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Identity, Media and Consumer Behavior

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IDENTITY, MEDIA AND CONSUMER BEHAVIOR

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January 30, 2021‡

Abstract

This paper examines how national identity affects day-to-day economic behavior. We exploit the Brexit referendum as a shock to the salience of identity and measure its impact on consumer choices in the UK, between British and EU grocery products. Drawing from a unique panel dataset with 12 million shoppers, we find that the referendum is associated with an increase in consumption of UK products (6%) and a reduction in demand for EU products (13%). Changes in consumption are driven by identity being top of mind: consumption of UK products is up to 7% higher during intense media discussions on Brexit, particularly during discussions on the politics of regaining sovereignty relative to the economic or social issues associated with Brexit. These findings underscore the importance of national identity in shaping routine economic decisions, and the mediating role that political events and the media can play by keeping identity top of mind.

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1 Introduction

Recent years have brought worldwide shifts toward nationalistic political agendas, with the rise of nationalistic parties in Europe, exclusionary policy drifts in India and in Japan, and nationalistic political events such as Brexit in the United Kingdom (UK) and the presidency of Donald Trump in the United States (Colantone and Stanig 2019). While progress has been made in understanding the drivers of these trends and some of its immediate policy outcomes, less is known about how this rise in nationalism has affected, perhaps more pervasively, day-to-day economic behavior. This paper fills this gap by looking at how an increase in the salience of national identity can shape routine consumer behavior. We exploit a plausibly unexpected political outcome that shifted the salience of British identity across the UK - the Brexit referendum revealing the collective decision for the United Kingdom to exit the European Union (EU) - to measure how national identity changed consumers' purchases of UK vs. EU products.

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).¹ The loyalty card scheme allows us to construct a panel of customers and their shopping transactions between March 2015 and March 2017, which spans 15 months before, and 9 months after, the 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 the 9 months following the referendum, supplier contracts were fixed in pounds, national prices were stable, and the share of UK and EU products available on shelf did not change. To ensure that no residual price variation is driving our results (e.g. promotions of different time lengths across stores), we identify both supply-side and aggregate demand factors that are plausibly exogenous, and can serve as instruments of local prices.

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. Google search and twitter data reveal that discussions about Brexit were very limited

¹The consumer base of the retail chain covers 95% of all LSOAs in the UK, which are administrative units that consist of approximately 1,500 households.

before the announcement of the Brexit referendum (see Section 3.1), but they increased significantly after that. We therefore 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. These effects double when we use aggregate supply and demand factors to instrument for local prices.² Switching is more frequent in product categories with lower average prices, but for more expensive goods within each product category. This is mostly driven by decreased price sensitivity to UK products and increased price sensitivity to EU products. More switching occurs in contestable categories for which there are UK alternatives available.³

In the aggregate, shifts in consumption due to the salience of national identity represent a 63 million GBP increase in revenue from UK products for our sample of shoppers alone.⁴ These shifts represented a 168 million GBP change in aggregate consumer surplus. In a back of the envelope calculation, we estimate the value of identity to be equivalent to an average price reduction of UK products of 4 pence, which represents 1.9% of the average price of UK products, and, importantly, is comparable to the most recent increase in average VAT rates in the UK in 2011. Moreover, these figures are likely to represent a lower bound since they double when we rely on our estimates that result from instrumenting prices with plausibly exogenous aggregate supply and demand shocks (the average price reduction would be of 9 pence and the corresponding change in consumer surplus would be of 82 pence per shopper-week and of 512 million GBP in terms of aggregate surplus).

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

²We rely on two sets of instruments. First, we instrument prices at the local level with the effective level of local competition: this measure is calculated based on the openings and closures of stores from competing grocery chains in each store locality. Second, we identify aggregate demand shocks in neighboring localities served by each of the retailer’s respective distribution centers: stockouts of UK or EU products in the previous week in the area are likely to affect prices of goods in any given store by affecting the speed with which shelves can be replenished. To further capture this dynamic, our instruments correspond to the demand shock in neighboring stores, and the demand shock interacted with distance to the retailer’s nearest distribution center. This discussion and the associated results are presented in section 7.4.

³The effects of identity on shopping behavior are also stable across the different UK countries in our sample (Scotland, Wales and England).

⁴If we expand this calculation to include shoppers that do not have loyalty cards but who might have had a similar response, the figure would correspond to approximately 79 million GBP.

that the increase in UK product market share is highest for products that are saliently labeled as being British, by having the union jack flag on the package, or by directly mentioning the place of origin in the product name (e.g. British ribs). This is consistent with the fact that it is product origin that is driving observed changes in consumption patterns. The flag leads to a 6% increase in sales relative to UK products without a flag and a 13% increase relative to EU products in the 9 months following the referendum. This corresponds to an approximate revenue increase for flagged products of over 194 million GBP.

Third, we draw on the literature on identity to identify the mechanisms through which identity-based preferences can shape consumption patterns. Our evidence from the event study is consistent with in-group or home bias in consumption (Shayo 2020), as consumers replace EU products in their baskets with similar UK products. We do not find evidence of shifts in taste triggered by a desire to move closer to prototypical consumption baskets associated with being British, such as consuming more “quintessential” British products like Scottish scones or Cadbury chocolate (Atkin et al. 2019; Shayo 2020). We also find no evidence that consumers shifted consumption patterns due to a desire to socially signal being British (Fouka and Voth 2013). An online survey of a random sample of 1,085 primary grocery shoppers in the UK conducted after the referendum revealed that consumers did not view a shift toward purchasing UK products as a way to signal conformity to British identity. Moreover, 96% of respondents reported having felt limited social pressure to purchase more UK products after the referendum. This suggests that our setting lacks the strong prescriptive norms associated with group behavior that define other environments studied in the identity literature (Fouka and Voth 2013; Pandya and Venkatesan 2016; Atkin et al. 2019). Consistent with this lack of demand for social conformity and limited potential for social signaling, when we match shopper behavior to store locality characteristics we find that levels of economic deprivation and socioeconomic context only marginally affect the observed attachment to national identity in grocery shopping.

Fourth, we explore an alternative mechanism through which identity can have a persistent and far-reaching effect on consumer behavior: how the media affects shopping behavior by keeping identity top of mind. To study the role of the media as a shifter of the salience of identity, we focus on both social media (twitter) and traditional media. First, we obtain 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 Brexit-related tweets published on Twitter in the UK during the period between March 2015 and March 2017, and we combine text analysis with machine learning to measure the level and direction of sentiment toward 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 at the locality level. 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 20% increase in the number of tweets in a given day (on average, an increase of 40 tweets) is associated with a 5% increase in the share of UK products purchased.

Consistent with an identity channel, the effect of twitter activity is particularly strong when tweets are about the politics of Brexit (e.g. becoming an independent, sovereign British nation) relative to economic or social concerns such as immigration, and also when twitter storms have strong identity connotations measured by the use of first-person plural pronouns such as “us, we or ours”.⁵

We interpret these results as suggestive of the role of the broader media in making identity salient to a larger segment of the population beyond just twitter users.⁶ Days with twitter storms are likely to occur when there is more discussion about Brexit in the traditional media as well. In fact, we find even stronger effects when we look at the impact of traditional media on consumer behavior.⁷ Using the universe of articles published on Brexit in a representative sample of UK newspapers, we find that a 10% increase in the number of articles published in a given day is associated with a 7% increase in the consumption of UK products. Sentiment analysis of newspaper content revealed that the effect of Brexit discussions on the shopping of UK products was highest in days in which opinion-based (not necessarily factual) articles used more positive language about Brexit.

Finally, we investigate whether the observed effects of identity are specific to major political events with potentially long-lasting effects on perceptions of identity or if they can also arise when

⁵Our findings are also robust to different ways of identifying twitter storms such as looking at the top 20% or 10% of episodes of intense twitter activity or by identifying tweets from the top influencers on Twitter. We identify influencers as twitter users who have the highest twitter activity and the largest number of friends and followers.

⁶We also find a strong positive correlation between twitter and perhaps more representative social media platforms such as facebook usage at the locality level.

⁷This also allays concerns about the possible strategic use of twitter to influence both voting behavior and attitudes toward Brexit.

any event or issue is made salient in the media. This might suggest that attention alone could be driving changes in consumption. While our content analysis of both the newspaper and the twitter data is consistent with an identity channel, we also examine how consumption of UK vs. EU products changed whenever England won a EURO 2016 football match. This type of event can still trigger an association with British identity (Campante et al. 2020), but it is far less likely to result in long-lasting changes to one’s perceived identity when compared to the Brexit referendum that resulted in a decision for the UK to depart from the EU after 43 years of a joint UK–EU identity. Consistent with this interpretation, we find that an English win in the football tournament is associated with a significantly smaller increase in consumption patterns of UK products (by a factor of 5) and a small decrease in the consumption of EU products. This suggests that attention alone cannot fully explain our results.

Grocery shopping is an ideal setting to measure the day-to-day economic consequences of changes in identity given the frequency and near universality of shopping transactions (Escalas and Bettman 2005; Pandya and Venkatesan 2016; Bertrand and Kamenica 2018; Atkin et al. 2019). This allows us to observe real-time temporal shifts in behavior at scale that are triggered by well-defined events. Relative to opinion surveys, purchases are also less subject to social desirability bias (Newman and Bartels 2011). Importantly, everyday grocery shopping is likely to have less social signaling value than purchases of durables such as cars, which has been an important focus of the literature to date (Hong et al. 2011; Fouka and Voth 2013). Agents in our setting are therefore less likely to be constrained by social signaling concerns when making purchasing decisions, which brings us closer to isolating individual preferences for identity that are not triggered by an explicit desire to socially conform.

The close outcome of the Brexit referendum also renders it an ideal event study. As discussed in Section 3, prior to the referendum there was scant public discussion on Brexit.⁸ 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. At the same time, while the referendum 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

⁸The referendum also pre-dated the rise of nationalist and autarkic rhetoric in some western democracies such as the US, as Donald Trump took power five months later.

with an appeal to buy British.⁹

Our findings build on, and contribute to, several literatures. First, we add to growing evidence on how identity can affect economic behavior (Akerlof and Kranton 2000; Pandya and Venkatesan 2016; Atkin et al. 2019). We 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 products do not hold inherent signaling value. These findings are reminiscent of an earlier argument in social psychology on the potentially far-reaching economic effects of hidden and pervasive forms of “banal” nationalism (Billig 1995). In fact, we are able to quantify the value shoppers attach to identity in terms of consumer surplus. Finally, we further propose a specific mechanism for this: the media can help bring latent identity preferences to the fore and keep identity top of mind during routine economic decisions.

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; Strömberg 2004; Gentzkow and Shapiro 2004); fertility (La Ferrara et al. 2012); conflict (Yanagizawa-Drott 2014) and social capital (Paluck 2009). What is perhaps less understood is whether some of these effects are driven by the mainstream media being able to turn on and off the salience of identity. Our evidence adds to this literature by suggesting that the media can sharpen identity preferences triggered by major political events and keep them intermittently top of mind, with important implications for fluctuations in day-to-day economic behavior.

Our findings also speak to an emerging literature on the psychological foundations of consumer behavior (Bordalo et al. 2020a; Bordalo et al. 2020b). 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

⁹The 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. These findings are consistent with lab experiments that find stronger evidence for in-group favoritism rather than outgroup detraction (Balliet et al 2014).

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 day-to-day shifter of the salience of group identity.

The rest of the paper is organized as follows: section 2 lays out the conceptual framework that will guide our analysis; section 3 describes the data used in our analysis including the transaction data, the census data, the data on twitter and on the traditional media, and the consumer survey data; while 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 grocery shopping. Section 6 discusses the main mechanisms behind our findings and Section 7 discusses several alternative interpretations. Section 8 concludes.

2 Identity and Consumer Behavior

The literature on identity in economics has followed closely from earlier developments in Social Identity Theory, which emphasises how individual identity can be partially derived from group affiliations (Tajfel 1981; Tajfel 1982; Nosofsky 1986; 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 (Davies et al. 2008), increasing the likelihood that individuals' preferences reveal in-group bias and that they adopt prototypical group behaviors. These behaviors could, among others, include consuming products that are consistent with their most salient political, ethnic, religious or economic identities (Khan et al. 2013; Pandya and Venkatesan 2016; Bertrand and Kamenica 2018; Atkin et al. 2019; Helms et al. 2020). The most compelling evidence to date on in-group bias and prototypical behaviors has, however, emerged in two types of settings. First, in settings with strong prescriptive norms about group behavior, driven by the value that individuals attach to conforming to group-specific behavioral norms or to being able to signal to others their identity (Fouka and Voth 2013; Pandya and Venkatesan 2016; Atkin et al. 2019). Second, in settings categorized by strong in-group bias when one's actions can directly benefit other members of the same group, such as in the case of decisions about hiring (Akerlof and Kranton 2000, Shayo 2009). Pandya and Venkatesan (2016) shows 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 signaling 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 debt crisis. [Atkin et al. \(2019\)](#) focus on how agents choose between ethno-linguistic and religious identities in a setting marked by strong taboos and norms associated with each identity. In all of these cases, identity preferences often arise because individuals attach value to conforming to prescriptive social norms or because they value the ability to signal their behavior to the group they identify with.

This paper builds on this work to pose a broader conceptual question and try to understand whether identity preferences can emerge even in settings that are not characterized by explicit opportunities for social signaling, and in which there are much weaker prescriptive norms associated with group behavior. This approach is likely to bring us closer to uncovering whether individuals derive utility (privately) from feeling an attachment to a particular identity.¹⁰ While we cannot firmly distinguish between the 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 ([Bénabou and Tirole 2004](#)).

A second conceptual question we address is the extent to which consumers respond to identity preferences. Motivated by standard hypotheses in the identity literature ([Shayo 2020](#)), we investigate whether changes in identity preferences are motivated by in-group bias and/or if they are driven by a desire to conform to prototypical group behavior. In-group bias might explain why Greeks would prefer to buy Italian cars over German cars during the Greek crisis but conformity to prototypical behavior might better explain why Indian Muslim households would consume less pork and alcohol following episodes of violence against Muslims. An in-group bias model applied to our setting predicts that patterns of consumption remain constant but consumers switch to domestic producers while the prototypical consumption model predicts that changes in consumption patterns may be more pronounced, with consumers changing their taste across product categories and moving toward consuming quintessentially British products.

Our third main conceptual question relates to the role of attention to identity in driving observed changes in consumer behavior. In particular, we focus on how the media can intermittently amplify

¹⁰In this paper we focus on behavioral measures of identity as reflecting preferences not beliefs ([Shayo 2020](#)).

the salience of identity (Bordalo et al. 2020b). If the media helps keep identity top of mind, then we should be able to observe an empirical association between intense exposure to identity-content in the media and the timing of changes in shopping behavior. However, it is also possible that any observed impact of the media on consumer behavior could be driven exclusively by attention, as opposed to real changes in the salience of identity preferences. If the media debates around Brexit keep Britishness top of mind, consumers could shop for British products even when they have no concerns about identity. To shed light on this hypothesis, we exploit variation in the intensity of the shock to identity, and observe the associated changes in consumer behavior. If attention alone drives consumption, then we should observe similar levels of changes in consumption whenever any event that makes identity salient takes place. If identity preferences also play a role, then we should observe that events that affect more deep-rooted identities elicit larger responses in consumption.

3 Setting and Data

3.1 The Brexit referendum Timeline

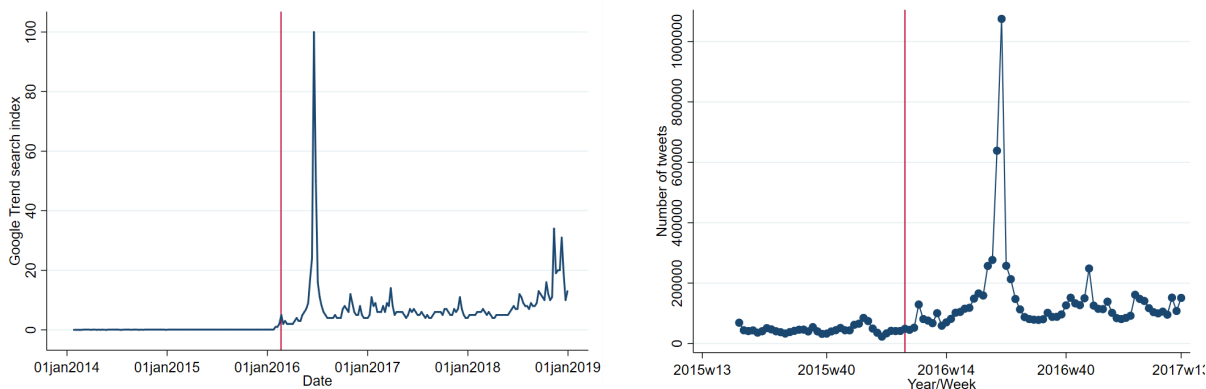
The UK joined the European Union in 1973. Survey evidence revealed that by 2015, over 60% of the UK population believed that participation in the block brought economic benefits to the UK and thus, supported continued membership in the EU (What the UK Thinks: EU 2015; British Social Attitudes Survey 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 fulfillment 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).

Crucial for our identification strategy, public interest in Brexit appears to have been extremely limited before the referendum took place.¹¹ This is evident from the two panels of Figure 1, showing the frequency of Google searches of the term Brexit (left panel) and of tweets mentioning Brexit

¹¹This is despite the fact that the term Brexit had been originally created in 2013 following the Greek crisis and the emergence of Grexit.

(right panel) across the UK during this period.¹²

Figure 1: Share of UK and EU products over time



Left panel reports the Google Trend Search Index of the Term “Brexit”. Right panel reports the number of Tweets that include the term “Brexit”. The red vertical line shows the date of the announcement of the referendum.

Searches and tweets about Brexit peaked during the referendum week and declined shortly after, plateauing at a higher level than before. 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”. In fact, an important part of the discussion that ensued the referendum 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 changes in identity preferences can affect consumer behavior.

3.2 Data

Understanding the nature and implications of identity is challenging since identity preferences are not directly observable and are usually endogenous to particular behaviors. 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 (Brewer and Gardner 1996; Aronczyk 2013). 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, near-universal economic decisions that can reveal preferences for identities that are associated with specific consumption bundles

¹²Note that the left figure represents 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.

(Pandya and Venkatesan 2016; Bertrand and Kamenica 2018; Atkin et al. 2019).

Consumption Data: To measure consumer responses to changes in the salience of identity we analyse weekly sales data for products labeled as being made 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. The consumer base of the retail chain covers 95% of all LSOAs in the UK, which are administrative units that aggregate approximately 1,500 people.

Our data span a period between March 2015 and March 2017. This covers the three months before David Cameron’s Conservative government came to power (May 2015), 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.

The universe of transactions during this period lists approximately 15 million shoppers, 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.¹³ The 15 million shoppers in the sample engage in a total of almost one billion shopping trips during our period of interest, the vast majority coming from the 12 million shoppers who have a loyalty card. For tractability, we draw a random sample of one million shoppers who engage in over 56 million shopping trips, which we then use in our analysis going forward.

Table 1 shows the descriptive statistics for our sample. Panel A reports descriptive statistics of shopping trips in the full sample while panel B reports shopping trip information across loyalty card and non-loyalty card shoppers. Panel C reports shopping statistics at the shopper/week level for a random sample of one million shoppers. 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 (e.g.: made in the UK).¹⁴

¹³Transaction activity of consumers with and without a loyalty card is qualitatively similar as shown in Table 1.

¹⁴When 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. 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.

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.¹⁵ 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.

Census Data: To examine whether the socioeconomic features of shoppers’ environments 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 each store’s location.¹⁶ We focus on the UK’s deprivation index¹⁷ and an indicator for whether the locality is rural or urban.

Consumer Surveys: We conduct an online survey of a sample of 1,085 primary grocery shoppers in different grocery chains in the UK, two years after the Brexit referendum. 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 following 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.¹⁸ 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 on content words related to Brexit following [Lopez 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,

¹⁵Note 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.

¹⁶Administrative units in the UK vary between output areas (OA) and Lower Layer Super Output Areas (LSOA), which are built from groups of contiguous OAs. OAs are the smallest census areas in the UK census and were built from clusters of adjacent unit postcodes, and designed to have similar population sizes and be as socially homogeneous as possible based on tenure of household and dwelling types. 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.

¹⁷The deprivation index is a composite measure of relative deprivation across LSOAs in the UK, covering seven domains: income, employment, education, health, crime, barriers to housing, and living environment.

¹⁸To avoid the problem of bot activity on twitter we remove from our sample all tweets that are repeated in consecutive seconds with the same content.

Table 1: **Descriptive Statistics**

Panel A: Shopping trips (N=831,995,817)				
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	Panel B: Split by loyalty card		With Card		Without Card	
			(N=775,494,094)		(N=56,501,723)	
	Mean	Std. dev.	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		

Panel C: Weekly shopping, 1 million shopper sample (N=56,947,974 T=108)				
Variable	Mean	Std. dev.	Mean	Std. dev.
Number shopping weeks	56.9	28.2	8.0	108.0
Total expenditure (weekly)	50.9	33.9	1.1	1995.9
Share UK products	67.9	8.5	0.0	100.0
Share EU products	19.9	6.8	0.0	100.0
Share National products	20.5	6.8	0.0	100.0
Deprivation Index [0-100] (LSOA)	60.65	26.77	1	100
Rural Dummy [0/1] (LSOA)	0.18	0.39	0	1
Share Immigrants (LSOA)	0.118	0.125	0.008	0.692

Source: Transaction Data. Notes: *Share National products* represents the share of UK products that display a union jack flag on the front package or have “British/UK/Welsh/Scottish/English” in the product name. The *DeprivationIndex* is a composite index of relative socioeconomic deprivation across the UK, which includes measures of income, employment, education, health, crime, barriers to housing, and living environment. *Rural Dummy* represents a binary indicator equalling 1 if the LSOA is defined as being rural by the UK census and 0 otherwise.

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 a training set of tweets that contained at least two key hashtags about Brexit and we used the TD-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 toward Brexit and to identify political, economic or social (immigration) arguments, again following Lopez

et al. (2017). This categorization is important to help us better understand the mechanisms through which social media content can shape identity and consumer behavior. Table 2 describes the sample of twitter data used in the analysis and their classification.

Table 2: **Descriptive Statistics: Twitter Data**

COUNTY/WEEK, N=7,547				
	Mean	Std. Dev.	Min	Max
Total tweets per week per county	1,495.7	8,924.2	1.0	375,025
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 Lopez et al. (2017). We train a SVM model with an RBF kernel to identify positive/negative sentiment toward Brexit and to identify political, economic or social (immigration) arguments.

Newspaper Data: To identify information shocks that are even less likely to be co-determined with shopping behavior, we extracted all articles and headlines on Brexit from six representative newspapers in the UK during our window of analysis (March 2015-March 2017). This sample was driven by availability and access to digital archives and includes a mix of newspapers with different stances on the Brexit referendum, but also with different rural vs urban audiences: the Daily Mail, the Evening Standard, the Express, The Guardian, The Independent, and The Times. We obtain the headlines and the first paragraph of each article to identify Brexit-related news.¹⁹ We conduct sentiment analysis of article and headline content using a standard polarity score from natural language processing methods. This score ranges from -1 to 1, depending on whether the article uses negative, neutral or positive language on a topic (Pang et al. 2002; Mullen and Collier 2004). Table 3 describes the newspaper data used in the analysis.

Table 3: **Descriptive Statistics: Newspapers**

Variable	Mean	Std. Dev.	Min	Max
Mean Daily Number of Headlines or Articles on Brexit	40.72	30.46	2	203
Mean Daily Polarity Score of Headlines or Articles	0.32	0.04	0.15	0.51

Source: Newspapers. Articles are identified by having a headline or the first paragraph related to Brexit. We capture the overall sentiment of the wording through a polarity score that ranges from -1 (negative), through 0 (neutral) and 1 (positive).

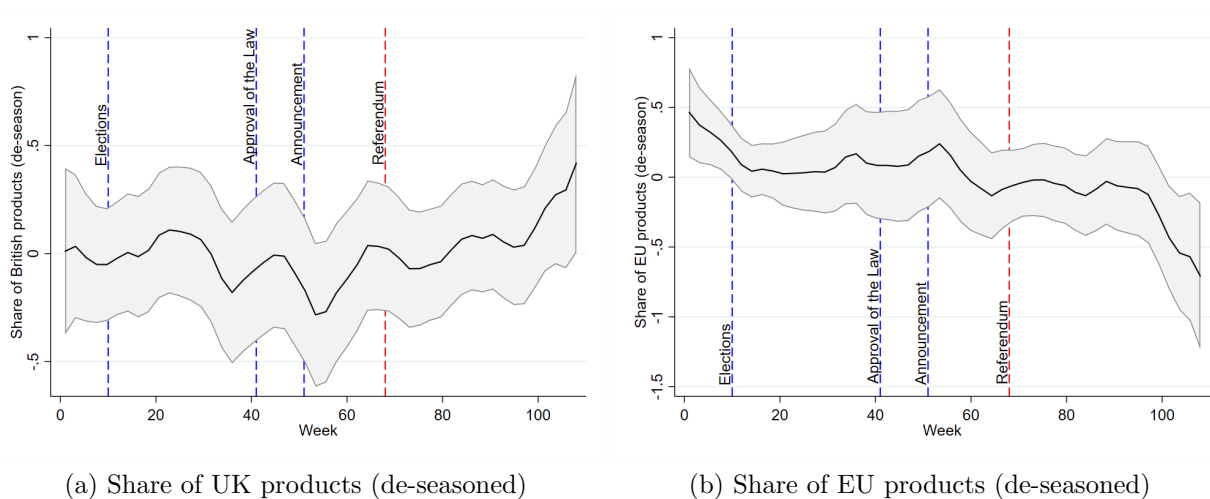
¹⁹Examples of keywords used to identify both headlines and text are “brexit”, “european union”, “eu”, “british”, “british identity”, “british passport”, “british culture”, “british heritage”, “british goods”, “british products”, “british manufacturing”, “made in britain”, “european identity”

4 Empirical Analysis

We begin by examining unconditional aggregate changes in market shares of both UK and EU labeled 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. When a product lists more than one origin country, we apply a simple weight to identify the share of the product that is UK or European. 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.

The two panels in Figure 2 show the share of expenditure on UK and EU products between March 2015 and March 2017 (de-seasoned with monthly dummies) in our shoppers' consumption baskets.

Figure 2: Share of UK and EU products over time



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: UK vs EU products

We conduct an event study to examine the impact of the Brexit referendum on consumer behavior. For each store-week in our sample between March 2016 and March 2017, we model the change in the weekly expenditure shares of UK and EU products for each shopper, 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:

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

where $Share_{isct}^k$ corresponds to the share of $k = UK, EU$ products in the shopper’s 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 .²⁰ The $Post Ref_t$ indicator equals 1 starting from the week after the referendum and 0 otherwise. We control for total weekly $Expenditure_{ist}$ 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 ϕ_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 goods within each product category

²⁰We consider posted prices throughout our analysis.

(e.g. within types of milk; types of biscuits; types of wine; etc).²¹ The fixed effects ensure that we are exploiting within shopper variation, in the same store, in the same time period and within similar categories of products.²² Standard errors are clustered at the shopper level.

Table 4: **Event Study: Changes in Shopping Behavior**

Dependent variable:	Share UK		Share EU	
	(1)	(2)	(3)	(4)
Post Ref	0.225*** (0.008)	0.223*** (0.007)	-0.293*** (0.007)	-0.277*** (0.006)
Log(Price UK)	-8.156*** (0.123)	-7.591*** (0.109)	7.687*** (0.103)	7.594*** (0.095)
Log(Price EU)	8.326*** (0.084)	8.120*** (0.080)	-7.483*** (0.071)	-7.216*** (0.068)
Weekly expenditure	-14.649*** (0.242)	-13.560*** (0.335)	8.882*** (0.162)	9.125*** (0.231)
Shopper FEs	NO	YES	NO	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R ²	0.072	0.115	0.142	0.175
Observations	217,713,424	217,712,029	217,713,424	217,712,029

Source: Transaction Data. Notes: *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds.

Table 4 reveals that UK labeled products gained a market share of 0.223 percentage points, representing a 0.3% overall increase in the share of UK products purchased. Following the referendum, EU products experienced a 1.4% decrease in market share relative to their mean share prior to the referendum.²³ 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 nine months that followed the Brexit referendum.²⁴

²¹We 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. The results are very similar when we do not include product category fixed effects.

²²The results are unchanged when we include store x week and store x product category fixed effects as shown in Tables 16 and 17 in the Appendix.

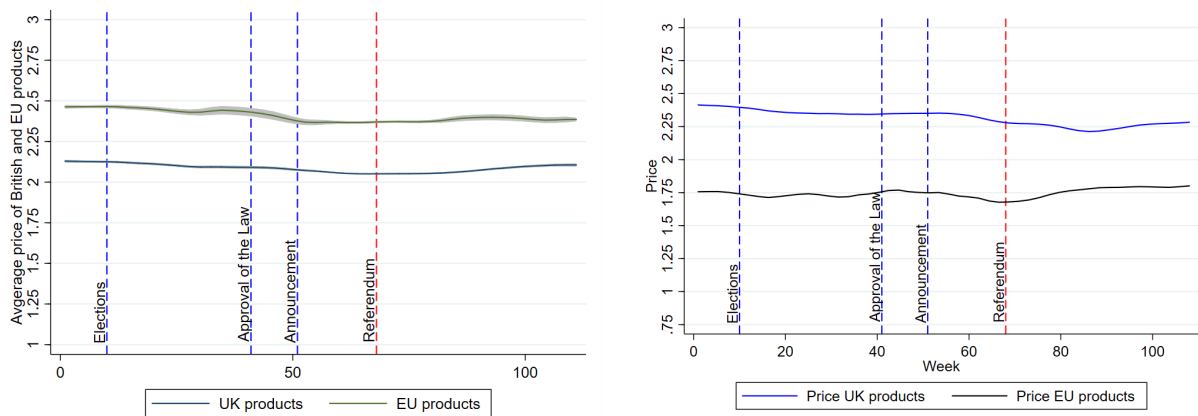
²³Figure 2 suggests that the campaign period and the associated polling already provided signals of the level of support for a British vs European identity. When we use the announcement of the date of the referendum as the start of our treatment, we can already detect changes to consumer behavior, albeit much smaller in magnitude.

²⁴Note that this is likely to be a 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 were to consider the universe of shoppers in the UK.

4.1.1 Heterogeneity: 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 due to the political and economic uncertainty that ensued the Brexit referendum, the fact that the retailer we worked with used at least a 6 month lag between pricing decisions and the fact that most contracts with international suppliers were in pounds.²⁵ Figure 3 (left panel) confirms that average prices for UK and EU products were stable during our period of analysis.²⁶ In Figure 3 (right panel) we zoom into the product categories with the top 20% of treatment effect and find that for these, prices of EU and UK products are also stable across time.²⁷ At the same time, we confirm in the raw data that 95% of products reported to be on shelf in March 2015 were still on shelf in March 2017. The 5% of 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 3: Average prices of UK and EU products over time



Left panel reports the average prices of UK and EU products between March 2015 and March 2017 (residualized from monthly dummies and product category fixed effects). Right panel reports average prices for product categories in the top 20% of treatment effects (residualized from monthly dummies and product category fixed effects).

While the retailer adopted a national pricing and promotional strategy, it is still possible that

²⁵Retailers' contracts with suppliers also constrained immediate changes to products' shelf space allocation or product packaging.

²⁶The slight price movement that is picked up in a thicker confidence interval around weeks 47 and 99 represents the period in the run-up for Christmas in 2015 and 2016.

²⁷Figures 8 and 9 in the Appendix show that price dispersion within product category was also constant for both sets of products during our period of analysis, with no changes occurring around the Brexit referendum. This suggests that limited compositional changes in pricing occurred within product categories.

there is some residual price variation at the store level, which could be driven by the timing of promotional endpoints. This could happen if for instance one store, depending on inventory, decided to keep a promotion running for an extra week. To account for this possibility, we identify supply-side and aggregate demand-side factors that are plausibly exogenous and can serve as shifters of local prices namely competition from other top retailers in the locality, demand shocks in UK or EU product categories taking place in nearby stores that can influence stock availability, and demand shocks interacted with each store’s distance to the nearest distribution center. Our results are similar when we use these instruments. These robustness checks are discussed in Section 7.4.

Given this evidence on short and medium-run price rigidity, we further examine how demand for “identity” products is mediated by prices. First, Table 5 shows that the observed shift toward UK products post referendum is driven mostly by a decrease in price sensitivity toward UK products and an increase in price sensitivity toward European products.

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

Dependent variable:	Share UK		Share EU	
	(1)	(2)	(3)	(4)
Post Ref	0.238*** (0.022)	0.222*** (0.021)	-0.351*** (0.020)	-0.318*** (0.019)
Log(Price UK)	-9.468*** (0.128)	-9.019*** (0.114)	8.186*** (0.107)	8.144*** (0.099)
Log(Price EU)	8.937*** (0.085)	8.659*** (0.080)	-7.747*** (0.071)	-7.448*** (0.068)
Log(Price UK) × Post Ref	2.299*** (0.042)	2.233*** (0.041)	-0.884*** (0.036)	-0.869*** (0.036)
Log(Price EU) × Post Ref	-2.252*** (0.031)	-2.171*** (0.031)	0.938*** (0.026)	0.900*** (0.025)
Weekly expenditure	-14.591*** (0.241)	-13.527*** (0.335)	8.861*** (0.162)	9.113*** (0.231)
Shopper FEs	NO	YES	NO	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R ²	0.073	0.115	0.142	0.175
Observations	217,713,424	217,712,029	217,713,424	217,712,029

Source: Transaction Data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

Second, we find that the most substantial shifts occurred in the cheapest product categories as shown in Table 6.²⁸ Column (5) also shows that as the share of UK products in a given product

²⁸The classification of cheap and expensive is based on the average price per category relative to the median price

category increases, shoppers are more likely to move toward UK products. Conversely, column (6) confirms that the higher the share of EU products in the category, the less likely shoppers are to substitute away from them toward UK products.

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

Dependent variable:	Share UK		Share EU		Share UK	Share EU
	Cheap (1)	Expensive (2)	Cheap (3)	Expensive (4)	(5)	(6)
Post Ref	0.414*** (0.010)	0.047*** (0.010)	-0.401*** (0.009)	-0.178*** (0.008)	-0.655*** (0.050)	-0.781*** (0.015)
Log(Price UK)	-6.144*** (0.169)	-9.614*** (0.137)	6.523*** (0.161)	8.671*** (0.110)	-7.647*** (0.110)	7.910*** (0.096)
Log(Price EU)	8.493*** (0.132)	7.492*** (0.092)	-8.219*** (0.126)	-6.298*** (0.073)	8.104*** (0.080)	-7.229*** (0.068)
Weekly expenditure	-10.385*** (0.210)	-16.086*** (0.487)	7.787*** (0.164)	10.329*** (0.319)	-13.559*** (0.335)	9.119*** (0.231)
Post Ref \times Share of UK					1.301*** (0.072)	
Post Ref \times Share of EU						1.957*** (0.063)
Household FEs	YES	YES	YES	YES	YES	YES
Week FEs	YES	YES	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES	YES	YES
R ²	0.137	0.141	0.203	0.191	0.115	0.175
Observations	108,480,773	109,224,324	108,480,773	109,224,324	217,712,029	217,712,029

Source: Transaction Data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Share of UK* represents the share of UK products on shelf in each product category and *Share of EU* represents the share of EU products in each product category prior to the referendum. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

5 The Value of Identity

We conduct a back of the envelope calculation of the value of identity in grocery shopping by calculating the change in prices that would have resulted in the same observed shift in consumption that we identified in Table 4. From here, we can have a plausible estimate of the associated welfare change following Hausman (1996). We use the estimated demand function for UK products to compute the change in average price that would be consistent with the observed change in quantities (due to the referendum) in our data. Then, we invert the demand function to compute the corresponding change in surplus.²⁹ For tractability, we assume that the price elasticity remained across categories.

²⁹Figure 10 in the Online Appendix depicts this inverse demand curve.

constant throughout the period of our analysis.³⁰

We estimate the value of identity to be equivalent to a price reduction of 4 pence for UK products, 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 27 pence per shopper-week, which aggregates to a yearly change in shopper surplus of approximately 168 million GBP for the entire sample. If we estimate the value of identity using the estimates in Section 7.4, where we account for the possibility of endogenous pricing, then the figures more than double, with the effect of identity on the consumption of UK products being equivalent to a price reduction of 9 pence and a corresponding change in consumer surplus of 82 pence per shopper-week and a 512 million GBP yearly change in aggregate consumer surplus.

The most recent increase in VAT rates in the UK provides a useful benchmark to help gauge the magnitude of the value of identity in grocery shopping. In 2011, the UK’s average VAT rate increased by 2.5% of average prices, which is comparable to the 1.9-3.8% price movement that would have led to the shift in quantities that we observe for UK products after the referendum. These findings suggest that while changes at the individual level might be (plausibly) small, changes in the aggregate are large and economically meaningful.

6 Mechanisms

This section examines the mechanisms driving the observed link between identity and consumer behavior. First, we confirm that our findings are driven by the salience of identity by exploiting heterogeneity across products with different levels of association with national identity. Second, we explore the role played by locality characteristics in shaping collective behaviors and creating incentives for social signalling. Third, we follow the literature on identity to examine whether the observed shifts in consumption result from a desire to conform to prototypical baskets of consumption, by examining changes in taste within and across product categories, with shoppers moving toward products that are widely recognized as being “quintessentially” British. Fourth, we conduct online consumer surveys to confirm whether changes in consumption are driven by a desire to socially signal national identity and/or a desire to conform to perceived norms associating British

³⁰Considering the *ex post* elasticity would result in a slightly lower estimate of changes in consumer surplus.

identity with shopping for UK products. Finally, we turn to the role of the media as a shifter of the salience of identity on a day-to-day basis, and how this can affect consumption patterns.

6.1 Difference-in-Differences: Salience of Identity

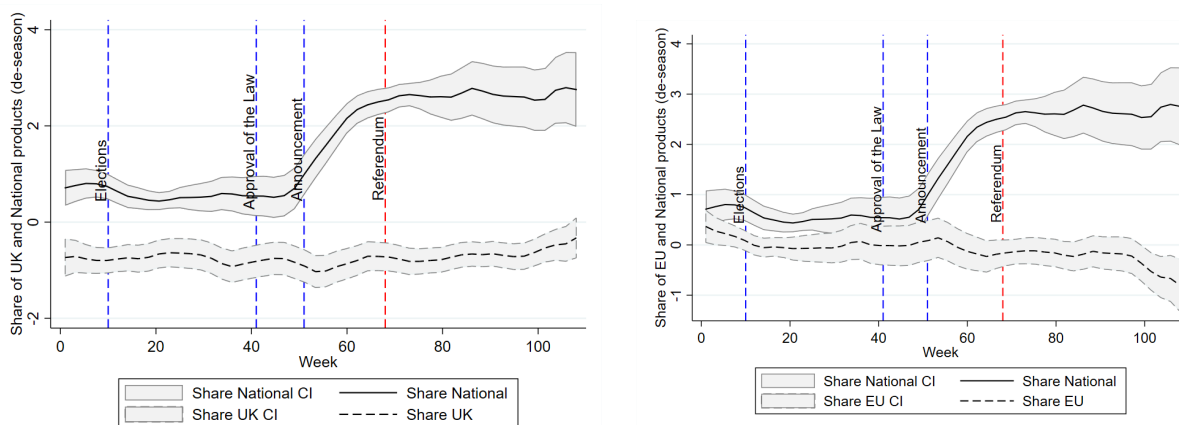
To confirm that changes in consumption are driven by the salience of identity, we exploit variation across products that differ in their association to national identity. If identity preferences are driving changes in consumption, we should observe that products that are more easily associated with national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

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”.

We focus on products with either a flag or the British name that are not affected by seasonality, but still represent 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.

The two panels of Figure 4 show the trends in purchases of products with the union jack flag or a British identifier, – national products –, against UK products (left panel) and against EU products (right panel), before and after the Brexit referendum.

Figure 4: Share of expenditure on national products against UK and EU products



Left panel reports share of expenditure on national products against UK products. Right panel reports the share of expenditure on national products against EU products.

Figure 4 reassuringly suggests 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 is then:

$$\begin{aligned} \Delta Share_{isct}^{Nat-k} = & \beta^{Nat} \ln(price_{sct}^{Nat}) + \beta^k \ln(price_{sct}^k) + \gamma Post Ref_t + \\ & + \beta Expend_{ist} + Week_t + \eta_i + \phi_c + \varepsilon_{isct} \end{aligned} \quad (2)$$

where $\Delta Share_{isct}^{Nat-k}$ corresponds to the difference in the market share of products with the UK flag or name saliently displayed relative to the share of $k = UK, EU$ products sold in stores. As before, *Post Ref* is an indicator that equals 1 for the period following the Brexit referendum (our difference-in-differences estimator). We further include average prices (of national, UK and EU products) at the level of the category and store; a control for total shopper weekly expenditure; week fixed effects; as well as individual shopper and product category fixed effects. We first examine the changes in consumption of national products with respect to the rest of UK products, and then the impact of the referendum on shifts in market share between national and EU products.

Table 7: **Difference-in-Differences Estimates: National vs UK and EU products**

Dependent variable:	Share National - UK		Share National - EU	
	(1)	(2)	(3)	(4)
Post Ref	1.472*** (0.031)	1.185*** (0.028)	2.684*** (0.033)	2.651*** (0.030)
Log(Price National)	-3.071*** (0.138)	-1.748*** (0.121)	-4.148*** (0.135)	-3.289*** (0.131)
Log(Price UK)	8.280*** (0.461)	2.927*** (0.407)		
Log(Price EU)			8.338*** (0.406)	12.075*** (0.330)
Weekly expenditure	21.447*** (0.383)	16.855*** (0.388)	-4.602*** (0.414)	-3.214*** (0.232)
Shopper FEs	NO	YES	NO	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R ²	0.066	0.217	0.031	0.214
Observations	33,219,109	33,183,012	33,216,766	33,180,651

Source: Transaction Data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price National)*, *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of national EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 7 shows that the union jack flag or the British name significantly increased 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 1.185 percentage points, which represents a 6% increase. EU products decrease their market share by 13% compared to products that are clearly identified as being British. These findings are consistent with our interpretation that the identity attribute of these products became more salient in the post-referendum period and that this had a significant impact on patterns of grocery shopping.

6.2 Conformity to Prototypical Consumption

Our results suggest that following the Brexit referendum, consumers revealed an in-group bias in shopping behavior, switching from EU to UK made products. In this section we examine the possibility that the shift in consumption patterns also represents a shift in taste, as shoppers might have sought out prototypical consumption baskets that they associated with British identity.

To explore this possibility, we identify “quintessential” British products by obtaining the list of products that are typically sold to UK citizens living abroad, and crossing it with the list of products made in the UK that are sold in the stores in our sample.³¹ We then re-run equation 2 but replacing national products with “quintessential” UK products. Table 8 shows the main results: while significant, the coefficient is close to zero suggesting that most of the observed shift in the consumption of UK goods is more likely to be driven by in-group bias than by a move toward prototypical consumption baskets.

6.3 Locality Characteristics

A common narrative in the US and in Europe is that areas that face economic hardship or increased immigration might experience heightened awareness and support for nationalistic rhetoric and behaviors. The redeeming value of national identity might be more acute when individuals feel connected through a common grievance. It is therefore possible that poor economic conditions are fertile ground for nationalistic group identities to rise to the fore. These areas may also place more value on socially signaling to others their attachment to national identity. Alternatively, shoppers’ preferences may not be affected by the socioeconomic features of their environment, particularly if

³¹The list of websites used include www.britishcornershop.co.uk; www.britishessentials.com; www.boxfromuk.co.uk; www.britsuperstore.co.uk; www.britishfooddepot.co.uk; and www.ukgoods.co.uk

Table 8: **Difference-in-Differences Estimates: Quintessential vs UK**

Dependent variable:	Quintessential-UK
Post Ref	-0.001*** (0.000)
Log(Price UK)	0.018*** (0.001)
Log(Price Quintessential)	-0.000*** (0.000)
Weekly expenditure	-0.002*** (0.000)
Shopper FEs	YES
Week FEs	YES
Product category FEs	YES
R ²	0.392
Observations	121,281,295

Source: Transaction Data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price UK)* and *Log(Price Quintessential)* correspond to the average category prices of UK and Quintessential products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

they lack explicit prescriptive norms and a clear mechanism to signal group belonging. In this case, the attachment to national identity could be 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 in 2015.³² Given that the vote in the Brexit referendum might have emphasized rural vs urban cleavages, we also include an indicator for whether the LSOA is rural. Finally, we included a measure of immigration at the locality level (the LSOA, with an average population of 1,500) and at a wider administrative level as well (the MSOA, with an average population of 7,800). Table 9 reveals that shopping patterns did not vary substantially with any of these locality characteristics.

Relatively less deprived and more rural areas were marginally more likely to switch to UK products following the referendum, but these effects are quantitatively very small and therefore unlikely to fully explain our findings.

³²The 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. The deprivation index is an ordinal measure that ranks the 32,844 small areas in England assigning them to the respective centile, from the most deprived to the least deprived. See <https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015>.

Table 9: Consumption Patterns and Locality Characteristics

Dependent variable:	Share UK			Share EU		
	(1)	(2)	(3)	(4)	(5)	(6)
Post Ref	0.268*** (0.016)	0.266*** (0.017)	0.285*** (0.020)	-0.320*** (0.014)	-0.317*** (0.014)	-0.356*** (0.018)
Log(Price UK)	-7.602*** (0.109)	-7.602*** (0.109)	-7.602*** (0.109)	7.603*** (0.095)	7.604*** (0.095)	7.603*** (0.095)
Log(Price EU)	8.123*** (0.080)	8.122*** (0.080)	8.122*** (0.080)	-7.215*** (0.068)	-7.215*** (0.068)	-7.215*** (0.068)
Weekly expenditure	-13.561*** (0.335)	-13.561*** (0.335)	-13.561*** (0.335)	9.126*** (0.231)	9.126*** (0.231)	9.126*** (0.231)
Post Ref \times deprivation	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Post Ref \times rural		0.029* (0.016)	0.021 (0.017)		-0.027* (0.014)	-0.013 (0.015)
Post Ref \times LSOA immigration rate			0.180 (0.177)			-0.048 (0.154)
Post Ref \times MSOA immigration rate			-0.279 (0.179)			0.241 (0.155)
Household FEs	YES	YES	YES	YES	YES	YES
Week FEs	YES	YES	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES	YES	YES
R ²	0.115	0.115	0.115	0.175	0.175	0.175
Observations	217,711,820	217,711,820	217,711,062	217,711,820	217,711,820	217,711,062

Source: Census and Transaction data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *Post Ref deprivation* interacts the *Post Ref* indicator with an index of relative deprivation [0-100]; *Post Ref Rural* interacts the *Post Ref* indicator with an indicator of whether the LSOA was rural. *Post Ref immigrationshareLSOA* interacts the *Post Ref* indicator with the share of immigrants in the LSOA. *Post Ref immigrationshareMSOA* interacts the *Post Ref* indicator with the share of immigrants in the MSOA. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

6.4 Social signaling: evidence from consumer surveys

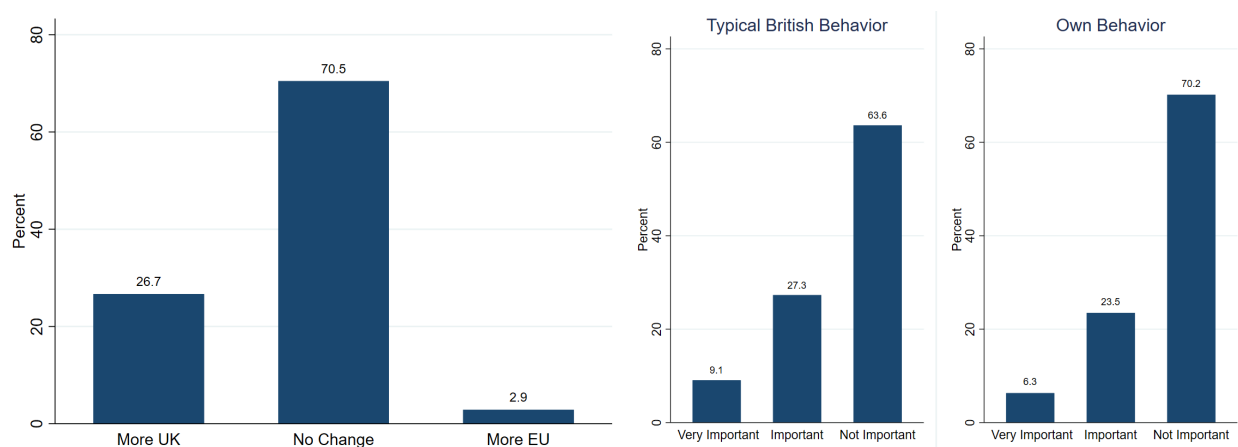
As discussed in section 2, consumers may respond to an increase in the salience of identity because they attach value, privately or socially, to conforming to social norms associated with the group they identify with. To shed more light on this point, we conducted an online survey of 1,085 primary grocery shoppers in the UK and obtained information on perceptions of social norms associated with British identity and grocery shopping. This survey was conducted two years after the Brexit referendum, a period marked by intense divergence between the EU and the UK with regards to an exit deal, which may have heightened even more the salience of UK identity relative to our period of analysis of the transaction data. The sample of respondents is similar to the sample of consumers we observe in the transaction data in terms of age, gender and average weekly expenditure.³³ Since only 14% of the online sample shop with our retailer, our survey results allow us to speculate on

³³Our online sample is slightly younger with an average age of 48.3 against 50 in the store sample but with a similar distribution.

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 toward 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.

Figure 5: **Changes in shopping behavior and Perceptions of Typical British Behavior**



Left panel reports share of consumers reporting a change in shopping behavior. Right panel reports the share of consumers reporting on the importance of purchasing UK products for the typical British consumer vs for themselves.

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 both for the typical British consumer, and for themselves, following the Brexit referendum.

The right panel of Figure 5 reveals that only about one third of respondents associate shopping for UK products as being a typical British behavior. Over 70% of respondents report that they conforming to the perceived typical British behavior when grocery shopping was not important to them. Moreover, over 96% of respondents reported feeling no pressure to shop for UK products following the referendum and the remaining 4% reported feeling only slight pressure to do so, usually out of a desire to support the local economy. These findings are very similar across shoppers shopping at different retailers.³⁴

³⁴Table 18 in the Appendix shows the p-values for tests of equality of proportions (chi-square) and of equality of distributions for behaviors 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. Figure 11 in the Appendix also shows perceptions of consumers who reported shopping at our retailer alone.

This evidence confirms that grocery shopping in the UK is a setting that lacks focal, prescriptive social norms associated with British identity and that grocery products have limited social signaling value in our context.

6.5 Media and Attention

Given the limited evidence on the role of social conformity, social signaling, or socioeconomic environment in driving changes in consumption behavior, we now examine an alternative hypothesis: identity preferences can be latent and political events and the media can help place them top of mind, thus affecting day-to-day economic behavior.

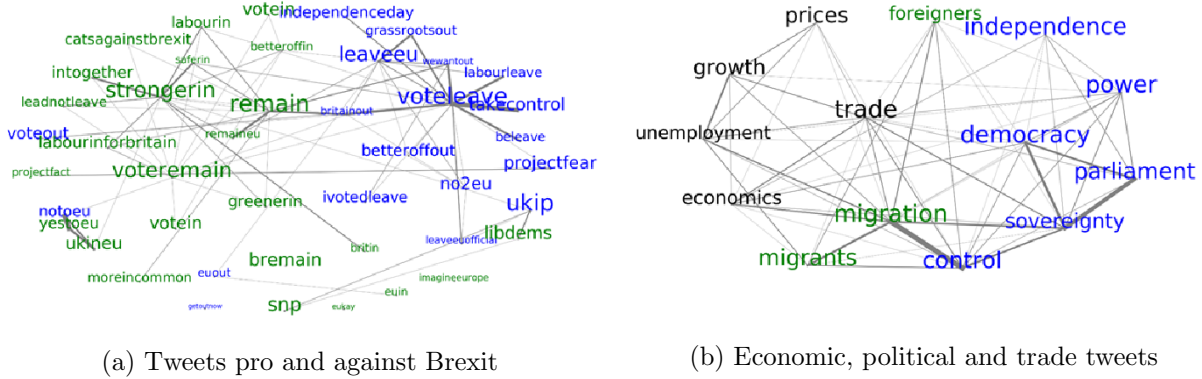
6.5.1 Evidence from Twitter and Newspapers

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 geo-located tweets published by twitter in the UK during the period between March 2015 and March 2017, totalling 11.3 million tweets. We then conduct slant/sentiment analysis to identify tweets that are pro or against Brexit using a supervised vector machine classification method. We use the radial basis function kernel (RBF kernel) as a learning algorithm applied to a training sample comprising of 21,704 tweets about Brexit in our dataset, identified by having at least two key hashtags suggested by [Lopez et al. \(2017\)](#). To do this we combine metric multidimensional scaling of co-occurrence and manual tweet inspection.³⁵ 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 ([Lopez et al. 2017](#)). The two panels of Figure 6 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 identify twitter storms as the days belonging to the top 20% of twitter activity about Brexit at the national level. For these events, we compute the share of UK and EU products purchased by the shoppers in our sample, on the day before (control) and on the day in which each twitter

³⁵The resulting matched dataset is very similar when we use a linear classification as opposed to an RBF kernel.

Figure 6: **Classification of Tweets**



Left panel reports the 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. The right panel reports the classification of tweets into economic (black), political (blue) or social (migration in green) issues.

storm took place (treated).³⁶ In case of a storm that lasts more than 1 day, we use the first day of the storm and exclude from the analysis the following days. We also exclude from the sample the month of the referendum and the one following it (June and July 2016) because of the high intensity of political discussion that took place during this period. Their inclusion would make all candidate days fall in these two months. Using this method, we identify 36 twitter storms during our period of interest between March 2015 and March 2017. The underlying assumption is that the timing of news about Brexit was not driven by shoppers’ decisions of when to shop at the local level.

We then estimate the following model:

$$Share_{isct}^k = \delta Treated_{isct} + \beta X_t + \eta_s \times Event_t + \phi_c + \varepsilon_{isct} \quad (3)$$

where $Share_{stic}$ corresponds to the share of $k = UK, EU$ products sold in store s , during storm event t , for product category c and shopper i . The $Treated_{stic}$ indicator equals 1 for each day of a twitter storm (event) and 0 for the day prior to the event. We include store-event and product category fixed effects.

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 county associated with each store - in logarithmic form.³⁷ Finally, we examine the relative impact of tweets that are

³⁶Our results are not sensitive to the choice of threshold to identify a twitter storm. Tables 19 and 20 in the Appendix show that results remain unchanged when we use a different intensity cut-off such as the top 10% of twitter storms during our period of analysis.

³⁷There are no zeros in this variable. Note that this analysis is now done at the county level as this is the level at

pro vs against Brexit to test whether shopping patterns are differentially affected by slant.

Table 10: **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	0.088*** (0.014)	-0.078*** (0.012)						
Log(Tweets)			0.161*** (0.023)	-0.158*** (0.020)				
Log(Tweets pro)					0.148*** (0.022)	-0.140*** (0.018)		
Log(Tweets against)							0.164*** (0.024)	-0.164*** (0.021)
Store × Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
Product Category FEs	YES	YES	YES	YES	YES	YES	YES	YES
R ²	0.088	0.151	0.088	0.151	0.088	0.151	0.088	0.151
Observations	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814

Source: Twitter and Transaction Data. *Treated* is an indicator that equals one for purchases occurring the day of 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)* is the number of tweets that were classified as being pro Brexit and *Log(Tweets against)* is the number of tweets that were classified as being against Brexit, both in logarithmic form. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 10 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 2.4% 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. In the Appendix, we show that these results are not driven by how we identify twitter storms: results are very similar, and in fact, even larger in magnitude, when we consider different cut-offs of twitter activity (e.g. 10%) and when we identify storms driven by the activity of “influencers”.³⁸

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

which tweets are geo-located in the data.

³⁸Table 19 of the Appendix, shows that these results are very similar when we use the top 10% of twitter activity at the national level, thus using a more conservative definition of twitter storms. Table 21 also shows that the results are similar when we use an alternative strategy to identify twitter storms based on tweets by “influencers”. We identify “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. Finally, we conduct a further placebo test and show in Table 22 in the Appendix that the bottom 2 deciles of days with the lowest twitter activity have no impact on consumption of UK vs EU products.

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 11: **Twitter Storms and Consumer Behavior**

Dependent variable:	Share UK	Share EU	Share UK	Share EU	Share UK	Share EU	Share UK
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log(Tweets immigration)	0.128*** (0.022)	-0.128*** (0.019)					
Log(Tweets politics)			0.199*** (0.020)	-0.185*** (0.017)			
Log(Tweets economics)					0.127*** (0.023)	-0.141*** (0.020)	
Storm							0.018 (0.025)
Identity storm							0.209*** (0.027)
Store \times Event FEs	YES	YES	YES	YES	YES	YES	YES
Product Category FEs	YES	YES	YES	YES	YES	YES	YES
R ²	0.088	0.151	0.088	0.151	0.088	0.151	0.071
Observations	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814	23,334,814

Source: Twitter and Transaction Data. *Log(Tweets immigration)* is the number of tweets classified as being about immigration during the twitter storms in logarithmic form. *Log(Tweets politics)* is the number of tweets classified as being about politics during the twitter storms and *Log(Tweets economics)* is the number of tweets classified as being about economics during the twitter storms, both in logarithmic form. *Storm* is an indicator that equals one for purchases occurring the day of a twitter storm and if the tweet storm is not classified as an identity storm. *Identity Storm* is an indicator that equals one for purchases occurring the day of a twitter storm if the tweet storm is classified as an identity storm. All specification include store times event and product fixed effects. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

Table 11 shows that discussions 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 larger in magnitude and statistically different from the coefficients for economic or social tweets.³⁹ This lends further support to the importance of national political identity in driving the observed changes in day to day economic decisions.⁴⁰

Table 11 provides a further test of the role of identity: we split the twitter storms into two categories depending on whether they have a strong identity connotation. To do so, we follow the methods used in social psychology to identify tweets that reflect group identity based on the frequency of first person plural pronouns such as “us”, “we”, “our” and the use of expressions that refer to British people as a group (Brewer and Gardner 1996; Pennebaker et al. 2003 and Sylwester and Purver 2015). This literature argues that exposure to first-person plural pronouns

³⁹When we consider different definitions of twitter storms this effect jumps to a 5% increase in the consumption of UK products for every 10% increase in tweets about the politics of Brexit.

⁴⁰In Table 20 of the Appendix we show that the differential impact of tweets about politics relative to economic and social issues is even larger when we consider a narrower definition of twitter storms to include the top 10% of twitter activity days only.

leads individuals to adopt a collectivist self-view. As shown in column (7), the effect estimated in column (1) of Table 10 is driven mostly by the storms with an identity connotation.

We interpret twitter activity, and in particular twitter storms, as a proxy for more intense general media discussions around Brexit, as twitter users will often tweet about news in the traditional media.⁴¹ To allay concerns about the representativeness of the twitter data, we also map the timing of mainstream newspaper headlines and articles about Brexit onto the timing of shifts in consumption behavior. To do so, we obtain the headlines and first paragraphs of all articles published about Brexit between March 2015 and March 2017 in six of the main newspapers in the UK with an online archive. This sample is balanced on newspapers that assumed different sides in the Brexit debate.

Table 12 shows that days with a higher number of articles about Brexit are days with higher consumption of UK products. A 10% increase in the number of articles and headlines about Brexit, increases consumption of UK goods by approximately 7%. We also conduct sentiment analysis of article and headline content using a standard polarity score from natural language processing methods (Pang et al. 2002; Mullen and Collier 2004) and find that days in which articles used more positive language about Brexit were days with higher movements in consumption toward UK goods. We interpret this as suggestive evidence of the importance of how national identity is framed in the media in shaping identity preferences, and then how these preferences can affect consumption behavior.

Taken together, our findings suggest that individuals may derive utility from privately consuming identity products, that identity preferences are latent and malleable and that they can have a significant impact on the composition of grocery shopping baskets when political events and the media keep this product attribute top of mind.

⁴¹Note that to avoid picking up bot activity we eliminate all tweets that are repeated in consecutive seconds with the same content. We also verify that twitter activity is strongly correlated with other social media activity usage at the local level such as Facebook as shown in Figure 13 in the Appendix.

Table 12: Newspaper Storms and Consumer Behavior

Dependent variable:	Share UK	Share EU	Share UK	Share EU
	(1)	(2)	(3)	(4)
Treated	0.218*** (0.015)	-0.183*** (0.012)		
Log(Articles and Headlines)			0.456*** (0.027)	-0.638*** (0.024)
Polarity Score			0.259*** (0.104)	-0.460*** (0.092)
Store \times Event FEs	YES	YES	YES	YES
Category FEs	YES	YES	YES	YES
R ²	0.089	0.159	0.031	0.023
Observations	25,841,885	25,841,885	25,841,885	25,841,885

Source: Newspaper and Transaction Data. *Treated* is an indicator that equals 1 in the day of a newspaper storm and 0 for the day before each storm. *Polarity Score* is a measure of positive language in text analysis, ranging from [-1, 1], from negative to positive. Store times event fixed effects and product category fixed effects are included. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

7 Alternative Explanations

7.1 Attention vs Identity

The previous section showed that the media can play an important role in keeping identity top of mind, which can then affect 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 consumers may simply think about British products when they enter the store and shop accordingly, without necessarily holding strong identity-based preferences. To shed some light on this issue, we examine whether shocks to the salience of identity that vary in intensity affect consumption patterns differently.

We focus on the Euro 2016 football championship and identify the days in which the England team won against a European team during the championship or during the qualifiers. While the EU championship is also likely to have made British identity salient (Campante et al. 2020), it is less likely to have exerted a profound and long-lasting shift in identity preferences when compared to a more impactful event such as the Brexit referendum. We then implement a sharp event study around each of the 15 football events and observe shopping behavior for UK and EU products before and after each event. For this exercise, we consider the week before a game is set to take place as the control period and the two days after the game took place as the relevant treatment

period, given that the anticipation of the game may have altered consumption patterns the week before the game took place (e.g. stockpiling on beer or snacks). The results are however very similar if we consider instead the day before the game as the control period and the day of the game as the treatment period, which is consistent with the approach we adopt in section 6.5.1 (see Table 23 in the Appendix).

Table 13 reveals that England’s wins had a small effect on the share of UK products purchased (a 0.06% increase) and a comparably small decrease in the share of EU products purchased (0.5%). Consumption shifts are significantly larger (by a factor of 5) when attention is placed on the national identity discussions around Brexit than on the national identity sentiment associated with a football match win, despite comparable news coverage during the day of each event. 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 13: **England’s wins in Euro 2016 and Consumer Behavior**

Dependent variable:	Share UK	Share EU
	(1)	(2)
Treated	0.043* (0.024)	-0.103*** (0.020)
Store × Event FEs	YES	YES
Product Category FEs	YES	YES
R ²	0.008	0.007
Observations	4,098,654	4,098,654

Source: EURO 2016 and Transaction Data. *Treated* corresponds to shopping visits that occurred two days after the match, compared to the week prior to the match. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

This evidence, together with the findings in Table 11 showing the importance of media content on national identity, lend support to the fact that the observed changes in consumption are unlikely to be solely explained by attention.

7.2 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. This could be a form of “adaptation”,

i.e. an attempt to form new habits, or a form of obtaining information about UK products. Our evidence is, however, inconsistent with these hypotheses. First, concerns about supply shocks due to a no deal Brexit appeared much later in the public discourse, outside our window of analysis.⁴² This suggests that disruptions to trade flows and supply shocks only became a public concern significantly later, by the end of 2017, at least 7 months after the end of our window of analysis.⁴³ Second, as discussed in sections 3 and 4, over 95% of the 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.⁴⁴ Crucially, we observe that absolute and relative prices were stable for UK and EU products (see Figures 3, 9 and 8). We also control for total shopper’s weekly expenditure in all our specifications, which is likely to be a good proxy for expectations about future economic conditions. In fact, we find no evidence to support the hypothesis that shoppers reduced inflation-adjusted weekly expenditure on groceries, either due to expectations or due to the depreciation of the pound following the referendum. Weekly expenditures are relatively stable as shown in Figure 17 in the Appendix. Moreover, we find that consumers shift selectively across products as shown in section 4.1.1, with the largest substitutions occurring for more expensive products in the cheapest product categories.

Our findings in section 6.5 are also not consistent with the discovery and adaptation hypotheses. Consumers who were strategically shifting consumption away from EU products and trying to discover and adapt to UK products would not need to be reminded by the media, and in particular by political discussion in the media, to do so. The fact that they consume more UK products when exposed to political identity content in the media suggests that strategic adaptation is unlikely to be the main reason for changes in shopping behavior.

Finally, we also find no evidence in our consumer surveys of consumers being concerned about not being able to source EU products after the referendum. Two years after the referendum at the height of concerns about a no deal Brexit, no respondent identified concerns about disruptions to

⁴²Figure 15 in the Appendix shows the frequency of Google searches on the term “no deal Brexit”.

⁴³This is also consistent with recent work showing that the labor market effects of the Brexit vote were only felt in the first quarter of 2018 (Javorcik et al. 2020).

⁴⁴Moreover, the discourse at the time was one of striking deals with other countries outside of the EU, which would have meant an increased diversity of products from the rest of the world, outside of the UK and the EU. This could explain a drop in consumption of EU products but not necessarily an increase in UK products.

supply chains affecting their choice between UK and EU products.

7.3 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 product prices, packaging and availability on shelf. 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 approach to the month immediately after the referendum, when any changes to packaging would have been extremely unlikely to occur as the retailer was locked into multi-month contracts with suppliers and products were already on shelf or in stock. Changing packaging at scale is extremely challenging and costly 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.

Table 14: **Difference-in-Differences Estimates: Supply-Side**

Dependent variable:	National-Share UK		National-Share EU	
	(1)	(2)	(3)	(4)
Post Ref within 4 weeks	1.929*** (0.055)	1.666*** (0.051)	2.528*** (0.067)	2.885*** (0.062)
Post Ref after 4 weeks	1.339*** (0.032)	1.037*** (0.029)	2.704*** (0.035)	2.594*** (0.031)
Log(Price National)	-2.996*** (0.139)	-1.651*** (0.121)	-4.239*** (0.136)	-3.350*** (0.132)
Log(Price UK)	7.927*** (0.460)	2.488*** (0.406)		
Log(Price EU)			8.167*** (0.406)	11.886*** (0.330)
Weekly expenditure	21.443*** (0.383)	16.836*** (0.387)	-4.607*** (0.414)	-3.247*** (0.232)
Household FEs	NO	YES	NO	YES
Week FEs	YES	YES	YES	YES
Product category FEs	YES	YES	YES	YES
R ²	0.066	0.217	0.031	0.214
Observations	33,219,109	33,183,012	33,216,766	33,180,651

Source: Transaction Data. *Post Ref within 4 weeks* corresponds to an indicator variable that takes the value 1 in the first four weeks following the referendum and *Post Ref after 4 weeks* takes the value 1 for the period after the first four weeks that followed the Brexit referendum and the value 0 for each week prior to the referendum. *Log(Price National)*, *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of National (flagged), EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

The evidence in Table 14 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, and that it persists even after this period. 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 have become significantly smaller as our control group in the difference-in-differences model would have become “treated” with time.

7.4 Price Endogeneity

As shown in Figure 3, average prices were stable throughout our period of analysis. While the retailer adopted a strategy of national pricing and national promotions, some residual price variation at the store level could still occur, driven by the timing of promotional endpoints. Some stores may, on occasion, keep a promotion going for an extra week. Our main models (1) and (2) include shopper and product category fixed effects, which already control for all time-invariant characteristics such as those related to the type of store, its promotional policy and the choice set available to shoppers. Nevertheless, to allay concerns about any residual price endogeneity, in this section we show results when we instrument UK and EU average prices. The instruments we employ are related to supply-side or aggregate demand factors that are plausibly exogenous and can shift prices at the local level: i) competition from other top retailers at the locality level; ii) demand shocks to UK or EU product categories taking place in nearby stores that can influence product availability (and in turn pricing); and iii) demand shocks interacted with each store’s distance to the nearest distribution center.

We identify local competition through the local opening and closures of the 3 main retail competitors to our retailer, which occurred during our window of analysis.⁴⁵ Thus, for every store in our sample, we compute the number of competitors in each week, focussing on two distances from each store. First, the number of competitors within 1 km of each store (close competitors) since this variable can capture any further confounder related to the commercial attractiveness of the area where the store is located. Second, we consider the number of competitors within the greater radius of 5 km around each of our stores. We further break down these competitor stores into their

⁴⁵On the role of market concentration on prices, see (Weiss 1989; Bresnahan and Reiss 1991; Goolsbee and Syverson 2008) and the extensive literature on market concentration and pricing.

potential “identity”, based on the approximate share of UK products sold in each retail chain. This leads us to identify competitor chains that are comparable to our retailer (*Comparable*), and stores that carry a significantly larger share of UK products (*Higher UK*).⁴⁶

The second set of instruments are based on (lagged) demand shocks happening to our retailer’s stores that operate in the same geographical area of each given store. The rationale for these instruments is that an unforeseen surge in demand for a certain type of product can generate local stock outs, which in turn can push the nearby stores to refrain from price discounts. We construct the *local demand shock* instrument as follows: i) given a store s in week t in our sample, we consider the set of stores that are located in the same LSOA area, and we examine consumption of UK(EU) product in week $t - 1$ (for each product category). We consider that a demand shock takes place if at least 30% of the nearby stores have experienced a demand for the product that belongs to the top 5% in the store’s history.⁴⁷ We also interact this measure with each store’s distance to a distribution center (*Distance DC*). The intuition for this interaction is that the effect of stock-outs in neighboring stores may be mediated by the distance between the store and its distribution center, as distance can influence the time required to replenish the shelves.

We estimate the same model as in (1), but now instrumenting for (log) prices so that the estimated coefficients can be directly compared with those reported in Table 4 in section 4.1. Table 15 reports the results.

The estimates are similar to our earlier findings on the impact of the Brexit referendum on consumption of UK and EU products, even when we account for potential residual variation in prices at the store level. Moreover, the magnitude of both the effect of the referendum and the estimated price elasticities increase, thus suggesting that our main results reported in section 4.1 might be a conservative estimate of the actual impact of identity on changes in consumption and associated consumer surplus.

⁴⁶This breakdown is based on a review of technical reports for each retailer, which provide approximate figures on the overall share of UK products on shelf.

⁴⁷More precisely, we flexibly model the demand of product category c , in store s , in week t using the following model:

$$Sales_{sct} = \phi_c \times \gamma_t + \eta_s + \varepsilon_{sct} \tag{4}$$

where $\phi_c \times \gamma_t$ are a set of product category-week fixed effects (to model seasonality in product category consumption) and η_s is a set of store fixed effects. The residuals that we obtain from the estimation $\hat{\varepsilon}_{sct}$, which capture the deviations from the seasonality captured (conditional on the stores’ idiosyncratic characteristics), are then the category/store week deviations that we use to identify abnormal consumption.

Table 15: Instrumenting for UK and EU Average Prices

Dependent Variable:	Log(Price UK)	Log(Price EU)	Share UK	Share EU
	IV 1st	IV 1st	IV 2nd	IV 2nd
Post Ref	-1.82*** (0.00)	-1.48*** (0.00)	0.49*** (0.06)	-0.54*** (0.05)
Ln(Price UK)			-33.93*** (5.10)	37.69*** (4.01)
Ln(Price EU)			57.08*** (5.08)	-61.88*** (4.13)
Num. Comparable stores within 5 km	0.02*** (0.00)	0.01*** (0.00)		
Num. Higher UK stores within 5 km	-0.18*** (0.00)	-0.22*** (0.00)		
Lag UK local demand shock	0.13*** (0.01)	0.05*** (0.01)		
Lag EU local demand shock	0.55*** (0.00)	-0.17*** (0.01)		
Lag UK local demand shock × Distance DC	-0.00*** (0.00)	0.00*** (0.00)		
Lag EU local demand shock × Distance DC	-0.00*** (0.00)	0.00 (0.00)		
Num. Comp within 1 km	-0.96*** (0.00)	-1.02*** (0.00)	0.30*** (0.04)	-0.29*** (0.03)
Weekly expenditure	0.49*** (0.02)	0.35*** (0.02)	-2.40*** (0.11)	1.64*** (0.08)
Controls	Yes	Yes	Yes	Yes
F-test			1491.484	1491.484
Observations	205,156,381	205,156,381	205,156,381	205,156,381

Source: Transaction Data. *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price UK)* corresponds to the average product category prices for UK products and *Log(Price EU)* corresponds to the average product category prices for EU products. *Num. comparable stores within 5km* is the number of competitors selling a comparable share of UK products within a radius of 5km. *Num. higher UK stores within 5km* is the number of competitors selling a larger share of UK products than our retailer within a radius of 5km. *Lag UK local demand shock* is an indicator variable equalling 1 if other stores of our retailer located in the same LSOA experienced a large positive demand shock for UK products in the previous week. *Lag EU local demand shock* is an indicator variable equalling 1 if other stores of our retailer located in the same LSOA experienced a large positive demand shock for EU products in the previous week. *Distance DC* is the distance between the store and the closest distribution center of the retailer. *Num. Comp within 1 km* is the (total) number of competitors within a radius of 1km around the store. *Weekly Expenditure* corresponds to total weekly expenditure at the shopper level. *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.

7.5 Sampling Bias

7.5.1 Retailer

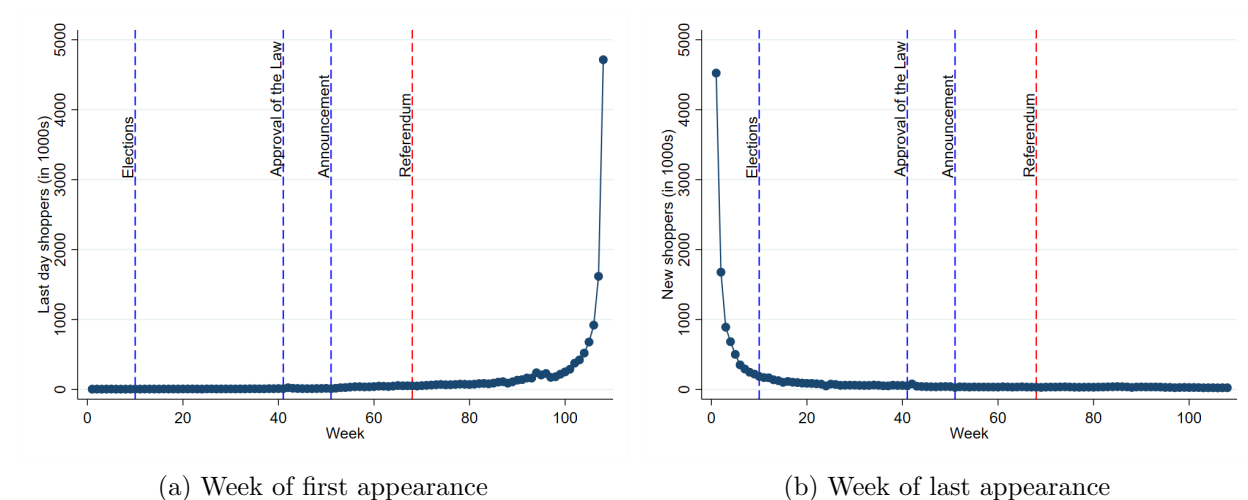
The consumer base of our retailer covers 39,775 LSOAs (95.3%) out of the 41,729 LSOAs in the UK. Table 24 in the Appendix shows that the remaining 5% of LSOAs not covered in our sample are almost identical to those included in the sample in terms of key socioeconomic characteristics such as demographic composition, share of unemployed, the deprivation index and whether the

LSOA is rural or urban.

7.5.2 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 who appear in our dataset. Our analysis is based on an unbalanced set of shoppers, as they enter and exit the sample during our window of analysis. We define exit as a shopper appearing regularly in our dataset and then not shopping again until the end of the analysis.⁴⁸ Reassuringly, Figure 7 confirms that there is no abnormal exit or entry of shoppers that coincided with the Brexit referendum. 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.

Figure 7: **Week of first and last appearance of shoppers in our sample.**



8 Conclusions

This paper provides novel evidence on how a rise in national identity can affect routine economic behavior. We examine the impactful yet unexpected outcome of the Brexit referendum as a shock

⁴⁸Patterns are similar 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 the Brexit referendum —.

to the salience of British identity on consumers' decisions to shop for UK vs EU grocery products. Following the referendum, shoppers were more likely to consume UK products and decrease consumption of EU products. Sales increased even further for products that prominently displayed their origin on the front package by including the union jack flag or the term "British" in the product name.

The richness of our data and setting allows us to explore several mechanisms and better document the effects of identity-based preferences on consumption patterns. First, we find that prices matter: salient identity preferences appear to have reduced price sensitivity to UK products and increased price sensitivity to EU products. Second, we find that changes in consumption patterns were driven by in-group bias, i.e. shoppers replacing similar EU products with UK products, but we find no evidence consistent with more far-reaching changes in taste and movements toward more prototypical types of consumption baskets. Third, we find that the socioeconomic characteristics of shoppers' localities play a very small role in explaining changes in consumption patterns, consistent with an interpretation that political ideology may have been more important than economic fundamentals. Instead, we find that a move toward UK products is strongly associated with media discussions about the politics of Brexit. Social and traditional media storms about political identity can significantly increase the salience of identity and result in substantial changes in consumer behavior.

Finally, we estimate that the effect of the salience of identity on consumption of UK products is equivalent to the change in prices (in absolute terms) induced by the most recent change in VAT rates in the UK in 2011. The shock to the salience of national identity has led to sizable changes in aggregate consumer surplus.

Overall, our findings underscore the fact that identity preferences can matter even in settings that lack focal, prescriptive social norms about group behavior, and that the media can play an important role in keeping it top of mind. How these shocks persist across time, and potentially across generations as habits are formed and supply chains are sticky, suggests an exciting area for future research.

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A Online Appendix

A.1 Event Study: Robustness Analysis

Tables 16 and 17 shows that the within shopper results are unchanged with the inclusion of different sets of fixed effects, including store x week and store x product category fixed effects.

Table 16: **Event Study: UK Products**

Dependent variable:	Share UK						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post Ref	0.225*** (0.008)	0.223*** (0.007)	0.204*** (0.008)	0.204*** (0.008)	0.245*** (0.007)	0.293*** (0.007)	0.277*** (0.006)
Log(Price UK)	-8.164*** (0.123)	-7.601*** (0.109)	-5.270*** (0.046)	-5.272*** (0.046)	-7.919*** (0.114)	-7.692*** (0.103)	-7.602*** (0.095)
Log(Price EU)	8.329*** (0.084)	8.122*** (0.080)	1.715*** (0.034)	1.717*** (0.034)	8.110*** (0.082)	7.482*** (0.071)	7.215*** (0.068)
Weekly expenditure	-14.649*** (0.242)	-13.560*** (0.335)	-11.770*** (0.207)	-11.756*** (0.207)	-15.748*** (0.261)	-8.882*** (0.162)	-9.125*** (0.231)
Household FEs	NO	YES	NO	NO	NO	NO	NO
Week FEs	YES	YES	YES	YES	NO	NO	YES
Product category FEs	YES	YES	NO	NO	YES	YES	YES
Store FEs	NO	NO	YES	YES	YES	YES	YES
Store * Week FEs	NO	NO	NO	YES	NO	NO	NO
Store * Product category FEs	NO	NO	NO	NO	NO	YES	NO
R ²	0.072	0.115	0.003	0.003	0.074	0.142	0.175
Observations	217,713,411	217,712,016	217,713,411	217,713,410	217,713,411	217,713,411	217,712,016

Source: Transaction Data. Notes: *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds.

Table 17: **Event Study: EU Products**

Dependent variable:	Share EU						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post Ref	-0.180*** (0.007)	-0.180*** (0.007)	-0.173*** (0.006)	-0.185*** (0.007)	-0.140*** (0.006)	-0.233*** (0.008)	-0.294*** (0.007)
Log(Price UK)	19.540*** (0.043)	19.549*** (0.043)	7.813*** (0.099)	13.191*** (0.090)	11.369*** (0.082)	7.206*** (0.117)	7.305*** (0.102)
Log(Price EU)	-10.801*** (0.030)	-10.809*** (0.030)	-7.026*** (0.070)	-9.866*** (0.059)	-8.732*** (0.052)	-8.325*** (0.083)	-7.398*** (0.071)
Weekly expenditure	21.056*** (0.328)	21.051*** (0.328)	10.045*** (0.179)	15.726*** (0.260)	10.023*** (0.179)	15.291*** (0.259)	9.312*** (0.173)
Household FEs	NO	YES	NO	NO	NO	NO	NO
Week FEs	YES	YES	YES	YES	NO	NO	YES
Product category FEs	YES	YES	NO	NO	YES	YES	YES
Store FEs	NO	NO	YES	YES	YES	YES	YES
Store * Week FEs	NO	NO	NO	YES	NO	NO	NO
Store * Product category FEs	NO	NO	NO	NO	NO	YES	NO
R ²	0.016	0.017	0.142	0.077	0.145	0.074	0.143
Observations	217,713,411	217,713,410	217,713,411	217,713,408	217,713,408	217,713,411	217,713,411

Source: Transaction Data. Notes: *Post Ref* corresponds to an indicator variable that takes the value 1 for each week after the Brexit referendum and the value 0 for each week prior to it. *Log(Price EU)* and *Log(Price UK)* correspond to the average category prices of EU and UK products respectively, in logarithmic form. *Weekly Expenditure* corresponds to total weekly expenditure in pounds.

A.2 Price Analysis

Figures 8 and 9 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. This supports our assumption of price rigidity during our window of analysis.

Figure 8: **Non-parametric fit of coefficients of variation computed for UK products per product category.**

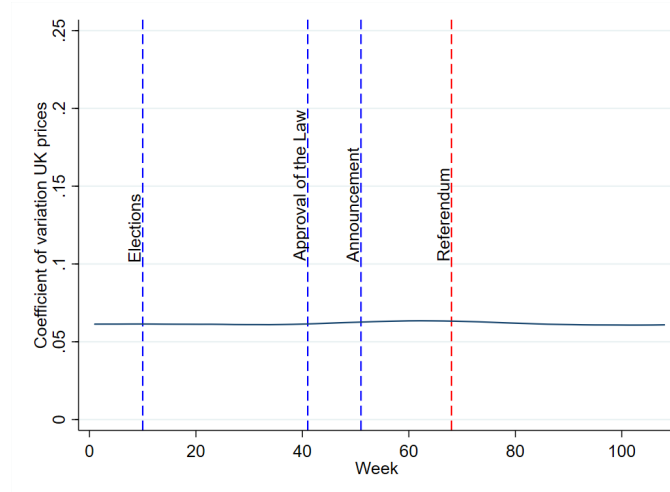
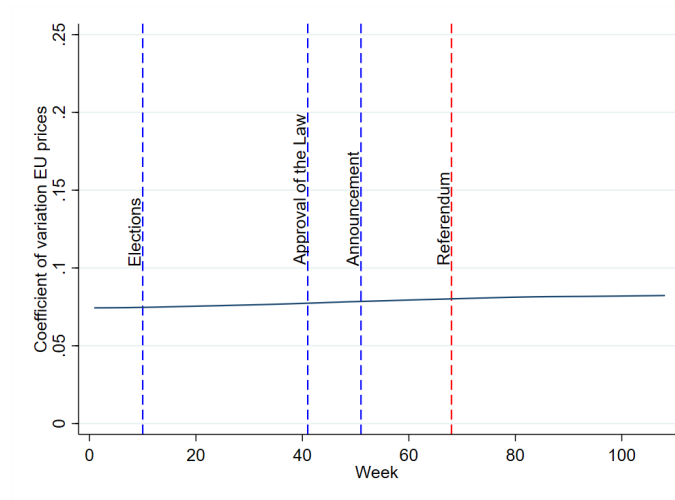


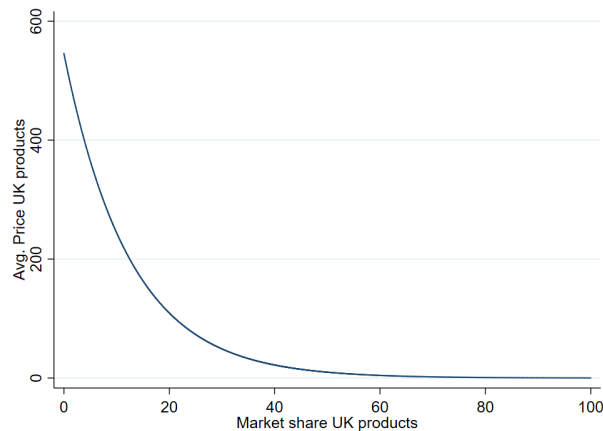
Figure 9: **Non-parametric fit of coefficients of variation computed for EU products per product category.**



A.3 The Value of Identity

Figure 10 shows the inverse demand for UK products in our sample.

Figure 10: **Inverse Demand for UK Products**



A.4 Consumer Surveys

To examine the external validity of our findings, we compare beliefs and reported behaviors of consumers in our consumer survey who report shopping at our retailer relative to those who report shopping at competing retailers. Table 18 shows the p-values for tests of equality of proportions (chi-square) and of the equality of distributions for the key reported behaviors and beliefs discussed

in the main paper.

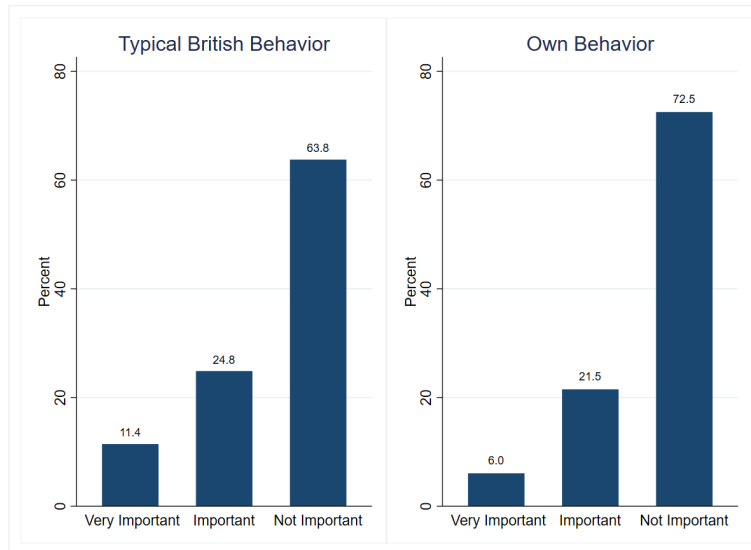
Table 18: **Shopper Beliefs Across Retailers**

	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. Figure 11 shows 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 and those who report shopping in competing retailers (see Figure 5 in the main paper).

Figure 11: **Share of consumers reporting on the importance of purchasing UK products for the typical British consumer vs for themselves, for shoppers in our retailer.**

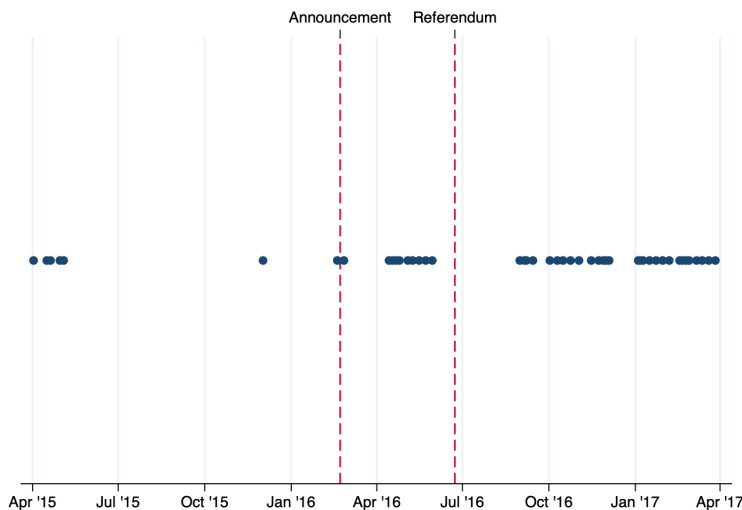


A.5 Media

A.5.1 Twitter Data

Figure 12 shows the dates of twitter storms identified as the days with the top 20% of twitter activity on Brexit. This excludes twitter activity in late June and July 2016, which correspond to the weeks during and immediately after the Brexit referendum.

Figure 12: **Twitters Storms as the Days with the top 20% of Twitter Activity.**



A.5.2 Identifying Twitter Storms: Intensity

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 20% of twitter activity around Brexit throughout our window of analysis. We now revisit this approach and tighten this classification to include the top 10% of twitter activity at the national level. Tables 19 and 20 show that our results remain stable.

Table 19: 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	3.124 (2.032)	-0.835 (1.723)						
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 \times Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
Product Category FEs	YES	YES	YES	YES	YES	YES	YES	YES
R ²	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Observations	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081

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.

Table 20: 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
Product Category FEs	YES	YES	YES	YES	YES	YES
R ²	0.008	0.008	0.008	0.008	0.008	0.008
Observations	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081	5,572,081

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.

The differential impact of tweets about politics relative to economics and social issues is even larger when we consider a narrower definition of twitter storms, which confirms our interpretation in the paper that arguments about the politics of Brexit are more likely to be affecting shopping behavior through the identity channel.

A.5.3 Identifying Twitter Storms: Influencers

In this section we test the robustness of our twitter findings to defining twitter storms based on the twitter activity of “influencers”. 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 21, our results are larger in magnitude when we use this strategy. A 10% increase in the number of tweets is now associated with a 6% increase in the consumption of UK products.⁴⁹

Table 21: **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 × Event FEs	YES	YES	YES	YES	YES	YES	YES	YES
Product Category FEs	YES	YES	YES	YES	YES	YES	YES	YES
R ²	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 of 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)* is the number of tweets that were classified as being pro Brexit and *Log(Tweets against)* is the number of tweets that were classified as being against Brexit. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

A.5.4 Placebo Twitter Storms

We conduct a placebo check by examining changes in consumption occurring during days with low levels of twitter activity. To do so, we consider the days with the bottom two deciles of twitter activity during our period of analysis and confirm, in Table 22 that low twitter activity has no impact on consumption behavior.

An additional potential concern is that twitter users may represent a non-random, non-representative sample of individuals. While we cannot fully dismiss this possibility, we find evidence that increased

⁴⁹Results are very similar when we use the 20% cutoff for identification of twitter storms.

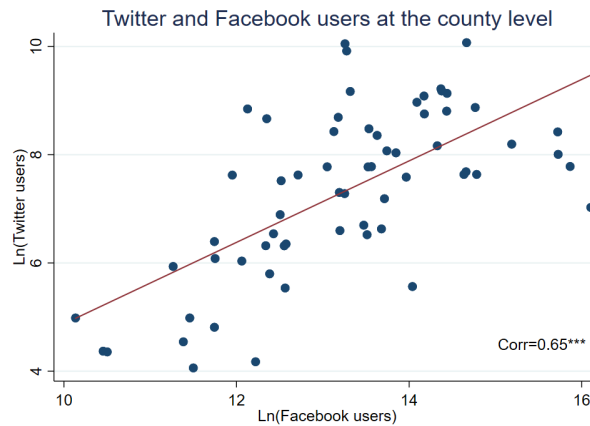
Table 22: **Twitter Storms and Consumption Behavior: Bottom Deciles of Twitter Activity**

Dependent variable:	Share UK	Share EU
	(1)	(2)
Treated	-0.000 (0.000)	-0.000 (0.000)
Store \times Event FEs	YES	YES
Product Category FEs	YES	YES
R ²	0.009	0.008
Observations	16,962,861	16,962,861

Source: Transaction and Twitter 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. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively. *, **, *** represent statistical significance at the 10%, 5% and 1% levels respectively.

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 13, there is a strong correlation between twitter and facebook activity at the locality level.⁵⁰

Figure 13: **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.

⁵⁰Facebook usage is retrieved by using Google search API to identify users that list a given locality in their user profile.

A.5.5 Newspaper Analysis

To confirm our twitter results, we examine whether news in more traditional media outlets also affect consumption patterns. We collect the content of Brexit related headlines and first paragraphs of the following newspapers between March 2015 and 2017: Daily Mail, Evening Standard, Express, The Guardian, The Independent, and The Times. This sample was selected based on the availability of digital archives and the need to include newspapers that adopted different sides on the Brexit debate.

We obtain the headlines and the first paragraph of each article to identify Brexit-related news. Examples of keywords used to identify both headlines and text are “brexit”, “european union”, “eu”, “british”, “british identity”, “british passport”, “british culture”, “british heritage”, “british goods”, “british products”, “british manufacturing”, “made in britain”. To identify the days with an intense news activity around Brexit, we use the same method used for twitter: we focussed on the top 20% of days during our period of interest in which the total number of articles about Brexit were highest. We exclude the months of June and July in 2016 due to the high number of articles about Brexit immediately before and after the referendum. When several consecutive days fall into the top 20%, we focus on the first day of a series. This leaves us with 41 newspaper “storms”, which we use to compare the expenditure share of UK vs EU products purchased on the day before (control) and on the day of each event (treatment). As before, we assume that shoppers’ decisions of when to shop at the local level do not drive the timing of news about Brexit. Figure 14 shows the distribution of newspaper storms across time, excluding the weeks around the referendum in late June and early July 2016.

A.6 Football Analysis

Table 23 shows that the results are very similar when we consider the day before an English win as a control and the day of the game as the treated day.

Figure 14: Newspaper Storms as the Days with the top 20% of articles on Brexit.

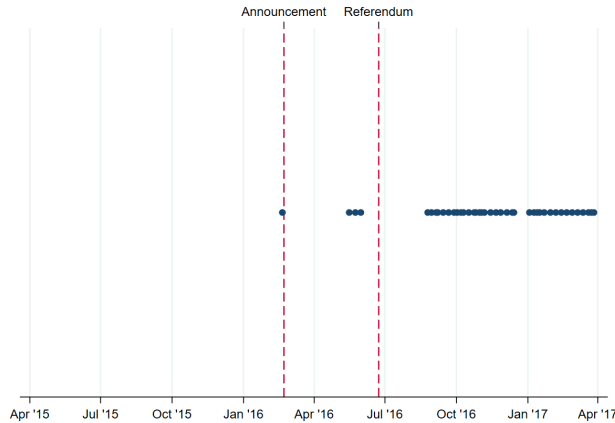


Table 23: England’s wins in Euro 2016 and Consumer Behavior

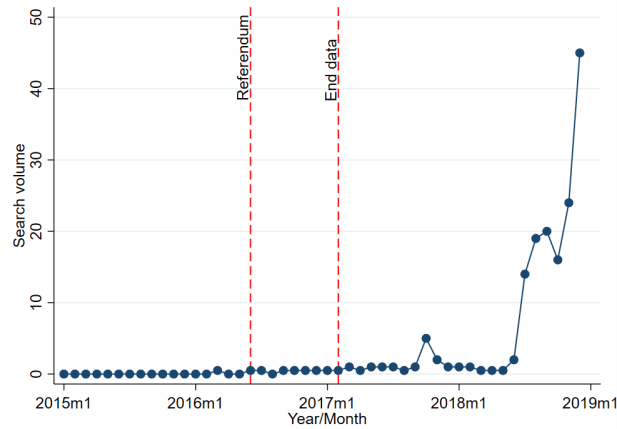
Dependent variable:	England win	
	Share UK (1)	Share EU (2)
Treated	-0.006 (0.030)	-0.124*** (0.025)
Store × Event FEs	YES	YES
Product Category FEs	YES	YES
R ²	0.010	0.010
Observations	2,600,263	2,600,263

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

A.7 Rational Expectations

Figure 15 shows that Google searches for the term “no deal” Brexit emerged at least 7 months after the end of our window of analysis. The index represents search interest relative to the highest point on the chart for the UK and for the time period. 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”.



A.8 Sampling Bias

A final potential source of sampling bias relates to the sample of tweets used in the twitter analysis. We attempt to match 11.3 million tweets to the localities in which there are stores. Figure 16 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, 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 behavior when we use the twitter data.

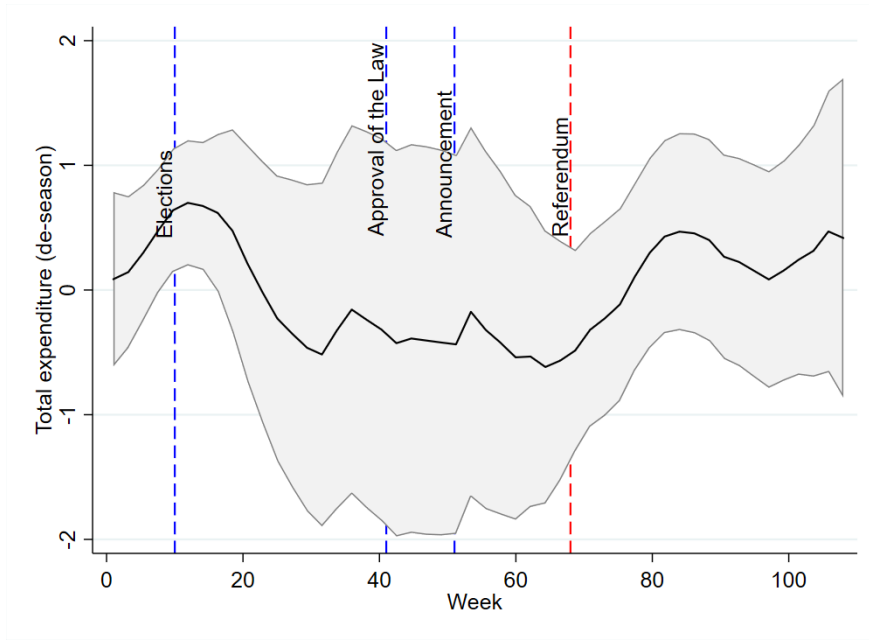
Figure 16: Matching Twitter data to LSOAs with store data



A.9 Weekly Expenditure

Figure 17 shows that shoppers' average weekly expenditure, CPI-adjusted, is relatively stable throughout our period of analysis. This finding, together with the finding of decreased price sensitivity to UK products after the referendum, allays concerns about the shift toward UK products being driven by shoppers' expectations about the worsening of future economic conditions. Similarly, it does not suggest that the depreciation of the pound that followed the referendum affected the level of expenditure on grocery shopping throughout our window of analysis.

Figure 17: **Total Weekly Expenditure (deflated and de-seasoned)**



A.10 Sampling Bias

Table 24 shows that the LSOAs covered in our sample are identical to those that are excluded from it.

Table 24: **Descriptive Statistics: LSOAs**

Variable	LSOA covered (N=39788)		LSOA UK (N=41729)	
	Mean	Std. dev.	Mean	Std. dev.
Whites (%)	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
Deprivation Index	50.75	28.63	50.27	28.77

Source: Census Data. All variables are at the LSOA level (1,500 people on average). *Share White* represents the share of white residents, *Unemployment* represents share of unemployment, *Blue collar* represents the share of blue collar workers, and *Rural* corresponds to an indicator that takes the value 1 if the LSOA is defined as rural by the UK census.