

# **Gone Fishin': Seasonality in Trading Activity and Asset Prices**

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**Abstract:** We investigate seasonality in trading activity and asset prices associated with vacation periods, typically the summer months for many countries. Using data from 51 stock markets, we find that trading activity is lower during the summer than during the rest of the year. This “gone fishin’” effect is stronger for countries located farther away from the equator, where vacations tend to occur during the summer. In countries with significant summer turnover effects, return volatility and mean returns also are lower during the summer as compared to the rest of the year, while bid-ask spreads are higher. These relationships become even stronger when we use a country’s distance from the equator as an instrument for its summer turnover effect. We extend a standard stock-trading model with risk-averse speculators and noise (liquidity) traders and evaluate whether seasonal variations in risk aversion and noise trading intensity can rationalize some of these findings.

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## 1. Introduction

In this paper, we investigate seasonality in trading activity and asset prices associated with vacation periods, typically the summer months for many countries. The study of seasonal fluctuations in economic activity and prices has a lengthy history in economics. Macroeconomists, going back to the turn of the century, have analyzed the relationship between seasonal cycles and business cycles (see, *e.g.*, Kuznets (1933), Barsky and Miron (1989)). For their part, financial economists have long tried to uncover and understand seasonality patterns in interest rates and stock returns (see, *e.g.*, Macaulay (1933)). The most famous of these patterns is the “January effect” in which stocks that have suffered recent losses (especially small stocks) tend to experience reversals of fortune at the turn of the year (see, *e.g.*, Dyl (1977), Roll (1983), Keim (1983), Reinganum (1983), Ritter (1988), and Lakonishok, Shleifer, Thaler and Vishny (1991)). A major reason why economists are interested in studying seasonal variations is that they are relatively exogenous factors, and hence studying them can help us better understand how markets work. To date, however, vacation activity as a source of seasonality in financial markets has received scant attention in the literature.

We begin our investigation of seasonality effects associated with vacation periods by examining whether trading activity is lower during the summer than during the rest of the year. Our basic hypothesis is that turnover dries up during this period because investors are “gone fishin’.” There is a substantial amount of anecdotal evidence in support of this hypothesis from stock markets in North America and Europe, where activity of all types stops during the summer months (particularly in August and September) when people are on vacation. Moreover, as we discuss below, data on hotel occupancy and travel indicate that summer is indeed a peak vacation period for many countries. Using individual stock return

and share turnover data from 51 stock markets, we attempt to measure this gone fishin' effect and examine its implications for asset prices.

We find that share turnover is significantly lower during the summer than during the rest of the year, where summer is defined as the third quarter (July, August and September) for Northern Hemisphere countries and the first quarter (January, February and March) for Southern Hemisphere countries. Across the 51 countries in our sample, turnover is lower on average during the summer as compared to the rest of the year by a statistically significant difference of 7.9%. The magnitude of this summer turnover effect is influenced by a number of factors. Most notably, it is larger for countries farther away from the equator, where seasons are pronounced and people plausibly time their vacations to take advantage of nice summer weather. We regress the percentage summer drop in turnover for each country (*i.e.*, the percentage difference between summer and the rest of the year) on its distance from the equator (measured by the absolute value of its latitude angle), while controlling for market size.<sup>1</sup> A one degree increase in the absolute value of a country's latitude angle is associated with a significant additional 0.4% drop in turnover during the summer.

To substantiate our interpretation of the summer turnover dip as a gone fishin' effect, we briefly examine the seasonal behaviors of two measures of vacation activity, namely airline passenger travel and hotel occupancy rates. In both of these vacation proxies, we find evidence of summer effects that increase with the distance of a country from the equator. These findings support our interpretation that trading activity is lower in the summer (and especially so for countries farther away from the equator) because investors are on vacation.

In countries with sizeable summer turnover effects, stock return volatility may be lower during the summer than during the rest of the year, for at least two different reasons.

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<sup>1</sup> The northernmost country in our sample, Finland, has a latitude angle of 64 degrees. The southernmost country in our sample, New Zealand, has a latitude angle of -41; and a country located at the equator has an angle of zero.

First, fundamental variance may be lower in the summer if Main Street has also gone fishin'. Second, less trading activity in the form of liquidity or "noise" trades may lead to lower return volatility. While we do not find evidence of a strong summer volatility effect on average, we do find that countries with more pronounced summer turnover effects experience lower return volatility during the summer as compared to the rest of the year. To demonstrate this, we regress each country's percentage summer dip in volatility on its percentage summer dip in turnover. The coefficient from this cross-country regression is 0.456 with a bootstrap  $t$ -statistic of 3.26. Each 1% drop in turnover during the summer is associated with an extra 0.45% drop in quarterly return volatility during the same period.

In order to interpret the relationship between summer volatility and summer turnover dips as stemming from lower fundamental variance or noise trading due to a gone fishin' effect, we must address the likely endogeneity of the summer turnover regressor. We use the absolute value of a country's latitude angle as an instrument for that country's summer turnover drop. The identifying assumption is that seasonality of return volatility in a country does not depend on its distance to the equator other than through our gone fishin' effect. The instrumental-variable regression indicates that each 1% drop in turnover during the summer is associated with a significant additional 0.276% drop in quarterly return volatility during the summer.

We then attempt to further disentangle whether the lower summer return volatility is due to a drop in fundamental variance or fewer noise trades. Using data from the U.S., we find that fundamental variance, as alternately measured by the variance of quarterly earnings per share, return on equity, or return on assets, is actually higher during the summer than during the rest of the year, which suggests that the lower return volatility during the summer is likely not due to lower fundamental variance.

Next, we look for a gone fishin' seasonality effect in stock returns by regressing monthly index returns on a summer dummy and a dummy for the month of January to account for the January effect. Across the 51 stock markets, on average, the mean monthly return in the summer is less than that of the rest of the year, with the difference given by a significant 0.90% for a value-weighted portfolio and 0.80% for an equal-weighted portfolio. Mean monthly returns in the other three quarters do not differ markedly from each other. This difference in the monthly returns between the summer and the rest of the year is economically significant given that the unconditional monthly return across all countries is about 2.9%.

As in the case of the summer volatility effect, the summer mean return effect turns out to have a statistically significant relationship with the summer turnover effect. When we regress the summer dip in returns on the summer dip in trading activity across the 51 countries, the coefficient is 0.063 with a bootstrap  $t$ -statistic of 2.81. Thus, a country with a 1% bigger summer drop in turnover has a lower monthly return in the summer compared to the rest of the year by a difference of 0.063% (or about 6.3 bps). The instrumental-variable regression using distance to the equator as an instrument yields similar results.

The fact that there is less trading activity during the summer also may have implications for bid-ask spreads, depending on the relative changes in the demand and supply of liquidity. Interestingly, we find that countries with bigger summer drops in turnover have significantly higher spreads during the summer. A cross-country regression of the difference in spreads between summer and the rest of the year on the summer dip in turnover yields the result that an extra 1% summer drop in turnover is associated with about 0.206% higher spreads. The instrumental-variable regression using a country's distance from the equator as an instrument for the summer turnover effect produces even stronger results.

Following our empirical investigation of gone fishin' effects on asset prices, we extend a standard stock-trading model with risk-averse market-makers (speculators) and liquidity (noise) traders (see, e.g., DeLong, Shleifer, Summers and Waldmann (1990), Campbell, Grossman and Wang (1993)) to allow for seasonal variations in risk aversion and noise trading intensity, and we show that this extension can rationalize some of our empirical findings. The expected share turnover in each quarter is determined by the variance of liquidity shocks (intensity of noise trading). If liquidity traders are gone fishin' and do not trade as much in the summer, then expected turnover is lower during the summer than during the rest of the year. Less noise or liquidity trading in the summer also means lower return volatility during the summer as compared to the rest of the year. The expected return in this model depends on both the risk aversion of the market-makers and the return volatility.

We then attempt to calibrate our model to see if it can match certain aspects of the turnover, volatility and returns data. One result from this exercise is that return volatility does not drop enough in the summer to completely account for the difference in expected return between summer and the rest of the year. Hence, seasonal variation in risk aversion also is needed to quantitatively account for seasonal variations in expected return. We discuss below one mechanism proposed by Kamstra, Kramer and Levi (2003) to explain why risk aversion is lower in the summer than during the rest of the year. However, the calibration exercise on our highly stylized theoretical model suggests that seasonal risk aversion alone is unlikely to account for the balance of seasonal variations in returns, and that we must continue to investigate other factors contributing to summer seasonalities in asset price behaviors.

Our paper is related to the literature on seasonality in stock returns. This literature has expanded beyond the January effect to consider other forms of seasonality in stock returns (see Saunders (1993), Bouman and Jacobsen (2002), Hirshleifer and Shumway

(2003), Kamstra, Kramer and Levi (2003), and Cao and Wei (2005)). Using smaller samples of countries than ours, a number of these papers also find that stock returns are lower in the summer as compared to the rest of the year. These studies consider a variety of mechanisms for these return patterns, such as time-varying risk aversion generated by seasonal affective disorder. Our paper is distinct from those in the literature in its focus on seasonality in trading activity and its simultaneous relationships with seasonalities in mean returns and return volatility. Our conclusion is that a simple model of investors “gone fishin’” can reconcile some of the new empirical findings in this paper as well as those in the existing literature.

The rest of our paper proceeds as follows. We describe the datasets in Section 2 and present our main empirical results in Section 3. In Section 4, we develop a theoretical model to rationalize the empirical analysis. We conduct some calibration exercises using our model and consider alternative explanations for our empirical findings in Section 5. In Section 6, we present a number of auxiliary empirical results motivated by our main analysis. Finally, our brief conclusion in Section 7 summarizes our key findings from this investigation.

## **2. Data**

Our data on the U.S. stock market come from the Center for Research in Security Prices (CRSP). From Datastream, we collect data on the other developed markets, including Australia, Canada, Finland, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, New Zealand, Singapore, Spain, Switzerland and the United Kingdom. From these two databases, we obtain monthly stock returns, monthly shares outstanding, monthly trading volume (shares traded) and monthly closing bid-ask spreads. (All prices and returns are expressed in the local currency.) Our data on the remaining, emerging stock markets come from the Emerging Markets Database (EMDB) provided by Standard and Poor’s. From

EMDB, we obtain monthly price and dividend data (in the local currencies) from which we are able to calculate monthly stock returns. EMDDB also provides monthly shares outstanding and trading volume. However, it does not provide bid-ask spread information. Accordingly, we locate this information for the emerging markets using Datastream, though it is not available for every market.

The summary statistics are presented in Table 1. There are 51 stock markets in our sample. These markets are listed alphabetically by the region or continent to which they belong, where that regional list includes Africa, Asia, Europe, Middle East, North America, Oceania and South America. For each market, we first report in column (1) the latitude angle of the country, which is obtained from the CIA Factbook, available online. Countries located on the equator have a latitude angle of 0. The northernmost country in our sample is Finland, with a latitude angle of 64. The southernmost country is New Zealand, with a latitude angle of -41. The country nearest to the equator, *i.e.* possessing the smallest absolute value of latitude angle, is Singapore, which has an angle of 1.22. The mean latitude angle of the countries in our sample is 24.

We use these latitude angles in assigning seasonal dummies. The seasonal dummies for countries in the Northern Hemisphere are assigned in the following manner: winter is January through March; spring is April through June; summer is July through September; and fall is October through December. For countries in the Southern Hemisphere, the seasonal dummies are given by the following: summer is January through March; fall is April through June; winter is July through September; and spring is October through December.

Columns (2) through (4) describe data on the relative sizes and maturities of the markets in our sample. We report in column (2) the start date of the data for each country. The country with the earliest start date is the U.S., beginning in 1962. The country with the latest start date is Oman in 1999. The largest stock markets in Western Europe and Asia

generally have start dates in the early seventies. This is followed in column (3) by the time-series average of the number of firms in each stock market (defined as those having price information) in a given month. For the U.S., the largest market, the average number of firms in a typical month is 5000. The smallest markets in terms of the number of firms are Bahrain and Venezuela, both of which contain an average of 14 firms in a typical month. The typical country in our sample contains about 300 stocks in a given year. In column (4), we report the total market capitalization of each country in the year 1999. The largest country is the U.S. with 14,500 billion dollars of market capitalization, while Slovakia is the smallest with only 0.56 billion dollars. The mean market capitalization of countries in our sample is roughly 578 billion dollars.

Columns (5)-(7) of the table report the time-series averages of the cross-sectional median, mean and standard deviation of individual stock turnover in a given month. Share turnover is simply trading volume (shares traded) divided by shares outstanding. The first thing to note is that for most countries, the median and mean are close to each other, and furthermore the numbers look reasonable. For instance, in the U.S., median turnover is 3.2% per month or about 36% per year, while the mean is 6% per month or about 72% per year (similar to figures reported by other studies). However, there are a number of countries, including Japan, Singapore, Finland, France, Germany, Hungary, Russia, Spain, United Kingdom, Canada and Australia, for which there is a huge disparity between means and medians. For instance, in the case of Germany, the mean turnover is 2000% per month, whereas the median is 2%. While the cross-sectional distribution for turnover is likely to be right-skewed, the sizes of these disparities suggest that they may simply be due to a handful of data errors in each of these countries.

Accordingly, we will work with the log of turnover, which will reduce the impact of outliers on our analysis; our results, however, are similar when we use raw turnover. Using

logs also will aid the interpretation of our seasonal analysis, as it will enable us to characterize the percentage difference in turnover between the summer and the rest of the year.

Columns (8)-(9) of Table 1 contain the descriptive statistics on stock return volatility in our sample. We calculate quarterly individual stock return volatility in a given year using the four quarterly return observations for that year. In column (8), we report the time-series mean of quarterly stock return volatility for each country in a given year. The country with the highest individual stock return volatility is Argentina, with a quarterly volatility of 91.5% or a 183% annual volatility. The country with the lowest volatility is Bahrain, which features a quarterly volatility of 10.4% or a 20.8% annual volatility. For the United States, quarterly volatility is 21.4%, implying an annualized return volatility for individual stocks of 42.8%, similar to that reported in other studies. In column (9), we report for each country the time-series average of the cross-sectional standard deviation of monthly return volatility in a given year.

For some of the countries in our sample, Datastream provides us with data on monthly closing bid-ask spreads. Where the data are available, we calculate the time-series average of the cross-sectional mean bid-ask spread as a fraction of the month-ending stock price. This is reported in column (10). Most of the European countries have a mean bid-ask spread to price ratio ranging between 3 and 10%, which is in the same vicinity as the 5% figure for the U.S. The time-series average of the cross-sectional standard deviation of bid-ask spreads in a given month for each country is reported in column (11). Finally, we report the time-series averages of the cross-sectional monthly mean and standard deviation of returns in each country in columns (12) and (13).

### **3. Empirical Findings**

### *A. Seasonality in Trading Activity*

We begin by examining whether there is indeed seasonality in share turnover across the markets in our sample. For each stock, we first calculate its average turnover in a given quarter by taking the mean of the three monthly turnover figures in that quarter. We denote this variable of interest as  $\text{TURNOVER}_{i,t}$  for firm  $i$  in quarter  $t$ , and we then take the log of it to give us  $\text{LOGTURNOVER}_{i,t}$ . We then implement the following regression specification country by country:

$$\text{LOGTURNOVER}_{i,t} = a_0 + a_1 * \text{SUMMER}_{i,t} + \text{YEARDUMMIES}, \quad (1)$$

where  $\text{SUMMER}$  is a seasonal dummy variable that equals one if stock  $i$ 's turnover observation is in the summer and zero otherwise. The coefficient of interest is the one in front of the seasonal dummy, which tells us how trading activity differs in the summer as compared to the rest of the year. Specifically,  $a_1$  is the percentage difference in turnover between summer and the rest of the year.

Our specification also includes year dummies to control for time trends that otherwise would add noise to our measurement of a pure seasonal effect.<sup>2</sup> For these country-by-country regressions, we cluster the standard errors by industries (using the Fama-French (1997) classification for the U.S. stock market and the classifications provided by Datastream and EMDB for the other countries). All subsequent country-by-country regressions involving individual stocks will utilize the same clustering scheme for standard errors.

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<sup>2</sup> In an alternative specification whose results are not reported in this paper, we also have explored the addition of stock fixed effects, *i.e.* fixed mean differences across stocks, to this regression. The results from this model were similar to those of the year effects model reported in this paper. One rationale for including stock fixed effects is that larger stocks may have higher turnover than smaller stocks, and the composition of stocks in the market may be changing over time.

For brevity, we report the detailed results of regression (1) for each of the 51 countries in Appendix Table A. The key finding from these results is that many countries, particularly those in Europe and North America, have a statistically significant, negative coefficient on the seasonal dummy variable, implying that turnover is lower during the summer than during the rest of the year. For instance, the coefficient for the U.S. is -0.09 with a  $t$ -statistic of -15.33, implying that monthly turnover during the summer is about 9% lower than during the rest of the year, an economically significant difference. Indeed, a number of European countries such as France, Spain and Italy have statistically significant turnover drops in excess of 20%.

In Table 2, we report our findings from various regression analyses of the seasonal effects measured in the country-by-country regressions. We begin in Panel A by calculating the (world) average summer drop in turnover across the 51 countries, which we accomplish by regressing the 51 seasonal dummy coefficients on a constant. The world average summer drop in turnover turns out to be -0.079 with a  $t$ -statistic of -2.38. For the stock markets around the world, turnover is on average about 8% lower during the summer as compared to the rest of the year, which is an economically significant seasonal effect.

In Panels B through D, we analyze the geographic variation of the seasonal coefficients from the country-by-country regressions. We begin in Panel B by regressing the 51 country coefficients on the seven continent or region dummies. Among the regions in the Northern Hemisphere, monthly turnover in the summer is lower than during the rest of the year by an average of 13.2% for countries in North America, 15.6% for countries in Europe, and 3.4% for Asian countries, while there does not appear to be a summer effect in trading activity for Middle Eastern countries.<sup>3</sup> Among regions in the Southern Hemisphere, the

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<sup>3</sup> All Asian countries reside in the Northern Hemisphere except for Indonesia, which dips slightly below the equator.

summer drop in turnover during January through March is 6.7% for countries in Oceania and 1.8% for South American countries, where two of the six countries in South America actually lie slightly above the equator. For Africa, a region in which two of its countries (South Africa and Zimbabwe) are located in the Southern Hemisphere and the other three lie squarely in the Northern Hemisphere, the average decline is 7.3%.

The magnitude of the summer drop in turnover varies across regions for at least a few reasons. One reason is the existence of cultural or religious observances that may exert their own (unmeasured) seasonal effects on trading activity. For instance, the absence of a significant summer turnover effect in the Middle East is likely due to those countries' major religious holidays of Ramadan and the Islamic New Year, which run through all of October and January, outside of the summer quarter. Citizens of these countries significantly curtail their activities for prayer during these periods. As a result, we do not find a significant summer turnover effect in this region using a regression model that does not also control for major cultural and religious observances.. We expect that similar unmeasured seasonal effects due to cultural observances also may exist in Asian countries that celebrate the Chinese New Year from late January through February.

Another explanation for the observed regional variation in the summer turnover effect is that some regions like Asia, Africa and Southern America include a number of countries near the equator, where there is not much seasonal variation in the weather. In the absence of strong seasons, people may spread their vacation activity more uniformly throughout the year, with the summer season conferring no particular advantage of better weather.

Accordingly, we expect to find smaller summer drops in trading activity among countries near the equator.

To show more transparently how the summer turnover effect depends on a country's distance from the equator, in Panel C we split our sample into non-tropical and tropical countries. For non-tropical countries, defined as those with an absolute latitude angle of greater than 23.5, turnover during the summer is lower by 11.8% as compared to the rest of the year. In contrast, among tropical countries we find no difference in turnover between summer and the rest of the year.

More formally, in Panel D we regress the summer drop in turnover for each of the 51 countries in our sample on a measure of how far that country is from the equator, which is the absolute value of a country's latitude angle. We add in as an additional explanatory variable the market capitalization of the country in the year 1999 (from column (4) of Table 1). Our rationale for including the market size regressor is that investors in smaller markets may enjoy less vacation time. If smaller markets are located near the equator, then the latitude angle in a simple regression might pick up an omitted market size effect.

We find that the summer turnover drop effect is greater for countries farther away from the equator, controlling for market size. The coefficient in front of the absolute latitude angle is -0.004 with a  $t$ -statistic of -7.03. A one degree increase in latitude leads to a 0.4% extra drop in turnover. The coefficient in front of market capitalization is basically zero. We then look to see if this effect is similar when we separate Northern from Southern Hemisphere countries. We re-run the same regression separately for countries in the two hemispheres. The coefficient in front of the latitude variable is somewhat larger for Southern Hemisphere countries as compared to Northern Hemisphere countries (-0.008 versus -0.003), but both coefficients are significant. All of our results from Panel D remain essentially changed in an alternative (unreported) specification in which we use the time-series average

of the number of firms in a given month (from column (3) of Table 1) instead of market capitalization as our measure of market size.

Up to this point, we have focused on specification (1) because it is our most parsimonious model, which allows us to make the most precise statistical inferences possible. The downside to its simplicity is that it does not confirm that summer turnover is lower as compared to each of the other quarters taken separately. To this end, we also consider a more elaborate specification allowing for individual comparisons to the other three quarters. In Panel E, we report our results from a variation of regression (1) in which we replace the SUMMER dummy variable with three new seasonal dummy variables, WINTER, SPRING and FALL. These results confirm that turnover is indeed lowest in the summer on average, and furthermore this effect is driven by the non-tropical countries in our sample.

#### *B. Seasonality in Vacation Activity Proxies*

We interpret our finding of trading activity dips in the summer as stemming from investors going on vacation. There is plenty of convincing anecdotal evidence that this is indeed the case in North America and particularly Europe, where many businesses (except exchanges) literally shut down during certain months. Moreover, other studies using data from the World Tourism Organization find that summer months feature particularly high air travel volumes in a number of countries, consistent with our interpretation that investors are “gone fishin’” in the summer.

To bolster our hypothesis of a gone fishin’ effect in trading activity, we seek to establish that vacation activities are indeed higher during the summer for the countries in our dataset. We tried but were unable to obtain data from the World Tourism Organization to conduct our own analysis. However, we do have data on hotel occupancy by month for a

sample of OECD countries (15 in all) through the publication *Tourism Policy and International Tourism in OECD Member Countries* (1986-1994), and for the U.S. through *Travel Industry Indicators* (1999-2003). We also obtain data on air travel volume, as measured by number of passengers per month, for a sample of twelve countries, as reported by the major airlines in those countries. We are assuming that hotel occupancy rates and/or number of monthly airline passengers in a country capture when residents of that country go on vacation. This is a big assumption, since the same variables also will capture the vacation activity of foreigners within a given country. Thus, while we are assuming that these variables are correlated with domestic vacation activity, we acknowledge that they are likely to be very noisy proxies. Moreover, the sample sizes are very limited, making statistical inference potentially problematic.

With these caveats in mind, Panel A of Table 3 presents the results of a country-by-country regression of the log of the monthly number of airline passengers on a constant, a summer seasonal dummy and year dummies. The coefficient in front of SUMMER is positive for all countries except for Thailand, and it is statistically significant for half of the countries in the sample. Panel B presents the results of a cross-sectional regression of these coefficients on the absolute value of a country's latitude angle. We find a positive and economically significant relationship. A 10 degree increase in a country's latitude angle leads to a 2% higher number of airline passengers in the summer as compared to the rest of the year. The *t*-statistic from this regression is around 3. In other words, countries farther away from the equator have a larger summer effect on vacation activity, as measured by air travel volume.

In Panel C of Table 3, we present the results of a regression of the log of the hotel occupancy rate (*i.e.* the fraction of hotel rooms occupied) by month in each country on a

constant, summer seasonal dummy and year dummies. The coefficient in front of SUMMER is positive for all countries and statistically significant in most of these countries, consistent with summer being a time of heightened vacation activity. Panel D presents the results of a cross-sectional regression of these coefficients on the absolute value of a country's latitude angle. Again, we find a positive and economically significant coefficient, indicating that countries farther from the equator have a bigger summer effect on vacation activity, though in this case the relationship is not statistically significant. A 10 degree increase in a country's latitude angle leads to a 5% higher hotel occupancy rate during the summer as compared to the rest of the year.

In sum, these findings are consistent with our interpretation of trading activity being lower in the summer due to investors going on vacation, as well as our earlier empirical finding that this summer trading dip is more pronounced for countries farther away from the equator.

### *C. Seasonality in Return Volatility*

We next examine whether stock return volatility is lower during the summer than during the rest of the year. Such a pattern might emerge for a couple of different reasons. First, there may be less fundamental variance in the summer if Main Street is also gone fishin'. Second, less trading activity in the form of liquidity or noise trades may lead to lower return volatility.

For each country, we calculate for each stock  $i$  its quarterly stock return volatility in quarter  $t$  using the stock's entire history, denoted by  $VOLATILITY_{i,t}$ . We then take the log of this to obtain our dependent variable,  $LOGVOLATILITY_{i,t}$ .

We implement the following regression specification, country by country:

$$LOGVOLATILITY_{i,t} = b_0 + b_1 * SUMMER_{i,t}, \quad (2)$$

where SUMMER is a dummy variable that equals one if stock  $i$ 's volatility observation is the summer and zero otherwise. The coefficient of interest is the one in front of the seasonal dummy, which tells us how stock return volatility differs in the summer as compared to the rest of the year. Again, the detailed results of the country-by-country regressions are reported in Appendix Table A.

The key summary results are presented in Table 4. In Panel A, we calculate the (world) average summer effect for volatility across the 51 countries by regressing the 51 summer coefficients on a constant. The world average is -0.029 with a  $t$ -statistic of -1.17. For the stock markets around the world, return volatility is on average about 3% lower during the summer than during the rest of the year, though the effect is not significant.

While the average effect may not be large, the summer effect for volatility may be larger for countries with a bigger drop in turnover if the latter effect itself leads to lower volatility, either because of lower fundamental variance or lower intensity of noise trading. To determine if this is the case, we turn to Panel B, where we regress the coefficient estimates in front of SUMMER from column (2) of Appendix Table A on the coefficient estimates in front of SUMMER from column (1) of Appendix Table A. This cross-country regression is likely to give us a downward-biased estimate due to classical measurement error (*i.e.* the right hand side variable is measured with error). Moreover, we have to calculate bootstrap standard errors because we are running estimates from one regression on estimates from another regression. The coefficient from this cross-country regression is 0.456 with a boot-strap  $t$ -statistic of 3.26. In other words, we find that countries with bigger summer drops in turnover also experience bigger drops in return volatility. A 1% drop in turnover during the summer is associated with a 0.456% drop in return volatility during that quarter.

If we wish to interpret this regression as being due to lower fundamental variance or lower noise trading stemming from a gone fishin' effect, then we must address the likely endogeneity of the summer turnover effect regressor. Toward this end, we use the absolute value of a country's latitude angle as an instrument for the country's summer turnover drop. Our identifying assumption is that a country's seasonality in return volatility does not depend on its distance to the equator other than through our gone fishin' effect. The first stage of this instrumental-variable regression, presented in Panel D of Table 2, turns out to be quite powerful with a  $t$ -statistic of over seven, allaying our concerns about a weak instrument. The instrumental-variable regression presented in Panel C yields the result that each 1% drop in turnover during the summer is associated with an extra 0.276% drop in monthly return volatility during the summer. The  $t$ -statistic from the instrumental-variable regression is 1.66. This result lends support to our causal hypothesis that the summer drop in return volatility is due to a gone fishin' effect.

In Panel D, we calculate the mean quarterly return volatility in the summer for countries with a sizeable gone fishin' effect, namely those with a summer drop in turnover of over 5%. For these countries, the summer drop in return volatility is a very significant 8.9%. In Panel E, we compare return volatility in the summer to each of the other three quarters. We find that return volatility in the summer is indeed the lowest among all the quarters, and this is especially true for countries with a summer drop in trading activity of over 5%.

In Table 5, we attempt to disentangle whether the lower summer return volatility is due to a drop in fundamental variance or a decline in noise trades. Using data from the U.S., the only country for which we have the relevant data, we calculate three measures of fundamentals, including earnings per share (EPS), return on equity (ROE) and return on assets (ROA). These three variables are measured quarterly. We then calculate the volatilities of these three variables and use them as proxies for fundamental volatility. We

run the same regressions for these three measures of fundamental volatility as we did for quarterly return volatility. We find that these proxies for fundamental volatility are not the lowest during the summer. Instead, they are higher during the summer than during the first two quarters of the year. These findings suggest that the lower return volatility during the summer is likely not due to lower fundamental uncertainty.

#### *D. Seasonality in Stock Index Returns*

We begin our analysis of seasonality in returns by regressing monthly stock index returns on a summer dummy (which again is defined differently for countries in the Northern versus the Southern Hemisphere) and a dummy for the month of January to account for the January effect. The dependent variable is  $RET_{i,t}$ , which is the index return of country  $i$  in month  $t$ . The regression specification that we implement is the following:

$$RET_{i,t} = d_0 + d_1 SUMMER_{i,t} + d_2 JANUARY_t + YEARDUMMIES \quad (3)$$

where  $SUMMER$  is a dummy variable that equals one if index  $i$ 's monthly return observation is in the summer and zero otherwise; and  $JANUARY$  equals one if month  $t$  is January and zero otherwise. As before, the regressions include year dummies to capture time variations in expected returns. The coefficient of interest is the one in front of the seasonal summer dummy, which tells us how returns differ in this quarter as compared to the rest of the year, controlling for the January effect. We run this model using both equal-weighted and value-weighted stock return indices. For brevity, however, we present the detailed country-by-country results for only the value-weighted portfolio in Appendix Table A, since the results from the regressions that use equal-weighted portfolio returns are similar.

The key summary results are presented in Table 6. Panel A calculates the world average for both the equal-weighted portfolio and the value-weighted portfolio. In both cases, the returns during the summer are lower than during the other months. The coefficient is -0.009 with a  $t$ -statistic of -2.56 for the value-weighted portfolio and -0.008 with a  $t$ -statistic of -2.22 for the equal-weighted portfolio.

In Panel B, we take the coefficients of interest in regression (3) and regress them on the estimated summer turnover effects from regression (1). We find, as expected, that countries with bigger summer turnover dips have lower returns during the summer months. The coefficient is 0.063 with a boot-strap  $t$ -statistic of 2.81 using the value-weighted portfolio and 0.069 with a boot-strap  $t$ -statistic of 2.71 using the equal-weighted portfolio.

Again, for the purposes of interpretation, we run the analogous instrumental-variable regression using a country's distance to the equator as an instrument for a country's summer dip in turnover. The results of this regression are reported in Panel C. For the value-weighted portfolio, each 1% drop in turnover during the summer is associated with an extra 0.102% decrease in monthly returns during the summer. The  $t$ -statistic from this instrumental-variable regression is 2.27. Using the equal-weighted portfolio, the corresponding numbers are 0.068% with a  $t$ -statistic of 1.5. This result enables us to state with some confidence that the summer dip in returns is likely due to a gone fishin' effect.

In Panel D, we compare mean quarterly returns in the summer to those in each of the other three quarters for the value-weighted portfolio. We find that quarterly returns in the summer are indeed the lowest among all the quarters, and this is particularly the case for countries with a summer drop in trading activity of over 5%. Panel E presents our comparable findings for the equal-weighted portfolio.

### *E. Seasonality in Trading Costs*

Finally, we apply our empirical analysis of summer seasonal effects to bid-ask spreads. We calculate the trading cost for each stock  $i$  in quarter  $t$ , denoted by  $TRADINGCOST_{i,t}$ , as the average of the three monthly bid-ask spreads (as a fraction of price) within that quarter. We take the log of it to give us our dependent variable  $LOGTRADINGCOST_{i,t}$ . We then implement the following regression, country by country:

$$LOGTRADINGCOST_{i,t} = c_0 + c_1 * SUMMER_{i,t} + YEARDUMMIES, \quad (4)$$

where SUMMER is a dummy variable that equals one if stock  $i$ 's trading cost observation occurs in the summer and zero otherwise. The coefficient of interest is the one in front of the summer seasonal dummy, which tells us how trading cost differs in the summer as compared to the rest of the year. Again, we report the coefficient in front of SUMMER for each country in Appendix Table A.

The summary results are presented in Table 7. In Panel A, we calculate the (world) average difference in trading cost between summer and the rest of the year from the country-by-country regressions. The world average is 0.034 with a  $t$ -statistic of 1.37. Across all stock markets, trading cost is on average about 3.4% higher during the summer than during the rest of the year.

In Panel B, we look to see whether bid-ask spreads are higher during the summer in countries that experience bigger summer drops in turnover. We regress the coefficient estimates in front of SUMMER from column (4) of Appendix Table A on the coefficient estimates in front of SUMMER from column (1) of Appendix Table A. Again, this regression is likely to give us a downward-biased estimate of this relationship due to classical measurement error. The coefficient from this cross-country regression is -0.206 with a bootstrap  $t$ -statistic of -2.86. We thus find that countries with bigger summer drops in turnover

experience more of an increase in trading cost during the summer. Each 1% drop in turnover during the summer is associated with a 0.2% higher trading cost during that quarter. This is consistent with the idea that the supply of liquidity during the summer drops off more than the demand for liquidity.

Again, for the purposes of interpretation, we run the analogous instrumental-variable regression using a country's distance to the equator as an instrument for that country's summer dip in turnover. The results of this regression are reported in Panel C. The instrumental-variable regression, presented in Panel C, shows that each 1% drop in turnover during the summer is associated with an extra 0.568% increase in bid-ask spreads during the summer. The  $t$ -statistic from the instrumental-variable regression is 2.24. This result enables us to conclude that the summer increase in bid-ask spreads is likely due to a gone fishin' effect.

In Panel D, we calculate the mean bid-ask spread in the summer for countries with a sizeable gone fishin' effect, *i.e.* those with a summer drop in turnover of over 5%. For these countries, the summer increase in bid-ask spreads is a very significant 5.7%. In Panel E, we compare bid-ask spreads in the summer to each of the other three quarters. We find that bid-ask spreads in the summer are indeed the highest among all the quarters, and this is particularly the case for countries with a drop in trading activity of over 5%.

#### **4. A Seasonal Stock Trading Model**

To provide our empirical findings with more solid theoretical underpinnings, we extend a standard stock-trading model with risk-averse market-makers (speculators) and liquidity (noise) traders (see, e.g., DeLong, Shleifer, Summers and Waldmann (1990), Campbell, Grossman and Wang (1993)) to allow for seasonal variations in risk aversion and noise trading intensity. This stylized model is meant to motivate the empirical analyses

presented in this paper and connect them to the existing literature on asset price behavior. It is far too simple, however, to address every angle of our empirical analysis or to predict the observed magnitudes of seasonality effects. Instead, we view the theoretical model developed in this section as a first step toward placing some structure on the empirical analysis, and its deficiencies will guide us on how to enrich the model in future work.

There are infinitely many dates denoted by  $t = 0, 1, 2, \dots, \infty$ . Each period corresponds to a quarter. There is one share of a risky asset (stock) that pays off  $d_t$  at the end of each period. The  $d_t$ 's are independent and normally distributed, with mean zero and variance  $\sigma_{d,t}^2$ , which can vary across quarters in a deterministic and seasonal manner. There also are riskless one-period bonds that pay an interest rate of  $r$  per period. The fundamental value of the risky asset is zero.

There are noise or liquidity traders who buy shares at each date without regard to price. We model their demand at each date as

$$Q_t = aQ_{t-1} + \varepsilon_t \quad (5)$$

where  $a$  is the mean reversion parameter; the  $\varepsilon_t$ 's are independent and normally distributed with mean zero and variance  $\sigma_{\varepsilon,t}^2$ , which also may vary across quarters in a deterministic and seasonal manner; and  $Q_{-1} = 0$ .

The market also contains speculators (market-makers) with CARA utility, *i.e.* each trader maximizes expected utility over his wealth next period:

$$E_t \left[ -e^{-\lambda W_{t+1}} \right] \quad (6)$$

where  $\lambda$  is the risk aversion parameter. The demand for the stock from each of these “smart traders” is given by

$$D_t = \frac{E_t[d_{t+1} + P_{t+1}] - (1+r)P_t}{\lambda V_t} \quad (7)$$

where  $P_t$  is the ex-dividend price of the stock and  $V_t = \text{Var}_t(d_{t+1} + P_{t+1})$ .  $V_t$  is a deterministic function of time given the distributional and preference assumptions. We assume that there are  $n_t$  smart traders at time  $t$  and that this number can vary in a deterministic and seasonal fashion.

The equilibrium price  $P_t$  at any point in time equates supply and demand:

$$n_t D_t = 1 + Q_t. \quad (8)$$

This yields (because of our assumption that  $E_t[d_{t+1}] = 0$ )

$$P_t = \frac{E_t[P_{t+1}] - \gamma_t(1 + Q_t)V_t}{1+r} \quad (9)$$

where  $\gamma_t = \lambda / n_t$  is the aggregate risk aversion of the smart traders.

The share return to holding a stock is given by

$$R_{t+1} = P_{t+1} - (1+r)P_t + d_{t+1}, \quad (10)$$

and the share turnover  $X_t$  is simply the change in the holdings of the speculators, given by

$$\begin{aligned} X_t &= |n_t D_t - n_{t-1} D_{t-1}| \\ &= |Q_t - Q_{t-1}| \\ &= |aQ_{t-1} + \varepsilon_t - Q_{t-1}| \\ &= |(a-1)Q_{t-1} + \varepsilon_t| \end{aligned} \quad (11)$$

We now prove a few propositions that will help us to interpret our earlier empirical findings in Section 3.

*Proposition 1: The expected share turnover in quarter  $t$  is given by*

$$E_t[X_{t+1}] = \exp\left(-\frac{(1-a)^2 Q_{t-1}^2}{2\sigma_{\varepsilon,t+1}^2}\right) \sqrt{\frac{2\sigma_{\varepsilon,t+1}^2}{\pi}} + (a-1)Q_{t-1} \frac{2}{\sqrt{\pi}} \int_0^{\frac{(a-1)Q_{t-1}}{\sqrt{2}\sigma_{\varepsilon,t+1}}} \exp(-\eta^2) d\eta \quad (12)$$

It can be verified that  $\frac{d}{d\sigma_{\varepsilon,t+1}^2} E_t[X_{t+1}] = \frac{1}{\sqrt{2\pi\sigma_{\varepsilon,t+1}^2}} \exp\left(-\frac{(1-a)^2 Q_{t-1}^2}{2\sigma_{\varepsilon,t+1}^2}\right) > 0$ . Hence,

expected turnover increases with  $\sigma_{\varepsilon,t+1}^2$  (the variance of noise trades).

Moreover, it is easy to show that

*Proposition 2: The variance of share return  $V_t$  increases with  $\sigma_{d,t}^2$  (fundamental variance)*

and  $\sigma_{\varepsilon,t+1}^2$  (the variance of noise trades).

Finally, we can obtain a closed-form expression for the expected quarterly return.

*Proposition 3: The expected return over a quarter is simply*

$$E_t[R_{t+1}] = \gamma_t V_t (1 + Q_t). \quad (13)$$

Hence, the mean return in a quarter increases with the variance of returns  $V_t$  and aggregate risk aversion  $\gamma_t$  in that quarter.

Notice from Proposition 1 that the expected share turnover in each quarter is determined by the variance of sentiment shocks (intensity of noise trading). If liquidity traders are gone fishin' and do not trade as much during the summer, then this model supports our first set of empirical findings, namely that expected turnover is lower during the summer than during the rest of the year. Moreover, according to Proposition 2, less noise trading in the summer also implies lower return volatility during the summer as compared to the rest of the year. Hence, we also are able to rationalize our second set of empirical results indicating that return volatility in the summer is lower than during the rest of the year for countries with pronounced summer turnover effects. In addition to the intensity of noise trading, return volatility in this model also depends on fundamental variance. A lower summer fundamental variance also could reconcile the return volatility finding. However,

our previous empirical analysis regarding fundamental volatility indicates that this latter channel is unlikely to explain our findings with respect to return volatility.

Proposition 3 shows that the expected return in this model is proportional to both the risk aversion parameter of the market-makers and the return variance. Accordingly, the model predicts that countries with pronounced summer turnover effects will experience lower expected returns during the summer as compared to the rest of the year, since return variances are lower in the summer for these countries. Note, however, that seasonal variation in the risk aversion parameter can generate seasonality in expected returns independent of variations in return variance.

Finally, we note that this model as it stands is too simple to be able to rationalize our empirical findings with respect to the bid-ask spread. The fact that there is less trading activity during the summer has ambiguous implications for bid-ask spreads. Since there may be both less demand for and less supply of liquidity during the summer, with both investors and market-makers going on vacation, spreads may be either lower or higher during the summer depending on these competing demand/supply effects. However, the model can be extended in a couple of different ways to account for the seasonal variation in bid-ask spreads. One way is to allow for some degree of asymmetric information, as in the models of Glosten and Milgrom (1985) and Admati and Pfleiderer (1988). These models show that bid-ask spreads are higher when the proportion of noise trading to informed trading is lower. Hence, we expect bid-ask spreads to be higher if more noise traders go away during the summer than informed traders. This is not an entirely unreasonable supposition, since retail traders are more likely than professionals to be away from the market for long periods of time.

## 5. Calibration Exercises and Alternative Explanations

We can push this stylized model a bit further by investigating whether it can plausibly generate the observed magnitudes of the seasonal variations in turnover, volatility and return. Toward this end, we consider the following calibration exercise. Let us consider the subset of countries with relatively strong gone fishin' effects, which we previously have defined as countries with summer turnover drops of 5% or greater. In this calibration exercise, we further assume that  $Q_t$  follows a random walk,

$$Q_t = Q_{t-1} + \varepsilon_t$$

Under this assumption, expected turnover each month satisfies

$$EX_t = \sqrt{\frac{2}{\pi}} \sigma_{\varepsilon,t}.$$

We have estimated the monthly turnover for these countries to be 18% lower during the summer. According to our theoretical model as calibrated here, this magnitude of a seasonal turnover effect would imply a percentage difference between summer and non-summer monthly return variances of 18%. As we have previously estimated, the actual percentage difference in monthly return variance is about 9%. Thus, our model predicts too much of a change in return variance relative to the change in turnover.

Another interesting question is the extent to which the documented seasonal variation in return variance alone can explain the lower mean returns during the summer for countries with pronounced seasonal effects in trading volume. Alternatively, how much seasonal variation in risk aversion is needed to reconcile the patterns of expected returns? Recall that the monthly expected return is given by  $E_t R_{t+1} = \gamma_t V_t (1 + Q_t)$ . For the sample of countries with pronounced summer turnover effects, the average monthly return is 0.031 for non-summer months and 0.014 for summer months. Denote the risk aversion parameter in

summer and non-summer by  $c\gamma$  and  $\gamma$ , respectively. Denote the return variances in summer and non-summer by  $bV$  and  $V$ . The regression result on seasonality in return volatility implies that  $b = 1 - 0.089 = 0.911$ . Given the random walk nature of  $Q_t$ , the ratio of non-summer to summer stock returns is

$$\frac{0.031}{0.014} = \frac{\gamma V}{c\gamma bV} = \frac{1}{cb}$$

which implies that

$$c = 0.5 .$$

Thus, according to our theoretical model as calibrated in this section, the observed magnitude of stock return seasonality can be generated by a risk aversion parameter that declines by half in the summer as compared to the rest of the year. In qualitative terms, this supposition is consistent with Kamstra, Kramer and Levi (2003) and Garrett, Kamstra and Kramer (2005), who argue that risk aversion can be significantly lower during the summer than during the fall due to seasonal affective disorder. However, a 50% drop is somewhat implausible, thus suggesting that there are explanatory factors other than seasonal risk aversion.

Along this vein, there are a few other models that we considered as potential theoretical frameworks for understanding the observed seasonal variations in expected return, return variance and turnover. The first is based on the idea that heterogeneous beliefs and short-sales constraints can generate a price premium (see, e.g., Miller (1977), Chen, Hong and Stein (2002), Harrison and Kreps (1978) and Scheinkman and Xiong (2003)). When investors have heterogeneous beliefs and there are short-sales constraints, investors pay prices that exceed their own valuations of future dividends as they anticipate finding buyers willing to pay even more in the future. The price of an asset exceeds its fundamental value as a result of this resale option. In this type of model, the stock price (or the speculative

premium) is the lowest at the beginning of summer, since there is little trading or speculation during the summer as compared to other quarters. As a result, the distinctive implication of this type of model is that expected returns are highest during the summer as compared to the rest of the year, because stock prices are the least over-valued during this period. This prediction therefore would run counter to our empirical findings on stock returns, unless we were to modify the model's assumptions such that investors were not so forward-looking or that the beginning of summer somehow would occur very late into the quarter.

Another possible theoretical rationale draws upon the notion that market-makers do not need as much inventory during the summer, since they recognize that there is not going to be a lot of trading. As a result, they sell off their inventories through the summer and buy them back after the summer. This leads to lower returns during the summer sell-off and a rebound after the summer when market-makers buy back their inventories. Unfortunately, we have not identified a convincing model that relates inventory to trading volume and expected returns. Since our calibration exercise has suggested that variation in risk aversion alone may not be sufficient to explain our empirical findings, however, a model of inventory management may merit further consideration in future work.

## **6. Additional Analyses**

### *A. Seasonality in Valuation Ratios*

Our model predicts that valuation ratios (*i.e.* price-to-fundamental) of stocks should peak at the beginning of summer and bottom out at the end of summer. Measuring fundamentals of stocks is notoriously difficult, and that is why most analyses choose to focus on returns instead of valuation ratios. Nonetheless, Chen and Jindra (2001) find that some valuation ratios estimated from structural models do peak in the summer and bottom out at the end of the summer, though their results are quite sensitive to how the valuation ratios are

estimated. We have replicated some of their work using market-to-book ratios and find similar results. For the most part, prices are highest at the beginning of summer, while book bottoms out either at the beginning or towards the middle of the fall, depending on how it is measured. We interpret these auxiliary results as somewhat consistent with our main findings, but their sensitivity to measurement methods reinforces the usual argument for working with returns instead of valuation ratios.<sup>5</sup>

### *B. Other Measures of Activity and News*

Finally, for the U.S. stock market, we consider other types of Wall Street activity such as the number of initial public offerings (IPOs) and frequency of analyst recommendation revisions per quarter. We find a similar but less pronounced drop in these activities during the summer, consistent with our hypothesis that the drop in turnover is due to Wall Street going on vacation. The summer quarter features about 5.6% fewer IPOs than the rest of the year and 0.5% fewer revisions of analyst recommendations. These results, while statistically and economically less significant than those found in our analysis of trading activity, provide additional evidence that Wall Street is indeed gone fishin' in the summertime. We omit these results for brevity but can provide them on request.

In addition, we attempt to investigate whether the number of company news stories exhibits seasonal variation in the form of a summer drop. We obtain from Chan (2003) data on the days in which there is public news released about a firm. This data has been painstakingly collected by hand using the Dow Jones Interactive Publications Library of past

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<sup>5</sup> Another issue we considered is whether we can test the seasonal stock trading model by looking at changes in prices at the beginning and end of the summer. In reality, trading volume and return volatility is likely to change gradually over a quarter (i.e. trading volume and return volatility should increase as the fall approaches), making event type analysis difficult since there is not a day in which return volatility falls or trading volume rises.

newspapers, periodicals, and newswires. Only those publications with over 500,000 current subscribers, daily publication, and stories available over as much of the 1980-2000 period as possible are used to construct the data. Due to the labor-intensive nature of his data collection, Chan focuses on a random subset of approximately one-quarter of all CRSP stocks. The result is a set of over 4200 stocks, with 766 in existence at the end of January 1980 and over 1500 at the end of December 2000. For each of these companies, Chan compiles all dates on which the stock was mentioned in the headline or lead paragraph of an article contained in the Dow Jones library. The dataset only records if there was any news on a particular day, not the number of stories appearing on that day. We refer the reader to Chan (2003) for more details on his database.

From Chan's database, we create the dependent variable  $NEWSDAYS_{i,t}$ , which represents the number of days within quarter  $t$  that stock  $i$  appears in news headlines. The mean of this variable (averaged across stocks) is 5.76 days, with a standard deviation of 6.75 days. We then implement the same regression as for return volatility, except that we replace return volatility with this new dependent variable. While we do not report the full results for the sake of brevity, we note that the coefficient in front of SUMMER in this regression is -0.082 but is statistically insignificant. Thus, it appears that there is only a slight dip in public news in the summer, an effect most likely not large enough to explain our volatility findings.

## **7. Conclusion**

We investigate seasonality in trading activity and asset prices associated with vacation periods, typically the summer months for many countries. Using data from 51 stock markets, we find strong support for the hypothesis that trading activity falls during the summer because investors are gone fishin'. The summer drop in turnover is stronger for countries farther away from the equator, where vacations tend to occur during the summer,

but is not related to market size. In countries with pronounced summer turnover effects, return volatility and mean returns also are lower during the summer than during the rest of the year, while bid-ask spreads are higher. These relationships manifest themselves even more strongly when we use a country's distance from the equator as an instrument for its summer turnover effect. We extend a standard stock trading model with risk-averse speculators and noise (liquidity) traders and show that seasonal variations in risk aversion and noise trading intensity can qualitatively rationalize some of the above findings. However, much work still remains to be done to support the full array of our empirical findings with theoretical models that can shed light on the relative contributions of various seasonal trading behaviors to the observed seasonalities in asset price behaviors.

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## Appendix

Proof of Propositions: Recursively substituting in for the  $P_t$  's, we have that

$$P_t = -\frac{\gamma_t V_t (1+Q_t)}{1+r} + \frac{E_t(P_{t+1})}{1+r},$$

$$P_{t+1} = -\frac{\gamma_{t+1} V_{t+1} (1+Q_{t+1})}{1+r} + \frac{E_{t+1}(P_{t+2})}{1+r}$$

$$E_t(P_{t+1}) = -\frac{\gamma_{t+1} V_{t+1} E_t(1+Q_{t+1})}{1+r} + \frac{E_t(P_{t+2})}{1+r},$$

and hence

$$P_t = -\frac{\gamma_t V_t (1+Q_t)}{1+r} - \frac{\gamma_{t+1} V_{t+1} E_t(1+Q_{t+1})}{(1+r)^2} + \frac{E_t(P_{t+2})}{(1+r)^2}.$$

Recursive substitution leads to

$$P_t = -\frac{\gamma_t V_t (1+Q_t)}{1+r} - \frac{\gamma_{t+1} V_{t+1} E_t(1+Q_{t+1})}{(1+r)^2} - \frac{\gamma_{t+2} V_{t+2} E_t(1+Q_{t+2})}{(1+r)^3} - \frac{\gamma_{t+3} V_{t+3} E_t(1+Q_{t+3})}{(1+r)^4} + \frac{E_t(P_{t+4})}{(1+r)^4}$$

$$= -\frac{\gamma_t V_t (1+Q_t)}{1+r} - \frac{\gamma_{t+1} V_{t+1} E_t(1+Q_{t+1})}{(1+r)^2} - \frac{\gamma_{t+2} V_{t+2} E_t(1+Q_{t+2})}{(1+r)^3} - \frac{\gamma_{t+3} V_{t+3} E_t(1+Q_{t+3})}{(1+r)^4}$$

$$- \frac{\gamma_{t+4} V_{t+4} E_t(1+Q_{t+4})}{(1+r)^5} - \frac{\gamma_{t+5} V_{t+5} E_t(1+Q_{t+5})}{(1+r)^6} - \frac{\gamma_{t+6} V_{t+6} E_t(1+Q_{t+6})}{(1+r)^7} - \frac{\gamma_{t+7} V_{t+7} E_t(1+Q_{t+7})}{(1+r)^8} + \frac{E_t(P_{t+8})}{(1+r)^8}$$

$$= \dots$$

Or that

$$P_t = -\gamma_t V_t \left[ \frac{1+Q_t}{1+r} + \frac{1+E_t Q_{t+4}}{(1+r)^5} + \dots \right]$$

$$- \gamma_{t+1} V_{t+1} \left[ \frac{1+E_t Q_{t+1}}{(1+r)^2} + \frac{1+E_t Q_{t+5}}{(1+r)^6} + \dots \right]$$

$$- \gamma_{t+2} V_{t+2} \left[ \frac{1+E_t Q_{t+2}}{(1+r)^3} + \frac{1+E_t Q_{t+6}}{(1+r)^7} + \dots \right]$$

$$- \gamma_{t+3} V_{t+3} \left[ \frac{1+E_t Q_{t+3}}{(1+r)^4} + \frac{1+E_t Q_{t+7}}{(1+r)^8} + \dots \right]$$

Let us define share return as:

$$R_{t+1} = P_{t+1} - (1+r)P_t + d_{t+1}.$$

Taking the expectation gives us

$$E_t R_{t+1} = E_t P_{t+1} - (1+r)P_t$$

Since we have that

$$\begin{aligned} P_{t+1} = & -\gamma_{t+1}V_{t+1} \left[ \frac{1+Q_{t+1}}{1+r} + \frac{1+E_{t+1}Q_{t+5}}{(1+r)^5} + \dots \right] \\ & -\gamma_{t+2}V_{t+2} \left[ \frac{1+E_{t+1}Q_{t+2}}{(1+r)^2} + \frac{1+E_{t+1}Q_{t+6}}{(1+r)^6} + \dots \right] \\ & -\gamma_{t+3}V_{t+3} \left[ \frac{1+E_{t+1}Q_{t+3}}{(1+r)^3} + \frac{1+E_{t+1}Q_{t+7}}{(1+r)^7} + \dots \right], \\ & -\gamma_t V_t \left[ \frac{1+E_{t+1}Q_{t+4}}{(1+r)^4} + \frac{1+E_{t+1}Q_{t+8}}{(1+r)^8} + \dots \right] \end{aligned}$$

it follows that

$$\begin{aligned} E_t R_{t+1} &= \gamma_t V_t \left[ (1+Q_t) + \frac{1+E_t Q_{t+4}}{(1+r)^4} + \dots \right] - \gamma_t V_t \left[ \frac{1+E_t Q_{t+4}}{(1+r)^4} + \frac{1+E_t Q_{t+8}}{(1+r)^8} + \dots \right] \\ &= \gamma_t V_t (1+Q_t). \end{aligned}$$

**Table 1: Summary Statistics**

This table presents various summary statistics for each of the 51 countries in our sample along with the (equal-weighted) world averages. Latitude is the latitude angle of a country. Starting date is the start date of the country's sample. No. Firms is the time-series average of the number of stocks in a given month. Market Cap is market capitalization, in billions USD. It is computed using the average of monthly total market capitalization of a country in the year 1999. The average exchange rate between USD and local currency in the year 1999 is used to convert the market capitalization to USD. Median Turnover is the time-series average of the cross-sectional median turnover in a given month. Mean Turnover is the time-series average of the cross-sectional mean turnover in a given month. SD Turnover is the time-series average of the cross-sectional standard deviation of turnover in a given month. Mean Vol is the time-series average of the cross-sectional quarterly stock return volatility calculated annually using quarterly returns. SD Vol is the time-series average of the cross-sectional standard deviation of quarterly stock return volatility calculated annually using quarterly returns. Mean Spread is the time-series average of the cross-sectional mean bid-ask spread as a fraction of stock price in a given month. SD Spread is the time-series average of the cross-sectional standard deviation of spread in a given month. Mean Ret is the time-series average of the cross-sectional mean stock return in a given month. SD Ret is the time-series average of the cross-sectional standard deviation of stock returns in a given month.

Region	Country	Latitude (1)	Starting Date (2)	No. Firms (3)	Market Cap (4)	Median Turnover (5)	Mean Turnover (6)	SD Turnover (7)	Mean Vol (8)	SD Vol (9)	Mean Spread (10)	SD Spread (11)	Mean Ret (12)	SD Ret (13)
Africa	Egypt	27	01/1996	58	10.66	0.013	0.027	0.046	0.179	0.134			0.004	0.114
	Morocco	32	01/1996	18	10.62	0.007	0.009	0.008	0.108	0.051			0.010	0.055
	Nigeria	10	12/1984	24	1.79	0.001	0.002	0.004	0.181	0.181			0.033	0.096
	South Africa	-29	12/1992	65	113.51	0.019	0.024	0.021	0.190	0.105	0.074	0.159	0.015	0.110
	Zimbabwe	-20	12/1975	15	1.17	0.003	0.005	0.006	0.290	0.182	0.048	0.037	0.037	0.161
Asia	China	35	12/1992	183	138.92	0.084	0.141	0.182	0.267	0.170	0.004	0.009	0.019	0.125
	Hong Kong	22.15	01/1973	337	424.02	0.018	0.062	0.206	0.281	0.265	0.034	0.046	0.018	0.159
	India	20	12/1975	62	91.29	0.013	0.048	0.129	0.212	0.123			0.018	0.102
	Indonesia	-5	12/1989	44	23.39	0.024	0.047	0.072	0.353	0.221	0.113	0.135	0.010	0.153
	Japan	36	01/1973	1983	3935.68	0.014	1.652	61.518	0.174	0.167	0.031	0.026	0.010	0.117
	Korea	37	12/1975	78	159.08	0.083	0.129	0.175	0.258	0.160	0.017	0.022	0.017	0.122
	Malaysia	2.3	12/1984	85	70.14	0.018	0.042	0.075	0.250	0.144	0.038	0.051	0.010	0.109
	Pakistan	30	12/1984	39	4.20	0.014	0.056	0.117	0.220	0.133			0.017	0.107
	Philippines	13	12/1984	38	30.96	0.017	0.035	0.051	0.282	0.163	0.141	0.167	0.019	0.140
	Singapore	1.22	01/1973	154	231.96	0.019	1.835	32.209	0.184	0.128	0.057	0.093	0.011	0.094
	Sri Lanka	7	12/1992	44	1.01	0.007	0.014	0.024	0.233	0.167			0.011	0.106
	Taiwan	23.3	12/1984	76	201.82	0.231	0.317	0.305	0.296	0.139			0.016	0.105
Thailand	15	12/1975	30	33.84	0.025	0.053	0.081	0.239	0.152	0.050	0.103	0.014	0.110	
Europe	Czech Rep.	49.45	01/1994	43	9.14	0.004	0.016	0.026	0.241	0.153			-0.002	0.140
	Finland	64	01/1987	124	215.45	0.065	2.471	25.830	0.186	0.169	0.047	0.064	0.016	0.123
	France	46	01/1973	559	1237.21	0.007	3.542	103.761	0.253	2.495	0.049	0.094	0.052	1.278
	Germany	51	01/1973	569	1290.54	0.020	20.321	174.177	0.147	0.280	0.039	0.057	0.009	0.152
	Greece	39	12/1975	24	78.94	0.015	0.023	0.027	0.230	0.117			0.014	0.094
	Hungary	47	12/1992	15	11.86	3.993	6.377	6.670	0.259	0.176	0.171	0.335	0.021	0.123
	Italy	42.5	01/1973	238	585.54	0.028	0.427	5.923	0.189	0.301	0.019	0.032	0.014	0.126
	Netherlands	52.3	01/1973	219	678.33	0.050	0.617	6.474	0.146	0.152	0.029	0.056	0.010	0.108

	Norway	62	01/1973	118	57.97	0.034	0.174	0.901	0.191	0.218	0.057	0.094	0.016	0.136
	Poland	52	12/1992	25	18.90	0.052	0.070	0.058	0.312	0.142	0.084	0.251	0.025	0.126
	Portugal	39.3	01/1986	18	45.01	0.017	0.024	0.026	0.313	0.199	0.078	0.163	0.024	0.107
	Russia	60	01/1996	24	20.29	1.661	4.688	10.238	0.802	0.967	0.622	0.491	0.075	0.297
	Slovakia	48.4	01/1996	16	0.56	0.004	0.032	0.070	0.574	1.121	0.130	0.156	0.058	0.347
	Spain	40	01/1986	128	327.43	0.048	4.059	41.176	0.169	0.180	0.014	0.020	0.018	0.116
	Switzerland	47	01/1973	269	726.41	0.037	0.485	2.874	0.129	0.248	0.038	0.089	0.009	0.111
	Turkey	39	12/1986	39	48.36	0.062	0.129	0.211	0.440	0.232			0.074	0.171
UK	54	01/1965	1772	2734.58	0.042	5.591	219.172	0.194	0.703	0.060	0.075	0.016	0.221	
Middle East	Bahrain	26	01/1999	14	5.14	0.003	0.008	0.013	0.104	0.091			0.001	0.070
	Israel	31.3	01/1997	48	34.06	0.023	0.037	0.050	0.164	0.098			0.008	0.086
	Jordan	31	01/1978	23	4.62	0.009	0.023	0.038	0.124	0.072			0.008	0.072
	Oman	21	01/1999	31	3.15	0.007	0.016	0.027	0.175	0.139			0.004	0.102
	Saudi Arabia	25	12/1997	21	35.46	0.030	0.072	0.108	0.106	0.058			0.008	0.047
North America	Canada	60	01/1973	1712	574.88	0.013	9.265	136.047	0.345	2.188			0.033	0.594
	Mexico	23	12/1975	45	93.16	0.014	0.025	0.034	0.305	0.193	0.051	0.095	0.042	0.142
	United States	38	07/1962	5000	14500.00	0.032	0.060	0.162	0.214	0.187	0.051	0.059	0.013	0.148
Oceania	Australia	-27	01/1973	578	469.91	0.016	16.443	224.136	0.291	1.093	0.087	0.138	0.032	0.352
	New Zealand	-41	01/1986	101	22.34	0.009	0.968	9.553	0.199	0.187	0.056	0.105	0.015	0.154
South America	Argentina	-34	11/1983	25	25.00	0.021	0.048	0.122	0.915	0.491			0.112	0.184
	Brazil	-10	06/1976	53	104.61	0.013	0.055	0.327	0.389	0.293	0.153	0.239	0.135	0.221
	Chile	-30	12/1975	30	42.91	0.003	0.005	0.008	0.261	0.140			0.231	0.999
	Colombia	4	12/1984	21	6.49	0.004	0.009	0.018	0.235	0.133			0.034	0.116
	Peru	-10	12/1992	32	7.69	0.035	0.049	0.053	0.232	0.170			0.019	0.132
	Venezuela	8	12/1984	14	4.55	0.007	0.015	0.021	0.273	0.136			0.038	0.136
World Average		24		300	578.52	0.137	1.581	20.854	0.261	0.320	0.081	0.115	0.029	0.185

**Table 2: Seasonality in Share Turnover**

Panel A takes the regression coefficients in front of SUMMER from column (1) of Appendix Table A and calculates the equal-weighted world average. Panel B takes these same coefficients and regresses them on regional/continent dummies. Panel C takes these same coefficients and calculates the equal-weighted averages for tropical and non-tropical countries. Panel D takes these same coefficients and regresses them on a constant, ABSLAT (the absolute value of the latitude angle of a country) and the market capitalization of each country. This regression is weighted by the number of observations in the country-by-country regressions and is done for all countries, as well as separately for countries in the Northern and Southern Hemispheres. We then re-estimate the country-by-country regressions with an alternative specification that replaces the SUMMER dummy with three quarterly dummies WINTER, SPRING, and FALL. Panel E takes the regression coefficients in front of the three quarterly dummies and calculates the equal-weighted world average and averages for tropical and non-tropical countries. Standard errors of all regressions are robust.

Panel A. World Average

	Summer Turnover Effect	t
World Average	-0.079	-2.38

Panel B. By region

	Summer Turnover Effect	t
Africa	-0.073	-1.26
Asia	-0.034	-0.92
Europe	-0.156	-2.89
Middle East	0.015	0.18
North America	-0.132	-6.11
Oceania	-0.067	-1.31
South America	-0.018	-0.58

Panel C. Summer turnover effect for tropics and non-tropics countries

	Summer Turnover Effect	t
Non-Tropics	-0.118	-4.06
Tropics	0.001	0.04

Panel D. Summer turnover effect by ABSLAT and market capitalization of country

	All Countries (1)	t	Only Northern Hemisphere Countries (2)	t	Only Southern Hemisphere Countries (3)	t
ABSLAT	-0.004	-7.03	-0.003	-5.67	-0.008	-3.88
Market Cap	-8.36E-08	-0.09	6.09E-07	0.53	3.41E-05	0.75
Constant	0.061	2.19	0.031	0.94	0.198	2.68
R-squared	0.45		0.40		0.81	

Panel E. Turnover effect for tropics and non-tropics countries, by quarter

	WINTER	t	SPRING	t	FALL	t
World Average	0.114	4.01	0.083	2.41	0.041	1.51
Non-Tropics	0.156	5.03	0.131	2.81	0.070	1.85
Tropics	0.028	0.53	-0.012	-0.34	-0.017	-0.59

**Table 3: Seasonality in Measures of Vacation Activity**

Panel A reports the country-by-country regressions of the log of the monthly number of passengers traveling by air on a constant and SUMMER, a Summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. The regressions include year dummies. Panel B takes the coefficients in front of SUMMER from Panel A and regresses them on ABSLAT (the absolute value of a country's latitude). Panel C reports the country-by-country regressions of the log of the monthly hotel occupancy rate on a constant and SUMMER, a Summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. The regressions include year dummies. Panel D takes the coefficients in front of SUMMER from Panel C and regresses them on ABSLAT (the absolute value of a country's latitude). The t-statistics for Panel A, B, C and D are robust.

Panel A: Country-by-country air travel seasonality regressions

Region	Country	SUMMER	t	Sample Period	Data Source
Asia	China	0.254	2.53	2003-2005	Air China, China Southern Airline
	Hong Kong	0.201	1.16	2003-2004	Cathay Pacific Airline
	Japan	0.139	2.24	2004	All Nippon Airways
	Malaysia	0.054	1.05	2003-2004	Malaysia Airlines
	Singapore	0.028	0.70	2004	Singapore Airlines
	Thailand	-0.019	-0.40	2004	Thai Airways
Europe	France	0.103	2.85	2004-2005	Air France
	Germany	0.130	4.94	2000-2005	Lufthansa Airline
	Norway	0.139	1.48	2003-2005	Norwegian Airline
	United Kingdom	0.146	5.61	2000-2005	British Airways
North America	United States	0.090	5.56	1990-2004	US Bureau of Transportation Statistics
Oceania	Australia	0.052	1.77	2002-2004	Qantas Airline

Panel B. Regress Summer Air Travel Effect on ABSLAT (the absolute value of a country's latitude)

	Summer Air Travel Effect	t
ABSLAT	0.002	3.10
Constant	0.047	1.41

Panel C: Country-by-country hotel occupancy seasonality regressions

Region	Country	SUMMER	t	Sample Period
Asia	Japan	0.04	1.63	1984-1991
Europe	Finland	0.15	5.92	1984-1994
	France	0.28	3.26	1994
	Germany	0.41	10.13	1986-1994
	Greece	0.68	6.76	1992-1994
	Italy	0.63	12.63	1984-1991
	Netherlands	0.46	6.03	1988-1992
	Norway	0.28	7.36	1984-1994
	Portugal	0.41	8.82	1985-1993
	Spain	0.37	14.77	1984-1994
	Switzerland	0.49	9.71	1984-1994
	Turkey	0.51	11.46	1984-1994
United Kingdom	0.40	9.63	1984-1992	
North America	Mexico	0.03	0.85	1992-1994
	United States	0.11	3.77	1999-2003
Oceania	Australia	0.04	1.68	1990-1994

Panel B. Regress Summer Hotel Occupancy Effect on ABSLAT (the absolute value of a country's latitude)

	Summer Hotel Occupancy Effect	t
ABSLAT	0.005	0.98
Constant	0.116	0.50

**Table 4: Seasonality in Stock Return Volatility**

Panel A takes the regression coefficients in front of SUMMER from column (2) of Appendix Table A and calculates the equal-weighted world average. Panel B takes these same coefficients and regresses them on the coefficients in front of SUMMER from column (1) of Appendix Table A. Panel C re-does the same regression in panel B except that the regression is instrumented by ABSLAT (the absolute value of a country's latitude) and that the regression is weighted by the number of observations in the country-by-country regression. Panel D reports the equal-weighted average of the regression coefficients in front of SUMMER from column (2) of Appendix Table A for countries whose SUMMER coefficients from column (1) of Appendix Table A are less than -0.05. In Panel E, we re-do the same regression as in column (2) of Appendix Table A except that the SUMMER dummy is replaced with quarterly dummies WINTER, SPRING, and FALL. Panel E takes the regression coefficients in front of the three quarterly dummies and calculates the equal-weighted world average and average for countries whose SUMMER coefficients from column (1) of Appendix Table A are less than -0.05. The t-statistics for Panel A, C, D, and E are robust. T-statistics for Panel B are calculated from bootstrap standard errors.

Panel A. World Average

	Summer Vol Effect	t
World Average	-0.029	-1.17

Panel B. Regress Summer Volatility Effect on Summer Turnover Effect

	Summer Vol Effect	t
Summer Turnover Effect	0.456	3.26
Constant	0.007	0.37

Panel C. Regress Summer Volatility Effect on Summer Turnover Effect, Instrumented by ABSLAT and Weighted by the number of observations in the country-by-country regression in column (2) of Appendix Table A

	Summer Vol Effect	t
Summer Turnover Effect	0.276	1.66
Constant	-0.020	-1.11

Panel D. Summer Volatility Effect for countries with Summer Turnover change < -0.05

	Summer Vol Effect	t
Summer Turnover change < -0.05	-0.089	-2.92

Panel E. Volatility Effect, by Quarter

	WINTER	t	SPRING	t	FALL	t
World Average	0.061	2.16	0.007	0.19	0.024	0.64
Summer Turnover change < -0.05	0.130	3.86	0.080	1.87	0.061	1.39

**Table 5: Seasonality in Fundamental Volatility**

This table reports the regressions of the log of the fundamental volatility in a quarter on a constant and quarterly dummies WINTER, SPRING and FALL using US quarterly earnings data from Compustat Industrial Quarterly database. Three measures of fundamentals are used: ROE (quarterly Item 8/Item 59), ROA (Item 8/Item 44), and EPS (Item 7). The sample period is 1962-2003. The standard errors are adjusted for heteroskedasticity and clustered at Fama-French industries.

	WINTER	t	SPRING	t	FALL	t
ROE	-0.122	-7.05	-0.024	-2.01	0.271	9.15
ROA	-0.125	-7.07	-0.017	-1.23	0.260	8.87
EPS	-0.069	-3.38	-0.006	-0.48	0.276	10.27

**Table 6: Seasonality in Market Index Returns**

Panel A takes the regression coefficients in front of SUMMER from column (3) of Appendix Table A and calculates the equal-weighted world averages. Panel B takes these same coefficients and regresses them on the coefficients in front of SUMMER from column (1) of Appendix Table A. Panel C re-does the same regression in panel B except that the regression is instrumented by ABSLAT (the absolute value of a country's latitude) and that the regression is weighted by the number of observations in the country-by-country regression in column (3) of Appendix Table A. Then we re-do the country-by-country regressions except that the monthly index returns are replaced with quarterly index returns, that the SUMMER dummy is replaced with quarterly dummies WINTER, SPRING, and FALL. There is no January dummy. Panel D and E take the regression coefficients in front of the three quarterly dummies and calculates the equal-weighted world average and the average for countries whose SUMMER coefficients from column (1) of Appendix Table A are less than -0.05. T-statistics for Panel A, C, D and E are robust. T-statistics for Panel B are calculated from bootstrap standard errors.

Panel A. World Average of Return Seasonality Coefficients

	Value-Weighted Portfolio SUMMER Effect	t	Equal-Weighted Portfolio SUMMER Effect	t
World Average	-0.009	-2.56	-0.008	-2.22

Panel B. Regress Return Seasonality Coefficients on Summer Turnover Effect

	Value-Weighted Portfolio SUMMER Effect	t	Equal-Weighted Portfolio SUMMER Effect	t
Summer Turnover Effect	0.063	2.81	0.069	2.71
Constant	-0.004	-1.23	-0.002	-0.57

Panel C. Regress Summer Return Effect on Summer Turnover Effect, Instrumented by ABSLAT and weighted by the number of observations in the country-by-country regressions in column (3) of Appendix Table A

	Value-Weighted Portfolio SUMMER Effect	t	Equal-Weighted Portfolio SUMMER Effect	t
Summer Turnover Effect	0.102	2.27	0.068	1.50
Constant	0.000	-0.06	-0.002	-0.35

Panel D. Return Seasonality Coefficients using quarterly returns of Value-Weighted Market Portfolio

	WINTER Coeffs	t	SPRING Coeffs	t	FALL Coeffs	t
World Average	0.021	1.43	0.024	1.81	0.049	2.34
Summer Turnover change < -0.05	0.053	3.68	0.047	3.04	0.065	3.64

Panel E. Return Seasonality Coefficients using quarterly returns of Equal-Weighted Market Portfolio

	WINTER Coeffs	t	SPRING Coeffs	t	FALL Coeffs	t
World Average	0.036	2.38	0.021	1.43	0.042	2.12
Summer Turnover change < -0.05	0.070	3.73	0.047	2.55	0.055	3.16

**Table 7: Seasonality in Bid-Ask Spreads**

Panel A takes the regression coefficients in front of SUMMER from column (4) of Appendix Table A and calculates the equal-weighted world average. Panel B takes these same coefficients and regresses them on the coefficients in front of SUMMER from column (1) of Appendix Table A. Panel C re-does the same regression in panel B except that the regression is instrumented by ABSLAT (the absolute value of a country’s latitude) and that the regression is weighted by the number of observations in the country-by-country regression in column (4) of Appendix Table A. Panel D reports the equal-weighted average of the regression coefficients in front of SUMMER in column (4) of Appendix Table A for countries whose SUMMER coefficients from column (1) of Appendix Table A are less than -0.05. Then we re-do the country-by-country regression except that the SUMMER dummy is replaced with quarterly dummies WINTER, SPRING, and FALL. Panel E takes the regression coefficients in front of the three quarterly dummies and calculates the equal-weighted world average and average for countries whose SUMMER coefficients from column (1) of Appendix Table A are less than -0.05. Standard errors for panels A, C, D, and E are robust. T-statistics for Panel B are calculated from bootstrap standard errors.

Panel A. World Average

	Summer Bid-Ask Spread Effect	t
World Average	0.034	1.37

Panel B. Regress Summer Bid-Ask Spread Effect on Summer Turnover Effect

	Summer Bid-Ask Spread Effect	t
Summer Turnover Effect	-0.206	-2.86
Constant	0.017	0.65

Panel C. Regress Summer Bid-Ask Spread Effect on Summer Turnover Effect, Instrumented by ABSLAT and Weighted by the number of observations in the country-by-country regressions in column (4) of Appendix Table A

	Summer Bid-Ask Spread Effect	t
Summer Turnover Effect	-0.568	-2.24
Constant	-0.042	-1.90

Panel D. Summer Bid-Ask Spread Effect for Countries with Summer Turnover Change < -0.05

	Summer Bid-Ask Spread Effect	t
Summer Turnover change < -0.05	0.057	3.35

Panel E. Bid-Ask Spread Effect, by Quarter

	WINTER	t	SPRING	t	FALL	t
World Average	-0.035	-1.74	-0.030	-1.96	-0.036	-1.69
Summer Turnover change < -0.05	-0.057	-2.56	-0.055	-3.85	-0.053	-1.86

**Appendix Table A: Country-by-country Seasonality Regressions**

Column (1) reports the country-by-country regressions of the log of the average monthly turnover of a stock in a quarter on a constant and SUMMER, a Summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. The regressions include year dummies. Column (2) reports the country-by-country regressions of the log of the quarterly stock return volatility in a quarter on a constant and SUMMER, a Summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. Column (3) reports the country-by-country seasonality regressions of the monthly market index (both equal- and value-weighted, only result from value-weighted index is shown) returns on a constant, SUMMER, a summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. The regressions include a dummy for the month of January and year dummies. Column (4) reports the country-by-country regressions of the log of the average monthly bid-ask spread as a percentage of stock price in a quarter on a constant and SUMMER, a Summer dummy defined as July-September in Northern Hemisphere countries and January-March in Southern Hemisphere countries. The regressions include year dummies. Standard errors of regressions are clustered at the industry level and the t-statistics are robust.

Region	Country	(1) SUMMER	t	(2) SUMMER	t	(3) SUMMER	t	(4) SUMMER	t
Africa	Egypt	-0.154	-3.17	0.010	0.10	0.016	1.04		
	Morocco	-0.248	-5.62	-0.077	-0.71	0.002	0.22		
	Nigeria	0.004	0.07	0.357	4.69	-0.016	-1.98		
	South Africa	-0.066	-3.21	0.098	1.36	0.007	0.58	-0.035	-0.48
	Zimbabwe	0.099	2.59	0.291	2.32	-0.004	-0.27	0.023	0.51
Asia	China	0.092	4.48	-0.078	-1.44	-0.008	-0.20	-0.092	-1.33
	Hong Kong	-0.033	-2.41	0.013	0.64	-0.028	-2.34	-0.013	-1.22
	India	-0.041	-1.32	0.035	0.86	0.001	0.12		
	Indonesia	0.243	5.77	0.091	0.94	0.013	0.65	-0.197	-1.01
	Japan	-0.042	-7.80	0.005	0.40	-0.019	-1.79	-0.005	-0.81
	Korea	-0.184	-12.15	-0.480	-8.18	-0.013	-0.98	0.103	1.69
	Malaysia	0.029	1.62	-0.227	-4.56	-0.027	-1.81	-0.029	-1.72
	Pakistan	-0.138	-3.01	-0.163	-3.29	-0.003	-0.17		
	Philippines	-0.121	-2.16	-0.224	-2.86	-0.039	-2.45	0.083	2.94
	Singapore	0.014	0.57	0.044	0.69	-0.021	-1.92	-0.005	-0.39
	Sri Lanka	0.076	2.07	0.141	0.84	0.001	0.06		
	Taiwan	-0.243	-10.72	-0.015	-0.22	-0.018	-0.89		
	Thailand	-0.090	-2.65	-0.284	-3.23	0.003	0.21	0.080	0.40
Europe	Czech Republic	-0.203	-3.73	0.140	1.56	0.004	0.20		
	Finland	-0.388	-11.70	0.010	0.18	-0.033	-2.54	0.132	9.14
	France	-0.201	-13.19	-0.057	-3.66	-0.033	-3.80	0.057	6.92
	Germany	-0.046	-3.11	-0.070	-3.47	-0.017	-2.66	0.064	9.17
	Greece	-0.076	-4.23	0.203	3.06	0.015	1.03		
	Hungary	0.533	3.81	0.194	1.45	-0.009	-0.41	0.015	0.22
	Italy	-0.240	-14.93	0.043	1.37	-0.027	-2.25	0.082	6.84
	Netherlands	-0.124	-8.02	-0.132	-2.54	-0.031	-3.42	0.085	4.26
	Norway	-0.256	-8.57	0.072	2.19	-0.026	-2.46	0.110	5.78
	Poland	-0.169	-4.37	-0.036	-0.37	-0.024	-0.79	-0.013	-0.28
	Portugal	-0.013	-0.26	0.338	2.59	0.047	1.36	0.130	1.26
	Russia	-0.417	-5.22	-0.456	-4.65	-0.119	-2.71	-0.048	-0.76
	Slovakia	-0.375	-2.41	-0.249	-1.30	0.016	1.04	0.235	1.44
	Spain	-0.253	-13.92	-0.202	-2.07	-0.026	-2.82	0.099	6.49
	Switzerland	-0.106	-7.47	0.053	2.20	-0.037	-4.02	0.072	7.97
Turkey	-0.216	-8.34	0.009	0.16	-0.029	-0.91			
United Kingdom	-0.096	-10.77	-0.053	-2.60	-0.013	-2.26	-0.003	-1.15	
Middle East	Bahrain	-0.134	-4.67	-0.264	-1.32	-0.015	-1.02		
	Israel	-0.196	-6.86	-0.297	-3.64	-0.030	-1.67		
	Jordan	-0.032	-0.74	0.051	0.57	-0.009	-1.35		
	Oman	0.275	4.02	-0.172	-0.96	0.005	0.24		
	Saudi Arabia	0.164	2.10	0.099	0.80	0.002	0.15		
North America	Canada	-0.175	-11.52	-0.064	-2.28	-0.017	-2.29		
	Mexico	-0.131	-3.51	-0.201	-1.42	-0.001	-0.11	0.002	0.03
	United States	-0.090	-15.33	-0.053	-3.33	-0.010	-2.12	-0.004	-1.06
Oceania	Australia	0.000	0.01	-0.047	-1.33	-0.010	-1.39	-0.033	-1.96
	New Zealand	-0.134	-5.86	-0.136	-2.57	-0.003	-0.29	-0.017	-1.05
South America	Argentina	-0.009	-0.25	-0.085	-1.23	0.041	0.56		

	Brazil	0.039	1.83	0.213	3.05	0.052	1.06	0.156	1.75
	Chile	-0.039	-1.20	-0.156	-2.40	0.023	1.28		
	Colombia	-0.114	-1.90	0.068	0.71	-0.015	-1.37		
	Peru	0.093	2.37	0.137	0.94	0.011	0.81		
	Venezuela	-0.077	-2.14	0.068	0.75	-0.001	-0.04		