Country Index Comovement

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ABSTRACT

This paper identifies international trade linkages as important determinants of cross-country stock return dynamics. In addition to positive linkages associated with direct trade between a pair of countries, we document a distinct effect of trade competition. The stock indices of countries that compete more intensely with the US in common export markets have lower correlations with the US stock index. Similar patterns are observed when the European Union is treated as the focal region. The results are robust to controlling for the effects of currency fluctuations. These findings have important implications for international portfolio allocation and risk management.

JEL classification: G11, G12, G15, F14

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I. Introduction

One of the basic tenets of modern portfolio theory is the benefit of diversification. This benefit is enhanced when investors reduce their exposures to country-specific risk by supplementing their domestic portfolio with international assets, particularly those with low correlations. Therefore, understanding the cross-sectional determinants of international stock return correlations is important for investors' asset allocation and risk management decisions.

This study focuses on two related but distinct dimensions of international trade linkages. The first dimension relates to direct trade linkages, e.g., how a country, such as Brazil or Chile, relies on the United States (US) as its export market. The second dimension relates to the competition between a pair of countries that export similar products to a common market, e.g., Germany and Japan both exporting automobiles to the US.

The direct and competition dimensions have different effects on the cross-country stock return dynamics. Countries may trade extensively with each other if they are part of a supply chain according to where they have comparative advantage, in terms of natural resources, labor, capital, or technology. A local shock in a country in this chain should have a direct impact on other interdependent countries. The stock returns of these countries would be highly positively correlated since they share a common source of shock.[1] This direct trade dimension is relatively straightforward to measure, and the direction of the effect seems unambiguously positive, i.e., more direct trade between two countries is associated with a higher correlation between the corresponding countries asset prices.

However, more international trade does not necessarily imply a higher correlation. For example, if the major industries of two countries compete intensely in a common market, a positive production shock in one country would result in lower product prices, harming the competitor country, as highlighted by Krugman, Obstfeld, and Melitz (2015) in their classical international economics textbook. The direction of the competition effect is more ambiguous as countries competing in common export markets may also be affected in the same direction by a common demand shock.

[1] See, for example, Griffin and Stulz (2001), Forbes (2004), and Baele (2005), among others.

As a result, whether the correlation of country stock indices should be higher or lower for two countries that actively participate in international trades would depend on the relative strength of these (positive) direct trade and (negative or positive) trade competition forces. In this paper, we first disentangle these two dimensions of trade linkages, and then empirically measure the direction and magnitude of their effects on equity markets around the world.

We begin the analysis by comparing the slopes of simple regressions of international stock index returns on different lags of US index returns. We document the following basic patterns. First, contemporaneous foreign index returns are strongly positively related to the US index returns, consistent with earlier studies documenting strong index comovements across countries.[2] To reflect asynchronous market trading, we define 'contemporaneous' returns as the next calendar day stock returns of all countries except for (North and South) American countries. Second, the subsequent day's index returns are also predictable in the positive direction for 11 countries (vs. none in the negative direction), out of 40 countries in our sample. Moreover, we observe a substantial variation in the relationship with the US market across countries.

The main focus of our subsequent analyses is to examine whether the two dimensions of trade linkages are related to the variation of cross-country return dynamics. To distinguish the effect of competition from the direct trade dimension, we employ the trade competition measure developed in Glick and Rose (1999), which is intended to capture the extent to which two focal countries compete in other countries, i.e., their shared export markets. We focus on competition between two countries at the product level and then aggregate across products to the country-pair level. The direct trade linkages is measured by each country's export concentration to the US – i.e., how much the country trades with the US as a fraction of its total trades.

Our results indicate that the two dimensions of trade linkages affect the cross-market relations in opposite directions. First, trade competition linkages are associated with lower return correlations. Stock index returns of countries that compete more with the US in common export markets are *less* likely to move with the US index returns. Second, direct trade linkages

[2] See, for example, Hamao, Masulis, and Ng (1990), Lin, Engle, and Ito (1994), and Copeland and Copeland (1998), among others.

are associated with higher return correlations. Stock returns of a country that rely more on the US as its export market are *more* likely to move with US returns.

These relations are observed contemporaneously and with some lags. The negative effect of competition linkages lasts longer, i.e., up to a week. This relatively longer persistence is consistent with the competition channel being more difficult to discern than the direct trade channel. These relatively persistent patterns allow us to form trading strategies using exchange-traded country funds (country ETFs) listed in the US. The resulting strategy generates 8.2 basis points (bps) per day (22% annualized returns), or 6.1 bps per day (15% annualized) after adjusting for transaction costs.

Investors' ability to process the effects of trade linkages is also likely to be diminished when there is more uncertainty in the market. To examine this, we examine whether the delay is more substantial during high volatility periods. We find that the delays in international stock market reactions to the US market are stronger during periods of high volatility in the US stock market.

Since the US is one of the largest economies in the world both in volume and the size of its stock market, our main analysis of the effects of trade linkages is naturally developed from the US perspective. However, the patterns that we document are not likely to be constrained within the US market and economy. Therefore, we perform an additional analysis that considers the European Union (EU) as the focal region. The EU as a block represents about the same share of the global economy as the US. We find a consistent set of results. The index returns of countries that trade more with the EU are more positively predictable by the European stock index returns. Also, the returns of countries that compete more with the EU (outside of the EU market) are more negatively predictable by the European stock returns.

We also document additional evidence that highlights the importance of the competition channel. Instead focusing on the cross-country patterns, we focus on a single country and ask whether the country's stock returns are more negatively affected by positive US industry returns, if they compete more with the US in that industry. Our empirical evidence supports this hypothesis. We find that the correlation of a country's index returns with US industry returns declines with the level of within-industry competition with the US. Out of 40 countries in the sample, we find consistent results for 38 countries, of which 31 are statistically significant.

Lastly, we examine whether US investors account for these two dimensions of trade linkages and their effects on cross-country return correlations in their international portfolio allocation. We find that US investors tend to allocate heavier portfolio weights on countries that compete more intensely with the US, but their allocations do not seem to be related to the direct trade measure. Therefore, our analyses suggest that US investors could improve their risk-return profile by allocating additional portfolio weights onto countries that rely less on the US as their export destination.

This study is related to several streams of research. Much of the recent literature on cross-country return correlations focus on the dynamics of the correlations. For example, Karolyi and Stulz (1996) find the correlations of daily Japanese and US stock market returns increase following large shocks in one of the markets, but not necessarily following macroeconomic announcements. They claim that the increase in comovement is due to the "contagion effect." On the other hand, Forbes and Rigobon (2002) assert that instead of contagion, there is only "inter-dependence." They suggest that asset correlations vary according to the economic fundamentals. In a recent study, Bekaert, Ehrmann, Fratzcher, and Mehl (2014) argue that local factors become more important than global factors during crises as the global market becomes disintegrated. In this paper, we focus on the cross-sectional patterns of the country index dynamics.

This article also contributes to the growing literature that examines the relationship between asset return correlations and international trades. The two dimensions of trade linkages as a determinant of the cross-market dynamics has been studied in multiple contexts. Glick and Rose (1999) study the influence of trade linkages to the foreign exchange market, particularly during periods of currency crises. In this context, the current study is related to Forbes (2004), which examines the effect of trade linkages on international stock return predictability during two currency crises – the Asian and Russian debt crises. She argues that tighter trade linkages, both direct trade and competition, are associated with a positive comovement of stock prices through the terms-of-trade effect. As will be described in detail in the following section, the implications of our framework is different since a country could benefit as its competitors suffer, for example, due to consumers' shifting tastes in the common market.

This paper is also related to studies of information flows across different stock markets and sectors. An empirical study by Rapach, Strauss, and Zhou (2013) investigates the lead-lag effect of country returns at the monthly frequency. They find that the US stock market leads to other markets due to information inefficiency. The current paper is different in at least two aspects. First, we consider the lead-lag effect at the daily frequency. Second, instead of focusing one whether one country leads the other, we study the cross-sectional patterns. We identify the two dimensions of trade linkages that characterize the sign and magnitude of the transmission of the shock.[3]

II. Trade Linkages and Equity Index Comovement

It is commonly perceived that international trade increases cross-country stock market comovement. For example, higher global demand for travel could increase the demand for airplanes, likely leading to higher stock prices among European firms that supply parts to the aircraft manufacturers. Similarly, an innovation in the technology industry in Japan increases the global demand for high technology products, which could subsequently increase the stock prices of the US retailers of these products. Hence, local shocks could positively transmit through the supply chain.

The direction of the transmission is rather ambiguous for two countries if they compete in the same market. Competition could increase the stock comovement among countries if they face a common demand shock. An increase in consumer demand in the US would benefit all countries exporting products to the US. Additionally, Forbes (2004) argue that the effect of terms of trade would also increase comovement. For example, a negative productivity shock

[3]Within the US market, Hong, Torous, and Valkanov (2007) find the predictability of country returns using US industry returns. Cohen and Frazzini (2008) study the lead-lag effect between customer and suppliers, which is akin to the importer-exporter relation in international trade. They argue that the lead-lag relationship is observed due to investors' limited attention to the supply chain linkages.

in one country could lead to a currency depreciation. This is unfavorable for the competing country as they need to reduce the price of their exporting products to remain competitive.

However, countries that compete with a focal country that experiences a negative productivity shock could benefit from the shock, as consumers may switch parts of their supply channel away from the focal country. One recent instance illustrates this potential effect. Following the Tohoku earthquake of Japan in 2011, the costliest natural disaster in the recent history, the South Korean and Taiwanese stock indices gained substantially over the next two months. While the Korean stock market index (KOSPI) increased by more than 12% two months after the earthquake, the Japanese index (TOPIX) decreased by 10.6%. In comparison, the US index return was slightly positive (+2.7%) during that period.

To further illustrate this idea, consider a simple economy with three countries and a single representative consumer. Denote the three countries by Germany (G), Japan (J), and Thailand (T). Assume the economy only consumes cars (with total global consumption C), with Germany and Japan being the only producers. While Germany produces cars entirely within the country, a fraction (ϕ) of the parts that Japan uses for its final assembly are produced in Thailand. Finally, the global production of cars is determined by the relative productivity of the two countries, Japan and Germany, each denoted by α_G and α_J, where $\alpha_G + \alpha_J = 1$.

The global consumption of German and Japanese cars equals $\alpha_G C$ and $\alpha_J C$, respectively. Hence, if stock prices are determined by the total amount of goods produced, the stock prices of these three countries equal:

$$
\begin{aligned}
S_G &= (1 - \alpha_J)C \\
S_J &= (1 - \phi)\alpha_J C \\
S_T &= \phi\alpha_J C
\end{aligned}
\tag{1}
$$

In this economy, the cross-country correlations of the three stock index returns are affected in three ways. First is by the demand shock. A positive global demand shock should equally increase the prices of all three countries regardless of their trade linkages, resulting in positive correlations. In a more sophisticated economy with multiple supply chain, a demand shock will affect countries that export products to the country.

Second is the cash flow effect due to a productivity shock in one of the countries. Such shock should increase the comovement of country stock prices in the same supply chain but decrease the comovement with those in competing supply chains. A positive productivity shock in Japan will increase the demand for Japanese cars and consequently stock prices of both Thailand and Japan, resulting in a positive correlation between these two countries. However, this demand shift would hurt German stock prices, resulting in a negative comovement of stock prices between Germany and Japan.

The third is through the currency channel due to changes in terms of trade. Assuming a positive equity shock in Japan leads to a relative Yen appreciation, as implied by the model of Pavlova and Rigobon (2007), Japan would become less competitive. Its competitor, Germany, can now increase the price of its cars. Hence, all else equal, German and Japanese stock prices should move in the same direction.

This simple model illustrates how the effect of competition on country index comovement depends on the relative strength of the cash flow effect vis-a-vis the currency effect. The empirical findings of the existing literature on this issue are mixed. The finding in Forbes (2004) is supportive of the third channel above, i.e., that competition facilitates the contagion effect. Following the Russian debt crisis and the Asian financial crisis in the late 1990s, countries competing with the focal crisis countries also experienced substantial negative returns in their respective equity markets. On the other hand, Griffin and Stulz (2001) find little evidence of foreign exchange shocks affecting competitive industry returns.

Our analysis is dissimilar from these extant empirical settings in two main dimensions. First, compared to Forbes (2004), we examine a longer and later sample period of 1995-2018, which includes primarily non-crisis periods. Our sample also spans a larger set of countries. Second, our analysis considers mainly equity shocks while the sample period considered in Forbes (the 1990s) is predominantly associated with currency crises. This paper is also different from Griffin and Stulz (2001) since we focus on equity shocks rather than currency shocks.

Our investigation of the significance of the two dimensions of international trade linkages is developed mainly from the US perspective. First, when a country's export activities are more concentrated into the US, we predict that the stock prices would respond more to shocks in the US equity market. Second, we explore the comovement when a country's export overlaps with those of US exports (i.e., when there is high competition with the US). All else equal, we expect that these country's stock prices to have a lower correlation with US stock prices.

III. Data and Estimation

We collect our data from several different sources. The international stock index returns are obtained from the Daily World Indices provided by Wharton Research Data Services. The database contains index returns from 39 countries from 1986 onward. Both developed and emerging economies are well covered in this database. The database covers four indices from Central and South America (Brazil, Mexico, Chile, and Colombia), two indices from Oceania (Australia and New Zealand), 12 indices from Asia (China, Hong Kong, India, Indonesia, Japan, Malaysia, Philippines, Singapore, South Korea, Taiwan, Thailand, and Turkey), two indices from Africa (Egypt and South Africa), and 19 indices from Europe (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, and United Kingdom).

In addition to the data from Daily World Indices, we obtain additional index returns for the Standard and Poor's (S&P) 500 Index (US), Euro Stoxx 600 (EU), the S&P/TSX Composite Index (Canada), and the MICEX stock index (Russia) from their respective exchanges.[4] We employ the US as the focal country for the main analyses, and the EU as the focal region for our supplementary analysis. Also, we notice that among countries in the top 15 in both total gross domestic product and total export, only Russia and Canada are not covered by the Daily World Indices. We remove Hong Kong from the analysis. We exclude Hong Kong because firms

[4]The S&P 500 Index data is available from the CBOE, Euro Stoxx 60 Index from Stoxx Ltd., S&P/TSX Composite Index from S&P, and the MICEX from Moscow Exchange.

listed in the Hong Kong stock exchange have a strong correlation with China's trade activities, probably even stronger than with Hong Kong's own trade activities.

These country-level stock index returns are converted to USD terms, using daily exchange rates compiled by the International Monetary Fund (IMF) from reports provided by each central bank at the end of the day. For currencies not reported on the IMF website, we obtain them directly from the corresponding central bank websites.

1. Trade Competition Measure

We consider two measures of trade linkages. We measure competition between two countries a and b using product-level trade database of the BACI database obtained from the Centre d'Etudes Prospectives et d'Informations Internationales (CDPII). This dataset originally comes from the United Nation (UN) Comtrade provided by the UN statistics division. The dataset covers international import and export for more than 200 countries and 5,000 products between 1994 and 2017, at the 6-digit level of the Harmonized Commodity Description and Coding System (HS). The details of the methodology used to compile and clean the data are provided in Gaulier and Zignago (2010).

Trade competition between a pair of countries is estimated following Glick and Rose (1999). We first measure competition between country a and b at the product level. The competition for product p is defined as

$$C_p(a,b) = \sum_{d \in D^{a,b}} w_p(a,d) \left(1 - \frac{|X_p(a,d) - X_p(b,d)|}{X_p(a,d) + X_p(b,d)} \right), \tag{2}$$

where $D^{a,b}$ is the set of all countries in the world excluding a and b, $X_p(a,d)$ is the export of product p from country a to d, and the weight, $w_p(d) = \frac{X_p(a,d)}{\sum_{d' \in D^a} X_p(a,d')}$, measures country a's export of product p to country d as a proportion of the export of the same product to the entire world.

There are two things to note from this product level competition measure. First, the numerator inside the parentheses, $|X_p(a,d) - X_p(b,d)|$, is negatively related to how countries a

and b compete in market d. If both a and b export an equal dollar value to a third country, country d, the numerator is zero, and there is perfect competition between a and b in country d. The measure in the parenthesis for the third country d is 1. In contrasts, if only one country exports product p to country d, the numerator equals the denominator, and the measure is 0.

Second, this measure is asymmetric, which comes from two potential sources. The first source is the weights $(w_p(a, d))$ that are defined from one countrys perspective. The weights are determined by the relative importance of country d for a only and ignore the importance of country d to b. Therefore, if countries a and d do not trade much each other, competition in d's market would not affect country a's competitive position even when countries b and d trade intensively. The asymmetry would especially be relevant if two countries a and b substantially differ in size. The second source is the potential asymmetry in the UN trade data itself as the database is based on self-reporting by the customs authority of each country.

From the product level, we define the country-level competition between a and b as the weighted average of the product-level competition:

$$\text{Competition}(a, b) = \sum_{\forall p} \frac{X_p(a)}{X(a)} C_p(a, b), \tag{3}$$

where $X_p(a)$ is a's total export of product p and $X(a)$ is the total export of country a of all products. We employ the measure of year t as a potential explanatory variable for stock return dynamics in the following year $t + 1$.

2. Direct Trade Measure

Direct trade measures how one country relies on a second country in international trade and proxies for the economic distance between the two countries. We obtain country level total exports and imports data from the IMF Direction of Trade Statistics (DOTS). The DOTS provides a breakdown of the annual total of merchandise imports and exports by each counterparty country. Using this data, we define direct trade, Direct Trade(a, b) of country a to b as the total export of country a to b divided by the total export of country a to the entire world. That is,

$$\text{Direct Trade}(a, b) = \frac{X(a, b)}{\sum_{d \in D^a} X(a, d)}, \tag{4}$$

where $X(a, b)$ is a's export to b and D_a is the set of all countries in the world excluding country a. We employ the measure calculated in year t as a potential explanatory variable for the cross-country return dynamics in the following year $t + 1$.

We note that our direct trade measure is slightly different from that of Glick and Rose (1999). They define direct trade as the *net* export of country a to b scaled by the average of the import and export between these two countries. The direct trade measure we propose is more suitable in the current context. Two countries that trade extensively may have a very small amount of net export and would be treated similarly to pairs of countries that do not trade with each other. While we do not expect to see strong stock market integration for the latter, the economies of countries that heavily import and export from each other are likely to be quite integrated. Therefore, we expect their stock returns to be more closely linked to each other.

Panel (a) of Figure 1 shows a scatterplot of the time-series averages of the direct trade and competition measures with the US. As can be observed the figure, Canada and Mexico are the two countries that heavily rely on the US for their export market. More than half of their export is shipped to the US. Other countries in America, including Colombia, Chile, and Brazil, also heavily rely on the US. Smaller countries in Europe, such as the Czech Republic, Portugal, or Hungary, rely the least on the US on their export market. For competition, several countries in Asia (Malaysia, Singapore, and Taiwan) and Western Europe (Belgium, Switzerland, and Great Britain) are counties that heavily compete with the US on their export products.[5]

The second observation is that the two trade measures are negatively correlated ($\rho = -0.46$). Countries that heavily rely on the US on their export market are countries that compete less with the US. However, this is largely due to the North American Free Trade Agreement, where Canada, Mexico, and the United States essentially often belong to the same vertical supply

[5]It is worth noting that the top three countries that compete with the US from the US perspective are Germany (0.262), France (0.194), and Great Britain(0.187).

chain. This is reflected in Panel (b) of the same figure. in which we take the rankings of the trade measures and divide the rankings by the total number of countries. The two rankings have a very low negative correlation (-0.08) suggesting that the high negative correlation of the raw measures in Panel (a) is largely driven by the two outliers. The low correlation between the two ranking measures allows us to better capture the two potentially distinct dimensions of trades, and therefore, we use rankings in our analyses to facilitate the inference of the slope estimates in the regression analyses. We use the notation $C(a, b)$ and $DT(a, b)$ to denote country a's ranking of the direct trade and competition measures, respectively, for a the focal country b. The results using the raw measures are qualitatively similar.

We also calculate the competition of two countries at the industry level, by aggregating the product level measures. We do this in two steps. The first step is to match the HS product codes to industry classifications. We follow the classification methodology employed in Pierce and Schott (2012).[6] The matching is initially done using the US import file. For the remaining unmatched HS codes, US export file is used. The files are both matched to the Standard Industry Classifications (SIC) and the North American Industry Classification System (NAICS).

Then, industry level competition is computed by taking the weighted average of the product-level competition measures. Each product-level competition is weighted by the relative proportion of export country a within the industry. That is, if industry I consists of different products (p), industry I's trade competition measure is defined as

$$C_I(a, b) = \sum_{p \in I} \frac{X_p(a)}{X_I(a)} C_p(a, b), \tag{5}$$

where $X_p(a)$ is a's total export of product p and $X_I(a) = \sum_{p \in I} X_p(a)$ is total industry I exports of a.

One may wonder whether the more granular UN Comtrade database can also be aggregated to the country level and used to measure direct trade. As noted by the UN, there are several limitations to this database. The main limitation is that the data is collected from the customs

[6]The data is available at http://faculty.som.yale.edu/peterschott/sub_international.htm.

authority in each country. The UN mentions that the "reported detailed commodity/service data do not necessarily sum up to the total trade value for a given country dataset. Due to confidentiality, countries may not report some of its detailed trade.". However, it also notes that "[f]or merchandise trade, this trade will – however – be included at the higher commodity level in the total trade value", which is how the IMF data is developed. For this reason, we believe that measuring direct trade from the IMF database is more accurate.

IV. Empirical Results

Analyzing international stock returns at the daily frequency requires extra caution. When the US stock market opens on 9:30 AM Eastern Standard Time (EST), the London Stock Exchange is in the middle of its trading hours of the same day (1:30 PM), whereas the market in the Tokyo Stock Exchange is already closed (10:30 PM). When the US stock market closes at 4 PM, most of the stock markets, including those in Australia and New Zealand, are closed. Hence, a shock that occurs during the US trading hours is likely incorporated into stock prices in markets the following trading day at the latest globally.

We take these asynchronous trading hours into account when we study the cross-market stock return dynamics. We refer to the first day the stock market closes after our focal market – i.e., the US market for most of our analyses – closes as 'contemporaneous,' the following trading day as 'one-day predictive,' and so forth. The exception is for markets in the rest of the North and South American continents, where 'contemporaneous' is defined as the same trading day, given the almost complete overlaps in trading hours with the US market. For example, a Monday in the US is contemporaneous with the Monday in the rest of the Americas and the Tuesday in markets of Asia-Pacific, Europe, and Africa. Tuesday for stock markets in the Americas and Wednesday for Asia-Pacific, Europe, and Africa are one-day predictive using US market's Monday returns as the baseline.

In this section, we test our main hypothesis by analyzing whether the two types of trade linkages – direct trade and competition – relates to the comovement of international stock returns. We take the US as the baseline and examine the rest of our sample of major countries and stock markets around the world.

1. Contemporaneous and Short-term Predictive Relations

The literature on cross-market return dynamics suggests that the global equity market is integrated, and stock prices across countries tend to move together. The literature has also observed some predictive relationship at a higher frequency, such as at the daily level, especially if some markets are less efficient, less liquid, or if the flow of information is slower in some markets.[7] In the rest of our discussion, we refer to the combined pattern of contemporaneous movement and short-term predictability of returns as "comovement" and make specific reference to "predictability" when we exclude the contemporaneous pattern.

Before performing our main analysis, we first examine how widespread these comovement patterns are. We do this by examining how international equity index returns correlate with each other both contemporaneously and with short lags. We consider the regression of

$$R_{i,t+k} = \alpha_i + \beta_i R_{US,t} + \epsilon_{i,t+k}, \tag{6}$$

where $R_{i,t+k}$ is the stock return of country i on day $t+k$ denominated in USD. As discussed above, we refer to the regression of $k = 1$ as contemporaneous and $k = 2$ as one-day predictive for all countries except for countries in the Americas, where k is instead 0 and 1 for contemporaneous and one-day predictive, respectively.

Table I summarizes the contemporaneous and short-lag predictive slopes of daily international index returns regressed on US index returns. The slopes and standard errors of the contemporaneous, one-day predictive, two-day predictive, and three to five days (one-week) predictive regressions are provided in the table. As has been previously documented, the con-

[7] See, for example, Karolyi and Stulz (1996), Griffin and Karolyi (1998), Griffin and Stulz (2001) Forbes and Rigobon (2002), among others, that study the comovement and predictability of international stock returns at the daily frequency. See also, Chordia and Swaminathan (2000), Hou and Moskowitz (2005), Hou (2007), among others, that suggest the lead-lag relation among US stock returns can appear due to slow diffusion of information.

temporaneous regressions show that there is a strong positive comovement observed between the US and each country's stock returns. One potential reason for this contemporaneous pattern is a global macro factor shared among different countries. Ferson and Harvey (1993), for example, report that international stock returns are partially predictable using global factors such as the world market index.

In addition to the contemporaneous comovement, some predictability may also be observed.[8] Therefore, we also examine the predictability of index returns using past US stock returns, by reporting the predictive slopes for different horizons in the next three columns: one-day, two-day, and one-week returns, respectively. As anticipated, some indices are predictable by US market returns with a day of lag. For some countries (e.g., Brazil, Chile, China, Colombia, Egypt, India, South Korea and Thailand), the predictability persists up to the weekly horizon.

It is important to note that there is a large variation in both contemporaneous and predictive betas. While the contemporaneous slopes are all positive, at longer horizons such as a week, some stock index returns (e.g., Finland, France, Spain, Sweden, Switzerland, and United Kingdom) are *negatively* predicted by US returns. This paper focuses on this heterogeneous response to US returns, highlighting the role of the cross-country linkages of import, exports, and trade competition.

The averages of each country's measures of trade linkages with the US are reported in the last two columns of Table I. As also shown in Figure 1, the two columns indicate that the two measures are unlikely to be highly correlated, providing a prima facie evidence that these linkages have potentially divergent effects on the heterogeneity of cross-market dynamics.

Two figures provide illustrations of the effects of these trade linkage measures on cross-market dynamics. First,Figure 2 illustrates the relationship between the rankings of the time-series averages of the competition measure and the predictive slopes of different lags. Panel (a), (b), (c), and (d) compares direct trade with the contemporaneous, one-day, two-day, and one-week slopes of the predictive regressions. The sum of the third, fourth, and fifth day leading

[8]There are at least two scenarios in which this may be the case. One is if the US market is relatively more efficient than other markets. Therefore, a global shock that affects all countries may first be reflected in the US stock market before other markets.(e.g., Rapach, Strauss, and Zhou (2013).) The other is if shock itself originates from the US economy.

returns is used as a dependent variable for the one-week slope. Overall, we observe a negative relationship between each country's competition ranking and its contemporaneous, one-day, two-day, and one-week predictive slopes, with a correlation coefficient of -0.34, -0.39, -0.15, and -0.33, respectively. This figure suggests that a higher trade competition is associated with a weaker relationship between the respective equity index returns.

Second, Figure 3 illustrates the relationship between the rankings of the time-series averages of the direct trade measure and the predictive slopes of different lags. We observe the opposite patterns for direct trade. The correlation between the contemporaneous and one-day predictive slopes and direct trade is positive and high $(0.38-0.60)$ in magnitude. However, the difference with the competition measure is that the slopes decrease substantially, to 0.08, for the two-day predictive regression and become close to zero for the weekly return predictions.

We next perform formal statistical analyses of these patterns using different lags of returns. One of our interest is to examine whether direct trade and competition reflect two separate dimensions of trade linkages that have distinct effects on the cross-country equity return dynamics.

2. Main Results

We hypothesize that the cross-country patterns of equity market dynamics is related to how countries are connected in the real market through the trade linkages. To formally test this hypothesis, we implement the two-step estimation procedure of Fama and MacBeth (1973). As a first step, for each country i, we estimate how international equity market changes with contemporaneous and lagged US market returns. That is, we estimate the daily time-series regressions of

$$R_{i,t+k} = \alpha_i + \beta_{i,0} R_{US,t} + \beta_{i,1} R_{US,t-1} + \beta_{i,2} R_{US,t-2} + \beta_{i,3} \sum_{\tau=3}^{5} R_{US,t-\tau} + \epsilon_{i,t+k}, \tag{7}$$

where $k = 1$ for countries outside of the Americas, and $k = 0$ for countries in the Americas. We estimate this regression annually without any overlapping observations. These annual regressions generate four series of annual estimates of $\beta_{i,\cdot}$s for each country i, representing different horizons of US returns' predictive pattern. The second stage regression is the cross-sectional regression of each of these $\beta_{i,\cdot}$s of year y on the lagged direct trade and competition measures of year $y-1$. The regression is given as

$$\hat{\beta}_{i,j,y} = b_{0,j} + b_{1,j}C(i,US)_{y-1} + b_{2,j}DT(i,US)_{y-1} + \mathbf{c}_j'\mathbf{Control}_{i,y-1} + e_{i,j,y}, \tag{8}$$

where **Control** is the vector of country specific control variables and $j = 0, 1, 2, 3$. We report the second-stage regression slope coefficients (b_1, b_2) and the associated Fama-Macbeth t-statistics calculated using Newey and West (1987) adjustment in Table II.

Panel A of Table II shows the results. The Fama-MacBeth coefficients, the Newey-West adjusted t-statistics, and the average of the R^2s of the cross-sectional regression are reported in the panels, for three different specifications. First, we consider only the contemporaneous variable in Equation (7) by letting $\beta_{i,1} = \beta_{i,2} = \beta_{i,3} = 0$ for all countries. The first set of rows of Panel A shows us how the contemporaneous correlations between equity index returns depend on our trade measures. Second, we focus only on the predictive variables in the first-stage regression (i.e., setting $\beta_{i,0} = 0$ in Equation (7)). The second set of rows of the panel summarizes the results of this alternative specification. Finally, the final set of rows of the panel summarizes the results of the full specification in Equation (7).

Three things are worth noting from the first panel of this table. First, the relationship between the international and US index returns is weaker when a country competes more with the US. In contrast, a countrys stock returns move together with the US when the countrys export is more concentrated towards the US. Countries that trade more with the US are likely to have both lower informational and trading frictions leading to higher stock market comovement. Therefore, these two dimensions of trade linkages have opposite roles in cross-country equity return dynamics.

Second, about 35.7% of the cross-sectional difference in the contemporaneous return beta is explained by the two trade measures. Although this number decreases for the one day predictive relationship, 32.3 – 34.9% can be explained by the two trade measures. For one week predictive relationship, they still explain more than 20% of the cross-sectional variation of the betas.

Third, there is some delay in reaction. US market shocks take at least two full days (three calendar days) to be completely transmitted through the direct trade linkage. The transmission through the competition channel takes even longer. A complete transmission of a US shock through the competition channel can take up to a week. The competition channel is potentially more complicated and therefore more difficult to understand, relative to the direct trade channel. Hence it may take more time for the market to understand how a US shock should affect the local market.

One may conjecture that competitors of the US are likely to be countries that are more developed and also comparable to the US in size. It is also possible that their capital markets are more advanced and more subject to their own economic shocks. As a result, the equity returns of these two countries may seem as if they move independently. To test this feasibility, we repeat the analysis after adding Gross Domestic Product (GDP) per capita and the total GDP as control variables that proxies for economic development and size, respectively. Since the relative level economic development should matter, we take the absolute difference of the logarithms of GDP and GDP per capita.

Panels C and D of the table summarize the results of this alternative specification. Even after controlling for GDP per capita and population, we find no difference in the magnitude and significance of our trade linkage variables in explaining the cross-country dynamics of stock index returns. As the marginal R^2s ($\Delta\bar{R}^2$) show, the two control variables explain little of the cross-sectional correlation between US and international stock returns.

3. Costly Information Acquisition

As Rapach, Strauss, and Zhou (2013) argue, one potential reason for the predictability of international stock returns may be related to informational inefficiency. Grossman and Stiglitz (1980) posit that information inefficiency is likely to be related to the cost of information acquisition. In this context, the market may react with a delay as information regarding how a country's shock would affect its trading partners and competitors propagate slowly. If the predictability is coming from information inefficiency, the delay would be more substantial when the trade linkages are more convoluted, i.e., the competition channel, or when the nature of the shock itself is more difficult to decipher, e.g., during highly volatile market condition.[9] In this section, we test whether the predictability becomes stronger when information cost is high.

We proxy the information acquisition cost by the VIX, the option-implied volatility of the S&P 500 Index. We use the VIX to proxy the noise-to-signal ratio in the market. Bloom (2009), among others, shows close similarities between the VIX and multiple measures of economic uncertainty, such as cross-sectional spreads of firm/industry-level and macroeconomic forecasts. Nagel (2012) posits that the VIX is an indicator of the risk compensation for liquidity provision, which is related to information cost.

We adjust the first-stage regression of (7) and let the slope coefficient to depend on VIX to test whether a higher information acquisition cost is associated with more delay in the cross-country return dynamics. The regression considered is

$$\begin{aligned} R_{i,t+k} =& \alpha + \left(\beta_{i,0} + v_{i,0}\frac{VIX_t}{100}\right) R_{US,t} + \left(\beta_{i,1} + v_{i,1}\frac{VIX_{t-1}}{100}\right) R_{US,t-1} \\ &+ \left(\beta_{i,2} + v_{i,2}\frac{VIX_{t-2}}{100}\right) R_{US,t-2} + \left(\beta_{i,3} + v_{i,3}\frac{VIX_{t-3}}{100}\right) \sum_{\tau=3}^{5} R_{US,t-\tau} + \epsilon_{i,t+k} \end{aligned} \quad (9)$$

estimated annually, where $k = 1$ for countries outside of the continent of America and $k = 0$ for countries in America. If the reaction is delayed through the competition (direct trade) channel, we expect to have higher v_i slopes for countries with lower competition (more concentrated direct trade) with the US.

Table III summarizes the Fama-Macbeth regression results for both direct trade and competition. Each row represents a different second-stage regression, and each column represents

[9]The other possibility is when the trade linkages receive only limited attention. Cohen and Frazzini (2008) argue that the cross-firm return predictability due to the supplier-customer channel is a result of investors' limited attention to this network structure. Cohen and Lou (2012) support this argument by showing that stock price movements of firms that engage in only a single business line predict future stock returns of firms engaging in multiple, related businesses. The presence of informed investors is likely to mitigate this issue, as Menzly and Ozbas (2010) document lower magnitude of the cross-industry momentum with higher participation of informed investors. We do not empirically distinguish limited attention from information inefficiency.

the coefficients of different variables used in the second-stage regression. The first two columns show the result for the direct trade and the next two columns for competition. As seen from the second and last columns (v_i) of the table, the cross-sectional differences in the contemporaneous relationship do not vary across different values of VIX.

However, whether a country's stock index returns have a high or a low predictive slope depends on the level of VIX. When VIX is high, the slope of the cross-sectional regression is steeper for both direct trade and competition. For example, when VIX is 10, the predictive slope of countries that relies most on the US as their export market is higher by only 0.05 than countries that rely the least. The difference increases to 3.2 when VIX is 30. Similarly, the predictive slope of the country that competes most with the US is only 0.02 lower than countries that compete the least. This number becomes very negative (−3.8) when VIX is 30.

Moreover, the week-long predictability through the competition channel observed in the previous table depends on the level of VIX. When VIX is high, it takes more than a week for a US shock to be transmitted through the competition channel. The table also confirms that any delay through the direct channel lasts at most two trading (three calendar) days, regardless of the level of VIX. In sum, the empirical evidence in this section indicates that the delay in the stock market reaction is related to the information inefficiency in the market, particularly regarding the competition channel.

4. Currency Effects

In addition to the direct effect of the two trade channels, stock prices of firms that trade internationally may also be affected by the terms-of-trade effect. In this section, we study whether changes in exchange rates may have an effect in explaining the pattern we observe for the cross-country stock index returns relationship.

In order for the cross-country return correlations that we document earlier to be consistent with the terms-of-trade effect, two conditions need to be satisfied. First, for countries that rely more on the US as their export market, their currency returns must be negatively related to US stock returns. Positive US returns must be associated with currency depreciation in these countries so that their stock returns are also positive. Second, for countries that compete more intensely with the US, their currency returns must be positively related to US stock returns. A positive US stock return should coincide with currency appreciation for countries that have competing firms, resulting in the deterioration in their terms of trade and negative stock returns.

To explore the possibility that our main result may result from the terms-of-trade effect, we repeat the analysis after decomposing the stock returns into currency returns relative to the USD and stock returns in local currency. Panel A of Table IV provides the results using currency returns. If the terms-of-trade effect was the main determinant of the cross-section of stock index return correlations, we should expect a lower comovement between US stock returns and the currency returns of countries with a high direct trade measure and a low competition measure. However, the table suggests that the patterns we observe for currency returns are inconsistent with this hypothesis, which indicates that the terms-of-trade does not directly affect the cross-country return correlations.

The dynamics of currency returns presented in Panel A confirms our hypothesis that shocks transmit internationally through the competition and direct trade channels. A positive US price shock can positively affect the economy of its exporters strengthening the fundamentals of these countries. Therefore, the currency values, as well as equity values of these countries, will increase. On the other hand, a positive US shock would negatively affect the firms in competing countries. The corresponding currency depreciation that we observe reflects the deterioration in the economic fundamentals of those countries.

The results in Panel A give raise to a natural question of whether most of the cross-sectional variation of stock index correlations due to international trade that we observe earlier is due to changes in currency values. Panel B shows the results of the analysis of stock returns denominated in local currency. Consistent with our earlier hypothesis, US stock returns are most positively correlated with local-denominated returns of countries that rely more on exports and compete less in the third country.

In sum, the empirical evidence in this section indicates that the observed patterns in earlier sections – the positive relationship of comovement to direct trade and the negative relationship of comovement to competition – are not driven by the terms of trade effect. Moreover, we find that the observed pattern of the USD-denominated returns is facilitated through the currency effect described above.

5. Upstream vs. Downstream Returns

In this section, we examine whether demand and supply shocks affect the comovement in stock returns differently. A technological supply shock in the US should have different effects on stock prices of other countries. A positive supply shock should increase the stock prices of countries within the same supply chain as the US, but decrease the stock prices of countries in competing supply chains. For example, a positive productivity shock in the US aircraft industry will increase the stock prices of Japanese firms that produce parts to be used by US aircraft manufacturers, but decrease the stock prices of European firms operating in a competing supply chain. This leads to a negative comovement of stock prices of two competing countries, but a positive comovement among countries in the same supply chain. In contrast, a US demand shock is likely to propagate only through the direct trade channel, i.e., suppliers producing and exporting goods to the US. A demand shock should have at most a small indirect effect to competitors that are located in a different supply chain.

Therefore, we test whether the cross-sectional relationship between comovement and our trade measures are relatively stronger for supply shocks. To facilitate this test, we construct upstream and downstream returns using US stock returns as described in Section III. Downstream firms correspond to firms lower in the supply chain that produces goods consumed by end customers, whereas upstream firms are higher in the supply chain; they process raw materials and supply parts and materials used for further processing by other firms in the supply chain. If supply shocks are transmitted through the trade channel, these upstream firms would have a stronger comovement with countries that trade more with the US. In contrast, countries that are highly competing with the US should move less with the stock prices of US upstream firms since a positive shock to these upstream firms would hurt the competitiveness of firms operating in competing supply chains.

We first sort industries by their vertical position in the supply chain (Antràs, Chor, Fally, and Hillberry 2012) and assign firms based on the industries they operate into three groups: upstream, midstream, and downstream firms. The details of construction of this measure are provided in the Appendix. We then repeat the main analysis after replacing the US returns with the returns of upstream, middle, and downstream industry portfolios, respectively, in excess of the US market returns, in the first-stage regression. Table V summarizes the results of the second-stage Fama-Macbeth regressions. Panel A reports the results of the coefficient that corresponds to competition, whereas Panel B shows those of direct trade. Each column of the panels uses a different portfolio of industry returns as an explanatory variable in the first-stage regression.

The results are consistent with the cross-sectional relationship we observe being driven by US supply shocks. A positive relationship is observed between direct trade and international stock comovement for US upstream excess returns, consistent with US supply shocks being propagated through the supply chain. We find the opposite patterns for downstream returns. For the trade competition measure, we see the opposite relationship. Positive excess returns of US upstream industries are associated with a negative index returns for countries that compete with the US, consistent with US supply shocks negatively affecting competing supply chains. We also find consistent evidence by employing the returns of a long-short (upstream minus downstream) portfolio in the last column to test the statistical difference between the effects of upstream and downstream returns.

6. Direct Trade and Competition with the European Union

There are two limitations in generalizing our framework and applying the concepts to other countries. First, no other economy is as prominent as the US in terms of both economic importance and the amount of trade. The US is among the largest economies in the world in terms of imports, exports, and GDP; it also has the world's largest equity market.[10] Therefore,

[10]As of August 2018, the market capitalization of the US as a proportion of the World is 40%. The proportion of the market capitalization of countries in the EU is about 21%. The largest among EU countries is the UK with, approximately, 4.5%. (Bloomberg)

it is difficult to imagine that any other stock market in the world would have a similar cross-market influence as the US stock market. Several empirical studies confirm that the cross-market return predictability is uni-directional. For example, Hamao, Masulis, and Ng (1990) find that among London, New York, and Tokyo stock exchanges, there are price volatility spillovers observed in the direction from New York to London to Tokyo, but not in the opposite direction. Rapach, Strauss, and Zhou (2013) confirm this pattern using monthly index returns. They find evidence consistent with the US returns leading other markets' stock returns, but no evidence that non-US returns predict US stock returns.

Second, as evidenced by the NAFTA for the US, an economic union can bias the result if the trade-return relationship is non-linear. A country that substantially relies on a single country for its international trades may bias the results of the analysis. Therefore, instead of focusing on a different individual country for our external validity analysis, we consider the entire European Union (EU) as if it is a single country. As a block, the EU is next to the US in terms of imports and exports, and its combined equity markets are about half of the size of the US. It seems sufficiently large to influence other countries' economies. In this part of the paper, we test whether the two dimensions of trade linkages – direct trade and competition – with the EU block influence the cross-market correlations of stock returns between EU countries and the rest of the world.

The analysis is implemented by first computing the share of export to the EU area as a fraction of the total export of each country at a given year. The competition measure with the EU is also recalculated, after dropping all trade linkages within the EU from the calculation. Finally, we use the Euro Stoxx 600 Index as a representative equity index of the EU area. The Euro Stoxx 600 Index consists of 600 largest and most liquid stocks in the Eurozone; it consists of stocks from European countries including United Kingdom, Germany, Netherlands, France, Belgium, Spain, Ireland, Italy, and Finland.

We repeat the analysis of our main amalysis in Table II using the EU area as a focal region. Table VI summarizes the results of the annual Fama-Macbeth regressions. In Panel A, we simply replace US returns of Equation (7) with EU returns (R_{EU}) in the first-stage regression. The regression is

$$R_{i,t+k} = \alpha + \beta_{i,0} R_{EU,t} + \beta_{i,1} R_{EU,t-1} + \beta_{i,2} R_{EU,t-2} + \beta_{i,3} \sum_{\tau=3}^{5} R_{EU,t-\tau} + \epsilon_{i,t+k}, \tag{10}$$

where $k = 1$ for countries in the Asia-Pacific region, and $k = 0$ for all other countries.

The second-stage regression consists of annual cross-sectional regressions of these EU betas on both competition and direct trade measures calculated with respect to the EU. We add competition and direct trade with the US as control variables in the second stage regression. The choice for adding these control variables is natural. The positive return predictability may come from a global factor that affects the stock returns of all countries (e.g., Ferson and Harvey (1993)). The market returns of the US may be closely related to the global factor, the EU returns may also be closely related to the global factor, and countries that trade more with the US may also trade more with the EU. At the same time, countries that compete more with the US may also do so with the EU.

The average of these coefficients and the t-statistics calculated using Newey and West (1987) adjustment are reported in Table VI. The results of Panel A are generally consistent with the US-based results in Table II. Countries whose export destinations are more concentrated towards the EU exhibit stronger comovements with the European stock index. The contemporaneous relation is statistically significant, regardless of whether we include lagged terms. Country index returns are also predictive up to the next trading day if a high proportion of their export goes to the EU.

Moreover, we also observe statistically significant negative estimates in the competition channel. The stock returns of countries that compete more with the EU tend to move in the opposite direction to the EU index returns. The EU index returns also predict next-day country index returns negatively if the country competes intensively with EU countries in other markets.

Panel B shows results for several alternative specifications. The first column shows the results for the raw trade measures. The results are largely consistent with Panel A. The second column controls for US returns in the first stage regression. This is to test whether the findings of the results in this table is representation of our earlier results, if one assumes that EU returns are highly correlated with US returns. The last columns of Panel B repeats the exercise of Table IV using EU as the focal country. This finding again confirms the hypothesis that this is, at least, not entirely driven by the currency effect.

In conclusion, the empirical patterns documented in Table VI provide another set of supporting evidence that the two dimensions of trade linkages are key channels determining the cross-country return dynamics.

7. Within-Country Analysis of Industry Competition

Overall, the results of cross-sectional regressions confirm the importance of trade linkages as a determinant of international stock return dynamics. However, one may question whether the two trade linkages merely reflect some other macroeconomic variables such as the relative levels of development or the variation in the sizes of the economies. To verify the importance of the trade channel, the remainder of this section focuses on examining the within country variation in the correlations between country equity returns and various US industry returns.

This analysis provides a conceptually independent setting to perform a more granular analysis of the trade competition dimension. We focus on the within-country variation in competition intensity with the US, i.e., how the country competes with different industries of the US. As a result, the analysis in this subsection provides empirical evidence that is distinct from our previous tests that are based on the country-wide trade competition with the US. In particular, this within-country focus mitigates the concern that our cross-country analyses merely capture the heterogeneity across countries, e.g., developed vs. developing countries.

To operationalize this test, for each country, we first sort US industries by their degree of trade competition with the country. Then, we examine how the extent of competition explains the correlation of those US industry returns and the country's index returns. If we posit competition as a key component of cross-country return dynamics, we expect to observe an analog of the cross-country return patterns at the *industry level* within each country. In particular, we expect that the equity index returns of a particular country have a lower correlation with the returns of a specific US industry if the country competes more with the US in that industry.

This analysis involves four procedures. First, we develop a measure of industry competition to allow for cross-industry comparison as described in the previous section. In particular, the industry-level trade competition measure is the weighted average of the focal country's product-level competition with the US. For illustration, consider a focal country whose total export in the auto parts industry consists of 40% in engines and 60% in tires. Therefore, the country's auto parts industry competition measure with the US is the weighted average of the two product competition measures with the US, weighted 40%:60%. After obtaining the industry-level competition measure with the US for each country-industry pair, we standardize the measure by subtracting the cross-country average of the industry and dividing by the corresponding standard deviation.

Second, we classify industries into five groups within each country using this measure.[11] The first group contains all industries whose competition measure with the US is zero, i.e., industries for which the country exporters share no export destination with the US. This also includes industries for which neither the US nor the focal country exports any products classified into the industry. The remaining industries with non-zero level of competition with the US are further classified into four groups based on whether the standardized industry competition measure is smaller than -1 (i.e., more than one standard deviation below the cross-country industry average), between -1 and 0, between 0 and 1, and greater than 1.

Third, we calculate the value-weighted average returns of US stocks whose industries belong to each industry group. It is important to note that as the industry grouping is country specific, and therefore these industry group returns would be different across countries even though we use only US stocks to calculate them.[12]

[11]The results are robust to the number of groups used for this classification.

[12]The US stock returns are obtained from the Center for Research in Security Prices (CRSP); our sample includes all common stocks listed in AMEX/NASDAQ/NYSE and we remove any penny stocks.

Finally, we regress the focal country's stock index returns on each of these US-based group returns to generate group-specific contemporaneous and one-day predictive betas. The specific regression we run is:

$$R_{i,t+k} = \beta_{0,j} + \beta_{1,j} R_{j,t} + \beta_{2,j} R_{j,t-1} + \beta_{3,j} \sum_{\tau=3}^{5} R_{j,t-\tau} + \epsilon_{i,j,t+k}, \tag{11}$$

where $R_{j,t}$ is the US industry returns of group j, $j \in \{1, 2, 3, 4, 5\}$, $R_{i,t+k}$ is country i's equity index return on day $t + k$, $k = 1$ for countries that are not in the Americas, and $k = 0$ for countries in the Americas. We perform this time-series regression for each group j and obtain three time-series of slope estimates of β_j, one for each return horizon. We then test whether the β_j estimates are decreasing in j. A decreasing pattern means that the returns of US industries in which the focal country competes less with the US (i.e., low j industries) is more correlated with the country's index returns, relative to industries in which the country competes more with the US (i.e., high j industries). We perform the formal statistical test using cross-sectional regressions, testing the significance of the relation between $\beta_{2,j}$ estimates and group numbers (j). We repeat this test for each country in our sample.

Table VII reports the results of the cross-sectional tests. Each row shows the coefficient estimates from the Fama-MacBeth regression for each country and the t-statistics calculated using Newey-West adjustment. The left-hand side of the table reports the results using the SIC 2-digit classifications. For both the contemporaneous and one-day predictive regressions, the slopes of the time-series regressions are typically negatively related to the degree of industry trade competition. For contemporaneous returns, only 2 (2.5%) out of 40 countries exhibit positive slopes, and none of them is statistically significant. In contrast, 38 countries display a negative correlation between the first-stage slopes and industry trade competition measures, with about three-fourth of them being statistically significant.

At the bottom of the table, we report the cross-country average of all country-specific coefficients and report the standard t-statistics of those coefficients. The average of the country-level slopes of the second-stage regressions is negative and highly statistically significant.

We also perform a Binomial test on whether there is an equal number of "+" and "−". Under the null hypothesis, where variations in trade competition linkages do not affect cross-market asset return dynamics, we expect to see an equal number of positives and negatives. We report the p-values of the Binomial Exact Test in the last row. Not surprisingly, this test also indicates a statistically significant negative relation between trade competition measures and the return regression slopes.

We observe similar patterns for one-day predictive regressions. This is quite surprising since, unlike the contemporaneous estimates, the estimates in the second column are purely predictive in that the country index returns are mostly two-day ahead returns relative to the US industry returns. Only 10 out of 40 countries display positive relation, and none of them is statistically significant. On the other hand, we observe 30 negative estimates, with 11 of them being statistically significant. This one-day predictive result is consistent with our earlier result of the information delay through the trade competition channel in the cross-country framework. However, in the within-country context, the delay associated with the competition channel essentially disappears within a week.

The right hand side of the table reports the results using the NAICS 3-digit classifications. Overall, the results are comparable, albeit slightly weaker, for the contemporaneous regressions. On average, the contemporaneous relation is still significantly negatively related to competition, and the sign test also shows statistical significance. The one-day predictive relations continue to be negative and highly statistically significant for both cross-country averages and the Binomial Exact Test. Only nine (22.5%) out of 40 slopes are positive, and one is statistically significant. On the other hand, the slopes are negative and statistically significant for a total of seven countries.

Overall, these results provide a confirmatory evidence that that the competition dimension of the trade linkages is an important channel of information transmission. We also find that the effect happens with a delay, consistent with our earlier result that the stock market reaction to competition shock is not immediate.

V. Implications

1. Trading Strategy of the Lead-lag Effect

The empirical analysis of this paper suggests that the two dimensions of international trade linkages direct trade and competition are linked to the international stock return dynamics. In this section, we focus on the economic significance of these relations and study whether a profitable trading strategy is implementable that resembles the empirical analysis of earlier sections.

We deviate from our main analysis by two dimensions. First, we do not employ index returns directly in this analysis as doing so would involve substantial trading cost, e.g., frequent trading of all stocks that are in the index. Instead of forming trading strategies from index returns, we use the returns of country ETFs. Second, we focus on the lead-lag relationship instead of the contemporaneous relationship.

There are several benefits of using ETFs. First, as mentioned, using country ETFs reduce trading costs. ETFs are generally more liquid than most individual stocks. Second, Using ETFs does not involve foreign exchange transactions. Our investment universe includes only ETFs that are listed on the US exchange, each denominated in USD. Finally, there is no crossing in time zones. Trades can be made as soon as new information becomes available.

One potential drawback of using only ETFs is that most ETFs began trading in more recent years, with most of them starting from this century. Moreover, trading volumes are especially lower in the earlier periods of the sample, and the tracking errors may have been higher. Yet another potential drawback is that the price of an ETF may divert from its fundamental, net asset value. If the price pressure is related to US fundamentals, the price of a country's ETF may not correctly reflect the value of its corresponding foreign index (Ben-david, Franzoni, and Moussawi 2018, Brown, Davies, and Ringgenberg 2018). Nevertheless, these drawbacks are likely to introduce an attenuation bias in the analyses we perform below.

With these caveats in mind, we first identify 37 different ETFs that track the country indices. If we find multiple ETFs that track a specific country's aggregate index, we choose the one with the longest trading history. We cannot identify an ETF for the Czech Republic and Hungary and have to drop the only ETF that tracks the Danish stock market from the sample since its average bid-ask spread is substantially higher (2.95%) than other ETFs in our sample. The information on these ETFs are summarized in Table VIII. The table reports the ticker, the first year the ETF is listed, the issuer and the brand, and the average bid-ask spread since 2003. Among the matched ETFs, 29 of them are from iShares by Blackrock, four from Global X, three from VanEck, and one from Wisdomtree. Most are traded on the New York Stock Exchange (NYSE), and the average bid-ask spread is 22.2 bp.

We start the analysis in 2003 to ensure that enough international stock ETFs are traded with reasonable liquidity. 20 ETFs are being traded as of January 2003. We implement the following trading strategy. Every year we calculate each country's direct trade and competition with the US according to our earlier definitions. Country ETFs are then sorted into quintile portfolios based on these trade measures. We then calculate the excess return of each equally weighted portfolios, relative to the US stock returns proxied by the ETF "SPY" for the following trading day.

Table IX summarizes the performance of a conditional trading strategy, in which the entire sample period into two subperiods based on the sign of the US returns. The '+ Ret' denotes days of which the day S&P Index returns is positive until 10 minutes before the close, whereas '− Ret indicates the remaining days when this return is negative. We evaluate the following day's returns in each subperiod. Panel A shows the results when portfolios are formed by direct trade, and Panel B reports the results for competition with the US.

Portfolios in Panel A report portfolios formed using the trade competition measure, and in Panel B portfolios are formed by sorting the countries on their direct trade measure. The results suggest that our earlier results can be applied to country ETFs. Countries that compete more with the US tend to move in the opposite direction to the US returns the following day whereas the opposite is observed for direct trade. In terms of economic magnitude, the trading strategy based on competition generates as much as 8.6 bp per day (or 22% annualized). The strategy based on direct trade yields, on average, 4.9 bp per day (or 12% annualized). The relatively strong performance of the competition-sorted portfolios is consistent with our earlier observation that the information transmission takes longer through the competition channel.[13][14]

While the returns reported in Panels A and B are highly economically significant, the trading strategies may still not be profitable due to the high trading cost. Therefore, we consider the profitability of the following alternative trading strategy that deviates from the main strategy in two dimensions. First, we reduce the number of portfolio rebalancing days into about one fourth (23%) by only switching the position when the absolute US returns are greater than 0.50%. The average holding period of this long-short portfolio is four trading days. Second, we drop all ETFs that has a bid-ask spread of higher than 30 bp during the previous month. The daily average bid-ask spread of these ETFs is 9.2 bp. We estimate the daily average trading cost to be 2.1bp (9.2 $\times$ 23%).

Panel C and D show the performance of the trading strategies. Panel C provides the results for direct trade, whereas Panel D shows those of the competition measure. The high minus low portfolio of the direct trade sorted portfolios generates 7.2 bp following positive US returns, but -6.4 bp following negative US returns. After adjusting for the bid-ask spread, the strategy generates an average return of 4.7 bp (12% annalized). The competition-based long-short portfolios show greater performance. They are -9.1bp following positive returns and $+7.2$ bp following negative returns. After adjusting for the bid-ask spread, the strategy generates an average return of 6.1 bp (15% annalized).

[13]One limitation with forming a trading strategy using country ETFs is the limited number of assets considered. This reduces our flexibility in performing bivariate sort to control for the negative correlation between the direct trade and competition measures. In unreported analysis, we sort countries on one measure (e.g., direct trade) after controlling for the other (e.g., competition) measure. We first form three groups based on the rankings of the control variable, and then form quintile portfolios by the main sorting variable. We then take the average of each quantile portfolio across all three groups. While the signs are consistent with our reported results, we find that the direct trade sorted portfolios become statistically insignificant. The performance of the competition measure sorted portfolios remains statistically significant.

[14] Also, the empirical analysis of Section IV suggests that upstream returns of the US propagate internationally though the competition channel. Therefore, we expect stronger results if the trading strategy is based on the US upstream returns than when it is based on the downstream returns. In untabulated analyses, we find a marginally higher return spread following both '+' and '−' returns when the classification is based on US upstream returns, relative to US downstream results.

In sum, this section displays the economic significance of both the direct trade and competition channel of trade linkages. We find shocks that transmitted through these two channels are partly delayed. These channels and the corresponding delays are economically significant since forming trading strategies generates profits of at least 12% in annualized returns.

2. Portfolio Allocation

An important implication of our findings is that investors should allocate their portfolios in relation to how the market of each particular country correlates to the investors' domestic market. In our final test, we ask whether US investors allocate their assets in a manner that is consistent with the patterns that we document: allocate more of their assets towards countries competing more with the US, and less towards countries that rely more on the US as the export market. To empirically test this hypothesis, we employ the international portfolio holdings data of US residents from the Treasury International Capital System (Table 2.b.), as obtained from the US Treasury website.

To allow for an effective comparison across countries, we first calculate the aggregate weight of US investors' portfolio holdings of a particular country as well as the proportion of market capitalization of that country, as calculated using data from the World Federation of Exchanges database. We define the relative equity holdings of US investors in a particular country as the ratio of the proportion of the aggregate US residents' international portfolio holdings invested into that country to the proportion of the country's stock market capitalization (of total non-US stock market capitalization).

Figure 4 depicts the cross-sectional relationships of this ratio with the two dimensions of trade linkages. The first figure displays the pattern of the competition measures and excess allocations, and the second figure displays the pattern of the direct trade measures and excess allocations. We find that US investors tend to allocate heavier portfolio weights on countries that compete more intensely with the US, but they do not underweight countries that rely more on the US as an export market. These results suggest that US investors could improve their portfolio allocations by allocating additional portfolio weights onto countries that rely less on the US as their export destination.

VI. Conclusion

This paper identifies two distinct dimensions of trade linkages: (1) direct trade between two countries and (2) trade competition between two countries in their common markets. We examine the effects of these trade linkages on international equity return dynamics across markets. We find that these two trade dimensions have opposite implications for equity market comovements. The stock returns of countries for whom the US is a more dominant trade destination tend to move in the same direction as the US index returns. In contrast, equity markets of countries that compete more with the US tend to move in the opposite direction to the US market. We find both statistical and economic significance of these distinct relations.

We also find supporting evidence using the following approaches: (1) replacing the US with the European Union as the reference market, (2) identifying potential market conditions that induce longer delays in comovement, (3) within-country analysis of the negative effect of industry-level trade competition on stock return comovement.

Ultimately, the conflicting effects of direct trade and trade competition dimensions of trade linkages indicate that the increasingly integrated global trade network may not necessarily lead to increasingly high correlation among cross-market asset returns. Similarly, the specter of trade wars and its potentially damaging effects on global trade do not necessarily herald lower equity market comovements. Understanding how these correlations vary with the shape of the global trade network is crucial for investors seeking diversification in foreign equity markets.

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A. Determining the Vertical Position of Industries

We use the Input-Output table of the Bureau of Economic Analysis (BEA) to quantify the vertical position of industries.

The BEA produces supply and use tables separately. Supply tables show the goods and services produced by each industry, while use tables show who uses these goods and services. The supply and use tables can be combined to produce a matrix of the flows of commodities to the final customer. We follow Antràs, Chor, Fally, and Hillberry (2012) to construct a measure of vertical position for each industry. The supply table ($M \times N$ matrix) shows how N different goods and services produced in each of the M industries. The use table ($N \times M + 1$ matrix) contains how these M industries, in addition to the end customer, use the N different produced products. To calculate the proportion of products produced in one industry that flows into another, we can combine the supply and use tables. The steps are detailed, e.g., in Ahern and Harford (2014).

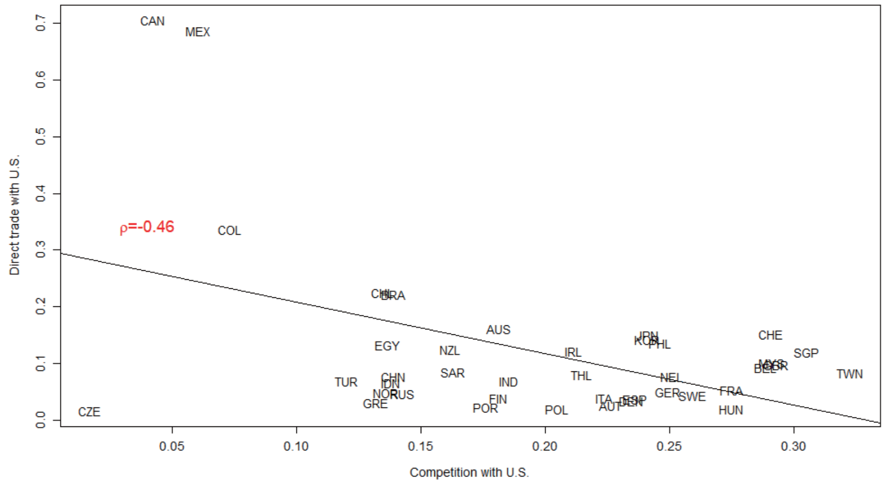
The first step is to normalize these two matrices by dividing each element by its row mean such that each row has a sum of one. The next step is to multiply the normalized supply table (S) by the use table (U) to generate a M by $M + 1$ matrix. The last column of this matrix contains information about the proportion of industry output that is consumed by the end customer. If this proportion is high, the industry is more likely to be a downstream industry. If this is low, the industry is more likely to be an upstream industry.

The vertical position (VP) is defined as in Antràs, Chor, Fally, and Hillberry (2012). That is,

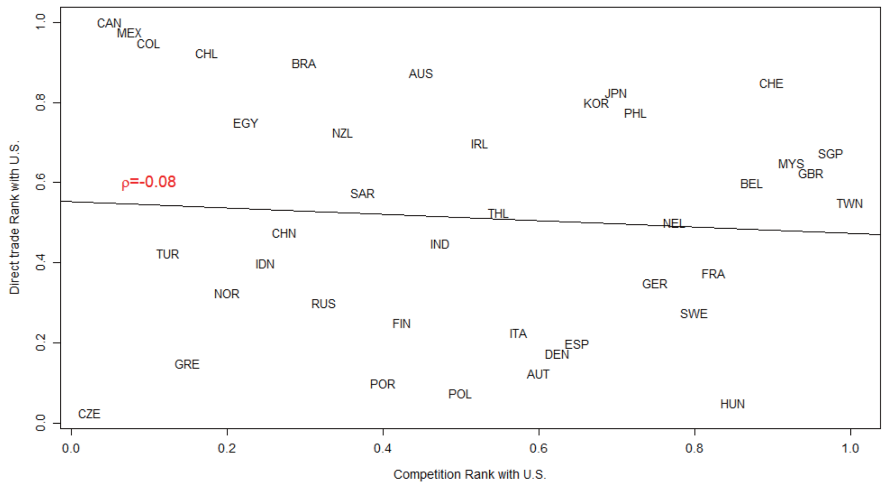
$$VP_{M\times1} = (I_{M\times M} - S_{M\times N} \times U_{N\times M})^{-1} 1_{M\times1}, \tag{12}$$

where $I_{M\times M}$ is a M-dimensional identity matrix and $1_{M\times1}$ is a vector of ones. Note that the last column of the user matrix is removed from the computation but is redundant after the normalization. The M-vector VP is the vertical position of each industry. If this is high the industry is more likely to be downstream and vice versa.

B. Figures and Tables



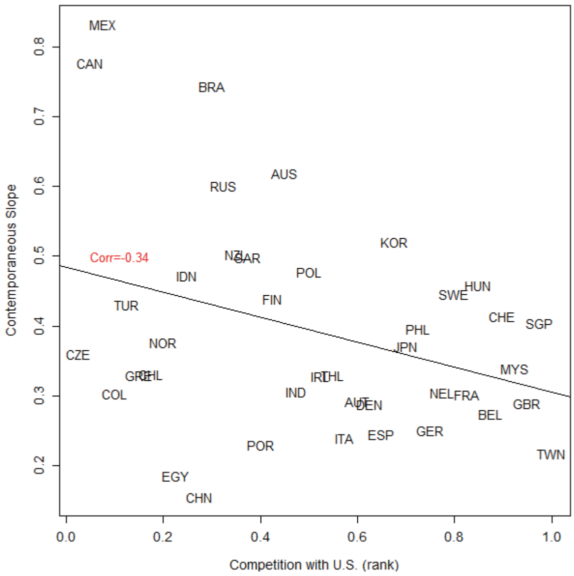
(a) Raw trade estimates



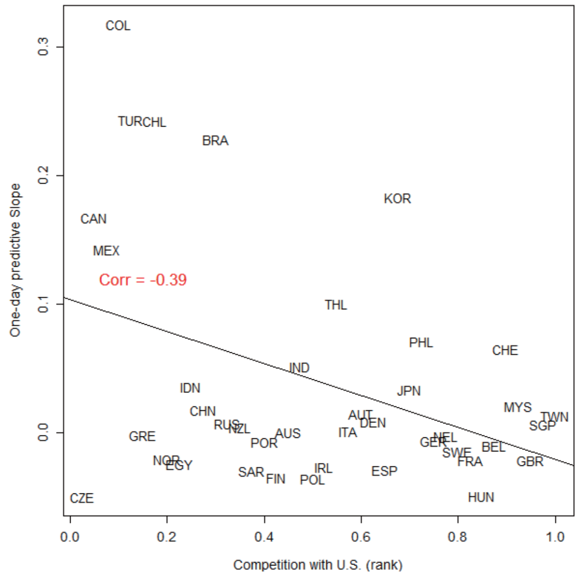
(b) Rankings of trade estimates

Figure 1: Competition and Direct Trade

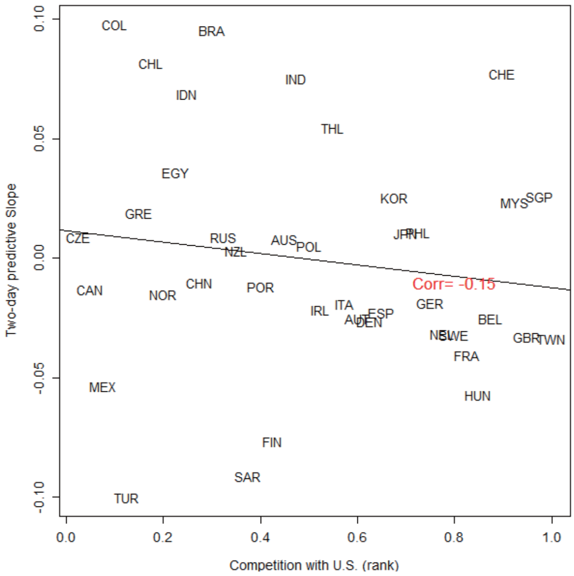
This figure plots the time-series averages of direct trade (y-axis) and competition (x-axis) with the US. Direct trade is the amount of trade of a country with the US as a proportion of its total trade. Competition with the US is computed at the product level and aggregated by taking the average, weighted by the exports of the focal country. Panel (a) shows the relationship for raw estimates, and panel (b) shows that for the country rankings. Countries are shown in three-letter ISO country codes.



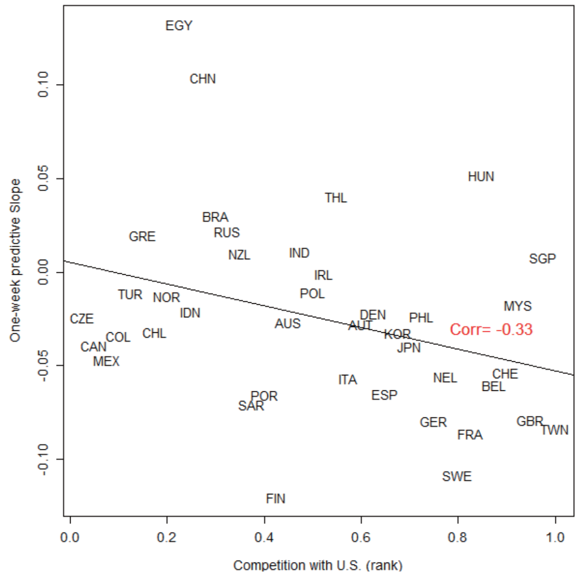
(a) Contemporaneous relationship



(b) One-day Predictive relationship



(c) Two-day Predictive relationship



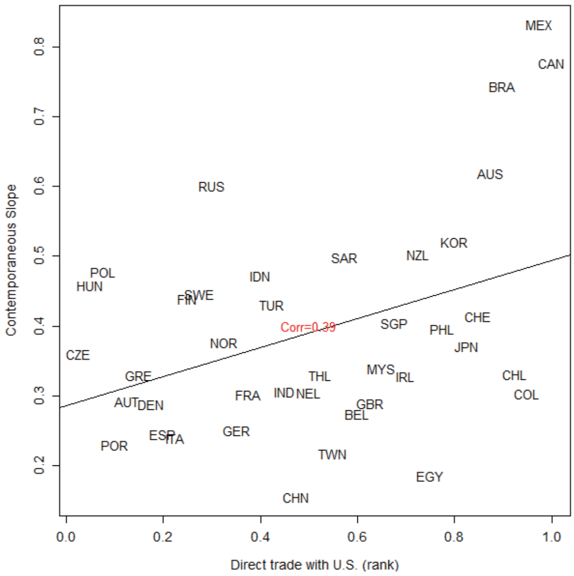
(d) One-week Predictive relationship

Figure 2: Competition and the Slope of Predictive Regressions

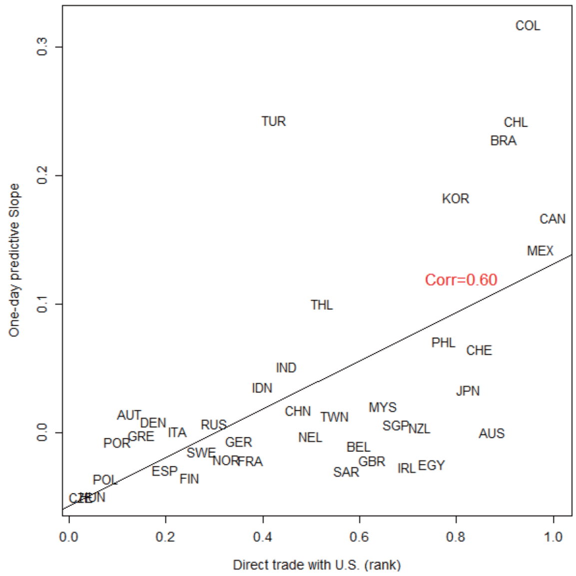
This figure plots the time-series averages of direct trade to the US (x-axis) and the slopes of the regression (y-axis)

$$R_{i,t+k} = \alpha + \beta_p R_{US,t-p} + \epsilon_{t+k},$$

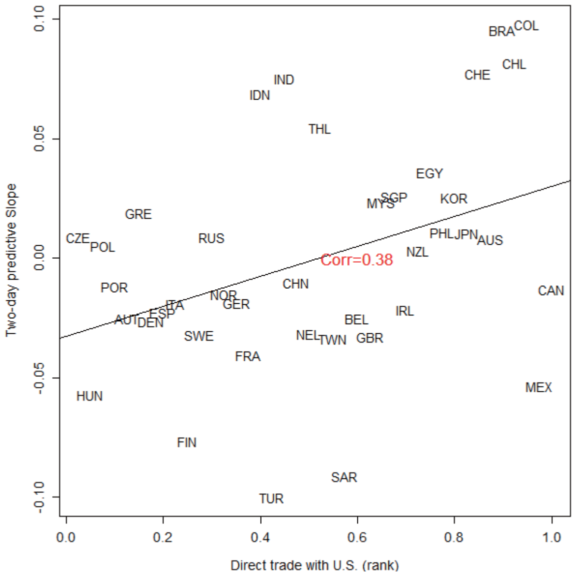
where $R_{i,t+k}$ is the stock return of country i on day $t+k$ denominated in USD. $k = 1$ if a country does not belong to the continents of America, otherwise $k = 0$. Panels (a),(b),(c) show the results for $p = 0, 1, 2$, respectively and panel (d) shows the result using $(\sum_{\tau=3}^{5} R_{US,t-\tau})$ as an independent variable. Competition is defined at the product level and aggregated to the country level.



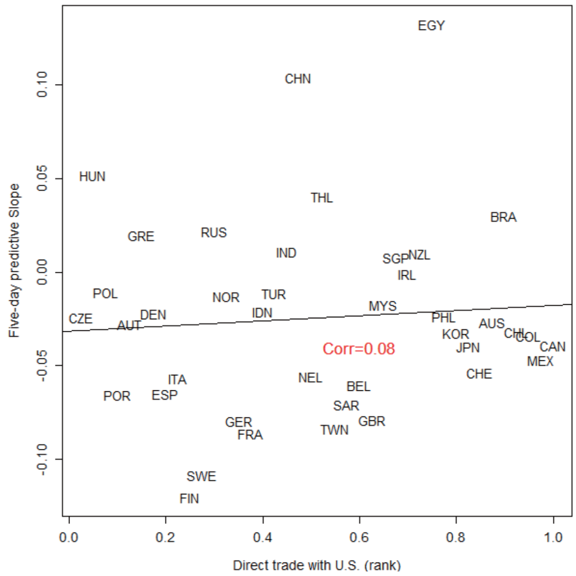
(a) Contemporaneous relationship



(b) One-day Predictive relationship



(c) Two-day Predictive relationship



(d) One-week Predictive relationship

Figure 3: Direct Trade and the Slope of Predictive Regressions

This figure plots the time-series averages of direct trade to the US (x-axis) and the slopes of the regression (y-axis)

$$R_{i,t+k} = \alpha + \beta_p R_{US,t-p} + \epsilon_{t+k},$$

where $R_{i,t+k}$ is the stock return of country i on day $t+k$ denominated in USD. $k = 1$ if a country does not belong to the continents of America, otherwise $k = 0$. Panels (a),(b),(c) show the results for $p = 0, 1, 2$, respectively and panel (d) shows the result using $(\sum_{\tau=3}^{5} R_{US,t-\tau})$ as an independent variable. Direct trade is defined as the sum of imports from and exports to the US as a fraction of a country's total trade.

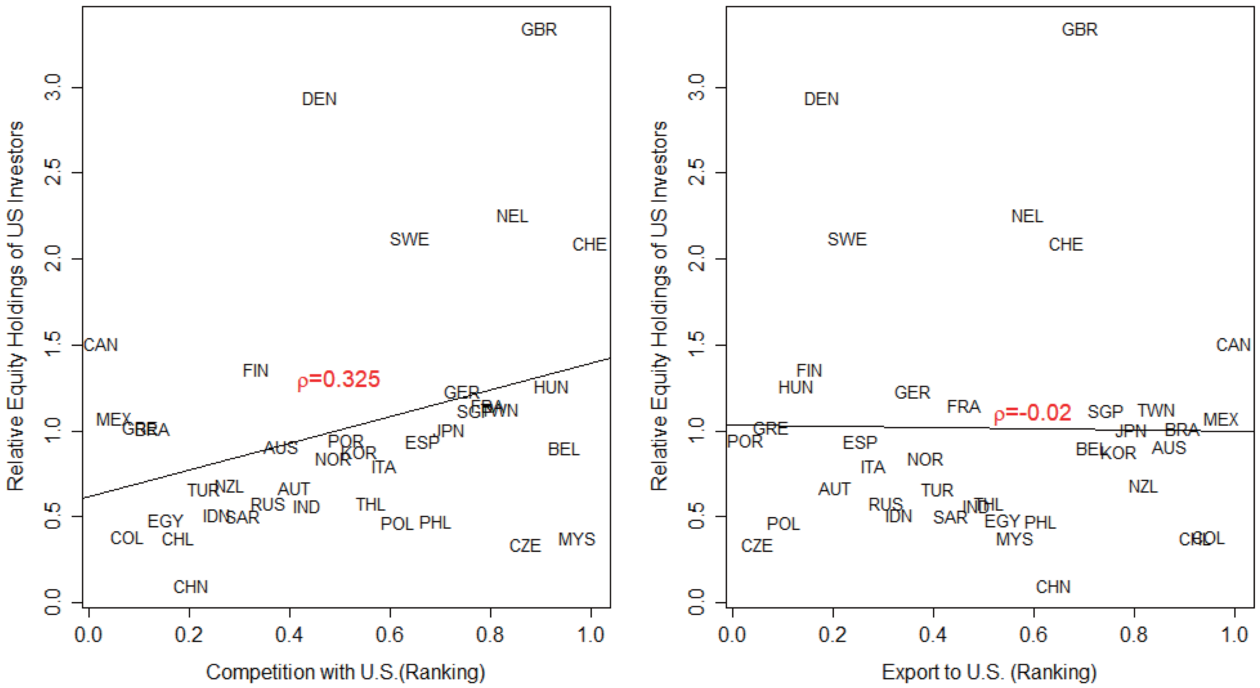


Figure 4: Relative Equity Holdings of US Investors and Trade Measures

This figure shows the cross-sectional relationship between relative equity holdings of the US investors and the two measures of trade linkages as of December 2016. Relative equity holdings of the US investors (A/B) is defined as the ratio of the proportion of equity holdings of US investors in particular country (A) divided by the proportion of market capitalization of that particular country. A high relative holding means that US investors over-weight their equity holdings in that country.

Table I
Daily Predictive Regressions

This table summarizes the slopes, the significance level determined by Newey-West standard errors, and the adjusted R-squares of the contemporaneous and predictive regressions of

$$R_{i,t+k} = \alpha + \beta R_{US,t} + \epsilon_{t+k},$$

where $R_{i,t+k}$ is the stock return of country i on day $t+k$ denominated in USD. The regression with $k=1$ is defined contemporaneous and $k=2$ as one-day predictive, $k=3$ as second-day predictive, the sum of $t=4$ to $t=6$ as one-week predictive for all countries except countries that belong to the continent of America. For American countries, the above is lagged by a day. Competition (C) and Direct trade (DT) is defined as in (4) and (3), respectively, and the time-series averages are reported.

		Dependent Variables: Returns									
		Contemporaneous		Predictive							
	Sample			One-day		Second-day		One-week			
Country	begins	Slope	Adj-R^2	Slope	Adj-R^2	Slope	Adj-R^2	Slope	Adj-R^2	$C(i,US)$	$DT(i,US)$
Australia	1995	0.619***	0.277	0.001	0.000	0.008	0.000	−0.018	0.000	0.182	0.162
Austria	1999	0.292***	0.062	0.014	0.000	−0.025	0.000	−0.038	0.000	0.226	0.026
Belgium	1999	0.274***	0.063	−0.01	0.000	−0.025	0.001	−0.095	0.002	0.289	0.093
Brazil	1995	0.744***	0.207	0.228***	0.019	0.095***	0.003	0.353***	0.008	0.139	0.222
Canada	1995	0.776***	0.481	0.164***	0.022	−0.015	0.000	0.116*	0.002	0.042	0.706
Chile	2002	0.331***	0.131	0.242***	0.071	0.082***	0.008	0.292***	0.014	0.135	0.225
China	1995	0.155***	0.008	0.017	0.000	−0.01	0.000	0.112**	0.001	0.139	0.076
Colombia	2005	0.304***	0.067	0.317***	0.072	0.098***	0.007	0.381***	0.016	0.073	0.337
Czech	1995	0.360***	0.07	−0.05	0.001	0.009	0.000	−0.066	0.000	0.266	0.017
Denmark	1995	0.287***	0.073	0.009	0.000	−0.026	0.001	−0.039	0.000	0.235	0.033
Egypt	2000	0.185***	0.018	−0.025	0.000	0.036	0.001	0.144**	0.002	0.137	0.133
Finland	1995	0.439***	0.077	−0.035	0.001	−0.076**	0.002	−0.232***	0.004	0.181	0.039
France	1999	0.302***	0.069	−0.021	0.000	−0.04	0.001	−0.148***	0.004	0.275	0.053
Germany	1999	0.250***	0.048	−0.006	0.000	−0.019	0.000	−0.105*	0.002	0.249	0.051
Greece	1999	0.330***	0.037	−0.002	0.000	0.019	0.000	0.037	0.000	0.132	0.030
Hungary	2001	0.459***	0.077	−0.049	0.001	−0.057	0.001	−0.055	0.000	0.275	0.019
India	1996	0.306***	0.049	0.051**	0.001	0.075***	0.003	0.138**	0.002	0.185	0.069
Indonesia	1995	0.472***	0.068	0.036	0.000	0.069**	0.001	0.084	0.000	0.138	0.066
Ireland	1995	0.328***	0.068	−0.026	0.000	−0.022	0.000	−0.049	0.000	0.211	0.122
Italy	1999	0.240***	0.036	0.001	0.000	−0.019	0.000	−0.075	0.001	0.224	0.039
Japan	1999	0.371***	0.111	0.033	0.001	0.01	0.000	0.004	0.000	0.241	0.150
Malaysia	1995	0.339***	0.074	0.021	0.000	0.023	0.000	0.027	0.000	0.291	0.100
Mexico	1995	0.832***	0.31	0.142***	0.009	−0.053	0.001	0.042	0.000	0.060	0.688
Netherlands	1995	0.305***	0.073	−0.003	0.000	−0.032	0.001	−0.09	0.001	0.251	0.078
Norway	1999	0.376***	0.074	−0.02	0.000	−0.015	0.000	−0.048	0.000	0.136	0.048
New Zealand	1995	0.503***	0.239	0.004	0.000	0.003	0.000	0.017	0.000	0.162	0.124
Philippines	1995	0.396***	0.113	0.071***	0.004	0.011	0.000	0.059	0.000	0.246	0.136
Poland	1995	0.477***	0.108	−0.036	0.001	0.005	0.000	−0.041	0.000	0.205	0.020
Portugal	1995	0.229***	0.044	−0.007	0.000	−0.012	0.000	−0.085	0.001	0.176	0.022
Russia	1999	0.601***	0.066	0.007	0.000	0.009	0.000	0.038	0.000	0.143	0.047
Singapore	1995	0.404***	0.13	0.006	0.000	0.026	0.001	0.04	0.000	0.305	0.120
South Africa	1995	0.498***	0.108	−0.029	0.000	−0.091**	0.004	−0.192**	0.003	0.163	0.085
South Korea	2002	0.521***	0.094	0.183***	0.012	0.025	0.000	0.175*	0.002	0.241	0.142
Spain	1995	0.245***	0.039	−0.029	0.001	−0.023	0.000	−0.117*	0.002	0.236	0.037
Sweden	1999	0.445***	0.104	−0.014	0.000	−0.032	0.001	−0.155**	0.003	0.259	0.043
Switzerland	1995	0.218***	0.047	0.013	0.000	−0.034*	0.001	−0.105**	0.002	0.323	0.083
Taiwan	1995	0.374***	0.094	0.058***	0.002	0.077***	0.004	0.083	0.001	0.291	0.152
Thailand	1995	0.330***	0.054	0.101***	0.005	0.055**	0.002	0.195***	0.003	0.215	0.080
Turkey	2006	0.431***	0.088	0.243***	0.028	−0.100**	0.005	0.132	0.001	0.120	0.069
United Kingdom	1995	0.290***	0.077	−0.021	0.000	−0.033	0.001	−0.133***	0.004	0.293	0.097

Table II
Predictive Slope and International Trade: Annual Fama-MacBeth Regressions

This table summarizes the slope and Newey-West adjusted t-statistics of the Fama and MacBeth (1973) regressions. The first-stage regression

$$R_{i,t+k} = \alpha + \beta_{i,0} R_{US,t} + \beta_{i,1} R_{US,t-1} + \beta_{i,2} R_{US,t-2} + \beta_{i,3} \sum_{\tau=3}^{5} R_{US,t-\tau} + \epsilon_{i,t+k},$$

where $k = 1$ for countries outside of Americas, and $k = 0$ for countries in America is estimated annually using daily data. The reported estimates are from the second-stage cross-sectional regressions of

$$\text{Dep}_{i,j,y} = b_{0,j} + b_{1,j} C(i,US)_{y-1} + b_{2,j} DT(i,US)_{y-1} + \mathbf{c}_j' \mathbf{Control}_{i,y-1} + e_{i,j,y},$$

for $j = 0, 1, 2, 3$ and y represent different years.

Panel A. Main Result without Controls

	$\hat{\beta}_{i,0}$	$\hat{\beta}_{i,1}$	$\hat{\beta}_{i,2}$	$\hat{\beta}_{i,3}$
$C(i,US)$	-0.264^{***}			
	(-13.18)			
$DT(i,US)$	0.275^{***}			
	(8.48)			
$\overline{R^2}$	0.357			
$C(i,US)$		-0.074^{***}	-0.016	-0.011
		(-4.55)	(-0.95)	(-0.97)
$DT(i,US)$		0.147^{***}	0.027	0.009
		(6.93)	(1.15)	(0.79)
$\overline{R^2}$		0.323	0.244	0.207
$C(i,US)$	-0.272^{***}	-0.088^{***}	-0.027^{*}	-0.018^{*}
	(-11.22)	(-4.54)	(-1.74)	(-1.68)
$DT(i,US)$	0.272^{***}	0.163^{***}	0.034	0.013
	(8.80)	(7.13)	(1.48)	(1.31)
$\overline{R^2}$	0.299	0.349	0.252	0.212

Panel B. Controlling for the Difference in GDP and Size

	$\hat{\beta}_{i,0}$	$\hat{\beta}_{i,1}$	$\hat{\beta}_{i,2}$	$\hat{\beta}_{i,3}$
$C(i,US)$	-0.272^{***}	-0.088^{***}	-0.027^{*}	-0.018^{*}
	(-13.11)	(-4.54)	(-1.74)	(-1.68)
$DT(i,US)$	0.285^{***}	0.163^{***}	0.034	0.013
	(8.46)	(7.13)	(1.48)	(1.31)
$\overline{R^2}$	0.366	0.349	0.252	0.212
$\Delta\overline{R^2}$	0.293	0.236	0.134	0.086

Table III
Predictive Slope and International Trade: Information Cost

This table summarizes the slope coefficients and Newey-West adjusted t-statistics of Fama and MacBeth (1973) regressions. The first-stage is a regression of

$$R_{i,t+k} = \alpha + (\beta_{i,0} + v_{i,0}VIX_t/100)R_{US,t} + (\beta_{i,1} + v_{i,1}VIX_{t-1}/100)R_{US,t-1} + (\beta_{i,2} + v_{i,2}VIX_{t-2}/100)R_{US,t-2} + (\beta_{i,3} + v_{i,3}VIX_{t-3}/100)\sum_{\tau=3}^{5} R_{US,t-\tau} + \epsilon_{i,t+k}$$

estimated annually, where $k = 1$ for countries outside of the Americas and $k = 0$ for countries in Americas. The reported parameter estimates are from the second stage cross-sectional regressions of each of these $\beta_{i,\cdot}$s and $v_{i,\cdot}$s on the rankings of competition and direct trade:

$$\text{Dep}_{i,j,y} = b_{0,j} + b_{1,j}C(i,US)_{y-1} + b_{2,j}DT(i,US)_{y-1} + e_{i,j,y},$$

for $j = 0, 1, 2, 3$, y represent different years, and Dep is $\hat{\beta}$ or $\hat{v}$ estimated from the first-stage regression.

	$C(i,US)$		$DT(i,US)$	
	$\beta_{i,j}$	$v_{i,j}$	$\beta_{i,j}$	$v_{i,j}$
$j = 0$	−0.100	−0.518	0.057	0.962
	(−0.80)	(−0.84)	(0.48)	(1.46)
$j = 1$	0.111	−1.323***	−0.084	1.339***
	(1.26)	(−2.81)	(−1.16)	(3.42)
$j = 2$	−0.035	−0.377	−0.103	0.731
	(−0.31)	(−0.54)	(−1.00)	(1.36)
$j = 3$	0.087***	−0.568***	0.046	−0.293
	(2.72)	(−3.02)	(0.75)	(−0.96)

Table IV
Stock Returns in Local Currency vs Currency Returns

This table summarizes the slope coefficients and Newey-West adjusted t-statistics of Fama and MacBeth (1973) regressions for currency returns (Panel A) and international stock returns denominated in local currency (Panel B) separately. The first stage is a regression of

$$R_{i,t+k} = \alpha + \beta_{i,0} R_{US,t} + \beta_{i,1} R_{US,t-1} + \beta_{i,2} R_{US,t-2} + \beta_{i,3} \sum_{\tau=3}^{5} R_{US,t-\tau} + \epsilon_{i,t+k}$$

estimated annually, where $k = 1$ for countries outside of the continent of America and $k = 0$ for countries in America. The reported parameter estimates are from the second stage cross-sectional regressions of each of these $\beta_{i,\cdot}$s on the rankings of direct trade and competition:

$$\hat{\beta}_{i,j,y} = b_{0,j} + b_{1,j} C(i, US)_{y-1} + b_{2,j} DT(i, US)_{y-1} + e_{i,j,y},$$

for $j = 0, 1, 2, 3$ and and y represent different years.

Panel A. Currency returns

	(1)		(2)		(3)	
Dependent Variable	$C(i,US)$	$DT(i,US)$	$C(i,US)$	$DT(i,US)$	$C(i,US)$	$DT(i,US)$
$\hat{\beta}_{i,0}$	-0.059^{***}	0.001			-0.065^{***}	0.008
	(-4.41)	(0.06)			(-4.60)	(0.37)
$\hat{\beta}_{i,1}$			-0.064^{***}	0.063^{***}	-0.069^{***}	0.062^{***}
			(-4.73)	(3.54)	(-4.71)	(3.49)
$\hat{\beta}_{i,2}$			-0.034^{***}	0.052^{***}	-0.036^{***}	0.052^{***}
			(-5.99)	(5.37)	(-6.53)	(5.83)
$\hat{\beta}_{i,3}$			-0.002	0.003	-0.003	0.002
			(-0.45)	(0.47)	(-0.84)	(0.33)

Panel A. Stock returns in local currency

	(1)		(2)		(3)	
Dependent Variable	$C(i,US)$	$DT(i,US)$	$C(i,US)$	$DT(i,US)$	$C(i,US)$	$DT(i,US)$
$\hat{\beta}_{i,0}$	-0.154^{***}	0.207^{***}			-0.157^{***}	0.210^{***}
	(-5.50)	(6.81)			(-5.53)	(6.84)
$\hat{\beta}_{i,1}$			-0.054^{***}	0.100^{***}	-0.059^{***}	0.114^{***}
			(-3.00)	(3.99)	(-3.39)	(4.84)
$\hat{\beta}_{i,2}$			-0.007	-0.019	-0.019^{*}	-0.015
			(-0.62)	(-0.92)	(-1.68)	(-0.76)
$\hat{\beta}_{i,3}$			-0.024^{**}	0.009	-0.028^{***}	0.013^{*}
			(-2.34)	(1.12)	(-2.78)	(1.76)

Table V
Supply vs Demand Shock

This table summarizes the slope coefficients and Newey-West adjusted t-statistics of Fama and MacBeth (1973) regressions for international stock returns. The first stage is a regression of

$$R_{i,t+k} = \alpha + \beta_{i,v,0}(R_{US,v,t} - R_{US,t}) + \beta_{i,v,1}(R_{US,v,t-1} - R_{US,t-1}) + \beta_{i,v,2}(R_{US,v,t-2} - R_{US,t-2}) + \beta_{i,v,3}\sum_{\tau=3}^{5}(R_{US,v,t-\tau} - R_{US,t-\tau}) + \epsilon_{i,t+k}$$

estimated annually, where $k = 1$ for countries outside of the continent of America and $k = 0$ for countries in America, and $R_{US,v,t}$ ($v = 1, 2, 3$) is the returns of the US portfolio formed by the vertical position of the industry. For up-down, the difference in upstream and downstream returns is used instead of excess returns. The reported parameter estimates are from the second stage cross-sectional regressions of each of these $\beta_{i,j,\cdot}$s on direct trade and competition:

$$\hat{\beta}_{i,v,j,y} = b_{0,v,j} + b_{1,v,j}C(i,US)_{y-1} + b_{2,v,j}DT(i,US)_{y-1} + e_{i,v,j,y},$$

for $j = 0, 1, 2, 3$, v=1,2,3, and y represent different years.

Panel A. Transmission through the competition channel

	Industry returns			
	Downstream	Midstream	Upstream	Up − Down
$\hat{\beta}_{i,v,0}$	0.525***	0.240***	−0.365***	−0.298***
	(7.18)	(3.01)	(−3.80)	(−6.37)
$\hat{\beta}_{i,v,1}$	0.122	0.134**	−0.171***	−0.079*
	(1.55)	(2.39)	(−3.01)	(−1.79)
$\hat{\beta}_{i,v,2}$	0.065	0.032	−0.053	−0.054**
	(1.32)	(0.50)	(−1.05)	(−2.18)
$\hat{\beta}_{i,v,3}$	0.059	−0.045*	0.027	−0.014
	(1.59)	(−1.85)	(0.97)	(−0.56)

Panel B. Transmission through the direct trade channel

	Industry returns			
	Downstream	Midstream	Upstream	Up − Down
$\hat{\beta}_{i,v,0}$	−0.452***	−0.059	0.227***	0.246***
	(−5.08)	(−0.43)	(2.78)	(4.49)
$\hat{\beta}_{i,v,1}$	−0.138	−0.045	0.195***	0.100**
	(−1.64)	(−0.68)	(2.86)	(1.97)
$\hat{\beta}_{i,v,2}$	−0.051	0.01	0.061	0.043
	(−0.77)	(0.10)	(1.18)	(1.19)
$\hat{\beta}_{i,v,3}$	−0.020	0.019	0.023	0.003
	(−0.63)	(0.37)	(0.89)	(0.21)

Table VI
From the European Union (EU)'s Perspective

This table summarizes the slope coefficients and Newey-West adjusted t-statistics of Fama and MacBeth (1973) regressions. In Panel A, the first stage is a regression of

$$R_{i,t+k} = \alpha + \beta_{i,0} R_{EU,t} + \beta_{i,1} R_{EU,t-1} + \beta_{i,2} R_{EU,t-2} + \beta_{i,3} \sum_{\tau=3}^{5} R_{EU,t-\tau} + \epsilon_{i,t+k}$$

estimated annually, where $k = 1$ for countries in Asia-Pacific and $k = 0$ otherwise. In Panel B, we add the lagged US returns as additional independent variables. The reported parameter estimates are from the second stage cross-sectional regressions of each of these $\beta_{i,\cdot}$s on direct trade and competition with the EU:

$$\hat{\beta}_{i,j,y} = b_{0,j} + b_{1,j} C(i,EU)_{y-1} + b_{2,j} DT(i,EU)_{y-1} + u_{1,j} C(i,US)_{y-1} + u_{2,j} DT(i,US)_{y-1} + e_{i,j,y},$$

for $j = 0, 1, 2, 3$ and y represent different years. Panel A summarizes the result for the basic specification, and Panel B considers several alternative specifications.

Panel A. Using Rankings of Trade Measures

	(1)		(2)		(3)	
Dependent Variable	$C(i,EU)$	$DT(i,EU)$	$C(i,EU)$	$DT(i,EU)$	$C(i,EU)$	$DT(i,EU)$
$\hat{\beta}_{i,0}$	-0.184^{***}	0.224^{***}			-0.186^{***}	0.230^{***}
	(-3.97)	(3.95)			(-4.12)	(4.00)
$\hat{\beta}_{i,1}$			-0.077^{***}	0.222^{***}	-0.075^{***}	0.226^{***}
			(-3.37)	(9.22)	(-3.35)	(9.47)
$\hat{\beta}_{i,2}$			0.010	0.025	0.002	0.030
			(0.61)	(0.99)	(0.12)	(1.19)
$\hat{\beta}_{i,3}$			-0.010	0.005	-0.018	0.012
			(-0.62)	(0.45)	(-1.12)	(0.95)

Panel B. Alternative Specifications

	Raw Trade		Control US Ret		Index in Local Currency	
Dependent Variable	$C(i,EU)$	$DT(i,EU)$	$C(i,EU)$	$DT(i,EU)$	$C(i,EU)$	$DT(i,EU)$
$\hat{\beta}_{i,0}$	-0.322^{***}	0.242^{***}	-0.171^{***}	0.209^{***}	-0.105^{***}	0.482^{***}
	(-2.91)	(14.55)	(-3.58)	(3.52)	(-3.28)	(11.09)
$\hat{\beta}_{i,1}$	-0.173^{**}	0.084^{***}	-0.052^{*}	0.161^{***}	-0.057^{***}	0.032^{*}
	(-2.38)	(7.57)	(-1.76)	(5.21)	(-2.80)	(1.69)
$\hat{\beta}_{i,2}$	-0.015	-0.003	0.011	0.029	0.012	-0.011
	(-0.22)	(-0.32)	(0.62)	(1.11)	(0.59)	(-0.56)
$\hat{\beta}_{i,3}$	-0.050	0.003	-0.017	0.014	-0.010	0.001
	(-0.91)	(0.44)	(-1.03)	(1.07)	(-0.78)	(0.13)

Table VII
Return Predictability and Within Industry Competition

This table summarizes the slope coefficients and Newey-West adjusted t-statistics of Fama and MacBeth (1973) regressions. The standardized industry-level competition with the US is computed for each country and industry. Then, each industries are grouped into five, where group 1 contains all industries without any competition with the US, and group 2-5 are formed after sorting industries by the degree of competition. The first stage is the time-series regression given in Equation (11). The second stage is the cross-sectional regression of the βs on the group numbers. The coefficients are multiplied by 100.

	SIC 2-digit classification						NAICS 3-digit classification					
	Contemp. $R_{t,t+1}$		1-day lag $R_{t+1,t+2}$		1-week lag $R_{t+1,t+6}$		Contemp. $R_{t,t+1}$		1-day lag $R_{t+1,t+2}$		1-week lag $R_{t+1,t+6}$	
Country	Slope	T-stat	Slope	T-stat	Slope	T-stat	Slope	T-stat	Slope	T-stat	Slope	T-stat
Australia	−0.597	(−0.82)	−0.007	(−0.02)	−0.009	(−0.05)	−0.806	(−1.12)	−0.280	(−0.69)	−0.118	(−0.74)
Austria	−1.974***	(−3.48)	−0.050	(−0.11)	0.156	(0.89)	−0.251	(−0.59)	−0.543*	(−1.84)	−0.207	(−1.37)
Belgium	−0.106	(−0.20)	−0.179	(−0.63)	0.559***	(3.93)	0.758*	(1.90)	−0.166	(−0.57)	0.149	(1.43)
Brazil	−4.010***	(−4.83)	−1.194*	(−1.84)	−0.127	(−0.42)	−2.791*	(−2.51)	−0.709	(−0.84)	−0.011	(−0.03)
Canada	−9.927***	(−17.69)	−2.786***	(−6.37)	−0.030	(−0.13)	−9.691***	(−5.99)	−3.179***	(−6.44)	0.136	(0.68)
Chile	−0.910*	(−1.95)	0.047	(0.11)	−0.003	(−0.01)	−0.614	(−1.14)	0.282	(0.57)	−0.123	(−0.43)
China	−0.426	(−1.42)	−0.477*	(−1.67)	−0.334*	(−1.74)	−0.287	(−1.04)	−0.278	(−0.94)	0.101	(0.74)
Colombia	−1.498*	(−2.04)	−2.369***	(−3.90)	−0.100	(−0.35)	−1.621*	(−2.08)	−2.514***	(−3.87)	−0.457*	(−2.24)
Czech	−4.313***	(−5.81)	−0.292	(−0.61)	0.232	(0.96)	−1.897***	(−2.92)	−0.259	(−0.55)	0.064	(0.44)
Denmark	−1.723***	(−3.98)	−0.017	(−0.06)	0.109	(0.68)	−0.196	(−0.37)	−0.056	(−0.21)	0.234*	(2.14)
Egypt	−2.672*	(−2.06)	−1.839	(−1.14)	−1.175	(−1.35)	−3.336*	(−2.28)	−1.807	(−1.27)	−0.958	(−0.94)
Finland	−2.910***	(−4.16)	0.484	(1.00)	0.628***	(3.22)	−1.417	(−1.47)	0.339	(0.68)	0.430*	(1.76)
France	−0.797*	(−1.77)	−0.175	(−0.75)	0.210	(1.45)	0.008	(0.03)	−0.280	(−1.44)	−0.048	(−0.36)
Germany	−1.416***	(−3.74)	−0.215	(−1.19)	0.247	(1.60)	−0.061	(−0.27)	−0.269	(−1.43)	−0.034	(−0.30)
Greece	−3.501***	(−4.44)	−0.156	(−0.19)	0.194	(0.94)	−3.755***	(−3.24)	−0.739	(−1.31)	−0.197	(−0.51)
Hungary	−4.546***	(−4.65)	−0.203	(−0.28)	0.119	(0.40)	−3.326***	(−4.07)	0.041	(0.06)	−0.157	(−0.54)
India	−2.465***	(−4.30)	−1.436***	(−2.85)	−0.324*	(−1.81)	−2.341***	(−3.22)	−0.774*	(−2.00)	−0.069	(−0.34)
Indonesia	−4.561***	(−5.26)	−1.039*	(−2.30)	−0.049	(−0.22)	−2.197*	(−2.12)	−0.496	(−0.95)	0.328	(0.87)
Ireland	−1.616***	(−3.49)	−0.608*	(−2.12)	−0.027	(−0.20)	−1.182*	(−1.98)	−0.300	(−0.71)	0.155	(0.85)
Italy	−0.191	(−0.45)	−0.029	(−0.09)	0.056	(0.28)	0.316	(1.20)	−0.119	(−0.35)	−0.122	(−1.06)
Japan	−0.803*	(−2.06)	0.225	(0.79)	0.129	(1.27)	0.536	(1.19)	−0.233	(−0.98)	−0.038	(−0.20)
Malaysia	−1.736***	(−4.40)	0.063	(0.30)	−0.081	(−0.38)	−1.444***	(−4.27)	−0.158	(−0.72)	0.089	(0.49)
Mexico	−11.138***	(−7.41)	−2.665***	(−3.38)	0.037	(0.15)	−5.175*	(−2.31)	−1.750*	(−2.15)	0.593*	(1.73)
Netherlands	−1.128***	(−3.17)	−0.199	(−0.74)	0.038	(0.32)	−0.210	(−0.64)	−0.164	(−0.56)	−0.090	(−0.97)
Norway	−0.269	(−0.38)	0.139	(0.28)	0.541*	(2.46)	1.251	(1.59)	0.023	(0.05)	0.083	(0.45)
New Zealand	−0.699	(−1.45)	0.295	(0.78)	−0.092	(−0.58)	−0.720	(−1.01)	0.142	(0.39)	0.056	(0.34)
Philippines	−5.072***	(−6.13)	−1.000*	(−2.01)	0.080	(0.43)	−3.458***	(−4.13)	−0.881*	(−2.18)	0.026	(0.15)
Poland	−4.179***	(−5.42)	−0.214	(−0.37)	0.195	(0.77)	−0.508	(−0.55)	−0.380	(−0.65)	0.071	(0.32)
Portugal	−2.614***	(−4.88)	−0.272	(−0.56)	0.378*	(1.83)	−1.805***	(−3.33)	−0.172	(−0.45)	0.336	(1.64)
Russia	−8.613***	(−6.30)	1.722	(1.08)	2.203	(1.24)	−7.965***	(−5.37)	0.483	(0.35)	0.523	(1.04)
Singapore	−2.129***	(−3.26)	−0.227	(−0.75)	0.001	(0.00)	−1.778*	(−2.35)	−0.401	(−1.18)	−0.247	(−1.46)
South Africa	−9.058***	(−4.54)	−0.724	(−0.81)	0.764***	(3.14)	−4.925***	(−4.45)	−0.879	(−0.88)	0.044	(0.14)
South Korea	0.024	(0.04)	0.186	(0.40)	0.153	(0.54)	1.907***	(3.30)	0.743*	(1.82)	0.036	(0.12)
Spain	−1.247***	(−3.12)	0.575	(1.31)	−0.024	(−0.09)	−0.148	(−0.42)	−0.131	(−0.38)	0.067	(0.35)
Sweden	−2.374***	(−3.72)	−0.082	(−0.18)	0.278*	(1.71)	−0.064	(−0.12)	0.095	(0.27)	−0.055	(−0.34)
Switzerland	−0.043	(−0.12)	−0.246	(−1.06)	0.122	(1.21)	0.462*	(1.66)	−0.329	(−1.40)	−0.012	(−0.13)
Taiwan	0.222	(0.45)	0.404	(1.21)	0.218*	(1.69)	0.485	(0.98)	−0.011	(−0.03)	0.040	(0.30)
Thailand	−2.407***	(−5.11)	−0.718***	(−2.59)	−0.096	(−0.69)	−0.926*	(−1.67)	−0.576	(−1.48)	0.375	(1.42)
Turkey	−7.218***	(−3.06)	−4.017***	(−3.38)	−0.898	(−1.31)	−5.817***	(−3.07)	−3.229*	(−2.36)	−0.309	(−0.49)
United Kingdom	−0.551*	(−2.03)	−0.349	(−1.41)	0.134	(1.38)	0.407	(1.52)	−0.244	(−1.44)	0.020	(0.26)
All sample	-2.779***		-0.491***		0.110		-1.614***		-0.504***		0.017	
# of +	2		10		25		9		8		22	
# of + significant	0		0		7		3		1		3	
# of −	38		30		15		31		32		18	
# of − significant	31		11		2		19		7		1	
Sign test (p-value)	0.0001		0.0022		0.1539 (Op. Sign)		0.0006		0.0002		0.6358 (Op. Sign)	

Table VIII
List of Country ETFs

This table summarizes the lists of country ETFs used in the analysis. For each country, the ticker, the year the ETF is first listed, the issuer and the brand, the exchange on which the ETF is traded, and the time-series of the bid-ask spread is reported.

ETF	Ticker	Available	Management	Listed	Bid-ask % (bp) (2003-2018)
Australia	EWA	1996	Blackrock (iShares)	NYSE	11.1
Austria	EWO	1996	Blackrock (iShares)	NYSE	22.2
Belgium	EWK	1996	Blackrock (iShares)	NYSE	23.7
Brazil	EWZ	2000	Blackrock (iShares)	NYSE	7.4
Canada	EWC	1996	Blackrock (iShares)	NYSE	9.5
Chile	ECH	2007	Blackrock (iShares)	CBOE	35.0
China	MCHI	2011	Blackrock (iShares)	NASDAQ	4.7
Colombia	GXG	2009	Global X	NYSE	93.5
Czech			* Unable to match ETF		
Denmark			* ETF Matched but high bid-ask spread (2.35% on average)		
Egypt	EGPT	2010	VanEck	NYSE	88.9
Finland	EFNL	2012	Blackrock (iShares)	CBOE	36.6
France	EWQ	1996	Blackrock (iShares)	NYSE	15.5
Germany	EWG	1996	Blackrock (iShares)	NYSE	10.9
Greece	GREK	2011	Global X	NYSE	35.1
Hungary			* Unable to match ETF		
India	EPI	2008	Wisdomtree	NYSE	11.4
Indonesia	EIDO	2010	Blackrock (iShares)	NYSE	8.8
Ireland	EIRL	2010	Blackrock (iShares)	NYSE	59.2
Italy	EWI	1996	Blackrock (iShares)	NYSE	21.0
Japan	EWJ	1996	Blackrock (iShares)	NYSE	8.5
Malaysia	EWM	1996	Blackrock (iShares)	NYSE	15.2
Mexico	EWW	1996	Blackrock (iShares)	NYSE	9.1
Netherlands	EWN	1996	Blackrock (iShares)	NYSE	18.5
Norway	NORW	2010	Global X	NYSE	21.7
New Zealand	ENZL	2010	Blackrock (iShares)	NASDAQ	19.8
Philippines	EPHE	2010	Blackrock (iShares)	NYSE	9.8
Poland	PLND	2009	VanEck	NYSE	33.5
Portugal	PGAL	2013	Global X	NYSE	41.4
Russia	RSX	2007	VanEck	NYSE	11.0
Singapore	EWS	1996	Blackrock (iShares)	NYSE	15.6
South Africa	EZA	2003	Blackrock (iShares)	NYSE	16.6
South Korea	EWY	2000	Blackrock (iShares)	NYSE	8.3
Spain	EWP	1996	Blackrock (iShares)	NYSE	13.5
Sweden	EWD	1996	Blackrock (iShares)	NYSE	17.7
Switzerland	EWL	1996	Blackrock (iShares)	NYSE	17.2
Taiwan	EWT	2000	Blackrock (iShares)	NYSE	12.4
Thailand	THD	2008	Blackrock (iShares)	NYSE	23.1
Turkey	TUR	2008	Blackrock (iShares)	NYSE	22.6
United Kingdom	EWU	1996	Blackrock (iShares)	NYSE	13.8
Mean					22.2

Table IX
Trading Strategy Using Country ETFs

This table summarizes the performance of portfolios of ETFs sorted by the countries' direct export to US (Panel A and C), competition with US (Panel B and D). Portfolios are formed every year based on their past year's trade measures. In Panel A and B, if US returns during the day (from close of the previous day to ten minutes before close today) is greater than or equal to zero it is classified as a "+ Ret" day, if it is negative, the day is classified as a "- Ret" day. Panel A and B show the performance of the country ETFs in excess of the market. The trading strategies of Panel C and D are implemented by removing all ETFs that has a bid-ask spread of 30 bp or more. The portfolios are re-balanced only if the realized S&P 500 Index during the day is either greater than 50bp or less than -50bp. For example, "+ Ret" day is when the most recent observed return that exceeds 50bp in absolute value is positive. The trading cost of 2.1 bp is calculated by multiplying the average bid-ask spread of 9.2bp by the proportion of trading days (23%). The means and Newey-West adjusted t-statistics of the portfolio returns excess to the S&P 500 Index returns are reported.

Panel A. Portfolios Sorted by Competition with US

	Low	Q2	Q3	Q4	High	High-Low
+ Ret	0.069	−0.024	−0.02	−0.002	−0.02	−0.090***
	(3.62)	(−1.37)	(−1.22)	(−0.13)	(−1.43)	(−4.80)
− Ret	−0.049	0.048	0.032	0.01	0.033	0.082***
	(−1.98)	(1.87)	(1.57)	(0.55)	(1.80)	(3.63)

Panel B. Portfolios Sorted by Direct Trade to US

	Low	Q2	Q3	Q4	High	High-Low
+ Ret	0.018	−0.006	−0.006	−0.03	0.076	0.058***
	(0.87)	(−0.36)	(−0.38)	(−1.75)	(4.38)	(2.74)
− Ret	−0.006	0.030	0.006	0.051	−0.045	−0.040*
	(−0.24)	(1.26)	−0.32)	(2.61)	(−2.01)	(−1.68)

Panel C. Direct Trade based Trading Strategy (Trading Cost: 2.1 bp)

	Low	Q2	Q3	Q4	High	High-Low
+ Ret	−0.026	0.01	−0.033	0.014	0.047	0.072***
	(−1.24)	(0.56)	(−2.15)	(0.91)	(2.36)	(3.06)
− Ret	0.042	0.063	0.021	0.001	−0.026	−0.064**
	(1.38)	(2.18)	(0.89)	(0.03)	(−0.90)	(−2.20)

Panel D. Competition based Trading Strategy (Trading Cost: 2.1 bp)

	Low	Q2	Q3	Q4	High	High-Low
+ Ret	0.061	0.005	−0.027	−0.003	−0.031	−0.091***
	(2.79)	(0.27)	(−1.604)	(−0.198)	(−1.817)	(−3.874)
− Ret	−0.031	0.039	0.026	0.029	0.042	0.072**
	(−1.07)	(1.24)	(1.13)	(1.37)	(1.90)	(2.49)