The Growth Effect of Uncertainty about Globalization: Evidence from the Option Market

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Abstract

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Keywords: Uncertainty about globalization, downside risk, risk-neutral skewness, call ratio, variance risk, economic recession, trade policy uncertainty

JEL Classification: F23, F36, F65, G11, G12, G13, G32.

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1. Introduction

Globalization has reached an unprecedented height in recent decades, as evidenced by the widespread international movement of goods and services and the continuing expansion and mutual integration of market frontiers.[1] A common view about the prospect of globalization is that it offers extensive opportunities for worldwide development and provides growth options that would enhance global, national, regional, and local economies. The literature has shown the positive consequences of international trade and international business, including the reduced price of final products and inputs (De Loecker *et al.* (2016)), increased product variety (Broda and Weinstein (2006); Bernard *et al.* (2011)), updated product quality (Hallak (2006); Hallak and Schott (2011)), improved productivity (Bernard *et al.* (2003); Hallak (2006); Keller and Yeaple (2009)), and technological advancements (Liu and Rosell (2013); Bloom *et al.* (2016)). Therefore, asset values are expected to increase due to better economic outcomes of globalization, such as increased consumption, investment, and production.

However, it is unknown the extent to which globalization will lead a country's economy to grow, and thus, it is unclear by how much assets value will increase. The uncertainties about globalization-led growth are perceived as good uncertainties because a rise in the mean-preserving risk implies higher expected profit when globalization-related growth options are exercised. According to the "growth options" argument, such uncertainties will encourage capital investment. For example, the reduction of international trade barriers can prompt companies to move their manufacturing to countries with low labor costs (offshoring), though they are unsure how much the production costs will be lowered (Antràs *et al.* 2006). Trade liberalization would encourage

[1] Globalization is the process through which an increasing free cross-border flow of ideas, people, goods, services, capital, information, and technology. It leads to the integration of markets, economics, and socialites. In this paper, we focus on international trade integration.

companies to export to countries with increasing demand, though they are uncertain how much demand will increase (Baldwin & Gu 2004). Their decisions are seen as investing in a "call option" on the future success of offshoring and market expansion. Moreover, intensive competition due to the integration of global markets motivates firms to innovate or acquire new patents (Amiti & Khandelwal 2013; Liu & Rosell 2013; Hombert & Matray 2018). Either innovation or patent acquisition is risky and can be viewed as investing in a "call option" on the future profit from the new product going to market. Therefore, consumption and cash flows are expected to go up with capital investment, increasing asset value. The uncertainty about globalization-led growth is good uncertainty and has a positive price (Segal *et al.* (2015)). Moreover, because risk-averse investors prefer early resolution of uncertainties, no matter whether the uncertainties are good or bad, they require a risk premium as compensation for uncertainties about the size of globalization benefits.

In this paper, we study how the uncertainty about the globalization outlook is priced in the options market. Options are uniquely well suited for this analysis for two reasons. First, options come with different strike prices, which allow us to estimate the distribution of the underlying asset's returns and help identify whether investors perceive globalization uncertainties as beneficial or harmful to economies. Firms that are affected by trade integration earn excess stock returns, suggesting globalization is risky; however, it is silent about the sign of the price of the risk. Second, option prices subsume expectations about investment opportunities, and thus options-based variables work well in predicting future asset dynamics and uncovering the view of investors regarding the globalization outlook.[2]

[2]For further information regarding the predictive power of information obtained from the options market for the future asset return dynamic, see Bollerslev *et al*. (2009), Bali and Murray (2013), Bollerslev and Todorov (2011), Bollerslev *et al*. (2015), Andersen *et al*. (2015), among others.

The uncertainty of globalization prospects has a heterogeneous effect across firms in a country and is more relevant for firms incurring lower barriers to international trade as their cash flows are more sensitive to foreign shocks. Transportation costs are natural barriers to the free movement of products across countries' borders and are used in the literature to measure globalization exposure (Barrot *et al.* (2019); DeLisle *et al.* (2020)). In line with the literature on international economics, we express transportation costs in ad valorem terms, that is, the cost of shipping relative to the value of the good.[3] Low shipping costs mean high globalization exposure because it is less costly for foreign firms to enter the domestic market and for domestic firms to access the global market. As the relative price of air transportation to ocean shipping falls, the transportation of goods shifts from ocean to air (Harrigan (2010)). The compositional shift of international transportation implies better and quicker ways of shipping and greater exposure to globalization, but the ad valorem shipping costs may remain the same or even increase, resulting in an underestimated measure of globalization exposure. Hence, according to Hummels (2007), we first adjust shipping costs by using the weight-to-value ratio to control for compositional change over time.[4] That is, we use the negative natural logarithm of adjusted shipping costs (*NLnSCAdj*) of a firm's industry to measure the globalization exposure of the firm.

The common view regards globalization as a beneficial process, and uncertainties about the size of globalization benefits encourage future economic activities. We employ three option market measures to test whether uncertainties about globalization-led growth are perceived as good uncertainties. The first one is the skewness of the risk-neutral distribution, for which we use the model-free measure of implied skewness (*MFIS*) developed by Bakshi and Madan (2000) and

[3]The costs associated with shipment are the charges paid by a seller (exporter) to cover the costs, insurance, and freight (CIF) of a buyer's (importer's) order while the cargo is in transit.

[4]The weight-to-value ratio is the ratio of kilograms shipped to the value of the shipment.

Bakshi *et al.* (2003). This measure is the third central moment of the distribution normalized by risk-natural variance and captures the asymmetry of the risk-neutral distribution. The extant literature documented a negative risk-neutral skewness in index options and at a smaller scale in individual equities, indicating that OTM put options on an asset are priced at a premium relative to their OTM calls counterpart (e.g., Bakshi *et al.* (2003)). Likewise, A higher value of *MFIS* in the cross-section of individual equities indicates a relocation of probability mass under the risk-neutral measure from the downside (left) to the upside (right) region, meaning that investors perceive a higher chance for positive price movements relative to negative price changes.

Second, we capture the investors' perception of jump risk associated with the globalization exposure by evaluating the evolution of the implied volatility smile across out-of-the-money (OTM) put option strikes (Rubinstein (1994)). More specifically, we measure the steepness of volatility curves implied from OTM puts with respect to options' moneyness (*SlopeD*) (see e.g., Bakshi *et al.* (2003), Kelly *et al.* (2016)). OTM put options provide insurance against downward price movements of the underlying stocks, and their prices depend on the price of such insurance. The insurance is more valuable when the likelihood that a negative price jump will realize is larger or when the tail risk price attached to such a shock is higher. Hence, the price of OTM put options relative to at-the-money (ATM) options is larger, and so is the steepness of the implied volatility smile slope. OTM puts have higher (less negative) deltas, namely the change in the option price with respect to the change in stock price. Therefore, considering delta as a measure of options' moneyness, the slopes of volatilities implied from OTM puts with respect to options' deltas (*SlopeD*) are higher (more positive) for stocks with higher downside tail risks. On the contrary, a less positive value of *SlopeD* means that deeper OTM puts are relatively less costly, and the downside tail risk is lower.

The third measure is the call ratio (*CR*), defined as the proportion of total options volume that is made up of call options, and is associated with investors' lottery preferences (Blau *et al.* 2016). The extant literature has documented strong evidence for investors' preferences for lottery-like returns.[5] The nonlinear payoff structure of call options, which allows for unlimited upside potential with limited downside risk, makes these assets attractive for investors with lottery preferences (Boyer and Vorkink (2014)). Also, options trading volume contains predictive information about the underlying stock performance (Pan and Poteshman (2006), Johnson and So (2012), Blau *et al.* (2016)) find that preferences for lottery stocks are reflected in higher call ratio (*CR*). Therefore, we evaluate the lottery-like characteristics of such stocks by evaluating investors' trading activities in the options market through the lens of the call ratio.

Good uncertainty implies investors expect good news about the future performance of firms with lower barriers to globalization trades. Therefore, higher globalization exposure would correspond to higher *MFIS*. Moreover, stocks with higher globalization exposure tend to have lottery-like characteristics because good news are more likely to be associated with them, and they would have higher *CR*. Good uncertainty also indicates that investors perceive a lower likelihood for negative jumps in the stock price of more-exposed firms, leading to a lower downside tail risk and a less positive *SlopeD*. In the main empirical analysis, we run fixed-effect regressions of one of the three option market measures (*MFIS*, *SlopeD*, and *CR*) on the measure of globalization exposure (*NLnSCAdj*) and a set of variables controlling for the characteristics of the firm, industry, and stock market. Besides, we employ the portfolio-sorting method and Fama MecBeth regressions. Consistently, we find significant and positive coefficients loading on *NLnSCAdj* for *MFIS* and *CR* and significantly negative coefficients for *SlopeD* in both fixed-effect and Fama

[5]Examples include Brunnermeier *et al.* (2007), Mitton and Vorkink (2007), Barberis and Huang (2008), Kumar (2009).

MecBeth regressions. Also, *MFIS* and *CR* take a larger value and *SlopeD* is less positive in the greater globalization-exposure portfolio. Taken together, the evidence supports the view that globalization leads the economy to grow and implies investors perceive uncertainties about such growth as good uncertainties. Also, stocks with high exposure to globalization tend to have lottery-like characteristics.

The variance of stocks' returns increases with the uncertainty, regardless of whether the uncertainty is good or bad. As a result, risk-averse investors would pay a higher price (or accept negative average excess returns) for options that provide a hedge against increased variance (Bakshi and Kapadia (2003), Carr and Wu (2009)). The implied variance (*IV*) derived from options reflects the risk-neutral expected value of returns variance. We compute the measure for options with 30 days to maturity, using the model-free approach of Britten-Jones and Neuberger (2000). The variance risk premium (*VRP*) captures the value of option protection against the variance risk, and is computed as the difference between the implied and realized variances. Therefore, *IV* and *VRP* should take larger values for firms with higher exposure to globalization. To test this conjecture, we first apply the portfolio sorting method, and then, run Fama MecBeth and fixed-effect regressions of *IV* and *VRP* on *NLnSCAdj* and a set of variables controlling for the characteristics of the firm, industry, and stock market. We find *IV* and *VRP* are larger in the portfolio with greater exposure to globalization. The coefficients of *NLnSCAdj* in all regressions are positive and significant for both *IV* and *VRP*. All findings consistently suggest that risk-averse investors are willing to pay a premium for increased variance risk due to uncertainties about the size of globalization benefits.

When the economy is in a recession, the stock price is more likely to decline, and the price drop might be larger. Consequently, investors tend to believe the good news associated with

globalization is less likely to occur in the downturn than in normal times. The adverse economic condition stimulates investors to look for protection against market downturns and to pay higher premia for options that provide such insurance. Moreover, the call options on stocks with lotter-like characteristics are more attractive in the weak economy time (Kumar (2009)). Therefore, the effect of globalization exposure in increasing *MFIS* and reducing *SlopeD* would be weakened by economic recessions, while the impact of globalization exposure to increase *CR* will be enhanced. To test how the impact of globalization exposure changes with economic conditions, we include an indicator of economic recession months (*Recession*) and its interaction with the measure of the exposure to globalization in the fixed-effect regressions of *MFIS*, *SlopeD*, and *CR*. We find a positive and significant coefficient of the cross term of *Recession* and *NLnSCAdj* for *SlopeD* and *CR* and a significantly negative coefficient of the cross term for *MFIS*. These results imply that in a weak economy, investors expect that the uncertainty about globalization-led growth is less likely to encourage future economic activities. The value of insurance against downside risk is higher and there is a greater demand for call options of lottery-like stocks.

Throughout the process of globalization, trade negotiations, proposals for a new trade policy or for revising old trade policies, and trade wars between countries impose uncertainty about the outlook of trade integration. This uncertainty not only slows down globalization-led growth but also discourages future economic activities. Hence, the negative consequence of trade policy uncertainty would weaken the growth effect of globalization, increase lottery preference, and increase the variance risk. Caldara *et al.* (2020) construct an aggregate index of trade policy uncertainty (*TPU*), using newspaper coverage, and find that *TPU* is associated with a decline in the aggregate investment rate. Consequently, *TPU* would weaken the impact of globalization exposure on *MFIS* and *SlopeD* and strengthen the effect on *IV* and *VRP*. Also, the adverse impact

of *TPU* To test this, we add *TPU* and its interaction with the measures of globalization exposure to the fixed-effect regressions of *MFIS*, *SlopeD*, *CR*, *IV*, and *VRP*, and in the meantime, we control for economic recessions. We find that the coefficient of the interaction, *TPU*× *NLnSCAdj*, in the regressions of *SlopeD*, *CR*, *IV*, and *VRP* is positive and significant, and in the regression of *MIFS* is significantly negative. It suggests that trade policy uncertainty erodes the positive consequences of globalization-led growth, intensifies the variance of stock returns associated with the globalization risk, and spurs investors' lottery preference.

To further support our findings, we run a series of robustness checks. First, to account for the possible measurement error of globalization exposure in our regressions, we substitute the variable *NLnSCAdj* with the negative natural logarithm of ad valorem shipping costs (*NLnSC*). Also, we include the natural logarithm of the weight-to-value ratio (*LnWTV*) to control for the compositional shift of international transportation. We find consistent results using this method of measuring globalization exposure. Second, in the empirical analysis, we focus on the option-market measures constructed from options with 30 days to maturity because short-term options are traded more frequently and have lower effective transaction costs relative to long-term options. However, we verify the robustness of our findings using options with longer tenors, i.e., 60 and 91 days to maturity, to construct *MFIS*, *SlopeD*, *IV*, and *VRP*. Third, we employ the trading volume of international trades (*Trade*) as an alternative measure of globalization exposure. Although *Trade* is an equilibrium outcome and captures domestic in addition to foreign shocks, we find consistent results. Last, the option sample is smaller than the sample of stock returns due to the availability of equity options. To alleviate the concern that the evidence from the option market is due to selection bias, we test the difference of excess returns between the low and high-exposure

portfolios in the option sample and find it is negative and significant, consistent with the findings in Barrot *et al.* (2019).

To summarize our empirical results, we find that the uncertainty about globalization is priced in the options market. The evidence on *MIFS*, *SlopeD*, and *CR* supports the view that globalization risk is perceived by investors as good uncertainty. The evidence on *IV* and *VRP* also indicates that investors prefer early resolution of the uncertainty and are willing to pay a premium to ensure their position against globalization risk. Moreover, economic recessions and trade policy uncertainty weaken the positive impact of globalization exposure on enhancing economic growth and provide investors incentives to buy lottery-like securities, and trade policy uncertainty amplifies the contribution of globalization uncertainty to returns variance. Our results survive many robustness tests, including a different way to control the compositional shift of international transportation, option measures constructed based on options with longer maturities, an alternative measure of globalization exposure, and selection bias.

2. Contributions and Related Literature

To the best of our knowledge, this is the first paper using options to examine globalization's implications for asset pricing. We are also the first to provide evidence that potential domestic benefits associated with foreign shocks are perceived in investors' expectations of asset value. Unlike many studies emphasizing the negative influence of uncertainty on economies, our results highlight the positive channel of influence – the growth options offered by globalization.

This paper builds on the growing literature that studies the relationship between risk, asset returns, and globalization. Barrot *et al.* (2019) and DeLisle *et al.* (2020) find firms that are more exposed to globalization carry a higher risk-adjusted excess return, and Barrot *et al.* (2019) provide a theoretical explanation for the globalization risk premium. Fillat and Garetto (2015) show that

multinational firms exhibit higher excess returns than non-multinational firms, and Hoberg and Moon (2019) find selling output abroad is associated with higher stock returns. Their evidence implies increased cash flow risk with trade integration and international business. However, it is unclear whether globalization risk enhances or destroys economic growth, and it is insufficient to identify the sign of the risk price from the stock market. We provide direct evidence from the option market that globalization risk leads to better future economic outcomes and thus is a good uncertainty with a positive price.

Our empirical work supports the theoretical framework of Segal *et al.* (2015), which emphasizes the impact of macroeconomic uncertainty on aggregate growth and asset prices depending on the type of uncertainty. Segal *et al.* (2015) decompose aggregate uncertainty into 'good' and 'bad' volatility components and show that good uncertainty predicts an increase in future economic activity, is positively related to asset valuations, carries a positive market price of risk, and contributes positively to the risk premium. We view the uncertainty about globalization-led growth as a good uncertainty, so it commands a positive risk premium and has a positive market price. Unlike Segal *et al.* (2015), which focus on the stock market aggregate index, we find evidence of equity options from the option market.

Barrot *et al.* (2019) develop a model of trade with asset prices and attribute globalization risk premium to the displacement risk of domestic firms by import competition. They explain, "*…the price of risk is negative. Given the potential domestic benefits associated with foreign shocks, including gains from variety, lower prices, and enhanced export opportunities, this finding is a puzzle*." Admittedly, import competition can destroy asset value. For example, trade openness and economic reforms in emerging economies increase the likelihood of local firms in the U.S. exiting the market (Bernard *et al.* (2006)). However, the potential risk of being displaced by foreign

rivals can encourage innovation and product quality upgrading that help domestic firms escape from import competition (Amiti & Khandelwal 2013; Liu & Rosell 2013; Hombert & Matray 2018). Also, firms undertake capital investment to develop the innovative capacity to facilitate uncertain growth option generation/exercise (Kumar and Li (2016)Kumar & Li 2016). Moreover, international trade leads to gains from increased product variety, a shift toward firms with higher productivity, and lower mark-ups (Melitz (2003); Fajgelbaum and Khandelwal (2016); Feenstra and Weinstein (2017); Feenstra (2018)). Our evidence from the option market is consistent with not only the international economics literature on the gains from trade but also the view that globalization is a beneficial process that moves forward with risk, solving the puzzle raised by Barrot *et al.* (2019).

Our study also contributes to the option literature on the pricing implications of uncertainty. For example, Kelly *et al.* (2016) show empirically and theoretically that options provide valuable protection against the price, variance, and downside tail risks due to political uncertainty. Ilhan *et al.* (2021) find the cost of option protection against climate policy uncertainty is higher for firms with more carbon-intense business models. Both papers unveil the negative impact of policy uncertainty on economic growth. The evidence in this paper indicates how growth options are important for firms involved in international trade and business, so that higher uncertainty can raise their value. Therefore, option protection is less valuable against tail risk due to the uncertainty of globalization growth. However, in line with those two papers, we find the growth effect of uncertainty about globalization is limited in economic recessions. Further, our study contributes to the growing literature investigating the tail risks in the cross-section of individual equities, such as Bollerslev and Todorov (2011, 2014) and Lin and Todorov (2019).

This paper is finally related to two papers that study the economic and stock-market consequences of trade policy uncertainty. Caldara *et al.* (2020) use both firm-level and aggregate macroeconomic data revealing trade policy uncertainty reduce business investment and develop a two-country general equilibrium model with nominal rigidities and firms' export participation to explain the empirical findings. Bianconi *et al.* (2021) examine how stock returns are affected by trade policy uncertainty arising from Congressional votes to revoke China's preferential tariff treatment between 1990 and 2001. They find trade policy uncertainty earns a risk-adjust return of 3.6%-6.2% per year. Consistent with their work, we provide evidence from the option market that trade policy uncertainty blunts the positive consequences of globalization-led growth and increases the risk of firms with high exposure to globalization.

3. Empirical Design

3.1. Globalization Exposure

The cross-border movement of goods and services is intensified by the reductions of barriers to international trade and business, such as lowered transportation costs, tariff reductions, reciprocal trade policies, and fewer restrictions and regulations imposed by host countries on foreign multinationals. Transportation costs are determined by the distance between countries and the nature of the goods and are considered natural barriers to international trade. Higher transportation costs make the integration of global markets more difficult and thus protect firms in a country from foreign shocks and uncertainties of globalization-led growth. Therefore, we measure the extent to which a firm is exposed to globalization by the negative of the natural logarithm of ad valorem shipping costs (*NLnSC*) of the firm's product market (industry) as in the international economics literature and recent studies (Hummels 2007; Barrot *et al.* 2019; DeLisle *et al.* 2020). The ad valorem shipping costs (*SC*) are calculated as the difference between the cost-

insurance-freight value and the free-on-board value of imports divided by the free-on-board value of imports for each industry per year.

There are two common ways of international transportation: air and ocean shipping. Air shipping is of higher quality of service and quicker, though it is more expensive. Cross-border transportation method shifts from ocean to air as the relative price of air-to-ocean shipping falls (Harrigan 2010). A concern of using *NLnSC* to measure globalization exposure is that it does not reflect this compositional shift and thus can bias the estimation. We follow Hummels (2007) and regress *NLnSC* on the natural logarithm of the weight-to-value ratio (*LnWTV*), year dummies, and industry dummies in an industry-year panel. The weight-to-value ratio (*WTV*) is computed as the ratio of the weight in kilograms to the free-on-board value of imports. The difference between *NLnSC* and the fitted value of *LnWTV* is the value of *NLnSC* after controlling for compositional change, and we name the value *NLnSCAdj* and use it as the main measure of globalization exposure in our empirical analysis.

We first obtain the annual data on international trade flows at the four-digit SIC industry level over the period 1989-2018 from Peter Schott's website.[6] We also aggregate the data up to the three- and two-digit SIC industry level. Next, we compute the ad valorem shipping costs (*SC*) and weight-to-value ratio (*WTV*) by four-, three-, and two-digit SIC for each year. Last, we construct *NLnSCAdj* based on the fixed-effect regressions of *NLnSC* on *LnWTV* and year dummies for the panels of three levels of SIC industries.

Before examining measures from the option market, we provide preliminary evidence that globalization encourages future economic activities. Specifically, we regress industry capital investment rate on the prior-year measure of globalization exposure, total factor productivity,

[6]Peter Schott's website: https://sompks4.github.io/sub_data.html

capital intensity, employment, and skill intensity and control for year fixed effects and four-digit SIC industry fixed effects.[7] Table 1 reports the results. Column (1) uses *NLnSCAdj* as the measure of globalization exposure, and column (2) uses *NLnSC* and includes *LnWTV* to control the compositional changes over time. The coefficient of *NLnSCAdj* in column (1) and the coefficient of *NLnSC* in column (2) are both positive and significant, suggesting globalization exposure encourages capital investments.[8]

3.2. Measures from the Options Market

We employ three option market measures to test whether uncertainties about globalization-led growth are perceived as good uncertainties. The first one is the skewness of the risk-neutral distribution. We use the model-free characterization of the risk-neutral skewness (*MFIS*) developed by Bakshi and Madan (2000) and Bakshi *et al.* (2003). It measures the return asymmetry using the cubic contract that simultaneously takes a long position in OTM calls and a short position in OTM puts. When the risk-neutral distribution is left-skewed, OTM puts will be priced at a premium relative to OTM calls, and thus the cost of positioning in puts exceeds the calls position, resulting in negative skewness. Further, the price of the cubic contract is normalized by the risk-neutral variance, which makes the skewness measure comparable across time and in the cross-section of individual equities.[9] The model-free *MFIS* is constructed using OTM options, for which the early exercise premia is negligible, and the small portfolio weighting applied to closer to ATM options will mitigate their impact (Bakshi *et al.* 2003). *MFIS* provides information about the expensiveness of protection against left tail events relative to right tail events. Less negative values

[7]The definition and data source of these industry-level control variables are described in Appendix.

[8]We winsoriz *NLnSC*, *LnWTV*, and *NLnSCAdj* at 1% and 99% and normalize them to [0,1] for all regressions in our empirical analysis. We also winsoriz the dependent and other control variables in at 1% and 99%.

[9]Although parametric measures of skewness have been suggested in the literature, using a model-free approach is particularly useful for stock options due to the challenges of characterizing risk-neutral densities for American options.

of *MFIS* indicate a relocation of probability mass under the risk-neutral measure from the left to the right tail, and vice versa. *MFIS* can be interpreted as the cost of protection against left tail events relative to the cost of gaining positive realizations on the right tail. Hence, we investigate investors' expectations of high globalization-exposed firms via the movement of probability mass - *MFIS*.

Second, we follow the previous studies and use the slope of the implied volatility curve or the so-called "volatility smile" relating implied volatility to moneyness, to capture the downside tail risk (Bakshi *et al.* 2003, Kelly *et al.* (2016)). More specifically, we use implied volatilities of OTM puts as the perceptions of investors regarding the likelihood of negative jumps are reflected in the pricing of these assets. Higher likelihood of adverse states or greater risk prices attached to these states results in higher prices of the OTM puts and, consequently, higher implied volatilities. The downside tail risk (*SlopeD*) is the coefficient estimate obtained from regressing OTM put implied volatilities of each stock on their corresponding moneyness and a constant.

We follow Kelly *et al.* (2016) and use options' delta as a proxy for moneyness because, unlike the alternative measure of strike over spot price, option delta accounts for the risk-free rate, volatility level and options' maturities (Hull and White (2017) and Kelly *et al.* (2016)). Deltas of put options are negative and increase (becomes less negative) for deeper OTM puts. OTM put options with higher delta best represent insurance against low-probability crashes in the underlying stock price. Therefore, when such insurance is more expensive due to the higher likelihood of crashes or greater risk price of such adverse states, the prices of OTM options are higher, resulting in a more positive slope coefficient (*SlopeD*). We study how investors perceive the likelihood of a sharp drop in stock price with respect to globalization using *SlopeD*.

The third measure is call ratio (*CR*), following Blau *et al.* (2016). It is the proportion of total options volume that is made up from call options, which is associated with investors' lottery preferences. Call options can be attractive financial securities for investors with lottery preferences because the nonlinear payoff structure of call options allows for unlimited upside potential with limited downside risk (Boyer and Vorkink, 2014). Blau *et al.* (2016) find that preferences for lottery stocks are reflected in higher call ratio. We test whether stocks with higher exposure to globalization have lottery-like characteristics because good news are more likely to be associated with them. Therefore, we examine the lottery-like characteristics of such stocks by evaluating investors' trading activities in the options market through the lens of the call ratio.

No matter whether the uncertainty about globalization is good or bad for economic growth, it increases the variance of an asset's return, and risk-averse investors would pay a higher price (or accept negative average excess returns) for options that provide a hedge against increased variance (Bakshi and Kapadia, 2003; Carr and Wu, 2009). We use two option measures to test whether stock returns become more volatile and whether a higher variance risk premium is associated with globalization. The first one is the implied variance (*IV*) derived from options reflects the risk-natural expected variance of the underlying stock's returns. It is computed for options with 30 days to maturity, using the model-free approach of Britten-Jones and Neuberger (2000). The *IV* captures volatility risk due to uncertainty.

The second measure is the variance risk premium (*VRP*), defined as the difference between the implied variance (*IV*) and realized variance (see e.g., Bollerslev, Tauchen, and Zhou, 2009; Carr and Wu, 2009). The realized variance is the variance of realized returns over the term of options, that is the next 30 calendar days. The *VRP* captures the cost of protection against general uncertainty related to the volatility risk.

The option data is obtained from OptionMetrics, which provides daily data on implied volatilities, deltas, trading volume, and open interest for all U.S. firms with equity options data. We obtain stock returns, prices, and trading volume from the Center for Research in Security Prices (CRSP). The balance sheet data of firms are from the Standard and Poor's Compustat database.

3.3. Sample and Empirical Methodology

We estimate the following regression of the option market measures on the globalization exposure proxy and a set of control variables

$$OMM_{i,j,m+1} = \beta_0 + \beta_1 NLnSCAdj_{j,m} + x_{i,j,m}\beta + +\varepsilon_{i,j,m} \quad (1)$$

where $OMM_{i,j,m+1}$ denotes one of the five option market measures: *MFIS*, *SlopeD*, *CR*, *IV*, and *VRP* for firm *i* in month *m+1* as described in Section 3.2. Each option market measure is the annualized value at the monthly level by taking the average of daily values. $NLnSCAdj_{j,m}$ is the measure of globalization exposure for firm *i* operating in the SIC industry *j* in month *m*.[10,11] We expect a positive β_1 in the regressions of *MFIS*, *CR*, *IV*, and *VRP* and a negative value for that of *SlopeD*.

The vector $x_{i,j,m}$ denotes a set of independent variables controlling for the firm, stock, option, and industry characteristics that can affect the option market measures. In line with the assets pricing literature, we control for firm size (*lnSize*), book-to-market (*BTM*), return on equity (*ROE*), capital investment (*Investment*), leverage (*Leverage*), and dividend payout ratio (*Dividends*). We also include measures of beta (*Beta*), return (*Ret*), momentum (*Momentum*),

[10] A firm's SIC industry classification is based on its historical SIC from Compustata Annual as well as its primary sector's SIC from Compustat Segment Database to consider the changes of a firm's industry. If both information is missing, we will use current SIC from Compustat Annual Database. If a firm cannot be classified to a definitive 4-digit SIC industry, we use its 3-digit SIC. If a firm cannot either be classified to a definitive 3-digit SIC industry, we use its 2-digit SIC. We use the Compustat-CRSP linked table to assign a firm's SIC industry to its option market measures

[11] *NLnSCAdj* is measured by annual frequency. Thus, a firm will have the same value within a year.

illiquidity (*illiquidity*), and volatility (*Volatility*) for the firm's stock. Since globalization is associated with technology developments, we include the natural logarithm of total factor productivity (*lnTFP*), a measure of capital intensity (*Capital Intensity*), skill intensity (*Skill Intensity*), and the natural logarithm of employment *(lnEmployment*) to measure industry productivity and characteristics.[12]

We use three empirical models to estimate the regression (1). The first model is Fama MecBeth regression, and we use the heteroscedasticity and autocorrelation consistent Newey and West (1987) standard error estimates. The second one is a panel regression controlling for fixed industry fixed effects and month fixed effects, and standard errors are robust and clustered by firm. The third model adds firm fixed effects to the second model.

Because of the availability of option data by OptionMetrics and International Trade Data, our sample period ranges from January 1995 to December 2019.[13] We maintain observation with non-missing values of the globalization exposure measure and non-missing values of one of the five option market measures. Our final sample includes all manufacturing firms and consists of 272,625 combinations of month-stock observations, including 2,957 distinct firms from 360 SIC codes. On average, there are 947 stocks per monthly cross-section. Table 2 presents the summary statistics of option market measures, the globalization exposure measure, and control variables in regression (1). All continuous variables are winsorized at 1st and 99th percentiles. Consistent with previous studies, we find that, on average, the risk-neutral distribution of stocks (*MFIS*) is negatively skewed (see, e.g., Bates 1991, Rubinstein 1994). *SlopeD* measures the steepness of volatility smile implied from OTM puts. The mean of *SlopeD* is 0.329, indicating that on average,

[12]We use the NBER-CES Manufacturing Industry Database to compute the industry-level measures

[13]The first year for which option data is available is 1996, and we link that to the annual trade measures in the previous year, which is 1995. The last year for which industry-level measures is available is 2018, and we link that to the next-year option data, which is 2019.

OTM put options, for which the delta is higher (less negative), are more expensive than their corresponding ATM puts. The mean value of call ratio is 0.667, which is comparable to that in Blau *et al* (2016). In addition, consistent with Bakshi and Kapadia (2003b), we see that the variance risk premium, measured as the implied variance minus realized variance, is on average positive in individual equities.

4. Empirical Results

This section explores whether and how the uncertainty about the globalization outlook is reflected in option-market measures of investors' expectations of future stock price dynamics. On the one hand, the common view regards globalization as a beneficial process, and uncertainties about the size of globalization benefits encourage future economic activities. Should investors expect positive future stock returns, option-implied skewness becomes less negative, the demand for call options increases, and the cost of insurance against downside price movement proxied by OTM put option price is lower. On the other hand, the variance of stocks' returns increases with uncertainty, no matter whether it is good or bad, and risk-averse investors would pay for the price premium of options that provide a hedge against increased variance. We first study the positive view of uncertainty about globalization and then examine the variance consequence of globalization exposure in the option market. In the subsequent analysis, we explore how economic conditions and the uncertainty about trade policy change the impact of globalization exposure on the option-market measures.

4.1. Good Uncertainty: MFIS, SlopeD, and CR

As described in the previous section, *MFIS* measures the asymmetry in the risk-neutral distribution of firms, *SlopeD* proxies for the likelihood of adverse states or the insurance cost attached to them, and *CR* is call ratio reflecting the proportion of total options volume that is made

up of call options. We use them to capture how uncertainties about the size of globalization benefits are perceived by investors. Table 3 provides the preliminary evidence on *MFIS*, *SlopeD*, and *CR* by sorting firms into quintiles each month based on the globalization exposure measure. Panel A reports the results using the main measure, *NLnSCAdj*, the negative of the natural logarithm of valorem shipping costs after controlling for the compositional shift of international transportation, and Panel B uses the negative of the natural logarithm of valorem shipping costs, *NLnSC*.

The results in both Panel A and B of Table 3 consistently deliver three messages. First, firms with higher globalization exposure have higher (less negative) skewness, indicating the buying pressure for OTM calls relative to their OTM puts counterparts, which can signal the investors' expectation for positive future stock returns of more exposed firms. Second, the steepness of implied volatility smile for highly exposed firms in the fifth quintile is significantly lower than that of the firms in the first quintile with the lowest exposure to globalization. It indicates that investors perceive a lower likelihood for downward price jumps in more exposed firms or consider a lower value for the insurance against such an event relative to the firms with larger barriers to international trades. Third, for firms with lower barriers to international trade (higher globalization exposure) in the fifth quintile, call options trading volume comprises a larger proportion of total monthly trading volume. It supports the argument that investors expect positive future stock returns for more exposed firms, and there is a demand pressure for call options with lottery-like payoffs on their underlying stocks.

Next, we estimate the regression (1) in which *MFIS*, *SlopeD*, and *CR* are the dependent variable, respectively, and present the results in Table 4. Panel A reports the average coefficients obtained from monthly Fama-MacBeth, Panels B reports the results of a panel regression controlling for fixed industry effects and fixed year-month effects, and Panel C adds firm fixed

effects to the model in Panel B.[14] Column (1), (4), and (7) present the coefficient estimates from the regressions using *MFIS* as the dependent variable. The coefficient loading on the globalization exposure proxy, *NlnSCAdj*, is positive and significant in the three models, implying greater risk-neutral skewness for more exposed firms. This is because traders have more positive forward-looking beliefs about the future performance of firms with higher globalization exposure, shifting the probability mass from downside to upside of the risk-neutral distribution.

Column (2), (5), and (8) reports the estimation results of regression (1) using *SlopeD* as the dependent variable. The coefficient loading on the measure of globalization exposure, *NlnSCAdj*, is negative and significant in the three models, meaning *SlopeD* decreases with globalization exposure. The price of OTM put options on a firm is relatively less expensive than their corresponding ATM options as the firm is more exposed to globalization, implying that lower cost of insurance against the downside tail risks due to uncertainties about the size of globalization-led economic growth.

Column (3), (6), and (9) reports the estimation results of regression (1) using *CR* as the dependent variable. The coefficient loading on the measure of globalization exposure, *NlnSCAdj*, is positive and significant in the three models, meaning *CR* increases with globalization exposure. The higher call ratio of more exposed firms indicates the presence of a higher demand pressure for call options on these assets because they provide exposure to upward price movements, confirming the findings and argument about *MFIS*.

4.2. Implied variance and Variance Risk Premium

The variance of stocks' returns increases with uncertainty about the outlook of globalization, no matter whether it is good or bad, and risk-averse investors would pay at a

[14] *NLnSCAdj* is scaled to range between zero and one for the inclusion of interactions in regression (1) in Section 4.3 and 4.4.

premium to hedge against increase variance. We use *IV* derived from options to measure price risk of their underlying stocks and *VRP* to capture the value of option protection against variance risk. We expect *IV* and *VRP* to take larger values for firms more exposed to globalization because stocks price is more likely to move upward and downward with the integration of global markets.

Sorting firms based on their negative adjusted shipping costs over the previous year (*NLnSCAdj*), Panel A of Table 5 shows that the *IV* of the firms in the quintile with the highest exposure to international trade is 0.5268, which is substantially higher than that of the least exposed firms, 0.3145. The difference between the implied variance of high and low-exposed firms in our sample is both economically and statistically significant. Panel A of Table 5 also documents the average *VRP* for quintiles of firms sorted on *NLnSCAdj* over the previous month. More exposed firms, on average, have higher *VRP*. Panel B uses the negative of the natural logarithm of valorem shipping costs, *NLnSC*, to group firms into quintile, and the results are consistent with Panel A.

Table 6 reports the coefficient estimates of regression (1) in which the *IV* is the dependent variable in column (1), (3), and (5), and *VRP* is the dependent variable in column (2), (4), and (6). A similar conclusion is obtained after controlling for the characteristics of firms, industry, and the stock market, by using Fama-MacBeth regressions in Panel A, as well as panel regressions, for which we apply year-month and industry fixed effects in Panel B, adding fixed firm effects in Panel C. The coefficient loading on *NLnSCAdj* are economically significant and positive, suggesting investors expect a higher volatility of stock return for more exposed firms and are willing to pay a premium for options providing insurance against increased variance risk.

The evidence on *IV* and *VRP* in Table 5 and 6 is consistent with the finding in the stock market in Barrot et al. (2019) that firms exposed to globalization earn higher excess returns. This is due to the increased price risk and variance of stock returns. However, the stock market evidence

cannot tell that the risk associated with globalization is perceived to be beneficial or harm to economic growth, while the option market finding makes it clear about the bright outlook of globalization.

4.3. The role of Economic Conditions

We exploit the role played by economic conditions in affecting investors' perception about the integration of global economy. Firms perform worse in the economic downturn than in normal times, and investors tend to believe the good news associated with globalization is less likely to occur when the economy is weak. Moreover, the stock price is more likely to decline, the price drop might be larger when the economy is in recession, and investors look for protection against adverse economic condition and pay higher cost for options that provide such insurance. Third, the call options of stocks have lotter-like characteristics are more attractive in the weak economy time. Therefore, the effect of globalization exposure in increasing *MFIS* and reducing *SlopeD* would be weakened by economic recessions, while the positive impact of globalization exposure on *CR* will be strenghtened.

To test how the impact of globalization exposure changes with economic conditions, we first create an indicator of economic recession months (*Recession*) according to the National Bureau of Economic Research (*NBER*) definition. Then, we include *Recession* and its interaction with the measure of the exposure to globalization in regression (1). Table 7 reports the estimation results of the fixed industry and year-month effect panel regressions. The dependent variable is *MFIS*, *SlopeD*, *CR*, *IV*, and *VRP* in column (1) – (5), respectively. For brevity, the coefficients of *NLnSCAdj*, *Recession*, and their interactions are reported.

Consistent with prior literature (Kelly et al, 2016) that investors pay higher costs for option protection against uncertainty and ask for compensation for increased variance of stock returns,

the coefficient of *Recession* is significantly positive for *SlopeD*, *IV*, and *VRP*, but significant and negative for *MFIS* and *CR*. More importantly, we find a positive and significant coefficient of the interaction between *Recession* and *NLnSCAdj* for *SlopeD* and *CR* and a significantly negative coefficient for *MFIS*. It implies weak economy prevents the uncertainty about globalization-led growth from promoting future economic activities, and lottery-like stocks are more attractive to investors in economic recessions.

4.4. Trade Policy Uncertainty

Most recent work has demonstrated that the uncertainty about trade policy has an adverse consequence to capital investment rate (Caldara *et al.*, 2020) as well as stock returns (Bianconi *et al.*, 2021). Trade negotiations, proposals for a new trade policy or for revising old trade policies, and trade wars between countries create such uncertainty about the outlook of trade integration, which can slow down the globalization-led growth and discount the prize of globalization. Hence, the negative consequence of trade policy uncertainty would weaken the growth effect of globalization but increase lottery preference and the risk of globalization.

Caldara *et al.* (2020) construct an aggregate index of trade policy uncertainty (*TPU*) using newspaper coverage, and we employ *TPU* to test whether the uncertainty about trade integration weakens the impact of globalization on *MFIS* and *SlopeD* and strengthens the effect on *IV* and *VRP*. Specifically, we add *TPU* and its interaction with the measures of globalization exposure to regression (1) and control for the role of economic conditions.[15] Table 8 reports the estimation results of the fixed industry and year-month effect panel regressions. The dependent variable is *MFIS*, *SlopeD*, *CR*, *IV*, and *VRP* in column (1) – (5), respectively. For brevity, Table 8 only reports

[15] *TPU* is scaled to range between zero and one.

the coefficients of *NLnSCAdj*, *TPU*, *Recession*, the interaction between *NLnSCAdj* and *TPU*, and the interaction between *NLnSCAdj* and *Recession*.

In line with prior studies' evidence, we find the coefficient of *TPU* is significantly positive for *SlopeD*, *IV*, and *VRP*, but significant and negative for *MFIS* and *CR*, implying the negative view of investors on the uncertainty of trade integration. More importantly, the coefficient of the interaction, *TPU*× *NLnSCAdj*, in the regressions of *SlopeD*, *CR*, IV, and *VRP* is positive, and in the regression of *MIFS* is significantly negative. It suggests that trade policy uncertainty erodes the positive consequences of globalization-led growth and strengthens the positive impact of globalization risk on the variance of stock returns. Also, investors' demand for call options on stocks with higher globalization exposure are even higher when there is uncertainty about trade policy because such assets deliver lottery-like payoffs. Besides, the coefficients of both *Recession* and *NLnSCAdj*×*Recession* are consistent with those in Table 7, suggesting the impact of either trade policy uncertainty or economic conditions is independent of the inclusion of each other.

5. Robustness Checks

5.1. Controlling for Compositional Shift of International Transportation

In the main empirical analysis, we adjust shipping costs by using the weight-to-value ratio to control the compositional shift of international transportation from ocean to air shipping (Harrigan, 2010; Hummels, 2007). Specifically, we first regress the negative natural logarithm of ad valorem shipping costs (*NLnSC*) on the natural logarithm of the weight-to-value ratio (*LnWTV*), year dummies, and industry dummies in the industry-year panel. Then, we use the difference between *NLnSC* and the fitted value of *LnWTV* to measure globalization exposure. This method can generate measurement error of the exposure measure *NLnSCAdj*.

To eliminate the concern of measurement error of globalization exposure, in our regressions, we substitute the variable *NLnSCAdj* with *NLnSC* and include *LnWTV* in the regression (1).[16] Table 9 reports the estimation results. It is comparable to Table 4 and 6, except that the measure of globalization exposure is the negative natural logarithm of ad valorem shipping costs, and the compositional shift of international transportation is controlled by the weight-to-value ratio. In line with Table 4, the coefficients loading on *NLnSC* are positive and significant for *MFIS* and *CR* and negative and significant for *SlopeD*. The evidence suggests that investors expect good news is more likely to occur and a lower likelihood of negative jumps in the stock price for firms more exposed to globalization. Consistent with Table 6, the coefficients of *NLnSC* are positive and significant for both *IV* and *VRP*. It indicates, no matter whether it is good or bad uncertainty, the variance of stocks' returns increases with uncertainty about the size of globalization-led growth.

Table 10 replicates the regressions in Table 8, which study how economic conditions and uncertainty about trade integration change the effect of globalization exposure on option market measures. But we replace *NLnSCAdj*, *NLnSCAdj*×*Recession*, and *NLnSCAdj*×*TPU* by *NLnSC*, *NLnSC*×*Recession*, and *NLnSC*×*TPU* and add *LnWTV* to control for the compositional shift of international transportation. First, consistent with Table 8 on the effect of trade policy uncertainty, we find a positive and significant coefficient of the interaction between *TPU* and *NLnSC* for *SlopeD, IV,* and *VRP* and a significantly negative coefficient for *MFIS*. The uncertainty about trade integration weakens the positive view of investors on globalization, and the variance of stock return and variance premium of more-exposed firms increase more in the period of trade policy uncertainty. Second, in line with Table 7 and 8 on the role of economic conditions, the coefficient

[16] *NLnSC* is scaled to range between zero and one for the inclusion of interactions in regression (1) in Table 10.

of *NLnSCj*×*Recession* is significant and negative for *MFIS* and positive for *SlopeD*, implying a weak economy discourages good uncertainty from promoting future economic activities. In addition, we find the positive impact of globalization exposure on variance risk premium is higher in the economic recession, as evidenced by the significantly positive coefficient on *NLnSCj*×*Recession* in column (5).

5.2. Alternative Measure of Globalization Exposure

We consider an alternative proxy of globalization exposure – trading volume, *Trade*, in this section. It is the sum of exports and imports divided by gross domestic production (GDP) and computed by industry and reflects the flow of international trade in a country's industries.[17] High *Trade* indicates a highly intensive cross-border movement of a product and high exposure to globalization for firms in the product market.

Columns (1)-(5) of Table 11 replicate the regressions in Panel B of Table 9, except we substitute the variable *NLnSC* with *Trade*. Columns (6)-(10) of Table 11 replicate the regressions in Table 10 except we substitute the variable *NLnSC*, *NLnSC*×*Recession*, and *NLnSC*×*TPU* with *Trade*, *Trade*×*Recession*, and *Trade*×*TPU*. For brevity, we only report the coefficient estimates of the variables of interest. Consistent with the main results, we find first that an increase in the volume of international trade is associated with an increase in *MFIS*, *CR*, *IV*, and *VRP* and a decrease in *SlopeD*. Second, the positive effect of trade volume on *MFIS* and negative effect on *SlopeD* are dampened by a weak economy and trade policy uncertainty. Third, the positive effect of trade volume on *CR*, *IV* and *VRP* are reinforced by the uncertainty about trade integration.

[17]Because exports are the equilibrium outcomes of foreign demand and domestic supply shocks, and imports are the outcomes of foreign supply and domestic demand shocks, the flow of international trades reflects the effect of domestic shocks. *Trade* may be a noisy measure of globalization exposure, and we only use it for robustness check.

5.3. Option Measures constructed by Options with 60- and 91-day Maturities

We conducted our main analyses using options with 30 days to maturity. In this section, we evaluate the robustness of our findings when option measures are constructed using options with 60 and 90 days to maturity, for which the results are documented in Tables 12 and 13, respectively. For brevity, we only report the coefficient estimates of the variables of interest.

Panel A of both Tables 12 and 13 confirms that higher globalization exposure of firms is associated with a shift in the probability mass from the left side of the risk-neutral density to the right side, reflected in higher (less negative) risk-neutral skewness (*MFIS*). Second, the value of options protection against negative jumps, captured by the left tail slope measure (*SlopeD*), is lower for more exposed firms. Third, the price risk (*IV*) and the value of options protection against the volatility risk (*VRP*) are higher for more exposed firms.

Panel B of both Tables 12 and 13 adds the interaction of globalization exposure with economic cycles and trade policy uncertainty to Panel A. Both tables show the marginal effect of globalization exposure to shift risk-neutral density to the upside events is weakened in economic recessions. The trade policy uncertainty leads to a higher variance risk premium to compensate for the globalization-induced increase in the volatility of stock return. The cost difference of option protection against a sharp stock price drop between less- and more-exposed firms shrinks in an economic downturn in Table 12 using options with 60 days to maturity and in the period of trade policy uncertainty in Table 13 using options with 90 days to maturity.

5.4. Sample Selection Bias

The option sample we used in the study is smaller than the stock sample used in the prior work (Barrot et al, 2019). Also, we use the SIC industry classification according to Compustat Annual and Segment Dataset, while the prior work uses the classification according to the CRSP.

To alleviate the concern of small sample and selection bias, we test the difference of 5-factor model risk-adjusted excess returns between the low and high-exposure portfolios in the option sample. Specifically, we replicate the regressions in Table V of Barrot et al. (2019) in which they tested the difference of five-factor risk-adjusted excess returns between the low and high-exposure portfolios. We report the estimation result in Table 14. Consistently, we find high exposure portfolio (low shipping cost or weight-to-value) has significantly higher alpha than a low exposure portfolio (high shipping cost or weight-to-value).

6. Conclusions

This paper use options to examine globalization's implications for asset pricing and finds the potential domestic benefits associated with globalization are perceived in investors' expectations of asset value.

We employ five options measures to examine how the uncertainty about globalization-led growth is priced in the options market. The first measure is the skewness of the risk-neutral distribution, and a high skewness of individual equities means that investors perceive a higher chance for positive price movements relative to negative price changes. The second one is the steepness of volatility curves implied from OTM puts with respect to options' moneyness, capturing the cost of insurance against downward price movements of the underlying stocks. The third one is the call ratio reflecting investors' lottery preferences. We use the implied variance as the fourth and the variance risk premium (*VRP*) as the fifth measure.

The uncertainty of globalization prospects is more relevant for firms incurring lower barriers to international trade, and we use the negative natural logarithm of adjusted shipping costs of a firm's industry to measure the globalization exposure of the firm. Good uncertainty implies investors expect good news about the future performance of firms more exposed to globalization.

It also indicates that investors perceive a lower likelihood for negative jumps in the stock price of more-exposed firms, leading to a lower downside tail risk. Consistently, we find a higher globalization exposure corresponds to a higher skewness and call ratio and a flatter volatility curve implied from the OTM puts. The variance of stocks' returns increases with the uncertainty, regardless of whether the uncertainty is good or bad. As a result, risk-averse investors would pay a risk premium for options that provide a hedge against increased variance. Consistently, we find globalization exposure increases the implied variance and variance risk premium.

Moreover, economic recessions and trade policy uncertainty weaken the positive impact of globalization exposure on enhancing economic growth and provide investors incentives to buy lottery-like securities, and trade policy uncertainty amplifies the contribution of globalization uncertainty to returns variance. Our results survive many robustness tests, including a different way to control the compositional shift of international transportation, option measures constructed based on options with longer maturities, an alternative measure of globalization exposure, and selection bias.

Appendix A. Option Sample

Following previous studies, (e.g., Kelly, P´astor and Veronesi (2016), Ilhan, Sautner, and Vilkov (2021)), we construct the risk-neutral skewness and tail risks using out-of-the-money (OTM) options with absolute value of delta ranging from 0.1 to 0.5. We exclude deep OTM options with the absolute value of delta between zero and 0.1, because the measurement of their implied volatility is very sensitive to small pricing errors (e.g., Hentschel (2003) and Beber and Brandt (2006)). For our main results, we use options with 30 days to maturity, because of the higher trading volume and lower transaction costs of short-term options relative to those with longer maturities (Muravyev and Pearson (2020)). In addition, we verify the robustness of our findings to using different maturities of options.

Implied volatility measures obtained from the Volatility Surface data. OptionMetrics applies a kernel smoothing technique to volatilities implied from closing option prices to inter- and extrapolate the volatility surface for standard levels of maturity and delta.[18] Further, we process the volatility surface data to make the surface less discrete in terms of moneyness, defined as the strike over spot price. To this end, we follow Ilhan et al. (2021) and interpolate the daily implied volatility surface for each stock and maturity level of options using a piecewise cubic Hermite interpolating polynomial function.

There are important advantages to using a standardized volatility surface. First, we can compute daily risk-neutral moments using volatilities implied by a sample of equity options homogeneous in maturity. Second, the lack of traded quotes for options with the exact moneyness and maturity levels of our interest does not result in missing the estimation of risk-neutral moments

[18]Individual equity options are American options and OptionMetrics uses a proprietary algorithm based on the Cox, Ross and Rubinstein (1979) binomial tree model to calculate implied volatilities of traded options and then inter- and extrapolate the smooth volatility surface. Further details about the kernel function are described in the IvyDB US Reference Manual (version 5.0).

because we can still interpolate the information from the neighboring data points on the volatility surface. Therefore, we maintain a larger cross-section of stocks than what is possible in the alternative approach of using traded option quotes.

Appendix B. Control Variables

Variable	Description
lnTFP	Natural logarithm of five-factor total factor productivity index.
Capital Intensity	Total industry real capital stock over total industry real value of shipments.
Skill Intensity	One minus production woker wages over total industry payroll.
lnEmployment	Natural logarithm of total employment (in 1000s) of an industry.
lnSize	The natural logarithm of the firm's size, which is the lagged market capitalization.
BTM	Book value of equity (ceq) divided by the end of fiscal year-end market capitalization (Rosenberg *et al.* (1985)).
Ret	Stock returns over the last month.
Beta	The CAPM beta is defined as the coefficient of three-year rolling regressions of weekly excess stock returns on excess market returns, prior to month *t*. We require at least one year of non-missing returns, and use equal-weighted CRSP index as the market index.
Momentum	11-month cumulative returns ending one month prior to month *t* (Jegadeesh (1990)).
Illiquidity	Amihud (2002) illiquidity measure computed as the average of daily (absolute return/dollar volume).
ROE	Return on equity computed as the income before extraordinary items (*ib*) divided by lagged book-value of equity (*ceq*).
Investment	Capital expenditure over net property, plant and equipment..
Leverage	Total liabilities (lt) divided by fiscal year-end market capitalization (Bhandari (1988)).
Dividends	The dividend yield is measured as total dividends (dvt) divided by market capitalization at fiscal year-end (Litzenberger and Ramaswamy (1982)).
Volatility	The realized volatility is computed as the standard deviation of stock returns over the month prior to month *t*.

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Table 1. Globalization Exposure and Future Economic Activities

This table examines whether globalization exposure encourages future economic activities. we regress industry capital investment rate (total real capital expenditure over total real capital stock) on the prior-year measure of globalization exposure, total factor productivity, capital intensity, employment, and skill intensity and control for fixed year effects and fixed four-digit SIC industry effects. Column (1) uses *NLnSCAdj* as the measure of globalization exposure, and column (2) uses *NLnSC* and includes *LnWTV* to control the compositional changes over time.

	(1)	**(2)**
NLnSCAdj	0.013**	
	(2.44)	
NLnSC		0.017***
		(2.64)
LnWTV		-0.003*
		(-1.79)
lnTFP	0.006	0.005
	(0.95)	(0.87)
Capital Intensity	-0.049***	-0.049***
	(-10.18)	(-9.98)
lnEmployment	0.009***	0.008***
	(4.01)	(3.74)
Skill Intensity	-0.024**	-0.023**
	(-2.03)	(-1.98)
Fixed Year Effects	Yes	Yes
Fixed Industry Effects	Yes	Yes
Adjusted R2	0.484	0.486
Observations	12724	12716

Table 2. Summary Statistics

This table reports the summary statistics of trade measures and economic activities in Panel A, including the negative natural logarithm of adjusted shipping costs (*NLnSCAdj*) of a firm's industry as a measure of the firm's globalization exposure, the natural logarithm of 5-factor TFP (*lnTFP*), capital intensity by industry (*Capital Intensity*), the natural logarithm of employment by industry (*lnEmployment*), and skill intensity using salary by industry (*Skill Intensity*). Panel B reports the summary statistics of the measures from the options market, including the model-free implied skewness (*MFIS*), the negative tail risk (*SlopeD*), the ratio of call options trading volume over the aggregate trading volume of options over the previous month (*CR*), the annualized model-free implied variance of options with 30 days to maturity (*IV*), the annualized variance risk premium (*VRP*) computed as the implied variance minus the stock return variance over the term of the options. Firm-level control variables reported in Panel C are the natural logarithm of the firm's market capitalization (*lnSize*), book-to-market (*BTM*), Beta from CAPM regressions of weekly returns over the last three years (*Beta*), one-month momentum (*Momentum*), Amihud illiquidity measure (*Illiquidity*), return on equity (*ROE*), investment (*Investment*), firm's leverage (*leverage*), dividend-to-price ratio (*dy*), realized volatility over the previous month (*volatility*). The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles.

Variable	N	Mean	STD	25th	Median	75th
MFIS	267,411	-0.337	0.488	-0.595	-0.302	-0.046
SlopeD	267,411	0.329	0.369	0.090	0.217	0.435
CR	269,869	0.667	0.215	0.537	0.684	0.831
IV	267,411	0.398	0.391	0.139	0.267	0.509
VRP	267,358	0.104	0.339	0.010	0.071	0.189
NlnSCAdj	272,625	2.899	0.393	2.663	2.900	3.173
LnTFP	263,542	0.276	1.043	-0.174	0.008	0.174
Capital Intensity	263,542	0.514	0.299	0.323	0.482	0.675
lnEmployment	263,542	4.228	0.937	3.624	4.268	4.919
Skill Intensity	263,542	0.526	0.153	0.400	0.549	0.647
lnSize	272,602	13.971	1.705	12.750	13.827	15.020
BTM	264,572	0.410	0.326	0.194	0.344	0.555
Ret	272,596	0.009	0.145	-0.068	0.006	0.079
Beta	263,335	1.365	0.648	0.891	1.282	1.760
Momentum	255,473	0.138	0.560	-0.201	0.061	0.339
Illiquidity	264,572	0.019	0.053	0.000	0.002	0.011
ROE	256,170	-0.012	0.639	-0.081	0.101	0.210
Investment	265,132	0.277	0.200	0.138	0.213	0.361
Leverage	263,822	0.561	0.825	0.107	0.293	0.653
Dividend	264,292	0.009	0.016	0.000	0.000	0.014
Volatility	272,621	0.467	0.280	0.270	0.395	0.582

Table 3. Good Uncertainty: Portfolio Sorts

This table presents the average of monthly left tail risk (*SlopeD*), model-free implied skewness (*Skew*), and call ratio (*CR*) for quintiles of firms constructed based on their globalization exposure over the previous year. The globalization exposure is measured as the negative of the natural logarithm of ad valorem shipping costs (*NLnSC*) of the firm's product market (industry). To construct portfolios in Panel A, firms are sorted based on the adjusted ad valorem shipping cost (*NLnSCAdj*) over the previous year, which controls for the compositional changes (Hummels 2007). Panel B reports the results when firms are sorted based on *NLnSC* before controlling for compositional changes. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. $* p < 0.1$; $** p < 0.05$; $*** p < 0.01$.

	Low Exp				**High Exp**	**Hgh-Low**	***t*-stat**
	1	**2**	**3**	**4**	**5**	**5 - 1**	
Panel A. *NLnSCAdj*							
MFIS	-0.3855	-0.3838	-0.3864	-0.2859	-0.2632	0.1218***	(39.48)
SlopeD	0.3630	0.3524	0.3612	0.2931	0.2911	-0.0723***	(-29.70)
CR	0.6407	0.6530	0.6566	0.6772	0.6856	0.0489***	(38.10)
Panel B. *NLnSC*							
MFIS	-0.4229	-0.4221	-0.3340	-0.3187	-0.2170	0.2069***	(70.83)
SlopeD	0.3760	0.3655	0.3351	0.3202	0.2691	-0.1080***	(-45.30)
CR	0.6376	0.6393	0.6627	0.6761	0.6960	0.0650***	(53.07)

Table 4. Good Uncertainty: Fama-MacBeth and Panel Regressions

This table reports the results from regressing the model-free implied skewness (*MFIS*), the left tail risk (*SlopeD*), and the call ratio (*CR*) on the globalization exposure of firms. The globalization exposure is measured as the negative of the natural logarithm of ad valorem shipping costs of the firm's product market (industry), after controlling for compositional changes (*NLnSCAdj*). We control for the characteristics of firms, industry, and the stock market. Panel A reports the average coefficients from monthly Fama-MacBeth regressions of option measures on *NLnSCAdj* and control variables. Panels B and C reports the results for the panel regressions, while we apply the year-month and industry-level fixed effect in Panel B, and we add firm-level fixed effect to the regressions in Panel C. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. *t*-statistics of Fama-MacBeth regressions in panel A are calculated using Newey and West (1994) adjusted standard errors, and those of the panel regressions in Panel B and C are based on the firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	A. FM			**B. Panel Reg.**			**C. Panel Reg.**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
	MFIS	***SlopeD***	***CR***	***MFIS***	***SlopeD***	***CR***	***MFIS***	***SlopeD***	***CR***
NlnSCAdj	0.084***	-0.047***	0.042***	0.080***	-0.062**	0.029***	0.078***	-0.081***	0.039***
	(5.88)	(-5.53)	(7.50)	(2.88)	(-2.53)	(2.89)	(3.12)	(-3.58)	(3.91)
lnTFP	0.021***	-0.015***	0.005***	0.088***	-0.067***	0.022***	0.087***	-0.061***	0.026***
	(6.96)	(-4.28)	(4.42)	(6.11)	(-5.55)	(3.76)	(5.77)	(-4.43)	(3.87)
Capital Intensity	0.047***	-0.032***	0.023***	0.196***	-0.109***	0.041***	0.159***	-0.107***	0.047***
	(5.43)	(-3.97)	(7.08)	(6.34)	(-3.60)	(3.72)	(4.61)	(-3.12)	(3.83)
lnEmployment	-0.004*	0.003**	0.001	0.012	0.010	0.002	0.014	-0.027	0.004
	(-1.94)	(2.01)	(1.02)	(0.75)	(0.73)	(0.31)	(0.76)	(-1.51)	(0.69)
Skill Intensity	0.128***	-0.091***	0.066***	-0.188**	0.156**	-0.048*	-0.072	0.138*	-0.034
	(5.87)	(-6.34)	(10.22)	(-2.28)	(1.98)	(-1.79)	(-0.79)	(1.69)	(-1.13)
lnSize	-0.055***	-0.035***	-0.021***	-0.069***	-0.029***	-0.024***	-0.122***	0.030***	-0.043***
	(-10.82)	(-7.20)	(-34.36)	(-21.86)	(-10.86)	(-21.00)	(-20.03)	(5.31)	(-20.31)
BTM	0.039***	0.023***	0.000	0.041***	0.021**	0.000	0.018	0.017*	-0.000
	(5.76)	(5.08)	(0.07)	(3.50)	(2.04)	(0.11)	(1.48)	(1.84)	(-0.06)
Ret	-0.464***	0.202***	0.062***	-0.394***	0.166***	0.058***	-0.356***	0.129***	0.071***
	(-22.04)	(16.98)	(9.78)	(-39.14)	(29.38)	(16.63)	(-34.20)	(20.61)	(19.63)
Beta	0.018***	-0.023***	0.008***	0.007	-0.020***	0.011***	-0.021***	-0.004	0.005**
	(3.65)	(-6.68)	(5.95)	(1.32)	(-4.18)	(5.31)	(-3.47)	(-0.72)	(2.20)

Table 4. (Continued)

	A. FM			B. Panel Reg.			C. Panel Reg.		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	MFIS	***SlopeD***	***CR***	***MFIS***	***SlopeD***	***CR***	***MFIS***	***SlopeD***	***CR***
Momentum	-0.094***	0.055***	0.012***	-0.070***	0.042***	0.011***	-0.048***	0.018***	0.019***
	(-12.77)	(7.67)	(5.25)	(-20.39)	(14.13)	(7.50)	(-12.15)	(5.46)	(11.29)
Illiquidity	1.134***	-1.306***	0.341***	0.982***	-1.279***	0.285***	0.434***	-0.737***	0.150***
	(12.29)	(-10.55)	(9.12)	(15.43)	(-24.69)	(11.24)	(7.88)	(-16.13)	(6.40)
ROE	-0.017***	0.018***	-0.011***	-0.020***	0.021***	-0.010***	-0.004	0.001	-0.002**
	(-7.18)	(6.51)	(-12.32)	(-5.41)	(5.41)	(-6.81)	(-1.28)	(0.42)	(-2.00)
Investment	0.016	-0.021***	-0.024***	-0.042***	0.012	-0.027***	-0.057***	0.027**	-0.021***
	(1.33)	(-2.79)	(-5.60)	(-2.89)	(0.84)	(-4.62)	(-4.30)	(2.18)	(-3.72)
Leverage	0.016***	-0.016***	-0.000	0.024***	-0.023***	-0.000	0.004	-0.014***	-0.003
	(4.01)	(-4.39)	(-0.33)	(5.15)	(-6.15)	(-0.11)	(0.77)	(-3.28)	(-1.56)
Dividends	0.217	-0.030	0.220***	0.021	-0.172	0.104	-0.479*	0.158	-0.094
	(1.36)	(-0.25)	(3.39)	(0.07)	(-0.74)	(1.12)	(-1.77)	(0.73)	(-1.13)
Volatility	0.298***	-0.239***	0.030***	0.231***	-0.188***	0.019***	0.136***	-0.077***	-0.006**
	(12.13)	(-8.14)	(7.92)	(24.10)	(-23.07)	(5.20)	(17.47)	(-12.67)	(-1.99)
Year-Month FE				Yes	Yes	Yes	Yes	Yes	Yes
Industry FE				Yes	Yes	Yes	Yes	Yes	Yes
Firm FE				No	No	No	Yes	Yes	Yes
Adjusted R2				0.280	0.273	0.123	0.388	0.443	0.192
Observations	240,271	240,271	242,648	240,271	240,271	242,648	240,271	240,271	242,648

Table 5. Implied Variance and Variance Risk Premium: Portfolio Sorts

This table presents the average of returns variance implied from options (*IV*) and the variance risk premium (*VRP*) per quintiles of firms constructed based on their globalization exposure over the previous year. The globalization exposure is measured as the negative of the natural logarithm of ad valorem shipping costs (*NLnSC*) of the firm's product market (industry). To construct portfolios in Panel A, firms are sorted based on the adjusted ad valorem shipping cost (*NLnSCAdj*) over the previous year, which controls for the compositional changes (Hummels 2007). Panel B reports the results when firms are sorted based on *NLnSC* before controlling for compositional changes. Implied variance (*IV*) is computed for options with 30 days to maturity, using the model-free approach of Britten-Jones and Neuberger (2000). Variance risk premium (*VRP*) is *IV* minus the realized variance, measured by the variance of realized returns over the term of options. Both *IV* and *VRP* are annualized. Panel B reports the results when firms are sorted based on *NLnSC* before controlling for compositional changes. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. **p<0.1; **p<0.05; ***p<0.01*.

	Low Exp				**High Exp**	**Hgh-Low**	***t*-stat**
	1	**2**	**3**	**4**	**5**	**5 - 1**	
Panel A. *NLnSCAdj*							
IV	0.3145	0.3349	0.3641	0.4549	0.5268	0.2112***	(74.69)
VRP	0.0685	0.0519	0.0667	0.0723	0.1112	0.0417***	(7.09)
Panel B. *NLnSC*							
IV	0.2539	0.2795	0.3945	0.4202	0.6254	0.3717***	(135.71)
VRP	0.0577	0.0573	0.0671	0.0620	0.1209	0.0641***	(10.98)

Table 6. Implied Variance and Variance Risk Premium: Fama-MacBeth and Panel Regressions
This table reports the results from regressing variances implied from options (*IV*) and variance risk premium (*VRP*) on the globalization exposure of firms. The globalization exposure is measured as the negative of the natural logarithm of ad valorem shipping costs of the firm's product market (industry), after controlling for compositional changes (*NLnSCAdj*). Implied variance (*IV*) is computed for options with 30 days to maturity, using the model-free approach of Britten-Jones and Neuberger (2000). Variance risk premium (*VRP*) is *IV* minus the realized variance, measured by the variance of realized returns over the term of options. Both *IV* and *VRP* are annualized. We control for the characteristics of firms, industry, and the stock market. Panel A reports the average coefficients from monthly Fama-MacBeth regressions of option measures on *NLnSCAdj* and control variables. Panels B and C reports the results for the panel regressions, while we apply the year-month and industry-level fixed effect in Panel B, and we add firm-level fixed effect to the regressions in Panel C. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. T-statistics of Fama-MacBeth regressions in panel A are calculated using Newey and West (1994) adjusted standard errors, and those of the panel regressions in Panel B and C are based on the firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01.*

	A. FM		**B. Panel Reg.**		**C. Panel Reg.**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	IV	***VRP***	***IV***	***VRP***	***IV***	***VRP***
NlnSCAdj	0.156***	0.066***	0.055***	0.041***	0.045**	0.039***
	(8.24)	(5.85)	(2.84)	(2.80)	(2.37)	(2.81)
lnTFP	-0.005*	-0.010***	-0.067***	0.011	-0.090***	0.026***
	(-1.82)	(-5.84)	(-6.50)	(1.47)	(-7.39)	(2.86)
Capital Intensity	0.033***	0.018***	0.059**	0.127***	-0.084***	0.036**
	(4.19)	(3.85)	(2.52)	(7.16)	(-3.75)	(1.97)
lnEmployment	-0.004***	-0.001	0.090***	0.042***	0.066***	0.016*
	(-6.13)	(-0.66)	(8.65)	(5.59)	(5.16)	(1.70)
Skill Intensity	0.114***	0.035***	-0.324***	-0.108**	-0.136**	0.066
	(7.98)	(5.63)	(-5.67)	(-2.55)	(-2.34)	(1.56)
lnSize	-0.079***	-0.037***	-0.087***	-0.044***	-0.109***	-0.065***
	(-19.52)	(-10.55)	(-35.40)	(-27.32)	(-24.61)	(-19.17)
BTM	-0.112***	-0.035***	-0.078***	-0.012*	-0.049***	0.005
	(-20.77)	(-7.12)	(-8.48)	(-1.85)	(-5.07)	(0.73)
Ret	-0.077***	0.029**	-0.075***	0.033***	-0.049***	0.047***
	(-4.20)	(2.05)	(-12.32)	(4.57)	(-7.99)	(6.49)
Beta	0.100***	-0.005	0.119***	-0.014***	0.084***	0.002
	(9.60)	(-1.18)	(25.46)	(-4.07)	(17.26)	(0.62)
Momentum	0.001	-0.004	0.020***	-0.017***	0.025***	-0.012***
	(0.18)	(-0.77)	(6.39)	(-6.55)	(7.97)	(-4.45)
Illiquidity	1.331***	0.693***	1.029***	0.404***	0.462***	-0.054
	(10.43)	(6.95)	(15.50)	(7.47)	(8.50)	(-0.96)
ROE	-0.065***	-0.024***	-0.045***	-0.016***	-0.009***	-0.003
	(-21.36)	(-10.60)	(-10.27)	(-5.27)	(-2.71)	(-1.17)
Investment	0.119***	-0.008	0.088***	-0.025**	0.038***	-0.028***
	(9.60)	(-0.81)	(6.66)	(-2.43)	(3.05)	(-2.64)

Table 6. (Continued)

	A. FM		B. Panel Reg.		C. Panel Reg.	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	IV	**VRP**	**IV**	**VRP**	**IV**	**VRP**
Leverage	0.021***	-0.002	0.022***	0.003	0.023***	0.001
	(5.02)	(-1.43)	(6.56)	(1.00)	(5.99)	(0.34)
Dividends	-0.174*	0.276***	0.241	0.254*	-0.206	-0.433***
	(-1.83)	(3.11)	(1.23)	(1.96)	(-1.13)	(-3.05)
Year-Month FE			Yes	Yes	Yes	Yes
Industry FE			Yes	Yes	Yes	Yes
Firm FE			No	No	Yes	Yes
Adjusted R2			0.559	0.195	0.678	0.273
Observations	240,271	240,245	240,271	240,245	240,271	240,245

Table 7. Economic Conditions

This table documents the interactive effects of globalization exposure (*NLnSCAdj*) and the economic recession months (*Recession*) on investors' expectations of firms' risk exposure and the price of such risks, as captured by model-free implied skewness (*MFIS*), left tail risk (*SlopeD*), the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). The data of economic recession months is provided by the National Bureau of Economic Research (NBER). We use panel regressions with year-month and industry level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. *t*-statistics are calculated using firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	MFIS	***SlopeD***	***CR***	***IV***	***VRP***
NLnSCAdj	0.089***	-0.068***	0.025**	0.055***	0.041***
	(3.13)	(-2.74)	(2.46)	(2.85)	(2.73)
Recession	-0.211***	0.081***	-0.112***	0.240***	0.093***
	(-8.62)	(4.76)	(-9.10)	(12.30)	(5.11)
*NLnSCAdj*Recession*	-0.089***	0.068***	0.041***	-0.006	0.006
	(-3.24)	(2.98)	(3.19)	(-0.20)	(0.24)
Controls	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.280	0.273	0.123	0.559	0.195
Observations	240,271	240,271	242,648	240,271	240,245

Table 8. Trade Policy Uncertainty

This table documents the interactive effects of globalization exposure (*NLnSCAdj*) and the aggregate index of trade policy uncertainty (*TPU*) on investors' expectations of firms' risk exposure and the price of such risks, as captured by model-free implied skewness (*MFIS*), left tail risk (*SlopeD*), the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). The index for *TPU* is obtained from Caldara *et al.* (2020). We use panel regressions with year-month and industry level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. *t*-statistics are calculated using firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	MFIS	***SlopeD***	***CR***	***IV***	***VRP***
NLnSCAdj	0.105***	-0.080***	0.015	0.045**	0.022
	(3.78)	(-3.30)	(1.43)	(2.30)	(1.47)
Recession	-0.233***	0.132***	-0.123***	0.253***	0.102***
	(-9.01)	(7.54)	(-9.44)	(12.71)	(5.47)
*NLnSCAdj*Recession*	-0.099***	0.075***	0.047***	-0.000	0.016
	(-3.68)	(3.43)	(3.66)	(-0.01)	(0.67)
TPU	-0.594***	1.267***	-0.211***	0.345***	0.294***
	(-7.22)	(18.12)	(-6.75)	(8.21)	(6.50)
*NLnSCAdj*TPU*	-0.125**	0.090	0.073***	0.073*	0.137***
	(-1.99)	(1.39)	(3.55)	(1.90)	(4.26)
Controls	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.280	0.273	0.124	0.559	0.196
Observations	240,271	240,271	242,648	240,271	240,245

Table 9. Compositional Shift of International Transportation

The results of panel regressions of option characteristics on globalization exposure are reported, where the globalization exposure is measured by the negative natural logarithm of ad valorem shipping costs (*NLnSC*) and the compositional shift of international transportation is controlled by the weight-to-value ratio (*LnWTV*). Dependent variables are left tail risk (*SlopeD*), the model-free implied skewness (*Skew*), and the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). Control variables include the natural logarithm of total factor productivity (*lnTFP*), capital intensity (*Capital Intensity*), skill intensity (*Skill Intensity*), and the natural logarithm of employment *(lnEmployment*) and firm characteristics. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSC* is scaled to range between zero and one. T-statistics of Fama-MacBeth regressions in panel A are calculated using Newey and West (1994) adjusted standard errors, and those of the panel regressions in Panel B and C are based on the firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	A. FM					**B. Panel Reg.**				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
	MFIS	***SlopeD***	***CR***	***IV***	***VRP***	***MFIS***	***SlopeD***	***CR***	***IV***	***VRP***
NLnSC	0.120***	-0.088***	0.074***	0.195***	0.071***	0.148***	-0.114**	0.051**	0.113***	0.075**
	(5.01)	(-5.42)	(7.41)	(9.00)	(4.87)	(2.65)	(-2.35)	(2.53)	(2.87)	(2.51)
LnWTV	0.003**	-0.004**	0.007***	-0.006***	-0.005***	0.019*	-0.027***	0.010***	0.005	-0.001
	(2.02)	(-2.55)	(7.89)	(-3.78)	(-3.83)	(1.71)	(-2.72)	(2.82)	(0.82)	(-0.19)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE						Yes	Yes	Yes	Yes	Yes
Industry FE						Yes	Yes	Yes	Yes	Yes
Adjusted R2						0.388	0.443	0.192	0.679	0.273
Observations	240,271	240,271	242,648	240,271	240,245	240,271	240,271	242,648	240,271	240,245

Table 9. (Continued)

	C. Panel Reg.				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	MFIS	***SlopeD***	***CR***	***IV***	***VRP***
NLnSC	0.145***	-0.155***	0.076***	0.104***	0.075***
	(2.91)	(-3.47)	(3.65)	(2.67)	(2.64)
LnWTV	0.032***	-0.035***	0.011***	-0.005	0.002
	(2.85)	(-3.56)	(3.15)	(-0.84)	(0.53)
Controls	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.388	0.443	0.192	0.679	0.273
Observations	240,271	240,271	242,648	240,271	240,245

Table 10. Compositional Shift of International Transportation: Economic Conditions and Trade Policy Uncertainty

This table documents the interactive effects of globalization exposure, measured by the negative natural logarithm of ad valorem shipping costs (*NLnSC*), and the aggregate index of trade policy uncertainty (*TPU*) and *Recession* on investors' expectations of firms' risk exposure and the price of such risks, captured by model-free implied skewness (*MFIS*), left tail risk (*SlopeD*), the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). The index for *TPU* is obtained from Caldara *et al.* (2020) and the data of economic recession months are collected from the National Bureau of Economic Research (NBER). We use panel regressions with year-month and industry level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. *t*-statistics are calculated using firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**
	MFIS	***SlopeD***	***CR***	***IV***	***VRP***
NLnSC	0.184***	-0.164***	0.031	0.057*	0.026
	(3.29)	(-3.45)	(1.50)	(1.73)	(0.89)
Recession	-0.221***	0.125***	-0.119***	0.164***	0.121***
	(-8.90)	(7.88)	(-9.74)	(11.41)	(7.07)
NLnSC*Recession	-0.136***	0.079***	0.052***	-0.008	0.048**
	(-5.51)	(3.95)	(4.71)	(-0.40)	(2.30)
TPU	-0.603***	1.204***	-0.192***	0.355***	0.238***
	(-7.75)	(18.52)	(-6.40)	(10.05)	(5.55)
NLnSC*TPU	-0.121**	0.202***	0.072***	0.209***	0.223***
	(-2.32)	(3.55)	(4.03)	(5.99)	(7.08)
LnWTV	0.019*	-0.029***	0.009***	0.000	-0.003
	(1.73)	(-2.91)	(2.68)	(0.01)	(-0.64)
Controls	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.281	0.274	0.124	0.639	0.213
Observations	240,271	240,271	242,648	240,271	240,245

Table 11. Alternative Measure of Globalization Exposure

The robustness of our findings is evaluated using an alternative measure of globalization exposure, namely the trading volume (*Trade*), measured as the sum of exports and imports divided by gross domestic production (GDP) and computed by industry, reflecting the flow of international trade in a country's industry. Dependent variables are left tail risk (*SlopeD*), the model-free implied skewness (*Skew*), and the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). The interaction effects of Trade with the aggregate index of trade policy uncertainty (*TPU*) and *Recession* are documented in Panel B. We use panel regressions with year-month and industry-level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. *t*-statistics are calculated using firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	MFIS	**SlopeD**	**CR**	**IV**	**VRP**	**MFIS**	**SlopeD**	**CR**	**IV**	**VRP**
Trade	0.164***	-0.067	0.039***	0.076***	0.097***	0.195***	-0.096**	0.035**	0.053**	0.071***
	(3.77)	(-1.61)	(2.59)	(2.58)	(4.42)	(4.43)	(-2.37)	(2.20)	(2.09)	(3.15)
Recession						-0.246***	0.135***	-0.095***	0.163***	0.144***
						(-10.32)	(9.30)	(-8.02)	(11.29)	(8.99)
Trade*Recession						-0.113***	0.076***	-0.005	-0.003	-0.008
						(-4.36)	(3.43)	(-0.37)	(-0.12)	(-0.38)
TPU						-0.611***	1.236***	-0.166***	0.417***	0.285***
						(-7.96)	(19.36)	(-5.65)	(12.67)	(6.92)
Trade*TPU						-0.129**	0.129**	0.019	0.104***	0.129***
						(-2.19)	(2.16)	(0.95)	(3.38)	(4.64)
lnWTV	0.017*	-0.022**	0.008**	-0.000	-0.001	0.016	-0.022**	0.008**	-0.002	-0.002
	(1.66)	(-2.41)	(2.56)	(-0.00)	(-0.32)	(1.60)	(-2.38)	(2.49)	(-0.35)	(-0.44)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.281	0.273	0.123	0.559	0.196	0.281	0.273	0.123	0.639	0.213
Observations	240,271	240,271	242,648	240,271	240,245	240,271	240,271	242,648	240,271	240,245

Table 12. Options with 60 Days to Maturity

This table documents the effects of globalization exposure (*NLnSCAdj*) and its interaction with economic cycles (*Recession*) and the aggregate index of trade policy uncertainty (*TPU*) on investors' expectations of firms' risk exposure and the price of such risks. We use the data of options with 60 days to maturity to measure the model-free implied skewness (*MFIS*), left tail risk (*SlopeD*), the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). We use panel regressions with year-month and industry level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. t-statistics are calculated using firm-level clustered standard errors. **p<0.1; **p<0.05; ***p<0.01*.

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	MFIS	**SlopeD**	**IV**	**VRP**	**MFIS**	**SlopeD**	**IV**	**VRP**
NLnSCAdj	0.081***	-0.045**	0.049***	0.036***	0.101***	-0.060***	0.047**	0.023
	(3.16)	(-2.06)	(2.68)	(2.58)	(3.86)	(-2.72)	(2.50)	(1.60)
Recession					-0.343***	0.204***	0.285***	0.128***
					(-14.95)	(12.45)	(14.97)	(6.82)
NLnSC*Recession					-0.091***	0.047**	-0.007	0.014
					(-3.63)	(2.21)	(-0.25)	(0.55)
TPU					-1.023***	1.106***	0.361***	0.301***
					(-14.38)	(18.66)	(9.32)	(6.93)
NLnSCAdj*TPU					-0.084	0.080	0.023	0.093***
					(-1.47)	(1.43)	(0.61)	(3.16)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.388	0.268	0.583	0.197	0.388	0.269	0.583	0.197
Observations	239,799	239,799	239,799	239,783	239,799	239,799	239,799	239,783

Table 13. Options with 90 Days to Maturity

This table documents the effects of globalization exposure (*NLnSCAdj*) and its interaction with economic cycles (*Recession*) and the aggregate index of trade policy uncertainty (*TPU*) on investors' expectations of firms' risk exposure and the price of such risks. We use the data of options with 90 days to maturity to measure the model-free implied skewness (*MFIS*), left tail risk (*SlopeD*), the call ratio (*CR*), implied variance (*IV*), and variance risk premium (*VRP*). We use panel regressions with year-month and industry level fixed effects, where we control for the characteristics of firms, industry, and the stock market. The sample period is determined by the overlap of data available for options and shipping costs, including globalization measures from 1995 to 2018, and option data from 1996 to 2019. All variables are winsorized at 1st and 99th percentiles, and *NLnSCAdj* is scaled to range between zero and one. t-statistics are calculated using firm-level clustered standard errors. *p<0.1; **p<0.05; ***p<0.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	MFIS	**SlopeD**	**IV**	**VRP**	**MFIS**	**SlopeD**	**IV**	**VRP**
NLnSCAdj	0.076***	-0.031	0.044**	0.031**	0.089***	-0.043**	0.045**	0.020
	(3.15)	(-1.54)	(2.52)	(2.30)	(3.59)	(-2.14)	(2.51)	(1.45)
Recession					-0.427***	0.267***	0.294***	0.137***
					(-20.75)	(18.58)	(16.29)	(7.31)
NLnSC*Recession					-0.063***	0.021	-0.009	0.012
					(-2.80)	(1.06)	(-0.35)	(0.48)
TPU					-1.260***	0.977***	0.330***	0.269***
					(-19.99)	(19.73)	(9.23)	(6.40)
NLnSCAdj*TPU					-0.058	0.082*	0.002	0.076***
					(-1.14)	(1.78)	(0.05)	(2.81)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R2	0.454	0.255	0.600	0.192	0.454	0.255	0.600	0.192
Observations	239,235	239,235	239,235	239,219	239,235	239,235	239,235	239,219

Table 14. Sample Selection Bias

This table reports the risk-adjusted excess returns of stocks, that are the underlying assets in our options sample. Underlying stocks are sorted based on their globalization exposure, measured by shipping cost (*SC*) or weight-to-value (*WTV*). Our findings are comparable to those in Barrot *et al.* (2019). *t*-statistics are calculated using Newey-West adjusted standard errors. *p<0.1; **p<0.05; ***p<0.01.

Panel A. SC						
SC	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Low Exp				**High Exp**	**High - Low**
Alpha	-0.035**	-0.039**	-0.005	0.028*	0.083***	0.119***
	(-2.50)	(-2.06)	(-0.20)	(1.70)	(3.06)	(3.87)
MKT	1.223***	1.288***	1.294***	1.103***	1.209***	-0.014
	(27.99)	(28.30)	(22.13)	(26.43)	(19.33)	(-0.19)
SMB	0.603***	0.610***	0.629***	0.797***	0.802***	0.199*
	(8.61)	(8.55)	(6.60)	(11.15)	(8.59)	(1.70)
HML	0.469***	0.312***	-0.080	-0.299***	-0.542***	-1.011***
	(7.43)	(4.04)	(-0.92)	(-3.99)	(-5.10)	(-8.18)
RMW	0.470***	0.295***	-0.502***	-0.374***	-0.964***	-1.435***
	(5.48)	(3.06)	(-4.11)	(-4.53)	(-6.81)	(-8.66)
CMA	0.033	0.071	-0.007	-0.042	0.228	0.195
	(0.35)	(0.57)	(-0.04)	(-0.35)	(1.38)	(1.02)
Adjusted R2	0.891	0.865	0.869	0.898	0.854	0.862
Observations	288	288	288	288	288	288
Panel B. WTV						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
	Low Exp				**High Exp**	**High - Low**
Alpha	-0.038**	-0.038*	-0.017	0.058***	0.073***	0.111***
	(-2.43)	(-1.96)	(-0.72)	(3.09)	(2.60)	(3.45)
MKT	1.216***	1.318***	1.241***	1.151***	1.201***	-0.014
	(29.56)	(26.63)	(22.08)	(25.20)	(18.47)	(-0.19)
SMB	0.549***	0.681***	0.619***	0.767***	0.819***	0.269**
	(8.78)	(8.94)	(6.54)	(9.39)	(8.59)	(2.36)
HML	0.452***	0.402***	-0.089	-0.319***	-0.579***	-1.031***
	(5.90)	(5.61)	(-1.01)	(-3.85)	(-5.41)	(-7.83)
RMW	0.487***	0.334***	-0.512***	-0.556***	-0.884***	-1.371***
	(6.10)	(3.14)	(-4.36)	(-5.56)	(-6.21)	(-8.40)
CMA	0.043	0.029	-0.082	-0.096	0.353**	0.310
	(0.47)	(0.22)	(-0.48)	(-0.68)	(2.15)	(1.64)
Adjusted R2	0.878	0.875	0.862	0.892	0.843	0.851
Observations	288	288	288	288	288	288