Price Risk and Momentum around the World: Buy Low and Sell High

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I. Introduction

Every investor want to know how to make money in the stock market. An ideal trading strategy is to buy low and sell high which is the ultimate guide to successful stock investing. However, it is challenging and difficult to identify these low and high levels and there are few literature to discuss this. In this paper, we examine how to quantify these low and high levels when asset prices are dictated by a dynamic information diffusion model. Specially, we assume that stock prices are generated by a diffusion process whose response to common shocks are delayed and may respond at the following time. The model shows that the lifecycle of the stock prices response to news which can be measured by the coexistence of implied price risk (Chung and Ho, 2013) and momentum (Jagadeesh and Titman, 1993).

Our argument is similar from Hong and Stein (1999) that information diffuses gradually across the population, from Manela (2014) that faster-diffusing information can be more or less valuable and from Albuquerque and Miao (2014) that the impact of advance information on stock prices dies out quickly once the advance information materializes. Suppose that a good news hits the stock price. The information is initially private and push the stock price rise below its true value. Because the laws of insider trade limit their trading and let the stock price underreact such good news. As the good news gradually diffuses across the population of investors, the momentum trader can gain the anomaly. However, as the good news goes public, the uninformed investors initially misreact to the news but gradually adjust their valuation afterward. There are two possible situations. One is that the markets may overreact such good news which cause the price pressure and its expected return drop. The other is that the markets persistently underreact such good news which cause the price lagged reaction and the momentum effect still exist. Therefore, the stock returns show medium-term momentum and short-term lag or reversal which can be perfectly described by our model.

A dynamic information diffusion model points to a lead-lag effect in the stock market. There are many studies on the lagged reaction of stock prices. From the overreaction view, DeBondt and Thaler (1985) and Fama and French (1988) show the stock returns show the long-run reversal. Jagadeesh (1990) and Lehmann (1990) show the short-run reversal. From the underreaction view, Jagadeesh and Titman (1993) create a momentum strategy and indicate the delayed reaction to firm-specific information. George and Hwang (2004) use the 52-week high as an indicator to show short-term lagged reaction. Moreover, Lo and Mackinlay (1990) indicate that stock prices show a delayed response to price change of other firms. Veronesi (1999) show s that stock prices overreact to bad news in good times and underreact to good news in bad times. Hong and Stein (1999) show that if there is ever any show-run under-reaction to the news, then there must eventually be overreaction in the longer run as well. Therefore, we can use the overreaction and underreaction of stock prices to show the dynamic information diffusion process.

Two of the most pervasive anomalies about the overreaction and underreaction are momentum and reversal. Momentum is the phenomena that the stock returns exhibit continuation. Jagadeesh and Titman (1993) use the relative strength strategies to show that over the medium-term performance persists: buying past winner and selling past losers over the previous 6 months generate higher future returns. Reversals are the phenomena that the stock returns exhibit mean-reverting. There are also two kind of reversals. On the one hand, the stock returns exhibit long-term reversal. DeBondt and Thaler (1985) and Fama and French (1988) find that buying past losers and selling past winner over the previous 3- to 5-years generate higher future returns. On the other hand, the stock returns exhibit short-term reversal. Jagadeesh (1990) shows that buying past losers and selling past winner over the past month generate higher future returns.

Both Long-term reversal and medium-term momentum have been confirmed in a wide variety of assets and several markets around the world in the recent financial literature (Asness, Moskowitz, and Pedersen 2013; Chui, Titman, and Wei 2003; Rouwenhorst 1999; Vayanos and Woolley 2013). However, there are relatively few studies on the short-term effect. Because, in the short-run, the stock returns may be influenced by the bid-ask spread, price pressure, and lagged reaction effects. Moreover, as Jagadeesh and Titman (1993) constructed the momentum strategies, they skipped the data in a recent period to avoid such problems. However, the price levels are more important determinants of short-term effect than the past price changes. George and Hwang (2004) use the 52-week high as an indicator of short-term lagged reaction. Chung and Ho (2013) develop the implied price risk (IPR) for the short-term price pressure and lagged reaction.

Furthermore, some literature also attempt to integrate both reversal and momentum into a horizon to explain the coexistence. Daniel, Hirshleifer, and Subrahmanyam (1998) and Hong and Stein (1999) state that stock prices which overreact to the new information causes momentum. However, such overreaction is eventually corrected causes long-term reversal. Bhootra and Hur (2013) show that conditioning on the recency of 52-week high price significantly increases the profitability of momentum strategy. Chung and Ho (2013) show that implied price risk can manage the tail risk of the momentum strategy and significantly improve the performance. Jacobs, Regele, and Weber (2015) indicate a strong relation between expected skewness and momentum.

In fact, we pursue the same goal as Bhootra and Hur (2013) and Chung and Ho (2013) and Jacobs, Regele, and Weber (2015) that of modified short-term strategy from the price levels and improvement on the momentum strategy. Furthermore, we construct a buy low and sell high strategy and extend our analysis to the international market. Our empirical evidence strongly supports the premium of buy low and sell high across all market we study. IPR-MOM effects are much stronger in 23 out of 24 markets. Using data from 1990 to 2014, the IPR strategy delivers significantly positive profits in 21 markets and the IPR-MOM strategy delivers significantly positive profits in 21 markets. The IPR-MOM strategy works in 13 developed markets, while it works in only 8 developing markets. Specifically, the IPR-MOM strategy outperforms the momentum strategy in 23 out of 24 markets, and 21 of them are statistically significant. As predicted, the IPR-MOM strategy can gain profits by buy low and sell high strategies.

This study has following contributions: First, this study is the first paper to examine how to buy low and sell high in equity market and to improve the performance of momentum strategy. This paper will have some contributions to the literatures of the investment area in the capital market. Second, this study also examines the IPR-MOM premium is consistent and everywhere. This paper will have some contributions to the literatures of the international capital markets.

The paper proceeds as follows. Section I introduces the implication. Section II describes the data and methodology. Section III describes momentum profits across countries. Section IV dictates a dynamic information diffusion of asset pricing model. Section V provides empirical results for IPR and Momentum strategies. Section VI concludes the paper.

II. The model

In this section, we develop a dynamic information diffusion of asset pricing model where stock prices are generated by a diffusion process whose response to common shocks is delayed and may respond at the following time. The model shows that the lifecycle of the stock prices response to news which can be measured by the coexistence of implied price risk (IPR) and momentum.

A. An asset pricing model

We first study the basic pricing model of Fama and French (1988) and Summers (1986), denote by S_t the stock price at time t and define $P_t \equiv log\ S_t$ as the log price process. The price can be written as the combination of permanent and temporary component:

$$P_t = q_t + \eta_t \tag{4}$$

where η_t is a slowly mean-reverting process and $q_t = \mu + q_{t-1} + \varepsilon_t$ is a random walk. μ is an arbitrary drift parameter and ε_t's are the independent shocks.

B. Dynamic information diffusion

According to Campell (1991), the ε_t is interpreted as news about expected returns. To develop our model, we assumed that stock prices are generated by a diffusion process whose response to the news may delayed and incomplete ($(1-u_t)\varepsilon_t$) and respond at the following time ($u_t\varepsilon_{t+1}$). Hence, we drive the following equations to show the evolution over time of investors' information.

$$q_t = \mu + q_{t-1} + (1-u_t)\varepsilon_t + u_t\varepsilon_{t+1} \tag{5}$$

$$= t\mu + \sum_{i=1}^{t} \varepsilon_i + u_t \varepsilon_{t+1}$$

where $\varepsilon_t's$ are the independent mean-zero shocks and $u_t's$ are the proportion of the shock ε_{t+1} diffused among investors at time t which depend on the shocks up to t, ε_s's, s ≤ t; $q_0 = u_0 \equiv 0$.

To show the idea that stock prices respond gradually to the news, we follows the assumption of Lewellen (2002), a slowly mean-reverting process is given by $\eta_t = -\rho u_{t-1}\varepsilon_t - \rho^2 u_{t-2}\varepsilon_{t-1} - \cdots$, which means that the stock prices take many periods to incorporate news. Hence, equations (4) and (5) can be combined to write the price as

$$p_t = t\mu + \sum_{i=1}^{t} \varepsilon_i + u_t \varepsilon_{t+1} + \eta_t$$

$$= t\mu + \sum_{i=1}^{t-1} (1 - \rho^{i+1} u_{t-i-1}) \varepsilon_{t-i} + u_t \varepsilon_{t+1} \quad (6)$$

We also can rewrite $\eta_t = -\rho\eta^*$, where $\eta^* = u_{t-1}\varepsilon_t + \rho u_{t-2}\varepsilon_{t-1} - \cdots$ which is approximately an AR (1) process. Therefore, the stock returns at time t is

$$r_t = \mu + \Delta q_t + \Delta \eta_t$$

$$= \mu + (1 - (1+\rho)u_{t-1})\varepsilon_t + u_t \varepsilon_{t+1} + \rho(1-\rho)\eta_{t-1}^* \quad (7)$$

Because our model assumed that stock prices are generated by a diffusion process whose response to delayed and incomplete, the proportion of the shock ε_{t+1} can be affected by the level of lead-lag effect (Underreaction or Overreaction) in the stock market which can be measured by the coexistence of the median-term price trend and the short-term implied price risk. Hence, we express the median-term price trend written as $r_{t,t-T_1} - r_{t,t-T_1}^m$ and the short-term implied price risk as $z_{t,t-T_2} - z_{t,t-T_2}^m$ where $T_1 > T_2$ and $r_{t,t-T_1}^m, z_{t,t-T_2}^m$ are market median. Define $M_t = H(r_{t,t-T_1} - r_{t,t-T_1}^m), H(.)$ is nondecreasing; $R_t = H\left(z_{t,t-T_2} - z^m_{t,t-T_2}\right), H(.)$ is nondecreasing. Therefore, we decompose the proportion of the shock ε_{t+1} into three components: Market uncertainty ($\bar{\sigma}$) which is constant, median-term price trend and Implied price risk. The proportion of the shock ε_{t+1} diffused among investors at time t can be approximate as

$$u_t \approx \bar{\sigma} \exp(M_t \times R_t), \bar{\sigma} > 0 \tag{8}$$

The equation (2) reveals that the proportion of the shock ε_{t+1} is smaller than one which means underreaction and is larger than one means overreaction. Furthermore, the equation (8) reveals that if the market uncertainty ($\bar{\sigma}$) is too larger, the market always overreact to the shocks. Therefore, the effect of the coexistence of the median-term price trend and the short-term implied price risk would be ambiguous. Under such market situation, it is difficult to investors from the strategies of momentum or implied price risk.

C. Future returns and Trading strategies

Base on the equations (7) and (8), we can write the future returns as

$$r_{t+1} = \mu + (1 - (1+\rho)\bar{\sigma} \exp(M_t \times R_t))\varepsilon_{t+1} + u_{t+1}\varepsilon_{t+2} + \rho(1-\rho)\eta^*_t$$

Let $\bar{\sigma} = 1/(1+\rho)$, which implies

$$\begin{aligned} \hat{r}_{t+1} &= E(r_{t+1} | p_s, s \leq t) \\ &= \mu + (1 - \exp(M_t \times R_t))\hat{\varepsilon}_{t+1} + \rho(1-\rho)\eta^*_t \\ &= \mu + information\ diffusion\ + price\ continuation \end{aligned} \tag{9}$$

The equation (9) show that the future returns can be decomposed into the expected drift, information diffusion and price continuation.

The implications in forecasting future returns are summarized in the table III. There are four possible paths to stock future returns:

[see Table III]

First, if the stocks are past winners where their returns underreacted the good news, their price trend is positive and the information expect to be positive at following time because their stock prices do not completely reflect this good news. Moreover, their stock prices overreact the good news in the short run where their price risk is high. Hence, the Information Diffusion is negative. It means that if the stocks are past winner but their prices overreact the good news in short run, their future returns will be negative.

Second, if the stocks are past winners where their returns underreacted the good news, their price trend is positive and the information expect to be positive at following time because their stock prices do not completely reflect this good news. Moreover, their stock prices also underreact the good news in the short run where their price risk is low. Hence, the Information Diffusion is positive. It means that if the stocks are past winner and their prices continued to underreact in short run, their future returns will be positive.

Third, if the stocks are past losers where their returns underreacted the good news, their price trend is negative and the information expect to be negative at following time because their stock prices do not completely reflect this bad news. Moreover, their stock prices overreact this bad news in the short run where their price risk is low. Hence, the Information Diffusion is positive. It means that if the stocks are past losers but their prices overreact this bad news in short run, their future returns will be positive.

Finally, if the stocks are past losers where their returns underreacted this bad news, their price trend is negative and the information expect to be negative at following time because their stock prices do not completely reflect this bad news. Moreover, their stock prices also underreact this bad news in the short run where their price risk is high. Hence, the Information Diffusion is negative. It means that if the stocks are past loser and their prices continued to underreact this bad news, their future returns will be negative.

These possible paths show that if the stocks are winners with underreaction or losers with overreaction, their stock prices are relatively low and If the stocks are winners with overreaction or losers with underreaction, their stock prices are relatively high. Therefore, we can form a portfolio with buying those relative low stocks and selling those relative high stocks which we call it as buy low and sell high strategy. It can improve the performance of momentum strategies and produce the anomalies.

III. Data and methodology

Our sample consists of the common stocks included on the Compustat database for 14 markets with MSCI developed equity markets: Australia, France, Germany, Hong Kong, Italy, Israel, Japan, the Netherlands, Norway, Singapore, Sweden, Switzerland, the United Kingdom, the United States and 10 markets with MSCI developing equity markets: Greece, Hungary, Indonesia, India, Korea, Malaysia, Poland, South Africa, Thailand, Turkey, and Taiwan. The period covered is from the start of the data series, in January 1990, through December 2014.

To mitigate the suspicious stock returns and ensure the anomalies are not driven by small or illiquid stocks. We screen out a number of observations and winsorizing the stock returns. As Chui, Titmam, and Wei (2003), if the market capitalization of a stock is below the fifth percentile of all the stocks within a given country in any month, its return in that month is treated as missing and set the returns that are larger (less) than 100% (-95%) equal to 100% (95%). Calculating returns from the Compustat data presents a problem. They do not provide the stock returns for each stock. We calculate the stock returns as follow:

$Stock\ Return =$

$$\left[\frac{(\text{Daily Close Price}_t/\text{Adjustment Factor}_t) * \text{Daily Total Return Factor}_t}{(\text{Daily Close Price}_{t-1}/\text{Adjustment Factor}_{t-1}) * \text{Daily Total Return Factor}_{t-1}} - 1\right] * 100$$

Table I summaries our samples. The starting date for each country varies according to the availability of data on Compustat. Table I reports the average returns and standard deviations for each markets and the number of firms that meet our sample requirements.

[see Table I]

To proxy the price risk, we construct an implied price risk (IPR). This concept can be found in Value at Risk (VaR) which has been widely used in practice to manage market risks. To prevent the portfolio from the risk of suffering an unsustainable loss, we can calculate the maximum loss over a horizon T at a pre-specified confidence level. We derive the VaR for the security price in the following:

$$\alpha = \mathrm{P}\left(\frac{Z_T - \mu}{\sqrt{T}\sigma} \leq \frac{log\left(\frac{V_\alpha(T)}{S_0}\right) - \mu}{\sqrt{T}\sigma}\right) \tag{1}$$

where $Z_T = \log(\frac{S_T}{S_0})$ is the log-return and S_T denotes an asset price at time T.

μ is the mean of the log-returns.

σ is the standard deviation of the log-returns.

According to the central limit theorem, the distribution of $\frac{Z_T-\mu}{\sqrt{T}\sigma}$ is approximately standard normal as for large T. Hence, we can denotes the quantile function of $\frac{Z_T-\mu}{\sqrt{T}\sigma}$ as $\mathrm{Q}(.)$ which can be derived from equation (1) as follows:

$$\frac{log\left(\frac{V_\alpha(T)}{S_0}\right)-\mu}{\sqrt{T}\sigma} \approx \mathrm{Q}(\alpha) \tag{2}$$

Base on Equation (2), we can use the monthly returns to calculate the quantile risk by the proper estimates of μ and σ. Therefore, an implied price risk is defined as follow:

$$IPR_t^j = \frac{\sum_{i=1}^{j} r_{t-i} - \hat{\mu}}{\sqrt{T}\hat{\sigma}} \quad (3)$$

where $r_t = \log(\frac{s_t}{s_{t-1}})$ is the log-return. $\hat{\mu}$ and $\hat{\sigma}$ denote the sample mean and the sample standard deviation of r_t.

In our empirical study, the parameters $\hat{\mu}$ and $\hat{\sigma}$ in equation (3) are estimated by the past 3-year monthly log-returns at the end of each month. The j period return $(\sum_{i=1}^{j} r_{t-i})$ in equation (3) stands for the aggregate of j monthly log-returns proceeding the last trading day of the current month. For the IPR strategy, stocks are ranked base on IPR_t^3 .

The IPR measures the short-term relative price strength to its past equilibrium level. If the stocks are high IPRs, their stock prices may overreact and face to the price pressure in the short run. If the stocks are low IPRs, their stock prices may underreact and face to lagged reaction in the short run. Both of them will exhibit short-term reversal. Therefore, we can gain profits by sell high IPRs and buy low IPRs. Table VI reports average monthly profits on these IPR portfolios for each market. Our empirical evidence shows that the IPR strategy delivers significantly positive profits in 21 out of 24 markets and it works in 13 developed markets, while it works in only 8 developing markets. Our results exhibit that IPR anomalies around the world.

IV. Momentum profits is not uniform

Many papers have documented that momentum strategies work in international stock markets. However, those findings have not been uniform. In general, evidence for momentum profits is stronger in developed markets than in developing markets. Rouwenhorst (1998, 1989) shows that momentum profits work in 11 of the 12

European markets but only work in 6 of the 20 emerging markets. Daniel and Moskowitz (2013) argue that momentum profits are punctuated with occasional strong reversals, or crashes. Fama and French (2012) argue that there are strong momentum returns in all regions (North America, Europe, Japan, and Asia Pacific) except Japan.

To show that IPR can improve the weaker performance of momentum strategies and produce the anomalies, we follow the methodology of Jacobs, Regele, and Weber (2015). We conduct a number of regressions of momentum profits on our IPR measure. We define the dependent variable, momentum profits $R_{i,mom,t}$ of firm I, as follow:

$$R_{i,mom,t} = (R_{i,t} - R_{median,t}) \times sign(R_{i,t-12\ to\ t-2} - R_{median,t-12\ to\ t-2})$$

where $R_{median,t}$ denotes the median profit of all stocks at month t. If the stocks with above median returns are winner and the stocks with below median returns are losers. Hence, $R_{i,mom,t}$ shows that the present winners who are past winners or the present losers who are past losers will get positive returns. On the contrary, they will get negative returns. The second columns of Table II show that momentum profits are significantly positive in 14 of the 24 countries (only about 58%). The empirical results exhibit that the weaker performance of momentum strategies.

Because of the conjectured impact of IPR on winner and losers, we proceed the independent variable $ADJ\_IPR_{i,t-1}$ of firm I, as follow:

$$\begin{aligned} ADJ\_IPR_{i,t-1} & \\ &= IPR_{i,t-1} \times sign(R_{i,t-12\ to\ t-2} - R_{median,t-12\ to\ t-2}) \\ &\times sign(IPR_{median,t-1} - IPR_{i,t-1}) \end{aligned}$$

It shows that the present IPRs who are past winners but low IPRs or the present losers who are high IPRs will get positive adjusted IPRs. On the contrary, they will get negative adjusted IPRs. Then, we use Fama and MacBeth (1973) regressions to show the impact of adjusted IPR on momentum profits. The fourth columns of Table II display that IPR significantly influences momentum profits in 21 out of 24 markets (about 93%). The empirical results show that IPR can improve the weaker performance of momentum strategies and it exits around the world.

[see Table II]

V. Empirical Results

This section reports, for each country, the profitability of IPR and momentum strategies. We start by constructing independent sorts of our IPR and formation period returns for each country. In each month, we sort all stocks into three portfolios based on IPR. Stocks with IPR in the bottom one-third during are assigned to the low IPR portfolio, while those in the top one-third are assigned to the high IPR portfolio. Our construction of momentum portfolios follows Jegadeesh and Titman (1993) who choose a formation period of past twelve months and a holding period of one month, but drop one month in between.

Panel A of table IV presents the characteristics of IPR and momentum profits for each of the 24 markets. The results in table IV show that all but three market (Hong Kong, Poland, and Taiwan) exhibit statistically significant positive IPR profits. The highest IPR profits are Sweden (3.89% per month), Norway (1.86% per month), and Greece (1.77% per month). However, there are only 8 markets who exhibit statistically significant positive momentum profits. The highest momentum profits are Australia (0.98% per month), Poland (0.77% per month), and Thailand (0.59% per month). Furthermore, the combination of IPR and momentum strategies also work. There are 21 markets who exhibit statistically significant positive IPR-momentum profits. The highest IPR-momentum profits are Sweden (4.70% per month), Switzerland (2.87% per month), and Norway (2.66% per month).

The IPR-MOM strategy works in 13 out of 14 developed markets, while it works in only 8 out of 10 developing markets. Specifically, the IPR-MOM strategy outperforms the momentum strategies in 23 out of 24 markets, and 21 of them are statistically significant. The empirical results show that the IPR-MOM strategies can gain profits by buy low and sell high strategies and it exits around the world.

[see Table IV]

To test whether the cross-market differences in IPR and momentum profits are persistent, we calculate market-average profits with different holding period for each strategy. Table IV present the average profits of the IPR, MOM, IPR-MOM strategies for the different holding period. With the holding period of 1 month, the average profits of IPR strategy are about 1.09% per month and significant greater than 0 which are higher than those of profits with momentum strategy. Moreover, the average profits of IPR-MOM strategy are highest among those strategies and are about 1.50% per month.

However, with the holding period extended to 6 months, the profits of IPR and IPR-MOM strategies disappear, but the profits of the momentum strategy are significant greater than 0 and is about 0.06% per month. With the holding period extended to one year, the profits of those strategies are not significant. The results show that IPR effect is short-term and those of profits are not persistent.

[see Table V]

VI. Conclusion

We use a dynamic information diffusion model to examine how to construct a sell low and high strategy. First, we propose an implied price risk, the IPR, to assess the short-term price pressure and lagged reaction. Furthermore, using the coexistence of implied price risk and momentum (IPR-MOM) to quantify these low and high levels by the dynamic information diffusion model.

Making use of finding, we construct a buy low and sell high strategy and extend our analysis to 24 MSCI markets from 1990 to 2014. The results show that there are 21 markets who exhibit statistically significant positive IPR profits and the average IPR profits are about 1.09% per month. Moreover, the IPR-MOM strategy outperforms the momentum strategies in 23 out of 24 markets, and 21 of them are statistically significant and the average IPR-MOM profits are higher and about 1.51% per month. Those of profits are not persistent. The results of Fama and MacBeth regressions also show that IPR significantly influences momentum profits in 93% markets. Therefore, this sell low and buy high strategy which we construct works across international markets but only in short-term.

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Table I

Summary Statistics

This table reports the number of firms for each country in the sample, the period for the return data, the average return, and the standard deviation of the return in local currency. Returns are expressed as percentage per month from starting date to December 2014.

Country	Period	No. of firms	Average returns	Standard deviations
	A.MSCI developed markets			
Australia	199001~201412	1162	0.8542	10.8650
France	199001~201412	1381	0.6757	12.4920
Germany	199001~201412	1263	0.3964	12.5648
Hong Kong	199001~201412	430	0.9598	13.5178
Israel	199008~201412	514	0.9550	13.2902
Italy	199001~201412	479	0.4512	11.0798
Japan	199001~201412	4848	0.2846	12.5051
Netherlands	199001~201412	322	0.7608	10.8178
Norway	199001~201412	383	0.7446	14.8943
Singapore	199001~201412	324	0.6156	10.8837
Sweden	199001~201412	585	0.6988	13.5195
Switzerland	199001~201412	365	0.6691	10.2808
United Kingdom	199001~201412	2658	0.7908	10.2276
United States	199001~201412	16602	1.2417	14.5568
	B.MSCI developing markets			
Greece	199006~201412	376	0.0225	14.8649
Indonesia	199012~201412	483	1.6395	18.5819
India	199005~201412	2725	1.0452	17.4406
Korea	199001~201412	2330	0.4110	18.1501
Malaysia	199001~201412	980	0.3499	13.7126
Poland	199505~201412	501	0.7089	14.5125
South Africa	199001~201412	665	1.3562	13.0268
Thailand	199001~201412	725	0.7816	15.5766
Turkey	199202~201412	391	2.7786	17.8666
Taiwan	199001~201412	1864	0.7799	14.4010

Table II IPR and Momentum: Fama and Macbeth Regressions

This table presents time-series averages of equal-weighted momentum profits by country together with coefficients which obtained from results of Fama and MacBeth (1973) regressions of momentum on adjusted IPR . * indicates significance at the 90% confidence level, ** indicates significance at the 95% confidence level, *** indicates significance at the 99% confidence level.

Country	Momentum Effect		P-Value	ADJ_IPR Coefficient		P-Value
Developed Markets						
Australia	0.3474	***	0.0000	0.4946	***	0.0003
France	0.0001		0.9967	1.0528	***	0.0000
Germany	0.0878	**	0.0119	0.5874	***	0.0000
Hong Kong	0.0761		0.2131	0.1584		0.6068
Israel	0.0284		0.6973	1.3864	***	0.0000
Italy	0.0558		0.2441	0.3017		0.1103
Japan	0.0351	**	0.0140	0.7497	***	0.0000
Netherlands	0.0983	*	0.0888	0.8927	***	0.0000
Norway	0.1959	**	0.0276	1.2750	***	0.0000
Singapore	0.1878	***	0.0001	0.9728	***	0.0000
Sweden	0.1302	**	0.0375	3.1401	***	0.0000
Switzerland	0.0948		0.1273	1.0804	***	0.0000
United Kingdom	0.1251	***	0.0000	0.1897	*	0.0503
United States	0.0220		0.1048	0.8899	***	0.0000
Developing Markets						
Greece	0.0697		0.3619	1.6089	***	0.0002
Indonesia	0.1712	*	0.0573	1.2001	**	0.0150
India	0.0555		0.1299	1.0040	***	0.0001
Korea	-0.0860	**	0.0197	1.0961	***	0.0000
Malaysia	0.1744	***	0.0000	0.6483	***	0.0013
Poland	0.2052	***	0.0063	0.1967		0.5695
South Africa	0.0345		0.5486	0.7397	***	0.0003
Thailand	0.1303	**	0.0399	1.4088	***	0.0000
Turkey	-0.1608	**	0.0395	1.2508	***	0.0035
Taiwan	0.0311		0.3172	0.5541	*	0.0823

Table III

The implications of forecasting returns

This table summarizes the direction predictions of future returns as depicted in the equation (9) which dictated by a dynamic information diffusion model. The information diffusion can be decomposed into the price trend, price risk, and information. ＋ indicates a positive effect. － indicates a negative effect.

Implications	Price Trend M_t	Price Risk R_t	Information $\hat{\varepsilon}_{t+1}$	Information Diffusion $(1-\exp(M_t \times R_t))\hat{\varepsilon}_{t+1}$
Winner & Overraction	＋	＋	＋	< 0
Winner & Underraction	＋	－	＋	> 0
Loser & Overraction	－	－	－	> 0
Loser & Underraction	－	＋	－	< 0

TABLE IV. Profits of IPR and momentum portfolios in the Developed and Developing Markets (1990-2014)

We form portfolios at the end of each month from 1990 to 2014, based on independent sorted values of IPR and MOM for each market. These equally weighted portfolios are held for one months. The high IPR portfolio is among the highest 30 percent of sorted in ascending order based on the IPR. The low IPR portfolio includes stocks in the bottom 30 percent. IPR(L-H) is the difference between the low and high returns. The winner (loser) portfolio include the stocks in the top (bottom) 30 percent of sorted in ascending order based on the past 12 months but drop latest one month cumulative returns. MOM(W-L) is the difference between the winner and loser returns. Panel A reports the summaries of the number of markets (percentage) whose profits are significant at the 90% confidence level. Panel B reports average monthly profits on these portfolios for each market. Corresponding p-value are in parentheses.

Panel A. Summary

	N	IPR (L-H)	MOM (W-L)	IPR-MOM (WL-LH)
Developed Markets	14	13 (93%)	5 (36%)	13 (93%)
Developing Markets	10	8 (80%)	3 (30%)	8 (80%)
Total	24	21 (88%)	8 (33%)	21 (88%)

Panel B. Statistics

Country	IPR (L-H)	MOM (W-L)	IPR-MOM (WL-LH)
Developed Markets			
Australia	0.4551	0.9809	1.3159
	(0.0056)	(0.0000)	(0.0000)
France	1.3905	-0.0499	1.4743
	(0.0000)	(0.7570)	(0.0000)
Germany	0.8432	0.1864	1.0981
	(0.0000)	(0.2241)	(0.0000)
Hong Kong	0.0894	0.2569	0.3795
	(0.7279)	(0.2680)	(0.2743)
Israel	1.2678	0.1217	1.4422
	(0.0000)	(0.5676)	(0.0000)
Italy	0.4840	0.2706	0.6174
	(0.0056)	(0.2138)	(0.0513)
Japan	0.8751	-0.0033	0.8366
	(0.0000)	(0.9853)	(0.0000)
Netherlands	1.4996	0.3779	2.0213
	(0.0000)	(0.0526)	(0.0000)

Norway	1.8851	0.2500	2.6584
	(0.0000)	(0.4870)	(0.0007)
Singapore	1.1044	0.4376	1.6088
	(0.0000)	(0.0772)	(0.0000)
Sweden	3.8931	-0.1796	4.7011
	(0.0000)	(0.7091)	(0.0000)
Switzerland	1.6721	0.5137	2.8729
	(0.0000)	(0.0631)	(0.0000)
United Kingdom	0.2312	0.3753	0.6839
	(0.0609)	(0.0047)	(0.0000)
United States	1.1637	0.1586	1.5192
	(0.0000)	(0.4059)	(0.0000)
Developing Markets			
Greece	1.7651	0.2479	2.4860
	(0.0000)	(0.5656)	(0.0010)
Indonesia	0.8252	-0.2121	1.2165
	(0.0638)	(0.6122)	(0.0276)
India	1.1324	0.0318	1.6427
	(0.0000)	(0.9145)	(0.0001)
Korea	0.9599	-0.0196	0.9541
	(0.0002)	(0.9385)	(0.0044)
Malaysia	0.6856	0.4469	1.1273
	(0.0005)	(0.0704)	(0.0001)
Poland	0.0693	0.7689	0.7420
	(0.7693)	(0.0008)	(0.0288)
South Africa	0.9581	0.3336	1.7279
	(0.0001)	(0.1267)	(0.0000)
Thailand	1.7322	0.5941	2.4047
	(0.0000)	(0.0777)	(0.0000)
Turkey	1.0705	-0.3805	0.7259
	(0.0012)	(0.2909)	(0.2062)
Taiwan	0.1756	-0.2697	-0.0964
	(0.5096)	(0.3289)	(0.7718)

Table V Persistence of Profits from IPR and momentum strategies

We form portfolios at the end of each month from 1990 to 2014, based on independent sorted values of IPR and MOM for each market. These equally weighted portfolios are held for 1-, 6-, 12-months. This table reports the average monthly profits on the composite portfolios. Corresponding p-value are in parentheses.

	K-month holding period		
	1	6	12
IPR	1.0928	-0.0471	-0.0401
	(0.0000)	(0.9999)	(0.9999)
MOM	0.2182	0.0559	-0.0039
	(0.1461)	(0.0000)	(0.7290)
IPR-MOM	1.5067	0.0049	-0.0461
	(0.0000)	(0.3376)	(0.9999)