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Momentum life cycle around the world

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Momentum Life Cycle around the World and Beyond[☆]

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Abstract

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Abstract

The momentum life cycle (MLC) hypothesis first proposed by Lee and Swaminathan (2000) applies also to global markets. Early-stage strategies significantly outperform the late-stage and conventional strategies in most countries. Individualism culture is positively associated with late-stage but unrelated to early-stage momentum profitability, suggesting that early- and late-stage momentums are driven by different underlying mechanisms. Consistent with Stein's (2009) model that arbitrageurs could amplify mispricing, we find that late-stage momentum profits are more pronounced in countries with lower limits to arbitrage. Furthermore, we find that the MLC also applies to exchange traded funds in the United States.

Keywords: Momentum life cycle; International; ETFs; Individualism; Limits to arbitrage; Momentum profits.

JEL Classification: G11; G12; G14

1. Introduction

Jegadeesh and Titman (1993, 2001) document that in the U.S., stocks that performed well (badly) in the past 3-12 months continued their winning (losing) streak over the next 3-12 months. A simple momentum strategy of longing past winners and simultaneously shorting past losers generates a monthly return of around 1% and is considered to be one of the most well-documented and pervasive anomalies in the asset pricing literature (Fama and French, 2008; Fama, 2014).[1] Momentum effects also exist in the international markets.[2] Moreover, momentum is also present in other asset classes, including country equity indices, commodities, currencies and bonds.[3] Lastly, Moskowitz, Ooi, and Pedersen (2012) find momentum effects in the time-series of exchange-traded future contracts.

Lee and Swaminathan (2000) extend the price momentum strategy by incorporating trading volume information and find that in the U.S, low-turnover winner stocks and high-turnover loser stocks exhibit stronger and more persistent price continuation. By contrast, high-turnover winner stocks and low-turnover loser stocks exhibit weaker and less persistent price continuation. They call the former the early-stage and the latter the late-stage momentum. They attribute this return pattern to that stocks constantly go through stages of undervaluation and overvaluation and that trading volume helps to locate a stock in its various stages of the momentum life cycle (MLC). In

[1] In his Nobel Lecture, Fama (2014, page 1480) remarks that "Most prominent is the momentum in short-term returns documented by Jegadeesh and Titman (1993), which is a problem for all asset pricing models that do not add exposure to momentum as an explanatory factor, and which *in my view is the biggest challenge to market efficiency* [emphasis added]."

[2] For example, Rouwenhorst (1998), Griffin, Ji, and Martin (2003), and Chui, Titman, and Wei (2010) find strong momentum effects in the international equity markets, especially in the developed markets.

[3] Asness, Liew, and Stevens (1997) and Bhojraj and Swaminathan (2006) document positive momentum profits in country equity indices, Okunev and White (2003) and Menkhoff, Sarno, Schmeling, and Schrimpf (2012) in currencies, Erb and Harvey (2006) in commodities and Jostova, Nikolova, Philipov, and Stahel (2013) in corporate bonds. See Asness, Moskowitz, and Pedersen (2013) for a synthesis.

this paper, we extend their study to an international setting to see whether the MLC hypothesis can be extended to other markets.

This not only represents an out-of-sample test of the MLC hypothesis, but also allows us to test alternative explanations, which cannot be completely achieved using only the U.S. data. Specifically, the international study allows us to test another implication of the MLC hypothesis that early- and late-stage momentum effects could be driven by distinct mechanisms. The MLC hypothesis suggests that early-stage momentum profits are largely derived from investors' inattention or underreaction to news (e.g., (Barberis, Shleifer, and Vishny, 1998; Hong and Stein, 1999), while late-stage momentum profits from investors' delayed overreaction (e.g., Daniel, Hirshleifer, and Subrahmanyam, 1998) or positive feedback trading (e.g., Stein, 2009).

Our empirical evidence strongly supports the MLC hypothesis in the international markets.[4] Momentum effects are much stronger and more persistent among the subset of stocks that are classified as being in the early stage of the MLC. Using data from 1988 to 2013, out of the 36 equity markets examined, the simple momentum strategy delivers significantly positive profits in 20 countries. As a comparison, the early-stage momentum strategy works in 31 countries, while the late-stage momentum strategy works in only 17 countries. The late-stage momentum strategy exhibits weaker price continuation than the simple momentum strategy and is often associated with quicker reversal. To give a sense of the economic magnitude of the difference, a global momentum strategy that weights each country-specific winner-minus-loser portfolio based on lagged country

[4] The sample period studied in Lee and Swaminathan (2000) is from year 1965 to 1995. We find that the MLC effect exists both before and after their sample period. The monthly return to the early-stage momentum strategy is 1.21% and 1.22% in the periods of 1927 to 1964 and 1996 to 2013, respectively. The corresponding returns for the late-stage momentum are negative with the returns of -0.30% and -0.58%. The result is not reported here but available upon request.

total market capitalization generates monthly returns of 1.29%, 0.83% and 0.46% for the early-, simple, and late-stage momentum strategies, respectively.

The results barely change when we use the local or global Fama-French (1993) three-factor model to adjust for the risk exposure of different momentum portfolios. The results are also robust to different sample periods, alternative momentum strategies, and to the use of both equal- and value-weighted returns. We also look at momentum returns beyond one year horizon to see how long momentum profits last. Consistent with the MLC hypothesis, the early-stage momentum strategy shows some price continuation effects beyond the first year, while the late-stage momentum strategy quickly reverses and even earns negative returns beyond the first year.

Although the MLC effect is pervasive in most international markets, cross-country variation does exist. In the second part of this paper, we conduct the cross-country analysis of momentum profits among various stages of the MLC. We find evidence consistent with Chui, Titman, and Wei (2010) that momentum profits are positively related to Hofstede's (2001) individualism index for the simple strategy by extending their sample period to 2013.[5] Surprisingly, we find that momentum profits are positively related to individualism only for the late-stage strategy but not for the early-stage strategy. If individualism is a good proxy for overconfidence and self-attribution bias that cause overreaction to private information (Daniel, Hirshleifer, and Subrahmanyam, 1998), it should only be associated with the late-stage but not the early-stage momentum effect. Our cross-country evidence indeed supports this conjecture and suggests that early- and late-stage momentums are driven by fundamentally different mechanisms.

Another piece of evidence for the distinct mechanisms underlying early- and late-stage momentums is that sentiment is positively associated with momentum profits only for the early-

[5] Chui, Titman, and Wei (2010) argue and provide evidence that individualism is a good proxy for overconfidence and self-attribution bias.

stage but not for the late-stage momentum strategy. This result is consistent with Antoniou, Doukas, and Subrahmanyam (2013), who argue that cognitive dissonance of conflicting signals between recent price move and sentiment lead to underreaction to news and momentum profits. The positive relation between sentiment and early-stage momentum profits suggests that early-stage momentum is more likely attributed to an underreaction phenomenon, while late-stage momentum is not.

If the momentum effect is a manifestation of mispricing rather than risk, arbitrageurs will exploit the profitable opportunities aggressively and eliminate the mispricing. However, arbitrage risks, trading costs, and other market frictions such as short-sale constraints may prevent arbitrageurs from trading on the anomaly aggressively and hence mispricing remains in equilibrium (DeLong, Shleifer, Summers, and Waldmann, 1990; Shleifer and Vishny, 1997). In contrast, recently, Stein (2009) argues that for a trading strategy such as momentum that has no fundamental anchor, arbitrage activities may get overly crowded and hence destabilize the market.

The MLC hypothesis prescribes that the early-stage momentum effect is mainly due to investors' underreaction to news, so the traditional limits-to-arbitrage argument would predict a stronger early-stage momentum effect among countries facing higher arbitrage costs. Since the late-stage momentum effect might be caused by positive feedback trading from arbitrageurs' participation, Stein's (2009) model would predict a stronger late-stage momentum effect among countries with a lower degree of limits to arbitrage. We find evidence consistent with both the limits-to-arbitrage argument and Stein's (2009) model that the early-stage strategy is more profitable in countries facing higher arbitrage costs, while the late-stage strategy is more pronounced in countries facing lower arbitrage costs.

As another out-of-sample test, we study whether the MLC hypothesis also applies to the exchange traded funds (ETFs) in the U.S.[6] Since ETFs are diversified portfolios, they do not contain firm-specific fundamental information. Hence existing momentum behavioral models based on information diffusion cannot apply to ETFs, making it an interesting attempt to study them. Consistent with the international evidence, the early-stage momentum strategy among ETFs generates a monthly profit of 0.86% (*t*-stat = 1.89), while it is only 0.58% and 0.10% for the simple and late-stage momentum strategies, respectively. To the best of our knowledge, the profitability of the momentum strategy has not been documented for ETFs and our results point to the pervasiveness of the MLC effect in a truly out-of-sample asset class.

The remainder of this paper proceeds as follows. Section 2 briefly reviews the momentum literature and develops our hypotheses. Section 3 describes the data used, explains the sampling procedures, and reports summary statistics. Section 4 uses international equity market data and ETFs data to conduct out-of-sample tests for the MLC hypothesis. Section 5 conducts cross-country analysis of the MLC effects and the impact of investor sentiment on early- and late-stage momentum profits. Finally, Section 6 concludes the paper.

2. Literature Review and Hypothesis Development

2.1. Literature review

Extensive evidence has shown that an intermediate-term price momentum strategy that buys past winners and simultaneously sells past losers can generate an average annual return of around 12% not only in the U.S. (Jegadeesh and Titman, 1993) but also in other developed markets

[6] The reason why we study only ETFs but not other asset classes is that only ETFs have sufficient and meaningful trading volume data.

(Rouwenhorst, 1998; Griffin, Ji, and Martin, 2003; Chui, Titman, and Wei, 2010). The momentum strategy is not only very profitable but also very persistent over time (except for the 2009 momentum crash around the world during our sample period) and pervasive across most asset classes. The biggest challenge is that both simple and the early-stage strategies generate implausibly large Sharpe ratios, especially for the latter strategy, and defy the existing rational arguments.[7] As a result, most explanations of the momentum effect are based on behavioral models.

For example, Daniel, Hirshleifer, and Subrahmanyam (1998) attribute the momentum effect to investors' overconfidence and self-attribution bias. They argue that overconfident investors, due to their self-attribution bias, become even more convinced about their private signals when their decisions are confirmed by public information that is subsequently released. This delayed overreaction leads to short-run return continuation and long-run reversal. Chui, Titman, and Wei (2010) use Hofstede's (2001) individualism index to proxy for overconfidence and self-attribution bias and find support for the prediction of Daniel et al.'s (1998) behavioral momentum model. They show that the momentum effect is stronger in countries with high individualism than in countries with low individualism.

In contrast, Barberis, Shleifer, and Vishny (1998) suggest that due to conservatism bias, investors fail to update their beliefs sufficiently when confronting new information, which generates momentum. The model of Hong and Stein (1999) generates momentum by assuming that firm-specific information diffuses gradually among groups of boundedly-rational investors.[8] Grinblatt and Han (2005) argue that increased demand for stocks trading at a capital loss and the

[7] Rational explanations for momentum are offered by Berk, Green, and Naik (1999), Johnson (2002) and Sagi and Seasholes (2007). Chordia and Shivakumar (2002) find momentum profits could be well explained by common macroeconomic variables that are related to business cycle. Liu and Zhang (2008) find risk exposure to an Industrial Production Growth factor could explain around 50% of momentum profits. In contrast, Griffin, Ji and Martin (2004) argue that macroeconomic risk cannot explain momentum profits around the world.

[8] Hong, Lim, and Stein (2000) employ firm size and analyst coverage to proxy for the speed of information diffusion and find support for the prediction of Hong and Stein's (1999) momentum model.

decreased demand for stocks trading at a capital gain caused by the disposition effect leads to a demand perturbation and momentum effect. Da, Gurun, and Warachka (2014) develop a frog-in-the-pan hypothesis that predicts investors underreact to information arriving continuously in small amounts. They find that momentum profit is indeed more pronounced for stocks with continuous information during the formation period. In essence, the models of Barberis, Shleifer, and Vishny (1998), Hong and Stein (1999), Grinblatt and Han (2005) and Da, Gurun and Warachka (2014) all attribute the momentum effect to investors' underreaction to firm-specific information.

Lee and Swaminathan (2000) hypothesize that momentum evolves across cycles from underreaction to overreaction. Trading volume provides useful information about a stock's current stage in its MLC. The momentum effect is amplified during the early stage, but attenuated during the late stage. Using U.S. data, they find strong evidence supporting their hypothesis.

2.2. Hypothesis development

Lee and Swaminathan (2000) attribute the MLC effect to trading volume as a proxy for investors' favoritism or negligence. Investors tend to pay little attention to or even neglect low-volume early winners and still favor high-volume early losers. This kind of behavior amplifies the momentum effect. In contrast, investors appear to chase high-volume late winners and shun away from low-volume late losers, which dampens the momentum effect. Since the simple momentum effect is pervasive across countries, especially among developed markets, the MLC hypothesis should extend to the international setting and in particular developed markets. The above discussion leads to our first hypothesis.

Hypothesis 1(H1): *The momentum life cycle hypothesis extends to international equity markets, especially developed markets.*

The above discussion also implies cross-country variations in the MLC effects. In particular, Daniel et al. (1998) attribute the momentum effect to investors' delayed overreaction due to their overconfidence and self-attribution bias—a prediction supported by international evidence from Chui, Titman and Wei (2010). Since the late-stage momentum is predominant at the overreaction phase, it should be stronger in countries with higher individualism. The early-stage momentum effect is an underreaction phenomenon, so it should not be associated with individualism.[9] The above discussion generates our second hypothesis.

Hypothesis 2 (H2): *The positive relation between momentum profits and individualism only exists for the late-stage strategy but not for the early-stage one.*

As discussed at the outset, if momentum is due to mispricing, the momentum effect should be stronger in countries with more severe impediments to arbitrage. However, as argued by Stein (2009), arbitrageurs can also amplify mispricing through their positive feedback trading. Thus, the overall net effect of market frictions on momentum profits is unclear. The differentiation between early- and late-stage momentum strategies, however, provides a natural ground to evaluate each hypothesis. Since the early-stage momentum effect is mainly due to investor underreaction, more arbitrage activities should help correct the mispricing and reduce momentum profits. On the other hand, since the late-stage momentum effect is likely the result of arbitrageurs' positive feedback trading, lower market frictions should lead to more arbitrageur trading, amplify mispricing and increase late-stage momentum profits. The above discussion is summarized in our last hypothesis.

Hypothesis 3 (H3): *The early-stage momentum profit should be positively associated with arbitrage frictions, while the late-stage momentum profit should be negatively related to arbitrage frictions.*

[9] Underreaction to new information is more likely driven by investors' conservatism bias (Barberis, Shleifer and Vishny, 1998), slow information diffusion (Hong and Stein, 1999), or the disposition effect (Grinblatt and Han, 2005).

3. Data Selection and Summary Statistics

We obtain firm-level stock return and accounting variables for a broad cross section of countries (except for the U.S.) from Datastream and Worldscope, respectively. For the U.S., the data is taken from CRSP and Compustat. We start with all firms in 45 countries in the MSCI All Country Index between 1988 and 2013. MSCI classifies 23 of these countries as developed markets and the remaining 22 as emerging markets. The sample includes live as well as dead stocks, ensuring that the data are free of survivorship bias. We compute stock returns using the return index (which includes dividends) supplied by Datastream. Since both return indexes and market capitalizations are provided in local currencies, we convert them to their U.S. dollar equivalents using the conversion function built into Datastream.

We apply the following sequence of filters that are derived from the extensive data investigations by Griffin, Kelly, and Nardari (2010), Chui, Titman, and Wei (2010), and Hou, Karolyi, and Kho (2011) as follows. First, we require that firms selected for each country are domestically incorporated based on their home country information (GEOGC). A single exchange with the largest number of listed stocks is chosen for most countries, whereas multiple exchanges are used for China (Shanghai and Shenzhen), Japan (Tokyo and Osaka), and the U.S. (NYSE, Amex, and NASDAQ). We eliminate non-common stocks such as preferred stocks, warrants, REITs, and ADRs.[10] A cross-listed stock is included only in its home country sample. If a stock has multiple share classes, only the primary class is included. For example, we include only A-shares in the Chinese stock market and only bearer-shares in the Swiss stock market.

[10] Specifically, to be included in our common stock sample, a stock must have a type of instrument indicator (TYPE) equal to equity (EQ). We then eliminate preferred stocks, closed-end funds, exchange-traded funds, real estate investment trusts, and warrants by identifying firms whose names contain words such as "pf", "pref", "fund", "reit", "trust", "warrant", etc.

To filter out suspicious stock returns, we set returns to missing for stocks that rises by 300% or more within a month and drops by 50% or more in the following month (or falls and subsequently rises). We also treat returns as missing for stocks that rise by more than 1,000% within a month. To ensure our results are not driven by micro-cap stocks, we exclude all the stocks whose market capitalizations place them in the bottom decile of market capitalization in a given country. Finally, in each month for each country, we winsorize returns, market capitalization, and turnover at the 1st and the 99th percentiles, to reduce the impact of outlier on our results (McLean, Pontiff, and Watanabe, 2009). For most of our tests, we require there to be at least 90 stocks in a country-month. This ensures that country-specific portfolios are reasonably well diversified. The final sample includes 36 countries, among which 21 are developed countries and 15 are emerging countries. [11]

Table 1 provides a brief overview of the sample. In this and other tables, we separate developed and emerging markets, and order countries alphabetically within each category. Although a country's designation as developed or emerging could have changed over time, we use the current MSCI definition. Data availability varies across countries. We report the starting date for the data series from which momentum portfolios can be constructed for each country. Not surprisingly, the available time series is longer for developed markets. We report the median firm size in each country as of the end of 2013 in millions of U.S. dollars. We also report the average and total number of stocks per country, where the average is computed over the entire (monthly) time series. Despite the fact that we require a minimum of 90 securities per month, there is still considerable variation in the average number of stocks per country. We urge caution in interpreting results for countries with a small universe of stocks.

[11] The number of countries is reduced to 36 because we only include countries that have at least 60 months of non-missing momentum portfolio return data.

3.1. The construction of risk factors

To estimate the abnormal returns (i.e., alphas) from the Fama and French (1993) three-factor model in a local market, we follow the procedures described in Fama and French (1993) to construct the country-specific HML (High minus Low), the SMB (Small minus Big), and the market factors.

3.2. The simple momentum strategy

We first confirm whether the simple momentum strategy continues to be profitably even after the recent global financial crisis. One can construct momentum portfolios in a number of different ways. We start our analysis by following Jegadeesh and Titman (1993) to adopt the simple approach of ranking stocks based on prior six-month cumulative returns, skipping the most recent month, and holding these portfolios for six months (called the 6-1-6 strategy). Specifically, we sort all stocks in a country-month with valid returns into quintiles based on the past cumulative returns from month −6 to month −1. We require at least 90 stocks per month per country for the sorting. We calculate and report equal-weighted monthly returns for each quintile (skipping month 0).[12] To increase statistical power, we follow Jegadeesh and Titman (1993) to construct overlapping momentum portfolios. In other words, there are six winner-minus-loser (WML) portfolios in each month and the monthly WML return is simply the average of the six WML portfolio returns. We also estimate the CAPM and the Fama and French (1993) three-factor alphas based on the time-series regressions of country monthly portfolio returns on the local market, SMB, and HML factors.[13]

[12] To check whether our results are robust, we also use value-weighted portfolio returns.

[13] Griffin (2002) and Fama and French (2012) find that the local Fama and French (1993) three-factor model better explain time-series variation in international stock returns than the global version.

Table A1 in the Online Appendix shows the returns of winner, loser, winner-minus-loser (WML) portfolios (called momentum portfolios), the CAPM alphas, and the Fama and French (1993) three-factor alphas for these momentum portfolios along with their corresponding t-statistics. In addition to country-specific momentum returns, we also report average momentum returns for the developed markets, the emerging markets, and the entire world. These returns are calculated by equal-weighting or value-weighting country-specific momentum returns, using the lagged country total market capitalization as the weight in the value weighting case. Countries where returns or alphas are significantly positive at the 5% level (one-tailed tests) appear in bold and red color.

We find that momentum strategies continue to be highly profitable in most countries in our sample period. Consistent with the literature, the momentum strategy does not work in Japan and most Asian countries (e.g., Chui et al. 2000; 2010). The Sharpe ratio of the momentum strategy is quite high. It appears that momentum returns are not affected by their exposures to risks and in some cases, risk-adjusted momentum profits are actually higher than unadjusted ones. In addition, consistent with Chui, Titman, and Wei (2010) and others, momentum effects are more pervasive in developed markets than in emerging markets. The equal-weighted country average momentum profit in developed markets continues to maintain at the same level as in previous studies of 0.99% per month and is highly significant (t-stat = 6.27), while that in emerging markets is relatively weaker at only 0.50% per month (t-stat = 2.99). The global equal-weighted average momentum profit is 0.80% per month with a t-statistic of 5.66. In general, the cross-country variation in momentum profitability is in line with the results in Chui, Titman, and Wei (2010), despite the fact that our sample period is different from theirs and covers the 2009 momentum crash in the U.S. (Daniel and Moskowitz, 2016) and other countries, in particular in the month of April 2009.

4. International Evidence on the Momentum Life Cycle Hypothesis

In this section, we conduct empirical tests on the MLC hypothesis using international equity market data. In Section 4.1, we examine the returns to the early- and late-stage momentum strategies and compare them with the simple momentum strategy using portfolio sorts. In Section 4.2, we establish the robustness of the MLC effect in international equity markets. In Section 4.3, we report long-horizon (one to three years) buy-and-hold returns to the early- and late-stage momentum strategies. In Section 4.4, we run Fama and MacBeth (1973) regressions to control for other firm characteristics that are known to predict returns in the cross section. In Section 4.5, we examine the comovment of momentum returns across countries. In Section 4.6, we document the MLC effect in ETFs in U.S.

4.1. The profitability of early- and late-stage momentum strategies

To test whether the MLC hypothesis is valid for our international sample, we sort all the stocks in each country into quintiles based on prior six-month cumulative returns and independently sort them into terciles based on monthly turnover ratios averaged over the past six months.[14] Since the dealer nature of the NASDAQ market makes the turnover on it difficult to compare with the turnover observed on NYSE and AMEX, we follow Gao and Ritter (2010) by adjusting trading volume for NASDAQ stocks.[15] We then form our early- and late-stage momentum strategies according to the definition of Lee and Swaminathan (2000). Specifically, the early-stage momentum strategy refers to a zero-investment portfolio that longs winner stocks

[14] While Lee and Swaminathan (2000) define trading volume as the average daily turnover during the portfolio formation period, in this paper we use the average monthly turnover since turnover is quite persistent and monthly data in Datastream is less noisy than daily data.

[15] Specifically, we divide NASDAQ volume by 2.0, 1.8, 1.6, and 1 for the periods prior to February 2001, between February 2001 and December 2001, between January 2002 and December 2003, and January 2004 and later years, respectively.

in the lowest turnover tercile and shorts loser stocks in the highest turnover tercile. The late-stage momentum strategy refers to a zero-investment portfolio that longs winner stocks in the highest turnover tercile and shorts loser stocks in the lowest turnover tercile. The time-series average of monthly returns to each momentum strategy is reported along with their corresponding t-statistics in Table 2. We also compare these two momentum strategies with the simple momentum strategy.

Table 2 shows that the results strongly support the MLC hypothesis. The early-stage momentum strategy generates significantly positive returns in 31 out of 36 countries, while the late-stage momentum strategy generates significantly positive returns in only 17 countries. The early-stage momentum strategy significantly outperforms both the simple and the late-stage strategy in 19 countries. For developed markets, the early-stage momentum strategy always beats the simple strategy except for four countries (Belgium, Denmark, Finland, and the U.K.) and it does so significantly in 11 of them. The economic difference between early-stage and simple momentum is sizeable. Take some of the big developed countries as examples. The monthly return to the early-stage momentum strategy is 0.98% higher than that to the simple momentum strategy in Australia and Canada, and 1.06% higher in Germany. As a comparison, the late-stage momentum strategy underperforms the simple momentum strategy in most developed markets and it does so significantly in 9 of them. An early-stage momentum strategy that takes equal position in each developed country's WML portfolio generates a monthly return of 1.42% (t-stat=5.79), while a late-stage strategy achieves only 0.61% (t-stat=4.31).

This pattern is not confined to developed markets, as the early-stage momentum strategy significantly outperforms the simple momentum strategy in 8 out of 15 emerging markets. An early-stage momentum strategy that takes equal position in each emerging country's WML portfolio generates a significant excess return of 0.93% (t-stat=3.75), while the corresponding

figure for the late-stage momentum strategy is an insignificant 0.01% (t-stat=0.06). A global momentum strategy that takes equal position in each country's WML portfolio generates a significant excess return of 1.26% (t-stat=5.65) for early-stage momentum, while it generates only 0.36% (t=2.88) for the late-stage momentum. This shows that the results documented by Lee and Swaminathan (2000) are not due to data mining and that trading volume indeed provides useful information about the magnitude and persistence of the momentum effects, which is consistent with the prediction of the MLC hypothesis.

To get a better sense of how the early- and late-stage momentum strategies compare with the simple momentum strategy from an investor's perspective, we compute cumulative returns to the global simple, early- and late-stage momentum strategies. Specifically, starting from January 1988, we compute the returns to global momentum strategies by value-weighting country-specific momentum returns using the lagged country total market capitalization as the weight. Figure 1 shows that the early-stage strategy dramatically outperforms both the simple and late-stage strategies in our sample. One dollar invested in the long-short portfolio based on the early-stage momentum strategy at the beginning of 1988 would have grown to 36 dollars at the end of our sample period (i.e., 2013), while this number is 10.7 and 3.6 dollars if the simple and late-stage strategies were adopted, respectively. Figure 1 also shows that all three momentum strategies suffer big sudden losses in 2009 during the recent financial crisis.[16] However, the global momentum crash does recover strongly post crisis. By the end of our sample (2013), the losses have already been more than fully recovered.

4.2. Robustness checks

[16] During our sample period, the worst month return to the simple momentum strategy occurs in 2009 for 14 out of 36 countries.

One may argue that the early- and late-stage momentum strategies give different returns simply due to their differential risk exposure. To rule out this possibility, we control for the country-specific or global Fama and French (1993) three factors and report alphas from these regressions.[17] In the Online Appendix, Tables A2 and A3 show that the results barely change and in some cases are even stronger. This is to be expected since the momentum portfolio is little exposed to the traditional risk factors. In sum, the results show that the differential returns accrued to momentum strategies at different stages cannot be simply explained by their differential exposure to traditional risk factors.

We present various robustness checks of our basic findings in the Online Appendix, Tables A4 to A6. Table A4 confirms that the results also hold, but are weaker, for value-weighted returns. The early-stage momentum strategy outperforms the simple momentum strategy in 24 countries (6 of them are significantly) while the late-stage momentum strategy outperforms only in 15 countries (4 of them are significantly). Table A5 confirms these patterns for two sub-periods. The first sub-period runs from 1988 to 2000 and the second sub-period runs from 2001 to 2013. In both sub-periods, we find that the early-stage momentum strategy significantly outperforms both the late-stage strategy and the simple momentum strategy. In fact, the results are stronger in the later sub-period. More specifically, the equal-weighted early minus simple WML from the entire world is 0.31% (t-stat = 1.90) per month in the earlier period and it increases to 0.57% (t-stat = 2.95) in the later period. Interestingly, although there is a global momentum crash in 2009, the simple and early-stage momentum strategies are still very profitable for almost all developed markets except Japan and the U.S. in the 2001-2013 period. In the U.S., while the early-stage and simple

[17] The global Fama and French (1993) three factors are downloaded from Ken French's Web site.

momentum strategies are very profitable (1.78% and 1.38% per month, respectively) in the 1988-2000 period, they reduce dramatically to only 0.64% and 0.12% in the 2001-2013 period.[18]

Our earlier results are all based on the 6-1-6 momentum strategy. But, our results are not specific to this momentum strategy. In the Online Appendix, Table A6 reports results using the 12-1-1 momentum strategy. We rank all the stocks in each country based on the prior cumulative returns from month -12 to month -1, skipping the most recent month 0, and holding the portfolios for one month. The early-stage momentum strategy still outperforms the simple momentum strategy in 28 out of 36 countries and 15 of them significantly so.

Overall, our results are consistent with the predictions of Hypothesis 1. We find that the MLC effect first documented in the U.S. is pervasive globally. The results are also robust to value-weighted returns, different sub-periods, and alternative ways of constructing momentum portfolios.

4.3. Long-horizon results

Previous studies (Jegadeesh and Titman, 2001; Chui, Titman, and Wei, 2010) have found that the momentum effect is followed by reversal after a year, suggesting that both investor underreaction and delayed overreaction may play a role in generating the momentum effect. The MLC hypothesis prescribes that high-turnover winner stocks and low-turnover loser stocks are in the late stage of the MLC, hence their momentum profitability is likely to reverse in the near future. Indeed, Lee and Swaminathan (2000) find that the late-stage momentum returns turn negative just one year after portfolio formation, while the early-stage momentum returns persist for three to four years after portfolio formation.

In this subsection, we construct event-time annual buy-and-hold returns to the early- and late-stage momentum strategies over the next three years. Year 1, Year 2, and Year 3 represent the

[18] Mao and Wei (2014) find that in the U.S., the momentum profit is negative (-0.17% per month) although insignificant (t-stat = –0.30) based on decile sorting during the period from 2001 to 2010.

annual returns of each portfolio in the three 12-month periods following the portfolio formation date. Because the number of stocks in many countries become small after we lengthen the horizon, we do not consider return horizons beyond three years. The annual portfolio returns are computed as an equal-weighted average of annual returns of the individual stocks in the portfolio. To correct for autocorrelations due to overlapping observations, we compute t-statistics using the Newey and West (1987) correction for autocorrelations with 11 lags.

Table 3 shows that the profits of the early-stage momentum strategy are much more persistent than those of the simple and late-stage momentum strategies, especially for the two- and three-year return horizons. While the simple momentum strategy is profitable in only 3 and 1 out of 36 countries in Year 2 and Year 3, respectively, the returns to the early-stage momentum strategy are still significantly positive in 11 and 10 countries even in Year 2 and Year 3, respectively. The early-stage momentum strategy generates significantly higher annual returns than the simple momentum strategy in 21 out of 36 countries in Year 1, 22 countries in Year 2, and 20 countries in Year 3. On the other hand, returns to the late-stage momentum strategy quickly reverse and become significantly negative one year after portfolio formation.

4.4. Fama-MacBeth regressions

The tables presented so far have shown extensively that the key predictions of the MLC hypothesis hold for our international sample and are robust to different sub-periods and alternative definitions of the momentum strategy. However, the empirical approach used is portfolio sorts. While the sorting method can address potential nonlinear relations between the sorting variable and future returns, it also suffers from the omitted variable problem in the sense that other firm characteristics may correlate with the sorting variable and drive the results. In this section, we use

the Fama-MacBeth (1973) regression method to control for additional firm characteristics that are typically associated with cross-sectional stock returns.

To capture the idea that the momentum effect is different among stocks with different turnover ratios, we run the following cross-sectional regression for each country in each month:

$$\begin{aligned} R_{i,t} = {} & \alpha + \beta_1 LnME_{i,t-1} + \beta_2 LnBM_{i,t-1} + \beta_3 R_{i,t-1} + \beta_4 Winner_{i,t-1} \\ & + \beta_5 Winner_{i,t-1} \times MTurn_{i,t-1} + \beta_6 Winner_{i,t-1} \times LTurn_{i,t-1} \\ & + \beta_7 Mid_{i,t-1} + \beta_8 Mid_{i,t-1} \times LTurn_{i,t-1} + \beta_9 Mid_{i,t-1} \times HTurn_{i,t-1} \\ & + \beta_{10} Loser_{i,t-1} + \beta_{11} Loser_{i,t-1} \times MTurn_{i,t-1} + \beta_{12} Loser_{i,t-1} \times HTurn_{i,t-1} + \mu_{i,t}, \end{aligned} \quad (1)$$

where *Winner* (*Loser*) is a dummy variable that equals one if a stock belongs to the portfolio in the highest (lowest) past six-month cumulative return quintile and zero otherwise. *Mid* is a dummy variable that equals one if a stock is not in the two extreme return quintiles and zero otherwise. *LTturn* (*HTurn*) is a dummy variable that equals one if a stock belongs to the portfolio in the lowest (highest) past average monthly turnover tercile and zero otherwise. Other independent variables are standard cross-sectional stock return predictors, including market capitalization (*LnME*), the book-to-market ratio (*LnBM*), and the past one-month return (*lret*). These controls are meant to capture the size effect, the value premium, and the short-term reversal effect. The coefficients of interest are β_6 and β_{12}. According to our Hypothesis 1, β_6 should be positive and β_{12} should be negative, since low turnover winner and high turnover loser stocks should exhibit stronger momentum effects relative to high turnover winners and low turnover losers.

Table 4 reports the Fama and MacBeth (1973) regression results for each country. Reported are the time-series averages of the monthly regression coefficients and associated t-statistics. We focus on the coefficients on the interaction terms between winner, loser, and turnover dummies. The coefficient β_6 is positive in 19 out of 36 countries and 4 of them are significantly so, while

the coefficient β_{12} is negative in 30 countries and 16 of them are significantly so. The results suggest that after controlling for other return predictors, the return difference between the early-stage and late-stage momentum strategies mainly comes from the short leg. Although low-turnover winner stocks do not significantly outperform high-turnover winner stocks in most countries, high-turnover losers do significantly underperform low-turnover loser stocks in most countries.[19] Coefficients on other explanatory variables are consistent with previous studies (e.g., Fama and French, 2012; Titman, Wei, and Xie, 2013), in that firm size is negatively associated with expected returns, book-to-market equity is positively associated with expected returns, and the prior month return negatively predicts future returns. The results in Table 4 are thus consistent with Hypothesis 1.

4.5. Comovment of momentum returns across countries

Our finding of the pervasive MLC effect around world raises the question of whether momentum returns in different countries comove with each other. Asness, Moskowitz, and Pedersen (2013) find that momentum has a strong factor structure and is correlated across asset classes. They argue global funding liquidity risk plays an important role driving the comovement of momentum across seemingly unrelated asset classes. In this section, we examine whether momentum returns in different stages are differentially correlated across countries. To do this, we regress the time series of the momentum return in country j on the global momentum return, controlling for global market, SMB, and HML factors. Country j is excluded from the calculation of global average momentum when the dependent variable is the momentum return in this country

[19] The finding that most return difference between early- and late-stage momentum profits arise from the short-leg should not be surprising in light of the recent evidence that short-selling overvalued securities is more costly and riskier than long undervalued ones (Stambaugh, Yu, and Yuan, 2012; 2015).

j. We separately look at the simple momentum strategy, as well as early and late-stage momentum strategies. The result is reported in Table 5.

In Panel A, we report the average of the country-by-country regression coefficient for the full sample period. Consistent with Asness et al. (2013), momentum profits are highly correlated across countries, with the average coefficient being 0.89. Over 36 countries examined, all have positive loading on the global momentum factor. In the second and third columns, we find early-stage and late-stage momentum returns are also highly correlated across countries, and the early-stage strategy has slightly higher correlation among different countries than does the late-stage strategy. In Panel B, we look at the comovement using the post-2007 data. As we can see, the average loadings of individual country's momentum return on the global momentum factor increase significantly for all three strategies. Since funding liquidity becomes more important during and after the 2007 global financial crisis, this is consistent with Asness, Moskowitz, and Pedersen (2013) that funding liquidity risk may be the reason behind the strong factor structure of momentum returns across the world.

4.6. The momentum life cycle in ETFs

In this section, we examine whether the MLC effect exists in other asset classes in addition to the global equity markets. Such a test would be useful to rule out data mining concerns as Lee and Swaminathan (2000) only look at equity markets. Due to data availability, we focus only on ETFs, which have been growing exponentially during the recent decade. At the end of year 2015, there are 1,594 ETFs managing 2.1 trillion dollars in the U.S. market, up from 201 ETFs and 296 billion dollars in 2005. Most ETFs track a particular stock or bond index by physically holding all or a sample of constituent securities as their underlying assets. As ETFs are traded intraday in

exchanges, and price and trading volume data are easily available for a large cross section, they are ideal for us to conduct a test to see the existence of the MLC effect.

We conduct the MLC test on ETFs following the same method as we do for international stock markets. That is, we sort all eligible ETFs into quintiles based on past six-month cumulative returns and independently sort into terciles based on past six-month turnover. ETF returns within each portfolio are equally weighted and held for six months.[20] The only difference is that we do not skip a month between portfolio formation and holding periods. The reason is because ETFs are much more liquid than stocks and the bid-ask bounce at the month end has a very small effect on ETF returns. The results are essentially the same when we skip by one month.

The results are reported in Table 6. As we can see, conditioning on turnover greatly enhance momentum profitability on ETFs. The simple strategy generates a monthly return of 0.58% (t-stat = 1.28), while it is 0.86% (t-stat = 1.89) for the early-stage strategy. The return is close to 0% for the late-stage strategy. The difference between the early- and the late-stage strategies is 0.76% per month and highly significant. We observe a similar pattern when we adjust the return using the Fama-French (1993) three-factor model. To the best of our knowledge, the profitability of the momentum strategy has not been examined for ETFs and our results point to the pervasiveness of the MLC effect in a truly out-of-sample asset class.

The MLC hypothesis proposed by Lee and Swaminathan (2000) focuses on periodic attention and negligence experienced for individual stocks, which may not fit the landscape of ETFs that are usually comprised of hundreds of stocks. The momentum effect and its associated life cycle phenomenon could be well explained by the style investment model of Barberis and Shleifer (2003), however. In their model, investors allocate funds at the style level and their

[20] ETFs are indicated in the CRSP monthly stock file with share code of 73.

allocation is based on the relative performance between distinct styles. Investors' performance-chasing behavior at the style level generates momentum and reversal for style portfolios. As many ETFs are explicitly constructed based on style classifications such as value/growth, asset allocation across different styles could be the reason driving the MLC effect for ETFs.

5. Cross-Country Analysis of the Momentum Life Cycle Effect

The results presented thus far have shown that the MLC effect first documented by Lee and Swaminathan (2000) in the U.S. market is a pervasive phenomenon in the global markets as well. However, it also varies considerably across different countries.[21] In this section, we conduct the cross-country analysis of the MLC effect, which should shed further light on the differential mechanisms underlying early- and late-stage momentums. Section 5.1 reports the results on the relation between individualism and the MLC effect. Section 5.2 discusses the results on the impact of arbitrage frictions on the MLC effect.

5.1. Individualism and the MLC effect

We first test whether cross-country differences in the MLC effect are related to the country-level individualism measure. According to Hofstede (2001), individualism reflects the degree to which people focus on their own internal attributes to differentiate themselves from others. Chui, Titman, and Wei (2010) argue and find that these psychological traits should lead to a stronger momentum effect as predicted by the model of Daniel et al. (1998).[22] However, our results show that early- and late-stage momentum are caused by differential mechanisms and hence the impact of investors' overconfidence and self-attribution bias on momentum might be different.

[21] The month return difference between early- and late-stage momentum strategies varies from 4.47% in India to -0.83% in China.

[22] Chui et al. (2010) document that individualistic countries tend to have higher trading activities and excess volatility, supporting their use of individualism as proxy for overconfidence and self-attribution bias.

Hypothesis 2 predicts that individualism should only positively related to the cross-country differences in the late-stage but not the early-stage momentum profits. To test this hypothesis, we run the Fama and MacBeth (1973) regression of returns to various momentum strategies on the individualism index at the country level. We also control for a comprehensive set of country-level institutional variables in the regression, including variables related to accounting quality (Acct and EMS), price efficiency (R-squared (R^2)), investor protection (Antiself, Antidir, and CR) and financial market development (MKT and Developed). Acct is the accounting standard index; EMS is the earnings management score; R^2 is R-squared from a stock return regression on market returns; Antiself is the anti-self-dealing index; Antidir is the revised anti-director rights index; CR is the creditor rights index; MKT is the stock market development index; and Developed is a dummy for developed markets. The details of these control variables are provided in Appendix A. These institutional variables have been documented to be associated with the cross-country difference in many stock return anomalies including the high-volume premium and the asset growth effect (Kaniel, Ozoguz, and Starks, 2012; Titman, Wei and Xie, 2013).

The results are reported in Table 7. In Column (1), we use returns to the simple momentum strategy as the dependent variable. In Columns (2) and (3), the dependent variable is the returns to the early- and late-stage momentum strategies, respectively. In Column (4), the dependent variable is the return difference between the early- and late-stage momentum strategies. The t-statistics are based on Newey and West (1987) to control for heteroscedasticity and autocorrelation. The results are broadly consistent with Hypothesis 2. First, we find that country-level momentum effects based on the simple strategy are significantly positively related to the individualism index, which is consistent with Chui, Titman, and Wei (2010). The coefficient on the individualism index in

Column (1) is 0.026 and highly significantly with a t-statistic of 4.11.[23] More importantly, we find that the return to the early-stage momentum strategy is not related to the individualism index, as the coefficient on the individualism index in Column (2) is -0.005 and insignificant. The result shows that although stocks at the early stage of the MLC exhibit stronger and more persistent price continuation, it is more likely explained by investors' underreaction to news as in Barberis, Shleifer, and Vishny (1998) or Hong and Stein (1999).

Consistent with idea that the late-stage momentum effect is driven by investors' delayed overreaction due to overconfidence and self-attribution bias, we find that the return to the late-stage momentum strategy is highly positively related to the individualism index. The coefficient on the individualism index in Column (3) is 0.050 (t-stat = 4.63), which almost doubles that reported in Column (1) for the simple momentum strategy. Thus in countries where investors are more likely to be overconfident about their private information and exhibit more self-attribution bias, the degree of overreaction-driven price continuation is greater but the extent of underreaction-driven momentum effects is not. In Column (4), we use the return difference between the early- and late-stage momentum strategies as the dependent variable, and the coefficient on individualism is significantly negative. This is to be expected since the early-stage momentum profitability is not related to individualism, while the late-stage momentum profitability is positively related to individualism.

In sum, we find evidence consistent with our Hypothesis 2 that early- and late-stage momentums arise from distinct mechanisms. While late-stage momentum stocks are in the

[23] The coefficient on the Developed dummy is significantly negative in the regression (1), however previously we show that returns to simple momentum strategies are more pronounced in developed markets than emerging markets. This is due to the multi-collinearity between Developed dummy and Individualism index. When Developed dummy is the only independent variable in the regression, it is significantly positive (t-stat = 1.81), consistent with the portfolio sorting results.

overreaction phase and momentum strategies are more profitable in high than in low individualism countries, early-stage momentum stocks are in the underreaction phase and momentum profits are unrelated to individualism.

5.2. Limits to arbitrage and the MLC effect

While stock market mispricing arises from investors behavioral biases, market frictions that prevent unlimited arbitrage are necessary to sustain mispricing (Barberis and Thaler, 2003). As documented extensively in the literature, many cross-sectional stock return anomalies are indeed more pronounced among stocks with a higher degree of limits to arbitrage (e.g., Ali, Hwang, and Trombley, 2003; Nagel, 2005; Lam and Wei, 2011; Drechsler and Drechsler, 2014). Analogously, if the momentum effect is indeed a form of mispricing rather than compensation for some omitted risk factors, we should be able to find stronger momentum effects among countries with more severe impediments to arbitrage.

However, in his presidential address at the American Finance Association annual meetings, Stein (2009) questions this traditional view on the role of arbitrageurs. Rather than eliminating mispricing and improving market efficiency, arbitrageurs may actually amplify the mispricing and, in turn, the momentum effect. His argument is that for an unanchored strategy like momentum, arbitrageurs' demand is based solely on past price changes and ignores the fundamental value of an asset. With many dispersed and uncoordinated arbitrageurs trading on the same price signal, it is unclear whether the prior price change is due to market underreaction to fundamentals or arbitrageurs' positive feedback trading. Sometimes there are too few arbitrageurs trading the momentum stocks, leading to profitable opportunities. Other times, arbitrageurs who trade on the momentum strategy may be too crowded and prices may overshoot. Stein (2009) thus concludes

that the presence of more sophisticated investors in the stock market may not necessarily lead to less mispricing and market efficiency improvement but may actually destabilize the market.[24]

Based on the above reasoning, the overall effect of arbitrage frictions on momentum profitability is unclear and depends on which of the two forces is stronger. The differentiation of stocks across momentum stages, however, provides a natural ground to evaluate each hypothesis.[25] Since the early-stage momentum effect is mainly due to stock price underreaction to news, more arbitrage activities should help correct the mispricing and reduce momentum profits. On the other hand, since the late-stage momentum effect is likely the result of arbitrageurs' positive feedback trading, lower market frictions should lead to more arbitrageur trading, amplify mispricing and increase late-stage momentum profits.

To test Stein's (2009) hypothesis (i.e., our Hypothesis 3), we run the Fama and MacBeth (1973) regressions of returns on various momentum strategies based on three proxies for limits to arbitrage at the country level. Following the literature (Titman et al., 2013; Watanabe et al., 2013), these three proxies are country-level idiosyncratic volatility (*IVol*), the measure of country-level trading costs (*TCost*), and a dummy variable indicating whether short selling is allowed in a given country (*Short*). Similar to Section 5.1, we also control for the same set of country-level characteristics in this regression. The results reported in Table 8 are consistent with Stein's (2009) conjecture and our Hypothesis 3. In Panel A of Table 8, we use the country-level idiosyncratic volatility as the proxy for the country-level limits to arbitrage. As we can see from Column (1) where the dependent variable is the returns to the simple momentum strategy, the coefficient on

[24] Consistent with Stein's (2009) model, Lou and Polk (2013) develop a measure of time-varying arbitrage capital exploiting momentum strategy and find that momentum tend to revert and crash when their measure of arbitrage activity is high compared to when arbitrage activity is low.

[25] Another way to test the Stein's (2009) model is to look at the time-series relation between momentum profits and arbitrage costs. A recent paper by Avramov, Cheng and Hameed (2015) documents a positive relation between aggregate market liquidity and momentum profits, which is consistent with the evidence in our paper.

IVol is negative, which indicates that the momentum profits are higher in countries with lower degree of limits to arbitrage. The result seems to contradict the traditional view on the role of arbitrageurs but is consistent with Stein's (2009) view on the role of arbitrageurs in amplifying mispricing.

In Columns (2) and (3), the dependent variables are returns to the early- and late-stage momentum strategies, respectively, where we find that the coefficients on the idiosyncratic volatility (*IVol*) have opposite signs. The positive coefficient (=0.964) in Column (2) indicates that the early-stage momentum strategy is less profitable in countries with lower idiosyncratic volatility, which is consistent with the traditional view that arbitrageurs facilitate the price discovery process and improve market efficiency. The negative coefficient (-2.401) on *IVol* in Column (3) indicates that the late-stage momentum strategy is more profitable in countries facing lower volatility. This is consistent with Stein's (2009) argument that less market frictions could potentially lead to more crowded trading by arbitrageurs and price distortions. In Column (4), we use the return difference between the early- and late-stage momentum strategies as the dependent variable, and find that the coefficient on *IVol* is significantly positive. This is to be expected since the early- and late-stage momentum profits have opposite signs on the coefficient of *IVol.*

In Panels B and C of Table 8, we use the trading cost measure (*TCost*) and the short-sale feasibility dummy (*Short*) to proxy for the severity of arbitrage friction and find consistent results. In both panels, we find that the early-stage momentum effect is less pronounced while the late-stage momentum effect more pronounced in countries facing lower limits to arbitrage. Overall, the results are supportive of Stein's (2009) argument that arbitrageurs may amplify the mispricing, and this is especially true for stocks at the late-stage of the MLC.

The literature on momentum usually treats stocks in the same winner or lose status as homogeneous. However, our results in Tables 7 and 8 suggest that the early- and late-stage momentum strategy behave quite differently in terms of their cross-country variation in momentum profitability. The early-stage momentum is more persistent, experiences no reversal and is more pronounced in countries with larger trading frictions, suggesting that it is more likely due to investors' underreaction. The late-stage momentum is less persistent, experiences quick reversals and is more pronounced in countries with higher individualism culture and less arbitrage impediments, suggesting that it is likely driven by investors' overreaction and positive feedback trading.

5.3 Sentiment and the MLC Effect

Our last test is to examine the time-series relation between sentiment and returns to early- and late-stage momentum strategies. This test is motivated by Doukas et al. (2013), who find that momentum profits are more pronounced following higher market sentiment. They argue that news that contradicts investors' sentiment causes cognitive dissonance, which slows the diffusion of signals that oppose the direction of sentiment. Consequently, loser stocks should underperform when sentiment is high, and winner stocks should outperform when sentiment is low. Due to short selling constraints, it is more difficult for arbitrageurs to correct the overpricing of loser stocks than underpricing of winner stocks. Hence, momentum profits should be more pronounced following the high sentiment period. The MLC hypothesis posits that early-stage momentum is mainly an underreaction, while late-stage momentum is an overreaction phenomenon. If underreaction to news is indeed caused by the cognitive dissonance of conflicting signals between recent price move and sentiment, we should expect to see sentiment only affects early-stage momentum but not late-stage momentum profits.

To test this hypothesis, we run the following predictive regression:

$$WML_{i,t} = \alpha + \beta_1 Sentiment_{t-1} + \beta_2 Up_{i,t-1} + \beta_3 Mktvol_{i,t-1} + e_t, \quad (2)$$

where the dependent variable WML represents monthly returns to different stage momentum strategies in month *t* and country *i*. The key explanatory variable is sentiment, which we use both the Baker-Wurgler sentiment index and the Conference Board Consumer Confidence as a proxy. Following Cooper et al. (2004), we compute the cumulative returns on the country market index over the past 24 months (i.e., months $t-24$ to $t-1$) and denote the non-negative market returns by a dummy variable (*Up*) that takes the value of one only if a non-negative cumulative two-year return is recorded in month $t-1$. Wang and Xu (2015) document that, in addition to market states, the aggregate market volatility significantly predicts momentum profits. We thus add another control, *Mktvol*, which is the standard deviation of monthly country index returns over past 24 months as our measure of aggregate market volatility. To increase the statistical power, we pooled all country-specific monthly momentum returns together and control for country-fixed effects. Because of the cross-correlation in returns, our significance tests use month-clustered standard errors.

The results are reported in Table 9. In Panel A, we use the Baker-Wurgler (2007) sentiment index. Consistent with Doukas, Antoniou, and Subrahmanyam (2013), we find that sentiment positively predicts next month's momentum profits for the simple strategy in Column (1). In Columns (2) and (3), we replace the simple momentum strategy return with early- and late-stage momentum profits, respectively. Consistent with our hypothesis, sentiment positively predicts momentum profits only for the early-stage momentum strategy but not for the late-stage momentum strategy. The coefficient on sentiment is 1.56 and significant at the 5% level when the dependent variable is the early-stage momentum returns, while it is negative and insignificant for

the late-stage momentum returns. The coefficients on control variables are consistent with previous findings. Specifically, momentum profits are higher following up market states and lower when market is more volatile. In Panel B, we use the Conference Board Consumer Confidence Index as proxy for sentiment and find similar results.

6. Conclusion

According to Lee and Swaminathan (2000), trading volume is able to predict both the magnitude and persistence of the price momentum effect. They propose a simple conceptual framework dubbed the momentum life cycle (MLC) hypothesis to reconcile their empirical findings. They classify low-turnover winner stocks and high-turnover loser stocks as being in the early stage of the MLC. They argue that these early-stage momentum stocks should exhibit stronger and more persistent future price continuation. In contrast, high-turnover winners and low-turnover losers are classified as being in the late stage of the MLC and should exhibit weaker and less persistent future price continuation.

In this paper, we test whether trading volume also predicts the cross-sectional momentum profits in an international setting. Our findings are broadly consistent with the MLC hypothesis. Using portfolio sorts, we find that the returns to the early-stage momentum strategy are significantly more pronounced than the returns to the late-stage momentum strategy. In addition, the early-stage momentum strategy is also much more profitable than the simple unconditional momentum strategy. These results are robust and the economic magnitude is large. The early-stage momentum strategy even delivers significant positive returns beyond the first year, while returns to the late-stage momentum strategy reverse quickly. The return difference between these two momentum strategies cannot be explained by the local or global Fama-French (1993) three-factor

model. Using the Fama-MacBeth (1973) regression methodology, we find that the results are mostly driven by the underperformance of high-turnover loser stocks relative to low-turnover loser stocks, and less so by the outperformance of low-turnover winner stocks over high-turnover winner stocks. Using a large sample of U.S. ETFs, we confirm the existence of the MLC even in this new asset class.

We find that momentum profits are positively related to individualism for the late-stage but not for the early-stage strategy. In time series, sentiment positively predict early-stage but not the late-stage momentum profits. These results are consistent with the predictions of the MLC hypothesis that early- and late-stage momentum effects are driven by different underlying mechanisms.

Finally, the early-stage momentum effect is weaker while the late-stage momentum effect is stronger among countries with lower impediments to arbitrage. These results are consistent with Stein's (2009) argument that arbitrageurs may amplify the mispricing generated by noise traders, especially for the late-stage momentum strategy.

Overall, our results strongly support the MLC hypothesis and provide further insights on the sources and determinants of momentum profits. More importantly, cross-country differences in the momentum effects are associated with individualism and arbitrage frictions in different ways depending on what the MLC stage of the stocks are at.

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Appendix A: Definitions of Country-level Characteristic Variables

Variable	Definition and data source
Individualism index (Indv)	Hofstede (1980, 2001) defines individualism as the extent to which people are integrated into groups. It reflects the degree to which people focus on their own internal attributes to differentiate themselves from others.
Idiosyncratic volatility (IVol)	For each firm-month, daily stock returns within the month are regressed on the returns on a value-weighted market portfolio of the country to which the firm belongs. Idiosyncratic volatility for the firm-month is the standard deviation of the regression residuals. Next, for each country-month, we calculate the value-weighted average of firm-month idiosyncratic volatilities. The country-level idiosyncratic volatility is the time-series average of the country-month idiosyncratic volatilities.
Index of trading costs (TCost)	Obtained from Chan, Covrig, and Ng (2005) and Chui, Titman, and Wei (2010) to proxy for transaction costs or limits to arbitrage. A higher value of the index indicates that it is more difficult to arbitrage in that country.
Short-sale feasibility dummy (Short)	Short-sale feasibility dummy equals one if short selling is a common practice in the country and zero otherwise. The values of this dummy are obtained from Bris, Goetzmann, and Zhu (2007).
Accounting quality (Acct)	The accounting quality index is taken from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) based on the reporting or omission of 90 items in corporate financial reporting. A higher value of Acct indicates higher accounting standards.
Earnings management score (EMS)	A measure of earnings management tendency developed by Leuz, Nanda, and Wysocki (2003), given by the average rank across the following four variables. EM1 is the country's median ratio of the firm-level standard deviations of operating income and operating cash flow (both scaled by lagged total assets). EM2 is the country's Spearman correlation between the change in accruals and the change in cash flow from operations (both scaled by lagged total assets). EM3 is the country's median ratio of the absolute value of accruals and the absolute value of the cash flow from operations. EM4 is the number of "small profits" divided by the number of ''small losses'' for each country. The aggregate earnings management measure EMS is the average rank across all four measures (i.e., EM1–4). A higher value of EMS indicates poorer earnings quality.
Stock return synchronicity (R^2)	The R-squared (R^2) of a regression in which weekly individual stock returns are regressed on contemporaneous weekly market returns as well as two leads and two lags of the weekly market returns. The inclusion of the leads and lags of market returns is to control for nonsynchronous trading. We run the regression for each stock every year and then take the average R-squared from the firm-level regressions within each country to compute the country-level R^2.

Anti-self-dealing index (Antiself)	A survey-based measure of ex ante and ex post restrictions on controlling shareholders' self-dealing, obtained from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008). The index ranges from 0 (weak control of self-dealing transactions) to 1 (strong control).
Revised Anti-director rights index (Antidir)	The sum of six components, three of which are on shareholder voting (voting by mail, voting without blocking of shares, and calling an extraordinary meeting), and the remaining three are on minority protection (proportional board representation, preemptive rights, and judicial remedies). Antidir is obtained from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008). The index ranges from 0 (weak shareholder protection) to 6 (strong shareholder protection).
Creditor rights index (CR)	An index measuring creditors' rights obtained from La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998). A score of one is assigned when each of the following rights of secured lenders are protected by laws and regulations. First, there are restrictions, such as creditor consent or minimum dividends, on a debtor who want to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved, i.e., there is no ''automatic stay'' or ''asset freeze.'' Third, secured creditors are paid first out of the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, management does not retain administration of its property pending the resolution of the reorganization. CR is the sum of the four scores, ranging from 0 (weak creditor rights) to 4 (strong creditor rights).
Stock market development (MKT)	The sum of the annual cross-country ranks of the following three variables: (1) a country's market capitalization to GDP ratio, (2) the number of publicly listed companies scaled by population, and (3) the number of IPOs scaled by population.
Developed dummy (Developed)	Developed dummy equals one if the country is classified as an advanced economy by the International Monetary Fund (IMF), and zero otherwise.

Table 1. Summary Statistics

This table shows summary statistics of the sample of 36 countries, including 21 developed countries and 15 emerging countries. The overall sample runs from 1988 to 2013. Stock return data and accounting information for international countries excluding the U.S. are taken from Datastream and Worldscope, respectively. U.S. stock return and accounting data are taken from CRSP and Compustat, respectively.

Country	Average # of stocks	Median firm size (Million USD)	Start date	Total # of stocks
Developed Markets				
Australia	1,113	23.1	198801	3,398
Belgium	202	72.9	198801	583
Canada	1,303	61.7	198801	4,030
Denmark	201	63.7	198801	442
Finland	124	142.3	198801	307
France	767	89.6	198801	2,168
Germany	730	109.8	198801	2,120
Greece	241	41.5	198802	493
Hong Kong	751	87.8	198801	1719
Israel	433	21.9	198801	864
Italy	312	194.8	198801	753
Japan	2,323	291.6	198801	3,394
Netherlands	182	256.2	198801	466
New Zealand	109	44.7	198801	350
Norway	179	100.9	198801	656
Singapore	359	93.5	198801	815
Spain	142	480.7	198801	339
Sweden	394	58.9	198801	1,501
Switzerland	291	269.4	198801	659
United Kingdom	1,577	62.4	198801	6,332
United States	7,003	186.3	198801	25,029
Emerging Markets				
Brazil	323	81.9	199002	1,083
Chile	157	186.9	198908	342
China	1,165	274.0	199102	2,641
India	1,063	12.0	198804	3,203
Indonesia	242	60.4	199005	567
Malaysia	613	66.6	198801	1,088
Mexico	125	366.1	198802	446
Philippines	162	46.2	198801	366
Poland	245	31.8	199105	1,062
Russian Federation	167	111.4	199407	950
South Africa	376	96.1	198801	1,070
South Korea	817	51.9	198801	1,441
Taiwan	523	232.8	198801	1,019
Thailand	387	48.0	198801	899
Turkey	239	55.1	198802	479

Table 2. Returns to the early-stage and late-stage momentum strategies in each market

This table reports monthly winner-minus-loser (WML) returns in percentage to the early- and late-stage momentum strategies and compares them to returns to the simple momentum strategy (without conditioning on turnover). Turnover is computed as the average monthly trading volume divided by shares outstanding over the previous six months. WML(early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.19**	6.05	0.44	1.41	**0.98**	3.80	-0.77	-3.50	**1.75**	3.89
Belgium	**0.86**	2.05	**0.64**	1.90	-0.14	-0.42	-0.36	-1.23	0.22	0.42
Canada	**2.15**	6.47	0.30	1.12	**0.98**	4.73	-0.88	-5.16	**1.86**	5.14
Denmark	**1.23**	3.20	**1.60**	5.46	-0.24	-0.82	0.12	0.47	-0.34	-0.70
Finland	**0.88**	1.74	**1.34**	3.48	-0.26	-0.70	0.21	0.60	-0.46	-0.74
France	**1.26**	3.00	**0.85**	2.98	0.12	0.38	-0.26	-0.87	0.46	0.82
Germany	**2.61**	5.34	**0.75**	2.24	**1.06**	2.96	-0.79	-2.31	**1.91**	3.28
Greece	**1.70**	2.60	-0.21	-0.48	**1.05**	2.45	-0.86	-2.47	**1.91**	2.64
Hong Kong	**2.35**	4.99	-0.66	-2.05	**1.53**	3.87	-1.48	-5.50	**3.02**	4.75
Israel	**1.39**	3.13	0.04	0.13	**0.54**	1.72	-0.81	-2.93	**1.35**	2.39
Italy	**1.20**	3.01	**0.72**	2.43	0.26	1.02	-0.20	-0.85	0.49	1.13
Japan	0.20	0.57	-0.30	-1.18	0.33	1.50	-0.20	-1.01	0.54	1.38
Netherlands	**1.66**	4.14	**1.12**	3.75	**0.44**	1.74	-0.10	-0.41	0.54	1.20
New Zealand	**1.98**	4.39	**1.01**	2.45	**0.55**	1.69	-0.43	-1.24	**0.98**	1.67
Norway	**1.20**	2.27	**1.41**	3.43	0.09	0.21	0.29	0.86	-0.20	-0.28
Singapore	**1.34**	3.08	-0.23	-0.68	**0.81**	2.85	-0.76	-3.11	**1.57**	3.14
Spain	**1.09**	2.25	0.31	0.91	0.31	1.01	-0.48	-1.65	0.78	1.46
Sweden	**1.78**	3.86	**0.99**	3.06	**0.52**	2.13	-0.27	-1.15	**0.79**	1.77
Switzerland	**1.01**	2.75	**1.03**	3.82	0.00	-0.01	0.01	0.06	0.04	0.09
United Kingdom	**1.40**	4.22	**1.88**	7.80	-0.22	-1.16	0.27	1.57	-0.49	-1.46
United States	**1.21**	3.13	0.36	1.24	**0.46**	2.17	-0.39	-1.71	**0.85**	1.99
Average (EW)	1.42	5.79	0.61	4.31	0.42	3.00	-0.39	-3.00	0.82	3.14
Average (VW)	1.30	4.31	0.50	2.49	0.44	2.76	-0.36	-2.20	0.81	2.58

Table 2 – Continued

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**1.30**	2.59	-0.12	-0.33	**0.71**	2.06	-0.71	-2.29	**1.42**	2.40
Chile	**1.33**	3.43	**1.17**	3.24	0.29	0.84	0.12	0.42	0.17	0.29
China	-0.21	-0.39	**0.62**	2.12	-0.54	-1.37	0.29	1.11	-0.83	-1.31
India	**1.76**	2.93	-2.71	-5.59	**2.21**	5.32	-2.26	-5.69	**4.47**	5.70
Indonesia	**1.40**	2.16	-0.54	-0.94	**1.07**	2.24	-0.88	-2.20	**1.94**	2.39
Malaysia	**1.08**	2.33	-0.04	-0.13	**0.70**	2.42	-0.42	-1.69	**1.12**	2.18
Mexico	**1.11**	2.26	**0.87**	2.00	0.33	0.88	0.09	0.21	0.24	0.35
Philippines	0.90	1.15	-1.44	-2.47	**1.21**	2.36	-1.14	-2.77	**2.34**	2.69
Poland	**1.60**	2.67	**0.94**	1.86	0.43	1.03	-0.23	-0.62	0.66	0.91
Russian Federation	**1.52**	1.97	-0.82	-1.05	0.80	1.46	-1.54	-2.71	**2.35**	2.45
South Africa	**2.63**	7.78	**1.35**	4.80	**0.65**	2.83	-0.63	-2.95	**1.28**	3.07
South Korea	**1.17**	2.17	-0.73	-1.60	**1.03**	3.12	-0.87	-3.49	**1.90**	3.44
Taiwan	**0.85**	1.95	-0.18	-0.49	**0.69**	2.03	-0.34	-1.30	**1.03**	1.79
Thailand	0.67	0.98	0.36	0.81	-0.02	-0.03	-0.33	-0.74	0.31	0.36
Turkey	-0.47	-0.88	-1.34	-3.21	0.19	0.47	-0.68	-2.08	0.87	1.26
Average (EW)	0.93	3.75	0.01	0.06	0.48	2.85	-0.44	-3.16	0.92	3.12
Average (VW)	1.06	5.09	0.11	0.74	0.53	3.41	-0.41	-3.67	0.94	3.70
Global Avg (EW)	1.26	5.65	0.36	2.88	0.46	3.62	-0.44	-3.69	0.91	3.79
Global Avg (VW)	1.29	4.55	0.46	2.48	0.46	2.99	-0.37	-2.42	0.84	2.82

Table 3. Annual returns to the early- and late-stage momentum strategies: Long holding horizons

This table presents annual buy-and-hold returns (in percent) to the simple (Simple), early-stage (Early) and late-stage (Late) momentum portfolios (WML) and their return differences. WML(Early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(Late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. Turnover is computed as the average monthly trading volume divided by shares outstanding over the previous six months. Panels A, B, and C report the annual returns of price momentum portfolios in the first, second, and third year after portfolio formation, respectively. The annual portfolio returns are computed as an equal-weighted average of annual returns of the individual stocks in the portfolio. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Panel A: The first year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-simple)	t-stat	WML (Late-simple)	t-stat	WML (Early-late)	t-stat
Developed Markets												
Australia	**10.16**	7.21	**19.18**	9.65	**4.32**	2.72	**9.02**	7.48	-5.84	-5.14	**14.86**	7.30
Belgium	**15.06**	9.17	**11.02**	4.29	**20.38**	8.80	-4.14	-2.18	**5.32**	2.58	-9.68	-2.71
Canada	**11.09**	6.04	**24.18**	10.60	-0.25	-0.14	**13.09**	9.68	-11.34	-10.57	**24.43**	11.65
Denmark	**13.66**	11.32	**15.45**	5.97	**16.11**	9.73	1.89	0.87	**2.55**	1.91	-0.65	-0.21
Finland	**9.89**	4.52	5.09	1.40	**13.49**	5.39	-6.91	-2.66	**4.15**	2.12	-11.53	-2.75
France	**13.89**	11.11	**13.45**	7.30	**11.34**	8.25	-0.44	-0.32	-2.55	-2.11	2.12	0.90
Germany	**14.41**	8.23	**22.92**	8.75	**8.60**	4.27	**8.50**	4.27	-5.82	-2.80	**14.32**	3.92
Greece	3.21	1.00	**17.37**	4.33	-8.88	-2.02	**14.25**	5.25	-12.09	-5.28	**26.43**	5.92
Hong Kong	**4.39**	2.77	**20.76**	8.79	-12.54	-7.32	**16.21**	9.63	-16.93	-13.84	**33.21**	13.24
Israel	**5.63**	4.02	**6.18**	2.35	**3.53**	2.18	0.56	0.27	-2.10	-1.41	2.65	0.82
Italy	12.02	9.32	**13.39**	7.45	**6.91**	4.58	1.36	0.98	-5.12	-5.48	**6.48**	3.19
Japan	0.71	0.69	**3.95**	3.20	-1.82	-1.67	**3.24**	3.99	-2.53	-4.04	**5.77**	4.27
Netherlands	**11.69**	8.53	**15.61**	6.01	**12.32**	8.06	**3.97**	2.04	0.38	0.25	3.61	1.23
New Zealand	**15.10**	8.55	**23.98**	5.96	**14.62**	3.90	**9.04**	2.47	-0.47	-0.16	**9.53**	1.66
Norway	**12.50**	5.06	4.34	1.28	**19.54**	5.82	-8.01	-2.96	**7.04**	2.93	-15.47	-3.60
Singapore	**5.38**	3.45	**18.51**	7.32	-4.61	-2.72	**12.99**	7.50	-10.00	-10.79	**23.22**	10.05
Spain	**7.18**	6.03	**6.24**	3.17	**6.23**	4.39	-1.09	-0.77	-1.16	-0.90	0.17	0.07
Sweden	**13.95**	9.31	**17.03**	7.57	**12.84**	7.51	**3.08**	1.94	-1.10	-0.89	**4.19**	1.69
Switzerland	**9.69**	6.61	**5.37**	2.61	**11.04**	6.64	-4.18	-2.74	1.42	1.25	-5.61	-2.32
United Kingdom	**13.41**	9.67	**14.37**	7.83	**13.20**	9.93	0.96	1.09	-0.22	-0.27	1.17	0.79
United States	**4.70**	2.95	**11.17**	6.22	-0.21	-0.13	**6.47**	8.08	-4.91	-5.38	**11.37**	6.99

Table 3 – Continued

Panel A: The first year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets												
Brazil	2.27	0.34	12.52	1.43	-3.62	-0.63	**10.26**	3.21	-5.88	-1.66	**16.14**	2.65
Chile	**9.98**	6.62	**18.96**	4.16	**6.81**	3.16	**8.87**	2.35	-3.17	-1.94	**11.99**	2.55
China	1.08	0.80	-2.37	-1.04	1.46	0.79	-3.63	-1.53	0.38	0.47	-4.00	-1.35
India	**22.38**	10.11	**35.17**	12.33	**10.74**	3.66	12.80	6.24	-11.64	-6.58	**24.44**	6.82
Indonesia	0.76	0.23	5.26	1.08	-5.22	-1.28	4.86	1.45	-5.94	-1.95	**9.98**	2.01
Malaysia	**3.24**	2.26	**8.11**	3.45	-2.43	-1.18	**5.31**	2.63	-5.65	-4.41	**10.92**	4.05
Mexico	**17.53**	8.65	**27.23**	7.26	**9.23**	2.04	**10.14**	2.58	-8.29	-1.97	**19.04**	2.90
Philippines	-2.04	-0.92	5.34	1.44	-11.03	-3.58	**7.26**	2.76	-9.27	-4.11	**16.44**	3.86
Poland	2.02	0.44	6.36	1.14	3.20	0.49	4.33	1.03	1.18	0.32	3.16	0.43
Russian Federation	-11.31	-1.07	-8.57	-0.68	-18.37	-1.38	2.74	0.57	-7.06	-1.83	9.80	1.36
South Africa	**21.49**	13.91	**26.77**	12.06	**17.01**	9.41	**5.27**	3.37	-4.49	-3.83	**9.76**	4.12
South Korea	-3.80	-2.14	**18.88**	9.38	-23.35	-10.39	**22.66**	12.10	-19.55	-13.21	**42.28**	14.11
Taiwan	0.83	0.62	**8.29**	5.08	-5.79	-3.32	**7.47**	5.41	-6.62	-7.17	**14.09**	7.16
Thailand	**3.56**	1.99	**9.44**	3.23	-2.42	-1.11	**5.88**	2.48	-5.98	-3.06	**11.86**	3.31
Turkey	-11.33	-4.29	-8.38	-2.03	-17.49	-6.87	3.06	1.41	-6.07	-2.90	**9.21**	2.35

Table 3 – Continued

Panel B: The second year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets												
Australia	-3.48	-3.10	**8.20**	5.20	-9.10	-5.36	**11.68**	8.70	-5.62	-4.22	**17.30**	7.44
Belgium	0.98	0.80	-1.54	-0.73	0.37	0.16	-2.89	-1.74	-0.61	-0.31	-2.66	-0.83
Canada	-7.33	-5.22	**6.03**	3.47	-16.85	-8.10	**13.35**	8.00	-9.52	-7.95	**22.88**	8.77
Denmark	-1.52	-1.35	-2.80	-1.46	-0.99	-0.52	-1.23	-0.76	0.44	0.32	-2.25	-0.87
Finland	-4.31	-2.01	-3.70	-0.97	-2.81	-1.00	-2.25	-0.84	1.35	0.54	-4.38	-0.98
France	-0.59	-0.61	**3.19**	1.95	-2.12	-1.47	**3.78**	2.86	-1.53	-1.27	**5.31**	2.32
Germany	1.46	1.02	**10.83**	4.08	-6.22	-2.62	**9.37**	4.52	-7.68	-2.89	**17.05**	3.84
Greece	-16.69	-2.84	-4.79	-0.73	-23.80	-3.73	**12.00**	3.38	-7.11	-3.03	**19.42**	4.82
Hong Kong	-5.65	-3.98	**6.22**	2.91	-14.64	-7.69	**11.81**	8.08	-8.99	-5.01	**20.84**	7.33
Israel	-3.70	-3.73	1.68	0.78	-5.43	-4.42	**5.38**	3.22	-1.73	-1.26	**7.11**	2.57
Italy	1.25	1.13	1.64	0.77	-1.17	-0.90	0.39	0.26	-2.42	-2.34	2.80	1.38
Japan	-3.81	-4.67	-1.33	-1.09	-4.83	-6.07	**2.48**	3.49	-1.02	-1.43	**3.51**	2.56
Netherlands	**4.09**	3.98	**7.52**	3.38	0.45	0.26	**3.51**	2.01	-3.62	-2.45	**7.21**	2.70
New Zealand	-0.47	-0.26	1.22	0.30	-4.88	-1.31	1.77	0.52	-4.40	-1.09	6.21	0.96
Norway	-6.58	-3.29	-5.62	-1.25	-6.82	-2.13	0.65	0.16	-0.30	-0.11	0.48	0.09
Singapore	0.41	0.40	**11.61**	6.02	-5.29	-3.01	**10.93**	6.85	-5.70	-3.82	**16.95**	6.46
Spain	-0.06	-0.06	0.59	0.29	0.47	0.28	0.69	0.44	0.83	0.57	-0.21	-0.08
Sweden	**3.49**	2.05	**6.51**	2.95	-3.29	-1.23	**3.02**	2.01	-6.73	-4.32	**9.70**	3.88
Switzerland	-4.13	-3.83	-5.17	-2.36	-3.66	-2.69	-0.95	-0.57	0.58	0.47	-1.64	-0.64
United Kingdom	-1.95	-2.05	0.14	0.10	-3.39	-2.97	**1.99**	1.88	-1.43	-1.63	**3.46**	2.02
United States	-7.83	-6.57	-5.39	-3.28	-10.34	-8.77	**2.43**	2.77	-2.52	-2.62	**4.95**	2.80

Table 3 – Continued

Panel B: The second year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets												
Brazil	-0.62	-0.20	2.94	0.66	5.18	1.12	3.57	0.92	5.80	1.23	-2.24	-0.30
Chile	-5.93	-4.10	-8.77	-3.05	-4.94	-2.30	-2.69	-1.17	0.82	0.45	-3.59	-1.01
China	-3.32	-2.91	-6.97	-4.00	-0.55	-0.43	-3.96	-3.18	**2.77**	3.96	-6.68	-3.81
India	**7.50**	5.15	**23.43**	8.01	-6.57	-2.39	**15.93**	6.13	-14.07	-6.46	**30.00**	6.66
Indonesia	-7.73	-2.53	2.18	0.45	-12.39	-2.69	**10.64**	2.81	-5.16	-1.38	**15.49**	2.55
Malaysia	-4.57	-3.05	1.67	0.80	-8.00	-4.21	**6.15**	5.15	-3.47	-2.26	**9.70**	4.08
Mexico	-5.63	-1.22	-5.62	-0.68	-11.42	-1.87	-1.67	-0.26	-4.54	-0.70	3.45	0.35
Philippines	-4.42	-1.81	0.80	0.23	-10.33	-2.80	**5.82**	1.98	-6.14	-2.54	**11.82**	2.57
Poland	-3.43	-1.76	**10.39**	3.31	-12.07	-4.08	**13.86**	6.00	-8.64	-3.35	**22.52**	5.71
Russian Federation	-4.86	-0.95	-12.17	-1.38	-12.76	-1.68	-7.31	-1.05	-7.89	-1.50	0.58	0.07
South Africa	-0.37	-0.22	2.57	1.06	-7.57	-4.16	**2.94**	2.00	-7.21	-5.40	**10.14**	4.10
South Korea	-2.02	-1.40	**8.30**	4.29	-14.50	-7.82	**10.33**	8.47	-12.48	-9.12	**22.84**	9.64
Taiwan	-2.83	-2.12	1.01	0.43	-7.25	-3.98	**3.84**	2.11	-4.41	-3.44	**8.25**	2.95
Thailand	-4.66	-2.18	-2.76	-0.84	-4.73	-1.74	1.87	0.75	-0.26	-0.09	2.11	0.45
Turkey	-4.84	-2.63	4.38	1.29	-14.25	-5.21	**7.68**	2.73	-9.33	-4.54	**17.15**	4.11

Table 3 – Continued

Panel C: The third year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets												
Australia	-5.90	-4.68	1.18	0.60	-7.62	-4.18	**7.08**	4.44	-1.72	-1.17	**8.80**	3.41
Belgium	1.37	1.15	3.17	1.46	1.10	0.48	1.22	0.58	-0.01	-0.01	0.84	0.23
Canada	-4.90	-4.15	**7.14**	4.95	-13.66	-8.10	**12.05**	9.63	-8.75	-7.63	**20.80**	10.29
Denmark	-0.73	-0.74	-0.96	-0.49	-1.15	-0.53	-0.68	-0.35	-0.39	-0.25	0.01	0.00
Finland	-0.76	-0.42	-1.06	-0.38	-0.68	-0.26	-1.50	-0.71	0.25	0.14	-2.27	-0.71
France	-2.71	-2.90	1.05	0.64	-1.73	-1.12	**3.76**	2.66	0.98	0.79	2.78	1.16
Germany	-6.33	-2.79	4.28	1.41	-17.72	-4.10	**10.62**	7.51	-11.39	-3.24	**22.01**	5.49
Greece	-17.80	-3.47	-8.36	-1.46	-18.12	-3.87	**9.98**	3.41	-0.31	-0.07	10.25	1.66
Hong Kong	-5.58	-3.03	4.51	1.49	-12.61	-5.50	**10.17**	4.52	-7.03	-4.34	**17.23**	4.99
Israel	-2.96	-2.56	1.24	0.72	-6.89	-3.24	**4.20**	2.91	-3.93	-2.49	**8.13**	3.31
Italy	-0.67	-0.71	**3.23**	1.85	-3.58	-2.33	**3.90**	2.79	-2.92	-2.21	**6.82**	2.98
Japan	-2.46	-3.66	-2.40	-2.20	-2.57	-2.91	0.05	0.07	-0.11	-0.17	0.16	0.12
Netherlands	1.24	1.08	**4.34**	2.04	-2.12	-1.29	**3.07**	2.10	-3.13	-2.34	**6.15**	2.65
New Zealand	0.61	0.34	**13.53**	2.72	-7.49	-2.20	**12.55**	2.98	-8.06	-2.55	**22.22**	3.77
Norway	-4.73	-2.47	-2.83	-0.74	-4.34	-1.09	0.60	0.18	0.36	0.12	-2.58	-0.48
Singapore	-2.90	-2.25	**6.44**	3.29	-6.70	-3.83	**9.16**	6.49	-3.80	-2.85	**13.01**	5.36
Spain	1.04	0.93	1.01	0.27	1.20	0.73	-0.07	-0.02	-0.10	-0.08	0.04	0.01
Sweden	0.03	0.03	1.29	0.59	0.18	0.10	1.16	0.66	0.13	0.08	1.43	0.49
Switzerland	0.82	0.78	-1.70	-0.95	**3.44**	2.31	-2.34	-1.40	**2.35**	2.08	-4.61	-1.83
United Kingdom	-4.93	-4.60	-4.76	-3.48	-6.20	-4.42	0.22	0.24	-1.29	-1.31	1.51	0.93
United States	-8.71	-6.85	-5.28	-3.42	-9.38	-6.73	**3.43**	4.46	-0.67	-0.74	**4.10**	2.65

Table 3 – Continued

Panel C: The third year after portfolio formation

Country	WML (Simple)	t-stat	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets												
Brazil	0.12	0.06	**15.25**	3.75	-12.00	-3.90	**15.13**	4.76	-12.12	-4.26	**27.25**	5.14
Chile	0.44	0.31	-4.15	-1.47	**7.89**	3.63	-4.82	-2.05	**7.46**	4.00	-12.20	-3.44
China	-2.47	-2.44	-7.67	-4.21	1.97	1.49	-5.70	-3.41	**4.43**	5.14	-9.87	-4.33
India	3.55	2.24	**18.20**	6.54	-9.11	-3.69	**14.65**	6.59	-12.66	-5.95	**27.31**	6.72
Indonesia	-11.46	-2.87	-0.47	-0.06	-22.80	-3.82	**9.72**	1.74	-15.07	-4.12	**29.98**	4.53
Malaysia	1.72	1.62	2.74	1.17	0.61	0.40	0.89	0.51	-1.33	-0.74	2.44	0.76
Mexico	**8.82**	2.40	0.61	0.05	**18.39**	3.60	-8.90	-1.01	8.82	1.80	-17.88	-1.41
Philippines	0.75	0.37	-1.06	-0.23	4.41	1.40	-1.59	-0.40	4.06	1.49	-5.50	-0.94
Poland	-1.12	-0.40	**12.90**	3.03	-9.86	-2.87	**12.76**	2.76	-8.74	-4.74	**21.65**	4.68
Russian Federation	2.28	0.85	2.93	0.69	-1.29	-0.37	0.65	0.14	-3.57	-1.41	4.22	0.72
South Africa	-7.87	-5.15	-2.87	-1.31	-12.70	-6.14	**4.99**	3.61	-4.83	-2.97	**9.83**	3.71
South Korea	-0.69	-0.53	**7.72**	3.66	-6.90	-4.22	**8.34**	5.16	-6.21	-5.38	**14.57**	6.03
Taiwan	0.67	0.56	**3.46**	1.85	-2.98	-1.95	2.79	1.65	-3.65	-3.19	**6.44**	2.61
Thailand	-3.85	-2.16	4.09	1.44	-3.73	-1.73	**8.02**	4.05	0.13	0.06	**7.97**	2.25
Turkey	-7.66	-3.21	2.99	1.05	-16.57	-4.18	**10.49**	4.16	-8.86	-3.48	**19.22**	4.58

Table 4. Fama-MacBeth regressions in each market

This table reports the results from the Fama-MacBeth regression of monthly stock returns (in percent) on firm and stock characteristics separately for each country. LnME is the logarithm of market capitalization, LnBM is the logarithm of the book-to-market ratio, Lret is the prior month's return, Winner (Loser) is a dummy variable that equals one if a stock belongs to the quintile portfolio with the highest (lowest) past six-month returns and zero otherwise. Similarly, Mid is a dummy variable that equals one if a stock belongs to the other three quintile portfolios with medium past six-month returns and zero otherwise. LTurn (HTurn) is a dummy variable that equals one if a stock belongs to the portfolio in the lowest (highest) turnover tercile and zero otherwise. For brevity, only coefficients of interest are reported. The t-statistics for the interaction terms with significance at the 5% level (one-tailed tests) are in red boldface.

Country	LnME	t-stat	LnBM	t-stat	Lret	t-stat	Winner	t-stat	Winner× LTurn	t-stat	Loser	t-stat	Loser× HTurn	t-stat
Developed Markets														
Australia	0.01	0.09	0.46	4.49	-0.03	-3.40	1.79	2.14	-0.07	-0.20	0.27	0.34	**-0.99**	-1.99
Austria	0.13	1.53	0.35	3.39	-0.02	-1.26	-0.04	-0.06	0.63	1.37	-1.12	-1.46	0.05	0.06
Belgium	0.04	0.79	0.31	3.57	-0.05	-4.05	1.72	3.34	0.06	0.16	0.34	0.67	-0.02	-0.05
Canada	-0.14	-2.21	0.08	0.79	0.00	0.16	2.61	3.54	-0.45	-1.32	1.25	1.72	**-0.75**	-1.92
Denmark	0.06	0.88	0.31	2.43	-0.01	-1.46	1.17	2.00	-0.78	-2.22	-1.05	-1.59	-0.04	-0.09
Finland	-0.01	-0.10	0.26	1.77	0.00	-0.20	1.78	2.28	-0.74	-1.34	0.18	0.26	0.87	1.62
France	0.02	0.41	0.28	3.42	-0.07	-9.05	1.66	2.63	-0.21	-0.66	1.07	1.82	**-0.85**	-2.13
Germany	0.06	1.54	0.28	3.83	-0.04	-5.65	1.05	2.23	0.01	0.04	-0.05	-0.10	**-1.07**	-2.31
Greece	-0.21	-1.13	0.18	1.17	-0.05	-3.31	1.93	1.32	-0.36	-0.61	2.30	1.58	**-1.38**	-2.30
Hong Kong	-0.01	-0.12	0.37	3.50	0.00	-0.13	0.14	0.13	**0.96**	1.86	0.74	0.79	**-2.09**	-4.90
Israel	0.27	2.22	0.45	3.27	-0.05	-3.27	0.75	0.81	-0.72	-1.53	-0.34	-0.30	-0.81	-1.44
Italy	0.15	2.92	0.29	3.20	-0.01	-1.50	-0.34	-0.53	**0.44**	1.80	-0.29	-0.48	**-1.09**	-3.18
Japan	0.00	0.05	0.35	4.90	-0.06	-6.67	-1.34	-1.55	0.03	0.14	-0.96	-1.21	-0.18	-0.78
Netherlands	0.06	0.96	0.32	3.58	-0.01	-0.68	1.12	1.79	0.08	0.22	0.04	0.05	-0.25	-0.53
New Zealand	-0.02	-0.17	0.15	1.03	-0.02	-1.76	2.27	2.64	0.34	0.58	0.51	0.62	-0.32	-0.49
Norway	-0.05	-0.65	0.10	0.68	0.00	-0.17	1.63	1.98	-0.09	-0.15	0.08	0.10	0.11	0.18
Portugal	0.09	0.58	0.54	1.77	0.01	0.37	1.17	1.15	-1.05	-1.22	2.74	2.32	**-2.82**	-2.80
Singapore	-0.03	-0.38	0.21	1.87	-0.04	-3.63	1.43	1.50	0.05	0.15	1.19	1.26	**-0.67**	-1.77
Spain	0.07	0.93	0.13	1.35	0.01	0.57	0.61	0.76	-0.27	-0.76	0.16	0.20	-0.49	-1.15
Sweden	0.13	1.78	0.11	0.94	-0.05	-5.39	0.82	0.98	0.01	0.04	-0.29	-0.38	-0.49	-1.08
Switzerland	0.08	1.89	0.23	3.71	-0.01	-1.37	1.07	2.02	-0.40	-1.48	-0.23	-0.42	0.05	0.17
United Kingdom	0.11	2.03	0.24	3.18	0.01	1.22	1.14	1.83	-0.10	-0.46	-0.68	-1.15	0.41	1.12
United States	-0.01	-0.23	0.16	1.91	-0.03	-6.07	1.63	2.25	0.07	0.27	1.03	1.65	-0.19	-0.64

Table 4 – Continued

Country	LnME	t-stat	LnBM	t-stat	Lret	t-stat	Winner	t-stat	Winner× LTurn	t-stat	Loser	t-stat	Loser× HTurn	t-stat
Emerging Markets														
Brazil	0.03	0.37	0.23	2.07	-0.03	-2.08	2.07	1.87	-0.54	-0.87	0.96	0.91	-0.51	-0.88
Chile	-0.03	-0.50	0.30	2.54	0.00	0.26	0.34	0.38	-0.61	-1.37	-0.22	-0.24	**-0.84**	-1.69
China	-0.09	-0.31	0.16	0.42	-0.03	-1.39	1.12	0.59	0.43	1.05	0.89	0.47	0.44	0.76
India	-0.31	-1.43	-0.24	-0.77	-0.09	-1.84	3.39	2.47	-0.43	-0.56	4.26	2.97	**-2.70**	-3.31
Indonesia	4.45	0.97	2.29	1.18	-1.07	-1.02	-0.52	-0.27	-0.12	-0.20	-0.44	-0.21	-1.04	-1.16
Malaysia	-0.02	-0.13	0.47	3.59	-0.05	-4.13	0.41	0.38	0.41	1.10	0.91	0.89	0.00	0.01
Mexico	0.31	3.61	0.42	3.13	0.00	-0.38	-0.86	-0.77	-0.44	-0.75	-3.06	-2.81	1.51	1.77
Peru	-0.30	-2.03	-0.08	-0.39	0.00	-0.06	5.37	4.65	-0.04	-0.03	1.84	1.58	-0.55	-0.55
Philippines	-0.08	-0.62	0.36	2.26	-0.08	-5.13	-0.83	-0.62	0.92	0.83	1.21	0.77	**-1.48**	-1.80
Poland	-0.06	-0.54	0.34	1.68	0.01	0.85	2.23	1.83	-0.84	-1.42	0.69	0.55	-0.67	-0.89
Russian Federation	-0.20	-1.37	0.25	1.04	-0.05	-1.86	2.32	1.10	-0.57	-0.50	2.53	1.05	**-2.53**	-2.92
South Africa	0.00	-0.06	0.39	4.75	-0.04	-4.13	1.52	2.05	0.23	0.58	-0.05	-0.08	0.04	0.10
South Korea	-0.16	-1.41	0.48	3.40	-0.06	-4.64	-2.42	-1.84	**1.02**	2.11	-1.49	-1.17	**-1.10**	-3.09
Taiwan	0.47	0.74	-1.39	-0.41	-0.01	-0.12	-0.55	-0.48	0.11	0.31	-1.49	-0.75	**-1.26**	-4.15
Thailand	1.08	1.56	-1.84	-1.26	0.18	0.87	-1.51	-1.54	0.10	0.20	0.48	0.34	-0.49	-0.87
Turkey	-0.21	-1.40	0.49	1.80	-0.03	-2.03	4.06	1.82	1.08	1.62	5.55	2.01	**-1.00**	-1.75

Table 5. Comovement of momentum returns across countries

This table reports the average coefficients estimated from country-by-country time-series regressions of monthly momentum return for country c on the global momentum return, controlling for global market, SMB and HML factors. The country c is excluded from the calculation of global average momentum when the dependent variable is momentum return in this country. Panel A reports the results from full sample and panel B reports the results using post 2007 sample. P-value* reports the p-value of the test that the proportion of positive and negative coefficients is different from 0.5, the chance result.

Panel A: Full sample			
	Gwml_simple	Gwml_early	Gwml_late
Mean	0.888	0.823	0.771
t-stat	(18.31)	(18.74)	(15.87)
Median	0.945	0.869	0.802
Pos/Neg	36/0	36/0	36/0
p-value*	0.00	0.00	0.00

Panel B: Post-2007 sample			
	Gwml_simple	Gwml_early	Gwml_late
Mean	0.967	0.921	0.914
t-stat	(19.69)	(19.02)	(14.48)
Median	0.974	0.917	0.911
Pos/Neg	36/0	36/0	36/0
p-value*	0.00	0.00	0.00

Table 6. The Momentum Life Cycle in ETFs

This table reports monthly winner-minus-loser (WML) returns in percentage to the early- and late-stage momentum strategies for ETFs and compares them to returns to the simple momentum strategy (without conditioning on turnover). Turnover is computed as the average monthly trading volume divided by shares outstanding over the previous six months. WML(early) represents a zero-investment portfolio that longs low-turnover winner ETFs and shorts high-turnover loser ETFs. WML(late) represents a zero-investment portfolio that longs high-turnover winner ETFs and shorts low-turnover loser ETFs. The sample runs from 2002 to 2014.

	WML (Simple)	WML (Early)	WML (Late)	WML (Early-Late)
Excess return	0.58%	0.86%	0.10%	0.76%
(t-stat)	(1.28)	(1.89)	(0.21)	(2.55)
FF3 alpha	0.58%	0.74%	0.30%	0.44%
(t-stat)	(1.26)	(1.61)	(0.64)	(1.77)

Table 7. Cross-country analysis: Individualism and the momentum life cycle effect

This table reports the results of the cross-country regressions of the returns to various momentum strategies on the individualism index (Indv) and a set of country-level control variables. Acct is the accounting standards index; EMS is the earnings management score; R^2 is R-squared from a stock return regression on market returns and is a measure of stock return synchronicity; Antiself is the anti-self-dealing index; Antidir is the revised anti-director rights index; CR is the creditor rights index; MKT is a stock market development index; and Developed is a dummy for developed markets. More details of these independent variables are provided in the Appendix. In Column (1), the dependent variable is returns to the simple momentum strategy. In Column (2), the dependent variable is the returns to the early-stage momentum strategy, which represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. In Column (3), the dependent variable is the returns to the late stage momentum strategy, which represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. In Column (4), the dependent variable is the return difference between the early- and late-stage momentum strategies. All measures of the momentum profits are calculated as returns in percent. All t-statistics are based on Newey and West (1987) to control for heteroscedasticity and autocorrelation. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
Indv	**0.0257*** **	**-0.0049**	**0.0499*** **	**-0.0548*** **
	(4.11)	(-0.44)	(4.63)	(-3.03)
Acct	0.0457**	0.0116	0.0713***	-0.0593*
	(2.32)	(0.44)	(3.17)	(-1.91)
EMS	0.0639***	-0.0078	0.0977***	-0.1054**
	(3.68)	(-0.25)	(3.20)	(-1.98)
R^2	-3.5586*	-7.5229***	0.9026	-8.4320**
	(-1.94)	(-2.77)	(0.40)	(-2.32)
Antiself	0.5631	-0.1988	0.3719	-0.5723
	(1.33)	(-0.32)	(0.69)	(-0.67)
Antidir	0.0735	-0.1621	0.3019	-0.4641
	(0.70)	(-0.88)	(1.53)	(-1.54)
CR	0.0012	0.2464**	-0.0462	0.2918
	(0.02)	(2.03)	(-0.37)	(1.43)
MKT	-0.0116	0.0077	-0.0228**	0.0304**
	(-1.64)	(0.86)	(-2.49)	(2.38)
Developed	-0.5538**	-0.2989	-0.6720***	0.3739
	(-2.42)	(-0.88)	(-2.64)	(0.87)
Constant	-3.2712**	2.1398	-7.8207***	9.9372***
	(-2.37)	(1.02)	(-4.18)	(3.30)
Avg R-squared	0.508	0.504	0.498	0.496
N. of obs.	6,246	6,245	6,246	6,245

Table 8. Cross-country analysis: Limits-to-arbitrage and the momentum life cycle effect

This table reports the results of the cross-country regressions of the returns to various momentum strategies on limits-to-arbitrage proxies (IVol, TCost, and Short) and a set of country-level control variables. Acct is the accounting standards index; EMS is the earnings management score; R2 is R-squared from a stock return regression on market returns and is a measure of stock return synchronicity; Antiself is the anti-self-dealing index; Antidir is the revised anti-director rights index; CR is a creditor rights index; MKT is the stock market development index; and Developed is a dummy for developed markets. More details of these independent variables are provided in the Appendix. Panel A reports the results for country-level idiosyncratic volatility (IVol), Panel B is for the index of trading costs (TCost), and Panel C is for the short-sale feasibility dummy (Short). In Column (1), the dependent variable is returns to the simple momentum strategy. In Column (2), the dependent variable is the returns to the early-stage momentum strategy, which represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. In Column (3), the dependent variable is the returns to the late stage momentum strategy, which represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. In Column (4), the dependent variable is the return difference between the early- and late-stage momentum strategies. All measures of the momentum profits are calculated as returns in percent. All t-statistics are based on Newey and West (1987) to control for heteroscedasticity and autocorrelation. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A: Idiosyncratic volatility (IVol) as the proxy for limits-to-arbitrage

	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
IVol	-0.858***	0.964*	-2.402***	3.361***
	(-2.92)	(1.95)	(-4.90)	(4.25)
Controls	Yes	Yes	Yes	Yes
Ave. R-sq	0.506	0.501	0.498	0.502
N. of Obs.	6,246	6,245	6,246	6,245

Panel B: Trading cost (TCost) as the proxy for limits-to-arbitrage

	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
TCost	-0.011**	0.008	-0.023***	0.031***
	(-2.38)	(1.52)	(-3.49)	(3.36)
Controls	Yes	Yes	Yes	Yes
Ave. R-sq	0.495	0.495	0.489	0.498
N. of Obs.	6,246	6,245	6,246	6,245

Panel C: Short-sale feasibility (Short) as the proxy for limits-to-arbitrage

	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
Short	0.313	-0.555**	0.824**	-1.386***
	(1.56)	(-1.98)	(2.48)	(-2.69)
Controls	Yes	Yes	Yes	Yes
Ave. R-sq	0.489	0.482	0.478	0.477
N. of Obs.	6,246	6,245	6,246	6,245

Table 9. Sentiment and the momentum life cycle effect

This table reports time-series regression of returns to various momentum strategies on lagged sentiment index, an Up market state dummy and market volatility. Up is a dummy equal to 1 if returns of the country index during the past 24 month is non negative and 0 otherwise. Mktvol is the standard deviation of monthly country index return during the past 24 months. In panel A, we use Baker-Wurgler (2007) investor sentiment index as proxy for sentiment. In panel B, we use conference board consumer confidence index as proxy for sentiment. In Column (1), the dependent variable is returns to the simple momentum strategy. In Column (2), the dependent variable is the returns to the early-stage momentum strategy, which represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. In Column (3), the dependent variable is the returns to the late stage momentum strategy, which represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. In Column (4), the dependent variable is the return difference between the early- and late-stage momentum strategies. All measures of the momentum profits are calculated as returns in percent. Standard errors are clustered at month level. ***, **, and * indicate significance at the 1%, 5% and 10% levels, respectively.

Panel A: The Baker -Wurgler sentiment index				
	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
BW_sent	0.856*	1.560**	-0.103	1.661**
	(1.84)	(2.08)	(-0.42)	(2.30)
Up	0.966**	1.428**	0.435	0.998*
	(2.26)	(2.30)	(1.43)	(1.77)
Mktvol	-9.186***	-13.055**	-6.583	-6.450
	(-2.69)	(-2.17)	(-1.59)	(-0.86)
Fixed effect	Country	Country	Country	Country
Ave. R-sq	0.034	0.030	0.025	0.023
N. of Obs.	8,263	8,252	8,263	8,252

Panel B: The conference board consumer confidence index				
	(1)	(2)	(3)	(4)
	WML(simple)	WML(early)	WML(late)	WML(early-late)
Board_sent	0.018**	0.021*	0.008	0.012
	(2.02)	(1.80)	(1.10)	(1.18)
Up	0.505	0.789*	0.177	0.615
	(1.53)	(1.72)	(0.68)	(1.40)
Mktvol	-14.839***	-16.898***	-11.051**	-5.836
	(-3.44)	(-2.96)	(-2.18)	(-0.83)
Fixed effect	Country	Country	Country	Country
Ave. R-sq	0.021	0.018	0.011	0.007
N. of Obs.	9,555	9,544	9,555	9,544

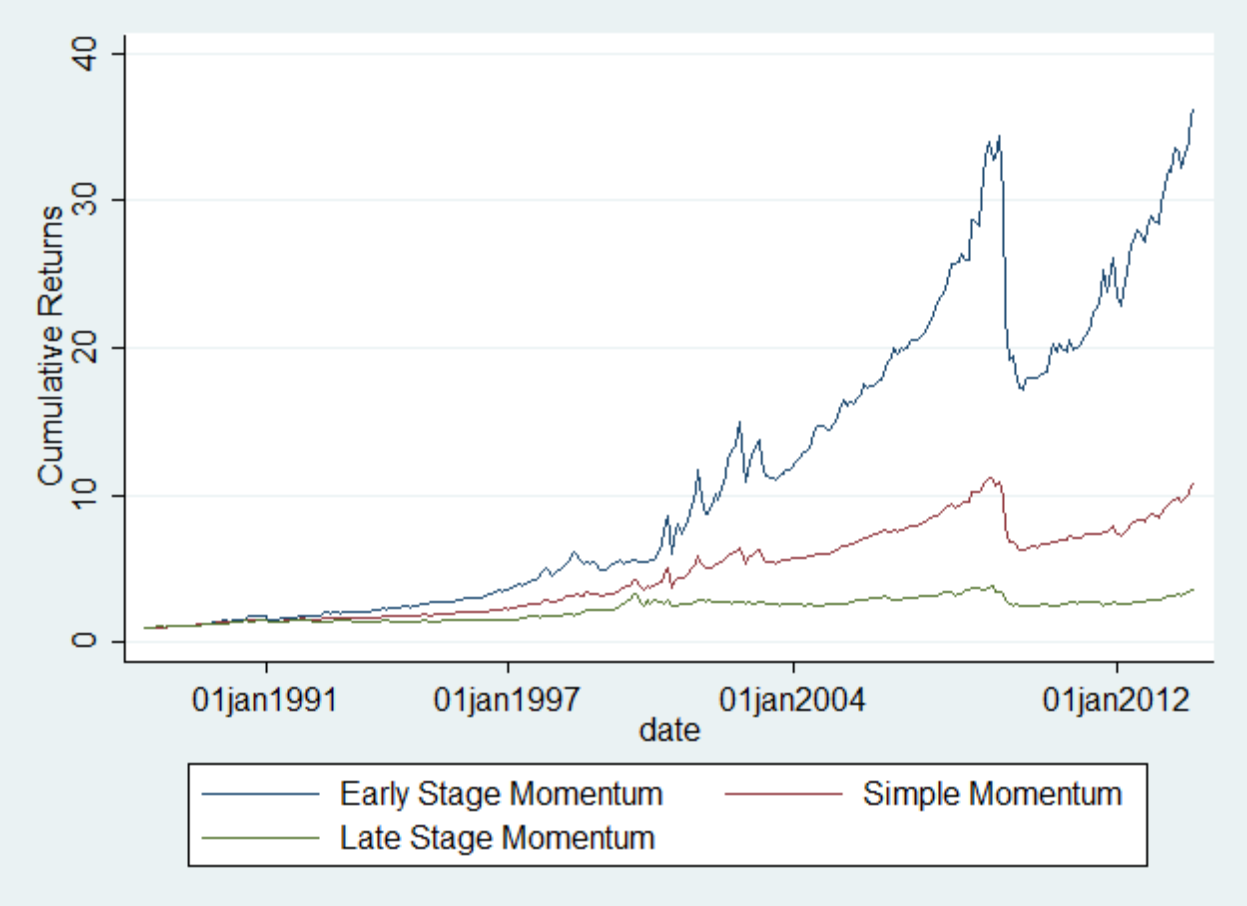

Figure 1. Cumulative returns to various momentum strategies

This figure shows the cumulative returns of the global early-stage, simple, and late-stage momentum strategies. Momentum strategies are constructed at the country level and returns are value-weighted each month using lagged total market capitalization of that country as the weight to obtain the global momentum returns. The sample period runs from January 1988 to December 2013. Returns are in US dollars and do not include currency hedging.

Online Appendix to "Momentum Life Cycle around the World and Beyond": Additional Empirical Results

Table A1. Returns and alphas of the simple momentum strategy in each market

All stocks in each country with valid data are sorted into quintiles based on prior returns over months -6 to -1. At least 90 stocks per month in a country are required to be included in the sample. Each quintile of portfolios is equal-weighted and holds for six months. All returns in percentage are in US$ per month. Reported are the mean excess returns, Sharpe ratios (annualized), CAPM alphas, and the Fama and French (1993) three-factor adjusted alphas for the WML (winners minus losers) portfolios. The three-factor alphas are based on the time-series regressions of monthly returns on country-specific local market, SMB (small minus big), and HML (high minus low) factors. The overall sample period is from 1988 to 2013. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML	t-stat	Sharpe ratio	CAPM alpha	t-stat	FF 3-factor alpha	t-stat
Developed Markets							
Australia	**1.21**	4.88	0.96	**1.25**	5.07	**1.24**	5.16
Belgium	**1.00**	4.16	0.82	**1.11**	4.69	**1.13**	4.78
Canada	**1.17**	4.87	0.96	**1.28**	5.32	**1.31**	5.47
Denmark	**1.48**	6.58	1.31	**1.52**	6.87	**1.52**	6.95
Finland	**1.14**	3.48	0.84	**1.27**	3.98	**1.24**	3.87
France	**1.01**	4.24	0.83	**1.15**	5.03	**1.15**	5.10
Germany	**1.48**	5.62	1.10	**1.59**	6.20	**1.37**	5.42
Greece	0.65	1.62	0.34	**0.68**	1.73	**0.70**	1.77
Hong Kong	**0.76**	3.01	0.59	**0.90**	3.65	**0.90**	3.67
Israel	**0.58**	2.49	0.49	**1.10**	3.56	**1.15**	3.78
Italy	**0.92**	3.71	0.73	**1.00**	4.22	**0.96**	4.14
Japan	-0.07	-0.30	-0.06	-0.07	-0.31	-0.03	-0.15
Netherlands	**1.22**	4.56	0.90	**1.36**	5.17	**1.38**	5.41
New Zealand	**1.44**	5.29	1.20	**1.57**	5.62	**1.60**	5.69
Norway	**1.12**	3.76	0.74	**1.21**	4.08	**1.21**	4.13
Singapore	**0.53**	1.82	0.36	**0.80**	3.04	**0.87**	3.53
Spain	**0.80**	2.74	0.56	**0.94**	3.37	**0.87**	3.21
Sweden	**1.26**	3.82	0.75	**1.43**	4.40	**1.24**	3.97
Switzerland	**0.95**	4.40	0.86	**1.08**	5.07	**1.08**	5.09
United Kingdom	**1.61**	7.06	1.38	**1.73**	7.82	**1.69**	7.93
United States	**0.75**	2.47	0.49	**0.94**	3.16	**0.97**	3.25
Average (EW)	0.99	6.27	1.23				
Average (VW)	0.84	3.80	0.75				

Table A1 –Continued

Country	WML	t-stat	Sharpe ratio	CAPM alpha	t-stat	FF 3-factor alpha	t-stat
Emerging Markets							
Brazil	**0.60**	2.03	0.47	**0.73**	2.58	**0.79**	2.79
Chile	**1.05**	4.29	0.89	**1.01**	4.26	**0.88**	3.67
China	0.33	1.16	0.26	0.29	1.19	**0.43**	1.85
India	-0.29	-0.82	-0.17	-0.32	-0.88	-0.10	-0.27
Indonesia	0.34	0.79	0.17	0.48	1.19	0.57	1.44
Malaysia	0.38	1.20	0.23	**0.58**	1.94	**0.52**	1.76
Mexico	**0.78**	2.65	0.57	**0.97**	3.30	**0.93**	3.17
Philippines	-0.31	-0.61	-0.14	-0.13	-0.28	-0.07	-0.16
Poland	**1.17**	3.22	0.82	**1.26**	3.54	**1.02**	2.80
Russian Federation	0.72	1.15	0.36	**1.00**	1.73	**1.21**	2.06
South Africa	**1.99**	8.79	1.82	**1.95**	8.59	**2.04**	8.93
South Korea	0.14	0.35	0.07	0.20	0.48	0.27	0.69
Taiwan	0.01	0.02	0.00	0.32	0.94	0.42	1.30
Thailand	**0.69**	1.66	0.33	**0.80**	2.02	**0.92**	2.33
Turkey	-0.66	-1.98	-0.42	-0.77	-2.46	-0.80	-2.65
Average (EW)	0.50	2.99	0.59				
Average (VW)	0.58	4.05	0.79				
Global Average (EW)	0.80	5.66	1.11				
Global Average (VW)	0.82	3.97	0.78				

Table A2. Local three-factor alphas of the early-stage and late-stage momentum strategies in each market

This table reports the Fama and French (1993) three-factor alphas (in percent) for winner-minus-loser portfolios of the early-stage and late-stage momentum strategies and compares them to the returns on winner-minus-loser portfolios from the simple momentum strategy (without conditioning on turnover). The three-factor alphas are based on the time-series regressions of monthly portfolio returns on country-specific market, SMB and HML factors. WML(Early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(Late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. Turnover is computed as the average monthly trading volume divided by shares outstanding over the previous six months. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.27**	7.91	0.42	1.35	**1.03**	4.92	-0.82	-4.35	**1.85**	5.09
Belgium	**1.24**	3.16	**0.62**	1.83	0.11	0.36	-0.51	-1.82	0.63	1.24
Canada	**2.53**	8.31	0.20	0.77	**1.22**	6.51	-1.10	-7.30	**2.33**	7.25
Denmark	**1.65**	4.56	**1.45**	5.07	0.13	0.52	-0.08	-0.31	0.20	0.46
Finland	**1.33**	3.02	**1.16**	3.08	0.09	0.28	-0.08	-0.27	0.17	0.33
France	**1.70**	4.63	**0.67**	2.54	0.45	1.55	-0.58	-2.29	**1.03**	2.22
Germany	**2.52**	5.54	0.56	1.62	**1.10**	3.12	-0.86	-2.63	**1.96**	3.63
Greece	**1.89**	3.28	-0.27	-0.62	**1.20**	3.23	-0.96	-3.22	**2.16**	3.56
Hong Kong	**2.94**	7.93	-0.84	-2.66	**1.99**	6.13	-1.79	-7.94	**3.78**	7.36
Israel	**2.31**	4.79	-0.25	-0.80	**1.15**	3.74	-1.40	-5.01	**2.56**	4.63
Italy	**1.39**	3.99	**0.63**	2.18	**0.41**	1.78	-0.35	-1.63	**0.76**	2.09
Japan	0.20	0.66	-0.40	-1.60	**0.33**	1.92	-0.27	-1.43	**0.60**	1.81
Netherlands	**2.10**	5.79	**1.05**	3.57	**0.72**	3.09	-0.33	-1.43	**1.05**	2.56
New Zealand	**2.40**	5.32	**0.81**	1.97	**0.80**	2.44	-0.79	-2.43	**1.59**	2.79
Norway	**1.65**	3.39	**1.18**	2.90	0.43	1.16	-0.04	-0.12	0.47	0.75
Singapore	**1.97**	6.02	-0.16	-0.50	**1.10**	4.46	-1.03	-4.96	**2.13**	5.05
Spain	**1.31**	3.10	0.17	0.55	0.45	1.63	-0.68	-2.70	**1.13**	2.44
Sweden	**1.92**	4.75	**0.87**	2.65	**0.67**	3.15	-0.37	-1.86	**1.05**	2.77
Switzerland	**1.40**	4.40	**0.87**	3.29	0.26	1.19	-0.27	-1.42	0.53	1.41
United Kingdom	**1.66**	5.70	**1.82**	7.60	-0.03	-0.19	0.13	0.82	-0.16	-0.54
United States	**1.74**	5.68	0.29	1.06	**0.77**	6.63	-0.69	-5.00	**1.46**	6.25

Table A2 – Continued

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**1.67**	3.61	-0.15	-0.42	**0.88**	2.73	-0.94	-3.32	**1.82**	3.39
Chile	**1.48**	3.92	**0.66**	2.02	**0.60**	2.00	-0.22	-0.83	0.81	1.59
China	**0.56**	1.87	0.33	1.25	0.13	0.54	-0.09	-0.73	0.22	0.65
India	**1.50**	2.89	-2.07	-4.60	**1.72**	4.73	-1.85	-5.47	**3.57**	5.34
Indonesia	**1.57**	2.80	-0.33	-0.61	**0.99**	2.51	-0.91	-2.53	**1.90**	2.77
Malaysia	**1.52**	4.52	-0.19	-0.63	**1.00**	4.59	-0.71	-4.14	**1.71**	4.84
Mexico	**1.83**	4.32	0.53	1.27	**0.90**	2.88	-0.41	-1.08	**1.31**	2.29
Philippines	**1.28**	1.85	-1.40	-2.37	**1.35**	2.84	-1.33	-3.46	**2.68**	3.34
Poland	**1.61**	2.95	0.49	0.95	0.59	1.56	-0.53	-1.47	1.12	1.64
Russian Federation	**2.21**	3.21	0.17	0.21	**1.00**	2.01	-1.04	-1.95	**2.04**	2.24
South Africa	**2.69**	8.03	**1.33**	5.10	**0.65**	3.20	-0.70	-3.54	**1.36**	3.62
South Korea	**1.62**	3.47	-0.78	-1.78	**1.36**	4.81	-1.05	-4.31	**2.40**	4.83
Taiwan	**1.24**	3.18	-0.18	-0.49	**0.82**	2.90	-0.60	-2.56	**1.42**	2.91
Thailand	**1.57**	3.08	0.04	0.11	**0.65**	2.19	-0.88	-2.60	**1.53**	2.63
Turkey	0.00	0.00	-1.81	-4.85	**0.80**	2.30	-1.01	-3.81	**1.82**	3.23

Table A3. Global three-factor alphas of early-stage and late-stage momentum strategies in each market

This table reports the Fama and French (1993) three-factor alphas (in percent) for winner-minus-loser portfolios of the early-stage and late-stage momentum strategies and compares them to the returns on winner-minus-loser portfolios from the simple momentum strategy (without conditioning on turnover). The three-factor alphas are based on the time-series regressions of monthly portfolio returns on global market, SMB and HML factors. WML(Early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(Late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. Turnover is computed as the average monthly trading volume divided by shares outstanding over the previous six months. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.27**	6.90	0.49	1.62	**1.08**	4.50	-0.70	-3.60	**1.78**	4.37
Belgium	**1.69**	4.38	**0.69**	1.92	**0.49**	1.71	-0.51	-1.73	**1.00**	2.01
Canada	**2.06**	6.33	0.17	0.59	**0.99**	4.81	-0.90	-5.52	**1.89**	5.40
Denmark	**1.65**	4.39	**1.64**	5.40	0.06	0.22	0.04	0.16	0.01	0.03
Finland	**0.85**	1.85	**1.29**	3.39	-0.20	-0.59	0.24	0.79	-0.44	-0.82
France	**1.63**	4.33	**0.70**	2.55	0.37	1.28	-0.56	-2.11	**0.93**	1.91
Germany	**2.88**	5.94	**0.89**	2.47	**1.22**	3.34	-0.77	-2.18	**1.99**	3.48
Greece	**2.34**	3.61	-0.19	-0.42	**1.37**	3.19	-1.16	-3.30	**2.53**	3.49
Hong Kong	**2.73**	5.90	-0.71	-2.06	**1.76**	4.51	-1.68	-6.22	**3.44**	5.48
Israel	**1.49**	3.52	0.11	0.39	**0.56**	1.95	-0.82	-3.15	**1.38**	2.65
Italy	**1.54**	4.06	**0.77**	2.43	0.35	1.52	-0.41	-1.76	**0.77**	1.89
Japan	0.53	1.62	-0.35	-1.48	**0.48**	2.54	-0.40	-2.64	**0.88**	2.72
Netherlands	**2.12**	5.50	**1.19**	3.61	**0.69**	2.77	-0.24	-0.96	**0.93**	2.09
New Zealand	**2.10**	4.80	**1.04**	2.51	**0.62**	1.98	-0.44	-1.30	**1.06**	1.89
Norway	**1.62**	3.24	**1.13**	2.58	0.46	1.16	-0.03	-0.09	0.49	0.73
Singapore	**1.79**	4.20	-0.11	-0.30	**1.00**	3.57	-0.90	-3.71	**1.90**	3.87
Spain	**1.49**	3.45	0.37	1.09	**0.50**	1.85	-0.62	-2.34	**1.13**	2.31
Sweden	**1.92**	3.94	**0.93**	2.57	**0.68**	2.70	-0.31	-1.31	**0.99**	2.20
Switzerland	**1.49**	4.80	**1.07**	4.04	0.21	0.93	-0.21	-1.18	0.42	1.14
United Kingdom	**1.86**	5.77	**2.01**	7.70	0.02	0.13	0.17	1.01	-0.15	-0.46
United States	**1.30**	3.70	0.39	1.27	**0.51**	3.28	-0.41	-2.34	**0.92**	2.95

Table A3 – Continued

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**1.50**	3.13	-0.18	-0.50	**0.77**	2.32	-0.91	-3.16	**1.68**	3.04
Chile	**1.47**	3.80	**1.05**	2.86	0.43	1.25	0.01	0.02	0.42	0.73
China	-0.37	-0.65	**0.64**	2.12	-0.62	-1.53	0.38	1.44	-1.01	-1.54
India	**2.07**	3.62	-2.60	-5.28	**2.31**	5.73	-2.37	-6.22	**4.68**	6.21
Indonesia	**1.91**	3.05	-0.60	-1.00	**1.36**	2.91	-1.14	-2.90	**2.50**	3.14
Malaysia	**1.40**	2.94	-0.38	-1.25	**1.02**	3.56	-0.76	-3.03	**1.79**	3.49
Mexico	**1.55**	3.40	0.56	1.34	**0.61**	1.76	-0.38	-1.01	0.98	1.60
Philippines	**1.42**	1.82	-1.42	-2.36	**1.51**	2.95	-1.33	-3.22	**2.84**	3.27
Poland	**1.90**	3.37	0.85	1.63	**0.68**	1.72	-0.37	-1.03	1.05	1.52
Russian Federation	**1.92**	2.59	-0.71	-0.89	**1.03**	1.89	-1.60	-2.78	**2.63**	2.74
South Africa	**2.76**	8.09	**1.21**	4.37	**0.78**	3.54	-0.77	-3.68	**1.54**	3.85
South Korea	**1.46**	2.47	-0.85	-1.75	**1.31**	4.00	-1.00	-3.71	**2.31**	4.05
Taiwan	**1.00**	2.26	-0.02	-0.05	**0.70**	2.11	-0.32	-1.21	**1.02**	1.79
Thailand	0.79	1.13	-0.10	-0.24	0.32	0.70	-0.57	-1.29	0.89	1.04
Turkey	-0.52	-0.96	-1.26	-2.95	0.13	0.30	-0.61	-1.86	0.74	1.05

Table A4. Value-weighted returns to early-stage and late-stage momentum strategies

This table reports monthly value-weighted winner-minus-loser (WML) returns in percentage to the early- and late-stage momentum strategies and compares them to returns to the simple momentum strategy (without conditioning on turnover). Turnover is computed as the average monthly turnover ratios over the previous six months. WML(early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.70**	7.23	**1.62**	4.41	**0.81**	3.67	-0.28	-1.02	**1.09**	2.61
Belgium	0.68	1.45	**1.10**	2.49	-0.43	-1.35	-0.01	-0.02	-0.42	-0.67
Canada	**1.44**	4.15	**1.17**	3.85	0.24	1.23	-0.03	-0.13	0.27	0.77
Denmark	**0.81**	1.99	**1.75**	4.59	-0.35	-1.04	**0.58**	1.77	-0.94	-1.69
Finland	0.59	0.90	**1.11**	2.33	-0.53	-1.07	-0.01	-0.02	-0.52	-0.65
France	0.17	0.40	0.54	1.64	-0.28	-0.92	0.11	0.32	-0.33	-0.57
Germany	**1.82**	3.29	**0.95**	2.38	**0.78**	1.83	-0.11	-0.24	0.90	1.27
Greece	**1.94**	2.72	0.46	0.83	**0.95**	2.08	-0.53	-0.95	**1.48**	1.70
Hong Kong	**1.64**	3.45	0.19	0.43	0.71	1.54	-0.73	-2.21	**1.44**	2.03
Israel	**1.16**	2.33	0.44	1.09	-0.19	-0.51	-0.92	-2.36	0.73	1.11
Italy	**1.06**	2.54	**0.74**	2.19	0.40	1.33	0.10	0.37	0.31	0.66
Japan	0.28	0.72	0.20	0.63	0.26	1.02	0.12	0.55	0.11	0.27
Netherlands	0.69	1.61	**0.76**	2.13	0.45	1.59	0.52	1.47	-0.06	-0.12
New Zealand	**1.21**	2.62	**0.80**	1.97	0.40	1.30	-0.01	-0.02	0.41	0.66
Norway	**1.02**	1.93	**1.32**	3.23	0.01	0.02	0.29	0.77	-0.28	-0.42
Singapore	**1.17**	2.68	-0.42	-1.12	**0.95**	2.98	-0.64	-2.06	**1.59**	2.85
Spain	0.19	0.38	0.33	0.84	-0.40	-1.12	-0.26	-0.74	-0.14	-0.23
Sweden	**0.93**	1.76	**1.03**	2.35	**0.42**	1.66	**0.52**	1.91	-0.10	-0.23
Switzerland	0.40	0.99	**1.05**	3.17	-0.10	-0.35	**0.53**	1.73	-0.56	-1.10
United Kingdom	**1.00**	2.60	**1.57**	5.22	0.17	0.76	**0.73**	2.83	-0.56	-1.44
United States	**0.66**	2.15	**0.66**	2.29	-0.05	-0.29	-0.06	-0.33	0.01	0.02
Average (EW)	1.05	5.13	0.78	4.53	0.25	1.78	-0.03	-0.21	0.28	1.22
Average (VW)	0.84	3.80	0.64	3.18	0.16	1.18	-0.03	-0.26	0.20	0.85

Table A4 – Continued

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**1.34**	2.24	0.43	0.78	**0.80**	1.82	-0.11	-0.25	0.91	1.22
Chile	**1.00**	2.22	**1.12**	2.55	0.15	0.35	0.28	0.85	-0.13	-0.19
China	-0.05	-0.10	0.53	1.60	-0.40	-1.00	0.17	0.74	-0.58	-0.99
India	**1.65**	2.52	-0.55	-0.83	0.72	1.29	-1.48	-2.99	**2.20**	2.36
Indonesia	**1.24**	1.67	0.20	0.27	0.43	0.67	-0.61	-1.17	1.04	1.01
Malaysia	0.73	1.53	0.14	0.38	0.45	1.39	-0.15	-0.59	0.59	1.13
Mexico	0.43	0.89	**1.04**	1.95	-0.33	-0.61	0.29	0.73	-0.61	-0.77
Philippines	0.23	0.27	-0.20	-0.32	0.10	0.17	-0.32	-0.66	0.43	0.45
Poland	**1.36**	1.88	**1.52**	2.20	0.15	0.28	0.31	0.54	-0.16	-0.18
Russian Federation	1.23	1.42	0.50	0.64	0.41	0.66	-0.33	-0.51	0.73	0.69
South Africa	**1.93**	4.53	**1.61**	4.03	0.43	1.38	0.11	0.33	0.32	0.59
South Korea	0.81	1.49	-0.27	-0.51	0.67	1.56	-0.42	-1.14	1.08	1.53
Taiwan	0.54	1.17	-0.19	-0.42	0.49	1.24	-0.24	-0.79	0.73	1.13
Thailand	0.21	0.32	0.77	1.51	-0.33	-0.69	0.24	0.45	-0.56	-0.63
Turkey	-1.06	-1.70	-1.08	-1.80	-0.19	-0.34	-0.21	-0.46	0.02	0.02
Average (EW)	0.70	2.67	0.22	1.03	0.34	1.49	-0.14	-0.96	0.48	1.39
Average (VW)	0.79	3.20	0.21	1.00	0.48	2.10	-0.11	-0.76	0.59	1.74
Global Avg (EW)	0.95	5.07	0.62	3.89	0.25	1.88	-0.08	-0.69	0.34	1.55
Global Avg (VW)	0.84	3.97	0.63	3.26	0.18	1.28	-0.03	-0.28	0.21	0.92

Table A5. Returns to early-stage and late-stage momentum strategies in sub-periods

This table reports monthly winner-minus-loser (WML) returns in percentage to the early- and late-stage momentum strategies and compares them to returns to the simple momentum strategy (without conditioning on turnover). We divided the whole sample into two periods, one from year 1988 to 2000 (panel A) and another from year 2000 to year 2013 (panel B). Turnover is computed as the average monthly turnover ratios over the previous six months. WML(early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Panel A: Subsample period of 1988-2000

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.33**	4.81	0.14	0.28	**1.02**	2.63	-1.17	-3.67	**2.19**	3.36
Belgium	0.54	1.08	**0.90**	1.96	-0.74	-1.51	-0.37	-0.96	-0.36	-0.51
Canada	**2.84**	6.52	0.47	1.48	**1.27**	4.45	-1.11	-5.18	**2.37**	5.04
Denmark	0.69	1.42	**1.36**	4.08	-0.55	-1.27	0.10	0.41	-0.61	-1.03
Finland	0.81	0.88	**2.00**	2.41	-0.32	-0.33	0.87	1.39	-1.19	-0.87
France	**1.11**	2.15	**1.25**	2.65	-0.04	-0.08	0.14	0.36	-0.04	-0.05
Germany	**2.48**	3.51	0.54	0.99	**1.32**	2.02	-0.64	-1.26	**2.06**	2.29
Greece	**2.64**	3.42	0.63	0.78	**1.24**	1.91	-0.77	-1.80	**2.02**	2.07
Hong Kong	**2.19**	2.81	-0.64	-1.22	**1.36**	1.92	-1.47	-3.40	**2.83**	2.59
Israel	0.65	1.13	0.46	0.79	-0.01	-0.03	-0.20	-0.53	0.19	0.21
Italy	0.83	1.53	**0.81**	1.73	0.14	0.33	0.15	0.41	0.02	0.04
Japan	-0.10	-0.16	-0.25	-0.55	0.14	0.37	-0.08	-0.24	0.24	0.37
Netherlands	**1.56**	3.75	**1.25**	3.48	0.28	0.89	-0.02	-0.10	0.31	0.62
New Zealand	**1.59**	2.15	0.87	1.12	0.78	1.49	0.06	0.10	0.71	0.72
Norway	0.67	0.92	**1.60**	2.73	-0.22	-0.38	0.71	1.90	-0.91	-1.03
Singapore	0.34	0.55	-0.06	-0.12	0.19	0.44	-0.21	-0.62	0.40	0.56
Spain	0.73	1.02	-0.10	-0.21	0.31	0.66	-0.51	-1.46	0.83	1.12
Sweden	**1.30**	2.09	**0.81**	1.85	0.52	1.42	0.03	0.10	0.49	0.76
Switzerland	**0.79**	1.99	**1.09**	2.71	-0.20	-0.51	0.09	0.33	-0.17	-0.29
United Kingdom	**1.47**	3.90	**1.88**	5.28	-0.25	-1.08	0.17	0.72	-0.42	-1.04
United States	**1.78**	4.58	**0.90**	2.03	0.40	1.19	-0.48	-1.67	0.89	1.44
Average (EW)	1.25	5.29	0.68	3.53	0.30	1.71	-0.26	-2.00	0.60	2.02
Average (VW)	1.43	4.86	0.73	2.47	0.36	1.56	-0.34	-1.79	0.72	1.78

Table A5 - Continued

Panel A: Subsample period of 1988-2000

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	1.60	1.48	-0.62	-0.88	1.09	1.36	-1.13	-1.93	**2.21**	1.83
Chile	**1.33**	2.31	**1.60**	2.73	0.01	0.01	0.28	0.69	-0.28	-0.31
China	-1.30	-0.96	**1.24**	1.87	-1.65	-1.61	0.89	1.38	-2.55	-1.57
India	1.25	1.48	-2.06	-2.05	**1.82**	2.27	-1.49	-2.39	**3.31**	2.40
Indonesia	0.77	0.64	-0.01	-0.01	0.67	0.70	-0.11	-0.13	0.78	0.49
Malaysia	0.55	0.68	0.02	0.03	0.41	0.80	-0.12	-0.27	0.53	0.59
Mexico	**2.21**	2.84	0.89	1.33	0.95	1.57	-0.37	-0.75	1.32	1.30
Peru	2.05	1.23	-2.84	-1.57	**2.45**	1.95	-2.45	-2.23	**4.90**	2.26
Philippines	2.35	1.42	-1.91	-1.62	**2.34**	2.27	-1.92	-2.28	**4.26**	2.39
Poland	-0.03	-0.02	2.12	1.24	-0.72	-0.68	1.42	1.64	-2.14	-1.36
South Africa	**3.08**	5.29	**1.68**	3.56	**0.83**	2.54	-0.56	-1.73	**1.39**	2.30
South Korea	0.72	0.77	-1.29	-1.54	**1.21**	2.11	-0.80	-2.15	**2.00**	2.22
Taiwan	**1.06**	1.67	0.06	0.09	0.69	1.24	-0.31	-0.85	1.00	1.14
Thailand	0.29	0.24	0.88	1.17	-0.58	-0.68	0.01	0.02	-0.59	-0.38
Turkey	-1.44	-1.39	-1.59	-1.85	-0.34	-0.39	-0.50	-0.84	0.15	0.11
Average (EW)	0.73	2.05	0.40	1.25	0.20	0.69	-0.13	-0.68	0.33	0.71
Average (VW)	1.04	3.36	0.41	1.38	0.40	1.39	-0.23	-1.36	0.63	1.44
Global Avg (EW)	1.10	4.75	0.52	3.08	0.31	1.90	-0.27	-2.20	0.61	2.19
Global Avg (VW)	1.42	5.00	0.70	2.51	0.38	1.70	-0.34	-1.87	0.74	1.89

Table A5 - Continued

Panel B: Subsample period of 2001-2013

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.05**	3.80	**0.75**	1.88	**0.94**	2.76	-0.36	-1.21	**1.30**	2.11
Belgium	**1.18**	1.75	0.38	0.77	0.46	1.08	-0.34	-0.78	0.80	1.01
Canada	**1.47**	2.94	0.12	0.29	**0.70**	2.31	-0.65	-2.45	**1.35**	2.45
Denmark	**1.73**	2.94	**1.82**	3.84	0.05	0.12	0.14	0.32	-0.09	-0.13
Finland	0.90	1.50	**1.12**	2.59	-0.23	-0.65	-0.01	-0.03	-0.22	-0.32
France	**1.40**	2.14	0.49	1.45	0.28	0.72	-0.63	-1.39	0.91	1.12
Germany	**2.72**	4.02	**0.96**	2.38	**0.82**	2.45	-0.95	-2.02	**1.77**	2.35
Greece	0.97	0.98	-0.86	-1.84	0.89	1.57	-0.94	-1.78	**1.83**	1.76
Hong Kong	**2.50**	4.62	-0.69	-1.75	**1.70**	4.50	-1.49	-4.56	**3.19**	4.72
Israel	**1.83**	2.95	-0.22	-0.68	**0.87**	2.31	-1.18	-3.13	**2.05**	2.83
Italy	**1.57**	2.69	**0.63**	1.74	0.38	1.35	-0.56	-1.79	**0.94**	1.68
Japan	0.45	1.11	-0.35	-1.21	**0.49**	1.91	-0.31	-1.25	0.79	1.62
Netherlands	**1.75**	2.56	**0.98**	2.06	0.59	1.52	-0.18	-0.40	0.77	1.03
New Zealand	**2.18**	3.83	**1.07**	2.23	0.43	1.06	-0.68	-1.62	1.11	1.53
Norway	**1.73**	2.25	**1.22**	2.11	0.39	0.67	-0.13	-0.23	0.52	0.49
Singapore	**2.33**	3.89	-0.40	-0.91	**1.43**	3.84	-1.31	-3.83	**2.73**	4.03
Spain	**1.39**	2.11	0.64	1.34	0.30	0.76	-0.45	-1.01	0.75	0.97
Sweden	**2.26**	3.31	**1.17**	2.45	0.52	1.62	-0.57	-1.70	**1.09**	1.76
Switzerland	**1.19**	2.04	**0.97**	2.69	0.16	0.46	-0.06	-0.16	0.21	0.33
United Kingdom	**1.33**	2.43	**1.88**	5.76	-0.18	-0.62	0.37	1.48	-0.56	-1.04
United States	0.64	0.96	-0.17	-0.45	**0.52**	2.01	-0.29	-0.83	0.81	1.37
Average (EW)	1.57	3.65	0.54	2.61	0.52	2.42	-0.50	-2.26	1.02	2.37
Average (VW)	1.14	2.16	0.23	0.84	0.53	2.39	-0.38	-1.45	0.91	1.91

Table A5 - Continued

Panel B: Subsample period of 2001-2013

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**1.17**	2.14	0.11	0.26	0.53	1.55	-0.53	-1.43	1.06	1.59
Chile	**1.34**	2.54	**0.82**	1.84	0.51	1.22	-0.01	-0.02	0.51	0.68
China	0.38	0.88	0.28	1.05	0.06	0.25	-0.04	-0.22	0.10	0.24
India	**1.99**	2.53	-3.01	-5.58	**2.39**	4.92	-2.60	-5.20	**4.99**	5.24
Indonesia	**1.80**	2.44	-0.87	-1.56	**1.31**	2.73	-1.36	-3.23	**2.67**	3.10
Malaysia	**1.62**	3.46	-0.09	-0.36	**0.99**	3.75	-0.72	-2.92	**1.71**	3.51
Mexico	0.39	0.62	0.86	1.50	-0.08	-0.16	0.39	0.64	-0.46	-0.49
Philippines	0.11	0.14	-1.19	-1.87	0.59	1.07	-0.71	-1.63	1.30	1.41
Poland	**1.90**	3.02	0.72	1.41	0.65	1.42	-0.54	-1.33	1.18	1.46
Russian Federation	**1.52**	1.97	-0.82	-1.05	0.80	1.46	-1.54	-2.71	**2.35**	2.45
South Africa	**2.28**	5.79	**1.09**	3.22	0.50	1.57	-0.69	-2.41	**1.19**	2.07
South Korea	**1.63**	2.98	-0.17	-0.47	**0.85**	2.56	-0.95	-2.81	**1.80**	2.81
Taiwan	0.70	1.16	-0.36	-0.84	0.70	1.62	-0.36	-0.99	1.05	1.37
Thailand	1.03	1.57	-0.13	-0.27	0.51	1.14	-0.65	-1.31	1.16	1.30
Turkey	0.22	0.40	-1.16	-3.14	**0.58**	1.79	-0.80	-2.23	**1.38**	2.11
Average (EW)	1.11	3.23	-0.23	-1.20	0.65	3.30	-0.69	-3.36	1.34	3.42
Average (VW)	1.05	3.81	-0.02	-0.08	0.54	3.09	-0.53	-3.23	1.06	3.24
Global Avg (EW)	1.38	3.65	0.22	1.22	0.57	2.95	-0.58	-2.89	1.16	2.96
Global Avg (VW)	1.14	2.31	0.19	0.75	0.54	2.60	-0.41	-1.66	0.95	2.12

Table A6. Returns to an alternative momentum strategy

This table presents returns (in percentage) to the early-stage and late-stage momentum strategies and compares them to the simple momentum strategy. The alternative momentum strategy is 12-1-1, using the past 12 months skipping one month as the ranking period, and the portfolios are held for one month. WML(early) represents a zero-investment portfolio that longs low-turnover winner stocks and shorts high-turnover loser stocks. WML(late) represents a zero-investment portfolio that longs high-turnover winner stocks and shorts low-turnover loser stocks. The t-statistics with significance at the 5% level (one-tailed tests) are in red boldface.

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Developed Markets										
Australia	**2.53**	6.01	**1.33**	3.40	**0.56**	1.87	-0.64	-2.49	**1.20**	2.41
Belgium	**1.60**	2.43	**1.52**	3.05	0.09	0.21	0.02	0.04	0.12	0.15
Canada	**3.68**	8.60	**1.41**	3.95	**1.30**	4.89	-0.97	-4.85	**2.27**	5.36
Denmark	**1.93**	3.56	**2.28**	5.71	-0.12	-0.31	0.22	0.65	-0.34	-0.55
Finland	**1.78**	2.21	**1.63**	2.76	0.17	0.30	0.06	0.10	0.08	0.08
France	**1.67**	3.47	**1.56**	4.86	-0.14	-0.42	-0.24	-0.71	0.10	0.17
Germany	**3.59**	5.33	**1.64**	3.28	**1.02**	2.81	-0.93	-1.78	**1.96**	2.40
Greece	**1.46**	1.77	0.08	0.14	0.59	0.97	-0.79	-1.75	1.40	1.50
Hong Kong	**2.75**	5.07	-0.84	-1.92	**1.82**	4.36	-1.78	-5.25	**3.60**	5.18
Israel	**1.83**	3.47	0.63	1.60	**0.59**	1.61	-0.61	-1.81	**1.20**	1.89
Italy	**1.96**	3.65	**0.97**	2.11	0.44	1.45	-0.55	-1.64	**0.99**	1.76
Japan	0.62	1.47	0.03	0.11	0.25	1.10	-0.33	-1.58	0.58	1.37
Netherlands	**2.20**	4.28	**1.77**	3.85	0.13	0.40	-0.27	-0.78	0.39	0.66
New Zealand	**3.35**	3.72	**1.85**	2.37	**1.40**	1.83	-0.09	-0.14	1.49	1.30
Norway	**2.37**	3.14	**2.49**	3.62	0.26	0.45	0.37	0.60	-0.11	-0.11
Singapore	**1.50**	2.85	-0.38	-0.71	**0.78**	2.29	-1.16	-3.67	**1.98**	3.33
Spain	**1.58**	3.14	0.69	1.61	0.45	1.42	-0.49	-1.63	**0.95**	1.74
Sweden	**3.31**	5.90	**2.13**	4.81	**0.89**	2.66	-0.28	-0.84	**1.17**	1.95
Switzerland	**1.17**	2.56	**1.43**	4.32	-0.38	-1.31	-0.12	-0.45	-0.26	-0.55
United Kingdom	**2.16**	5.59	**2.51**	8.02	-0.11	-0.54	0.24	1.22	-0.35	-0.93
United States	**1.83**	3.98	**0.91**	2.57	**0.56**	2.33	-0.36	-1.45	**0.91**	1.95
Average (EW)	1.98	6.63	1.25	6.28	0.47	3.36	-0.26	-1.63	0.74	2.61
Average (VW)	1.65	4.64	1.02	3.71	0.42	2.63	-0.22	-1.28	0.64	2.07

Table A6 – Continued

Country	WML (Early)	t-stat	WML (Late)	t-stat	WML (Early-Simple)	t-stat	WML (Late-Simple)	t-stat	WML (Early-Late)	t-stat
Emerging Markets										
Brazil	**3.05**	2.08	-0.18	-0.18	**1.73**	2.25	-1.49	-2.13	**3.22**	2.38
Chile	**1.26**	2.73	**1.32**	3.08	-0.22	-0.64	-0.13	-0.38	-0.16	-0.27
China	-0.04	-0.08	-0.03	-0.09	-0.23	-0.72	-0.23	-1.45	-0.01	-0.02
India	**2.41**	3.75	**1.14**	2.12	0.65	1.63	-0.62	-1.89	**1.27**	1.84
Indonesia	-0.22	-0.22	-0.95	-1.17	-0.03	-0.06	-0.77	-1.30	0.73	0.69
Malaysia	**1.58**	2.68	-0.32	-0.74	**1.03**	2.75	-0.82	-2.70	**1.83**	3.00
Philippines	1.28	1.31	-1.05	-1.26	0.95	1.39	-1.39	-2.55	**2.34**	2.18
Poland	**2.02**	1.91	-0.02	-0.02	0.78	1.12	-1.27	-2.06	**2.04**	1.78
Russian Federation	0.68	0.38	-0.40	-0.31	0.91	1.05	-0.16	-0.22	1.07	0.78
South Africa	**2.36**	5.04	**2.67**	6.41	-0.23	-0.76	0.08	0.27	-0.31	-0.58
South Korea	**2.20**	3.41	-1.54	-3.18	**1.86**	4.86	-1.88	-5.23	**3.74**	5.38
Taiwan	**1.00**	1.79	-0.13	-0.28	**0.69**	1.77	-0.43	-1.32	**1.13**	1.68
Thailand	0.86	1.13	-0.20	-0.33	0.29	0.60	-0.77	-1.51	1.05	1.16
Turkey	0.29	0.40	-1.60	-2.82	**1.02**	2.02	-0.87	-2.01	**1.89**	2.29
Average (EW)	1.05	3.27	0.14	0.61	0.43	2.19	-0.46	-2.84	0.87	2.64
Average (VW)	1.16	4.21	0.18	0.95	0.54	3.05	-0.43	-2.96	0.96	3.24