes both relatively cheap and expensive stocks. All else equal, it is reasonable to posit that profitable firms selling at relatively cheap prices should yield higher returns than unprofitable firms selling at similarly cheap prices as the former should be more desirable to investors than the latter. Likewise, all else equal, an unprofitable firm selling at relatively expensive price should yield smaller returns than a profitable firm selling at the similarly expensive price as the former should be much less desirable than the latter. This suggests that one would do quite well to long profitable, value (cheap) stocks and short unprofitable, growth (expensive) stocks.

This value-profitability paradigm is quantified by Greenblatt (2006, 2010) who heralds the approach as the "magic formula" for beating the market. Because of the straightforward and unambiguous methodology, Greenblatt's magic formula lends itself to rigorous testing, and if effective, also to easy implementation. In this paper, we test Greenblatt's magic formula for its ability to generate positive risk-adjusted abnormal returns and to explain the cross-section of returns across global developed stock markets.

Following the magic formula (MF) methodology, we construct a portfolio that is long the quintile portfolio of profitable, value stocks (PV) and is short the quintile portfolio of unprofitable, growth stocks (UG) which we refer to as PV-UG. Profitability is defined as the return on capital (EBIT-to-tangible capital employed) and value is defined using the earnings yield (EBIT-to-enterprise value). The PV-UG portfolio is constructed for the four global regions of North America, Europe, Japan, and Asia using stock return data representing twenty-three developed markets over the period January 1991 through December 2016 thus providing four distinct samples in which to test the magic formula. Finding similar results across the four geographic regions increases confidence in the robustness of the results, decreases data mining concerns, and demonstrates a degree of global market integration. Further, as finance practitioners have become more globally focused, understanding how the returns of stocks across global markets are similar and different is of primary interest.

We find that the magic formula, as described by Greenblatt (2006), is not very magical. While PV-UG yields positive and significant risk-adjusted returns in Europe, results are insignificant and sometimes negative in North America, Japan, and Asia. This is quite different from the univariate results reported by Greenblatt for the U.S. market.

Motivated by Novy-Marx (2013), we make one modification to the magic formula. EBIT, the profitability measure used by Greenblatt, is replaced with gross profits, the profitability measure proposed by Novy-Marx.[2] Novy-Marx argues that profitability measures located farther down the balance sheet, such as EBIT, are noisy due to accounting items subtracted from earnings that may not be directly related to expenses incurred to generate revenues. Profitability measures located closer to the top of the income statement, such as gross profits, are therefore cleaner, less noisy measures of a firm's true economic profitability. This claim is not without dissent. Ball, Gerakos, Linnainmaa, and Nikolaev (2015) challenge this assertion and find that different profitability measures, when deflated by the same value, perform similarly regardless of their location on the income statement. Hence, changing EBIT to gross profits in the magic formula can be considered a test of Novy-Marx's profitability hypothesis.

Our analysis of the improved magic formula (IMF) yields a number of interesting new results. First, the four regional value-weighted PV-UG portfolios formed using IMF yield positive and significant univariate return differentials and risk-adjusted abnormal returns for all global regions. Monthly alphas from the Fama-French-Carhart four factor model for North America, Europe, Japan and Asia are 1.19 (t-stat = 3.91), 0.45 (t-stat = 2.08), 0.53 (t-stat = 3.56) and 0.82 (t-stat = 2.74). Profitable, value stocks significantly outperform unprofitable, growth stocks in all regions. Additionally, for the purposes used here, our results suggest that gross-profits is a more powerful predictor of the cross-section of returns than EBIT, consistent with Novy-Marx's (2013) profitability hypothesis.

Second, the PV-UG portfolios constructed using IMF have negative and significant market betas. Estimated market betas for North America, Europe, Japan and Asia are -0.40 (t-stat = -4.33), -0.19 (t-stat = -4.13), -0.07 (t-stat = -1.97) and -0.53 (t-stat = -9.21), respectively. Counter to asset pricing theory, PV stocks yield higher average returns and have lower average betas than

[2] This is the only change made to the methodology. Everything else remains exactly the same.

UG stocks. This finding is related to the low beta anomaly where low beta stocks have been shown to provide higher average returns than high beta stocks (Baker, Bradley, and Wurgler (2011) and Frazzini and Pedersen (2014)). We add to this literature by identifying firm-specific characteristics that yield the same low beta result without having to estimate betas.

Third, we test whether our results are driven by small stocks which tend to be illiquid, have high trading costs, and are often difficult to short. Such a finding would make it challenging to implement any strategy to capture the observed abnormal returns. Results show that PV-UG return differentials are large and statistically significant for both big and small stocks, though spreads are larger within the set of small stocks. This is an interesting result in light of Fama and French (2012) who find returns to value and momentum strategies to be primarily found only in the set of small (microcap) stocks. In contrast, IMF yields positive and significant risk adjusted returns for both small and big stocks.

Last, we test whether size, book-to-market, and momentum are able to explain the relationship between IMF and the cross-section of returns. Results from independent double sorts and Fama-MacBeth regressions suggest that IMF captures a unique dimension of the cross-section of returns. Twenty-five portfolios are constructed by independently double sorting on IMF and market capitalization (size) as well as on IMF and book-to-market equity (B/M). We find significant IMF return differentials for nearly all size and most B/M quintiles. Using the Fama-MacBeth multivariate regression framework, the cross-section of returns is regressed on IMF, size, B/M and momentum. For all regions, IMF is highly significant. This is true whether the test is performed on the set of all stocks or on the subsets of large cap and small cap stocks. Consistent with all previous results, profitable, value stocks yield significantly greater returns than unprofitable, growth stocks. This result is consistent across all four global regions studied here thus demonstrating that the magic formula is indeed magical in its ability to predict the cross-section of returns globally.

2 Magic Formula: The Setup

2.1 Data

Stock return and fundamental data for twenty-three countries are from Datastream for the sample period January 1991 through December 2016 and includes both large and small cap stocks as well as both active and inactive firms.[3] The twenty-three countries represent the developed markets as classified by MSCI. This is the same set of countries studied by Fama and French (2012) with the one exception that our set replaces Greece with Israel. Countries are grouped into four regions:

1. North America – United States and Canada,
2. Europe – Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Israel, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom,
3. Japan
4. Asia – Australia, New Zealand, Hong Kong, and Singapore.

All returns are denominated in U.S. dollars.[4]

2.2 Constructing the Magic Formula

It has long been the investor's goal to purchase high quality, profitable companies at cheap prices. This is the objective of Greenblatt's magic formula. There are a number of econometric

[3] Though Greenblatt (2006, 2010) recommends removing firms related to the financial sector from the data set, we opt to keep all financial stocks in our sample.
[4] Throughout the paper, returns are expressed in U.S. dollars. Issues related to exchange rate risk are assumed away.

methods and accounting measures that could be used to achieve this. To alleviate data mining concerns that would certainly arise if we were to systematically produce results for all possible permutations of methodologies and metrics, we specifically study and implement the approach advocated by Greenblatt (2006, 2010). The MF, as described by Greenblatt, requires two financial ratios. The first is the profitability measure return on capital (ROC) defined as EBIT divided tangible capital employed, the sum of net working capital and net fixed assets. EBIT and net working capital both come directly from Datastream. For net fixed assets, we use property, plants, and equipment also available from Datastream. While different profitability measures have been proposed in the literature, such as return on equity or return on assets, Greenblatt argues that ROC is the appropriate profitability metric. EBIT, since it does not include taxes and interest, is preferred over earnings. Taxes and interest, which do not describe the firm's operating efficiency, can vary substantially across firms and would add substantial noise if included. This is particularly important for international studies where tax and interest rates can differ widely from country to country. The choice of deflator, tangible capital employed, measures the total amount of capital required to conduct the firm's business. Tangible capital employed excludes intangibles, specifically goodwill, which is a historic cost related to acquisitions and therefore has no bearing on the current or future operation of the firm. The more commonly used deflator, total assets, includes intangibles making it a noisier measure of the assets required to operate the company.

The measure of value, earnings yield, is defined as EBIT divided by enterprise value - earnings (before interest and tax) relative to the purchase price of the firm. We use the enterprise value data item available from Datastream. It has already been argued that EBIT is preferred to earnings as in the price-to-earnings valuation ratio. The deflator, enterprise value, is defined as the market value of equity, both common and preferred, plus net interest-bearing debt. Enterprise value takes into account both the market value of the equity and the debt financing used to fund projects that generate earnings for the firm. Including both debt and equity in the denominator makes the metric neutral to differences in capital structure. Other valuation ratios, such as the price-to-earnings ratio, may lead to questionable conclusions when comparing across firms with large differences in capital structure.

For each month t, all N firms within a particular region are ranked from 1 to N based on the ROC observed in month $t-7$. The firm with the highest ROC is given the rank of 1 and the firm with the lowest ROC is given the rank of N. Lagging by seven months ensures that the data is actually available to be used to form portfolios in month t.[5] Firms are then independently ranked from 1 to N based on earnings yields also observed in month $t-7$. The firm with the highest earnings yield (value) is assigned the rank of 1 and the lowest earnings yield firm (growth) is given the rank of N. As the final step, the two rankings are added together to form the MF ranking and all stocks are sorted into quintile portfolios according to MF. Stocks in the first quintile are profitable, value stocks (PV) and the stocks in the fifth quintile are unprofitable, growth stocks (UG). The portfolio formed from longing PV and shorting UG is referred to as PV-UG.

Our implementation of the magic formula modestly deviates from Greenblatt's proposed methodology in two ways. Greenblatt recommends picking the top thirty PV stocks each month and then holding the portfolio for one year thus creating a series of overlapping portfolios. We instead use quintile portfolios that are rebalanced every month. This variation of the methodology leads to a more challenging test of the magic formula. Holding quintile portfolios

[5] Datastream updates accounting variables each June. By lagging seven months, the same value of each accounting item is held constant over the calendar year.

rather than a portfolio of thirty stocks creates less of a distinction between the PV and UG portfolios. Additionally, value strategies often require patience to allow time for the market to realize the quality of undervalued stock. The one-month holding period does not allow much time for the prices of value stocks to reverse. Ultimately, the optimal specification of the magic formula is an empirical issue.

Novy-Marx (2013), in his study of profitability as a predictor of the cross-section of returns, considers a different approach to combining value and profitability. Novy-Marx double sorts all U.S. stocks by gross profits-to-assets (profitability) and book-to-market equity (value) into 5×5 portfolios. Using this approach, the portfolio of profitable, value stocks yields an average excess return of 1.08% while the unprofitable, growth portfolio yields -0.08%. Our study is different as we focus specifically on Greenblatt's MF methodology and its ability to predict the cross-section of returns in global markets.

2.3 Factor Construction

For each region, we consider four region-specific asset pricing factors: the excess return on the value-weighted market portfolio, small minus big market capitalization (SMB), high minus low book-to-market equity (HML), and the winner minus loser momentum factor (WML). Factors are constructed for each region closely following the methodology used by Fama and French (2012). For month t, size is the market capitalization from month $t-1$. For B/M, we use the ratio available on Datastream which computes B/M each month using the currently available book value equity and the current month's market value of equity. For each month t, we use B/M from month $t-7$. Momentum is the cumulative stock return over months $t-12$ to $t-2$.

The market factor, Mkt, is the value-weighted portfolio of all stocks within the region less the return on the three-month U.S. treasury. For the size and B/M factors, SMB and HML, all stocks are sorted into two size and three B/M groups. Small stocks are those in the bottom 10% of market capitalization and big stocks are those in the top 90%. B/M breakpoints are determined by sorting the big stocks into the bottom 30% (growth), middle 40% (neutral), and top 30% (value). The breakpoints are then applied to the sets of small and big stocks to form six value-weighted portfolios: SV, SN, SG, BV, BN, and BG. B and S denote big and small market capitalization stocks, respectively, and V, N and G denote value, neutral, and growth, respectively. SMB is the portfolio SV + SN + SG – BV – BN – BG. For B/M, we construct HML_S = SV – SG which is the high minus low B/M portfolio comprised only of the small stocks and HML_B = BV – BG which is the high minus low B/M portfolio of only big stocks. HML is the average of HML_S and HML_B.

The momentum factor, WML, is constructed in a similar fashion as HML. The set of big stocks are sorted into the bottom 30% (losers, L), middle 40% (neutral, N), and top 30% (winners, W) according to momentum. The momentum breakpoints computed from the big stocks are then applied to both the big and small stocks to create six value-weighted portfolios: SL, SN, SW, BL, BN, and BW. Three momentum portfolios are constructed. WML_S = SW – SL is comprised only of small stocks, and WML_B = BW – BL includes only big stocks. WML is the average of WML_S and WML_B.

2.4 Descriptive Statistics

Year by year descriptive summary statistics are provided in Table 1 for each of the four global regions. On average, the sample includes 11,000 stocks each year distributed across the four regions: 3,499 North American firms, 3,462 European firms, 2,626 Japanese firms, and

1,600 Asian firms. There are large differences in average log market capitalization across regions. North America is by far the largest with average log market cap of 5.71 ($300.65 million), Japan is the next largest with average log market cap 5.25 ($191.03 million). The average log market caps of Europe and Asia are considerably smaller at 4.83 ($125.21 million) and 4.58 ($97.51 million), respectively. There are also substantial cross-region differences in ROC and earnings yield. ROC is on average largest for Europe (14.04%) followed by North America (11.93%), Asia (10.05%), and Japan (9.80%). Europe has the largest earnings yield, 7.77%, followed by Japan (6.99%), Asia (5.96%), and North America (5.94%).

3 Magic Formula Results

3.1 The Not So Magical Magic Formula

Greenblatt (2010) provides year by year results from 1988 to 2004 that demonstrate the superiority of his magic formula relative to both the S&P 500 and an equal-weighted portfolio of 1000 U.S. stocks. Using a sample of U.S. stocks, he reports an average annual return of 30.8% for his magic formula compared to an average annual return of 11.7% for the portfolio of 1000 stocks and 12.4% for the S&P 500. We test the magic formula using four distinct and well-defined global regions; hence, this can be considered a set of independent out-of-sample tests of the magic formula. Further, as asset managers have become more globally focused, understanding how MF performs globally is of great interest.

Following the MF methodology, we conduct univariate tests of the magic formula by sorting all stocks in each region equally into quintiles. Profitable, value (PV) stocks comprise the 1st quintile and unprofitable, growth stocks comprise the 5th quintile. Both equal-weighted and value-weighted portfolios are formed from the stocks within each quintile. Table 2 lists the results of the univariate sorts for each region. The table includes average monthly portfolio returns, both value- and equal-weighted, as well as the average size, B/M, market share, and number of stocks for each quintile portfolio. The columns labeled EW and VW are the average monthly returns of the equal-weighted and value-weighted portfolios, respectively. Size is the average log market capitalization of the portfolio, B/M is the average book-to-market equity, M-Shr is the average fraction of total market capitalization captured by the stocks in the portfolio, and N is the average number of stocks in each portfolio.

We begin by first describing the characteristics of the PV and UG portfolios. There is a large difference in market capitalization between the two extreme portfolios. PV firms are on average much larger than UG firms. This is best seen from the M-Shr column. Stocks in the PV portfolio account for 30% of the North American market (Panel A) compared to only 4% for the UG stocks. This holds consistently across all regions – 20% vs 6% for Europe, 17% vs 11% in Japan, and 19% vs 4% in Asia. If we consider size as a proxy for liquidity, then PV stocks appear to more liquid than UG stocks. What is surprising is the difference in B/M across PV and UG portfolios. Since stocks are sorted by their valuation using the earnings yield measure, it would be reasonable to assume that PV stocks would have greater B/M than UG stocks. This is not the case. On average there is little difference in B/M between the portfolios. Average B/M for North America PV is 0.49 as compared to 0.48 for UG. There is some difference in Japan with B/M being a little larger for UG relative to PV, but in Asia, PV has on average greater B/M relative to UG. Last, we see that each portfolio holds an equal number of stocks which range from 320 to 700 depending on the region. As previously discussed, this is a departure from Greenblatt who recommends holding just 30 stocks in the PV portfolio.

Does the magic formula live up to its name? Table 2 clearly shows that it does not. Beginning in North America, Panel A, the PV-UG spread is -0.36% when equal-weighting and is

0.29% when value-weighting. Not only are both values statistically indifferent from zero, the equal-weighted result has the wrong sign. Similar results are found for Japan and Asia. Japan's equal-weighted and value-weighted return differentials, PV-UG, are -0.03% and 0.11%, respectively, and for Asia they are 0.09% and 0.41%, respectively. All return differentials are statistically insignificant. The one bright spot in Table 2 is found in Europe, Panel B. The equal-weighted PV-UG portfolio yields a statistically significant return of 0.95% per month (t-stat = 4.75) and the value-weighted portfolio yields 0.59% per month (t-stat = 2.14).

Table 2 also lists risk-adjusted returns estimated using three different empirical asset pricing models. The first is Sharpe's (1964) single factor Capital Asset Pricing Model (CAPM) that uses Mkt as the market portfolio. Next is the Fama-French three-factor model (FF) that includes regionally-defined SMB and HML factors in addition to Mkt (Fama and French (1993)). We also use the Fama-French-Carhart four factor model (FFC) that includes the region-specific UMD (up minus down momentum) factor in addition to the Fama-French three factors (Carhart (1997)). The intercept, alpha, from regressing PV-UG on the different sets of factors is reported in Table 2 along with their Newey-West t-statistics.

Alpha, when using the equal-weighted European PV-UG is large and highly significant for all three model specifications. Specifically, the FFC EW monthly alpha is 0.67% with a t-statistic of 4.16. For the value-weighted results, while alpha remains large and significant when using the CAPM and FF, but alpha loses significance when using the four factor FFC model. For North America, Japan, and Asia, alpha is nearly always indistinguishable from zero.

The overall results presented in Table 2 are different from the results presented by Greenblatt. The magic formula is not very magical when applied to global stock returns over our

1991-2016 sample period. While results are quite strong for Europe, the strategy is not successful in North America, Japan, and Asia. Moreover, return differentials are sometimes even negative, specifically for the equal-weighted PV-UG portfolio in North America and Japan. These results are subject to the joint hypothesis problem. The failure of Greenblatt's MF may be due to an ineffectual strategy, or it may be a result of our particular implementation of the strategy. For example, rebalancing annually rather than monthly may provide the necessary time for the market to identify the undervalued, profitable stocks and then to act on the information.

3.2 A Much More Magical, Magic Formula

Recent research on profitability may help resurrect the magic formula. Novy-Marx (2013) argues that profitability measures located farther down the income statement are "polluted." Hence, the cleanest measure of the true economic profitability must be one found at the top of the income statement – gross profits (GP), defined as revenues less cost of goods sold. This suggests that we may be able to resurrect Greenblatt's MF by using GP instead of EBIT as the measure of profitability.

Novy-Marx's claim is not without challenge. Ball, Gerakos, Linnainmaa, and Nikolaev (2015) argue that Novy-Marx's conclusion is founded on the flawed comparison between GP-to-assets and earnings-to-book equity. Since both the profitability measures and their deflators differ across the two ratios, it is unclear whether the superiority of GP-to-assets is due to the choice of profitability measure, GP vs earnings, or the choice of deflator, assets vs book equity. Ball, et al. find that GP performs as well as other profitability measures regardless of where they appear on the income statement when the same deflator is used.

In this section, we test a variation of MF referred to as the Improved Magic Formula (IMF). The only difference between MF and IMF is the replacement of EBIT with GP in both the profitability and value measures. Instead of EBIT-to-enterprise value, we now use GP-to-enterprise value as the valuation measure, and instead if EBIT-to-tangible capital employed, we now use GP-to-tangible capital employed. Consistent with the initial construction methodology, we use GP from month $t-7$ to ensure its availability at time t. All other parts of the MF methodology remain the same.

Table 3 lists the results for IMF. Looking first at the portfolio characteristics, we find no clear relation between the market capitalizations of the PV and UG portfolios. For North America and Europe, the average market share (M-Shr) of PV is nearly the same as UG – 12% vs 9% for North America and 13% vs 11% for Europe. In Japan, M-Shr is much larger for UG, but in Asia, M-Shr is much larger for PV. This is different relative to MF where we found the UG portfolios to be comprised of much smaller stocks than the PV portfolios. Similar to our result for MF, we do not find any consistent relation between the PV and UG portfolios with B/M. B/M is a little larger for PV than UG for North America, Japan, and Asia, but UG has a larger average B/M in Europe.

Unlike with MF, IMF yields significant return differentials between the PV and UG portfolios. Whether equal-weighted or value-weighted, the PV-UG return differentials are positive, economically large, and statistically significant for all countries except Asia. The value-weighted monthly PV-UG return differentials for North America, Europe, Japan and Asia are 0.88% (t-stat = 2.74), 0.65% (t-stat = 3.25), 0.66% (t-stat = 3.98), and 0.62% (t-stat 1.50), respectively. While the differential is not significant in Asia, the magnitude of the spread is on par with Europe and Japan. The lack of significance is due to the higher volatility we observe in the return data. Surprisingly, for all regions except Europe, the PV-UG spreads are larger when value-weighting than when equal-weighting.

Alphas from the CAPM, FF, and FFC models for both the equal-weighted and value-weighted PV-UG portfolios are listed at the bottom of each panel in Table 3. We observe that alphas are significant for nearly all model specifications and for both value- and equal-weighted portfolios. For North America, Europe, Japan and Asia, the value-weighted monthly alphas from the FFC model are 1.19% (t-stat = 3.91), 0.45% (t-stat = 2.08), 0.53% (t-stat = 3.56), and 0.82% (t-stat = 2.74), respectively. As a comparison, Petajisto (2013) reports average U.S. mutual fund alphas over the 1990-2009 period of 0.31% annually (0.02% monthly), and Joenväärä, Kosowski and Tolonen (2016) find that U.S hedge funds earn an annual alpha of 4.00% (0.14% monthly) over the period 1994-2012. The simple strategy of sorting by profitability and value greatly outperforms the average actively managed mutual fund and hedge fund, and the consistency in results across models and across regions provides great confidence in the ability of IMF to generate returns above what is expected as compensation for risk.

The alphas reveal another interesting and surprising result - alphas when value-weighting tend to be larger than the alphas when equal-weighting. This is the case for all regions except Europe and it implies that the observed risk adjusted returns are not a result of a small firm effect. Instead, large cap stocks contribute significantly to the alpha. This is different from what is generally found in the empirical asset pricing literature. For example, Fama and French (2012) find that the value premium and momentum returns are only significant within the set of small capitalization stocks. We investigate the relation between size and IMF in greater detail in the next section.

Regarding the debate on whether GP has greater predictive power than profitability measures located farther down the income statement. When using EBIT, MF fails to generate significant abnormal returns that are consistent across global regions; however, when we use GP instead of EBIT, the results are indeed magical. Alphas using GP are economically large and statistically significant, and the results are consistent across all four global regions. Hence, in the context of the magic formula, Novy-Marx's (2013) gross profits profitability measure, located at the top of the income statement, outperforms EBIT which is located farther down the income statement. It is important to note that the comparison is fair since only the one change was made in the methodology. Specifically, we use the same deflators for both the profitability and value measures when comparing MF to IMF.

3.3 Sensitivity to Risk Factors

Table 4 lists the estimated factor loadings from regressing the value-weighted PV-UG portfolios on the FFC four factors. The alphas presented in Table 4 are the same as those listed in Table 3. The estimate coefficients inform us on the general characteristics of the PV-UG portfolios. Loadings on HML are positive for all regions but tend to be negative for SMB with the exception of Japan. The relation with momentum is ambiguous with some coefficients being positive while others negative. This suggests that the PV-UG portfolios constructed using IMF have properties similar to large cap, value portfolios.

The most significant results from Table 4 are the negative coefficients on the regional value-weighted market portfolios. The PV-UG portfolios have negative market beta. The market beta for North America is -0.40 which is highly significant with a t-statistic of -4.33, and for Europe, Japan, and Asia, the market betas are -0.19 (t-stat = -4.13), -0.07 (t-stat = -1.97), and -

0.53 (t-stat = -9.21). Profitable, value stocks have smaller betas but yield larger returns relative to unprofitable, growth stocks. This contradicts fundamental asset pricing theory which associates high expected returns with high risk.

This result is related to the literature on the low-beta, low-volatility anomaly. The PV portfolios yield large average returns and have smaller betas than the UG portfolios which yield smaller average returns but have larger betas. Baker, Bradley, and Wurgler (2011) find evidence of the low-volatility, low-beta anomaly over the long sample period extending from 1968 through 2008, and they find that the result is robust to risk measure and stock size. Frazzini and Pedersen (2014) show that the low-beta anomaly not only exists in the U.S. stock market, but also in international equity markets, equity indices, commodities, country bonds, and foreign exchange. They theorize that the anomaly is due to leverage aversion. Whereas classic asset pricing theory asserts that investors with low aversion to risk will leverage the portfolio with maximum Sharpe ratio to achieve higher expected returns; the leverage aversion theory argues that investors will avoid leverage and will instead tilt their portfolios toward high beta stocks and away from low beta stocks to achieve high expected returns. The shift in demand leads to an increase in expected returns for the less desirable low beta stocks and a decrease in expected returns for high beta stocks. Our results add a new dimension to this theory. Investors who overweight high beta stocks may also be overweighting expensive, unprofitable stocks at the expense of holding cheap, profitable stocks.

3.4 Dissecting the Magic Formula

As both profitability and value have been shown to individually explain the cross-section of returns, it seems pertinent to ask whether it is profitability or value that is driving the performance of IMF. To do this, we look at both components separately. All stocks within each region are sorted into quintile portfolios according to the profitability and value measures, GP-to-tangible capital employed and GP-to-enterprise value. For profitability, we long the value-weighted quintile portfolio of profitable stocks (P) and short the quintile portfolio of unprofitable stocks (U) to form the P-U portfolio. Similarly for value, we long the quintile portfolio of stocks that are relatively undervalued (V) and short the quintile of overvalued stocks (G) which we denote as the V-G portfolio. The portfolios P-U and V-G are then regressed on the four factors of the FFC model. Factor sensitivities are provided in Table 5 with profitability results in Panel (A) and value results in Panel (B).

The P-U portfolio, Panel A, yields economically and statistically significant alphas for all regions. Depending on the region, alphas range from 0.55% (Europe) to 1.16% (North America). The large alphas are consistent with the profitability results found by Novy-Marx (2013) for the U.S. market. Market betas as well as the factor loadings on SMB and HML all tend to be negative with large t-statistics. This implies that the P-U portfolio behaves similar to a large cap, growth portfolio while being counter-cyclical to the market.

From Table 5, Panel (B), value yields smaller and less significant alphas relative to profitability. Alphas are larger and significant for North America and Asia, but are much smaller and have lower t-statistics for Europe and Japan. Market betas again tend to be negative and significant. What is particularly interesting are the loadings on SMB and HML. Whereas the SMB and HML factor sensitivities tend to be negative for P-U, they are mostly positive for V-G. Hence, when the profitability and value measures are combined to construct the PV-UG portfolio, the sensitivities to HML and SMB offset each other making the PV-UG less sensitive to both factors. At the same time, since market betas are negative for both P-U and V-G, combining the two measures strengthens the negative sensitivity of PV-UG to the market as seen by the larger t-statistics on the PV-UG market beta in Table 4 (except for Japan).

Take North America as an example. The market beta for profitability and value are -0.31 (t-stat = -3.50) and -0.30 (t-stat = -3.34). The market beta for the PV-UG from Table 4 is -0.40 with a larger t-statistic of -4.33. Profitability and value are both highly sensitive to HML but with opposite signs, -0.46 (t-stat = -4.04) for profitability and a sensitivity of 0.68 (t-stat = 4.52) for value. The diversification effect leads to a PV-UG portfolio that is less sensitive to HML. From Table 4, the factor sensitivity of PV-UG to HML is 0.13 (t-stat = 0.81), which is approximately the average of the sensitivities of the two individual characteristics. We see a similar result with SMB. The coefficient on SMB for P-U and V-G are -0.73 and 0.16, respectively. From Table 4, the loading on SMB for PV-UG is -0.27 which is a reduction in exposure relative to profitability and it is the opposite sign relative to value.

In addition to the changes in risk characteristics, combining the two characteristics also pays in terms of risk adjusted returns. Comparing alphas in Tables 4 and 6, for all regions except Asia, PV-UG provides greater risk adjusted returns than the value portfolio but provides similar alphas relative to profitability. Altogether, the PV-UG portfolio maintains the large alpha from sorting on profitability but profitability is highly sensitive to HML and SMB. Combining profitability with value, which also has positive alphas, changes the risk characteristics by decreasing the sensitivity to both SMB and HML. PV-UG behaves like a large cap, value portfolio with less sensitivity to the size factor (SMB) relative to the profitability portfolio and less sensitive to the value factor (HML) relative to the value portfolio. The magic of the magic formula comes from the diversification of risk that is realized from combining the two characteristics. Both characteristics predict the cross-section of returns, but portfolios formed from the two characteristics have opposite sensitivities to asset pricing factors.

4 Double Sorts

4.1 Double Sort on IMF and Size

A concern with the magic formula is whether it is actually tradeable. Fama and French (2012), for example, find significant returns to value and momentum internationally, but the results are primarily focused in the set of small stocks where trading costs and illiquidity likely make strategies based on the results unprofitable. Novy-Marx (2013) considers a strategy similar to MF using the sample of large and highly liquid Fortune 500 stocks and finds a statistically significant 0.37% alpha. We now ask whether the large risk-adjusted returns are driven by small, illiquid stocks or whether they are also obtainable by trading large cap, liquid stocks.

All stocks within each region are independently double sorted into twenty-five value-weighted portfolios according to market capitalization and IMF. Portfolios are rebalanced each month and the monthly average excess returns are provided in Table 6.[6] We additionally provide the 1-5 portfolio average return for IMF, the 5-1 average portfolio return for size. The row labelled as 'Mean' is the column average. All t-statistics are Newey-West.

The 1-5 IMF return differentials are significant for nearly all size groups across all regions. Most importantly, the average spreads are significant for the set of big stocks. For the 5th quintile size group, big stocks, IMF spreads are 0.56%, 0.51%, 0.43%, and 0.18% for North America, Europe, Japan, and Asia, respectively, which are significant for all regions except Asia. Fama and French (2012) find that value and momentum returns decrease with size. We find the similar

[6] All double sorted average returns presented in this section are excess of the three-month U.S Treasury rate.

result with IMF. With return differentials for the smallest quintile for North America, Europe, Japan, and Asia of 0.88%, 0.81%, 0.13%, and 0.73%, respectively, spreads are larger within the set of small stocks for all regions except Japan.

Risk adjusted alphas are also found to be significant for big stocks as well as for small stocks. All stocks within each region are divided equally into big and small subsamples according to market capitalization. The two portfolios PV-UG_B and PV-UG_S are constructed from the stocks within each set. Table 7 shows the estimated coefficients obtained from regressing PV-UG_B and PV-UG_S on the region specific FFC four factors. Whether big stocks (Panel A) or small stocks (Panel B), alphas are positive and significant with the alphas for PV-UG_S being larger than the alphas for PV-UG_B. Similar to the results using the full set, market betas are negative and significant for both size groups. Market betas are also very similar in magnitude across the two size groups suggesting that PV-UG_B. Additionally, loadings on SMB and HML continue to be close to zero and are often insignificant for both big and small subsets.

4.2 Double Sorts on IMF and Book-to-Market Equity

Value is one of the two fundamental inputs into IMF, it is possible that conditioning on the widely used book-to-market equity measure of value may subsume the IMF performance results. To check for this possibility, stocks are independently double sorted into twenty-five portfolios by book-to-market equity and IMF. Table 8 reports the average monthly returns for the twenty-five portfolios.

Starting in Panel A of Table 8, the 5-1 book-to-market spreads in North America tend to be small and insignificant while IMF leads to larger spreads with larger t-statistics. Even when controlling for variation in B/M, IMF return differentials tend to be economically large, ranging from 0.31% to 0.82%, though not always significant. Results are similar for Europe and Asia. For Europe, all IMF return differentials are economically large, ranging from 0.37& to 0.87% and are all significant – at the 10% level for the 5th B/M quintile and at the 5% level or higher for all other B/M quintiles. Meanwhile, the B/M spreads are significant for three of the five IMF quintiles – marginally significant for IMF quintile 4 and higher levels of significance for IMF quintiles 1 and 5. In Asia, IMF return differentials range from 0.30% to 1.19% with three spreads being significant at the 10% level or higher. B/M 5-1 returns are also large and often significant. Japan is a little different in that both IMF and B/M return differentials tend to be highly significant.

The results presented here are interesting. IMF sorts stocks according to both value and profitability. Though B/M and GP-to-enterprise value are both measures value, our previously reported results in Table 3 do not show a strong or consistent relationship between B/M and IMF quintiles. That we find significant return differentials for both IMF and B/M is further evidence that IMF and B/M capture different dimensions of the cross-section of returns.

4.3 Fama-MacBeth Regressions

To further show the differences between IMF and the FFC factors, we use the Fama and MacBeth (1973) multivariate regression framework to determine whether IMF explains the cross-section of returns in addition size, B/M, and momentum. For each month t, we regress the cross-section of returns for each region on a set of four characteristics. These include the log market capitalization (size) measured at time $t-1$, the log book-to-market equity (B/M) from time $t-7$, and momentum (MOM) computed as the cumulative return over $t-12$ to $t-2$. We additionally add the log of IMF – the sum of the rankings on the profitability and value measures. Table 9 presents results for the set of all stocks. Results are also provided for the 50% of stocks with the smallest market capitalization (small stocks) and the 50% of stocks with the largest market capitalization (big stocks).

Table 9 shows that IMF is an important determinant of the cross-section returns. The results are consistent across all regions as well as for the sets of all stocks, small cap stocks, and large cap stocks. The negative coefficient on log IMF shows that PV stocks yield higher returns than UG stocks which is consistent with all previous results. The estimated coefficient on log IMF is significant for all cases except for small stocks in Japan.

Estimated coefficients on size, B/M, and momentum are generally as expected. With the exception of Japan, momentum tends to have a positive coefficient and is statistically significant for the set of all stocks, small stocks, and big stocks in Europe and Asia. Momentum is not significant in North America regardless of the size subsamples. B/M is positive and highly significant in all cases showing that value stocks tend to outperform growth stocks. Size yields mixed results. The size coefficient is negative and highly significant within the set of small stocks; however, the coefficient tends to be positive, much closer to zero, and sometimes insignificant within the set of big stocks. Overall, IMF is significant with the expected sign while accounting for other characteristics widely known to explain the cross-section of returns. This provides additional confidents that IMF captures a unique dimension of returns not captured by the FFC factors.

5 Conclusion

Greenblatt's (2006, 2010) magic formula recognizes and exploits the complimentary characteristics of value and profitability. It is well known that value stocks outperform growth stocks (Fama and French (1992) and (1993)), and it has been shown that profitable stocks outperform unprofitable stocks (Novy-Marx (2013)); however, value stocks may be either profitable or unprofitable, and profitable stocks may be either cheap or expensive. Assuming the market is efficient, it is more likely that the price of an inexpensive, profitable stock will trend upward than the price of an inexpensive, unprofitable stock, and in the same way, it is more likely that the price of an expensive, unprofitable stock will fall than the price of an expensive, profitable stock. Combining the two characteristics together yields an intuitively appealing strategy that is missed when focusing on only one of the two characteristic. This paper explicitly tests Greenblatt's magic formula to determine whether it is indeed magical.

Our sample includes twenty-three developed markets divided into the four regions of North America, Europe, Japan, and Asia, and it extends from January 1991 through December 2016. Our empirical results do not show global support for the magic formula using the measures of profitability and value prescribed by Greenblatt – EBIT-to-tangible capital employed (return on capital) and EBIT-to-enterprise value (earnings yield). Return differentials from portfolios sorted using the magic formula methodology are insignificant as are the risk-adjusted alphas from the Fama-French-Carhart model for North America, Japan, and Asia. Return differential are only significant in Europe.

The magic formula, however, is easily resurrected by simply replacing EBIT with gross profits (GP). Novy-Marx (2013) claims GP to be a cleaner measure of economic profitability than EBIT. Motivated by this, we substitute GP for EBIT and construct the new measures GP-to-tangible capital employed for the profitability measure and GP-to-enterprise value as our valuation measure. Contributing to the debate on the superiority of GP over other profitability measures located farther down the income statement (Novy-Marx (2013), Ball et al (2015)), we find that this substitution leads to results that are much more magical. Profitable value (PV) stocks significantly outperform unprofitable growth (UG) stocks, and with return differentials (PV-UG) of 0.88%, 0.65%, 0.66%, and 0.62% for North America, Europe, Japan, and Asia, respectively, the results are consistent and strong across all regions.

We provide a number of additional results that support our primary conclusions. While PV-UG yields larger returns within the set of small stocks, spreads are also significant within the quintile of large market cap stocks. Double sorts on IMF and book-to-market equity show that IMF captures a different dimension of the cross-section of returns than the book-to-market value measure. Both book-to-market and IMF yield significant return differentials. Last, using the Fama-Macbeth regression framework, we show that IMF explains the cross-section of returns in addition to size, book-to-market equity, and momentum. This is shown using the sample of all stocks, small stocks, and big stocks. The multivariate regressions confirm that low IMF (profitable, value), small market cap, high book-to-market, and high momentum are predictors of high returns.

Though the magic formula measures prescribed by Greenblatt do not hold up globally, a modest tweak motivated by the asset pricing literature yields a magical formula for predicting the cross-section of returns. While we attempt to stay close to Greenblatt's original formula in this paper, further tweaking may lead to even stronger results. Some possibilities may be to use different profitability and value measures, double sorting instead of taking the sum of two ranks, or sorting into deciles instead of quintiles. Overall, our results confirm Greenblatt's value and profitability paradigm and provide strong and consistent evidence that it is globally magical.

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Table 1: Descriptive Statistics

Twenty three countries are divided into four regions: North America (United States and Canada), Europe (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom), Japan, and Asia (Australia, New Zealand, Hong Kong, and Singapore). For each year, this table lists the average log market capitalization (size), book-to-market equity (B/M), return on capital (ROC), earnings yield (EY), and the number of firms for each region. ROC is EBIT divided by the sum of net working capital and net fixed assets. EY is EBIT divided by enterprise value. The last row is the time-series average across all years.

	North America					Europe					Japan					Asia				
	Size	B/M	ROC	EY	N	Size	B/M	ROC	EY	N	Size	B/M	ROC	EY	N	Size	B/M	ROC	EY	N
1991	5.47	0.83	16.27	10.46	1821	4.50	0.86	19.31	12.20	2697	6.50	0.37	17.49	5.26	1260	5.23	1.00	21.16	12.18	248
1992	5.60	0.71	14.67	9.16	1893	4.45	0.93	14.63	11.54	2819	5.95	0.47	15.92	6.32	1582	5.26	0.90	16.86	10.11	279
1993	5.72	0.65	14.10	7.85	2036	4.44	1.08	13.77	10.31	2869	5.99	0.62	13.45	6.68	1756	5.36	0.87	16.10	8.81	320
1994	5.77	0.58	14.34	7.64	2159	4.73	0.78	12.63	8.98	2932	6.13	0.53	11.33	5.46	1807	5.65	0.70	15.07	7.65	343
1995	5.71	0.61	15.29	8.09	2499	4.79	0.72	14.61	8.89	3024	6.01	0.56	9.77	4.65	1883	5.50	0.80	15.76	7.62	382
1996	5.68	0.56	16.22	8.25	2914	4.88	0.75	15.58	10.02	3046	6.00	0.61	8.98	5.06	1979	5.46	0.84	15.23	8.20	482
1997	5.77	0.55	15.56	7.50	3144	4.91	0.72	14.93	9.46	3216	5.54	0.65	8.81	4.97	2047	5.38	0.80	13.74	7.33	612
1998	5.76	0.48	15.45	6.97	3250	4.86	0.63	14.75	8.84	3498	5.07	1.03	8.76	5.67	2080	4.66	0.94	12.87	7.11	681
1999	5.64	0.63	15.18	6.62	3305	4.74	0.71	15.78	8.59	3599	5.12	1.26	7.21	5.66	2385	4.67	1.49	10.65	7.64	720
2000	5.67	0.66	14.04	6.39	3362	4.79	0.70	14.60	7.94	3635	4.95	1.20	6.59	5.08	2717	4.66	1.06	10.02	6.42	774
2001	5.54	0.73	13.78	6.31	3437	4.51	0.73	13.48	6.93	3822	4.71	1.35	6.83	5.36	2794	3.97	1.17	9.61	6.43	1020
2002	5.51	0.71	11.52	5.31	3508	4.30	0.82	11.94	6.35	3919	4.52	1.46	6.45	5.56	2861	3.54	1.17	5.73	4.21	1487
2003	5.61	0.79	10.27	5.75	3512	4.39	1.03	10.88	6.56	3679	4.59	1.60	6.19	5.51	2937	3.46	1.25	4.00	3.64	1809
2004	5.97	0.58	11.29	5.30	3628	4.83	0.79	10.80	6.62	3553	5.01	1.27	8.01	6.79	2984	3.83	0.89	5.51	4.15	1921
2005	6.08	0.54	13.84	5.66	3705	5.02	0.68	12.65	6.79	3537	5.21	1.03	9.85	7.17	3105	3.91	0.84	8.84	5.56	2086
2006	6.04	0.60	14.00	5.44	3952	5.11	0.63	14.89	6.74	3692	5.28	0.81	10.43	6.46	3234	4.05	0.84	9.61	5.73	2266
2007	5.95	0.67	13.56	5.36	4204	5.24	0.62	17.39	6.48	4001	5.06	0.89	12.08	7.51	3315	4.53	0.76	10.95	5.58	2391
2008	5.59	0.67	12.11	5.03	4282	4.86	0.71	18.30	6.76	4213	4.79	1.10	12.54	9.08	3318	4.18	0.67	11.78	4.52	2565
2009	5.19	1.08	8.57	5.01	4265	4.50	1.23	14.77	8.07	4064	4.71	1.58	9.30	8.93	3152	3.86	1.39	7.13	4.92	2558
2010	5.55	0.83	3.91	2.29	4334	4.79	1.08	9.90	5.56	3881	4.84	1.48	5.14	5.34	3098	4.37	0.99	2.59	1.75	2645
2011	5.71	0.73	8.10	4.36	4400	4.96	0.98	13.32	6.75	3760	4.99	1.53	9.03	9.60	3008	4.57	0.92	7.82	4.86	2720
2012	5.55	0.76	9.03	4.94	4460	4.84	1.05	14.76	7.45	3632	5.00	1.55	8.97	10.58	2936	4.38	1.14	7.06	4.85	2769
2013	5.58	0.87	7.87	4.41	4438	5.05	1.08	12.81	6.94	3450	5.10	1.50	9.07	10.97	2910	4.41	1.19	5.21	3.95	2744
2014	5.81	0.84	7.18	3.62	4336	5.31	1.05	12.55	5.89	3331	5.16	1.26	10.26	9.76	2999	4.55	1.16	5.20	3.89	2677
2015	5.82	0.83	7.46	3.51	4251	5.29	1.11	12.53	5.75	3243	5.16	1.13	10.99	9.31	3074	4.65	1.09	6.01	3.96	2664
2016	6.04	1.03	6.58	3.33	3872	5.46	1.13	13.60	5.62	2891	5.19	1.12	11.38	9.08	3061	4.91	1.19	6.67	3.83	2424
Mean	5.71	0.71	11.93	5.94	3499	4.83	0.87	14.04	7.77	3462	5.25	1.08	9.80	6.99	2626	4.58	1.00	10.05	5.96	1600

Table 2: The Magic Formula

In each month t and for each region (North America, Europe, Japan, and Asia), stocks are ranked by return on invested capital and by EBIT to enterprise value (EBIT/EV). The two rankings are then added together to form a combined rank and the stocks are sorted into quintiles according to the combined ranking using the 20, 40, 60, and 80 percentile breakpoints. Time t returns of the equal-weighted (EW) and value-weighted (VW) portfolios comprised of the stocks in each quintile are averaged across all month from January 1991 to December 2016. Size is the average log market capitalization, B/M is the average book-to-market equity, M-Shr is the fraction of the total market capitalization in each quintile, and N is the number of stocks. The return difference between the 1st and 5th quintiles (PV-UG) is reported. Alphas are the risk adjusted return from regressing the PV-UG portfolio returns, both EW and VW, on the regional market portfolio (CAPM), on the market, SMB, and HML (FF), and on the market, SMB, HML, and momentum (FFC). Newey-West t-statistics are reported in parentheses.

	Panel A: North America						Panel B: Europe					
Quintile	EW	VW	Size	B/M	M-Shr	N	EW	VW	Size	B/M	M-Shr	N
1 (PV)	1.50	1.10	6.21	0.49	0.30	700	1.28	0.99	4.75	0.56	0.20	693
2	1.33	0.90	6.58	0.48	0.34	700	1.03	0.90	5.37	0.56	0.33	692
3	1.33	0.84	6.35	0.54	0.22	700	0.85	0.75	5.32	0.62	0.27	692
4	1.32	0.71	5.23	0.59	0.11	700	0.58	0.56	4.52	0.73	0.14	692
5 (UG)	1.86	0.81	4.01	0.48	0.04	700	0.34	0.40	3.48	0.61	0.06	692
PV-UG	-0.36	0.29					0.95	0.59				
	(-0.94)	(0.76)					(4.75)	(2.14)				
	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}
Alpha	-0.07	-0.21	-0.18	0.70	0.47	0.46	1.01	0.92	0.67	0.74	0.61	0.24
	(-0.19)	(-0.65)	(-0.56)	(1.93)	(1.77)	(1.63)	(5.43)	(5.61)	(4.16)	(3.07)	(2.68)	(0.87)

	Panel C: Japan						Panel D: Asia					
Quintile	EW	VW	Size	B/M	M-Shr	N	EW	VW	Size	B/M	M-Shr	N
1 (PV)	0.75	0.47	5.03	0.87	0.17	526	1.52	1.09	4.74	0.73	0.19	320
2	0.61	0.42	5.30	0.92	0.27	525	1.20	0.95	5.15	0.74	0.34	320
3	0.49	0.21	5.29	0.96	0.25	525	1.13	0.87	5.02	0.86	0.32	320
4	0.53	0.37	5.12	1.01	0.21	525	1.00	0.71	4.13	0.77	0.11	320
5 (UG)	0.77	0.36	4.43	1.01	0.11	525	1.42	0.67	3.15	0.67	0.04	320
PV-UG	-0.03	0.11					0.09	0.41				
	(-0.16)	(0.45)					(0.34)	(1.09)				
	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}
Alpha	-0.01	0.09	0.00	0.13	0.25	0.25	0.27	0.08	0.12	0.65	0.42	0.66
	(-0.06)	(0.60)	(-0.01)	(0.52)	(1.08)	(1.08)	(1.04)	(0.32)	(0.55)	(1.92)	(1.20)	(2.53)

Table 3: Univariate Sorts – The Improved Magic Formula (IMF)

In each month t and for each region (North America, Europe, Japan, and Asia), stocks are ranked by gross profits-to-tangible capital employed and by gross profits-to-enterprise value. The two rankings are then summed to form a combined rank. Stocks are sorted into quintiles according to the combined ranking using the 20, 40, 60, and 80 percentile breakpoints. Time t returns of the equal-weighted (EW) and value-weighted (VW) portfolios comprised of the stocks in each quintile are averaged across all month from January 1991 to December 2016. Size is the average log market capitalization, B/M is the average book-to-market equity, M-Shr is the fraction of the total market capitalization in each quintile, and N is the number of stocks. The return difference between the 1st and 5th quintiles (PV-UG) is reported. Alphas are the risk adjusted return from regressing the PV-UG portfolio returns, both EW and VW, on the regional market portfolio (CAPM), on the market, SMB, and HML (FF), and on the market, SMB, HML, and momentum (FFC). Newey-West t-statistics are reported in parentheses.

	Panel A: North America						Panel B: Europe					
Quintile	EW	VW	Size	B/M	M-Shr	N	EW	VW	Size	B/M	M-Shr	N
1 (PV)	1.97	1.17	5.25	0.57	0.12	700	1.26	1.08	4.23	0.62	0.13	667
2	1.66	1.10	5.96	0.50	0.31	700	0.96	0.89	5.03	0.58	0.26	667
3	1.42	0.82	6.24	0.48	0.28	700	0.84	0.74	5.17	0.59	0.27	667
4	1.16	0.83	6.24	0.51	0.20	700	0.77	0.76	5.01	0.64	0.23	667
5 (UG)	1.17	0.30	4.45	0.51	0.09	700	0.39	0.43	4.12	0.66	0.11	666
PV-UG	0.79	0.88					0.87	0.65				
	(2.08)	(2.74)					(6.75)	(3.25)				
	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}
Alpha	1.00	0.96	0.95	1.19	1.16	1.19	0.90	0.87	0.75	0.75	0.62	0.45
	(2.66)	(2.50)	(2.39)	(4.01)	(4.05)	(3.91)	(7.25)	(7.22)	(6.60)	(4.01)	(3.59)	(2.08)

	Panel C: Japan						Panel D: Asia					
Quintile	EW	VW	Size	B/M	M-Shr	N	EW	VW	Size	B/M	M-Shr	N
1 (PV)	0.84	0.91	4.67	0.96	0.10	517	1.66	1.02	4.39	0.77	0.15	315
2	0.77	0.46	4.89	0.99	0.16	517	1.26	1.08	4.81	0.76	0.28	314
3	0.58	0.27	5.08	0.96	0.19	517	1.14	0.86	5.14	0.79	0.34	314
4	0.54	0.34	5.37	0.94	0.25	517	0.93	0.73	4.67	0.80	0.19	314
5 (UG)	0.44	0.25	5.35	0.87	0.31	517	1.34	0.40	3.21	0.68	0.04	314
PV-UG	0.40	0.66					0.32	0.62				
	(3.30)	(3.98)					(1.00)	(1.50)				
	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}	$CAPM_{EW}$	$FF\text{-}3_{EW}$	$FF\text{-}4_{EW}$	$CAPM_{VW}$	FF_{VW}	FFC_{VW}
Alpha	0.41	0.44	0.36	0.66	0.58	0.53	0.59	0.30	0.25	1.03	0.75	0.82
	(3.49)	(3.54)	(3.15)	(4.15)	(3.74)	(3.56)	(2.08)	(1.12)	(0.99)	(3.02)	(2.24)	(2.74)

Table 4: The Improved Magic Formula – Factor Loadings

Stocks are sorted into quintile portfolios according to the IMF methodology as in Table 3. In Panel A, the hedge portfolio (PV-UG) that longs the portfolio of PV (profitable, value) stocks and shorts the portfolio of UG (unprofitable, growth) stocks is regressed against the Fama-French-Carhart four factors. In Panel B, the portfolio comprised of 50% Mkt and 50% PV-UG is regressed on the Fama-French-Carhart factors. In both panels, the estimated coefficients are reported. Alpha is the intercept term. MKT is the loading on the value-weighted market portfolio less the risk-free rate. SMB is loading on the small minus big market capitalization portfolio. HML is estimated coefficient on the high minus low market-to-book equity portfolio, and WML is coefficient on the winner minus loser momentum portfolio. All factors are constructed at the regional level. Data is from January 1991 to December 2016. Values in parentheses are Newey-West t-statistics.

	Panel A: PV-UG				
	Alpha	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}
North America	1.19	-0.40	-0.27	0.13	-0.03
	(3.91)	(-4.33)	(-2.11)	(0.81)	(-0.37)
Europe	0.45	-0.19	-0.11	0.36	0.14
	(2.08)	(-4.13)	(-1.34)	(3.01)	(2.09)
Japan	0.52	-0.07	0.28	0.19	0.13
	(3.56)	(-1.97)	(5.38)	(3.21)	(3.23)
Asia	0.82	-0.53	-0.85	0.00	-0.05
	(2.74)	(-9.21)	(-7.98)	(0.02)	(-0.64)

Table 5: Gross Profits-to-Tangible Capital Employed and Gross Profits-to-Enterprise Value

Stocks are sorted into quintile portfolios according to the gross profits-to-tangible capital employed (Panel A) and also by gross profits-to-enterprise value (Panel B). For both sorts, the hedge portfolio that longs the value-weighted quintile five portfolio and shorts the value-weighted quintile one portfolio is regressed against the Fama-French-Carhart four factors. The estimated coefficients are reported. Alpha is the intercept term. MKT is the loading on the value-weighted market portfolio less the risk-free rate. SMB is loading on the small minus big market capitalization portfolio. HML is estimated coefficient on the high minus low market-to-book equity portfolio, and WML is coefficient on the winner minus loser momentum portfolio. All factors are constructed at the regional level. Data is from January 1991 to December 2016. Values in parentheses are Newey-West t-statistics.

	Panel (A): Gross Profits-to-Tangible Capital Employed (P-U)				
	Alpha	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}
North America	1.16	-0.31	-0.73	-0.46	-0.04
	(4.04)	(-3.50)	(-7.33)	(-4.04)	(-0.66)
Europe	0.55	-0.07	-0.43	-0.46	0.07
	(2.78)	(-2.13)	(-6.04)	(-5.04)	(1.05)
Japan	0.60	0.01	0.04	-0.56	0.12
	(3.29)	(0.24)	(0.62)	(-4.91)	(1.73)
Asia	0.78	-0.44	-1.09	-0.22	-0.12
	(2.50)	(-7.89)	(-8.79)	(-1.50)	(-1.29)
	Panel B: Gross Profits-to- Enterprise Value (V-G)				
North America	0.94	-0.30	0.16	0.68	0.13
	(3.46)	(-3.34)	(1.08)	(4.52)	(1.92)
Europe	0.36	-0.06	0.09	0.62	0.20
	(1.91)	(-1.32)	(0.78)	(5.81)	(2.80)
Japan	0.30	-0.11	0.49	0.57	0.07
	(1.88)	(-3.38)	(6.14)	(7.12)	(1.70)
Asia	1.02	-0.49	-0.53	0.32	-0.06
	(4.01)	(-8.37)	(-5.28)	(3.04)	(-0.80)

Table 6: Double Sort – The Improved Magic Formula vs Size

This table reports the value-weighted returns of portfolios formed by double sorting by the Improved Magic Formula (IMF) and size. Stocks are first independently ranked by gross income to tangible capital employed and by gross income to enterprise value. The sum of the two rankings is IMF. All stocks are then independently double sorted by size and IMF. For both measures, we use the 20, 40, 60, and 80 percentile breakpoints. For IMF, quintile 1 is comprised of profitable, value (PV) stocks while quintile five is comprised of unprofitable, growth (UG) stocks. For size, quintile 1 is the portfolio of small stocks and quintile 5 is the portfolio of big stocks. The 5-1 size and the 1-5 IMF return differentials are provided. Newey-West t-statistic are provided in parentheses. The row labelled Mean lists the returns obtained from averaging the five quintile portfolios in each column.

Panel A: North America

	Improved Magic Formula						
Size	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Small)	1.53	1.38	1.23	1.07	0.65	0.88	(3.62)
2	1.12	1.14	1.05	0.99	0.53	0.58	(2.55)
3	1.02	1.06	1.01	0.80	0.62	0.40	(1.76)
4	0.97	1.04	0.96	0.83	0.36	0.60	(2.63)
5 (Big)	0.81	0.67	0.58	0.57	0.25	0.56	(2.33)
Mean	1.09	1.06	0.96	0.85	0.48	0.61	(2.94)
5-1	0.72	0.71	0.65	0.50	0.40		
	(2.75)	(2.66)	(2.45)	(2.10)	(1.51)		

Panel B: Europe

	Improved Magic Formula						
Size	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Small)	0.94	0.67	0.62	0.42	0.13	0.81	(5.99)
2	0.97	0.85	0.70	0.61	0.33	0.65	(4.45)
3	0.79	0.74	0.64	0.61	0.51	0.28	(2.07)
4	0.84	0.65	0.70	0.62	0.55	0.29	(1.79)
5 (Big)	0.76	0.65	0.54	0.44	0.25	0.51	(2.61)
Mean	0.86	0.71	0.64	0.54	0.35	0.51	(4.35)
5-1	0.18	0.02	0.08	-0.02	-0.12		
	(0.88)	(0.11)	(0.31)	(-0.10)	(-0.57)		

Panel C: Japan

Size	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Small)	0.55	0.50	0.51	0.47	0.42	0.13	(1.41)
2	0.35	0.34	0.19	0.16	0.08	0.27	(2.47)
3	0.32	0.21	0.06	0.18	-0.13	0.45	(3.02)
4	0.36	0.25	0.13	0.07	0.02	0.34	(2.40)
5 (Big)	0.47	0.04	0.13	0.10	0.04	0.43	(2.30)
Mean	0.41	0.27	0.21	0.20	0.09	0.32	(3.53)
5-1	0.08	0.47	0.38	0.37	0.38		
	(0.26)	(1.36)	(1.32)	(1.14)	(1.19)		

Panel D: Asia

Size	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Small)	1.31	0.93	1.19	0.72	0.58	0.73	(2.93)
2	0.83	0.65	0.86	0.66	0.15	0.67	(2.61)
3	1.03	0.75	0.55	0.47	0.25	0.78	(2.81)
4	1.02	0.84	0.51	0.50	0.47	0.55	(2.05)
5 (Big)	0.74	0.80	0.64	0.64	0.56	0.18	(0.58)
Mean	0.99	0.79	0.75	0.60	0.40	0.58	(3.17)
5-1	0.57	0.13	0.55	0.08	0.02		
	(1.88)	(0.41)	(1.48)	(0.26)	(0.05)		

Table 7: Improved Magic Formula – Factor Loadings: Big vs Small

Stocks are first divided equally into big and small market capitalization groups. Stocks within each group are sorted into quintile portfolios according to the Improved Magic Formula (IMF) methodology as in Table 3. The hedge portfolio that longs the value-weighted quintile one portfolio and shorts the value-weighted quintile five portfolio is regressed against the Fama-French four factors. The estimated coefficients are reported. Alpha is the intercept term. β_{MKT} is the loading on the value-weighted market portfolio less the risk-free rate. β_{SMB} is loading on the small minus big market capitalization portfolio. β_{HML} is estimated coefficient on the high minus low market-to-book equity portfolio, and β_{WML} is coefficient on the winner minus loser momentum portfolio. All factors are constructed at the regional level. Data is from January 1991 to December 2016. Values in parentheses are Newey-West t-statistics.

	Alpha	β_{MKT}	β_{SMB}	β_{HML}	β_{WML}
Panel A: Big Stocks					
North America	0.72	-0.27	-0.13	0.16	-0.02
	(3.15)	(-3.86)	(-1.26)	(1.10)	(-0.22)
Europe	0.38	-0.12	-0.17	0.19	0.10
	(1.99)	(-3.52)	(-2.42)	(1.95)	(1.71)
Japan	0.57	-0.05	0.09	0.03	0.13
	(3.29)	(-1.61)	(1.50)	(0.28)	(2.18)
Asia	0.58	-0.35	-0.52	-0.22	0.07
	(2.05)	(-6.20)	(-4.88)	(-2.64)	(1.13)
Panel B: Small Stocks					
North America	1.36	-0.25	-0.12	0.26	-0.01
	(3.72)	(-2.66)	(-0.87)	(1.90)	(-0.13)
Europe	1.08	-0.13	-0.09	0.16	0.13
	(7.46)	(-3.83)	(-1.42)	(1.92)	(2.16)
Japan	0.24	-0.15	-0.17	0.03	0.19
	(1.68)	(-4.92)	(-3.24)	(0.53)	(5.45)
Asia	0.69	-0.37	-0.27	0.29	-0.09
	(2.33)	(-7.28)	(-2.10)	(2.20)	(-1.46)

Table 8: Double Sort – Improved Magic Formula vs Book-to-Market

This table reports the value weighted returns of portfolios formed by double sorting by the Improved Magic Formula (IMF) and book-to-market equity (B/M). Stocks are first independently ranked by gross income to tangible capital employed and by gross income to enterprise value. The sum of the two rankings is IMF. All stocks are then independently double sorted by B/M and IMF. For both measures, we use the 20, 40, 60, and 80 percentile breakpoints. For IMF, quintile 1 is comprised of profitable, value (PV) stocks while quintile five is comprised of unprofitable, growth (UG) stocks. For B/M, quintile 1 is the portfolio of growth stocks and quintile 5 is the portfolio of value stocks. The 5-1 B/M and the 1-5 IMF hedge portfolios are provided. Newey-West t-statistic are provided in parentheses. The row labelled Mean lists the returns obtained from averaging the five quintile portfolios in each column.

Panel A: North America

	Improved Magic Formula						
B/M	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Low)	0.72	0.72	0.53	0.62	0.34	0.39	(0.94)
2	0.91	0.72	0.61	0.47	0.35	0.56	(1.92)
3	1.01	0.75	0.86	0.87	0.19	0.82	(2.90)
4	0.72	0.98	0.83	0.65	0.41	0.31	(1.39)
5 (High)	1.38	0.82	0.74	0.88	0.62	0.76	(3.21)
Mean	0.95	0.80	0.72	0.70	0.38	0.57	(2.62)
5-1	0.66	0.11	0.21	0.26	0.28		
	(2.79)	(0.40)	(0.80)	(0.74)	(0.72)		

Panel B: Europe

	Improved Magic Formula						
B/M	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Low)	0.55	0.56	0.57	0.14	-0.32	0.87	(3.09)
2	0.81	0.53	0.50	0.16	0.12	0.69	(3.25)
3	0.88	0.67	0.86	0.63	0.42	0.46	(2.62)
4	0.91	0.81	0.76	0.57	0.45	0.46	(2.35)
5 (High)	1.10	0.91	0.78	0.81	0.73	0.37	(1.81)
Mean	0.85	0.69	0.70	0.46	0.28	0.57	(4.05)
5-1	0.55	0.35	0.21	0.67	1.05		
	(2.21)	(1.09)	(0.67)	(1.85)	(3.40)		

Panel C: Japan

B/M	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Low)	0.43	-0.18	-0.22	-0.30	-0.29	0.72	(2.29)
2	0.25	-0.07	0.14	-0.30	-0.13	0.38	(1.76)
3	0.35	0.13	0.22	0.20	0.33	0.02	(0.11)
4	0.61	0.44	0.38	0.49	0.15	0.46	(2.27)
5 (High)	0.71	0.70	0.61	0.53	0.35	0.36	(2.27)
Mean	0.47	0.20	0.23	0.13	0.08	0.39	(2.89)
5-1	0.29	0.88	0.83	0.83	0.65		
	(0.83)	(2.52)	(2.49)	(2.51)	(2.02)		

Panel D: Asia

B/M	1 (PV)	2	3	4	5 (UG)	1-5	t-stat
1 (Low)	0.60	0.66	0.60	0.55	-0.05	0.65	(1.14)
2	1.11	0.59	0.64	0.19	-0.08	1.19	(3.16)
3	0.85	0.95	0.19	0.33	0.32	0.53	(1.72)
4	0.81	0.93	0.46	0.68	0.30	0.51	(1.90)
5 (High)	1.36	1.27	1.09	1.07	1.06	0.30	(1.18)
Mean	0.94	0.88	0.59	0.56	0.31	0.64	(2.99)
5-1	0.76	0.61	0.49	0.52	1.11		
	(2.52)	(1.75)	(1.16)	(1.69)	(1.99)		

Table 9: Fama-MacBeth Regression

For each month t from January 1991 to December 2016, returns of all firms in the regions of North America (NA), Europe (EUR), Japan and Asia are regressed on the log of the More Magical, Magic Formula (IMF), log market capitalization (Size), log book-to-market equity (BM), and momentum (MOM). This table shows the cross-sectional regression coefficients averaged across all months. Avg R^2 is the time-series average R-square. Newey-West t-statistics are provided below each estimate. IMF is the sum of the rankings obtained by sorting stocks by gross profits-to-tangible capital employed and by gross profits-to-enterprise value using income statement data from time t-7. Size is measured using market prices from month t-1. B/M is computed using the book value from month t-7 and market prices from month t-1, and MOM is the cumulative return over t-12 to t-2. Results labelled as 'Big Stocks' and 'Small Stocks' refer the 50% of stocks with the largest and smallest market capitalizations, respectively.

	Panel A: All Stocks				Panel B: Small Stocks				Panel C: Big Stocks			
	NA	EUR	Japan	Asia	NA	EUR	Japan	Asia	NA	EUR	Japan	Asia
log(IMF)	-0.34	-0.34	-0.13	-0.29	-0.41	-0.32	-0.08	-0.37	-0.29	-0.33	-0.22	-0.44
	(-2.94)	(-7.16)	(-2.13)	(-2.77)	(-3.34)	(-6.00)	(-1.29)	(-2.86)	(-2.49)	(-6.16)	(-2.90)	(-4.45)
log(Size)	-0.22	0.00	-0.09	-0.29	-0.64	-0.32	-0.58	-1.30	-0.06	0.07	0.06	0.12
	(-4.02)	(0.07)	(-1.72)	(-5.26)	(-7.65)	(-7.58)	(-8.28)	(-10.88)	(-1.30)	(2.17)	(1.08)	(2.32)
log(B/M)	0.37	0.56	0.37	0.68	0.40	0.66	0.35	0.91	0.28	0.41	0.49	0.56
	(4.02)	(7.45)	(4.46)	(6.37)	(4.22)	(9.57)	(4.21)	(7.04)	(2.91)	(4.50)	(4.94)	(5.90)
MOM	0.15	0.75	-0.37	0.40	0.16	0.81	-0.77	0.67	0.32	0.88	-0.01	0.48
	(0.81)	(3.13)	(-1.27)	(1.92)	(0.92)	(3.32)	(-2.28)	(2.24)	(1.30)	(3.16)	(-0.01)	(2.56)
Constant	5.51	3.63	2.11	4.69	7.67	4.51	3.49	8.15	3.94	3.06	1.93	3.23
	(7.02)	(6.91)	(3.36)	(7.39)	(10.23)	(8.23)	(5.42)	(10.13)	(3.79)	(4.65)	(2.59)	(4.46)
Avg R^2	3.12	2.26	4.47	3.25	2.58	1.80	3.55	3.89	4.64	3.42	5.72	4.23