that investors are particularly bearish on firms with heavily European GVCs. Second, as the Sterling falls post-Brexit, this increases the firm's return from exporting while simultaneously increasing the cost of intermediate inputs, generating an ambiguous e ect. Here, we find that on average these e ects cancel out. That said, after controlling for the importance of imported intermediates, we find significant e ects with one-third of firms doing worse compared to expectations when the Sterling fell relative to their key markets' currencies. As expected, this group is concentrated in those industries that are imported intermediates intensive. Beyond these main hypotheses, we also find that larger firms fared better whereas those with more a liates (and potentially more complex GVCs) performed worse relative to expectations. This indicates that, even as the market as a whole fell, investors did not respond equally to all firms in the wake of Brexit and were particularly concerned with those whose GVCs are most vulnerable to increased trade barriers. Consistent with the growing body of literature demonstrating the productivity gains that come from being part of a GVC (e.g. Halpern, Koren, and Szeidl, 2015), one would expect a greater decline in the share price of such firms, which is indeed what we find.

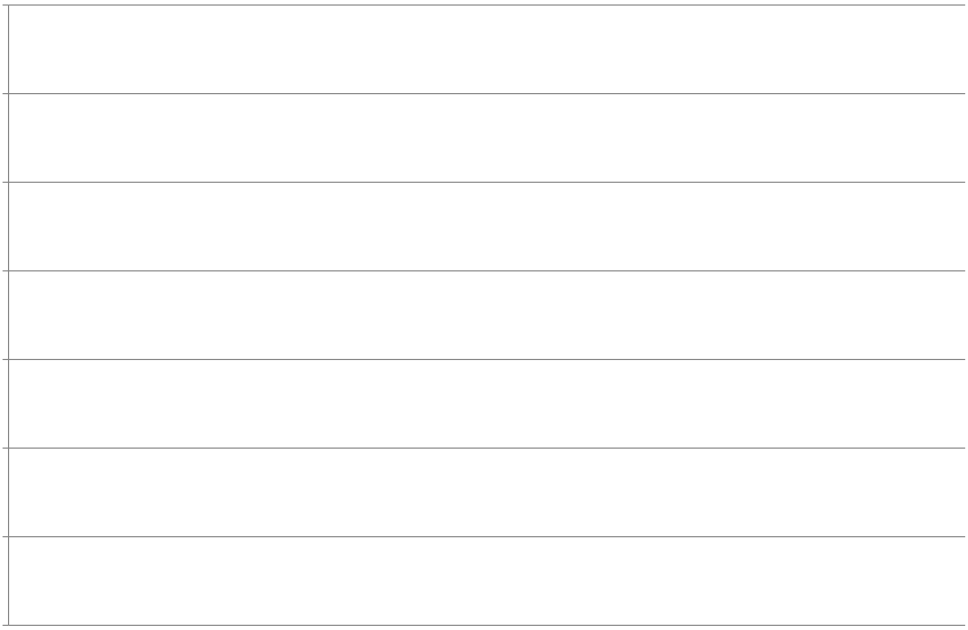
Beyond this, we find that the market's reaction was sizable and remarkably swift. Following the announcement of the referendum's results in the evening of 23 June, the FTSE 350 lost 7% of its value over 24 and 27 June (the first two trading days following the result's announcement).[5] However, by a week later (June 30) it had reached its former level. Our analysis shows that, as with the decline, this recovery was not equal across firms. In particular, we find two things. First, the di erential treatment in line with GVC di erences was short-lived and confined to the first three trading days during which at-risk GVCs did markedly worse on the 24th and 27th but slightly better on 28 June. After that, however, the GVC variables no longer explain actual versus expected performance. Second, the cumulative abnormal return of such firms (the sum of the abnormal returns over a longer window) remained significantly lower. This means that, despite the slight rally for the most a ected firms on 28 June, this was insu cient to o set their losses, with a net negative e ect observable even four weeks after the referendum. Thus, while the market as a whole lost 7% of its value in those two days and then regained it over the next three, for firms with heavily European GVCs and small currency depreciations, the initial underperformance had a lasting e ect.

In addition to the outcome of the referendum, we consider five subsequent Brexit related \events": 5 October 2016 (Brexit speech by Prime Minister May outlining her plan for negotiations), 3 November 2016 (referral of a case challenging the legality of Brexit to the Supreme Court), 17 January 2017 (the \Hard Brexit" speech by Prime Minister May), 24 January 2017 (the Supreme Court ruling that Parliament must be permitted to vote on Brexit), and 29 March 2017 (triggering of Article 50, commencing the two year negotiation period before Brexit). Unlike the aftermath of the referendum's outcome, the market reaction to these events was slight. This suggests that these subsequent events may have revealed little useful information. Further, we find little significance for our GVC variables in the determination of firms' abnormal returns. Thus by analyzing this set of quasi-placebo dates, we are able to

are fairly insulated from Brexit's implications due to their low UK presence and the fact that Brexit does not impact trade policy among remaining EU members. Here, although the market fell with a similar spike in abnormal returns after the Brexit vote, as expected the GVC variables have no explanatory power.

That the market's response was so swift and decisive may seem somewhat surprising. However, in preparation for their responses, many brokerage firms took steps to ensure that their traders were prepared to respond as soon as the markets were open, some going so far as to book hotels nearby so that traders could arrive at 2 am to prepare.[6] In addition, the firms that provide the technical framework for the operating of the major markets prepared by adding system capacity and halting upgrades in anticipation of the heavy volume.[7] Thus, it is clear that the markets were ready to respond when the results became clear. This anticipation, however, has the potential to cause concern for our event study since, if investors were altering their behavior prior to 24 June, this can muddy the waters when estimating the impact of the event. In our case, however, we do not feel that this is likely for two reasons. First, although the date of the referendum was known, its outcome was at best uncertain. Figure 1 shows the outcome of various polls for the year leading up to the referendum.[8] As can be seen, for the bulk of the period there was no clear dominance of the \remain" or \exit" camps. Only during the last few days of the campaign did one side dominate, with the remain voting leading. As an alternative metric for what was expected, one can look to the book-makers. On 23 June, betting agency Paddy Power had the odds for remain at 1/12 while the payo for exit was 7/1, indicating that they (and other betting houses) expected the remain camp to prevail.[9] Thus,

Figure 1: Brexit polls



S ˙ l (0).

estimates, our regression results in an adjusted R-squared of .063; when also including our GVC controls, this rises to .463 indicating that a major part of the variation is firm-specific rather than industry-specific. Thus, our results point to a key role of firm-specific, within-industry variation that their analysis does not address. Second, they do not discuss the timing of the market's reaction to Brexit whereas we are able to demonstrate that it was a very rapid and persistent reaction. Third, they do not consider other markets whereas we also analyse the HDAX. Beyond this, our analysis extends both of these studies by considering five subsequent Brexit-related events, finding that the Brexit vote was by far the one that provoked the strongest reaction. Thus, our results contribute by providing a more nuanced framework for understanding the heterogeneous responses to Brexit.

In addition to the event study literature, our analysis is linked to the literature on global value chains. Here, a significant part of the discussion is given over to describing the fragmentation of production across borders using both case studies, such as Dedrick, Kramer,

2.1 A

First, we use data on companies listed on London Stock Exchange. There are almost 1,400 companies listed on the main market of the Exchange.[11] The largest companies are grouped into two main indices: the FTSE 100 Index and the FTSE 250 Index, with the FTSE 350 being their union. The FTSE 100 represents the performance of the 100 companies with the highest market capitalization, a group which comprises around 85% of the Exchange's total value. The next 250 largest firms (the FTSE 250) make up a further 12.5% of the total Exchange's market capitalization. Both of these groups vary over time as the sizes of individual firms vary. We use the list of FTSE 350 companies from the Exchange as of October 2016 and maintain this set of firms through all of our analysis.[12] This was then trimmed to 339 firms

γ_i by the number of days in the window. This AR/CAR can be positive or negative. A negative CAR means that, relative to what the overall market's performance during the event

slightly elevated, indicative of some continuing disruption in the market. Thus, the summary statistics on our ARs suggest that there was indeed an uptick in market turbulence as embodied in our ARs following the referendum, but that this was largely confined to the first two trading days after the referendum.

Table 1: Abnormal Returns Surrounding the 23 June Referendum

	Mean	St. Dev.	Min	Max
20-June-16	0.74%	2.28%	-6.53%	13.15%
21-June-16	-0.09%	1.7%	-13.13%	13.06%
22-June-16	0.04%	1.48%	-8.26%	8.19%
23-June-16	0.44%	1.44%	-5.88%	5.34%
24-June-16	-3.41%	7.49%	-28.28%	13.53%
27-June-16	-3.8%	5.96%	-27.68%	8.37%
28-June-16	0.92%	2.95%	-15.79%	12.87%
29-June-16	0.36%	2.88%	-6.75%	19.34%
30-June-16	0.08%	2.37%	-7.44%	15.05%
14-July-16	0.27%	2.01%	-10.97%	16.71%
21-July-16	0.12%	2.65%	-13.68%	28.21%

S *l* *l* *(0).*

In Table 2, we report the number of statistically significant ARs for the dates surrounding the referendum with a further breakdown into those that were significantly positive (i.e. firms that did significantly better than expected) and those that were significantly negative.[22] This again shows the very swift { and significant { reaction of the market. In the four days prior to the announcement of the referendum's results, there were on average 38 significant ARs per day, with this number even smaller for the three days leading up to the vote. In contrast, on the two days after the results came out, there were six times as many significant ARs (with the large share being significantly negative). After that, the number of significant ARs fell, although they are still somewhat elevated relative to the days prior to the announcement. This again shows that a major part of the market's reaction was capitalized into share prices in the two days following the announcement.

As mentioned above, while a significantly positive AR indicates that a firm did better than expected, it is still possible that its return was negative. On 24 June, 61 of our 339 firms saw their stock prices rise (a positive return). In our data, all of these had positive ARs on that day since the market overall fell. However, as Table 2 indicates, not all of them

Table 2: Significant ARs Surrounding the 23 June Referendum

Date	Total Significant ARs	Positive AR	Negative AR
20-June-16	80	70	10
21-June-16	21	13	8
22-June-16	25	14	11
23-June-16	24	18	6
24-June-16	229	64	165
27-June-16	217	38	179
28-June-16	98	82	16
29-June-16	76	51	25
30-June-16	76	38	38
14-July-16	39	25	14
21-July-16	29	14	15

S *l* *l* *(0).*

days so that over the longer window there is no cumulative abnormal return. Alternatively, if the net e ect remains negative this would suggest that the firm underperforms relative to expectations even if there is a partial correction. We use seven di erent event windows for our CARs, starting on the day of the referendum and then extending to the first day of trading after the results are known all the way up to four weeks after the results were announced. The summary statistics for these CARs are in Table 3.

Table 3: Descriptive Statistics for CARs

Window	Obs.	Mean	Std. Dev.	Min	Max
(-1,0)	339	-2.84%	7.03%	-27.59%	13.92%
(-1,+1)	339	-6.37%	11.54%	-44.4%	21.68%
(-1,+2)	339	-5.49%	10.66%	-61.3%	20.24%
(-1,+3)	339	-5.56%	10.88%	-43.75%	26.01%
(-1,+4)	339	-5.8%	12.21%	-49.0%5	28.77%
(-1,+14)	339	-4.76%	12.9%	-42.92%	40.56%
(-1,+19)	339	-4.63%	12.83%	-44.24%	35.41%

S *l* *l* *(0).*

These CARs indicate that the average firm in our sample performed worse than expected during the days after the referendum. Further, although these shortfalls grew smaller in magnitude, they remained four weeks after the referendum. Putting these results and those of the daily ARs found in Table 1 together, the picture they paint is one in which the average firm did markedly worse relative to expectations in the two days following the referendum and that these losses were not regained over the next month.[23]

[23]

2.2 F . C

Our main goal is to investigate how these firm ARs and CARs relate to firm-specific characteristics, particularly those related to GVCs. Here, we draw from three key sources.

First, we utilize ownership data from Bureau van Dijk's Orbis (2016) dataset which covers worldwide activity. While we would prefer to have data on each firm's trade patterns to measure GVC activity, such confidential customs data were not available to us. As an alternative, based on the evidence provided by Hanson, Mataloni, and Slaughter (2005) which shows the significant role of intra-firm trade in multinational's GVCs, we instead use information on the location of the a liates of the multinational of which the firm is a part.[24] For each of the FTSE 350 firms, we attempted to match it to a global ultimate owner (GUO) in the Orbis data. We were unable to do so for 11 firms, which is why our analysis utilizes only 339 firms. 325 of our 339 listed firms were their own UK-based GUOs.[25] For each GUO, we then constructed the number of a liates it owned in the UK, in the rest of the EU, and elsewhere (not counting the GUO itself).[26] We then calculated the share of its a liates in the UK and in the rest of the EU. Summary statistics from this are reported in Table 4. Note that the mean number of a liates is 176 a liates, a number driven in part by a firm with 3,393 a liates worldwide.[27] The median firm in our sample has 81 a liates. Of the 339 firms, 58 are entirely UK-based. When omitting those 58 firms we obtain comparable results.[28] While it would have been desirable to control for a liate size (i.e. to use the share of employment or investment in a country rather than the share of a liates), missing data in Orbis made this infeasible.

Table 4: Summary Statistics for A liate Ownership

Variable	Obs.	Mean	Std. Dev.	Min	Max
No of a liates	339	173.4	304.1	1	3,392
No of EU a liates	339	28.4	67.3	0	908
No of non-EU a liates	339	74.6	181.6	0	1,909
No of UK a liates	339	70.3	106.3	0	892
Share of a liates in the UK	339	55.1%	34.4%	0%	100%
Share of a liates in the EU	339	14.3%	17.7%	0%	100%
Share of a liates non-EU	339	30.6%	30.0%	0%	100%

S . l l (0).

Based on the results of Hanson, Mataloni, and Slaughter (2005), who find that trade barriers significantly hamper trade in intermediates within US multinationals, our expectation is that Brexit is expected to impede the e cient working of the firm's GVC. As such, relative to the average firm, investors would be particularly keen to sell shares of firms for which the

a liates in those regions. In particular, given that Brexit requires the UK to negotiate new trade deals not just with the EU but with other countries as well, we anticipate this e ect to be larger for the UK share of a liates than the EU share of a liates. This yields our first hypothesis.

Hypothesis 1 *As the share of a liates in the UK and the EU grow, the abnormal return and CAR should fall (so that the firm does worse relative to expectations). This decline should be more severe for the share in the UK.*

In addition to trade barriers, Brexit has the ability to a ect the GVC via exchange rate fluctuations. In particular, the British Pound fell markedly against other currencies immediately following the referendum, declining by 7.8% against the dollar and by 5.8% against the Euro on the first day after the results were announced. As the Sterling declines relative to the source of the firm's intermediate inputs, this increases costs and lowers imports. Given the results of Halpern, Koren, and Szeidl (2017) who find a positive relationship between imports of intermediates and productivity, we expect this to lower the firm's return. On the other hand, as the Sterling falls this increases the Pound-denominated benefit from exporting (be that an intermediate or a final good). This increase in the value of exporting might generate expectations of an improvement in the firm's future value. An additional positive e ect from a depreciation could arise from the firm's overseas a liates. As the Sterling falls, this would increase the Pound value of repatriated profits, thus boosting the Pound-denominated value of the parent firm. Combining these, the net e ect of a devaluation is ambiguous and depends in part on whether the import or export e ect dominates.

To estimate this net e ect, we construct the average depreciation of the Sterling against other currencies where the firm has a liates.[29] We obtain our exchange rate information from Financial Times (2017). Note that this is a depreciation (a decline in the Sterling) so that a higher value of the depreciation is a larger percentage fall in the Pound. When we examine CARs, the depreciation measure we use is the exchange rate change from the start of the event window to the end, meaning that as we increase the length of the CAR, we increase the period of time where we look at the exchange rate change. In unreported results we also used just the depreciation over 23-24 June for all CARs. This gave us similar results to those reported here. This leads to our second hypothesis.

Hypothesis 2 *If the importance of imported intermediates dominates, then the larger the depreciation of the Sterling relative to other key currencies, the worse the firm does relative to expectations. If the importance of exports dominates, then the larger the depreciation the better its relative performance.*

[29]

Table 5: Summary Statistics for Additional Controls

or industries, our analysis di ers in that we estimate the impact of non-categorical firm characteristics and their role in within-group heterogeneity.

For the ordered probit, we have three categories, a significantly negative AR, an insignifi-

Table 7: Ordered Probit Estimates

	1.124	*1.012*	*0. 21*
	0.22	*0. 03*	*0.114*
	-0.02	*1. 0*	*-0.0*

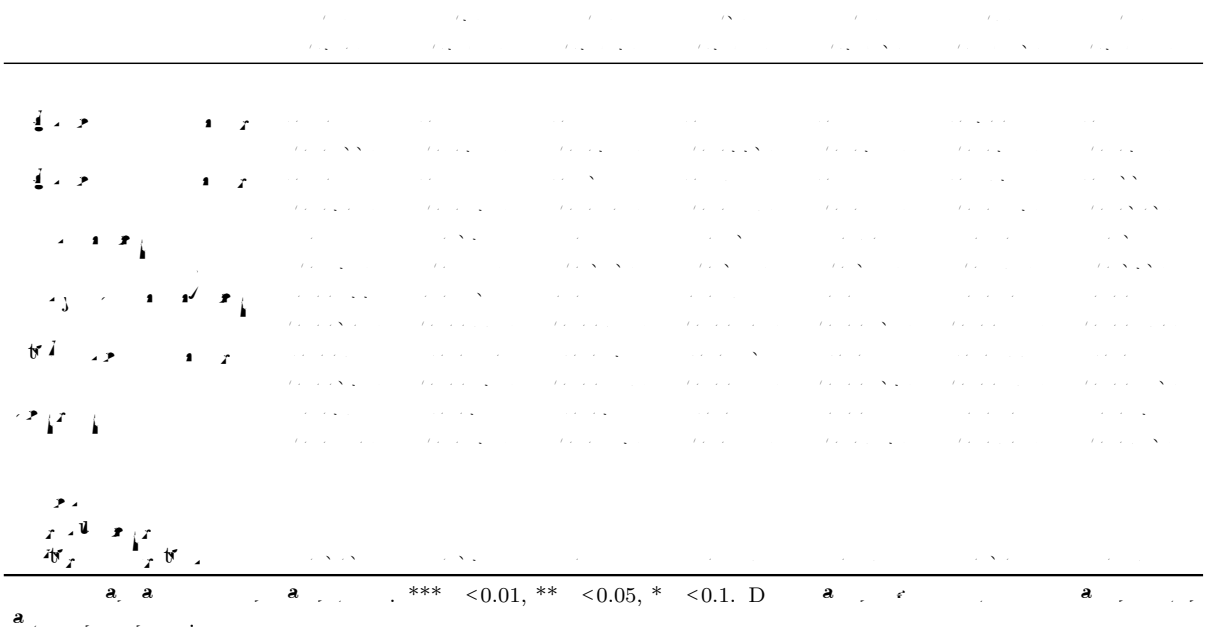
zero during a longer window.[37] That said, across all these windows, we find very comparable results.

In particular, in line with Hypothesis 1 we find significantly negative coefficients on the UK and EU affiliate shares. Using the results from column (1), these would suggest that a 10% increase in the average firm's UK affiliate share (i.e. a shift of 5.5% of its affiliate structure from outside the UK or the EU into the UK) would result in a 20.8% lower CAR.[38] In comparison, a 10% increase in the average EU share (a shift of only 1.4% of the affiliate structure) would result in a 5% lower CAR. This difference however is due to the lower mean EU affiliate share; a shift of 5.5% of the affiliate structure from outside Europe into the EU would result in a 19.1% lower CAR. Thus, as expected, the impact for the UK is greater than that for the EU, however, in no case were we able to reject the null hypothesis of equality. Thus, these GVC impacts are of economic as well as statistical significance.

Turning to the depreciation variable, we again to find no significant impact of the change in the Sterling relative to the currencies where the firm's affiliates are located. That said, using column (1)'s results, a 10% smaller depreciation relative to the sample mean would

Table 8: June 24; Size of CAR

Table 9: June 24; Size of CAR, Early Event Window



*** <0.01, ** <0.05, * <0.1. D

the losers even a month after the referendum, its significance begins to fade for the gainers within a week of the referendum and disappears a month later. Thus, for those firms that saw their price rise on 24 June, being heavily oriented towards the UK was penalized in early trading but that underperformance was erased a month later. Beyond this di erence, the market capitalization and number of a liates are only significant for the size of the CAR for the gainers. Thus, as with the full sample results, it appears that the most important factors for the CAR are the share of a liates a firm has in the UK or the EU and that this is true for both gainers and losers.

As discussed in Table 2, the bulk of the market response appeared to have occurred in the two trading days after the referendum's results were known. Furthermore, within five trading days, the FTSE 350 had recovered its overall value. Nevertheless, the CAR results of Table 8 indicate that, even as the market as a whole regained its losses, not all firms did so equally, with some overperforming relative to expectations and others underperforming even a month later. To explore the timing of the market's recovery, Table 12 presents estimates for the day-by-day AR, rather than the CAR over the event window.

As can be seen, on 23 June, the day of the referendum, firms' ARs were correlated with the share of EU a liates and the two size variables in a manner consistent with the estimates in Table 8. The estimated coe cients, however, are a mere 1% of what was found there. This suggests that, to the extent that the market was preparing for a pro-Brexit vote on the day of the referendum, such reactions were very slight. In contrast, on the first two trading days after the outcome was known, 24 and 27 June, the results are comparable to the baseline specification with heavily British and/or EU firms doing worse than expected. Notably, these e ects begin to fade out almost immediately, with the estimated coe cients for the share variables half as big on the 27th as on the 24th. Similarly, although larger firms and

Table 10: June 24; Size of CAR, Gainers Only

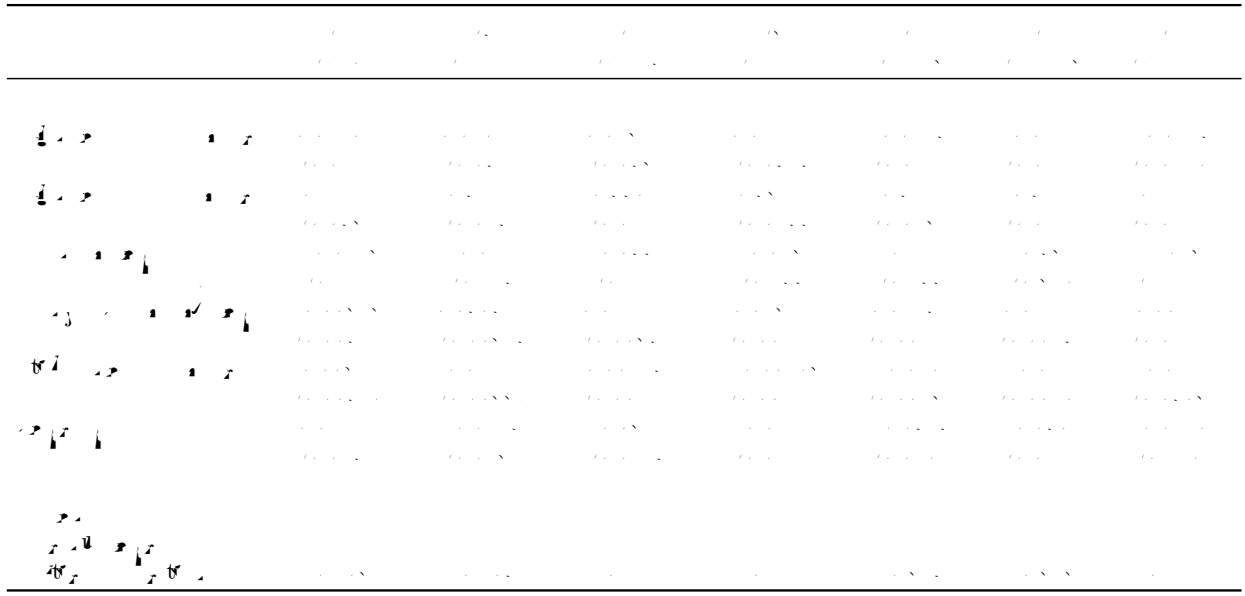
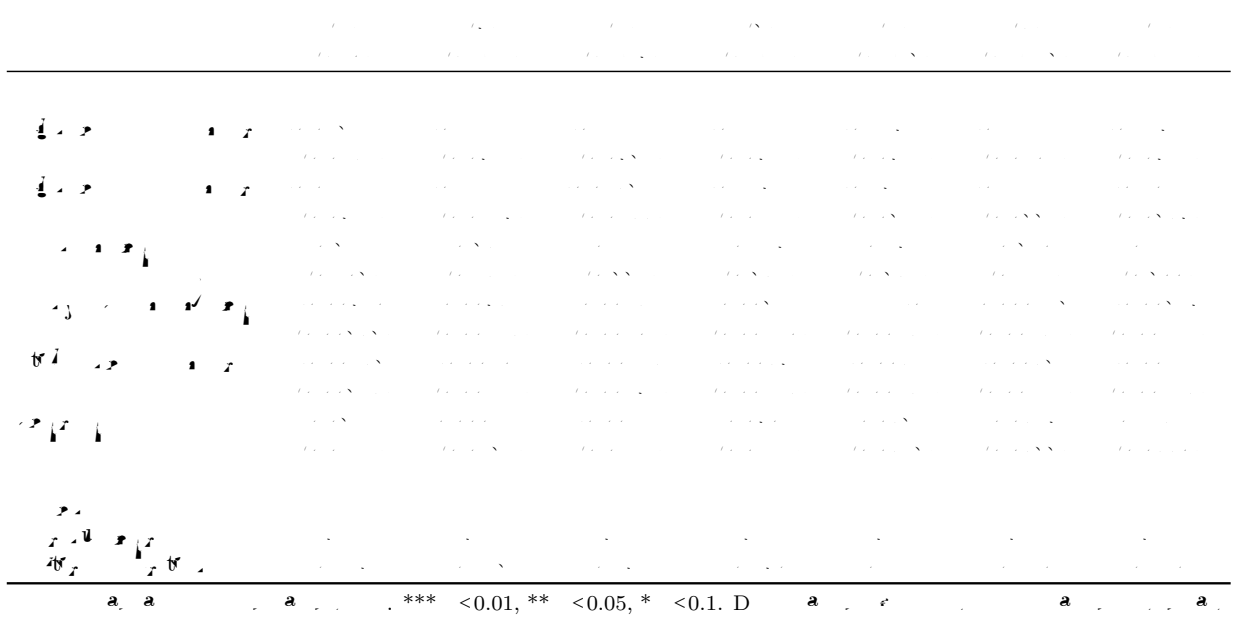


Table 11: June 24; Size of CAR, Losers Only



firms with greater UK or EU shares did better relative to expectation. By the end of that week, however, the coe cients are generally insignificant. This should not be interpreted as firms lacking ARs after 27 June; indeed Table 2 shows that some did. Instead, these estimates mean that a firm's AR was no longer significantly correlated with the GVC characteristics we control for.

Table 12 tells us two things. First, it says that the market altered its GVC-driven expectations primarily within the first two days of trading post-referendum, with those expectations very quickly moving to their new equilibrium level. Further indications of this are found by examining the adjusted R-squareds, where we see that the GVC-based reaction is mostly felt on 24 and 27 June. Second, it shows that the market did not fully reverse itself, i.e. it did not su er from exuberant pessimism. To recognize this, consider the pattern of coe cients for the share variables. While they were significantly negative on 24 and 27 June, they were significantly positive on 28 June, albeit smaller in magnitude. After that they were insignificant. This means that on the first two trading days, firms heavily invested in Europe did worse than expectations. Although such firms did slightly better on the third day, suggesting some overshooting, this recovery was not enough to reverse the cumulative e ect (as seen in the CAR results in Table 8). After that, such firms did no better or worse on average compared to their expected returns. Taken together the results of Table 12 suggests that the market

costly. This may be the reason for the lack of significance of the deprecation variable in the bulk of the estimates to this point. As a method of trying to separate out these two e ects, in Table 13 we explore Hypothesis 3 by introducing the forwards and backwards participation indices, both on their own and interacted with the depreciation variable.[42]

Table 13: June 24; Size of CAR, Interactions with Participation

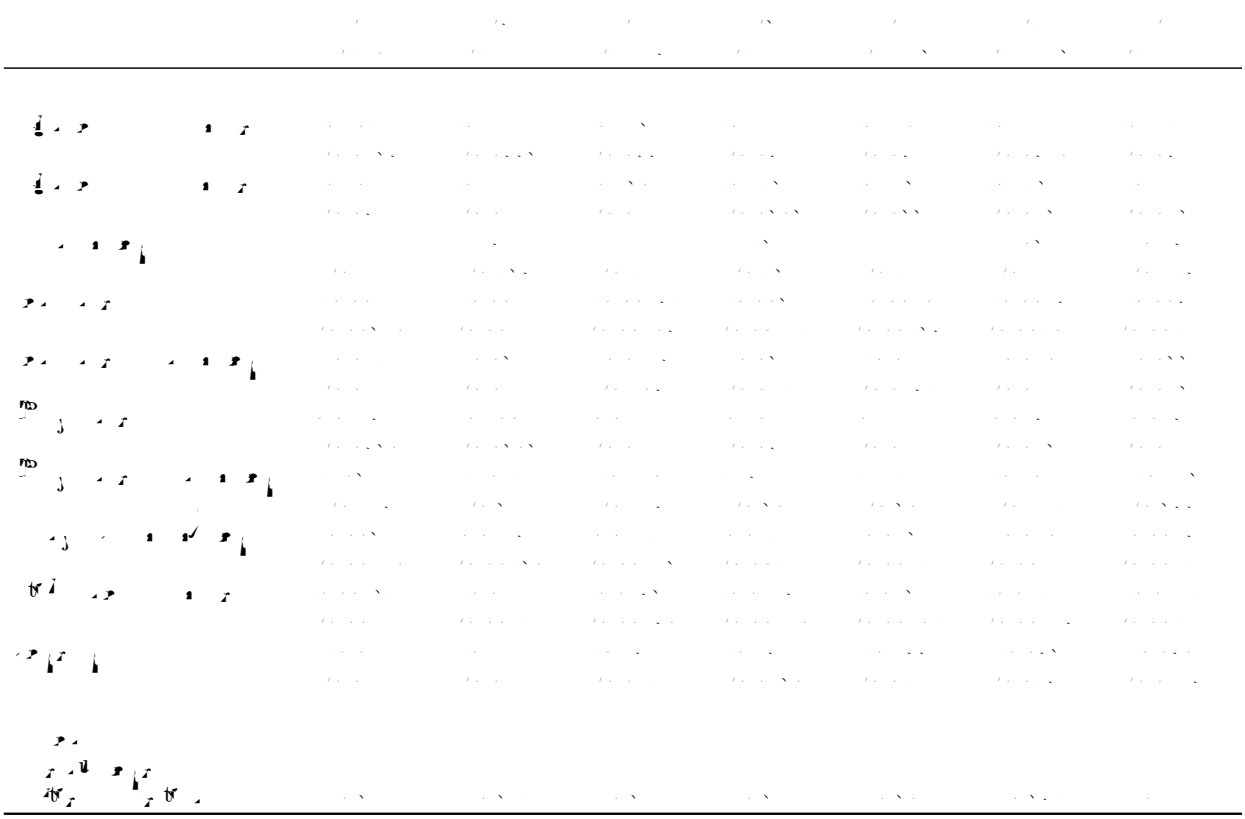


Table 14: June 24; Using 2-Digit NACE Dummies

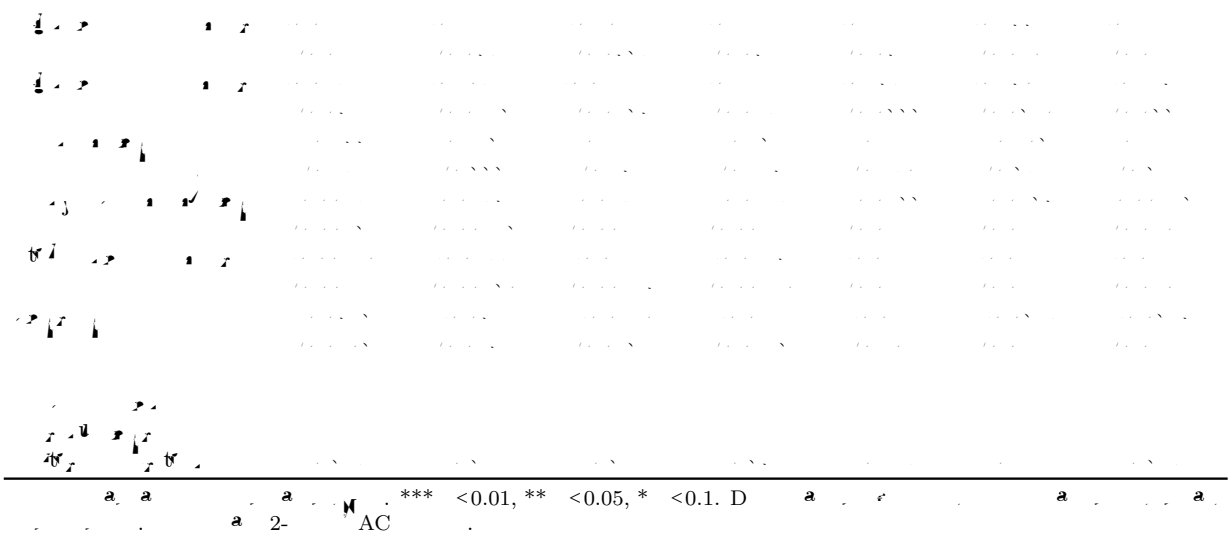


Table 15: June 24; Size of CAR, Return Variance

	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

B [illegible] *** <0.01, ** <0.05, * $<$ [illegible]

(i.e. that their large returns drive the weighted-average based market return used when estimating CARs, creating outliers in the CAR data). Again, this does not alter our baseline findings. All of these alternative results are in the Appendix.

For the final robustness check discussed here, we turn from the British FTSE 350 to the German HDAX, which covers 110 of the largest firms traded on the Frankfurt Stock Exchange.[46] For these firms, we repeated the process we used for the FTSE 350, that is, for the 94 firms we could match to Orbis data, we constructed their returns, estimated their CARs, and then regressed these on the same set of firm-specific variables.[47] Comparable to the FTSE 350, the HDAX fell following the referendum (with a market return of -6.3% on 24 June and -3.3% on 27 June with a recovery thereafter; see the Appendix for details). In this sample of firms, however, there are two important di erences compared to the British firms. First, they are far less heavily invested in the UK. Whereas the average UK a liate share was 55% in the FTSE data, in the HDAX data it is only 3.9%. Even more telling is that 31 of our 94 firms have no British holdings at all, with half having less than 2.7% of their a liates in the UK. Therefore we expect that the ability of the UK a liate share to explain the CAR to be fairly small. Second, since Brexit a ects dealings between the UK and the rest of the EU rather than between the remaining member states, Brexit should have little impact on dealings between German firms and their non-British EU a liates. Therefore, unlike in the FTSE, we do not expect any role for the EU a liate share in determining the CAR.

Table 16 presents our results for the CARs over the same estimation windows as our baseline British results. As can be seen, firm CARs are not significantly correlated with our firm characteristics. This is much as one might expect given the small exposure of these firms to the UK and the fact that Brexit has no obvious implications for trade between remaining EU members. This is not to say that these firms had no abnormal returns; as reported in the Appendix the number of significant abnormal returns spiked following the referendum with half of the HDAX firms having a significant AR on 27 June. Instead, this insignificance means that as expected our firm characteristics do not have much explanatory power for this alternative set of firms.

[46]

[47]

Table 17: Additional events; AR

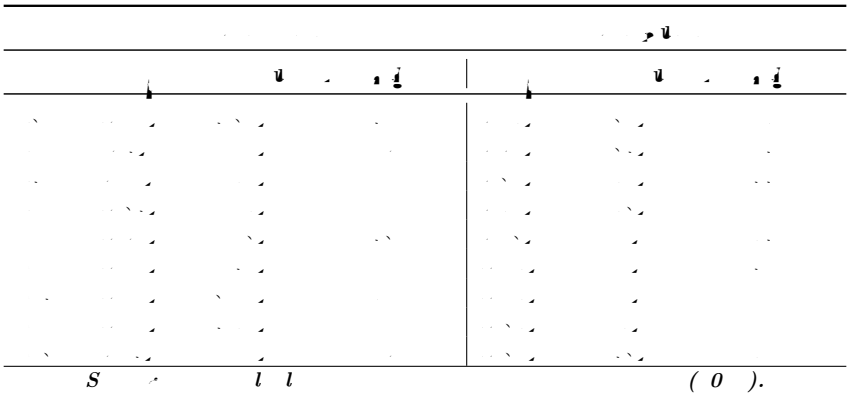
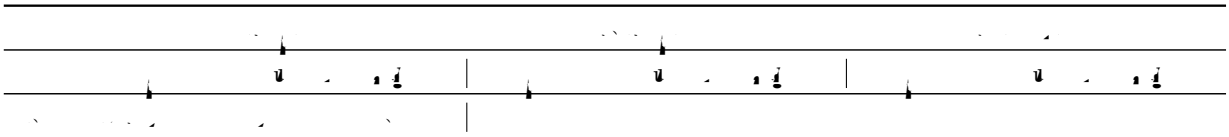


Table 18: Additional events; AR



item to note is that for the two events challenging the legality of Brexit (3 November and 24 January), in contrast to the referendum, the estimated variables are generally of the opposite sign of those in Table 8 even though they are only occasionally significant. Since these two events might have led investors to hope that Brexit would not occur, this is in line with our overall expectations.

Table 19: October 5 (Speech on Negotiations); Size of CAR

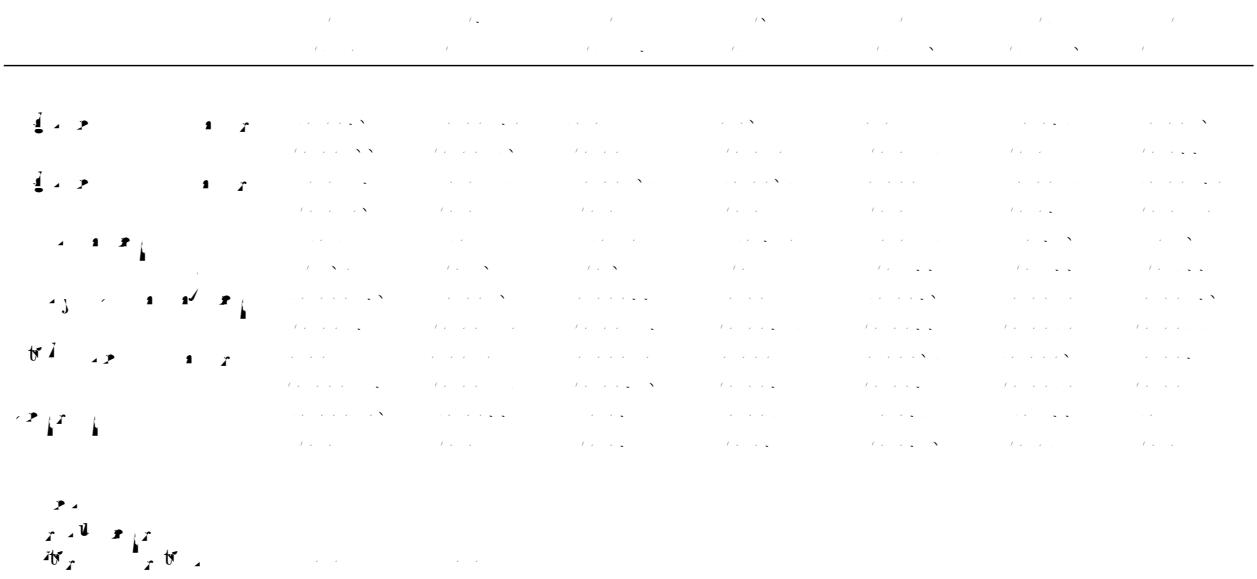


Table 20: November 3 (Challenge of Brexit); Size of CAR

Table 22: January 24 (Supreme Court Ruling); Size of CAR

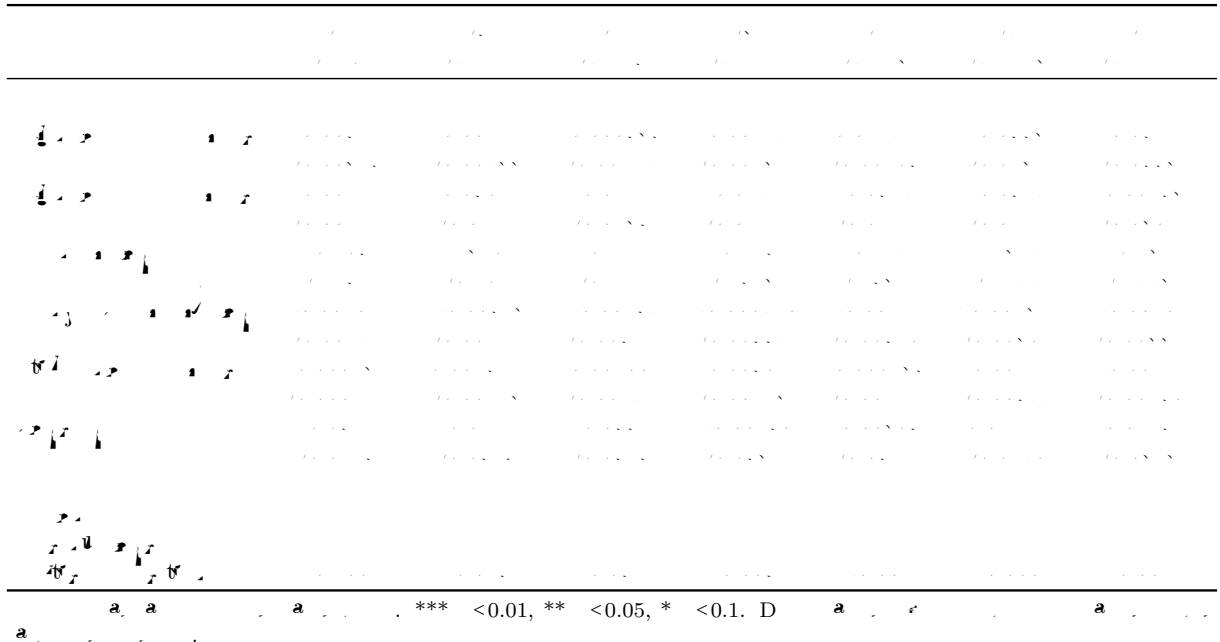
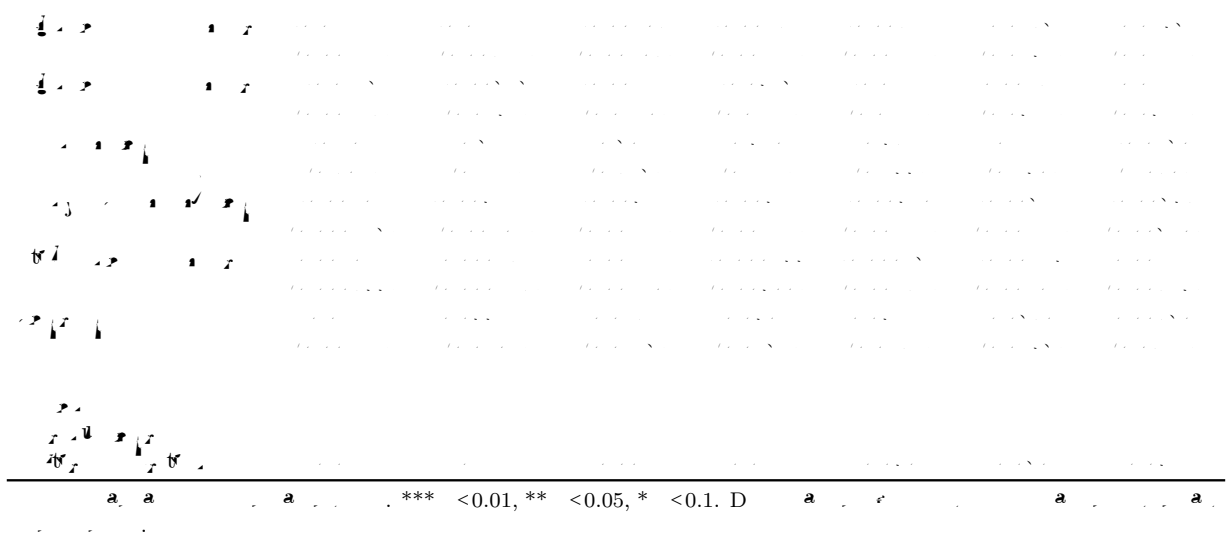


Table 23: March 29 (Article 50); Size of CAR



5 C

[1] Altomonte, C., Aquilante, T., Békés, G., and Ottaviano, G.I.P. (2013). Internationalization and innovation of firms: evidence and policy. Economic Policy, 28(76), 663-700.

[2] Amador, J. and Cabral,S. (2016) Global Value Chains: A Survey of Drivers and Measures. Journal of Economic Surveys 30(2), 278-301.

[3] Amiti, M., Itskhoki, O., and Konings, J. (2014). Importers, Exporters, and Exchange Rate Disconnect. American Economic Review 104(7), 1942-1978.

[4] Armitage, S. (1995). Event Study Methods and Evidence on Their Performance. Journal of Economic Surveys 9(1), 25-52.

[5] Baldwin, R. and Lopez-Gonzalez, J. (2015). Supply-chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses. The World Economy 38(11), 1682-1721.

[6] Blonigen, B., Tomlin, K., and Wilson, W. (2004). Tari -jumping FDI and Domestic Firms' Profits. Canadian Journal of Economics, 37(3), 656-677.

[7] Caves, T. and Irrera, A. (2016, 20 June). 'Code freezes', 'fast markets' and

[20] Financial Times (2017). FT Guide to World Currencies. Financial Times. Retrieved from https://markets.ft.com/data/archive.

[21] Fraser of Allander (2016). The Economic Implications of Brexit. SPICe: Edinburgh.

[22] Halpern, L., Koren, M., and Szeidl, A. (2015). Imported Inputs and Productivity. American Economic Review, 1015(12), 3660-3703.

[23] Hanson, G., Mataloni Jr., R. and Slaughter, M. (2005). Vertical Production Networks in Multinational Firms, Review of Economics and Statistics, 87(4), 664-678.

[24] Head, K. and Mayer, T. (2015). Brands in Motion: How Frictions Shape Multinational Production. CEPII Working Paper 2015-26.

[25] HM Treasury. (2016). HM Treasury Analysis: The Long-term Economic Impact of EU Membership and the Alternatives. Crown: London.

[26]

[39] New Statesman (2016, 23 June). The latest Brexit betting: what are the odds for the EU referendum?. New Statesman. Retrieved from http://www.newstatesman.com/.

[40] Nickerson, M., and Konings, J. (2007). Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia. American Economic Review, 97(5), 1611-1638.

[41] OECD (2012). Mapping Global Value Chains. TAD/TC/WP/RD(2012)9.

[42] OECD (2016). The Economic Consequences of Brexit: A Taxing Decision. OECD Economic Policy Paper No. 16.

[43] Orbis (2016). Orbis. Bureau van Dijk. Retrieved from https://orbis2.bvdep.com/.

[44] PWC (2016). Leaving the EU: Implicatons for the UK Economy. PWC: London.

[45] Ries, J.C., (1993). Windfall Profits and Vertical Relationships: Who Gained in the Japanese Auto Industry from VER's. Journal of Industrial Economics 41, 259-276.

[46] Ramiaha, V., Phama, H.N.A., and Moosab, I. (2017). The sectoral e ects of Brexit on the British economy: early evidence from the reaction of the stock market. Applied Economics, 49(26), 2508-2514.

[47] Sampson, T. (2017). Brexit: The Economics of International Disintegration. Journal of Economic Perspectives, 31(4), 163-184.

[48] Sampson, T., Dhingra, S., Ottaviano, G., and van Reenan, J. (2016). Economists for Brexit: A Critique. CEP Brexit Analysis No. 6.

[49] Schafer, A., Schnabel, I., and Weder di Mauro, B. (2016). Financial Sector Reform After the Subprime Crisis: Has Anything Happened? Review of Finance, 20(1), 77-125.

[50] Schiereck, D., Kiesel, F., and Kolaric, S. (2016). Brexit: (Not) another Lehman moment for banks? Finance Research Letters, 19, 291-297.

[51] Timmer, M.P., Dietzenbacher, E., Los, B., Stehrer, R., and de Vries, G. (2014a). The World Input-Output Database (WIOD): Contents, Concepts and Applications. GGDC Research Memorandum 144, Groningen Growth and Development Centre.

[52] Timmer, M.P., Erumban, A.A., Los, B., Stehrer, R., and de Vries, G. (2014b) Slicing Up Global Value Chains, Journal of Economic Perspectives, 28(2), 99-118.

[53] Woolridge, J.M. (2010) Econometric Analysis of Cross Section and Panel Data, Second Edition. MIT Press: Cambridge, MA.

[54] Wright, B. (2016, 28 June). Why We Should be Looking at the FTSE 250 and not the FTSE 100 to Gauge the Impact of Brexit. The Telegraph. Retrieved from http://www.telegraph.co.uk.

[55] Yahoo Finance (2016). Retrieved from https://uk.finance.yahoo.com/.

[56] Zellner, A. (1962). An E cient Method of Estimating Seemingly Unrelated Regressions and Tests for Aggregation Bias. Journal of the American Statistical Association, 57(298), 348-368.

A A

Here we present some of additional results referred to in the main body of the paper.

In our main results, we use the SUR methodology of estimating CARs. One alternative is the \residual method" in which the estimation window is used to estimate $R_i = \alpha_i + \beta_i R_m + "_i$, the estimated coe cients from which are then used to calculate the AR as $\widehat{AR}_{it} = R_{it} \quad (\widehat{\alpha}_i + \widehat{\beta}_i R_{mt})$. Table A1 presents the baseline results using these alternative CARs. As can be seen, the results are comparable with the exception that the depreciation variable is now generally signi cant at the 10% level.

As noted in the paper, we do not use the a liate share weighted depreciation due to colinearity with the UK share variable. Table A2 presents the correlation between the two a liate share variables and the a liate share weighted depreciation. The results of the baseline estimation when replacing the depreciation variable in the text with this weighted version are found in Table A3. As expected, introducing this colinear variable wipes out the signi cance of the UK share and reduces the signi cance of the other variables. Nevertheless, the overall pattern in terms of coe cient signs remains, even for the UK share.

Although we do not use the NACE two-digit industry dummies for the reasons discussed in the paper, it is useful to see how their inclusion a ects the results when also including the forward and backwards linkages interactions (as no NACE category has multiple values of the participation variables, we do not include them on their own). These estimates are found in Table A4. As in the main body of the paper, when including these interactions the depreciation variable is signi cantly positive. The interaction with the backwards linkages, however, is insigni cant in all the event windows. Given the small variation in this across rms within a 2-digit NACE category, this is not unexpected.

One method of dealing with outliers is to employ the robust regression methodology of Chatterjee and Hadi (1988). When doing so in Table A5

Table A1: June 24; Size of CAR using Residual Method for CAR Construction

Table A3: June 24; Size of CAR, Weighted Depreciation

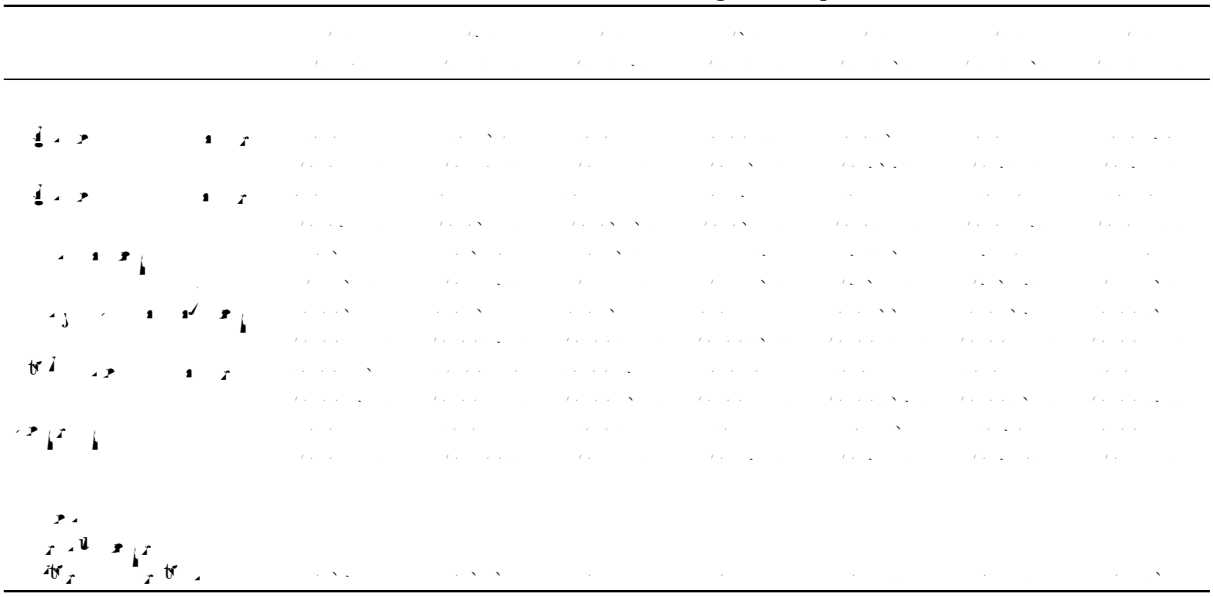


Table A4: June 24; Size of CAR, Interactions with Participation and NACE classifications

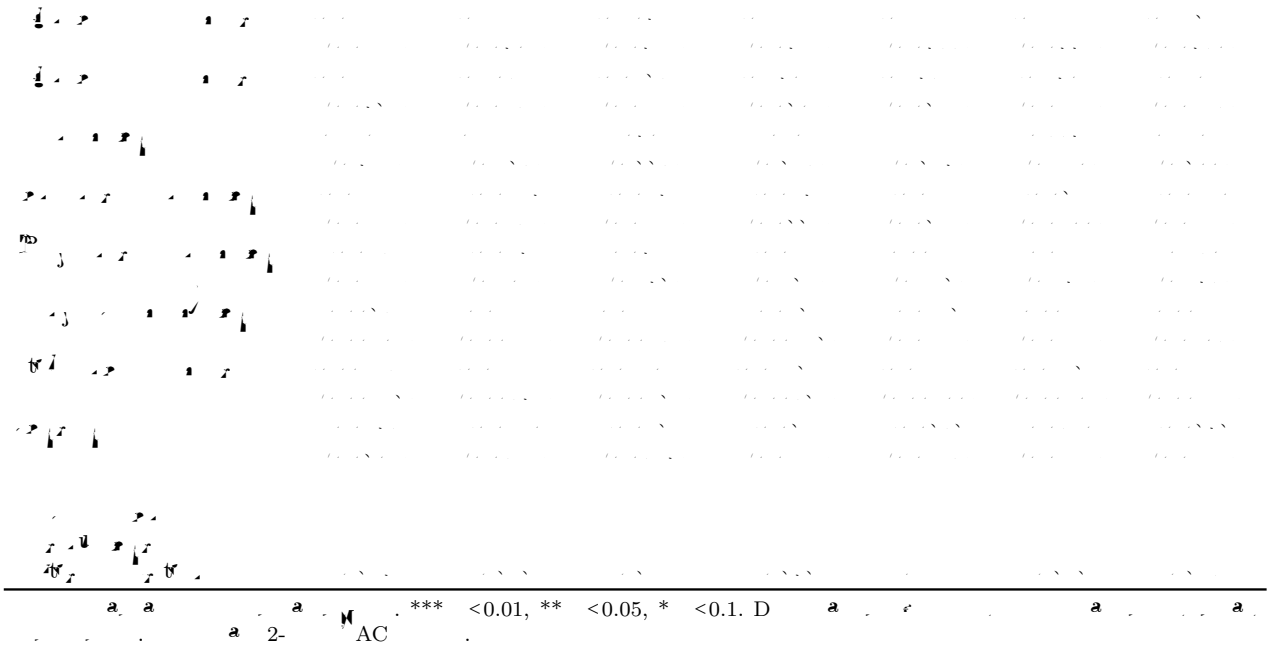


Table A5: June 24; Size of CAR, Robust Regression Estimator

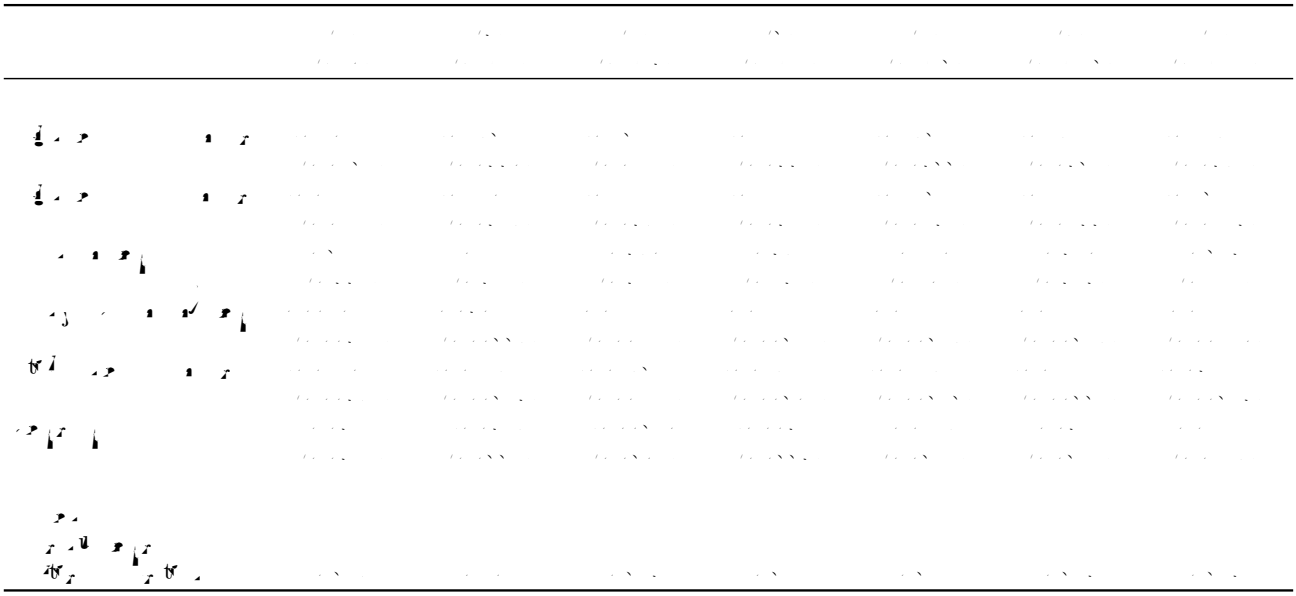


Table A6: June 24; Size of CAR, Omitting Financial Sector Firms

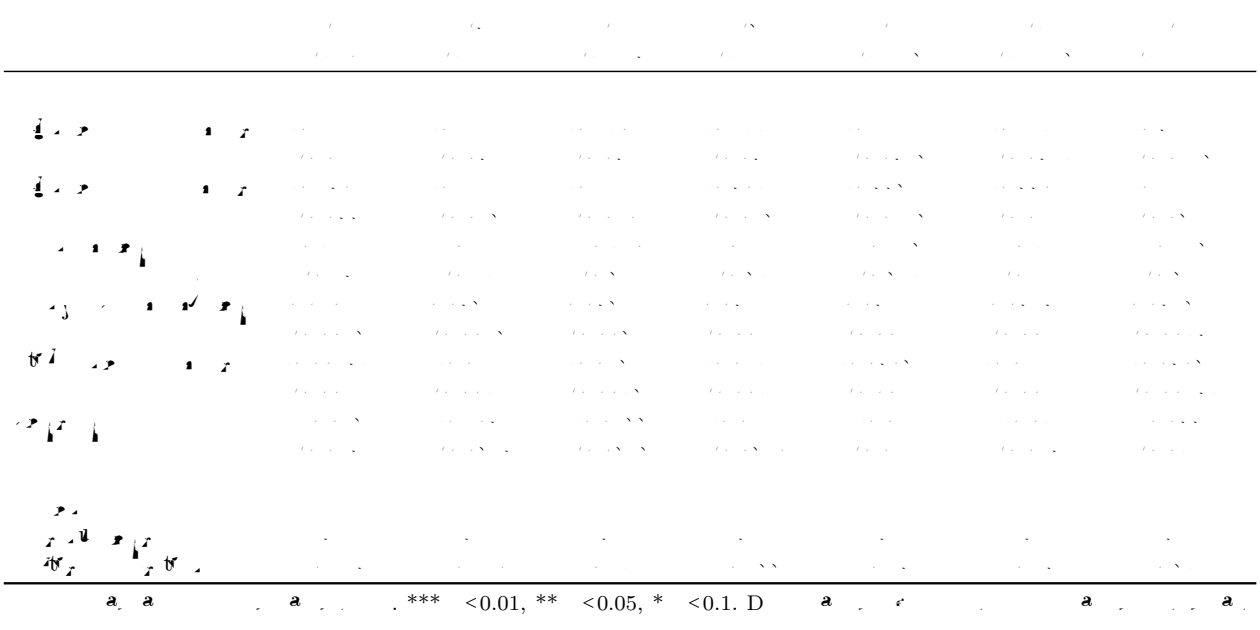


Table A7: June 24; Size of CAR, Only Firms not 100% UK

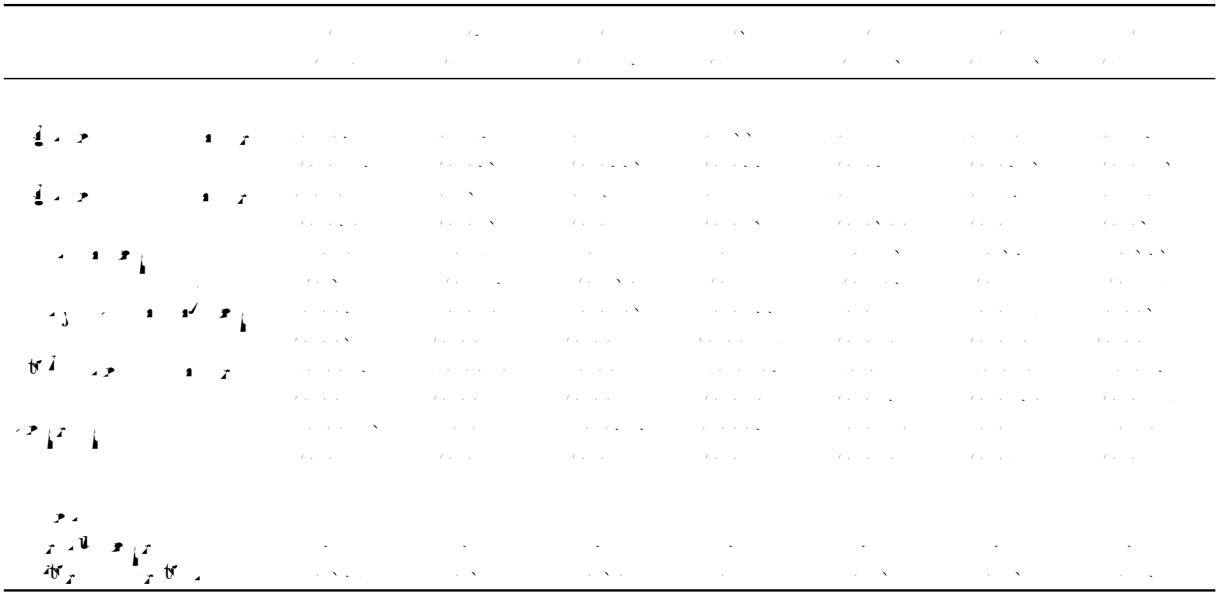


Table A8: June 24; Size of CAR, Firms with British Owner

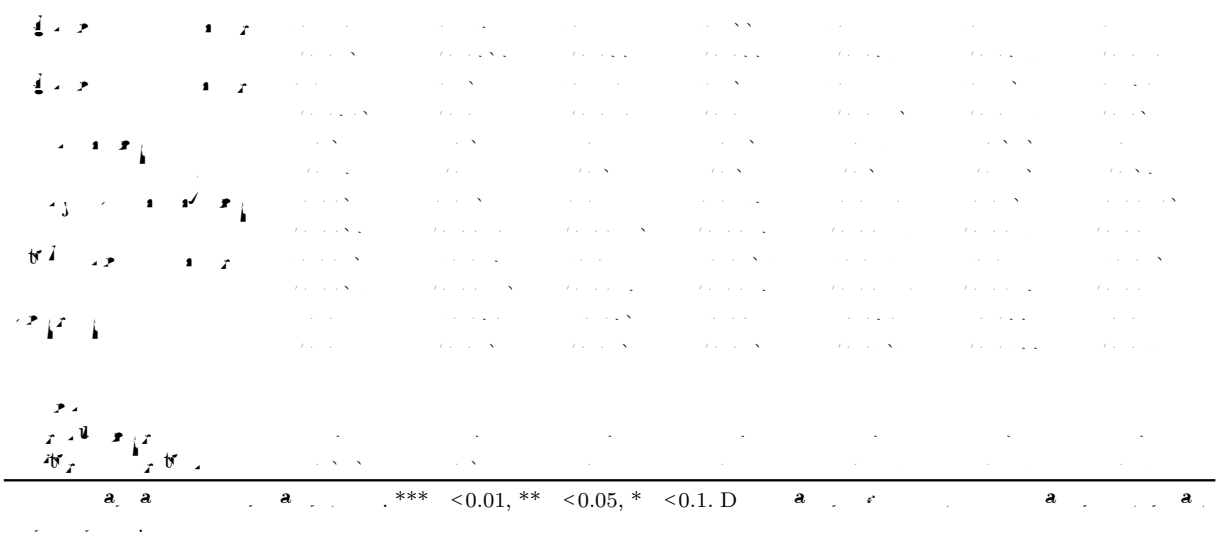


Table A9: June 24; Size of CAR, Omitting Largest Firms

	(1) (-1,0)	(2) (-1,+1)	(3) (-1,+2)	(4) (-1,+3)	(5) (-1,+4)	(6) (-1,+14)	(7) (-1,+19)
Affi	-0.107***	-0.160***	-0.137***	-0.141***	-0.153***	-0.155***	-0.180***
	(0.015)	(0.0237)	(0.0219)	(0.0226)	(0.0259)	(0.0261)	(0.0298)
Affi	-0.097***	-0.147***	-0.133***	-0.155***	-0.165***	-0.160***	-0.138***
	(0.021)	(0.0331)	(0.0308)	(0.0337)	(0.0389)	(0.0377)	(0.0419)
D	0.477	0.496	0.588	0.606	0.642	0.516	0.463
	(0.312)	(0.377)	(0.442)	(0.463)	(0.462)	(0.378)	(0.408)
C	0.003	0.0109	0.0122	0.0130	0.0104	0.0103	0.004
	(0.005)	(0.00823)	(0.00831)	(0.00858)	(0.0103)	(0.0102)	(0.009)

Table A11: May 24 2016; Size of CAR, Placebo Test