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RESEARCH ARTICLE

The Arab Spring and the International Defense Market

Jeroen Klomp

Netherlands Defence Academy, Faculty of Military Sciences, The Netherlands
Corresponding author: Jeroen Klomp, Email: klomp_j@yahoo.com

Abstract
The aim of this study is to analyze the impact of the political violence during the Arab Spring on the stock market return of international defense firms. The direction of this impact is not directly straightforward as the civil unrests influence the expectations of investors in two opposite ways. On the one hand, investors might expect that when the peaceful demonstrations were turned into violent events, the Arab governments involved will start acquiring more military-strategic goods to repress the protests or send a strong signal of power to ensure their stay in office. However, on the other hand, when the popular protests escalated, investors, perhaps, became more concerned about the possible imposition of international military sanctions against the Arab Spring countries to restore peace and protect human rights. The main empirical findings of a dynamic panel model clearly confirm this pattern and point out that when the Arab Spring originated, the abnormal return of international defense stocks starts to rise immediately. However, in the course of time, the concerns of the introduction of arms embargoes become stronger and eventually start to dominate, causing the abnormal return to fall again, while the idiosyncratic risk began to fall due to enhanced diversification. It turns out that firm-specific factors can explain a substantial part of the effect found. For instance, the reaction of investors to the Arab Spring is significantly larger for firms that produce predominantly military goods.

Keywords: Arab Spring; defense industry; abnormal return

Introduction

On 18 December 2010, a young vegetable vendor from a small town in Tunisia set himself ablaze in protest of the alleged police corruption and ill-treatment. This incident reignited the political activism of the entire region, triggering a revolutionary wave of demonstrations and protests, first in Tunisia and then spreading elsewhere in the Arab world, especially in countries that have long been subject to political and social repression (i.e., Syria, Bahrain, Yemen, Egypt, Libya, Algeria, Iraq, Jordan, Morocco, Oman, Kuwait, Lebanon, Mauritania, Saudi Arabia, and Sudan). These widespread political protests are collectively referred to as the "Arab Spring." The Arab Spring is unique in the sense that the mass civil protests culminated in different political outcomes across the region. In several countries, the civilian protests produced immediate regime changes, and rulers were forced to resign from power along with changes in domestic and foreign policies.[1] However, in a few other states, like Syria, the government severely responded to the protests with military repression, which finally led to a civil war and sectarian violence. Generally, the violent events during the Arab Spring marked the end of a long period of reasonable political stability in the Arab region.

The broad literature on the relationship between political violence and military spending claims that the start or intensification of a conflict has two opposing effects on the international transfer of arms. On the one hand, the escalation of a conflict is associated with an increase in the demand for weapons and other military-strategic goods that directly can be used for security or offensive purposes

[1]For instance, these popular protests have resulted in the overthrow of governments in Tunisia, Libya, and Egypt, while substantial political and governmental reforms have been conceded in Morocco and to a lesser extent in Algeria.

(hoarding effect).[2] On the other hand, the escalation of a conflict also raises the likelihood of more rigorous arms trade control policies or could even lead to a complete ban on arms transfers to particular countries or regions (control effect).[3] These two channels affect the business perspectives of international defense companies in opposite directions. In particular, the hoarding effect would enlarge the international market for arms, while the control effect would worsen the competitiveness of the defense industry. As a result, it is not directly clear which of the two effects will dominate, and thus what the reaction of investors in the defense industry will be after the start of a violent conflict. A key element in this debate is that it is rather likely that investors will update or even change their expectations during a conflict. In the beginning, investors might believe that when peaceful protests are turned into political violence, the parties involved will start acquiring more arms for repressing purposes, thereby creating a window of opportunity for defense firms to expand their exports. However, over time, when the conflict escalates, investors may become more concerned that foreign governments will take rigorous arms trade control measures against a country to stop the politically motivated violence and protect human rights. But before these coercive trade policies are in place and effectively being enforced, the political process of reaching an international agreement will take some time.

Even though it is clear that the Arab Spring was born of a desire for more social, political, and economic freedom, the timing of the uprisings came as a complete surprise. These events provide, therefore, a unique setting for a natural experiment to analyze the impact of unexpected violent political protests on the expected profitability of the defense-related industry in the United States and the European Union, as they are, together with Russia, the main arms exporters to this region.[4] The extent to which investors already anticipated changes in the political violence is most likely to be reflected in the market value of major US and EU defense companies. Under the semi-strong form of the efficient market hypothesis, equity prices are assumed to reflect all public information and to adjust swiftly to the arrival of new public information.[5]

The question that this study tries to answer is whether the intensity of violence during the Arab Spring has affected the abnormal stock market return of international defense companies, and if so, in which direction. For this purpose, I have created a new dataset on the political violence during the Arab Spring based on the number of related news articles published by major international newspapers. In addition, I used the daily abnormal stock market return of seventy-five major and public listed defense companies from the United States and the European Union between January 2010 and December 2014.[6] My sample period covers the several waves of popular protests and violent conflict in the Arab region in response to the overthrow of the governments in Tunisia, the arresting of Hosni Mubarak in Egypt, and the execution of Muammar Gaddafi in Lybia. Only when protest-related news contains new or unexpected information about the course of the violent events, will the equity price react as it alters market beliefs about the trade volume and conditions of arms to the Arab region in the near future. A dynamic panel approach is adopted based on the pooled mean group (PMG) technique that was first proposed by Pesaran et al. (1999). This estimator allows the short-run coefficients and error variances to differ freely across firms, but the long-run coefficients are constrained to be the same.

My main empirical findings clearly point out that the intensification of violence-related news increases the abnormal return of defense companies in the short-run, while in the long-run, the abnormal returns significantly fall, and the idiosyncratic risk starts to fall due to enhanced diversification. Based on these findings, I argue that when the Arab Spring started, investors expected that the involved

[2]I.e., Maisels and Nissanke (1986); Deger and Sen (1995); Dunne and Mohammed (1995); Collier and Hoeffler (2007); Wezeman (2014).

[3]I.e., DellaVigna and La Ferrara (2010); Klomp (2019a); Erickson (2013).

[4]To illustrate the importance of the Arab countries for arms trade, in the period 2013 to 2017, slightly less than half of the total arms exports of the United States is exported to this region (SIPRI, 2019).

[5]Merton (1973); Black and Scholes (1973).

[6]China and Russia are two other major arms exporters to the Arab region. However, most defense-related companies are not publicly trade or are government owned.

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governments would start to import more military equipment from the European Union and the United States. However, over the course of the Arab Spring, when the protests started to escalate, the concerns about international trade sanctions began to dominate the expectations of investors. It turns out that firm-specific factors can explain a substantial part of the effect found. For instance, the reaction of investors to the Arab Spring was significantly larger for firms that produce predominantly military goods.

The remainder of the paper is structured as follows. The next section provides the theoretical considerations underlying the relationship between the market value of the international defense industry and the Arab Spring. In section three, I present my data and methodology used, while in section four, I report my estimation results. Finally, I end in section five with my conclusions and discussion.

The Arab Spring and the international defense industry

It is well documented in the previous literature that capital markets are not immune to geopolitical risks with adverse effects observed at both the aggregate and sector level.[7] Geopolitical risks are defined as the risks associated with wars, terroristic attacks, armed conflicts, violent protests, and political tension between and within states that affect the normal and peaceful course of international relations. Geopolitical risks capture both the risk that these events materialize and the development of new risks that result from the escalation of current events.[8] The economic intuition of geopolitical risks in driving capital markets is that armed or political contests create uncertainty over the economic costs. In particular, geopolitical events tend to serve as a learning mechanism for investors, with them re-assessing the risk component in their portfolios. When traders fear future geopolitical risks, they will become more risk-averse in the aftermath of a security shock and try to escape into less risky alternatives by investing in industries that are stable and strong. As a result, portfolios that are exposed to a great extent to geopolitical events will face a sudden and substantial increase in risk that cannot be diversified immediately. This will result in large movements in the market due to the reshuffling of portfolios and also panic selling by investors in their search for safer financial assets. This behavior will continue until the perception of investors about a stable future is restored again, and the fear and insecurity associated with geopolitical events have disappeared.[9] Thus, a negative collective belief about the possible course of action reduces the aggregate value of the stock market and, in particular, the market value of sectors that are the most vulnerable to the costs of conflict. For instance, the empirical results reported by Tanyeri (2018) indicates that the abnormal stock market returns in several Middle-East countries decrease by around one-percentage-point after each major violent event during the Arab Spring period.[10]

However, the equity return of defense-related companies might follow the opposite pattern compared to the aggregate stock market. In more detail, the equity returns of non-defense-related firms are determined by the economic uncertainty created by geopolitical events, while defense-related stocks are much more influenced by the expected change in demand for military goods by countries who are highly susceptible to geopolitical risks and events and also from those nations who plan to undertake military action against threats of such risks.[11] Violent events dampen the activity of most economic sectors, but at the same time, may improve the perspectives of companies in the defense and security industries.[12] The unstable climate originated by geopolitical incidents causes investors

[7]More generally, earlier empirical evidence indicates that the equity return in the defense industry is affected by news items that contain information about: (i) merger and acquisition activities; (ii) geopolitical risks; and (iii) major changes in military expenditures of powerful states (see, e.g., Capelle-Blancard and Couderc, 2008). News items that are related with the start and escalation of the Arab Spring can be classified both in the second and third category. E.g., Chen and Siems (2004); Charles and Darné (2006); Kollias et al. (2010); Kollias et al. (2011a; 2011b); Chau et al. (2014); Karolyi and Martell (2010); Brounen and Derwall (2010); Bouri et al. (2019).

[8]Caldara and Iacoviello (2018).

[9]Apergis and Apergis (2016); Kis-Katos et al. (2011); Ciner et al. (2013).

[10]See also Chau et al. (2014).

[11]Akerman and Seim (2014).

[12]Apergis et al. (2018); Capelle-Blancard and Couderc (2008).

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to expect increased dividends from the defense industry. For instance, the findings of Berrebi and Klor (2005) demonstrate that whereas terrorist attacks have a significant negative impact on the equity return of Israeli nondefense related companies, the effect of terrorism on defense and security-related firms is significantly positive. On a similar note, McDonald and Kendall (1994) find that during periods of extreme violence, including armed conflicts and terrorist attacks, the US defense sector experienced positive, abnormal returns.

Thus, based on the discussion provided above, one can argue that the Arab Spring creates a window of opportunity for international defense companies to expand their exports as the violent protests raise the demand for military goods. Arab governments might buy more military equipment to repress the violent protests or send a signal of power to the protesters and other political challengers in the attempt of the state leader to stay in power. However, when investors behave rationally, they will also take into account that the escalation of the protests and ending up in a violent conflict will increase the likelihood of more rigorous arms trade control policies or could even lead to arms embargoes to particular countries or regions.[13] This latter effect will again hamper military exports or at least make it more expensive as the costs of compliance, transportation, financing, and brokering may rise. Besides, the trade costs of dual-use goods that do not directly fall under the embargo but are also often produced by defense firms will rise.[14] Arms export control policies differed substantially among countries during the Arab Spring period. For instance, the United States and the United Kingdom revoked and withdrawn dozens of export licenses for equipment they feared could be used to quash civil unrest or cause a large number of civilian casualties. In contrast, many EU member states have considered the lion's share of arms export license applications for the Middle East as unproblematic. This latter issue suggests that the reaction of investors in the US and EU defense industry to the escalation of the conflict is likely to differ. It is well-known that changes in expectations about the future imposition of sanctions can lead to a change in investor behavior long before the sanction is really implemented or even agreed on. In particular, investors update their expectations about the economy much more frequently during periods of high news coverage than in periods of low news activity.[15] Thus, investors—in advance of the expected sanctions or arms embargoes—will rearrange their portfolios based on their own assessment of the likelihood of these measures. In turn, this assessment is built on (i) the severity of the underlying conflict and its consequences for human rights; (ii) the expression of earlier credible threats by EU and US government officials to impose or strengthen arms trade controls; and (iii) the importance of foreign relations with the Arab region. That is, the formal imposition of trade sanctions may come as no surprise to investors and should therefore not lead to any change in asset prices as predicted by the efficient market hypothesis.[16]

Based on the discussion above, I formulate the two hypotheses that will be tested in the empirical section.

H1 - Hoarding hypothesis:
In the short-run, the escalation of the Arab Spring increases the equity return of international defense firms due to the expectations of expanding arms exports.

H2 - Control hypothesis:
In the long-run, the escalation of the Arab Spring lowers the equity return of international defense firms due to the expectations of more restrictive arms trade policies and regulations.

However, the complete effect of the Arab Spring on the stock return of the international defense companies goes beyond the influence on the expected cash flow accruing directly from the sales of military equipment to this region. Stock returns are also affected by systematic movements in the discount

[13]See also Boogaerts et al. (2016).
[14]Salisbury (2013).
[15]Doms and Morin (2004).
[16]Hoffmann and Neuenkirch (2017); Klomp (2019a).

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rates. A rise in the discount rate leads to a negative impact on the stock return of companies. For instance, there is some empirical evidence indicating that the Arab Spring has created some upward pressure on the oil prices as the uncertainty about the oil production in the Middle-East region rises. This increase is likely to be reflected in the future inflation rate and the production costs of firms.[17]

Data and methodology

Data on political violence and abnormal equity return

One of the key challenges in analyzing the capital market impact of the violent protests during the Arab Spring is finding a suitable indicator for the intensity of the violent events. In my attempt, I follow the methodology proposed by Dreger et al. (2016) and Hoffmann and Neuenkirch (2017). This approach builds on the assumption that when a conflict intensifies and becomes more violent (i.e., creates more civil casualties or large-scale destruction), it will be more widely covered in the media. Thus, it is assumed that there is a positive relationship between the number of published news articles and the escalation of the conflict. For this purpose, I use information provided by the LexisNexis Academic database that collects the world's most reputable news. In particular, I consider all news items published in major international newspapers, including some specifically devoted to the defense industry (e.g., *Aerospace Daily*, *Air Force Times*, *Aviation Week's Homeland Security and Defense*, *Avionics*, *Defense Daily*, *Defense News, Defense and Security*, *IAC Aerospace and Defense*, *Inside the Pentagon*, etc.) and all the major world financial newspapers (*Wall Street Journal*, *Financial Times*, etc.). All news articles are collected containing a joint occurrence of the keywords "Arab Spring," "Arab winter," "conflict," "violence," "protest," "demonstrations," or "riots," in any combination with the name of the countries that have been affected by the Arab Spring (Syria, Lebanon, Egypt, Libya, Tunisia, Yemen, Bahrain, Algeria, Jordan, Oman, Kuwait, and Morocco). In the next step, I count all entries for each day for a joint occurrence of the keywords between 1 January 2010 and 31 December 2014. The frequency of occurrence can be used as a proxy for the violence intensity of the Arab Spring. Or, put differently, as an indirect measure of the conflict's escalation level from an investor perspective. Since the combinations of search terms do not fully guarantee that a particular news item contains information about the Arab Spring, especially before January 2010, I set the composite news index to zero from 1 January 2010 through 18 December 2010.[18] In total, there are more than three thousand articles that were published in my period of analysis.

Figure 1 shows the density of violence-related news items during the Arab Spring (y-axis). The graph shows various peaks in the frequency that coincides with a number of major violent events that caused many casualties. The intensity of newspaper articles is clearly nonlinear distributed. After December 2012, the number of newspaper articles containing information about the Arab Spring drops quickly. This implicitly assumes the intensity of violence also to be lower after this month. Based on this data, I create my violence variable by computing a cumulative indicator of the number of newspaper articles. I apply a log plus one transformation to the indicator variable measuring the intensity of violence as the information content of an individual newspaper article diminishes with the total number.[19]

The next step in conducting the event study is to define the sample of defense-related firms. In order to have a representative sample and to avoid any selection bias, I start with the various editions of the "World Top 100 Defense Firms" reported by the Defense News Media Group and the "Top 100 arms-producing and military services companies" published by the Stockholm International Peace Research Institute (SIPRI). These rankings are based on annual defense sales. This data is supplemented using the Google Finance list on defense-related stocks. In order to obtain a coherent sample for my study, I follow Capelle-Blancard Couderc (2008) by applying some exclusion criteria. As I am only interested in publicly listed companies, I drop out of the sample: (1) fully and partly state-owned

[17]Mohanty et al. (2011); Noguera-Santaella (2016); Maghyereh and Al-Kandari (2007).
[18]See also Dreger et al. (2016).
[19]Hoffmann and Neuenkirch (2017).

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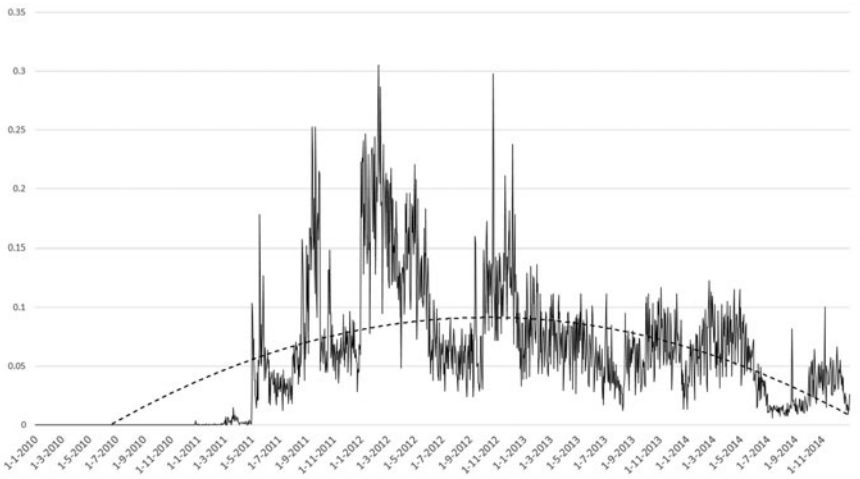

Figure 1: Density of Arab Spring newspaper articles

firms; (2) family-owned firms; (3) firms with one dominant shareholder or with a low free float rate; and (4) firms with defense revenue below ten percent of their total revenue. In the next step, I collect the daily stock prices of the selected firm. This data is primarily taken from Thomson Datastream, Bloomberg, and Yahoo Finance. After dropping the firms for which no data was available, I was left with the seventy-five firms that constitute my sample. About two-thirds of the considered defense companies have their statutory headquarters located in the United States. In figure 2, I report the price index of the considered defense-related stocks in my period of analysis.[20] [21]

In order to isolate stock market reactions to the conflict intensity during the Arab Spring, I control for market co-movement and exclude potentially confounding events. In particular, I explore the impact of the Arab Spring on the abnormal return in the international defense industry. In finance, the abnormal return is the difference between the actual return of a security and the expected return. Abnormal returns are typically triggered by events that influence the profitability of a firm, but have not yet been priced by the market. To compute this abnormal return, I apply a two-step approach. In the first step, I follow Liu et al. (2017) by estimating an asset pricing model that includes the risk-free rate, the market return, and the so-called Fama-French factors. In particular, the following empirical model is estimated using the OLS-FE estimator.

$$R_{ijt} - R^F_{jt} = \beta_0 + \beta_1(R^M_{jt} - R^F_{jt}) + \beta_2 SMB^q_{jt} + \beta_3 HML^q_{jt} + \beta_4 UMD^q_{jt} + e_{ijt} \quad (1)$$

Where R_{ijt} is the stock market return of defense company i at day t[22], R^F is the risk-free rate based on the ten year government bond rate in country j; R^M is the market return measured by the aggregate stock market return in the country j where the statutory headquarters of defense firm i is located. The variable *SMB* (small minus big) is the difference between the daily returns of the small and big firms' portfolios; *HML* (high minus low) is the difference between the daily returns of high book-to-market and low book-to-market firms' portfolios; and *UMD* (up minus down) is the momentum factor computed as the daily return differential between a portfolio of winners and a portfolio of losers. These latter Fama–French factors are taken for the EU and US market and obtained from the homepage

[20]Stock prices are adjusted for dividend pay-outs and stock splits. In more detail, to construct the graph, I first calculate a stock price index for each of the companies considered (based on local currencies). Thereafter, I create an aggregate index by weighting the firms by their market value in US dollars. This implies that the market value of non-US firms is converted from local currencies into US dollars. This final step might influence the graph through exchange-rate changes.

[21]The data used in this study are available from the corresponding author upon reasonable request.

[22]The stock market returns are computed using local currencies.

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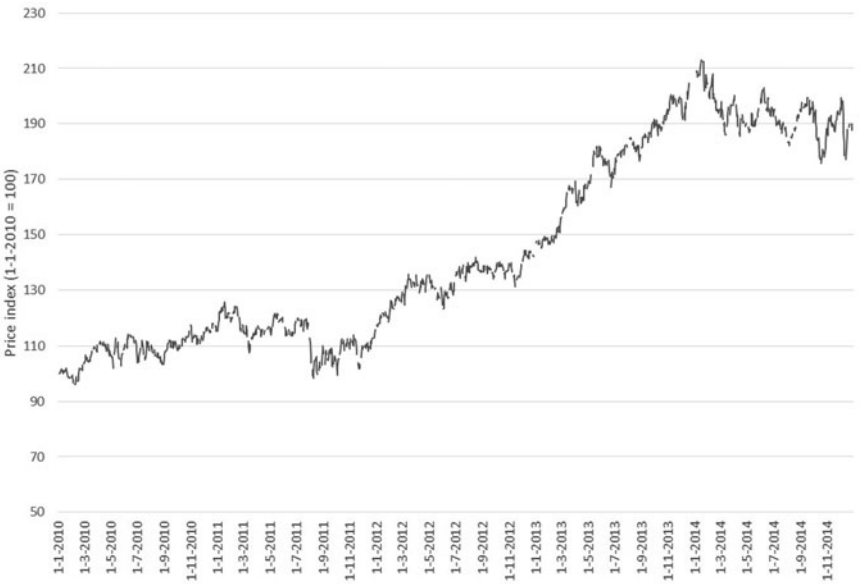

Figure 2: Weighted equity price development defense companies

of Kenneth French at Dartmouth College. The detailed results of the estimation of equation (1) are shown in table A2 in the appendix. Next, I use the residual e_{ijt} as my measure of the abnormal stock return of defense company *i*. In the second step, I use the abnormal return as my dependent variable in a heterogenous dynamic panel model.

Empirical model

Given the heterogeneity of the defense firms included in this study, the assumption that the data can be pooled might be questioned. The expected short-run benefits of expanding arms exports and long-run costs of more rigorous arms trade regulations are probably not shared evenly among the wide range of defense-related firms competing around the world.[23] Standard dynamic panel models can produce inconsistent and misleading estimates if the sample is very heterogeneous.[24] The econometric literature suggests two approaches to consistently estimate parameters in dynamic panels with considerable heterogeneity. First, under the so-called Mean Group (MG) estimator, an equation for each firm is estimated, and the distribution of the estimated coefficients across groups is examined. To be precise, this estimation method produces consistent estimates of the average of the parameters in heterogeneous panels, provided that group-specific parameters are independently distributed and the covariates are exogenous. However, it has also been shown that MG estimates will be inefficient if parameters are the same across groups, i.e., if the long-run slope homogeneity restriction holds.[25] In this case, Pesaran et al. (1999) propose a maximum likelihood-based pooled mean group (PMG) estimator that combines pooling and averaging of the individual regression coefficients. In particular, this estimator allows the short-run coefficients and error variances to differ freely across groups, but the long-run coefficients are constrained to be the same. Not imposing equality of short-run slope coefficients allows the number of lags included to differ across groups.[26] This approach has strong economic

[23]Klomp (2019b).

[24]Pesaran et al. (1999); Pesaran et al. (1996); Pesaran and Yamagata (2008); Pesaran and Shin (1998).

[25]Pesaran et al. (1999).

[26]An important assumption for the consistency of the pooled mean group estimates is the independence of the regression residuals across countries. In practice, nozero error covariances usually arise from omitted common factors that influence the countries' autoregressive distributed lag processes. I attempt to eliminate these common factors and, thus, ensure the

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appeal, in that it is likely that investors in the long-run would hold firms to the same standards, but in the short-run, firm and market-specific factors most likely have dominant and differential effects. In particular, in the short-run, the opportunity to expand arms exports might be determined by the internal economies of scale of a particular firm, while in the long-run the arms trade control regulations by the government are enforced at the country level (US) or even on a supranational level (EU), creating a more homogenous effect on defense companies. To already anticipate the main results, for my purposes, the PMG estimator offers the best available compromise in the search for consistency and efficiency.

The relationship between the abnormal equity return of defense-related firms and the violent protests during the Arab Spring is estimated using the following autoregressive distributed lag (ARDL) $(p, q_1, \ldots, q_n)$ specification based on a dynamic panel between January 2010 and December 2014. This estimation technique allows separating the short and long-run dynamics and models the long-run convergence process, under the form of unique coefficients for the variables in the long-run and heterogeneous ones in the short-run. To be specific, as the short-run parameters vary across firms, I can use the following dynamic panel representation of the model

$$AR_{it} = \Phi_i\left(AR_{it-k} - \mu_i + \sum\nolimits_{j=1}^{J} \delta_j \mathbf{x}^j_{it-k-1} - \varphi\, protest_t\right) + \sum\nolimits_{j=1}^{J} \gamma_{ji}\Delta\mathbf{x}^j_{it-k-1} + \theta_i\Delta protest_t + \varepsilon_{it} \quad (2)$$

Where AR_{it} is the abnormal stock market return at day t of defense company i, the lagged abnormal return is included to control for autoregressive tendencies and serial correlation. The vector $\mathbf{x}^j$ is my set of control variables containing j elements. The terms between brackets represent the long-run relationship, including a firm-specific intercept μ_i and the long-run coefficients on the explanatory variables δ_j. These coefficients are restricted to be the same across firms to satisfy the long-run slope homogeneity condition, while in the short-run they may differ across firms (γ_{ji}). However, for a long-run relationship to exist, the error correction coefficient Φ_i, representing the speed of adjustment, must be significantly different from zero.

The variable *protest* represents my proxy composed above for the intensity of the violent protests during the Arab Spring. The average of a rolling window of two days is used for my news indicator since information may be released after the closing of the trading system. The parameters θ_i and φ can be interpreted as, respectively, the short and long-run abnormal return due to the expectations of the intensified violent protests. Under the efficient market hypothesis, security prices are assumed to reflect all public information and to adjust swiftly to the arrival of new public information. My first hypothesis presented above suggests that abnormal stock market return of defense-related firms are expected to increase in the short-run in response to the Arab Spring as the hoarding behavior of the parties involved creates a window of opportunity to expand arms exports ($\theta_i > 0$). The second hypothesis argues that, over the course of violent protests, investors become more concerned and might expect that foreign governments will take more rigorous arms control measures or even introduce an arms embargo against specific countries. These coercive trade measures will again reduce the trading volume or at least increase the trade costs. As a result, the firm profits will drop, and subsequently, the abnormal return of a defense firm will fall ($\varphi < 0$).

In the vector of control variables, I consider variables suggested by previous studies on explaining stock market returns and are required to avoid an omitted variable bias. First, the Arab Spring region is one of the most important regions for oil exports. The political violence might hamper the oil production, which increases the uncertainty about the number of barrels oil that will be traded on the world

independence condition by allowing for time-specific effects in the estimated regression. For each firm the order of the ARDL process must be augmented chosen to ensure that the residual of the error-correction model is exogenous and serially uncorrelated. At the same time, with a limited number of time series observations, the ARDL order should not be overextended as this imposes excessive parameter requirements on the data.

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market in the near future. This would lead to upward pressure on the current oil price.[27] In turn, this price uncertainty might create some spillover effects and may have important implications for monetary policy. For instance, investors might be concerned that the exchange rate starts to appreciate reducing the competitiveness of the US and EU defense industry. Consequently, there could be a danger that my results do not show the impact of the Arab Spring on the equity return of the international defense industry, but instead reflect the relationship between defense stocks and other financial assets or commodities. To address this issue, I include the daily log-change of the Brent spot oil price and the monthly log-change in the real exchange rate in my analysis. Additionally, the defense sector is a large buyer of base materials such as steel and aluminum. When the price of these raw materials increases, this will raise the production costs of a defense company. As a consequence, the future profits of a defense-firm are likely to fall. To capture this issue, I include the log-change in the monthly Base Metals Price Index reported by the IMF. Furthermore, I include the daily log-change of the trading volume of specific defense stock to capture its degree of liquidity. Finally, I add month and year fixed effects and a day-of-the-week dummy to capture trading day effects.

The PMG estimator involves the existence of a long-run equilibrium relationship. One crucial assumption is that the model cannot be consistently estimated when all the single variables have unit roots or are nonstationary of order one, unless the variables in the long-run relationship are co-integrated. Hence, I need to perform panel unit roots tests for all the variables and test whether a co-integrating equilibrium relationship between variables exists. If the time series mean-variance is constant, then it is said to be stationary over a period. The augmented Dickey-Fuller (ADF) test is used to test for the nonstationarity of the time series.[28] The results in table A1 in the appendix present the p-values of panel ADF unit root tests for each variable applying the test suggested by Im et al. (2003). The null hypothesis of this test is that all series are nonstationary. An advantage of this specific unit root test is that it allows for heterogeneous short-run dynamics. The lags included in the ADF regressions are selected on the basis of the Akaike Information Criterion (AIC). The results in the upper part of the table suggest to accept the null of unit roots for most of the variables in the level form at the five percent significance level, whereas the variables are mainly stationary in the first-difference form.

In the next step, I check for cointegration using the empirical tests suggested by Pedroni (1999), testing the null of no co-integration without imposing homogeneity of the co-integrating vector. The results are reported in the lower part of table A1 in the appendix. My findings suggest that the null hypothesis of no co-integration can be rejected most of the time. Hence, it may imply that there is a long-run steady, state relationship between all variables in my model after allowing for a firm-specific effect. Thus, PMG modeling is likely to be appropriate to use for my purpose.

Empirical findings

Baseline results

This section presents the estimation results on the relationship between the violent protests during the Arab Spring and the abnormal equity return of international defense companies. The optimal number of lags for each variable is determined using the Schwarz Bayesian Information Criterium (SBC).[29] To obtain robust standard errors, I use the bootstrap estimator with one thousand replicators of the Newton-Raphson optimization algorithm to maximize the likelihood function. Using the bootstrap procedure reduces the error-in-error problem, as my dependent variable is based on the residual from a previous regression.

In column (1) of table 1, I report my baseline estimation results. To test for long-run homogeneity, I use the Hausman test based on the null of equivalence between the PMG and MG

[27]See, for instance, Kollias and Papadamou (2013).
[28]Dickey and Fuller (1981).
[29]All results are robust for alternative selection criteria like AIC and the Hanna-Quinn Information Criteria (HQ).

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Table 1: Abnormal stock market return and the Arab Spring

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Long-run coefficients							
Violent protests news	−0.004**	−0.005**	−0.002*	−0.003**	−0.004*	−0.002**	−0.003*
	(0.0015)	(0.0295)	(0.0012)	(0.0011)	(0.0022)	(0.0006)	(0.0018)
Violent protests news × Exposure		0.0006					
		(0.0009)					
Violent protests news × US headquarters			−0.001*				
			(0.0003)				
Violent protests news × Military goods				−0.001*			
				(0.0006)			
Violent protests news × aircraft, ships, and vehicles					−0.001*		
					(0.0007)		
Violent protests news × Services and maintenance					0.001		
					(0.0009)		
Violent protests news × Electronics and communication					0.001		
					(0.0011)		
Violent protests news × Artillery and missles					−0.001**		
					(0.0003)		
Post-major violence period						0.001	
						(0.0017)	
Violent protests news × Post-major violence period						−0.001**	
						(0.0002)	
Violent protest and riot events							−0.007
							(0.0049)
Political change events							−0.007*
							(0.0042)
Terror events							−0.007*
							(0.0039)
Violent protests news × Violent protest and riot events							−0.002
							(0.0022)
Violent protests news × Political change events							−0.002*
							(0.0012)
Violent protests news × Terror events							−0.002*
							(0.0012)

(*Continued*)

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Table 1: (*Continued.*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Error correction variable Φ	0.058**	0.058**	0.060**	0.069**	0.063**	0.067**	0.051**
	(0.026)	(0.026)	(0.0254)	(0.0283)	(0.0178)	(0.0300)	(0.0156)
Short-run coefficients							
Violent protests news	0.006**	0.007*	0.006**	0.007**	0.008**	0.005**	0.007
	(0.0027)	(0.0668)	(0.0019)	(0.0027)	(0.0026)	(0.0019)	(0.0068)
Violent protests news × Exposure		0.0003					
		(0.0004)					
Violent protests news × US headquarters			0.001*				
			(0.0009)				
Violent protests news × Military goods				0.002			
				(0.0030)			
Violent protests news × aircraft, ships, and vehicles					0.002*		
					(0.0012)		
Violent protests news × Services and maintenance					−0.003		
					(0.0021)		
Violent protests news × Electronics and communication					−0.002		
					(0.0027)		
Violent protests news × Artillery and missles					0.002*		
					(0.0014)		
Post-major violence period						−0.002*	
						(0.0012)	
Violent protests news × Post-major violence period						−0.001*	
						(0.0007)	
Violent protest and riot events							0.016*
							(0.0091)
Political change events							0.015*
							(0.0079)
Terror events							0.016*
							(0.0085)
Violent protests news × Violent protest and riot events							−0.002*
							(0.0011)
Violent protests news × Political change events							−0.002*
							(0.0011)

(*Continued*)

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Table 1: (*Continued.*)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Violent protests news × Terror events							−0.002*
							(0.0011)
Hausman test (p-value)	0.20	0.23	0.21	0.13	0.23	0.33	0.32
Loglikelihood test (p-value)	0.12	0.31	0.35	0.13	0.35	0.21	0.37

Note: **/* Indicating significance levels of respectively 5 and 10 percent. The table shows short and long run results using the Pooled Mean Group estimator. Bootstrapped standard errors are shown between brackets. Estimated including the controls outlined in the main text.

estimation.[30] Rejecting the null implies rejecting the homogeneity of the cross-section's long-run coefficients.[31] The joint Hausman test statistic accepts the long-run slope homogeneity restriction at the 5 percent level. This implies that the consistency of the MG estimate is not warranted, and so the PMG estimate should be preferred.[32] The consistency and efficiency of the PMG estimates rely on two further conditions. First, the intensity of the violent protest should be identified as exogenous for international defense firms. This criterion is satisfied by arguing that individual defense firms are not able to influence the intensity and escalation of the violent protests and take it as given. The second criterion is that the residuals are serially uncorrelated. To capture this issue, I include firm-specific effects by allowing for an intercept for each firm. Besides, to control for cross-firm common factors, I demean the data on the explanatory variables using the corresponding cross-sectional means.

Based on the PMG estimation results, I can conclude that the short- and long-run response of investors in the defense industry to the intensity of the violent protests during the Arab Spring differs. On the one hand, I find a significantly positive short-run effect of the number of newspaper articles containing information about the Arab Spring on the abnormal stock return of EU and US defense companies, but on the other hand, the abnormal return of these firms drop in the long-run at common confidence levels after the publication of protest-related news. One possible explanation is that investors recognized the intensification of the Arab Spring protests as a window of opportunity for defense firms in the short-run to expand exports. However, in the long-run, when the protests were escalating, investors became more concerned that the US and EU governments would start to strengthen their export control policies or even impose a complete ban on arms transfers to the Arab region. Both policies would have dampened arms exports again.

To provide an approximation of the overall impact of violence-related news items on the considered defense-related stocks, I multiply the cumulative abnormal return of the escalation indicator by the coefficients found in column 1. In the short-run, the Arab Spring increases the abnormal stock market return of a defense firm by 4.9 percentage points, while in the long-run, the abnormal equity returns drop by 2.7 percentage points. This latter finding indicates that the long-run effect compensates for a large part of the short-run positive return. The significant error correction term indicates that approximately 2 percent of the adjustment to the steady-state takes place each day. This means that about half of the news effect would disappear within a week. Thus, the abnormal equity return of the considered defense companies adjusts fairly quickly to its equilibrium level. This demonstrates that defense-related stocks have a rather efficient price discovery since most information is taken into account rather fast. To conclude, these findings provide some empirical support for both hypotheses outlined above.

[30]Pesaran et al. (1996).

[31]An alternative to the Hausman test is the likelihood ratio test for short-run or long-run parameter heterogeneity that has homogeneity as the null (Hsiao et al., 1999). The results of the likelihood test throughout this paper does not differ to the Hausman test and is available upon request.

[32]The individual MG estimation results are available upon request.

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The results found so far indicate that there is only a small economic effect of the Arab Spring on the stock market return of US and EU defense firms. One possible explanation is that the exposure to the Arab Spring of these firms is not immediatly clear. On the one hand, although the United States and European Union are important arms suppliers for the Arab region, the value of the arms trade to the countries that are directly subject to the Arab Spring is remarkably lower. Only about 15 percent of the total value of the military trade to these countries in the five years preceding the start of the Arab Spring comes from the US or an EU country. On the other hand, this latter figure is based on official statistics. It is well documented in the existing literature that during armed conflicts, the volume of re-exports and illicit transfer of arms increases substantially. This is especially the case when military sactions are imposed and firms try to avoid these restrictions as arms embargoes raise the price of military equipment on the black market in target countries.[33] For instance, DellaVigna and La Ferrara (2010) find that the intensity of a conflict during an embargo period creates an upward pressure on the stock prices of weapon-making companies as many of them are trading illegally and violating the embargo. All of these practices are not directly reflected in the official figures reported by the defense firms. Besides, there might exist a contagious effect. When a particular Arab country is not directly subject to the Arab Spring, it may still influence the stock market return of a defense company indirectly, as investors may believe that in the near future, the civil protests will spread to other countries. As a reaction, investors might anticipate these expectations in advance.

To explore whether the reaction of investors in the international defense industry relies on the direct exposure to the Arab Spring, I include an interaction term between my violent protest measure and an indicator capturing the exposure of the defense sector of a country to the Arab Spring region. This country-specific exposure is based on the value of arms trade between country j and the countries that are subject to the Arab Spring as a share of the total value of the arms trade of a country j.[34] This ratio is calculated as the average value over the five years preceding the Arab Spring to overcome any simultaneity concerns with my violent protest measure and to smooth out extreme values. The results in column 2 of table 1 again indicate that there is a general significant, positive short-run effect of the Arab Spring on the abnormal return, while in the long-run, the abnormal stock return drops.[35] However, the interaction term is both in the short and long run statistically insignificant. This finding implies that the reaction of investors is not immediately based on the direct exposure to the Arab Spring, but relies probably more on the expections that the civil protests will spread to other countries in the region. An alternative explanation for this latter finding is that investors are maybe less well informed about the actual exposure of the EU and the US defense sector to the Arab Spring and assume that all arms supplying countries are equally exposed.

Firm-specific effects

It is highly questionable whether the Arab Spring has the same impact on the abnormal equity return of the broad range of defense-related firms competing around the world. For instance, the new trade theory stresses the importance of firms rather than sectors in understanding the challenges countries face in international trade.[36] This latter argument suggests that the threats and opportunities offered by the Arab Spring rely, to a certain extent, on firm-specific characteristics. Consequently, the Arab Spring might have a significant impact on the abnormal equity return of one firm (or group of firms) and is insignificant in another. Thus, an important question to which I will turn now is whether firm-specific characteristics affect the impact of the violent protests during the Arab Spring on abnormal equity

[33]Tierney (2005).

[34]Based on data reported by the SIPRI.

[35]As an additional robustness test, I have excluded newspaper articles that explicitly contain information about Syria, Libya, Algeria, and Yemen, as they mainly buy military equipment from Russia. However, the correlation with my original violent protest indicator remains large ($r = 0.8$). Although, the magnitude of the variables of interest differ, the main conclusions drawn throughout this study still hold (detailed results are available upon request).

[36]Markusen and Venables (1998).

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returns. In more detail, I estimate the following model.

$$\begin{aligned} AR_{it} =& \Phi_i\Big(AR_{it-k} - \mu_i - \sum_{j=1}^{J} \delta_j \mathbf{x}^j_{it-k-1} - \sum_{m=1}^{M} \varsigma_m \mathbf{Z}^m_{it-k-1} \\ & - \varphi\, protest_{it} - p(protest_t \times \sum_{m=1}^{M} \mathbf{Z}^m_{it-k-1})) + \sum_{j=1}^{J} \gamma_{ji} \Delta \mathbf{x}^j_{it-k-1} \\ & + \sum_{m=1}^{M} \psi_m \Delta \mathbf{Z}^m_{it-k-1} + \theta_i \Delta protest_t + \nu_i (protest_t \times \sum_{m=1}^{M} \Delta \mathbf{Z}^m_{it-k-1}) \Big) + \varepsilon_{it} \end{aligned} \tag{3}$$

Where $\mathbf{z^m}$ is a vector containing m firm-specific characteristics represented by a series of dummies. The other variables have the same meaning as in equation (2). Moreover, I can test whether the impact of the violent protests differs between firms using the following long-run (*LR*) and short-run (*SR*) marginal effect.

$$\boldsymbol{LR}\text{:}\ \frac{\partial AR}{\partial protest} = \varphi + \rho \boldsymbol{z^m},\ \boldsymbol{SR}\text{:} \frac{\partial AR}{\partial \Delta protest} = \theta_i + \nu_i \boldsymbol{z^m} \tag{4}$$

In the remaining of table 1, I report the regression results on the conditional impact of the violent protests on the abnormal equity return in the defense industry. First, the industrial base between the European Union and the United States substantially differs. The European defense industry is highly fragmented across countries and relies, to a great extent, on national protection, while the US industrial base is regarded to be much more competitive and dominated by economies of scale. Additionally, the stringency, implementation, compliance, and enforcement of export control policies differ significantly between the European Union and the United States. As already mentioned above, during the Arab Spring period, the United States revoked much of its export licenses to this region, while EU based firms were still able to export to the affected Arab countries. To explore whether the impact of news items containing information about violent protests on the abnormal return diverge between US and EU defense firms, I create an interaction term between the violence-related news indicator and a dummy taking the value one when a particular defense company has its statutory headquarters located in the United States. The results in column 3 of table 1 indicate that the magnitude of both the short- and long-run effects is significantly larger for US public listed defense companies. This finding suggests that investors in US firms reap more benefits in the short-run, when the intensity of the Arab Spring increased, but in the long-run, traders also expect that the US government will implement more stringent arms trade policies compared to other countries. One possible explanation for the difference in the magnitude of the effect is that US firms are likely to produce more strategic goods that can directly be used to repress the violent protests. This kind of equipment is likely to be most affected by the window of opportunity to expand exports as well as more subject to arms trade control. Alternatively, due to the political and legislative procedure and the national interest of the individual EU countries, it is much more difficult to reach a political agreement on common foreign policies such as the imposition of arms embargoes.

To elaborate some further on whether the impact of the Arab Spring on the abnormal equity return of defense companies relies on the type of goods a firm manufactures, I perform two sensitivity tests. First, I add an interaction term between the violence-news indicator and a dummy variable taking the value to one, when at least half of the firm revenues can be contributed to the sales of only military goods or services (based on information taken from Defense News and SIPRI).[37] The results in column 4 indicate that firms that produce predominantly military goods benefit more from the hoarding effect in the short run compared to firms that produce mainly dual-use or civil goods. One explanation is that these former firms produce equipment that can readily be used for repressive purposes or within the escalation phase. In turn, in the long-run, the downward pressure on the equity prices caused by

[37]I have also used alternative thresholds of 40 and 75 percent. However, the results do not dramatically change.

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the violent protests is insignificant for firms that produce goods that also have a civil purpose as they are perhaps better able to diversify their business activities and effectively mitigate the adverse effects of arms embargoes as it is expected that only a small part of their products will be subject to an embargo. This view is strengthened some further when I apply a more detailed split on the types of military goods a firm produces by adding interactions with dummies that capture different product categories: (i) aircraft, ships, and vehicles; (ii) service and maintenance; (iii) electronics and communication; (iv) artillery and missiles; and (v) other strategic military goods (reference category). The information on this categorization is taken from the Defense Top 100, and a firm can appear in multiple categories as it produces different goods and services. The results in column 5 of table 1 indicate that especially the abnormal return of companies that produce goods that fall in the categories "aircraft, ships, and vehicles" or "artillery and missiles" are influenced by the violent protests. On the one hand, firms producing these types of military equipment benefit the most in the short-run from expanding military demand as the use of these types of goods can immediately be used for security purposes or provide a strong signal of power. On the other hand, in the long-run, firms manufacturing these kinds of goods suffer from the expected risk to be subject to coercive trade measures as these types of military goods may cause many civilian causalities. One important note regarding these latter results is that the sample size is reduced substantially due to the lack of detailed information about the military goods a particular firm produces. As a result, there might be a sample selection bias present as this data is only readily available for the largest defense companies.

The strength of the relationship between the intensity of violence and abnormal equity return might also alter during the course of the Arab Spring. The sample period used in my analysis covers the long period from the start of the Arab Spring in December 2010 to the end of April 2013, when the fragile peace was restored in many countries again. Splitting the period establishes a more consistent identification of the impact of the protests at different points in time, depending on the violence-intensity across the periods. Figure 1 clearly shows that there is a nonlinear time trend in the number of news articles containing information about the Arab Spring. Based on this figure, one can argue that the degree of violence peaks around the beginning of January 2012. To capture this issue in more detail, a post–major violence period dummy is created, taking the value one on the days after 1 January 2012, and zero before this date. I add this dummy variable in my empirical specification, together with the corresponding interaction term with my news indicator. The results in column 6 of table 1 demonstrate that news items published around the inception of the Arab Spring have a significantly larger positive effect in the short-run on the abnormal equity return. In contrast, the publication date leaves the long-run effect almost unaffected. One explanation is that after January 2012, the attention of investors declines as the media coverage is falling, or that the news content of the articles has become lower.

One alternative explanation of the latter finding is that the vast majority of the major violent incidents took place during the first half of my period of research. To determine whether my results are driven by the media coverage around these extreme violent events, I use the timelines prepared by two publications: Al-Jazeera and *The Guardian*. Combining these timelines leaves me with more than 150 significant incident days during the Arab Spring period. In the next step, I have classified the events in three broad groups and created count variables capturing (i) major (violent) protests and riots, (ii) political changes including government and regime change, and (iii) terror events, like suicide attacks and terrorist acts.[38] To control for these major events, I add the count variables together with the interaction terms and the news indicator into the empirical estimation. Some of the events occur in tandem, for instance, major violent protests sometimes coincide with terror attacks. Simultaneous inclusion of the different events allows for isolation of the effects of each event. The results in column 7 of table 1 indicate, not surprisingly, that a lot of the variation in the abnormal return caused by the Arab Spring is explained by a number of major events. However, even after controlling for these events, the news indicator remains statistically significant at common confidence levels.

So far, I have explored the impact of the Arab Spring on the abnormal equity return of defense companies. Given the relative insignificance of the share of defense firms in these aggregate stock indices, it

[38]See also Tanyeri (2018).

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Table 2: Stock market return and idiosyncratic risk

	Stock market return				Idiosyncratic risk
	S&P500	DAX100	CAC40	FTSE100	
	(1)	(2)	(3)	(4)	(5)
Long-run coefficients					
Violent protests news	−0.001	−0.001	−0.001	−0.001	−0.005**
	(0.0008)	(0.0012)	(0.0012)	(0.0011)	(0.0021)
Error correction variable Φ	0.025**	0.028**	0.037**	0.023**	0.041**
	(0.007)	(0.007)	(0.011)	(0.009)	(0.011)
Short-run coefficients					
Violent protests news	−0.002	−0.002	−0.002	−0.002	0.007**
	(0.0019)	(0.0039)	(0.0011)	(0.0018)	(0.0020)
Hausman test (p-value)	0.365	0.113	0.347	0.156	0.390
Loglikelihood test (p-value)	0.102	0.269	0.359	0.355	0.210

Note: **/* Indicating significance levels of respectively 5 and 10 percent. The table shows short and long run results using the Pooled Mean Group estimator. Bootstrapped standard errors are shown between brackets. Estimated including the controls outlined in the main text.

is expected that the Arab Spring should not affect these indices. However, when the stock market return is affected, focusing only on the abnormal return would underestimate the true effect due to endogeneity issues. To formally test the validity of the assumption underlying the previous results, I use the aggregate return on four major stock exchanges as my dependent variable (US S&P500; Germany DAX100; France CAC40; UK FTSE100). In table 2, I report the results of this placebo test. My expectations are mainly confirmed since, for any of the aggregate indices, there is a significant effect of my violence news indicator.

Idiosyncratic volatility

The previous analyses were mainly focused on the impact of the Arab Spring on the abnormal equity return of international defense companies, thereby neglecting the risk in investing in these firms. Risk in investments means that future returns are unpredictable, and the absolute abnormal returns are likely to be large. In the context of the stock market, two broad types of risks are generally identified—systematic and idiosyncratic risk. Systematic risk is defined as a risk that cannot be avoided, assuming participation in the stock market. This is because there are certain risk elements that are market-wide; these risks cannot be avoided by portfolio diversification. In turn. Idiosyncratic risks are firm-specific risks that can be diversified away by holding a diverse portfolio. In particular, in Merton's (1987) framework, firms' idiosyncratic risk is priced because of the imperfect diversification that stems from a lack of investor recognition. Firms with higher idiosyncratic volatility should offer a return premium to compensate shareholders for the undiversified risk they impose.[39] In the next analysis, I explore whether, next to the abnormal return also, the idiosyncratic risk is affected by the Arab Spring. Following Ang et al. (2009), I estimate firms' idiosyncratic volatility as the daily variance of the abnormal stock returns taken from the asset pricing model shown in equation (1).[40] The results in column 5 of table 2 indicate that, in the short-run, the idiosyncratic risk has significantly increased due to the Arab Spring, while in the long-run this risk drops. These findings imply that in the short-run investors ask a risk premium to compensatie for the higher idiosyncratic risk as they can not

[39]Chen and Petkova (2012); Fu et al. (2009).
[40]See also Prabhat and Primo (2019).

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immediately diversify this risk. In the long run, when the newspaper coverage of the Arab Spring increases investor recognition, this will improve diversification and cause a fall in the idiosyncratic risk.

Conclusion

Starting in December 2010, a revolutionary wave of demonstrations and protests spread throughout the Arab region, collectively referred to as the "Arab Spring." These mass civil protests culminated in different political outcomes across the region. In many countries, the civilian protests produced immediate regime changes, and rulers were forced to resign from power, along with changes in domestic and foreign policies. However, in a number of other countries, the government severely responded to the protests with military repression, which finally led to civil violence. One can argue that the start or intensification of a violent conflict has two opposing effects on the international transfer of arms. On the one hand, the start of a conflict is associated with an increase in military spending (hoarding effect). On the other hand, the escalation of a conflict raises the concerns of implementing more rigorous arms trade regulations or can even lead to a ban on military imports (control effect). Thus, it is not straightforward which of the two effects will dominate, and thus what the reaction of investors in the defense industry was going to be at the start of the Arab Spring.

Even though it is clear that the Arab Spring was born of a desire for more social, political, and economic freedom, the timing of the uprisings came as a complete surprise. These events provide, therefore, a unique setting for a natural experiment to analyze the impact of unexpected violent political protests on the expected profitability of the international defense-related industry. The main findings presented throughout this study clearly point out that the intensification of news containing information about the violent protests increases the abnormal equity return of defense-related firms by about 5 percentage points in the short-run, while it declines the abnormal equity return of these companies in the long-run by approximately 3 percentage points. Thus, when the protests started, investors expected that the involved parties would start to hoard military equipment, creating an opportunity to expand exports over the course of the conflict. The concerns of international sanctions started to take over their expectations. The empirical results, therefore, provide support for both the hoarding as well as the control hypothesis. The results are in line with expectations from the efficient market hypothesis and indicate that investors act rather rationally, taking into account all information that is available when making an investment decision. Nevertheless, it turns out that firm-specific particularities can explain a significant part of the effects found. For instance, the magnitude of the effect is larger for firms that produce predominantly military goods. This supports the so-called new trade theory that stresses the importance of firms rather than sectors in understanding the challenges countries face in international trade.

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