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INVESTING IN THE ASSET GROWTH ANOMALY ACROSS THE GLOBE

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We document the existence of an anomalous asset growth effect globally and find that it comprises some combination of a market mispricing and some pervasive global systematic risk. To support our findings, we explore a battery of tests to include how country-level governance and market characteristics explain the cross-country differences in the effect. We also find evidence that any profits to a trading strategy based on the asset growth effect globally are reduced, though not eliminated, by arbitrage costs.

1 Background and motivation

Recent research widely examines the viability of the fundamental-based anomaly commonly known as the asset growth effect.[1] The research findings show that firms that increase asset expansion or capital expenditures subsequently earn negative abnormal stock returns. In our research effort here, we examine the practical implications related to extracting the excess returns associated with the anomalous asset growth effect globally and provide numerous important findings for investment practitioners. The expanding research among both the academic and practitioner communities on asset pricing anomalies in international capital markets lends significance to our effort.

In this paper, we extend research efforts into the asset growth effect in a number of important new directions. First, we review the global evidence for the total asset growth anomaly and its persistence over time by examining 23 countries across multiple global regions. We then provide insight into the risk associated with the asset growth effect, globally; in particular whether the effect can be attributable to a market mispricing or to some systematic risk(s). Next, we explore the extent to which the anomalous returns associated with the asset growth effect, globally can be attributed to higher arbitrage costs, in particular, due to the lack of close substitutes, idiosyncratic volatility, and transactions costs. Finally, we explore whether the degree of country-level governance and

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market development have meaningful power to explain cross-country differences in the asset growth effect.

Importantly, we seek to gain a better understanding of the practical issues affecting investing in the global asset growth effect among the global universe of stocks. We hope our straightforward methodology will prove useful to practitioners in verifying the extent of any opportunity to profit from identified investment signals.

Given the relatively similar variable specifications and largely overlapping samples present in the extant literature, our paper alleviates the potential concern about data snooping as argued by Lo and Mackinlay (1990). Our paper also relates to the literature that examines anomalies such as value, momentum, and idiosyncratic risks globally (e.g., Fama and French, 1998; Rouwenhorst, 1998; Griffin *et al.*, 1998; Ang *et al.*, 2009; Asness *et al.*, 2009; Li *et al.*, 2012; Li and Sullivan, 2011). By differentiating between the systematic risk and mispricing explanations for the return predicting power of growth in assets and investments, our analysis contributes to similar investigations on various well-known anomalies (e.g., Daniel and Titman, 1997; Daniel *et al.*, 2001; Davis *et al.*, 2000; Grundy and Martin, 2001; Li and Sullivan, 2015). Finally, by exploring the impact of country-level governance and market characteristics on cross-country differences in the asset growth effect, we provide insight into possible global characteristics that may lie behind it (Ang *et al.*, 2009).

2 Empirical analysis

2.1 Data description

We obtain annual financial statement data from Worldscope and stock return data in U.S.[2] dollars from the MSCI monthly stock returns files for the 1985 through 2009 period. We use the MSCI World Index for our sample universe and begin our study in 1985 as international returns data prior to then are deemed less reliable. We restrict the sample to all nonfinancial firms with available data. We identify financial firms by Global Industry Classification Standard (GICS) sector code of 40. For exposition purposes, in tests of return predictability, we focus only on those firms with fiscal year end in December. We merge financial statement data available at the end of March with the subsequent 12 monthly stock returns (inclusive of dividends) from April to March. In this way, we implement a three-month lag after the end of the fiscal year from which we gather the Worldscope data items; an approach commonly used among practitioners in order to minimize the potential impact of look-ahead bias.

Both Worldscope and MSCI data are commonly used in practice and in the prior literature for obtaining financial statement and returns data, respectively. Worldscope is clearly the dominant source for financial statement data. Although sometimes other sources are used for returns data, the MSCI data includes all active and defunct firms and thus has the important advantage of being relatively free from survivorship bias (e.g., see Fama–French, 1998). The MSCI data also provide a unique identifier allowing researchers to better track firms over time versus other identifiers such as sedols.

For our purposes, we employ the MSCI World Index universe which currently includes 23 developed countries with investable equity markets. The MSCI World Index includes large-cap and mid-cap stocks and covers approximately 85% of the free-float adjusted market capitalization of each country. Our chosen MSCI index therefore has high coverage but contains no-small or micro-cap firms as often included in other research efforts. This makes our approach more relevant to investment practice as any significant asset growth effects we observe in the data are much less likely to be driven by small and illiquid firms. Research shows that the presence of high barriers to arbitrage often inhibits the profitable extraction of many observed anomalies (e.g., Pontiff, 2006, Li and Sullivan, 2011, 2014). These research findings support omitting the smallest and most illiquid stocks, which create well-known limits to effective arbitrage. Overall, we believe the sample of firms used for our analysis gives credibility to our results and are more robust for practitioners in their ability to implement such findings (e.g., Pontiff, 2006). We obtain the final sample by merging the firms in Worldscope and MSCI that meet our sample criteria and have non-missing values for two-year asset growth rates.

Research has shown that that asset growth rate offers meaningful stock return predictive power. In this paper, we build on these earlier efforts, by contributing an innovative understanding of the sources of the observed outperformance and the extent to which the effect can be captured, globally.

3 Exploring the asset growth effect

3.1 Fama–MacBeth regressions

We use Fama–MacBeth (1973) cross-sectional regressions in which we regress monthly stock returns during the May–April period against the asset growth measure calculated with accounting data from the prior fiscal year. Fama–MacBeth (1973) regressions have the advantage of controlling for the effects of covariates commonly shown to relate to stock returns such as size and book-to-market. Accordingly, we estimate the following equation:

$$r_{t+1} = a_{0,t} + a_{1,t} AssetG_t + a_{2,t} Size_t + a_{3,t} BM_t + \varepsilon_{i,t+1}. \tag{1}$$

Where r_{t+1} is the subsequent monthly stock return; *AssetG* represents the growth measure (CGS2)[3] defined from Cooper *et al.* (2008) as: total assets$_t$/total assets$_{t-2} - 1$; *Size* is the logarithm of the equity market capitalization obtained at the end of each April; and *BM* is the logarithm of one plus the book-to-market ratio of equity. Market value of equity is measured at the end of each April and the book equity is the stockholders' book equity, plus balance sheet deferred taxes and investment tax credit, minus book value of preferred stock.

For the purposes of this paper, we employ our preferred definition of asset growth, CGS2, two-year asset growth. This metric is quite straightforward and was determined in prior research to be more robust versus alternative measures (Li *et al.*, 2012; Li and Sullivan, 2011). A statistically significant coefficient estimate on CGS2 as used for *AssetG* in Equation (1) would suggest that stock prices do not fully reflect the future return implication of the past asset growth-related measures. Accounting standards, and thus the calculated rate of asset growth, may vary significantly by country. As our focus is to investigate the ability of asset growth to predict cross-sectional returns, we normalize our asset growth measure by converting it into percentiles within each country or region (Li, 2010). For this, we use the three regions as shown in Table 1. Table 1 also reports the summary statistics for the firm-year observations for those nonfinancial firms that have non-missing monthly returns and two-year asset growth values in December of 1985, 1995, and 2005, as well as over the whole sample period. We also report the average monthly observation during the whole sample period.[4]

Table 1 Summary statistics.

Region	Country	Start date	Number of observations 1985	1995	2005	Average	Total
North America	CANADA	1/31/1985	1	85	197	105	31,379
	US	12/31/1984	282	399	1879	881	264,177
Asia Pacific	AUSTRALIA	1/31/1985	4	16	41	22	6,524
	HONG KONG	1/31/1985	9	34	75	43	12,985
	JAPAN	1/31/1985	19	36	97	49	14,614
	NEW ZEALAND	3/31/1998			4	2	151
	SINGAPORE	1/31/1985	21	30	61	36	10,898
Europe	AUSTRIA	1/31/1985	4	28	24	22	6,626
	BELGIUM	1/31/1985	12	34	39	31	9,172
	DENMARK	1/31/1985	5	21	39	26	7,715
	FINLAND	1/29/1988		23	56	34	9,011
	FRANCE	1/31/1985	45	117	153	114	34,147
	GERMANY	1/31/1985	48	104	134	107	32,094
	GREECE	6/29/2001			53	54	5,531
	IRELAND	5/31/1993		13	15	14	2,793
	ITALY	1/31/1985	22	107	141	107	31,942
	NETHERLANDS	1/31/1985	14	40	68	46	13,886
	NORWAY	1/31/1985	4	26	59	31	9,408
	PORTUGAL	12/31/1997			20	21	3,091
	SPAIN	1/31/1985	15	53	76	56	16,608
	SWEDEN	1/31/1985	11	55	98	61	18,271
	SWITZERLAND	1/31/1985	29	64	109	78	23,316
	UK	1/31/1985	56	103	204	137	40,899

Note: Returns data are from MSCI and financial data are from Worldscope.

3.2 *Factor-adjusted performance of quintile hedge portfolios*

In Table 2, we review the impact of the asset growth effect across the globe. The reported results are factor-adjusted alphas for two-year asset growth hedge, or quintile spread, portfolios formed by taking a long position in those firms in each country/region found in the bottom quintile (20%) of two-year asset growth, and a short position in the top quintile of one-year asset growth firms in each country/region. We find that the asset growth effect exhibits significant return predictive power across countries as well as regions. For example, as shown in the last row of Table 2, the estimated coefficient of the quintile hedge portfolio one-year post formation for all countries combined, adjusted for the Fama–French (1993) three factors for 1985–2009, we calculated the implied annualized abnormal portfolio return for the asset growth effect as 10.30% [$= (1 + 0.82\%)^{12} - 1$]. In sum, the return predictive power of two-year asset growth rates is empirically an important indicator of future performance

Table 2 Monthly factor-adjusted returns of long-short quintile hedge portfolios in year $t + 1$.

Region	Country							
North America	Canada	U.S.						
1–5	0.47***	0.85***						
	(2.33)	(4.96)						
Asia Pacific	Australia	Hong Kong	Japan	New Zealand	Singapore			
1–5	1.18***	0.85***	0.84**	1.24	0.55			
	(3.02)	(2.37)	(2.26)	(0.74)	(1.55)			
Europe	Austria	Belgium	Denmark	Finland	France	Germany	Greece	Ireland
1–5	1.05*	0.23	1.71***	1.44***	0.46**	1.09***	0.51	1.84*
	(1.93)	(0.82)	(4.13)	(2.68)	(2.04)	(3.22)	(0.82)	(1.85)
	Italy	Netherlands	Norway	Portugal	Spain	Sweden	Switzerland	U.K.
1–5	0.82***	0.62*	1.41**	1.53	0.73***	0.78***	0.40*	0.91***
	(3.22)	(1.93)	(2.21)	(1.26)	(2.52)	(2.39)	(1.66)	(3.11)
1–5	All countries		All countries (ex-U.S.)		Asia Pacific (ex-Japan)		Europe	
	0.82***		0.89***		0.74***		0.84***	
	(6.43)		(6.13)		(2.90)		(5.99)	

Notes: Table 2 reports the coefficient estimates for the intercept of a three-factor model in percentage. The three factors are the size and book-to-market factors constructed by following Fama and French (1998), as well as the excess returns of the value-weighted MSCI global market index over the three-month U.S. T-bill rates. The dependent variable, 1–5, is the difference portfolio between the lowest- and the highest-ranked quintile portfolios, or quintile spread portfolios. The quintile portfolio returns are the monthly excess returns of equal-weighted quintile portfolios formed annually by assigning firms within each country into quintiles based on the magnitude of the two-year asset growth rates using firms with fiscal year end in December. The return measurement period is in year $t + 1$, or the first April–March period after the construction of two-year asset growth based on the prior fiscal-year accounting data. Stock returns adjusted for dividends and delisting returns are from MSCI and financial variables are from Worldscope. Heteroscedasticity-consistent t-statistics (White, 1980) measuring the significance of excess returns are in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009.

and does not seem to be restricted to a select few countries. Furthermore, Li *et al.* (2012) find that the abnormal returns to asset growth exist on a value-weighted and equal-weighted basis, are robust to various sub-periods, decrease with portfolio quintile rankings, and persist for up to a four-year holding period, although diminishing beyond the second year.

Together, these results serve to reinforce the economic significance and importance of asset growth in predicting subsequent stock returns, at least *before transaction costs*, and in year $t + 1$. We explore later, the degree to which limits to arbitrage may inhibit investors from capturing the full extent of this effect. It is also possible that the results are due, in part, to a smaller sample size during the first part of our sample period.

4 Is the asset growth effect due to systematic risk or to mispricing?

Table 2 and other research results highlight the need for investors to gain a better understanding of the underpinnings of the asset growth anomaly. In this section, we undertake a comprehensive effort to understand whether the anomalous effect is driven by some pervasive systematic (undiversifiable) risks or by investor mispricing.

In making the risk versus mispricing differentiation, we address a fundamental issue for investors. The asset growth affect may be driven by a mispricing, as perhaps associated with an imperfection such as investor irrationality. For instance, perhaps investors overreact to recent past asset growth rates by extrapolating the past growth rate into future periods. However, stock returns attenuate when investors are disappointed by the subsequent mean reversion in asset growth rates (e.g., Lakonishok *et al.*, 1994).

Alternatively, the anomaly may be viewed as arising from some, as of yet unknown, common risk factor(s). A growing literature points out that the mix of growth options and assets in place changes when firms exercise growth options to undertake investments. Given the potentially different risks related to growth options and assets in place, these changes may induce time-varying risks that may explain the asset growth effect (e.g., Berk *et al.*, 1999; Carlson *et al.*, 2004; Zhang, 2005; Li *et al.*, 2009).

This investigation is also important because our findings would not pose a serious challenge to rational asset pricing theories and market efficiency if they could be explained by systematic risks. In a frictionless rational asset-pricing framework, the higher average returns of firms with higher abnormally high asset growth rates would necessarily reflect a compensation for higher systematic risks (e.g., Merton, 1973; Ross, 1976). Using methods designed by the existing asset pricing literature, we differentiate the mispricing and systematic risk explanations for global equity markets.

4.1 *Cross-sectional regressions and risk versus mispricing*

To investigate which of these two explanations most likely explains the asset growth effect, we first investigate whether the asset growth anomaly represents returns to some not yet identified risk factor, or whether it is related instead to the characteristic of asset growth itself. As we will show, our initial regression results indicate that there is no return premium associated with a factor formed on the basis of asset growth which suggests that the abnormal returns identified in Table 2 cannot be viewed as compensation for some systematic market risk. On the other hand, we later find evidence suggesting that asset growth is also associated with some market risk factor(s).

We first conduct research to determine if it is the pricing of the characteristic itself which can better explain the outperformance of low asset growth stocks. Specifically, we follow methodologies found in the asset pricing literature (e.g., Daniel and Titman, 1997) to test whether the differential returns between high and low asset growth stocks can be attributed to their factor loadings and/or certain firm characteristics. This frequently used approach allows us to empirically determine whether the asset growth anomaly is associated with a mispricing or some pervasive systematic risk. One attraction of the asset pricing methodologies done in the spirit of Daniel and Titman (1997) is that they allow researchers to be agnostic about the specific sources of the anomalous effect. For example, if an anomaly is truly due to systematic risks, this approach would still be able to capture and attribute the latent systematic risks to the anomaly, even if the source of the systematic risks is unknown (i.e., not among those already identified by the prior literature).

More specifically, the approach examines whether variations in the factor loadings based on the variable of interest, after controlling for the characteristics of the variable of interest, are still able to predict future returns. The test that we apply is an extension of the monthly Fama–MacBeth (1973) cross-sectional regressions in which we regress individual stock returns on the level of our two-year total asset growth variable (CGS2) and the two-year asset growth factor loadings while controlling for the well-known size and style effects. The asset growth factor loading provides an estimate of that factor's risk premium. Thus, the systematic risk explanation requires that the estimated coefficient of the loadings on asset growth-based factors in the cross-sectional regressions is statistically significant. If however, after controlling for the observed level of asset growth, loadings on the asset growth factor are unable to explain cross-sectional stock returns (i.e., there is no risk premium), then we can reasonably conclude that the asset growth anomaly is consistent with some market mispricing.

To elaborate, we follow Fama and French (1992) and Daniel and Titman (1997) by constructing zero-investment factor mimicking portfolios for asset growth. When estimated, our model will load most heavily on those risk factors potentially responsible for the return predicting powers of the asset growth characteristic (if risk is indeed the driver). This procedure extracts risk factors even if the researcher does not directly observe the factor structure underlying stock returns.

We begin this investigation by applying an extension of the monthly Fama–MacBeth (1973) cross-sectional regressions in which we regress individual stock returns on the loadings on the asset growth factor and the level of asset growth while controlling for the well-known size and style effects. Table 3 presents the results from these Fama–MacBeth (1973) regressions. Column (1) shows that the loading on the asset growth-based factor is insignificantly related to subsequent stock returns when measured alone ($t = 0.39$). Column (2) shows that the asset growth factor is also little changed when controlling for the well-known size and style factors. Column (3) presents the results with the inclusion of all control variables to include the asset growth factor loading and asset growth characteristic. As column (3) shows the asset growth characteristic is highly significant at the 1% level, however while in all regressions, we find a statistically insignificant loading on the asset growth-based factor. The results from our cross-sectional regressions thus indicate that average subsequent returns are determined by common variation associated with the asset growth characteristic rather than factor loadings. This analysis suggests that the return predictive power associated with asset growth is best explained by a market mispricing rather than some pervasive market risk factor premium.

Table 3 Monthly regressions of stock returns on asset growth rates and asset growth factor loadings.

Variable	(1)	(2)	(3)
Panel A. International universe			
Asset growth factor beta	0.18	0.18	0.17
	(0.39)	(0.41)	(0.38)
Asset growth characteristic			0.56***
			(4.78)
Control variables Included? (Equation (1))	No	Yes	Yes

Notes: Table 3 reports the results of Fama–MacBeth (1973) regressions. Reported coefficient estimates are time-series means of estimated parameters from monthly cross-sectional regressions (in percentage). Stock returns are adjusted for dividends and delisting returns are from MSCI and financial data are from Worldscope. Robust Newey–West (1987) t-statistics are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009.

4.2 *Double Sorting on both characteristics and factor loadings*

In this section, we form "characteristic-balanced" portfolios in order to further test whether the (high and low) asset growth factor loadings or the asset growth characteristic better explain future stock returns.[5] Through such tests, we are able to examine whether variations in the loadings on factors created on the basis of asset growth, in the fashion of Fama and French (1993), after controlling for actual return variability, are still able to explain future stock returns.

Our approach provides another method to differentiate the market inefficiency and risk factor explanations. As noted by Daniel and Titman (1997), in tests where factors are constructed from characteristics shown to predict returns, the factor loadings may appear to predict stock returns even though their predictive power is not due to systematic risk. This can happen if the characteristic and the constructed factor tend to positively correlate. The fix is to double sort the portfolios. In detail, we double sort individual stocks into quintile portfolios based separately on the asset growth characteristic and the loading on the asset growth-based factor. Should the asset growth factor loading explain the cross-section variation of stock returns in these double sorts as measured by the significance of the quintile spread portfolio returns, then the predictive return ability of the asset growth characteristic would likely be due to systematic risk. In contrast, the mispricing hypothesis requires that the asset growth factor loadings have no additional return predicting power associated with the characteristic-balanced asset growth quintile portfolios.

We now conduct the formal test using "characteristic-balanced" loading-based quintile spread portfolios within the asset growth characteristic quintiles. To accomplish this, we obtain value-weighted returns for the 25 portfolios created through independent quintile sorts on the asset growth characteristic *and* the loadings on the asset growth-based factor. For brevity, we focus attention here on equal-weighted portfolios.

Table 4 reports the regression intercepts resulting from time series regressions of the excess returns of the 25 portfolios on the Fama–French (1993) three factors of size, book-to-market, as well as the excess returns of the value-weighted MSCI global market index over the three-month U.S. T-bill rates. We sort all stocks into quintiles based on the asset growth-factor beta and then based on the asset growth characteristic. Specifically, we independently sort all stocks within each country into quintiles based on two-year asset growth (CGS2) and the loadings on the asset growth factor constructed following Fama and French (1998). We estimate the individual firm-level pre-sorting loadings on the asset growth factor with a rolling regression of the monthly excess returns of each firm over the last 36 months (24 months minimum) on the three factors and the asset growth factor. For each month, we take the difference in portfolio return for the quintile spread portfolios.

Table 4 shows that when controlling for factor loadings, on an equal-weighted basis, asset growth characteristics are significantly related to subsequent stock returns. As evidence, note that the quintile spread portfolios, based on the asset growth characteristic, shown in the far right column yield highly significant profits for each of the quintiles based on the loadings on the corresponding asset growth-based factor. In contrast, controlling for asset growth characteristics, the loadings on the asset growth-based factor have no explanatory power in the cross-section of subsequent stock returns. In contrast to the asset growth characteristic spread portfolios, none of the quintile spreads based on the loadings on the asset growth-based factors are significant. Consistent with our earlier findings,

Table 4 Factor-adjusted portfolio returns from conditional sorts on two-year asset growth rates and asset growth factor loadings.

		Asset growth characteristic quintiles					
		1	2	3	4	5	1–5
Asset Growth Factor Loading Quintiles	1	0.36	0.18	0.01	−0.08	−0.39	0.75***
		(1.24)	(0.78)	(0.05)	(−0.27)	(−1.12)	(3.04)
	2	0.30	0.38***	0.18**	0.01	−0.28	0.58***
		(1.63)	(2.45)	(1.06)	(0.04)	(−1.35)	(3.17)
	3	0.37**	0.20	0.24	0.06	−0.31*	0.68***
		(2.20)	(1.30)	(1.48)	(0.39)	(−1.92)	(4.65)
	4	0.38**	0.40***	0.32*	0.19	−0.21	0.59***
		(1.99)	(2.40)	(1.94)	(1.25)	(−1.24)	(3.90)
	5	0.55**	0.59***	0.45**	0.13	−0.12	0.67***
		(2.06)	(2.58)	(2.10)	(0.62)	(−0.52)	(3.14)
	1–5	−0.19	−0.41	−0.43	−0.21	−0.26	
		(−0.44)	(−1.20)	(−1.26)	(−0.55)	(−0.61)	

Notes: Stock returns are adjusted for dividends and delisting returns are from MSCI and financial data are from Worldscope. Robust Newey–West (1987) t-statistics from the time series of portfolio returns are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009. 1–5 is the difference portfolio between the lowest- and the highest-ranked quintile portfolios, or quintile spread portfolios.

these results reject the systematic risk explanation in favor of the mispricing explanation.[6] In sum, we find that variations in the loadings on the asset growth-based factor do not predict subsequent stock returns after controlling for the asset growth characteristic in double sorted quintile portfolios.

Taken together, results from Tables 3 and 4 suggest that the international asset growth effect cannot be explained by some pervasive global systematic market risk(s). In particular, both of our test methods thus far demonstrate that an asset growth-based factor explains little of the return predictive power of the asset growth effect, while an asset growth-based characteristic contributes significantly to explaining future stock returns. These results, therefore, suggest that some market mispricing dominates the international asset growth effect. In other words, the previously identified underperformance of high asset growth stocks may not arise because of the correlations of these stocks with pervasive (systematic) global risk factors. Instead, our results thus far indicate that the poor relative returns on high asset growth stocks arise from some market mispricing associated with certain characteristics present in high asset growth firms. Next, we consider additional methods for assessing the risk versus mispricing explanations and discover some interesting results.

4.3 Asset growth and global risk factor(s)

Table 5 explores the international co-movement in two-year asset growth portfolios. By exploring asset growth co-movement globally, we can understand whether the presence of the asset growth effect observed for each country can be explained by the existence of a pervasive asset growth risk factor that exists globally after

Table 5 Is global asset growth anomaly driven by some pervasive risk factor(s)?

	Panel A			Panel B			Panel C	
Variable	U.S. 1	Asia Pacific 2	Europe 3	U.S. 4	Asia Pacific 5	Europe 6	Asia Pacific 7	Europe 8
Intercept	0.65***	0.59***	0.67***	0.31***	0.39***	0.39***	0.46***	0.40***
	(5.26)	(3.39)	(6.04)	(2.76)	(2.25)	(3.96)	(2.65)	(3.52)
Market Return	−0.20***	−0.15***	−0.18***	−0.08***	−0.08*	−0.08***	−0.12**	−0.10***
	(−5.25)	(−3.04)	(−5.53)	(−2.39)	(−1.68)	(−2.92)	(−2.28)	(−3.28)
SMB	−0.11*	−0.06	0.09	−0.10*	−0.06	0.09*	−0.04	0.13***
	(−1.69)	(−1.05)	(1.54)	(−1.65)	(−0.98)	(1.84)	(−0.71)	(3.27)
HML	−0.36***	−0.01	−0.11***	−0.27***	0.05	−0.02	0.06	0.05
	(−7.69)	(−0.19)	(−2.53)	(−4.78)	(0.75)	(−0.68)	(0.86)	(1.16)
AG (World)				0.59***	0.35***	0.50***		
				(7.08)	(3.17)	(7.79)		
AG (US)							0.19***	0.43***
							(2.21)	(5.49)

Table 5 reports the coefficient estimates and the intercept, in percentage, for a three- and a four-factor model. The three factors are the size and book-to-market factors constructed by following Fama and French (1998), as well as the excess returns of the value-weighted MSCI global market index over the three-month U.S. T-bill rates. The four-factor model adds to the three-factor model an asset growth factor based on all developed markets or on U.S. market data. The dependent variables are the monthly excess returns of equal-weighted asset growth factors formed within each region following Fama and French (1998). The return measurement period is for year $t + 1$, or the first April–March period after the construction of two-year asset growth based on the prior fiscal-year accounting data. Stock returns adjusted for dividends and delisting returns are from MSCI and financial variables are from Worldscope. Heteroscedasticity-consistent t-statistics (White, 1980) measuring the significance of excess returns are in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009.

controlling for the well-known size and style factors. Table 5, Panel A reports a baseline comparison of asset growth alpha not controlling for a global or U.S. specific asset growth factor. Table 5, Panel B, adds a world asset growth factor as an explanatory variable that is invariant across countries and regions. From a comparison between the intercepts (alpha) shown in columns 1 and 4, we can infer that the roughly 50% decline in alpha from 0.65 to 0.31 for the U.S., taken along with the highly statistical significance of the world asset growth factor, that a global risk-based asset growth factor explains an important portion of the U.S. specific asset growth effect. Thus, excess returns to the asset growth effect observed in the U.S., can at least be partially attributed to a global asset growth risk factor. Table 5 further shows similar results for the regions of Asia Pacific and Europe. However, given that the alphas shown in the first row of Panel B remain statistically significant, even after controlling for a world (Panel B) and U.S. (Panel C) specific asset growth factor, it cannot be said that a global risk factor associated with asset growth completely explains the asset growth affect. In contrast to our findings discussed earlier, these results suggest that some combination of risk and mispricing describes the asset growth affect across countries and regions.

These results suggest that trading strategies that go long stocks with low asset growth while shorting high asset growth stocks across countries appear to have meaningful exposures to some global asset growth risk factor, or to some global trading strategy. This suggests that the high degree of covariation that exists between country-specific asset growth trading strategies and a global asset growth factor cannot be fully diversified away. This implies that investors take into account a pervasive risk factor associated with global asset growth which explains some, but not all, of the asset growth effect. However, even after controlling for a global asset growth risk exposure and to a U.S. asset growth risk exposure, as shown in Panels B and C, respectively, the excess returns, as shown in the first row, to the asset growth persists. This suggests that a market mispricing also exists.

Altogether, the evidence in Table 5 suggests that some combination of a global risk-based pricing and some market mispricing together describe the asset growth affect across countries and regions. Table 5 therefore offers a slightly different view on the underpinnings of the asset growth anomaly versus our earlier findings.

5 The asset growth effect and corporate governance

We next investigate how the cross-country differences in the return predictive power of total asset growth are affected by various country-level characteristics such as corporate governance, market development, and cultural environment. We hypothesize that the asset growth effect should be less prominent in those countries with more effective and robust governance standards. We further hypothesize that the asset growth effect should be less prominent in those countries with more efficient capital markets. Our findings will further illuminate whether the asset growth effect is being driven by some market mispricing or by systematic market risk.

Our governance characteristics include four corporate law measures from La Porta *et al.* (1998): *Shareholder Rights*, which measures the extent to which corporate laws protect shareholder rights, *Judicial Efficiency*, which is produced by Business International Corp and measures law enforcement quality; *Rule of Law*, which is produced by International Country Risk and assesses the law and order tradition; and *Accounting Standards*, which is produced by the Center for International Financial Analysis and Research (CIFAR) and measures the quality of financial disclosures contained in corporate financial reports.

For measures of market development, we include *per capita GDP*, *credit to GDP*, and *market capitalization to GDP*, all sensible proxies for country-level financial development. *Per capita GDP* is measured as the natural logarithm of the average per capita GDP between 1999 and 2001. All market development data are from the World Bank's World Development Indicators database (www.worldbank.org). It is reasonable to expect that countries with higher levels of economic development possess more efficient capital markets.

We further measure a country's cultural environment with the *individualism index* developed by Hofstede (1980). The individualism index proxies for the level of overconfidence associated with individuals residing in a particular country. Chui *et al.* (2010) show that higher levels of this metric are associated with higher levels of trading volume, volatility, and return momentum.

Table 6, Panel A reports the correlation statistics for our various country-level governance and economic development characteristics. As one would expect, as proxied by our various measures, we find positive correlations between a country's level of governance and its level of economic development. Interestingly, shareholder rights demonstrates a rather weak relationship

Table 6 Country-level characteristic analysis (1996–2009).

	Shareholder rights	Judicial efficiency	Rule of law	Market cap to GDP	Credit to GDP	Log GNP Per Capita	Individualism
Panel A. Correlations							
Accounting Standards	0.19	0.55	0.53	0.55	0.56	0.55	0.40
Shareholder Rights		−0.06	−0.04	0.10	0.17	−0.11	−0.20
Judicial Efficiency			0.66	0.47	0.58	0.67	0.64
Rule of Law				0.32	0.66	0.89	0.63
Market Cap to GDP					0.70	0.35	0.06
Credit to GDP						0.66	0.32
Log GNP Per Capita							0.60
Individualism							

Panel B. Regression analysis

Shareholder rights 1	Accounting standards 2	Judicial Efficiency 3	Rule of law 4	Market cap to GDP 5	Credit to GDP 6	Log GNP Per Capita 7	Individualism 8
−0.06	0.07***	0.46***	0.53***	0.01*	0.02***	1.47***	0.04***
(−0.29)	(2.79)	(3.53)	(3.87)	(1.72)	(3.28)	(3.59)	(3.67)

Notes: Panel A reports the correlation statistics for country-level governance and economic development characteristics. Panel B reports results from a regression analysis where the dependent variable is two-year asset growth within each country and the independent variables proxy for each country's level of governance, economic development, and individualism. The results employ the method proposed in Titman *et al.* (2010). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

with all of the other governance and economic development characteristics. Finally, a country's level of overconfidence, as proxied by our individualism index, positively relates to all of our governance and economic development metrics with the exception of shareholder rights.

Table 6, Panel B reports results from a regression analysis conducted to further explore the relationship among asset growth, governance, economic development, and individualism. In conducting our analysis, we followed the method proposed in Titman *et al.* (2010). Table 6, Panel B reports our regression results[7] over the period 1996–2009, where the dependent variable is the equal-weighted size and book-to-market adjusted monthly return in U.S. dollars for each country-specific one-year asset growth zero-cost hedge portfolio. As before, our one-year asset growth hedge portfolio is that portfolio which takes a long position in those firms in each country found in the bottom quintile (20%) of one-year asset growth, and a short position in the top quintile of one-year asset growth firms in each country. The independent variables in our regression are the various governance and economic development country-level characteristics described earlier, and are shown in each column. The regression also includes control variables for size, book-to-market, and one-year asset growth, not shown in the table. We calculate our control variables as the natural log of the median firm size, book-to-market, and one-year asset growth respectively, for each country for each year.

The regression results shown in Table 6, Panel B, indicate that country-level governance and market characteristics do factor importantly in explaining the cross-country differences in the asset growth effect in that our various governance and economic development variables are all statistically significant, with the exception of shareholder rights. However, our results generally run counter to our expectations. Consider how our findings suggest that countries with more efficient capital markets, as measured by various economic development characteristics, also have a stronger, not weaker, excess returns associated with company asset growth. That is, the asset growth effect is stronger for countries with easier access to equity markets as proxied by market cap to GDP, higher credit to GDP, and higher GDP per capital. Furthermore, we do not find the existence of a relationship between investor protection and the asset growth effect. These findings do not appear consistent with the asset growth effect being driven by some market mispricing.[8]

As it relates to country governance characteristics, we also find surprising results. In particular, countries with stronger governance, as measured by accounting standards, rule of law, and judicial efficiency, also have a statistically greater asset growth effect. That is, the asset growth anomalous effect is stronger, not weaker as expected, for companies in countries that exhibit stronger governance characteristics. Finally, we further find that countries with cultures exhibiting higher levels of managerial confidence, as proxied by individualism, have a statistically significant stronger asset growth effect than countries with less overconfident cultures.

Overall, our results tend to be consistent with the notion that the asset growth effect is influenced by the degree of governance and economic development across countries, but not in a way that is consistent with some market inefficiency, or mispricing. Why? Because, those countries with easier access to capital and stronger governance tend to also have a stronger asset growth anomalous affect. One would expect the opposite to be true—countries with more efficient capital markets and more robust governance would demonstrate *weaker* asset growth anomalous affects. Instead, in this section, we find the opposite to be the case—more developed countries with more efficient capital markets and stronger governance seem to have *higher* levels of asset growth effect. This all suggests that the existence of the asset growth anomaly is inconsistent with a market mispricing because one would expect any mispricing would be arbitraged away over time in an efficient market. This finding leads us to our next section, exploring the ability of investors to effectively arbitrage away the excess returns associated with the asset growth effect.

6 The limits to arbitrage and the global asset growth anomaly

As discussed earlier, should the return predicting power of the asset growth effect become widely known, it is more likely to be eliminated by arbitrage if a market mispricing is responsible for its existence. As our results thus far have pointed to a mispricing as an important, though not sole, driver of the asset growth effect, and that its strength has persisted globally across time, we expect its predictive power to be concentrated among those stocks with relatively higher arbitrage costs.[9] That is, should higher arbitrage costs lie behind the persistence of the global asset growth effect, this would suggest market mispricing as a key driver.

Pontiff (2006) separates arbitrage costs into two types, transaction costs and holding costs. Transaction costs are those costs proportional to acts of initiating and terminating arbitrage positions such as bid–ask spreads, market impact, commissions, and dollar volume. Holding costs are those costs which are proportional to the amount of time the arbitrage position is held which include interest on margin requirements, short sale costs (e.g., the haircut on short sale rebate rate) and the risk exposure of maintaining a position with idiosyncratic volatility that is difficult to hedge. To test our thesis, we next provide estimates of the impact of both types of arbitrage costs on extracting the international asset growth effect. Given that our asset growth related measure is updated annually and its predictive power can last for as long as three years, holding costs are likely to pose greater limits to arbitrage, if they do play a role, in comparison to transaction costs. Following Li and Sullivan (2011), among others, we use idiosyncratic volatility to proxy for holding costs. We measure idiosyncratic volatility as the residual standard deviation of a regression of daily returns on the Fama–French (1992) factors.

To proxy for transaction costs, we use three variables following prior research (e.g., Stoll, 2000; Li *et al.*, 2014). In particular, we proxy bid–ask spread and commission costs with the proportion of trading days with zero returns as proposed by Lesmond *et al.* (1999). We proxy market impact with the time series average of the ratio of absolute value of daily returns to daily dollar volumes as proposed by Amihud (2002). We use dollar volume, the product of daily closing prices and daily share volume, to proxy for the ease with which arbitragers accumulate and liquidate trading positions. We calculate all of our measures of arbitrage costs over the 12 months prior to the April of the ranking year for the asset growth related measures. Due to the aforementioned challenges associated with trading small-cap stocks, we additionally report the relationship between total asset growth and market capitalization. We calculate all the measures of arbitrage costs over the 12 months prior to the April of the ranking year for the asset growth measure. The return measurement period is in year $t + 1$, or the first April–March period after the construction of two-year asset growth based on the prior fiscal-year accounting data.

These five metrics give a comprehensive reporting of the likely impact of arbitrage costs on the efficacy of extracting abnormal returns from the asset growth effect internationally after controlling for the size and book-to-market effects. Should the return predicting power of asset growth be consistent with costly arbitrage, then the abnormal returns to the asset growth effect will be larger when arbitrage costs are high and smaller when arbitrage costs are low. More specifically, our hypothesis is that the predictive power of total asset growth rates will decrease with higher dollar volume and will increase with higher levels of the remaining measures of arbitrage costs; namely idiosyncratic volatility, the Amihud (2002) measure and the Lesmond *et al.* (1999) measure. With respect to market capitalization, given the capacity constraint to arbitraging away abnormal returns, we expect that the return predicting power of asset growth to be more concentrated among smaller firms and thus will decrease among firms with higher market capitalization.

Table 7 presents the international results on the relation between total asset growth rates and subsequent stock returns (in year $t + 1$) for those firms with above and below the median idiosyncratic volatility, Lesmond *et al.* (1999) measure, Amihud (2002) measure, dollar volume, and market capitalization, respectively. The large and small categories are those with above and below median idiosyncratic volatility, Lesmond measure, Amihud measure, and dollar volume, respectively. Table 7 reports the coefficient estimates for the intercept of the Fama and French (1998) three-factor model in percentage with excess returns calculated as the value-weighted MSCI global market index over three-month U.S. T-bill rates. The dependent variables are the monthly excess returns of equal-weighted quintile

Table 7 Monthly factor-adjusted returns of quintile portfolios by limit to arbitrage measures, year $t + 1$.

	Idiosyncratic volatility		Amihud		Lesmond		Dollar volume		Market capitalization	
	Large 1	Small 2	Large 3	Small 4	Large 5	Small 6	Large 7	Small 8	Large 9	Small 10
Low	0.33*	0.60***	0.58***	0.05	0.49***	0.59	0.46***	0.32*	0.42**	0.51**
	(1.84)	(4.11)	(3.58)	(0.31)	(3.24)	(1.38)	(3.10)	(1.69)	(2.98)	(2.92)
2	0.25	0.59***	0.46***	0.16	0.42***	0.82**	0.40***	0.27	0.42***	0.53***
	(1.63)	(4.06)	(3.28)	(0.93)	(3.01)	(2.25)	(2.95)	(1.55)	(3.24)	(3.23)
3	0.18	0.50***	0.36***	0.02	0.32**	−0.24	0.26*	0.12	0.25*	0.35**
	(1.07)	(3.35)	(2.37)	(0.11)	(2.19)	(−0.73)	(1.88)	(0.63)	(1.83)	(2.06)
4	−0.25	0.36***	0.06	−0.26	0.07	0.62*	0.05	−0.06	0.02	0.12
	(−1.44)	(2.42)	(0.40)	(−1.64)	(0.49)	(1.73)	(0.32)	(−0.38)	(0.14)	(0.72)
High	−0.57***	0.14	−0.25	−0.67***	−0.33*	−0.14	−0.31*	−0.67***	−0.25	−0.47**
	(−2.58)	(0.83)	(−1.31)	(−3.63)	(−1.84)	(−0.36)	(−1.75)	(−3.18)	(−1.39)	(−2.24)
1–5	0.90***	0.46***	0.82***	0.72***	0.82***	0.73	0.77***	0.99***	0.67***	0.98***
	(5.03)	(4.78)	(5.67)	(5.16)	(6.21)	(1.15)	(5.53)	(5.58)	(4.95)	(5.97)
Large–Small	0.44		0.10		0.09***		−0.22		−0.32***	
	(2.39)		(0.98)		(0.58)		(−0.95)		(−2.56)	

Notes: Stock returns are adjusted for dividends and delisting returns are from MSCI and accounting variables are from Worldscope. 1 (5) corresponds to the quintile firms with the lowest (highest) two-year asset growth rates within each country. 1–5 is the difference portfolio between the lowest- and the highest-ranked quintile portfolios, or quintile spread portfolios. Heteroscedasticity-consistent t-statistics (White, 1980) measuring the significance of excess returns are in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009.

Table 8 Persistence of asset growth anomaly limits to arbitrage.

	Idiosyncratic volatility		Amihud		Lesmond		Dollar volume		Market capitalization	
	Large 1	Small 2	Large 3	Small 4	Large 5	Small 6	Large 7	Small 8	Large 9	Small 10
	Year $t + 2$									
1–5	0.55***	0.15	0.38***	0.31*	0.44***	0.76*	0.27	0.46***	0.35***	0.49***
	(3.34)	(1.45)	(2.96)	(1.77)	(3.39)	(1.65)	(1.46)	(3.45)	(2.62)	(3.15)
	Year $t + 3$									
1–5	0.44***	0.10	0.30***	0.15	0.26**	0.36	0.23	0.21*	0.25**	0.30**
	(2.83)	(0.88)	(2.35)	(0.92)	(2.18)	(0.69)	(1.40)	(1.72)	(2.13)	(2.25)

Notes: Stock returns are adjusted for dividends and delisting returns are from MSCI and accounting variables are from Worldscope. 1–5 is the difference portfolio between the lowest- and the highest-ranked quintile portfolios, or quintile spread portfolios. Heteroscedasticity-consistent t-statistics (White, 1980) measuring the significance of excess returns are in parenthesis. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. The data are from 1985 through 2009.

portfolios formed annually by assigning firms within each country into quintiles based on the magnitude of the two-year asset growth using firms with fiscal year end in December.

Columns (1) and (2) of Table 7 show that investors could potentially earn monthly abnormal quintile spread returns of 0.90% and 0.46% based on total asset growth rates for stocks with above and below median idiosyncratic volatility, respectively. Thus, consistent with our hypothesis, the magnitude of abnormal returns among the stocks with greater idiosyncratic volatility is twice as large as that among the stocks with smaller idiosyncratic volatility.

Columns (3)–(8) explore whether the total asset growth rate is primarily concentrated among stocks with low levels of liquidity and thus higher transactions costs. As per our expectations, the data show that the abnormal returns associated with the asset growth effect increases with the Lesmond *et al.* (1999) measure (return = 0.82% and 0.72% for the large and small groups, respectively) and the Amihud measure (return = 0.82% and 0.73% for the large and small groups, respectively). The data further show that the asset growth effect is also more concentrated in those stocks with lower dollar volume and thus lower levels of liquidity; that is, it decreases as dollar volume rises (return = 0.77% and 0.99% for the large and small groups, respectively).

Columns (9) and (10) show that investors could potentially earn monthly abnormal returns of 0.67% and 0.98% on the quintile spread portfolio based on total asset growth rates on those stocks with above and below median market capitalization, respectively. All together, results from Table 7 demonstrate that the magnitude of abnormal returns is about 20% greater among smaller stocks with lower liquidity and higher transactions costs than among their larger, higher liquidity, and lower transactions cost counterparts.

We next explore the persistence of the asset growth anomaly and how this persistence relates to limits to arbitrage. Table 8 presents results for quintile spread portfolios for the asset growth effect in years $t + 2$ and $t + 3$ as impacted by each of our arbitrage limiting covariates, thereby extending the $t+1$ results of Table 7. We first note that results from Tables 7 and 8, taken together, show that the effectiveness of the asset growth effect dissipates with time, confirming the results found in Li *et al.* (2011). This is evidenced in that the coefficient estimates for all of our limits to arbitrage metrics universally decline as we move from year $t+1$ to $t+3$. Results from Table 8 also confirm that the asset growth effect in years $t+2$ and $t+3$ continue to be more concentrated among those firms with higher idiosyncratic volatility, higher transactions costs and smaller capitalization. Furthermore, the anomalous effects are insignificantly different from zero among only those stocks with relatively lower transactions costs. The one exception is with small-cap stocks where the spread portfolio return is statistically significant for both large-cap and small-cap stocks, although the effect is more robust and thus more concentrated among small-cap stocks.

Altogether, the evidence on limits to arbitrage suggests that the existence of the global asset growth anomalous returns are somewhat attributable to higher arbitrage costs thereby hindering, but not eliminating, its effective profitability. Constraints imposed especially by idiosyncratic volatility and small and illiquid stocks explain a meaningful portion of the anomalous returns associated with the total asset growth anomaly. Investors seeking to profit from abnormal returns associated with long–short portfolios (formed as the difference between high and low quintiles) of asset growth therefore face greater uncertainty in outcomes in extracting abnormal returns from the asset growth effect than previously understood.

7 Robustness checks

We next conduct a variety of sensitivity tests but, for reasons of brevity, do not report the results. We find qualitatively the same results when we: (1) include firms that do not have fiscal year end in December; (2) use annual returns instead of monthly returns as the dependent variable of our Fama–MacBeth regressions; (3) censor the asset growth related measures at the top and bottom 1% or 0.5%; (4) normalize the asset growth related measures into deciles instead of percentiles within each country for the purpose of conducting our Fama–MacBeth (1973) regressions. Also, we find that the asset growth effect presents no ability to predict abnormal returns in emerging markets either as a composite group or by individual country. Future research might consider extending our analysis conducted here to further investigate these issues.

8 Summary and conclusions

In this paper, we thoroughly examine the practical implications related to capturing the excess returns associated with the anomalous asset growth effect. We provide numerous important findings that will inform investment practitioners. We confirm that the asset growth effect is present in international markets with strong predictive power coming from the straightforward two-year total asset growth measurement. It furthermore persists across time, in different subsample periods, and is present among both large and small firms. We also show that the asset growth effect meaningfully impacts firm performance for up to three years after initiation.

We further provide insight into the risk associated with the asset growth effect; in particular whether the effect can be attributable to a market mispricing or to some pervasive systematic market risk(s). Our initial battery of tests suggests that in extracting abnormal returns, market mispricing dominates in describing the asset growth effect across countries and regions.

On the other hand, we go on to find that country-level governance and market accessibility characteristics show that countries with easier access to capital and studier governance tend to have a stronger asset growth anomalous effect. This finding is hardly consistent with a market mispricing explanation because one would expect that more developed countries with more efficient capital markets and stronger governance would have *lower*, not *higher*, degree of asset growth mispricing. Adding to the evidence that at least part of the asset growth effect pertains to some pervasive global market risks, we show that a high degree of covariation exists between a country-specific asset growth trading strategy and that a global asset growth factor cannot be fully diversified away.

Taken together, the evidence in our paper suggests that a combination of some global risk factor and some market mispricing together describes the asset growth effect across countries and regions. But overall, we believe that our results tend to favor the mispricing explanation over that of systematic risk. For instance, perhaps overconfident investors overreact to recent past asset growth rates by extrapolating the past growth rate into future periods only to be disappointed when growth and stock returns revert to a more normal level. We invite research into alternative explanations.

We continue our effort by exploring the ability of traders to profitably trade on this apparent anomaly. Using a host of proxies for arbitrage costs and arbitrage risks, we find that the effect is more prevalent among the universe of high idiosyncratic volatility stocks and among high transaction cost stocks. That is, the asset growth effect is more pronounced among small and illiquid stocks with greater idiosyncratic volatility. These arbitrage costs reduce, though not eliminate, the opportunity to extract excess returns.

In sum, our results indicate that investors seeking to profit from the asset growth anomaly are extracting some combination of market mispricing and compensation for some market risk premium. However, in so doing, we also find that investors must bear greater uncertainty in outcomes than previously understood. This uncertainty comes in the form of higher idiosyncratic risk and higher transactions costs which raises costs and hinders, though not eliminate, profitable arbitrage. Therefore, an opportunity exists globally to extract abnormal returns, but in attempting to do so, investors must take into account a pervasive global risk factor(s) associated with global asset growth and that market mispricing also explains some part of the global asset growth anomalous returns.

Notes

1 See for instance, Anderson and Garcia-Feijoo (2006), Cooper *et al.* (2008), Fama and French (2008), Li *et al.* (2012), Li and Sullivan (2011), Lyandres *et al.* (2008), Polk and Sapienza (2009), Titman *et al.* (2004), and Xing (2008).

2 The MSCI data contained herein is the property of MSCI Inc. (MSCI). MSCI, its affiliates and its information providers make no warranties with respect to any such data. The MSCI data contained herein is used under license and may not be further used, distributed or disseminated without the express written consent of MSCI.

3 As all the various measures of asset growth studied in Li *et al.* (2012) yield similar results, for ease of exposition, we focus our results on the most straightforward, and most statistically robust, definition for *ASSETG*; the two-year change in total firm assets (CGS2).

4 By comparison to Fama–French (1998) our sample, as reported in Table 1, represents fewer firms for each country. As explained earlier, this smaller sample size is due to our chosen benchmark, MSCI World which excludes small and micro-cap stocks, by excluding all financial firms, by including only those firms with fiscal year end in December, and by requiring the two-year asset growth rate to be non-missing.

5 In the language of Daniel and Titman (1997), we perform characteristics versus covariances tests commonly used to examine anomalies such as size, book-to-market, and momentum (e.g., Daniel and Titman, 1997; Daniel *et al.*, 2001; Davis *et al.* 2000; Grundy and Martin, 2001). See also Li and Sullivan (2015) who apply this approach to explore the competing explanations for the low risk stock anomaly.

6 In untabulated results, we find that sorting on the asset growth-based factor loadings alone generates insignificant differences in returns across the factor loading quintiles.

7 The regressions apply the Petersen (2008) approach clustered by country.

8 We cannot rule out other explanations. As noted by Morck *et al.* (2000), emerging markets exhibit greater stock-price synchronicity which likely deters stock specific arbitrage. Markets in which stock prices tend to move together makes firm-level information harder to arbitrage, therefore prices may be less reflective of fundamental information. For such less efficient markets, our evidence may not be inconsistent with a market pricing of the asset growth effect.

9 We point the interested reader to Li *et al.* (2014) and Li and Sullivan (2011) who explore the limits to arbitrage for several well-known anomalies using U.S. data.

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