

# IDENTITY, MEDIA AND CONSUMER BEHAVIOR

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## Abstract

This paper examines how political events that sharpen identity can affect day to day economic behaviour, even in contexts that lack prescriptive social norms about group behavior. We study the impact of the Brexit Referendum on consumer choices in the UK between British and EU grocery products. Using a unique panel dataset from a major retailer in the UK with almost a billion shopping trips for 12 million shoppers, we find that consumers respond to the referendum results by increasing consumption of UK products (by 3%) and reducing demand for EU products (by 12%). We provide further evidence that changes in consumption are driven by national identity being top of mind: the increase in consumption of UK products is 4% higher in days following intense social media discussion on Brexit. Consistent with the identity mechanism, this effect is stronger when there is more discussion on the politics of regaining sovereignty as opposed to the economic consequences or social issues associated with Brexit. We provide suggestive evidence that attention alone cannot drive these effects: the day after England wins a EURO 2016 football match results in almost no changes to consumption patterns. Overall, these findings underscore the importance of political events associated with deep changes to perceived identity in shaping routine economic decisions, and the mediating role that the media can play by keeping it top of mind.

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# 1 Introduction

A growing literature in economics focusses on the importance of identity in shaping a variety of economic behaviors and outcomes (Akerlof and Kranton 2000; Shayo 2009; Grossman and Helpman 2018; Atkin et al 2019; Gennaioli and Tabellini 2019). Recent shifts towards nationalistic identities in Europe and in the US have brought renewed urgency to understanding the full extent to which identity affects economic behavior.

A common thread in the literature to date is that the mechanism linking identity to economic behavior operates by increasing the value that individuals attach to conforming to group-specific behavioral norms or to being able to signal to others one's identity. In fact, most work has followed closely from earlier developments in Social Identity Theory (Tajfel 1981; Tajfel 1982; Tajfel and Turner 1986), which emphasises how individual identity is partially derived from group affiliations (Nosofsky 1992; Tajfel and Turner 1986). This theoretical framework predicts that in periods in which the group experiences some external threat, individual identification with the group may strengthen (Branscombe, Ellemers, Spears, and Doosje, 1999; Davies, Steele, and Markus, 2008), increasing the likelihood that individuals' preferences reveal in-group bias and that they adopt prototypical group behaviors. These behaviors could include consuming products that are consistent with their most salient political, ethnic, religious or economic identities (Khan, Misra, and Singh, 2013; Bertrand and Kamenica 2018; Atkin et al 2019; Pandya et al 2019).

This paper asks a broader question: does identity shape routine economic behavior even in settings in which group belonging lacks a deep-rooted set of prescriptive social norms, and consumption has limited social signalling value? To answer this question, we examine whether a plausibly unexpected political outcome - the Brexit Referendum revealing the collective decision for the United Kingdom (UK) to exit the European Union (EU) -, which made British identity salient across the UK, changed consumers' behavior towards consuming UK vs. EU products. Google search and twitter data reveal that discussions about Brexit were very limited before the announcement of the Brexit referendum (see section 3.1).

To study consumer behavior we use scanner data from a major UK retailer, with over 600 stores across the UK and a set of 12 million customers who shop regularly with a loyalty card (out of

a universe of 15 million customers shopping at this chain). Our stores cover 95% of all localities in the UK (administrative units that consist of approximately 1,500 households – LSOAs) for the period between March 2015 and March 2017. The loyalty card allows us to construct a panel of customers and their shopping transactions. Our data span the entire period from three months prior to the rise of prime-minister David Cameron to power in 2015, to his calling of the referendum in February 2016, and up to 9 months following the June 2016 referendum. This allows us to observe and control for any pre-trends or anticipatory movements in consumption bundles that might have been driven by expectations around the timing of the referendum and its outcome. While we always account for prices in our analysis, we also take advantage of the (verified) fact that during our window of analysis following the referendum (9 months), supplier contracts were fixed in pounds, prices did not change and the share of UK and EU products available on shelf was stable.

Our empirical analysis proceeds in five steps. First, to examine the effect of the Brexit referendum on consumer behavior we exploit variation in identity preferences across the same shoppers over time. We conduct an event study with shopper, store-week and product category fixed effects to estimate changes in the share of UK vs EU products purchased before and after the Brexit referendum. We find that the market share of UK products increased by 0.3% for up to 9 months following the Brexit Referendum. Switching is more frequent in product categories with lower average prices, but for more expensive goods within each product category driven mostly by decreased price sensitivity to UK products and increased price sensitivity to EU products.

In the aggregate, shifts in consumption represent a 63 million GBP increase in revenue from UK products for our sample of shoppers alone.<sup>1</sup> In a back of the envelope calculation, we estimate the value of identity to be equivalent to an average price reduction of UK products by 4 cents, which represents 1.9% of the average price of UK products, and is comparable to the most recent increase in average VAT rates in the UK in 2011. These shifts represented a 168 million GBP change in aggregate consumer surplus. These effects are stable across different UK countries (Scotland, Northern Ireland, Wales and England). Importantly, levels of economic deprivation and

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<sup>1</sup>If we expand this calculation to include shoppers that do not have loyalty cards the figure would correspond to approximately 79 million GBP.

socioeconomic context at the locality (LSOA administrative unit) level do not appear to drive the attachment to national identity in shopping.

Second, to provide evidence that the change in consumption patterns is driven by changes in the salience of identity we exploit variation across products for which place of origin is more salient, before and after the referendum took place. Within a difference-in-differences framework, we find that the increase in UK product market share is particularly pronounced for products that are saliently labelled as being British, by having the union jack flag on the package or by directly mentioning the place of origin in the product name (eg. British ribs), which is consistent with the fact that it is product origin that is driving observed changes in consumption patterns. The flag leads to a 3% increase in sales relative to UK products without a flag and a 12% increase relative to EU products in the 9 months after the referendum. This corresponded to an approximate revenue increase from flagged products of over 194 million GBP.

Third, to shed light on the motivation behind this change in consumption patterns we take a closer look at consumers' perceived importance of identity in grocery shopping. An online survey of a random sample of 1,085 primary grocery shoppers in the UK revealed that consumers did not view a shift towards purchasing UK products as a way to signal conformity to British identity and 96% of respondents felt limited social pressure to purchase more UK products in the aftermath of the referendum. Taken together, the evidence suggests that individuals can potentially derive utility (privately) from consuming national goods even in settings that lack strong prescriptive social norms and even when products lack important signalling value.

Given the limited evidence on demand for conformity to social norms or on the structural features of shoppers' socioeconomic environment inducing the observed shift in consumption patterns, we explore the hypothesis that political events and the media help keep identity top of mind. If identity preferences are latent and malleable, individuals may then derive utility from consuming national goods whenever identity is particularly salient to them. To study the role of the media as a shifter of the salience of identity, we rely on a panel of twitter data to proxy for changes in exposure to discussions about Brexit and to the salience of UK vs EU identities. We obtain data on the universe of tweets published on Twitter in the UK during the period between March 2015 and March 2017 that related to the Brexit referendum, and we combine text analysis with machine

learning to measure the level and direction of sentiment towards Brexit. To help establish causality, we identify twitter storms, i.e. peaks in twitter activity at the national level, as exogenous shocks to the salience of identity. We then compare sales of UK vs EU products in the same store, the day before and after each twitter storm took place. This empirical strategy rests on the assumption that the timing of tweets at the national level is exogenous to the timing of grocery shopping at the local level. We find that a 10% increase in the number of tweets is associated with a 4% increase in the share of UK products purchased. These findings suggest that identity preferences are latent and that making identity top of mind can change consumption behaviors.

Consistent with an identity channel, the effect of twitter activity is particularly strong when tweets are about the politics of Brexit (eg. being an independent, sovereign British nation) relative to economic or social concerns such as immigration. Note that we interpret these results as suggestive of the role of the broader media in making identity salient to a larger segment of the population, not just twitter users. Days with twitter storms are likely to occur when there is more discussion about Brexit in the traditional media as well. <sup>2</sup>

Finally, we investigate whether these effects are specific to major political events with potential long-lasting effects in perceptions of identity or if they can also arise when any event or issue is made salient in the media. This might suggest that the main channel of impact is not necessarily identity but attention alone. To do so, we look at how consumption of UK vs EU products changed whenever England won a EURO 2016 match. While these events can still trigger an association with British identity, they are far less likely to result in long-lasting changes to one's perceived identity when compared to the Brexit referendum. We find no evidence of changes in consumption patterns of UK products and only a limited reduction in the consumption of EU products (by 0.6%) following an English win in the tournament.

Consumption choices are an ideal outcome to measure the economic consequences of changes in identity given the frequency of shopping transactions (Escalas and Bettman 2005; Pandya et al

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<sup>2</sup>While there are no data available on readership of traditional media in the UK at the required level of granularity, we find a strong positive correlation between twitter and perhaps more representative social media platforms such as facebook usage at the locality level. Our findings are also robust to different ways of identifying twitter storms such as looking at the top 2 or 10% episodes of intense twitter activity or by identifying tweets from the top influencers on Twitter. This corresponds to twitter users who have the highest twitter activity and the largest number of friends and followers.

2018; Bertrand and Kamenica 2018; Atkin et al 2019). Since supermarket shopping is a frequent and near universal activity, we can observe real-time temporal shifts in behaviour at scale that are triggered by a well-defined political event. Relative to opinion surveys, purchases are also less subject to social desirability bias (Newman, B. J. and Bartels, B. L. 2011). Moreover, everyday grocery shopping is likely to have less social signalling value than purchases of durables with signalling value such as cars, which are the focus of most of the literature to date (Hong et al 2011; Fouka and Voht 2018). Agents in our setting are therefore less likely to be constrained by social signalling concerns when making purchasing decisions, which brings us closer to isolating individual preferences for identity.

The close outcome of the Brexit referendum renders it an ideal event study. As discussed in section 2, prior to the referendum there was scant public discussion on Brexit. During the campaign and particularly after the vote, interest in Brexit soared and a potentially latent form of “British identity” was revived in the media and in the public discourse. Discussions around Brexit have dominated the political debate up to three years following the referendum, resulting in the resignation of two prime ministers and in a renewed threat of the disintegration of the United Kingdom.<sup>3</sup> At the same time, while the referendum and its aftermath have triggered extensive debate on the categorization of a “British vs EU political and social identity”, there is no evidence that it was associated with explicit boycotts of EU products or an appeal to buy British.<sup>4</sup> We directly observe that product availability in store remained constant throughout the period of our analysis with 95% of the products sold in March 2015 still being sold in March 2017. The 5% of new products replaced older, discontinued products, whilst keeping the overall share of UK vs EU products constant on shelf.

Our findings build on, and contribute to, several literatures. First, they add to growing evidence on how identity affects economic behavior. In particular, we add to recent empirical papers documenting the impact of political, religious or ethnic identity on consumer purchases (Pandya et al 2018; Bertrand and Kamenica 2018, Fouka, V. and Voth, H. J. 2013; Atkin et al 2019). But we

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<sup>3</sup>The referendum also pre-dated the rise of nationalist and autarkic rhetoric in some western democracies such as the US, with the ascent of Donald Trump to power happening five months after the referendum.

<sup>4</sup>The Brexit referendum did not produce explicit calls for consumers to change their consumption patterns. Our twitter data reveals that less than 0.02% of all tweets in our dataset refer to an explicit boycott of EU products. Additionally, google trends report no data on searches about boycotting EU products during our period of analysis.

depart from this work conceptually by showing that identity can matter much more broadly, even in settings in which there are no clear focal, prescriptive social norms about identity and group behavior, and in which products do not hold inherent signalling value. We further propose a specific mechanism: important shocks to identity that the media keeps top of mind can lead individuals to derive utility (privately) from purchasing identity goods. An additional contribution is that we are able to quantify the value shoppers attach to identity following an event that increases the salience of identity and to quantify associated changes in consumer surplus.

Second, an established literature has examined the role of the media on a variety of important economic outcomes namely voting and political beliefs (Besley and Burgess 2001; Stromberg 2004; Gentzkow and Shapiro 2004; Gentzkow 2006; Snyder and Stromberg 2010), fertility (Kearney and Levine 2014; La Ferrara, Chong and Duryea 2012); educational outcomes (Gentzkow and Shapiro 2008; Huang and Lee 2010); conflict (Yanagizawa-Drott 2014) and social capital (Paluck 2009). What is perhaps less understood is whether these effects are driven by the media making identity salient. Our evidence adds to this literature by suggesting that the media can sharpen identity preferences triggered by major political events and keep them top of mind, with important implications for day to day economic behavior.

Our findings also speak to an emerging literature on the psychological foundations of consumer behaviour (Bordalo, Gennaioli and Shleifer 2020; Bordalo, Nardotto and Sequeira 2020). In particular, we provide novel evidence on how “identity” preferences may not be fully stable across time and with relation to price. As a result, our findings can help augment and improve the predictive power of existing models, by documenting how consumers may systematically deviate from workhorse rational models of consumer behavior.

Finally, we contribute methodologically to the study of identity. The existing literature relies mostly on lab experiments, surveys and ethnographic studies to measure shifts in identity. In line with recent papers (Bertrand and Kamenica 2018; Atkin et al 2019), we rely on a revealed preference approach to elicit meaningful shifts in identity through consumption data. We advance on this literature by suggesting the use of the media as an important shifter of the salience of group identity.

The rest of the paper is organized as follows: section 2 describes our retail setting and the

timeline for the Brexit referendum. Section 3 describes the data used in our analysis including the scanner data, the twitter data; the census and voting data and the online survey data. Section 4 discusses our identification strategy and presents the main results. Section 5 conducts a back of the envelope calculation of the value of identity in shopping. Section 6 discusses the consumers' perceptions about identity and grocery shopping, section 7 examines the mediating role of the media in keeping identity top of mind and section 8 discusses several key robustness checks. Section 9 concludes.

## 2 Identity, Media and Consumer Behavior

A growing literature has focussed on the role of identity in shaping a variety of important economic behaviors such as discrimination in hiring (Akerlof and Kranton 2000); conflict (Depetris-Chauvinand and Durante 2017); attitudes towards redistribution (Shayo 2009) and trade policy (Grossman and Helpman 2018), among others. Recent work has begun to link political, ethnic and religious identities to consumer behavior. Pandya et al (2018) show that during the 2003 U.S. France dispute over the Iraq War, consumer boycotts of French-sounding brands led to significant changes in consumption patterns. Fouka and Voth (2013) focus on the role of collective memory on the purchase of goods with intrinsic social signalling value: they show that in places in Greece where during WWII German troops conducted more massacres, German car sales declined during the 2009 Greek sovereign crisis. Atkin et al (2019) focusses on a setting in which agents choose between ethno-linguistic and religious identities in a context in which there are strong taboos and norms associated with each identity.

What is common to most of the literature on identity in economics, is that identity preferences arise because individuals attach value to conforming to prevailing social norms or because they value the ability to signal their behaviour to the group they identify with. Conceptually, in response to shocks that shape perceptions of identity, individuals may change their preferences in the direction of in-group bias – the affective view – or they may derive their identity from group affiliations via categorization (Tajfel 1981; Tajfel 1982; Tajfel and Turner 1986; Nosofsky 1992) – the cognitive view. In both cases, social identity theory predicts that in periods in which the group experiences



some external threat (relative to the out-group), identification with the group strengthens. The increased utility from identifying with the group during these shocks increases the likelihood that individuals conform to their preferred group behavior. This mechanism is likely to explain why Americans would boycott french fries over a dispute with France, why Greeks would refuse to buy German cars during the Greek crisis and why Indian Muslim households would consume less pork and alcohol following episodes of violence against Muslims.

In this paper, we pose a broader question to try to understand whether identity preferences can emerge even in settings that are not characterized by explicit opportunities for social signalling, and in which there are much weaker prescriptive norms associated with particular groups and behaviors. This approach is likely to bring us closer to uncovering whether individuals derive utility (privately) from feeling attached to a particular identity. While we cannot firmly distinguish between different motivations behind this attachment, possible mechanisms include individuals deriving warm-glow type of utility (Andreoni 1990, Crumpler and Grossman 2008) or valuing the ability to self-signal (Benabou and Tirole 2004), which are distinct from either the utility associated with social signalling or the utility associated with conforming to the prevailing social norm.

To study the effect of identity on day to day economic behavior we examine how the rise in the salience of the British identity following the close outcome of the Brexit referendum in the UK in 2016, which determined the collective decision for the UK to exit the EU, affected routine grocery shopping and consumers' choice between UK and EU products.

Understanding the nature and implications of identity is challenging since identity preferences are not directly observable and are usually endogenous to particular behaviours. While identity is often studied in lab experiments, real-time collective shocks to identity are hard to reproduce in the lab, and they may lack external validity (Aronczyk 2013; Brewer 1984). Alternatively, studies can measure identity based on self-reported surveys but these are often constrained by social desirability bias and demand effects. We build on recent literature and adopt a revealed preference approach by focussing on consumption choices as high frequency, nearly universal economic decisions that can reveal preferences for identities that are clearly identified with specific consumption bundles (Bertrand and Kamenica 2018; Pandya et al 2019; Atkin et al 2019). Moreover, we exploit the unexpected outcome of the Brexit Referendum as a positive shock to the salience of British identity

to mitigate concerns about endogeneity.

To measure the impact of identity preferences on consumer behavior we start by exploiting within shopper variation in consumption, before and after an increased salience of national identity. Our event study relies on the assumption that local level shopping behavior was orthogonal to the outcome of the referendum.

To confirm that changes in consumption are driven by the salience of identity, we exploit variation across products that differ in their association to national identity. If identity preferences are driving changes in consumption, we should observe that products that are more easily associated with national identity experience larger increases in market share once identity becomes salient.

We then turn to examining the potential mechanisms behind the link between identity preferences and shopping behavior. A common narrative in the US and in Europe is that areas that face economic hardship might experience heightened awareness and support for certain political identities and support nationalistic rhetoric and behaviors. Shoppers may place more value on national identity and associated group behavior in areas in which national identity and group dynamics are more salient and connected through a common grievance (eg: deprivation). These areas may also attach more value to social signalling. Alternatively, shoppers' preferences may not be affected by the socioeconomic features of their environment, particularly if they lack explicit prescriptive norms and a clear mechanism to signal group belonging. It is also possible that the attachment to national identity is driven by political ideology, as opposed to economic fundamentals. To test these hypotheses, we examine heterogeneity in changes of consumption across areas with high and low levels of socioeconomic deprivation in the UK.

To come closer to understanding consumers' motivation behind any changes in consumption associated with the salience of identity, we conduct online surveys of a sample of 1,085 primary grocery shoppers in the UK. These data allow us to infer the perceived social norm associated with being British and shopping, and to ascertain how important it is for individual shoppers to follow this norm. While self-reported, this evidence can help gauge the extent to which changes in shopping behavior are driven by the desire to conform to social norms or signal one's identity.

We then examine an alternative hypothesis: our results could be driven by the role of the

media in keeping British identity top of mind (Bordalo, Gennaioli and Shleifer 2020).<sup>5</sup> We focus on exposure to social media, as a proxy for exposure to the media more generally. If the media helps keep issues top of mind, then we should be able to observe an empirical association between intense media exposure and the timing of changes in shopping behavior. We examine whether days of intense twitter discussion about Brexit are associated with significant changes in consumer behavior. This analysis also allows us to go further and examine the content of social media: in particular, we test whether consumption changes are mostly driven by discussions that are more commonly associated with national identity (eg: regaining sovereignty and independence), relative to economic arguments (eg: the economic costs of foregone trade) or arguments about social issues (eg: immigrants and threats to jobs). While all three topics could arguably be associated with different dimensions of national identity, we hypothesize that political arguments are more likely to affect consumption of “made in the UK” products exclusively via the identity channel.

This analysis of identity, the media and consumer behavior raises a final issue: if the media plays a role in keeping identity top of mind, is the observed impact on consumer behavior driven exclusively by attention or is it driven by real changes in identity preferences? It is possible that media debates around Brexit keep Britishness top of mind, and that as a result, consumers shop for British products even when they have no concerns about identity. To test this hypothesis, we vary the intensity of the shock to identity and observe the associated changes in consumer behavior. In particular, we examine the impact of a contemporaneous event that should elicit a weaker, and perhaps less long-lasting, shift in identity preferences: England’s wins in the EURO 2016 football championship.

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<sup>5</sup>An extensive literature has shown that the media can have an impact on economic outcomes such as voting behavior and political beliefs (Besley and Burgess 2001; Stromberg 2004; Gentzkow and Shapiro 2004; Gentzkow 2006; Snyder and Stromberg 2010); fertility (Kearney and Levine 2014; La Ferrara, Chong and Duryea 2012); educational outcomes (Gentzkow and Shapiro 2008; Huang and Lee 2010); conflict (Yanagizawa-Drott 2014) and social capital (Paluck 2009; Olken 2009). What is less clear is whether the mechanism behind these findings is the fact that the media can shift the salience of identity and keep it top of mind.

## 3 Setting and Data

### 3.1 The Brexit Referendum Timeline

The UK joined the European Union in 1973. Survey evidence suggests that by 2015, over 60% of the UK population believed that participation in the block brought economic benefits to the UK and thus, supported continued membership in the EU (What UK Thinks: EU 2015; British Social Attitudes Survey 2015). In an unexpected turn of events, David Cameron became prime minister of the UK as the leader of the Conservative party in May of 2015. In fulfilment of his electoral platform, Cameron enacted the EU Referendum Act in December 2015 and the referendum on whether the UK should remain in the EU was announced in February 2016. The vote was held on June 23, 2016. The race was tight, and the option to leave the European Union prevailed by only 4 percentage points (51.9% voted in favor of leaving the EU while 48.1% voted to remain in the block).

Importantly for our identification strategy, actual public interest on Brexit appears to have been extremely limited before the referendum took place. This is evident from figures 1 and 2, showing the frequency of google searches of the term “Brexit” and tweets mentioning Brexit across the UK during this period.<sup>6</sup>

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<sup>6</sup>Note that the figures represent search interest relative to the highest point on the chart for the given region and time. A value of 100 corresponds to the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means that there was not enough data for this term in a given period.

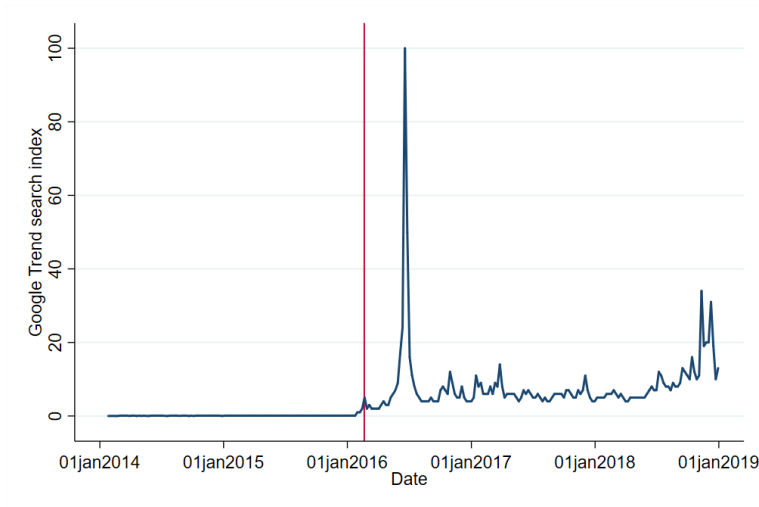


Figure 1: Google Trend Search Index of the Term “Brexit”.

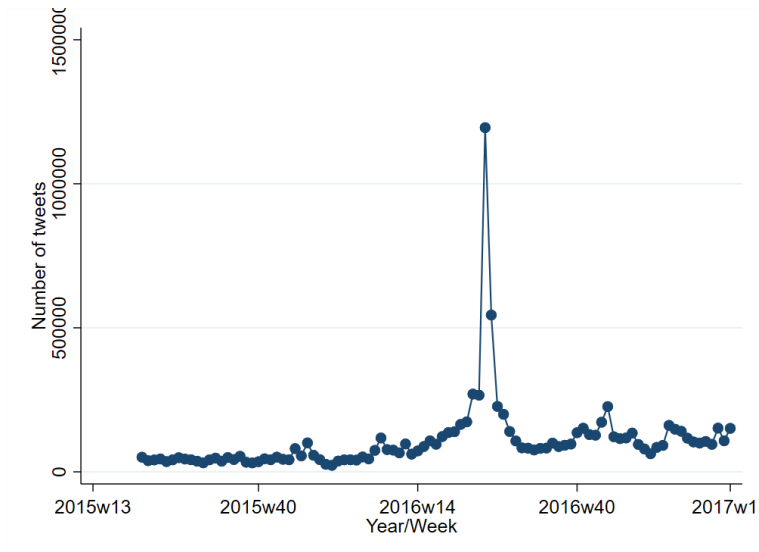


Figure 2: Tweets that include the term “Brexit”.

Searches and tweets about Brexit peaked during the Referendum week and declined shortly after. The referendum, and the campaign that preceded it, may have represented an important coordination device from which consumers could extract a clear signal of the degree of support for a “British identity”. The discussion that ensued in the media revolved around the UK’s search for a new identity outside of the European Union. We exploit this shock to the salience of British identity to understand how identity preferences in the form of attachment to national identity can

affect consumer behavior.

## 3.2 Data

**Consumption Data:** To measure consumer responses to changes in the salience of identity we analyse weekly sales data for products labelled as originating in the UK or in the EU, in a major retail chain across the UK, before and after the Brexit Referendum took place. Our retail partner has over 600 stores across Wales, England and Scotland, serving a mainstream segment of the grocery market. Our sample of stores covers about 95% of all LSOAs in the UK (administrative units that aggregate approximately 1,500 people).

Our data span a time period between March 2015 and March 2017. This covers the three months before David Cameron’s Conservative government came to power (May 2015), the announcement of the Referendum Act (December 2015), the announcement of the referendum (February 2016); the Brexit referendum (June 2016) and up to nine months after the referendum, as shown in Figure 3.

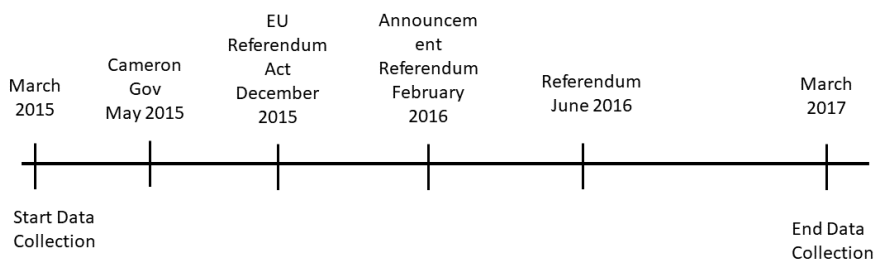


Figure 3: The timeline of the Brexit Referendum and the Transaction Data

The universe of transactions during this period lists approximately 15 million customers, out of which, 12 million have a loyalty card that they frequently use. To construct a panel of frequent shoppers, we restrict our analysis to the subset of consumers with a loyalty card to be able to observe within shopper variation across time.<sup>7</sup> This sample of 12 million customers engages in a total of almost a billion transactions during our period of interest.

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<sup>7</sup>We find that transaction activity of consumers with and without a loyalty card is qualitatively similar (see online appendix Table 1).

Table 1 shows the descriptive statistics for our sample. To identify the share of UK products in a shopper’s consumption basket we ascribe an “identity” to each product based on a label displayed on the product package specifying its country of origin (eg: made in the UK). When a product lists more than one origin country, we apply a simple weight to identify the share of the product that is British or European. We use a similar strategy to identify products that are European. As a result, the definition of UK vs EU products represents a score from 0 to 1.<sup>8</sup>

We use machine learning to assign products to product categories based on product descriptions. These consist of distinctive categories such as wine; biscuits and crackers; and breakfast cereals, among others, for a total of 20 product categories.<sup>9</sup> The scanner data provides a shopper unique identifier, a product unique identifier (Stock Keeping Unit –SKU– number), information on the price and quantity bought, and the store location. The loyalty card data includes demographic information for approximately 12 million shoppers, including age and gender.

**Census Data:** To measure how socioeconomic features of shoppers’ environment can shape the impact of identity on consumer behavior, we obtain measures of locality-level characteristics from the 2011 UK census that we then match to our stores’ location.<sup>10</sup> We rely on the UK census’ deprivation index, a rurality index, income levels and share of blue collar workers, as key potential drivers of economic and political identities.<sup>12</sup>

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<sup>8</sup>Our results are not sensitive to this classification method. For example, using a lexicographic binary classification capturing whether the product has any link to the UK leaves the results unchanged.

<sup>9</sup>Note that the results are robust to using the retailer’s definition of product categories, consisting of 385 categories. These include several cross-cutting categories such as ‘new and trendy’. We prefer to use our classification since it is likely to be more representative of how consumers search through their choice sets.

<sup>10</sup>Administrative units in the UK vary between output areas (OA) -which were built from clusters of adjacent unit postcodes, and designed to have similar population sizes and be as socially homogenous as possible based on tenure of household and dwelling types<sup>11</sup> - and Lower Layer Super Output Areas (LSOA) built from groups of contiguous OAs. LSOAs have been automatically generated to be as consistent in population size as possible and typically contain from four to six output areas. The minimum population is 1,000 and the mean is 1,500.

<sup>12</sup>A growing literature has documented that support for leaving the EU was stronger in geographic areas of the UK characterized by recent poor economic performance. The Leave vote share was higher in regions with higher unemployment rates and lower real wage growth, as well as larger increases in inequality and poverty, and sharper declines in manufacturing employment (Becker et al. 2016; Bell and Machin 2016; Clarke and Whittaker 2016; Darvas 2016; Langella and Manning 2016; Colantone and Stanig 2019; Darvas 2016). Langella and Manning (2016) find that a declining share of employment in agriculture, manufacturing, mining and construction in the past three decades was associated with higher regional leave shares and a similar correlation is found with declining employment in services over the same period. Bella and Machin (2016) find that support for leaving the EU was higher in areas of Britain witnessing poorer performance in terms of real wage growth in the last two decades.

Table 1: Descriptive Statistics

<b>Panel A: Shopping trips (N=831,995,817)</b>				
Variable	Mean	Std. Dev.	Min	Max
Total expenditure	32.44	36.12	0.01	500.00
Share UK products	68.74	23.84	0.00	100.00
Share EU products	19.24	19.93	0.00	100.00
Share National products	20.25	23.24	0.00	100.00

Variable	<b>With Card (N=775,494,094)</b>		<b>Without Card (N=56,501,723)</b>	
	Mean	Std. dev.	Mean	Std. dev.
Total expenditure	32.62	36.21	29.91	34.66
Share UK products	68.74	23.77	68.72	24.68
Share EU products	19.23	19.87	19.40	20.63
Share National products	20.27	23.19	20.03	23.88
Whites OA (%)	83.97	16.93	81.77	18.42
Unemployment OA (%)	6.63	4.72	6.85	4.84
Blue collar OA (%)	21.91	8.04	21.16	8.23
Rural	3.67	18.80	3.37	18.04

Source: Transaction Data. Notes: *Share National Products* represents the share of UK products that display a union jack flag on the front package.

**Consumer Surveys:** We conduct an online survey of a sample of 1,085 primary grocery shoppers in different grocery chains in the UK. This sample is similar in age, gender and average weekly expenditure to the sample of loyalty card customers we use for the main analysis. These data can shed light on shoppers’ beliefs about social norms associated with British identity, whether shoppers have a preference to conform to social norms and whether shoppers felt any social pressure to purchase products made in the UK in the aftermath of the referendum.

**Social Media Data:** We extract 19.8 million tweets and re-tweets from Twitter’s Historic database covering the period between March 2015 and March 2017. Out of these, we are able to geo-tag 11.3 million tweets according to the users’ profile or by identifying tweets that are geo-tagged. We rely on a machine learning algorithm to implement sentiment analysis based on hashtags and the content of each tweet. We identify key hashtags and content words related to Brexit following Amador et al (2017) and calculate the TF-IDF (Term Frequency - Inverse Document) frequency



for each tweet, which corresponds to a measure of how often each stem word occurred within the tweet, adjusted for frequency over all tweets. This created a vector with all the TF-IDFs per tweet. We then trained support vector machine (SVM) models on the training set obtained from Amador et al (2017) and used the TF-IDF vector as an input. Intuitively, SVM models try to identify a border between two subgroups that separates them as best as possible in a multidimensional space. As a robustness check, we train SVM models with linear, polynomial and RBF kernels and specify the optimal model parameters by cross-validation (sampling the training set into further subsets and comparing the model’s performance within those). We identified the RBF kernel as our preferred specification and trained the SVM model again on the complete identified tweet dataset. We repeat these procedures to identify positive/negative sentiment towards Brexit and to identify political, economic or social (immigration) arguments, again following Amador et al (2017). This categorization is important to help us better understand the mechanisms through which social media content can shape identity and consumer behaviour. Table 2 describes the sample of twitter data used in the analysis and their classification.

Table 2: Descriptive Statistics: Twitter Data

LSOA/WEEK, N=7,547				
	Mean	Std Dev	Min	Max
Total tweets per week per county	1495.7	8924.2	1.0	375025
Share Pro-brexit	44.4	49.7	0.0	100.0
Share Against-brexit	55.6	49.7	0.0	100.0
Share Political	35.9	48.0	0.0	100.0
Share Economics	22.8	41.9	0.0	100.0
Share Immigration	10.4	30.6	0.0	100.0

Source: Twitter. Tweets are classified on slant through the use of key hashtags and content words related to Brexit following Amador et al (2017). We train a SVM model with an RBF kernel to identify positive/negative sentiment towards Brexit and to identify political, economic or social (immigration) arguments.

## 4 Empirical Analysis

We begin by examining unconditional aggregate changes in market shares of both EU and UK labelled products before and after the Brexit referendum took place. We compute the market share

of UK products and EU products as the number of UK product units sold as a percentage of all units in the product category sold in that store-week. For example, if a product (e.g., rice) had a 50% market share in a given store in a given week, the product accounted for half of all units of rice sold in that store in that week. Measuring market share, as opposed to the total number of units sold, allows us to scale each store’s sales of a certain product relative to the overall demand for that product category in that store-week. Changes in market share also capture shifts in demand for products distinct from changes in demand for a particular product category.

Figures 4 and 5 show the share of expenditures on UK and EU products between March 2015 and March 2017 (de-seasoned with monthly dummies).

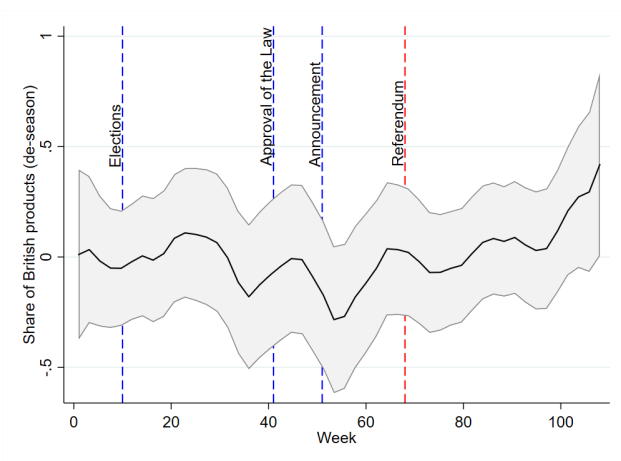


Figure 4: Share of UK products (de-seasoned with monthly dummies)

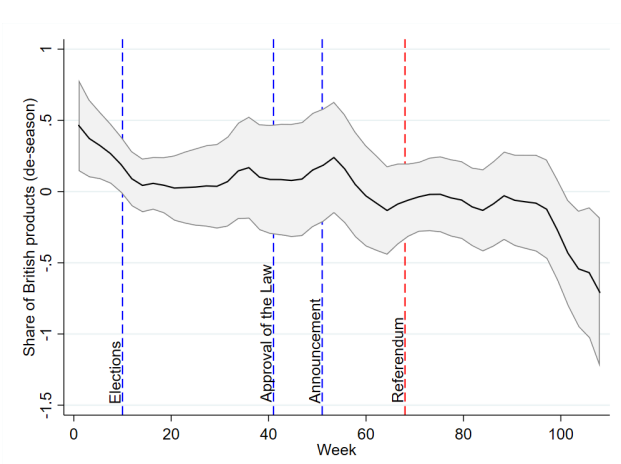


Figure 5: Share of EU products (de-seasoned with monthly dummies)

In the months prior to the referendum, the shares of each product were fairly stable and following a parallel trend. At the time of the referendum, the market share of UK products increased at the expense of the market share of EU products. These changes persisted, and became stronger, up to 9 months after the referendum took place.

This comparison does not however account for baseline heterogeneity in shopper preferences, store characteristics, or prices.

#### 4.1 Event Study: Changes in the Shares of UK vs EU products

We conduct an event study to examine the impact of the Brexit referendum on consumer behaviour. For each store-week in our sample between March 2016 and March 2017, we model the change in the weekly market share of UK and EU products, compared to the same store-week in 2015, which precedes any anticipation of the Brexit referendum. By analysing differences, we hold constant time-invariant store characteristics including the ex-ante demand for UK and EU products, customer demographics, and seasonal fluctuations. In doing so, we assume that the timing of a store's exposure to the Brexit Referendum is orthogonal to consumers' shopping decisions.

We control for seasonal effects by including week and flexible monthly dummies and we account for shopper level heterogeneity in preferences through shopper fixed effects. This allows us to control for omitted variables that generate persistent deviations in consumption patterns across shoppers or across time. We also hold constant seasonal fluctuations by comparing 2015 and 2017 shares in the same week.

Our baseline specification is:

$$\begin{aligned}
 Share_{ist}^k &= \beta^{UK} \ln(price_{sct}^{UK}) + \beta^{EU} \ln(price_{sct}^{EU}) + \gamma Post Ref_t \\
 &+ \beta Expend_{ist} + Week_t + \eta_i + phi_c + \varepsilon_{ist}
 \end{aligned} \tag{1}$$

where  $Share_{ist}^k$  corresponds to the share of  $k = UK, EU$  products in the household budget for shopper  $i$  in store  $s$ , for product category  $c$  and week  $t$ .  $Price_{sct}$  corresponds to the average product category  $c$  price, in store  $s$  and week  $t$ . The  $Post Ref_t$  indicator equals 1 starting from the week after the referendum and 0 otherwise. We control for total  $Expenditure_{ist}$  to isolate compositional

changes in shopping patterns distinct from changes in total expenditure, and we include week of the year dummy variables and a trend (flexible month dummy) together with shopper fixed effects. We also include product category fixed effects  $\phi_c$  to absorb heterogeneity in product-level characteristics that could be correlated with changes in consumption patterns. This will allow us to identify how shoppers may trade off UK vs EU close substitutes within each product category (eg. within types of milk; types of biscuits, types of wine, etc.)<sup>13</sup> The fixed effects ensure that we are exploiting within shopper variation, shopping in the same store, in the same time period and between similar categories of products. Standard errors are clustered at the shopper level.

Table 3: Event Study: Changes in Shopping Behavior

Dependent variable	Share UK (1)	Share EU (2)
Post Referendum	0.221*** (0.007)	-0.264*** (0.006)
Log(Price UK)	-12.444*** (0.111)	12.166*** (0.098)
Log(Price EU)	12.070*** (0.082)	-10.867*** (0.070)
Weekly expenditure	-2.346*** (0.102)	1.580*** (0.071)
Household FEs	YES	YES
Week FEs	YES	YES
Product category FEs	YES	YES
R <sup>2</sup>	0.115	0.176
Observations	217,415,406	217,415,406

Source: Transaction Data.  $\text{Log}(\text{Price UK})$  corresponds to average product category prices for UK products and  $\text{Log}(\text{Price EU})$  corresponds to average product category prices for EU products.  $\text{Weekly Expenditure}$  corresponds to average weekly expenditure at the shopper level.  $\text{Post Ref}$  represents an indicator equalling 1 for the period after the Brexit referendum between June 2016 and March 2017 and 0 for the period between March 2015 and June 2016. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

<sup>13</sup>We group product categories into 20 categories based on their product description using machine learning. The results are unchanged when we use a much finer categorization used by the retailer that includes up to 385 categories. These include categories like “new and trendy”, which we find harder to conceptualize in our analysis.

Table 3 reveals that UK labelled products gained a market share of 0.221 percentage points, representing a 0.3% overall increase in the share of UK products purchased. Following the referendum, EU products lost a market share of 0.264 percentage points, corresponding to an overall 1.5% decrease relative to the mean share prior to the referendum.<sup>14</sup> In the aggregate, this led to a substantial shift in revenue from the different bundles of products across all stores of the retail chain. Aggregating across 12 million consumers (the sample that we observe with loyalty card data), these changes suggest a yearly increase of 63 million GBP in revenue from sales of British products in the 9 months following the Brexit Referendum alone.<sup>15</sup>

#### 4.1.1 Prices and Product Availability

One possibility is that shifts in market share are driven by shifts in prices that coincided with the Brexit referendum. In our analysis, we take advantage of short-run price rigidity as the retailer we worked with used at least a 6 month lag between pricing decisions, and they had limited exposure to currency fluctuations in the short-run by having all contracts in pounds.<sup>16</sup> In fact, Figure 6 confirms that the political and economic uncertainty that ensued the Brexit referendum did not move average prices for UK or EU products during the period of analysis.<sup>17</sup>

In Figure 7 we zoom into the product categories with the top 20% of treatment effects and find that for these, prices of EU and UK products are also stable across time. Figures 1 and 2 in the Online Appendix show that price dispersion was also constant for both sets of products during our period of analysis, with no changes occurring around the Brexit referendum. At the same time, we confirm in the raw data that 95% of products reported to be on shelf in March 2015 are still

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<sup>14</sup>Figures 4 and 5 suggested the possibility that the campaign period and the associated polling already provided signals of the level of support for a British vs European identity. We find that this was indeed the case: when we use the announcement of the date of the referendum as the start of our treatment, we can already detect changes to consumer behavior, albeit much smaller in magnitude.

<sup>15</sup>Note that this is likely to be the lower bound since the company had approximately 15 million shoppers. Assuming that the non-loyalty cards responded similarly to the Brexit referendum, these figures would increase to 79 m GBP per annum and even more if we consider the universe of shoppers in the UK.

<sup>16</sup>Retailers' contracts with suppliers also constrained immediate changes to products shelf space allocation or product packaging. We also instrument for any residual price changes occurring during our window of analysis by exploiting variations in local competition and distance to feeder ports in the UK. Changes in UK prices are instrumented with changes in local competition defined through entry and exit of stores in competitive chains, whereas changes in EU prices are instrumented by distance to three of the main UK products processing EU cargo. The results remain unchanged when we instrument prices.

<sup>17</sup>The slight price movement that is picked up in a thicker confidence interval around weeks 47 and 99 represent the period in the run-up for Christmas in 2015 and 2016.

on shelf in March 2017. The new products that were introduced between March 2015 and March 2017 were replacing discontinued products, while keeping the overall share of UK and EU products available constant throughout.

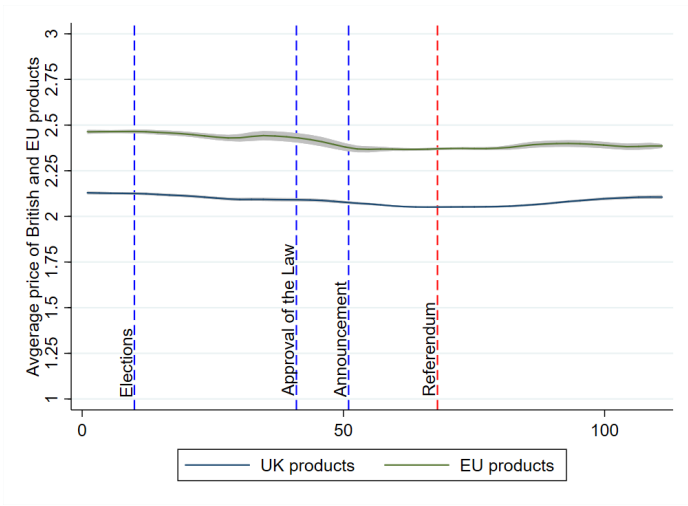


Figure 6: Average Prices of UK and EU products between March 2015 and March 2017 (residualized from monthly dummies and product category fixed effects)

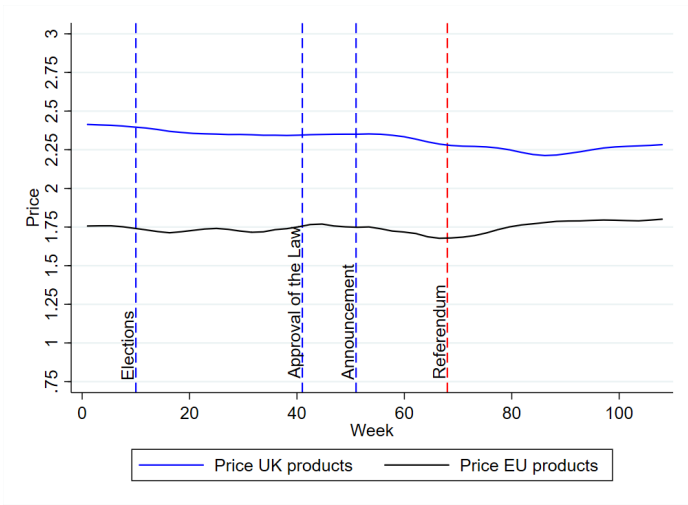


Figure 7: Prices for product categories in the top 20% of treatment effects (residualized from monthly dummies and product category fixed effects)

Given this evidence on short-run price stability, we further examine how demand for “identity” products is affected by prices. First, Table 4 shows that the observed shift towards UK products

post referendum is driven mostly by a decrease in price sensitivity towards UK products and an increased price sensitivity towards European products.

Table 4: Event Study: Changes in Shopping Behavior and Prices

Dependent variable	Share UK (1)	Share EU (2)
Log(Price UK) $\times$ Post Brexit	2.462*** (0.041)	-1.071*** (0.036)
Log(Price EU) $\times$ Post Brexit	-2.360*** (0.031)	1.064*** (0.026)
Post Referendum	0.194*** (0.021)	-0.280*** (0.019)
Log(Price UK)	-14.050*** (0.116)	12.861*** (0.101)
Log(Price EU)	12.665*** (0.082)	-11.141*** (0.071)
Weekly expenditure	-2.341*** (0.102)	1.578*** (0.071)
Household FEs	YES	YES
Week FEs	YES	YES
Product category FEs	YES	YES
R <sup>2</sup>	0.115	0.176
Observations	217,415,406	217,415,406

Source: Transaction Data. *Log Price UK* corresponds to average product category prices for UK products and *Log Price EU* corresponds to average product category prices for EU products. *Weekly Expenditure* corresponds to average weekly expenditure at the shopper level. *Post Brexit* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Second, we find that the most substantial shifts occur in the cheapest products categories, as shown in Table 5.

Table 5: Event Study: Changes in Shopping Behavior and Prices

Dependent variable:	Share of British products		Share of EU products	
	Cheap (1)	Expensive (2)	Cheap (3)	Expensive (4)
Post Referendum	0.382*** (0.011)	0.067*** (0.010)	-0.360*** (0.010)	-0.186*** (0.008)
Log(Price UK)	-14.575*** (0.174)	-11.834*** (0.137)	14.837*** (0.167)	10.454*** (0.110)
Log(Price EU)	15.404*** (0.138)	9.936*** (0.094)	-14.912*** (0.132)	-8.400*** (0.075)
Weekly expenditure	-1.759*** (0.059)	-2.807*** (0.153)	1.282*** (0.046)	1.857*** (0.103)
Household FEs	YES	YES	YES	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R <sup>2</sup>	0.137	0.141	0.203	0.191
Observations	108345953	109062483	108345953	109062483

Source: Transaction Data. *Log Price UK* corresponds to average product category prices for UK products and *Log Price EU* corresponds to average product category prices for EU products. *Weekly Expenditure* corresponds to average weekly expenditure at the shopper level. *Post Ref* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Finally, we examine how the availability of products of each type (UK vs EU) in the choice set affects substitution patterns.



Table 6: Event Study: Changes in Shopping Behavior and Prices

Dependent variable:	Share UK (1)	Share EU (2)
Post Referendum	-0.711*** (0.050)	-0.863*** (0.015)
Log Price UK	-12.511*** (0.111)	12.559*** (0.099)
Log Price EU	12.053*** (0.082)	-10.882*** (0.070)
Weekly expenditure	-2.346*** (0.102)	1.580*** (0.071)
Post*Avg UK Share in category	1.381*** (0.072)	
Post*Avg EU Share in category		2.333*** (0.064)
Household FEs	YES	YES
Week FEs	YES	YES
Product category FEs	YES	YES
R <sup>2</sup>	0.115	0.176
Observations	217,415,406	217,415,406

Source: Transaction Data. *Log Price UK* corresponds to average product category prices for UK products and *Log Price EU* corresponds to average product category prices for EU products. *Weekly Expenditure* corresponds to average weekly expenditure at the shopper level. *Post Brexit* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. *Average UK Share Category* represents the average share of UK products available across product categories and *EU Share Category* represents the average share of EU products available across product categories. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 6 shows that as the share of UK products in a given product category increases, shoppers are more likely to move towards the consumption of UK products. Inversely, the higher the share of EU products in the category, the less likely shoppers are to substitute away towards UK products.

#### 4.1.2 Locality Characteristics

We examine whether the impact of identity varies differentially across localities depending on their socioeconomic characteristics. A small but growing literature has shown that constituencies with

higher unemployment, higher inequality and higher incidence of austerity measures were more likely to vote Leave in the referendum (Becker et al. 2016; Bell and Machin 2016; Clarke and Whittaker 2016; Darvas 2016; Langella and Manning 2016; Darvas 2016; Fetzer 2018; Colantone and Stanig 2019). It is therefore possible that poor economic conditions are fertile ground for nationalistic group identities to rise to the fore.

By matching our store data to census localities, we measure changes in consumption patterns across areas with different levels of economic deprivation in 2015.<sup>18</sup>

Table 7 reveals that shopping patterns did not vary with the level of socioeconomic deprivation in each LSOA.<sup>19</sup>

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<sup>18</sup>The Index of Multiple Deprivation is the official measure of relative deprivation for LSOAs in England. It combines information from seven domain indices (which measure different types or dimensions of deprivation including income, unemployment, education, health, crime, access to housing and living environment) to produce an overall relative measure of deprivation. Deprivation deciles are calculated by ranking the 32,844 small areas in England from most deprived to least deprived and dividing them into 10 equal groups. These range from the most deprived 10 per cent of small areas nationally to the least deprived 10 per cent of small areas nationally. For our analysis, we use the bottom 25%, 50-70% and over 70%. <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>

<sup>19</sup>In Table 3 of the Online Appendix, we use different measures of socioeconomic characteristics including income, unemployment share of blue collar workers and level of rurality of an LSOA. The results are very similar. While the coefficients for income and rurality are significant, they are all economically extremely small suggesting that economic conditions do not play a role in driving consumption changes.

Table 7: Consumption Patterns and Locality Characteristics

Dependent variable:	Share UK (1)	Share EU (2)
Post Referendum	0.218*** (0.009)	-0.257*** (0.007)
Log(Price UK)	-12.444*** (0.111)	12.166*** (0.098)
Log(Price EU)	12.070*** (0.082)	-10.867*** (0.070)
Weekly expenditure	-2.346*** (0.102)	1.580*** (0.071)
Post Brexit $\times$ Most Deprived	0.022 (0.035)	-0.029 (0.030)
Post Brexit $\times$ Mid Deprived	0.009 (0.014)	-0.017 (0.012)
Household FEs	YES	YES
Week FEs	YES	YES
Product category FEs	YES	YES
R <sup>2</sup>	0.115	0.176
Observations	217415406	217415406

Source: Census and Transaction data. *LogPriceUK* corresponds to average product category prices for UK products and *LogPriceEU* corresponds to average product category prices for EU products. *WeeklyExpenditure* corresponds to average weekly expenditure at the shopper level. *PostBrexit* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. *Most Deprived* corresponds to the bottom 25% of LSOAs in the deprivation index and *Mid Deprived* to the range 25-70%, with the omitted category representing the over 70%. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

## 4.2 Difference-in-Differences

While all products in our dataset have a label specifying the country of origin, a subset of products also include an image of the union jack displayed on the front of the package, while others include a clear identifier in the product name such as “British ribs” or “Scottish Oatcakes”. If changes in consumption patterns are driven by a preference for identity, then we should observe that products with country of origin more saliently displayed on the package experience larger increases in market share.

We focus on products with either a flag or the British name, that are not affected by seasonality, while still representing an important share of total average shopper expenditure (approximately 33%). This allows us to rely on a difference-in-differences estimator to identify moves toward products with a salient UK identity, before and after the Brexit referendum.

8 and 9 show the parallel trends in purchases of products with the union jack flag or a British identifier, hereafter called national products, against UK products and against EU products, before and after the Brexit Referendum.

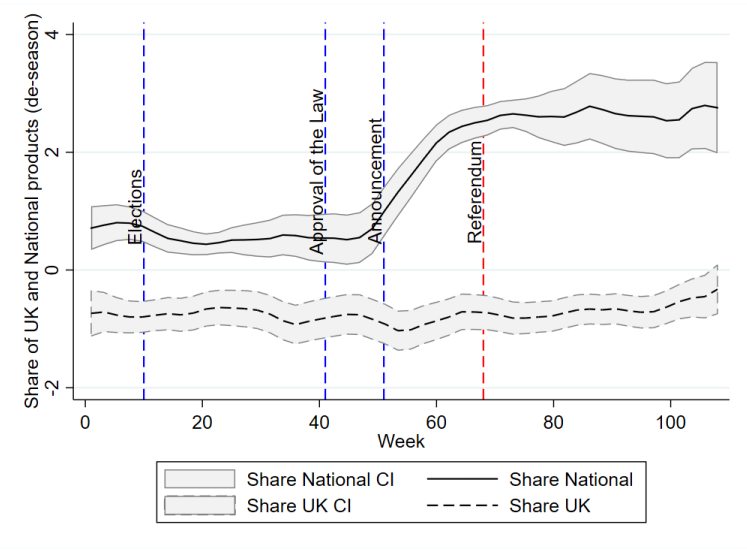


Figure 8: Share of expenditure on national products against UK products

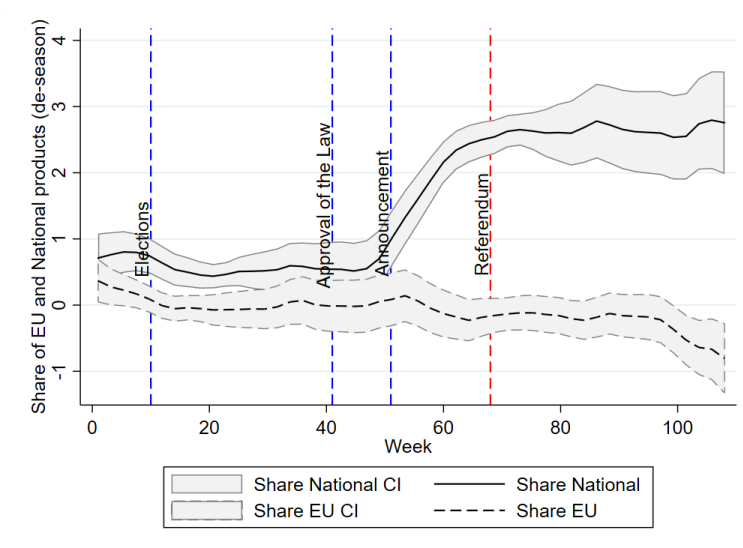


Figure 9: Share of expenditure on national products against EU products

Figures 8 and 9 reassuringly suggest that market shares of all products were stable and parallel before the announcement of the Brexit referendum, after which the market share of national products increased significantly relative to competitive products within each category.

Our difference-in-differences model corresponds to:

$$\begin{aligned}
 Diff\ Share\ Nat - UK/EU_{ist} &= \beta_1 Avg\ Price\ Nat + \beta_2 Avg\ Price\ UK/EU + \gamma Post\ Brexit_t \\
 &+ Week_t + Product_c + \eta_i + \varepsilon_{ist}
 \end{aligned} \tag{2}$$

Where  $Diff\ Share\ Flag\ UK_{ist}$  corresponds to the difference in the market share of products with the UK flag or name saliently displayed relative to the Share of UK products sold in stores that do not have the flag. As before,  $Post\ Brexit$  is an indicator that equals 1 for the period following the Brexit referendum (our difference-in-differences estimator). We further include a control for total shopper weekly expenditure; week and monthly dummies; individual shopper and product category fixed effects. We replace as the dependent variable  $Diff\ Share\ National\ EU_{ist}$  and replace the price control for  $Avg\ Price\ EU$  to examine the impact of the referendum on shifts in market share between national and EU products.

Table 8: Difference-in-Differences Estimates: National vs UK and EU products

<b>Dep. variable:</b>	<b>National-UK</b>	<b>National-EU</b>
Post Ref	0.967*** (0.028)	2.299*** (0.029)
Log(Price Flag)	-2.219*** (0.120)	-3.271*** (0.126)
Log(Price UK)	12.011*** (0.399)	
Log(Price EU)		20.374*** (0.322)
Household FEs	Y	Y
Week FEs	Y	Y
Product category FEs	Y	Y
Weekly expenditure	Y	Y
R <sup>2</sup>	0.178	0.196
Observations	33,148,839	33,146,511

Source: Transaction Data. *LogPriceUK* corresponds to average product category prices for UK products and *LogPriceEU* corresponds to average product category prices for EU products. *WeeklyExpenditure* corresponds to average weekly expenditure at the shopper level. *PostBrexit* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. *AverageUKShareincategory* represents the average share of UK products available across product categories and *EUShareincategory* represents the average share of EU products available across product categories. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 8 shows that the union jack flag or the British name significantly increase the impact of identity on shopping behavior. The presence of the flag increases sales of UK products (relative to UK products that do not have a flag) by 0.967 percentage points, representing a 3% increase. EU products decrease their market-share by 12% compared to products that are clearly identified as being British. These findings confirm our interpretation that the identity attribute became more salient in the post referendum period, particularly for products clearly identified as being British, and that this had a significant impact on patterns of grocery shopping.

## 5 The Value of Identity

In this section we conduct a back of the envelope calculation of the value of identity in grocery shopping. To do so, we follow Hausman (1996) to compare shifts in quantities purchased and shifts in prices, so as to measure the value of identity in terms of changes to consumer surplus. We begin by deriving the inverse demand function for UK products (Figure 10) to identify the changes in average prices that would be consistent with the observed change in quantities in our data. For tractability, we assume that the price elasticity remained constant throughout the period of our analysis.

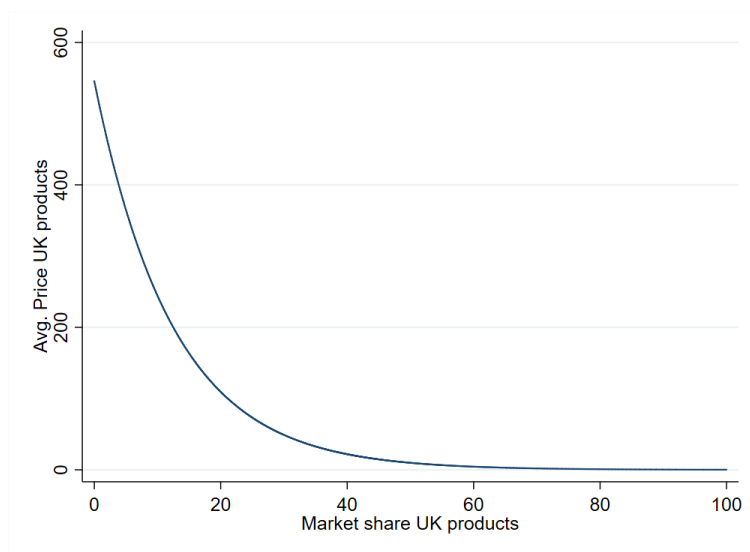


Figure 10: Inverse Demand for UK Products

We estimate the value of identity to be equivalent to a price reduction of 4 cents, which represents 1.9% of the average price of UK products prior to the referendum. This value corresponds to a change in consumer surplus of 0.27 cents per household-week, which aggregates to a yearly change in shopper surplus of approximately 168 million GBP for the entire sample.<sup>20</sup>

The most recent increase in VAT rates in the UK provides a useful benchmark to help gauge the magnitude of the effect of the value of identity and attachment to national identity on consumption.

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<sup>20</sup>If we include the entire universe of 15 million shoppers this value increases to a 211 million GBP change in consumer surplus.

In 2011, the UK’s average VAT rate increased by 2.5% of average prices, which is comparable to the 1.9% price movement that would have led to the shift in quantities that we observe for UK products after the referendum.

This finding confirms that while changes at the individual level might be (plausibly) small, changes in the aggregate are large and economically meaningful.

## 6 Consumer Surveys

In this section we explore potential channels through which identity preferences affect grocery shopping. One possibility is that consumers respond to an increase in the salience of identity because they attach value, privately or socially, to conforming to social norms associated with the group they now identify with. Our evidence so far does not, however, appear to support this interpretation. To begin with, our setting is one that lacks explicit prescriptive norms about the typical British behavior when shopping and grocery products have limited social signalling value. Moreover, we found no evidence that general community-level characteristics predicted any changes in consumption, making it less likely that the motivation behind observed shifts in consumption is a desire to signal to, or conform to, group identity and behaviors.

To shed more light on this point, we conducted an online survey of 1,085 primary grocery shoppers in the UK and obtained information on perceptions of social norms associated with British identity and grocery shopping. This sample is very similar to the sample of consumers we observe in the transaction data in terms of age, gender and average weekly expenditure.<sup>21</sup> 14% of the online sample shop with our retailer, which allows us to speculate on the potential external validity of our findings, beyond the retailer we worked with. Moreover, while all data are self-reported, the nature of online surveys and the anonymity they allow for make respondents less likely to bias the data towards socially desirable answers.

In the survey, we ask consumers to report on whether they changed consumption patterns following the Brexit referendum. About one-third of respondents (27%) report to have purchased more UK products in the months after the referendum.

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<sup>21</sup>Our online sample is slightly younger with an average age of 48.3 against 50 in the store sample but with a similar distribution.



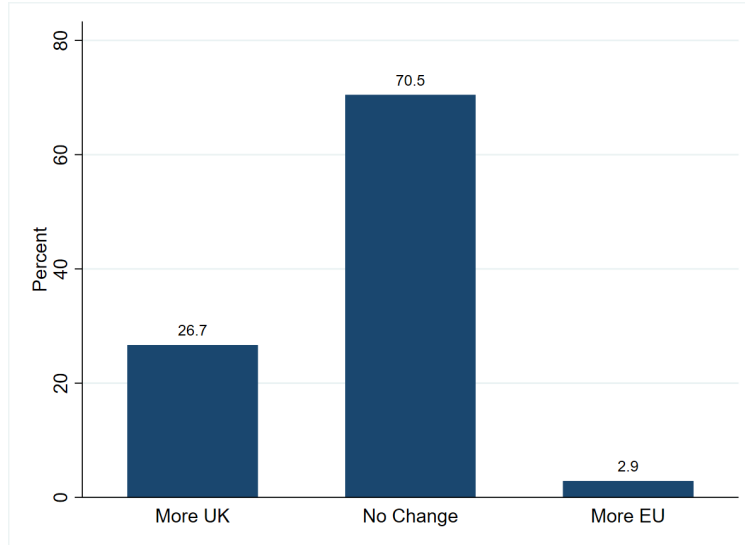


Figure 11: Share of consumers reporting a change in shopping behavior.

To gauge the extent to which consumers associate British identity with a particular social norm about shopping, we ask consumers to report on their perceptions of the importance of shopping for products made in the UK for the typical British consumer in the aftermath of the Brexit referendum. Additionally, we examine how much importance respondents themselves attach to shopping like the typical British shopper.

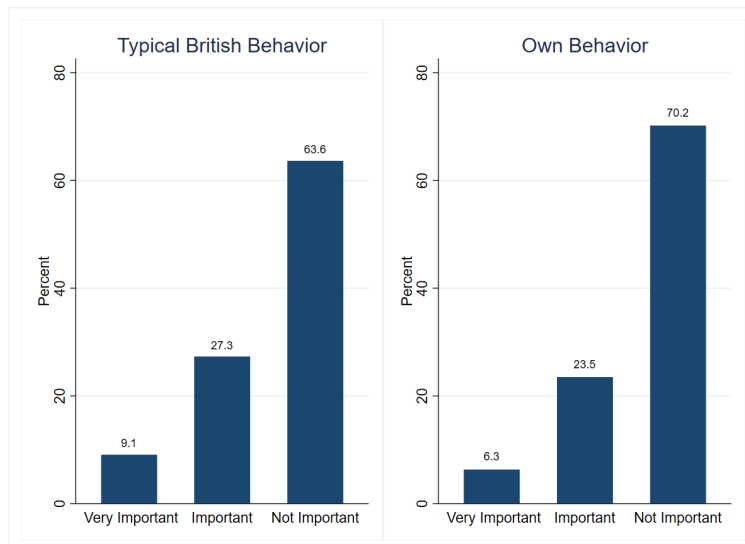


Figure 12: Share of consumers reporting on the importance of purchasing UK products for the typical British consumer vs for themselves.

Figure 12 reveals that only about one third of respondents associate shopping for UK products as being the typical British behaviour. Over 70% of respondents report that they are not trying to conform to the perceived typical British behavior when grocery shopping. Moreover, over 96% of respondents reported feeling no pressure to shop for UK products in the aftermath of the referendum and the remaining 4% reported feeling only slight pressure to do so, and usually out of a desire to support the local economy. These findings are very similar across shoppers shopping at different retailers: Table 2 in the Online Appendix shows the p-values for tests of equality of proportions (chi-square) and of equality of distributions for behaviours and beliefs of shoppers in our retailer relative to those who report shopping at different retailers. Reassuringly, the p-values are all well above 0.4.<sup>22</sup>

This evidence confirms that identity preferences are unlikely to be driven by the desire to conform to a specific social norm associating British identity and shopping behavior, or to the desire to social signal one's identity.

## 7 Mechanism

### 7.1 Media, attention and the salience of identity

Given the limited evidence on how the observed changes in consumption behavior were driven by social conformity or social signalling, we now advance an alternative hypothesis: i) identity preferences can be latent and malleable, and ii) political events and the media can help place them top of mind and, by doing so, affect day to day economic behavior.

To test this hypothesis, we examine the impact of social media discussing Brexit on the timing of changes to shopping behavior. We obtain the universe of tweets published by twitter in the UK during the period between March 2015 and March 2017, totalling 19.8 million tweets. Out of this sample, we are able to geo-locate 11.3 million tweets either because the user has identified a location in the user profile or because the tweet itself was geo-tagged.<sup>23</sup> We then conduct slant/sentiment analysis to identify tweets that are pro or against Brexit using a supervised vector machine clas-

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<sup>22</sup>Figure 3 in the Online Appendix also shows perceptions of consumers who reported shopping at our retailer alone.

<sup>23</sup>Only about 2% of tweets are geo-tagged overall.

sification method. We use the radial basis function kernel (RBF kernel) as a learning algorithm applied to a training sample comprising of 43,221 tweets about Brexit identified in Amador et al (2017). To do this we combine metric multidimensional scaling of co-occurrence and manual tweet inspection.<sup>24</sup> Using the same method, we further classify tweets as being predominantly about politics, about economics or about social issues such as migration, the three key issues that dominated the Brexit debate (Amador et al 2017). Figures 13 and 14 show examples of the hastags and words used in the classification process.

To establish a causal link between exposure to media, identity and consumer behavior, we exploit the timing of the breakout of intense discussions about Brexit in the form of twitter “storms”. We select the top 2% of twitter storms occurring at the national level and compare the share of UK vs EU products purchased at the store level, in the day before (control) and after (treatment) each twitter storm took place.<sup>25</sup> Using this method, we identify 12 twitter storms during our period of interest between March 2015 and March 2017. The underlying assumption is that the timing of news about Brexit is not driven by shoppers’ decisions of when to shop at the local level.

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<sup>24</sup>Note that the resulting matched dataset is very similar when we use a linear classification as opposed to an RBF kernel.

<sup>25</sup>Note that our results are not sensitive to the choice of this threshold. In the online appendix we show that results remain unchanged when we use a different intensity cut-off such as 10%.

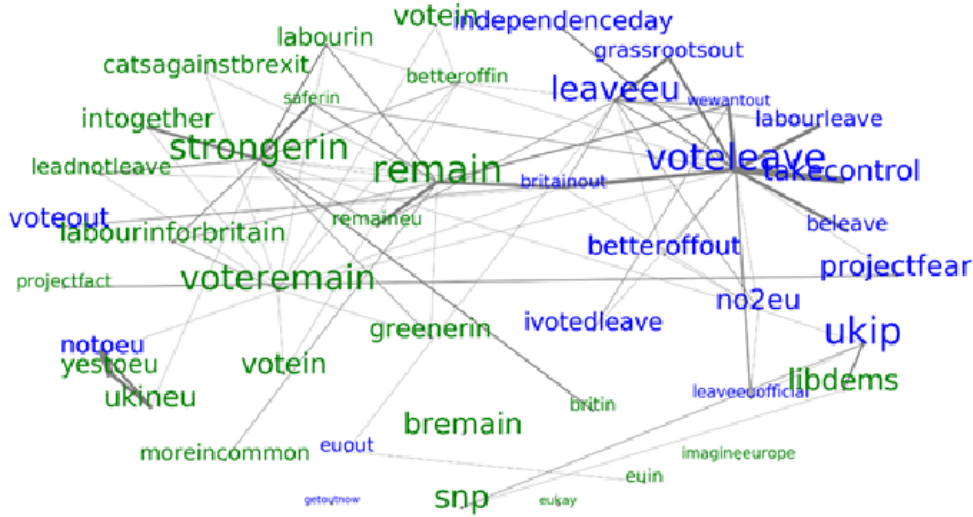


Figure 13: Classification of tweets into pro and against Brexit: in green are hashtags and expressions classified as being against Brexit and in blue hastags and expressions classified as being pro Brexit.

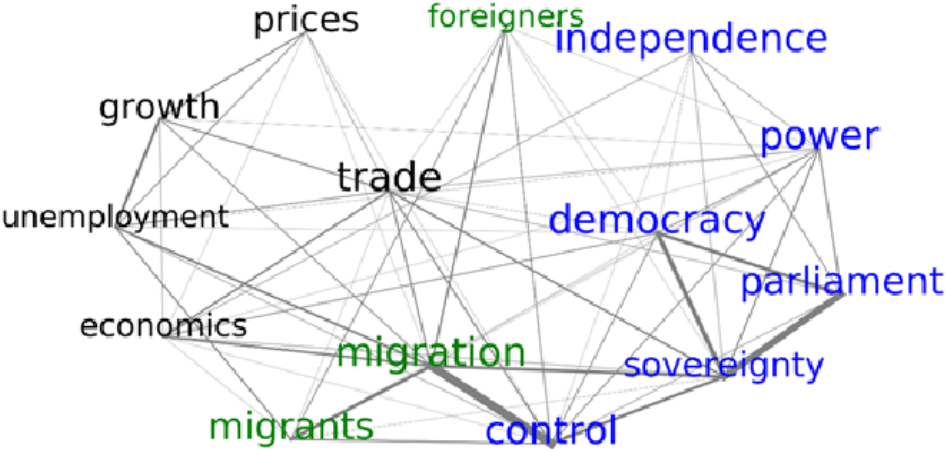


Figure 14: Classification of tweets into economic (black), political (blue) or social (migration in green) issues.

We then estimate the following model:

$$Share_{slt}^k = \delta Treated_{slt} + \beta X_t + \eta_s \times Event_t + \varepsilon_{slt} \tag{3}$$

Table 9: Twitter Storms and Consumer Behavior

Dependent variable:	Share UK (1)	Share EU (2)	Share UK (3)	Share EU (4)	Share UK (5)	Share EU (6)	Share UK (7)	Share EU (8)
Treated	0.103*** (0.018)	-0.045*** (0.015)						
Log(Tweets)			0.261*** (0.028)	-0.168*** (0.024)				
Log(Tweets pro)					0.237*** (0.026)	-0.147*** (0.022)		
Log(Tweets against)							0.270*** (0.029)	-0.176*** (0.025)
Store $\times$ Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
R <sup>2</sup>	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Observations	6874833	6874833	6874833	6874833	6874833	6874833	6874833	6874833

Source: Twitter and Transaction Data. *Treated* is an indicator that equals one for purchases occurring the day after a twitter storm and 0 for the day before a twitter storm. *Log Tweets* corresponds to the number of tweets during a twitter storm related to Brexit, aggregated at the LSOA level but excluding the respective LSOA. *Log Tweets Pro* corresponds to the number of tweets that were classified as being Pro Brexit and *Log Tweets Against* corresponds to the number of tweets that were classified as being Against Brexit. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

where  $Share_{slct}$  corresponds to the share of  $k = UK, EU$  products sold in store  $s$ , in LSOA  $l$  and in event  $t$  relative to the preceding day. The  $Treated_{slt}$  indicator equals 1 for each day following a twitter storm (event) and we include store-event across stores and across events. Note that in this analysis we use the universe of shoppers in each store as opposed to the panel of consumers used in section 3.

To exploit the intensity of tweets we replace the *Treated* variable with the number of tweets in each event - adding all tweets nationally with the exception of those from the LSOA associated with each store - in logarithmic form.<sup>26</sup> Finally, we examine the relative impact of tweets that are pro vs against Brexit to test whether shopping patterns are differentially affected by slant.

Table 9 shows that an increase in the number of tweets about Brexit (pro or against) at the national level is associated with a significant increase in the share of UK products and a significant decrease in the share of EU products purchased. A 10% increase in the number of tweets is associated with a 4% increase in the share of UK products purchased. We do not find a significant difference between tweets that are classified as pro or against Brexit, which suggests that it is the discussion around Brexit and keeping identity top of mind that is inducing changes in shopping behavior.<sup>27</sup>

To further investigate how media content mediates the impact of identity on consumer behavior

<sup>26</sup>There are no zeros in this variable.

<sup>27</sup>In Table 4 of the Online Appendix we show that these results are very similar when we use the top 10% of twitter activity at the national level, thus increasing the number of twitter storms we use for identification.

we examine how market shares of UK vs EU products changed with exposure to discussions about the economics, the politics or the social issues associated with Brexit. Our key hypothesis is that, while all three themes can be connected to different dimensions of identity, discussions around the politics of regaining sovereignty are more likely to affect shopping behavior exclusively through the identity channel.

Table 10: Twitter Storms and Consumer Behavior

Dep. var.	Share UK	Share EU	Share UK	Share EU	Share UK	Share EU
	(1)	(2)	(3)	(4)	(5)	(6)
Log(Tweets immigration)	0.194*** (0.027)	-0.123*** (0.023)				
Log(Tweets politics)			0.360*** (0.023)	-0.218*** (0.019)		
Log(Tweets economy)					0.230*** (0.028)	-0.182*** (0.024)
Store $\times$ Event FEs	YES	YES	YES	YES	YES	YES
R <sup>2</sup>	0.008	0.008	0.008	0.008	0.008	0.008
Observations	6,874,833	6,874,833	6,874,833	6,874,833	6,874,833	6,874,833

Source: Twitter and Transaction Data. *Log(Tweets immigration)* corresponds to the number of tweets classified as being about immigration during the twitter storms in logarithmic form. *Log(Tweets politics)* corresponds to the number of tweets classified as being about politics during the twitter storms in logarithmic form and *Log(Tweets economics)* to the number of tweets classified as being about economics during the twitter storms, both in logarithmic form. Store times event fixed effects are included. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 10 shows results that are consistent with our main hypothesis: discussion around all three themes are associated with an increase in the purchase of UK products and a decrease in the purchase of EU products, but the coefficient for political tweets is relatively larger in magnitude and statistically different from the coefficient for economic or social tweets. This lends further support to the importance of identity, and particularly political national identity, as driving the observed changes in day to day economic decisions.<sup>28</sup>

We interpret twitter activity and in particular twitter storms as a proxy for more intense general media discussions around Brexit, given that we are unable to match twitter users to consumers and the fact that twitter users will often tweet about news in the traditional media. We discuss this point further in the robustness section ahead.

<sup>28</sup>In Table 5 of the Online Appendix we show that the differential impact of tweets about politics relative to economics and social issues is even larger when we consider a broader definition of twitter storms to include the top 10% of twitter activity days.

All in all, our findings suggest that individuals may derive utility from privately consuming identity products, that identity preferences are malleable and that a determinant of their importance in shaping economic behavior is the ability of the media to keep this product attribute top of mind.

## 8 Robustness

### 8.1 Attention vs Identity

Our findings suggest that the media can play an important role as a shifter of the salience of identity, with implications for everyday consumer behavior. In this section we explore an alternative hypothesis: can the observed effects be fully explained by changes in attention to a particular attribute of a good, in this case country of origin? If the media makes Britishness top of mind, then will consumers simply think about British products when they enter the store and shop accordingly, without necessarily thinking about identity? To address this point, we vary the intensity of the identity signal of an event, and observe the corresponding change in consumer behavior.

We focus on the Euro 2016 football championship and identify the days in which the England team won against a European partner during the championship or during the qualifiers. We then implement a sharp event study around each of the 15 events and observe shopping behavior for UK and EU products before and after each event. In principle, the EU championship is less likely to exert a profound and long-lasting shift in perceived identities relative to the Brexit referendum.

Table 11 shows that England's wins have no effect on the share of UK products purchased and are associated with a small reduction (0.6%) in consumption of EU products. These findings suggest that shifts in attention to national identity are more likely to have a significant impact on consumer behavior when they trigger strong and latent identity preferences.

Table 11: England’s wins in Euro 2016 and Consumer Behavior

<b>Dependent variable:</b>	<b>England win</b>	
	<b>Share UK</b>	<b>Share EU</b>
	(1)	(2)
Treated	-0.006 (0.030)	-0.124*** (0.025)
Store $\times$ Event FEs	YES	YES
R <sup>2</sup>	0.010	0.010
Observations	2600263	2600263

Source: EURO 2016 and Transaction Data. *Treated* corresponds to shopping visit that occurred a day after the match, compared to the day prior to the match. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

## 8.2 Rational expectations and demand-side changes

An alternative interpretation of our findings could be that shoppers anticipate either the worsening of economic conditions following Brexit or future negative supply shocks for European products. If they were hyper-rational and sophisticated, consumers could potentially begin to phase out consumption of EU products in anticipation of these changes. Our evidence is, however, inconsistent with this hypothesis. First, concerns about supply shocks due to a no deal Brexit appeared much later in the public discourse, outside our window of analysis. In Figure 15 we show the frequency of google searches on the term “no deal Brexit”.<sup>29</sup>

<sup>29</sup>Note that the figures represent search interest relative to the highest point on the chart for the given region and time. A value of 100 corresponds to the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means that there was not enough data for this term.



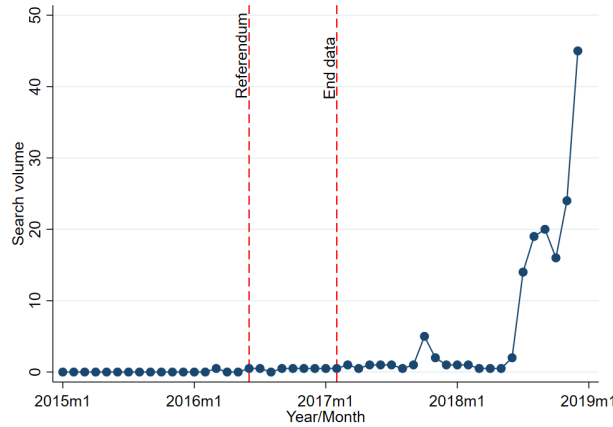


Figure 15: Google Search Index for the Term “No Deal Brexit”.

This confirms that disruptions to trade flows and supply shocks only became a concern significantly later, by the end of 2017. Second, as discussed in sections 3 and 4, over 95% of products in our sample were continuously traded and on shelf throughout our period of analysis, which is consistent with the fact that there was no short-run disruption to supply chains (and therefore no likely anticipation of such) during our period of analysis. Crucially, we observe that absolute and relative prices were stable for UK and EU products. Nonetheless, in all specifications, we control for total household weekly expenditure, which is likely to be a good proxy of expectations about future economic conditions.

### 8.3 Supply-side Changes

Our difference-in-differences and event study identification strategies rely on the (verified) assumption that there were no changes on the supply side including prices, packaging and availability on shelf. The stability of prices was already discussed in Figures 6 and 7 and section 3 discusses the fact that the vast majority of products (95%) remained on shelf in all stores throughout our period of analysis. While we can verify that this was indeed the case by using information directly obtained from the retailer, we also conduct a robustness exercise in which we restrict our analysis in the difference-in-differences exercise to the month immediately after the referendum, when any changes would have been extremely unlikely to occur as the retailer was locked into multi-month contracts

Table 12: Difference-in-Differences: Robustness

Dependent variable:	Share UK (1)	Share EU (2)
Post Brexit within 4 weeks	0.035** (0.015)	-0.048*** (0.013)
Post Brexit after 4 weeks	0.257*** (0.008)	-0.305*** (0.007)
Log(Price UK)	-12.561*** (0.112)	12.291*** (0.098)
Log(Price EU)	12.099*** (0.082)	-10.881*** (0.070)
Weekly expenditure	-2.348*** (0.103)	1.583*** (0.071)
Household FEs	YES	YES
Week FEs	YES	YES
Product category FEs	YES	YES
R <sup>2</sup>	0.115	0.176
Observations	215,220,529	215,220,529

Source: Transaction Data.  $\text{Log}(\text{PriceUK})$  corresponds to average product category prices for UK products and  $\text{Log}(\text{PriceEU})$  corresponds to average product category prices for EU products.  $\text{WeeklyExpenditure}$  corresponds to average weekly expenditure at the shopper level.  $\text{PostBrexit}$  represents an indicator equalling 1 for the period after the Brexit referendum between June 2016 and March 2017 and 0 for the period between March 2015 and June 2016. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

with suppliers. Changing packaging at scale is extremely challenging for suppliers or for the retailer in the short-run, so restricting the analysis to the first four weeks following the referendum is the most conservative test we can consider.

The evidence in Table 12 suggests that the effect of the treatment –having a flag or a British identifier in the name– is positive during the first month following the referendum, but it increases seven-fold in the remaining 8 months. Had there been significant changes on the supply side, particularly through changes in packaging to increase the number of products carrying a British flag, the coefficient should be smaller as our control group in the difference-in-differences model would have become ‘treated’. The broader fact that the treatment effect increases with distance from the event is consistent with our previous findings that there was relatively limited discussion

in the media prior to the Brexit campaign, followed by several media storms that kept identity increasingly top of mind in the 9 months following the Brexit referendum.

## 8.4 Twitter Analysis: identification

To verify the robustness of our media results, we explore an alternative identification strategy to examine the causal link between exposure to the media and consumer behavior. We identify top “influencers” on twitter by creating an index that equally weights the number of tweets, the weekly frequency of tweets, the number of friends and the number of followers, as a measure of twitter usage and influence. We then identify twitter storms based on the timing of the top 10% influencers’ tweets, and again compare shopping activity the day before and after the top 10% of twitter episodes triggered by influencers occur. As shown in table 13, our results remain unchanged.

Table 13: Twitter Storms and Consumer Behavior: Influencers

Dependent variable:	Share UK (1)	Share EU (2)	Share UK (3)	Share EU (4)	Share UK (5)	Share EU (6)	Share UK (7)	Share EU (8)
Treated	0.132*** (0.018)	-0.080*** (0.015)						
Log(Tweets)			0.407*** (0.029)	-0.271*** (0.024)				
Log(Tweets pro)					0.357*** (0.029)	-0.245*** (0.024)		
Log(Tweets against)							0.409*** (0.029)	-0.268*** (0.024)
Store $\times$ Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
R <sup>2</sup>	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Observations	7420818	7420818	7420818	7420818	7420818	7420818	7420818	7420818

Source: Twitter and Transaction Data. *Treated* is an indicator that equals one for purchases occurring the day after a twitter storm and 0 for the day before a twitter storm. *LogTweets* corresponds to the number of tweets during a twitter storm related to Brexit, aggregated at the LSOA level but excluding the respective LSOA. *LogTweetsPro* corresponds to the number of tweets that were classified as being Pro Brexit and *LogTweetsAgainst* corresponds to the number of tweets that were classified as being Against Brexit. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

## 8.5 Sampling Bias

### 8.5.1 Retailer

Our sample of stores covers 39,775 LSOAs (95.3%) out of 41,729 LSOAs in the UK. As shown in table 14, the remaining 5% of LSOAs not covered in our sample are almost identical on key socioeconomic characteristics.

Table 14: Descriptive Statistics: LSOAs

Variable	LSOA covered (N=39775)		LSOA UK (N=41729)	
	Mean	Std. dev.	Mean	Std. dev.
Share White (%)	86.65	18.51	86.75	18.60
Unemployment (%)	6.47	4.01	6.58	4.13
Blue collar (%)	24.10	7.25	24.22	7.30
Rural	17.47	36.97	17.20	36.75

Source: Census Data. All variables are at the LSOA level (1,500 people on average). *ShareWhite* represents the share of white residents, *Unemployment* represents share of unemployment, *Bluecollar* represents the share of blue collar workers, and *Rural* corresponds to a rurality index increasing from 0 to 1.

### 8.5.2 Shoppers

A potential confounding factor in our analysis is that the observed change in consumption patterns could be driven by compositional changes in the type of shoppers that appear in our dataset. Our baseline analysis is based on an unbalanced set of shoppers, as they enter and exit the sample during the period under analysis. We define exit as a shopper appearing regularly in our dataset and then not shopping again until the end of the analysis.<sup>30</sup> Reassuringly, Figures 16 and 17 confirm that there is no abnormal exit or entry of shoppers that coincided with the Brexit referendum.

<sup>30</sup>When we use an alternative definition of exit – one in which a shopper exits when there is a below median persistent drop in shopping frequency following Brexit –, results remain unchanged.

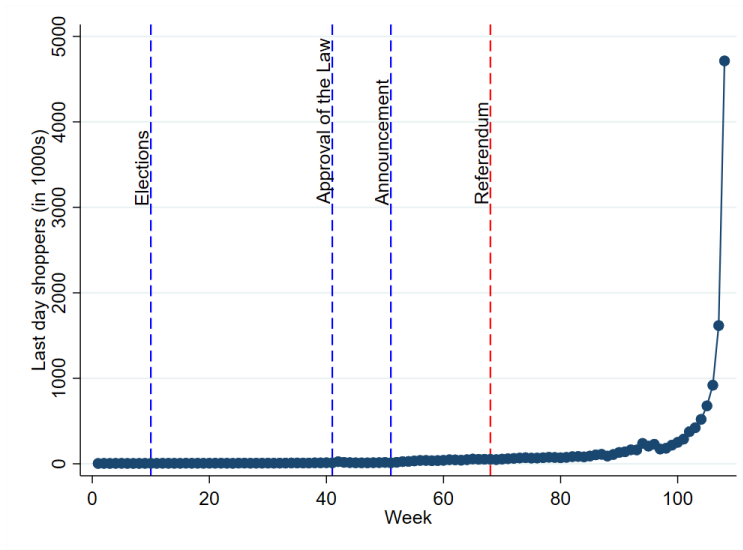


Figure 16: Correlation between Twitter and Facebook usage at the locality level.

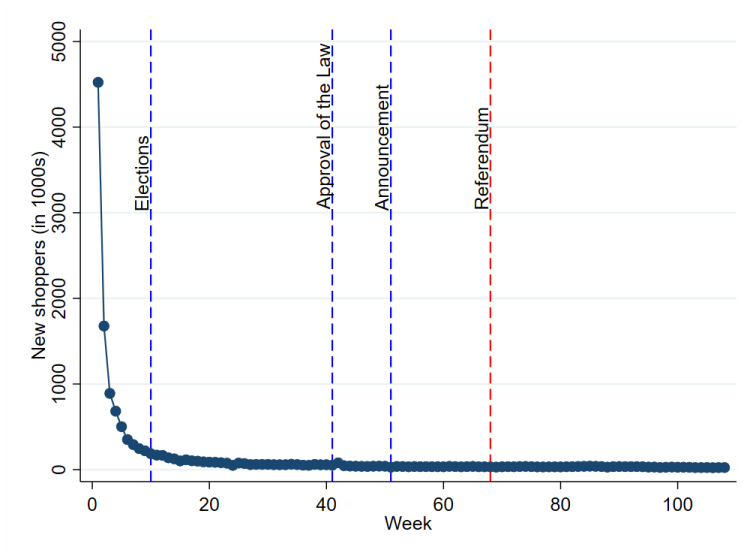


Figure 17: Correlation between Twitter and Facebook usage at the locality level.

Moreover, shoppers who enter our dataset in the three months after the Brexit referendum do so at the same rate as shoppers who entered the dataset in the three months prior to the referendum. Importantly, these new entrants are similar in average expenditure relative to those in the main sample of shoppers from before the referendum.

### 8.5.3 Twitter Data

An additional potential concern is that twitter users represent a non-random, non-representative sample of individuals at the locality level. While we cannot fully dismiss this possibility, we find strong evidence that increased twitter activity at the locality level is strongly correlated with increased usage of other, perhaps more representative, social media platforms such as facebook. As shown in figure 18, there is a strong correlation between twitter and facebook activity at the locality level.<sup>31</sup>

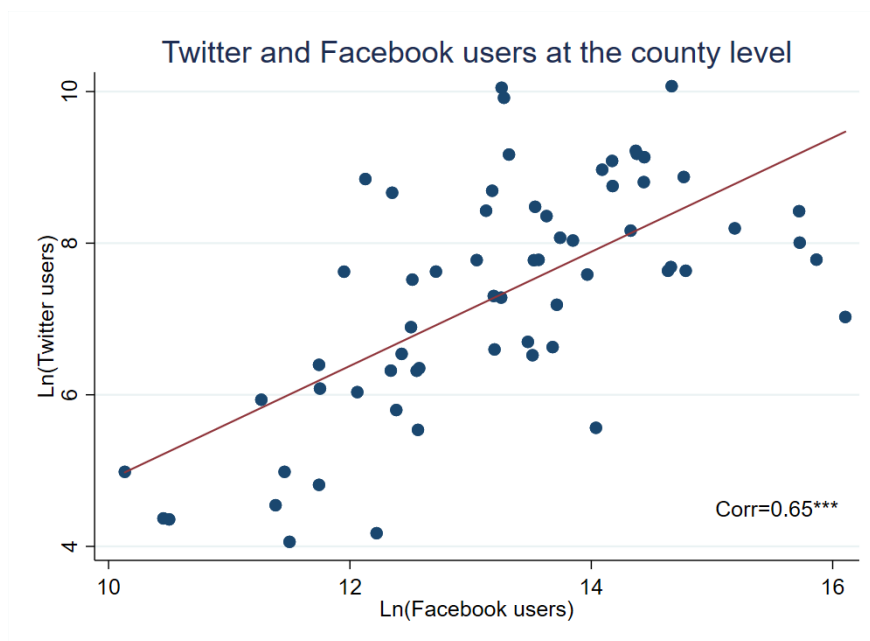


Figure 18: Correlation between Twitter and Facebook usage at the locality level.

This evidence reinforces our interpretation of the twitter data as a proxy for exposure to the media more broadly.

A final potential source of sampling bias relates to the sample of tweets used in the twitter analysis. We are able to geo-locate 11.3 million tweets out of a universe of 19.8 million tweets. Figure 19 confirms that we can match twitter data to most LSOAs in the UK. We further find that the share of tweets that are pro and against Brexit is similar in counties with and without stores,

<sup>31</sup>Facebook usage is retrieved by using Google search API to identify users that list a given locality in their user profile.

as are the shares of tweets about politics, economics and migration. This is reassuring since it suggests that there is limited sampling bias in our analysis of the role of the media on consumption behaviour.



Figure 19: Matching Twitter data to LSOAs with store data

## 9 Conclusions

This paper provides novel evidence on the impact of political events in shaping identity, and on how identity can affect routine and near-universal economic behaviors. We examine the impactful yet unexpected outcome of the Brexit referendum as a shock to the salience of British identity on consumers' decisions to shop for UK vs EU grocery products. We find that in the aftermath of the referendum: i) shoppers were more likely to consume UK products and to decrease consumption

of EU products; ii) sales increased even more for products that prominently displayed their origin in the front package (by including a flag or a British moniker in the name), iii) identity preferences impacted not only the levels of consumption but also the price sensitivity associated with each identity good and iv) consumers shifted selectively across product categories depending on the shares of EU vs UK products available and relative prices in each product category.

Importantly, we find no evidence of identity preferences being driven by a desire to socially conform to a prototypical behavior associated with being British. Instead, our findings underscore the fact that identity preferences can matter even in settings that lack focal, prescriptive social norms about group behavior. Attachment to national identity can be malleable and is likely to shape economic behavior when the media makes it top of mind. The content of media discussions also appears to matter as shifts in consumption are larger when individuals are exposed to discussions about the politics of national identity. But attention alone is unlikely to explain our results - similar events that keep weaker associations with identity top of mind do not lead to substantive changes in consumption patterns.



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ONLINE APPENDIX FOR  
Identity, Media and Consumer Behavior

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(NOT FOR PUBLICATION)

September 1, 2020

# 1 Price Analysis

Figures 1 and 2 show a non-parametric fit of the coefficients of variation of UK and EU products. In both cases, price dispersion was fairly stable throughout our period of interest. The dispersion of EU prices is on a very slight upward trend that is not affected by the Referendum. This confirms our assumption of price rigidity during our window of analysis.

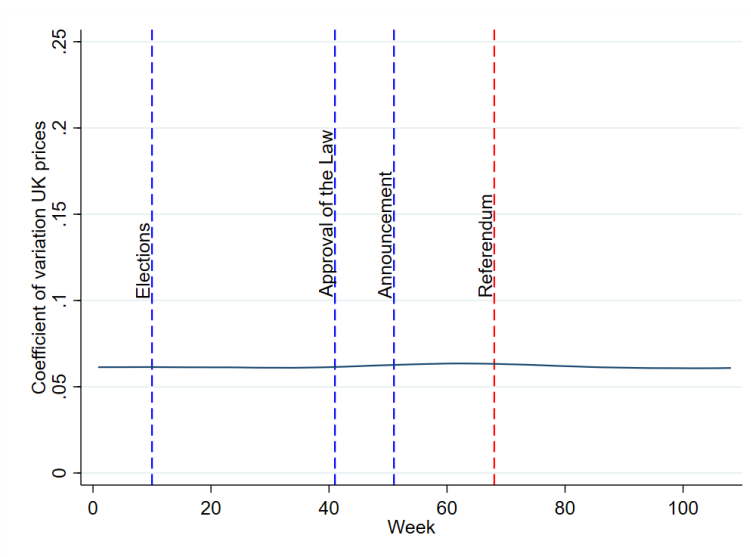


Figure 1: Non-parametric fit of coefficients of variation computed for UK products per product category.

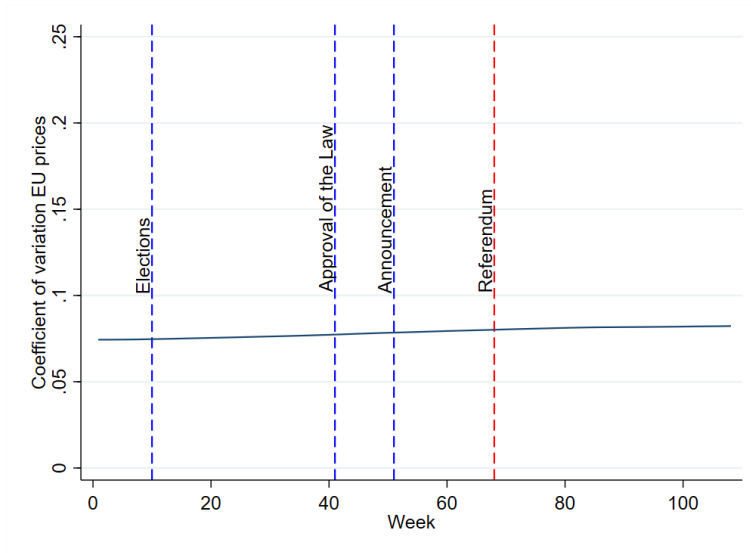


Figure 2: Non-parametric fit of coefficients of variation computed for EU products per product category.

## 2 Consumer Surveys

To examine the external validity of our findings, we compare beliefs and reported behaviors of consumers who report shopping at our retailer relative to those who report shopping at alternative retailers. Table 2 shows the p-values for tests of equality of proportions (chi-square) and of equality of distributions for the key reported behaviours and beliefs discussed in the main paper.

Table 1: Shopper Beliefs Across Retailers

	P-values Equality of	
	Proportions	Distributions
Changed Shopping Behavior	0.40	0.85
Typical British Consumer Behavior	0.49	1
Own Behavior	0.76	1

Source: Online Consumer Survey with a sample of 1,085 consumers. The table compares reported beliefs and behaviors for shoppers who shop in our partner retailer to those of shoppers who shop in the remaining retailers in the UK. The table reports the P-values for tests of equality of proportions (chi-square) and for a kolgomorov-smirnov test for equality of distributions for the main variables captured in the survey.

The p-values are all well above 0.4. In 3, we show that the key findings on perceptions about social norms about British behavior in shopping and own behavior are very similar between shoppers who report shopping in our retailer relative to those who report shopping in alternative retailers.

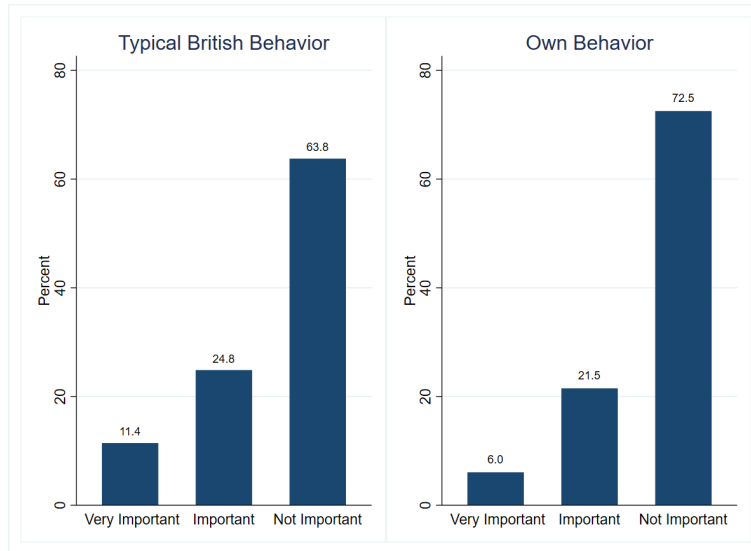


Figure 3: Share of consumers reporting on the importance of purchasing UK products for the typical British consumer vs for themselves, for shoppers in our retailer.

### **3 Locality Characteristics**

In this section we consider alternative measures of socioeconomic development at the LSOA level. Instead of the index of multiple deprivation used in the main paper, we use data on income, share of blue collar workers, unemployment and an index of rurality (between 0 and 1). These indicators are all captured at the LSOA level and were obtained from the UK census.

Table 2: Consumption Patterns and Locality Characteristics

Dependent variable:	Share UK		Share EU	
	(1)	(2)	(3)	(4)
Post Brexit	0.257*** (0.024)	0.207*** (0.022)	-0.266*** (0.021)	-0.210*** (0.019)
Log(Price UK)	-12.444*** (0.111)	-12.445*** (0.111)	12.165*** (0.098)	12.166*** (0.098)
Log(Price EU)	12.070*** (0.082)	12.070*** (0.082)	-10.867*** (0.070)	-10.867*** (0.070)
Total daily expenditure	-2.346*** (0.102)	-2.346*** (0.102)	1.580*** (0.071)	1.580*** (0.071)
Post Brexit × I(high income)	-0.038*** (0.014)		0.046*** (0.012)	
Post Brexit × Blue collar	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001* (0.001)
Post Brexit × Unemployment		0.004** (0.002)		-0.004** (0.002)
Post Brexit × Rural	0.041** (0.017)	0.035** (0.017)	-0.034** (0.015)	-0.026* (0.015)
Household FEs	YES	YES	YES	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R <sup>2</sup>	0.115	0.115	0.176	0.176
Observations	217415406	217415406	217415406	217415406

Source: Census and Transaction data. *LogPriceUK* corresponds to average product category prices for UK products and *LogPriceEU* corresponds to average product category prices for EU products. *WeeklyExpenditure* corresponds to average weekly expenditure at the shopper level. *PostBrexit* represents an indicator equalling 1 for the period after the Brexit referendum until March 2017 and 0 for the period between March 2015 and June 2016. *I(high income)* corresponds to an indicator for LSOA average income above median value and 0 otherwise. *Rural* corresponds to a rurality index obtained from the UK census that ranges from 0 to 1. *Blue Collar* corresponds to the share of blue collar workers in the LSOA and *Unemployment* corresponds to the share of unemployment at the LSOA level. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

Confirming the results in the main paper, we find that while some coefficients are statistically significant –income, unemployment and rurality index – the results are quantitatively extremely



small revealing that the socioeconomic features of one’s environment are not necessarily changing the probability of identity preferences affecting shopper behavior.

## 4 Media: defining twitter storms

In this section we test the robustness of our analysis of the intensity of twitter discussions and changes in shopping patterns. In our main analysis, we identify a causal relationship between exposure to the media (via twitter activity) and shopping behavior by exploiting twitter storms that are defined as episodes among the top 2% of twitter activity around Brexit throughout our window of analysis. We now revisit this approach and relax this classification to include the top 10% of twitter activity at the national level. Tables 4 and 5 show that our results remain qualitatively similar, even if, quite plausibly, they are smaller in magnitude.

Table 3: Twitter Storms and Consumer Behavior

Dependent variable:	Share UK	Share EU	Share UK	Share EU	Share UK	Share EU	Share UK	Share EU
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treated	0.031 (0.020)	-0.008 (0.017)						
Log(Tweets)			0.124*** (0.028)	-0.135*** (0.023)				
Log(Tweets pro)					0.126*** (0.026)	-0.117*** (0.022)		
Log(Tweets against)							0.123*** (0.029)	-0.148*** (0.024)
Store × Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
R <sup>2</sup>	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Observations	5572081	5572081	5572081	5572081	5572081	5572081	5572081	5572081

Source: Twitter and Transaction Data. *Treated* is an indicator that equals one for purchases occurring the day after a twitter storm and 0 for the day before a twitter storm. *LogTweets* corresponds to the number of tweets during a twitter storm related to Brexit, aggregated at the LSOA level but excluding the respective LSOA. *LogTweetsPro* corresponds to the number of tweets that were classified as being Pro Brexit and *LogTweetsAgainst* corresponds to the number of tweets that were classified as being Against Brexit. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

The differential impact of tweets about politics relative to economics and social issues is even larger when we consider a broader definition of twitter storms, which lends support to our interpretation in the paper that arguments about the politics of Brexit are more likely to be affecting

Table 4: Twitter Storms and Consumer Behavior

Dependent variable	Share UK (1)	Share EU (2)	Share UK (3)	Share EU (4)	Share UK (5)	Share EU (6)
Log(Tweets immigration)	0.098*** (0.025)	-0.101*** (0.021)				
Log(Tweets politics)			0.329*** (0.031)	-0.249*** (0.026)		
Log(Tweets economy)					0.121*** (0.029)	-0.156*** (0.025)
Store $\times$ Event FEs	YES	YES	YES	YES	YES	YES
R <sup>2</sup>	0.008	0.008	0.008	0.008	0.008	0.008
Observations	5572081	5572081	5572081	5572081	5572081	5572081

Source: Twitter and Transaction Data. *Log(Tweets immigration)* corresponds to the number of tweets classified as being about immigration during the twitter storms in logarithmic form. *Log(Tweets politics)* corresponds to the number of tweets classified as being about politics during the twitter storms in logarithmic form and *Log(Tweets economics)* corresponds to the number of tweets classified as being about economics during the twitter storms, both in logarithmic form. Store times event fixed effects are included. \*, \*\*, \*\*\* represent statistical significance at the 10%, 5% and 1% levels respectively.

shopping behavior through the identity channel.