Food for the Soul and the Planet: Measuring the Impact of the Return of Meatless Fridays for (some) UK Catholics*

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Abstract

We measure the impact of a return to meatless Fridays for English and Welsh Catholics on consumption behaviour, climate change mitigation and religiosity. We find evidence of partial compliance with the reimposed obligation. We then measure the corresponding greenhouse gas reductions - which are non-trivial. The estimated religiosity coefficients are insignificant. We highlight the important role that religious regulations can play in achieving environmental sustainability. We identify a new source of low-cost greenhouse emissions reductions, especially if this practice were to be reinstated by the Catholic Church at a global scale.

JEL-classifications: Q2, D1, KE, Z1.

Key words: Food and Religion, Climate Change, Non-State Institutions, Legal Pluralism, Catholic Church

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1 Introduction

On 16 September 2011, the Catholic bishops of England and Wales instructed their followers not to eat meat on Fridays. This obligation, with its ancient origins and backed by Canon Law, was re-established after a 26 year hiatus. We focus on measuring the behavioural, climate change and religiosity impact of this reinstated obligation. We use this case study to highlight the impact that religious and ethical rules can have on environmental outcomes. We also aim to highlight the future role they could play in mitigating climate change and achieving environmental sustainability.

The need for deep and lasting reductions in greenhouse gas emissions is well known. However, despite the increasing urgency for emissions reductions, government action remains insufficient to avert its potentially devastating effects (IPCC 2022). The need for action on climate change, and its moral dimension, has not been lost on the current leader of the Catholic Church - Pope Francis. In his encyclical letter *Laudato si'*, he highlighted the importance of lifestyle change, the moral dimension of our consumption decisions and the important role that civil society can play in achieving sustainability. More recently, in the lead-up to COP26 in 2021 he called for "radical" and "effective" responses to climate change.[1]

The recent systematic analysis of the vast demand-side climate change mitigation literature by Creutzig et al (2022) has prioritised shifts toward low-or-no-meat diets, and has identified them to be both impactful and relatively low cost options. Calls for reduced meat diets are also being translated into concrete action, for instance, New York City Mayor Eric Adams has announced that the city's schools would serve vegan meals its 1.1 million students on Fridays.[2] Our analysis joins a growing list of researchers analysing the impact of dietary change for the improvement of human health, animal welfare and environmental sustainability (see Willet et al 2019, Springmann et al 2018 and Godfray et al 2018). We aim to provide insight into the consequences of behavioural change from a sub-group of people within a society and how these consequences can manifest in potentially large environmental benefits, especially over time. While many religions have dietary proscriptions, there is surprisingly little quantification on the impact of religiously motivated behaviour on food consumption and environmental outcomes (see D'Haene et al 2019 and Norman 2012).[3]

The stated aims of the reintroduction of meatless Fridays was to encourage religious practice and shared identity by partaking in a common identifiable practice.[4] Given these aims, we also

[1] https://www.bbc.co.uk/news/world-europe-59075041

[2] New York City's public school system goes meat-free on Fridays https://www.reuters.com/world/us/new-york-citys-public-school-system-goes-meat-free-fridays-2022-02-04/

[3] Of course, there is a vast literature on the impact of religion and religiosity on a wide range of social, cultural and economic outcomes (and vice versa). For an introduction see (Iyer 2016 and Chen and Hungerman 2014)

[4] See the statement by the bishops of The Catholic Church for England and Wales (2011, p1), who state

measure the impact the reinstatement had on religiosity (service attendance and difference to one's life). While this analysis is important in its own right, it also enables us to highlight the link between sustainability and religious proscriptions, which by their very nature require certain behaviours and self-restraint. Measuring the religiosity outcomes also provides insight into the welfare costs (or even benefits) from the changes in consumption behaviour and consequent emissions reductions. It could be that the reinstated obligation led to a faith-environment "win-win". For instance, Iannaccone (1992) showed that more stringent religious obligations can lead to more committed followers in more vibrant religious organisations.[5] Furthermore, while the Theory of Revealed Preference implies that substituting away from meat would involve welfare losses to those who would otherwise consume it on a Friday, motivating this substitution away from meat through a religious obligation may reduce or eliminate these welfare losses through a process of *internalisation* of the obligation at the individual consumer level. The process of internalisation can see the obligation become incorporated into an individual's moral framework and preference set - that would then see compliance generate internalised rewards, and non-compliance generate internalised penalties (see Larcom, Panzone and Swanson 2019, Kaplow and Shavell 2007, Etzioni 2000, Cooter 1998, McAdams 1997). As noted by Etzioni (2000, p. 167) internalisation is "a remarkable process through which imposed obligations (compliance with which must be forced or paid for) become desires."[6]

We also consider this religious faith-environment case study to be particularly important. As noted by Dasgupta et al (2015) and Danielsen et al (2021), the Catholic Church is very well placed to help mitigate climate change - given its hierarchical institutional structure (including its own legal system) and that it has more than one billion followers globally. Despite these institutional advantages, it has been criticised by some, particularly in the United States, for not doing enough to combat climate change (see Danielsen et al 2021). However, even if the Catholic Church did tell its followers to abstain from eating meat or undertake some other measure, what would be the behavioural response? We know that many UK Catholics choose not to comply with the teachings and rules of the church in other spheres of social life.[7] Did Catholics simply ignore the bishops, or did they comply? If so, to what degree? The answer to this question drives the magnitude of the environmental impact of obligation. However it

'They believe it is important that all the faithful again be united in a common, identifiable act of Friday penance because they recognise that the virtue of penitence is best acquired as part of a common resolve and common witness.'

[5]As noted by Posner (2002), signalling devices to promote group loyalty extend well beyond religion, and can often involve anti-social behaviour. With the case of meatless Fridays for UK Catholics, we would seem to have an example where the activity is pro-social, or more specifically pro-environmental.

[6]This is similar to Hart's (1997) concept of the internal point of view, where individuals can take the decision to accept, in this case *Canon*, law as a guide for conduct and appropriate behaviour.

[7]For instance, survey data suggests that many UK Catholics do not adhere to the church's teachings in relation to sexual practices and abortion (see National Center Social Research, 2017 and BBC 2011)

is not so easily predicted. In addition to non-compliance in other spheres of life, there was no (external to the individual) penalty attached by the Church for non-compliance in our case study. At the time of the reinstatement of the obligation, the bishops were clear that it was the *intention* to observe Friday penance that was important and not the specific act of *not* eating meat.[8] Therefore, we can expect compliance to be generated primarily voluntary acceptance of the obligation through a process of internalisation, rather than a fear of an externally imposed penalty.

The remainder of this manuscript is as follows. First there is an outline of the practice of meatless Fridays within the Catholic Church. Then a brief discussion of the Catholic Church in the UK, including the different jurisdictional boundaries, which helps guide our difference-in-differences analysis. We then provide an overview of our data sources and empirical strategy. We next provide the descriptive statistics and outline our econometric estimation methods. This is then followed by the presentation and discussion of our results, in terms of consumption (and greenhouse gas emissions) and religiosity. We then conclude by highlighting the potential for further, and much larger, emissions reductions from the adoption of meatless Fridays in other jurisdictions, or globally.

2 Meatless Fridays

Many religions have dietary proscriptions. For Christians, the practice of not eating meat on Fridays dates back to the First Century AD, and from at least Pope Nicholas I's (858-867) declaration, Catholics were required to abstain from eating meat on Fridays, as penance and in memory of Christ's death and crucifixion (Catholic Encyclopedia 1912).[9] While meat was deemed to include the flesh, blood, or marrow; fish, vegetables, mollusks, crabs, turtles, and frogs were permitted (Catholic Encyclopedia 1912). Therefore, while the requirement was to not eat meat, the common practice emerged to eat fish as a substitute of meat on Fridays. Such was the practice observed so fervently amongst American Catholics that it led to the invention of the Filet-o-Fish by McDonald's franchisee Lou Groen out of financial necessity given his restaurant was in a predominately Catholic neighbourhood in Cincinnati.[10] In the UK, this obligation was so well observed in the past, and with Catholics being a significant minority across the UK, many state institutions (schools, hospitals and prisons) served fish on Fridays to

[8] At the time of the reintroduction the Bishops' Conference published a document titled: Catholic Witness - Friday Penance: Question and Answer (2011) that included text on whether failure to abstain from meat on a Friday would constitute a 'sin'. It stated that the most important aspect of observance was the *intention* to observe penance on Fridays and not the specific act of penance, and therefore [f]ailure to abstain from meat on a particular Friday then would not constitute a sin.'

[9] As noted by Fagan (2006) many Catholic saints, including St Augustine of Hippo, St Jerome and St John Chrysostom highlighted the spiritual co-benefits from fasting and abstaining from meat.

[10] See Business Insider, https://www.businessinsider.com/history-of-mcdonalds-filet-o-fish-2018-1?

allow compliance; and many non-Catholics also chose to eat fish on Fridays.[11] This obligation, along with past practice and the introduction of battered fried fish by Portuguese Sephardic Jewish people fleeing persecution, is said to have led to the broader 'tradition' of eating fish (and chips) on Fridays in Britain.[12].

For much of its history, the Catholic Church instructed its followers to abstain from meat on Fridays, which became one of its most visible and enduring marks of religious observance.[13] In addition to tradition, the requirement of not eating meat on Fridays is a precept (or fundamental rule) of the Catholic Church and also encoded in Canon Law. The fourth precept of the Catholic Church requires the observance of established days of fasting and abstinence from certain types of food.[14] In the past, in addition to Fridays, there were a number of other abstinence days and seasons imposed on Catholics (including Saturdays, Wednesdays, Ember Days, Lent, Advent and Rogation Days). In pre-Reformation medieval England, around half of the days of the year were designated to be meat free; these included Wednesdays, Fridays, Saturdays, the whole of Lent and the eves of other important feast days (Woolgar 2006). However, it must also be noted that practices varied over place and time, and there seems to have always been a degree of flexibility and adaptability to the rules of fasting and abstinence, allowing for "[d]iversity in customs, in climate, and in prices of food" (Catholic Encyclopedia 1912).

The Second Vatican Council (1962-65) led to the apostolic constitution, Paenitemini, issued under Pope Paul VI in 1966.[15] This decree allowed local bishops to substitute other forms of Friday penance (such as works of charity or prayer) in place of not eating meat. Many bishops' conferences acted upon their new found autonomy, and some with great haste. The bishops of the United States removed obligatory meatless Fridays (except during the 46 day Lenten period that precedes Easter) in December 1966. Bell (1968) estimated that this saw a sudden and sustained drop in fish demand in the north-east of the United States, with fish landing prices falling by 12.5 per cent. Over time, most other bishops' conferences across the world followed suit including Ireland, Scotland, and England and Wales (in 1985).[16]

[11] See Oddie 2011.

[12] See Oddie 2011

[13] As noted by Fagan (2006, 23) ''From the fall of the Roman Empire to the Black Death of 1343, Lenten and weekly fasting, especially on Fridays, remained a basic mark of Christian observance. By the eleventh and twelfth centuries, a Christian was someone who minimally relieved yearly Communion, fasted on Fridays and during Lent, paid tithes, and had his or her children baptized."

[14] The Catholic Church lists five precepts that can be seen as the basic requirements for living in Communion with the Church. The Compendium of the Catechism of the Catholic Church (1993) lists them as: 1. You shall attend Mass on Sundays and on holy days of obligation and remain free from work or activity that could impede the sanctification of such days. 2. You shall confess your sins at least once a year. 3. You shall receive the sacrament of the Eucharist at least during the Easter season. 4. You shall observe the days of fasting and abstinence established by the Church. 5. You shall help to provide for the needs of the Church.

[15] Following this decree, changes in the Code of Canon Law were made in 1983 (Canons 1250-53).

[16] Prior to the reinstatement of the obligation, English and Welsh Catholics were still required to abstain from eating meet during Lent, which includes 7 Fridays.

While most bishop's conferences have continued to allow individual discretion in relation to Friday penance (including Ireland and Scotland), the bishops of England and Wales decided to explicitly reintroduce the practice of not eating meat on every Friday of the year in 2011. On 9 May 2011 the Catholic Church for England and Wales (2011) issued a statement that reminded Catholics "that every Friday is set aside as a special day of penitence" and that they have "decided to re-establish the practice that this penance should be fulfilled simply by abstaining from meat", and informing their congregations that the decision will come into effect on Friday 16 September 2011.[17] The decision was covered by national media outlets, including the major newspapers and the BBC. In explaining the decision, the Bishops noted the importance of tangible "acts of witness" and that Catholics will "again be united in a common, identifiable act of Friday penance".[18] They also noted that many Catholics seemed to have forgotten the obligation to do any penance on a Friday.[19] The bishops expressed their view that they hoped that not eating meat on Fridays would encourage prayer, works of charity, and see Catholics more openly express their faith. The reaction amongst UK Catholics at the time was mixed. Some such as commentator Oddie (2011) enthusiastically welcomed the move, stating that the "bishops have done something really substantial towards the restoration of what was lost from the spiritual life of the faithful". Others, however, such as Barbieri (2011) considered it a retrograde step, and raised concerns about already depleted fish stocks.

3 The Catholic Church in the United Kingdom

There is an imperfect alignment between ecclesiastical and political jurisdiction in the United Kingdom concerning the Catholic Church. Catholics in England and Wales fall under the jurisdiction of the Conference of Bishops for England and Wales, in Scotland they come under the Bishops' Conference of Scotland, while in Northern Ireland they come under the Irish Catholic Bishops' Conference (which incorporates the whole of the island). We aim to use this variation as part of our empirical strategy, as while many rules and obligations apply to Catholics universally, some decisions are delegated to local bishops, including the requirements for Friday penance.

In terms of numbers, Catholics are a minority in all of the countries that make up the United Kingdom; approximately 8 per cent in England, 5 per cent in Wales, 15 per cent in Scotland and 40 per cent in Northern Ireland. There is also considerable regional variation within the countries of the UK; for example Catholics make up approximately 15 per cent of the

[17] They went to inform "those who cannot or choose not to eat meat as part of their normal diet should abstain from some other food of which they regularly partake".

[18] Catholic Church for England and Wales (2011) Catholic Witness: Friday Penance: Question and Answer. http://www.catholicchurch.org.uk/content/download/22658/144819/file/friday-penance.pdf.

[19] Telegraph (2011)

population in North West England and Inner London. Despite some decline, the Catholic share of the British population has remained broadly stable at a little under 10 per cent over the last 30 years. While many people identify as Catholic, the intensity of practice varies considerably.[20]

4 Consumption Methods and Data

In order to measure the behavioural and religious impact of the re-introduction of the obligation for meatless Fridays for a minority group within the UK (approximately 10 percent of the population total population) we employ three datasets. The first is a nationally representative survey, commissioned in 2021. The second is the National Diet and Nutrition Survey, that is conducted on a yearly basis, and which includes a food diary (NDNS) administered by Public Health England. To measure any impact on religiosity, we employ the longitudinal Understanding Society panel data set.

4.1 Survey Data

Data were collected as part of a nationally representative survey via an online survey implemented by Dynata. The respondents were drawn from its panel of approximately 300,000 individuals. To obtain a nationally representative sample, quota-sampling was employed; with quotas set for age, gender, education, income and regional distribution at the Classification of Territorial Units for Statistics Level 1 (NUTS 1) of the population to match UK characteristics. Data were collected from two survey waves (over July to September 2021). There were a total of 5055 respondents, of which 489 (9.67 percent) identified as Catholic, which is in line with other estimates of the UK Catholic population.

As can be seen from Table 1 below, our sample of UK Catholics share similarities to the full sample. However, they have higher levels of education and income than the total sample (see Figure A1 in the Appendix for data descriptions). [21]

[20]For instance, as noted by Bullivant (2016), around one third report that they attend church on a weekly (or more) basis, while approximately 40 per cent report that they rarely or never go to church.

[21]Note that the number of observations for the descriptive statistics, and regression below, are less than those who identified as Catholic, due to incomplete answers to some demographic variables, in particular, in relation to income and education

Table 1: Survey Data Descriptive Statistics

	Catholic				**Total Sample**			
	Mean	S.D	Min	Max	Mean	S.D	Min	Max
Age	4.522	1.559	2	7	4.632	1.656	2	7
Income	4.126	2.262	1	8	3.595	2.072	1	8
Female	1.493	0.501	1	2	1.5	0.5	1	2
Education	3.075	1.094	1	5	2.766	0.954	1	5
Observations	452				4575			

Note: See Figure A1 for definitions of categorical variables

Of those who identified as Catholic, we used a recall method to gather data on the behavioural response to the reinstatement. While recall methods can suffer from measurement error, due to imperfect recall or deliberate misstatement, they can be a highly effective tool for gathering data when designed appropriately (Sanchez de la Sierra 2020). Such survey methods also enable us to gain insight into the motivations for compliance or non-compliance, something that is not easily attainable otherwise.

Catholics were first asked the following question: "On 16 September 2011 the Catholic bishops in England and Wales reinstated the practice of abstaining from eating meat on Fridays. Did this influence your dietary habits?" Depending on their answer they were then asked a follow-up question. For those who answered "Yes", they were asked "How did this influence your dietary habits?" and were asked to choose one of the following options: 1. "I reduced my meat consumption on Fridays", 2. "I stopped eating meat on Fridays" or 3. "Other (such as eating more ethically on Fridays)". For those who answered "No", they were asked "Why didn't this influence your dietary habits?" and were asked to chose from the following (non-exclusive) options: 1. "I do not live in England or Wales", 2. "I did not know of the change", 3. "I already didn't eat meat on Fridays", 4. "I prefer to decide myself what I eat" and 5. "Other people in my household choose the meals I eat". The order of the answer options for all questions were presented to individual respondents in randomised order.

4.2 Survey Results

We first estimate a simple OLS regression to measure the probability of answering 'yes' to the behavioural change question by jurisdiction. It also enables us to measure the correlates between compliance and demographic attributes. We estimate the following regression equation:

$$c_{i,s} = \beta_0 + \delta d_i^{treat} + X_{i,s}^{'}\Phi + \mu_{i,s} + \epsilon_{i,s} \tag{1}$$

Where c is a binary term for whether individual i in place s changed their dietary habits following the reinstatement, where yes takes the value of 1 and no takes the value of 0. β_0 represents the intercept term. d_i^{treat} is a dummy variable that takes the value of 1 if individual i was surveyed in England or Wales, and zero otherwise. X' is a vector of demographic attributes (age, income, gender, education) for individual i. μ_i represents country/region fixed effects. ϵ represents the error terms.We adjust the standard errors for clustering at the UK NUTS 1 level (Abadie, Athey, Imbens and Wooldridge 2017).

The OLS results can be interpreted as a linear probability model. As can be seen from Table 2 below, those in the treatment group are much more likely to have changed in behaviour - by approximately 10 *percentage points*. It can also be seen that females are approximately 9 percentage points less likely to have changed their behaviour, along with older people.

Table 2: Stated behavioural change in dietary habits

	Behaviour Change
Treatment (England and Wales)	0.0987***
	(0.000)
Female	-0.0891***
	(0.033)
Education	0.0417*
	(0.022)
Age	-0.0470***
	(0.017)
Income	0.0191
	(0.014)
Constant	0.424***
	(0.000)
Country/Region FE	Yes
Observations	452
R^2	0.158

Notes:Wild bootstrap clustered at UK NUTS Level 1 (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

We now present the survey results of the sub-sample of Catholics in England and Wales. This helps us to better understand the degree of compliance and reasons for non-compliance. As can be seen in Figure 1 below, of those who were sampled in England and Wales who identified as Catholic (413 people in total), 28 percent answered that the reinstatement of the practice of not eating meat on Fridays changed their dietary habits. Of those who changed their dietary habits (Figure 2), 55 percent answered that they reduced their meat consumption on Fridays, 41 percent answered that they stopped eating meat on Fridays, and 4 percent answered Other

(such as eating more ethically).

Of the 72 percent who stated that it did not influence their dietary habits, the main stated reasons for noncompliance were preferring to decide what to eat themselves or not knowing of the change. Specifically, as can be seen in Figure 3, 1 percent answered that they lived outside England or Wales, 35 percent answered that they did not know of the change, 18 percent answered that they already did not eat meat on Fridays, 56 percent answered that they prefer to decide themselves what to eat, and 3 percent answered that other people choose their meals. Note that for this question (due to the possibility of multiple reasons for non-compliance) respondents were able to choose more than one answer. The survey results indicate that approximately 41 percent of Catholics changed their dietary habits or were already not eating meat on Fridays following the reinstatement of meatless Fridays in England and Wales (Figure 4).[22]

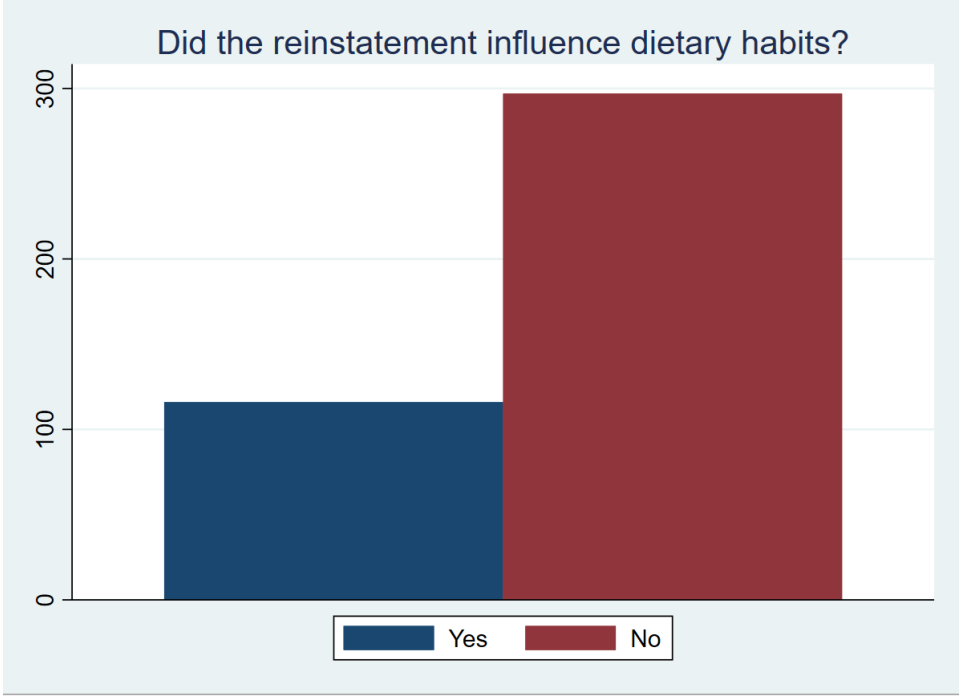

Figure 1: Stated change in dietary habits

[22]The survey results indicate that approximately one quarter (24 percent) of English and Welsh Catholics stated that they are fully compliant with the obligation of meatless Fridays (47 stopped eating meat on Fridays and 54 already did not eat meat on Fridays).

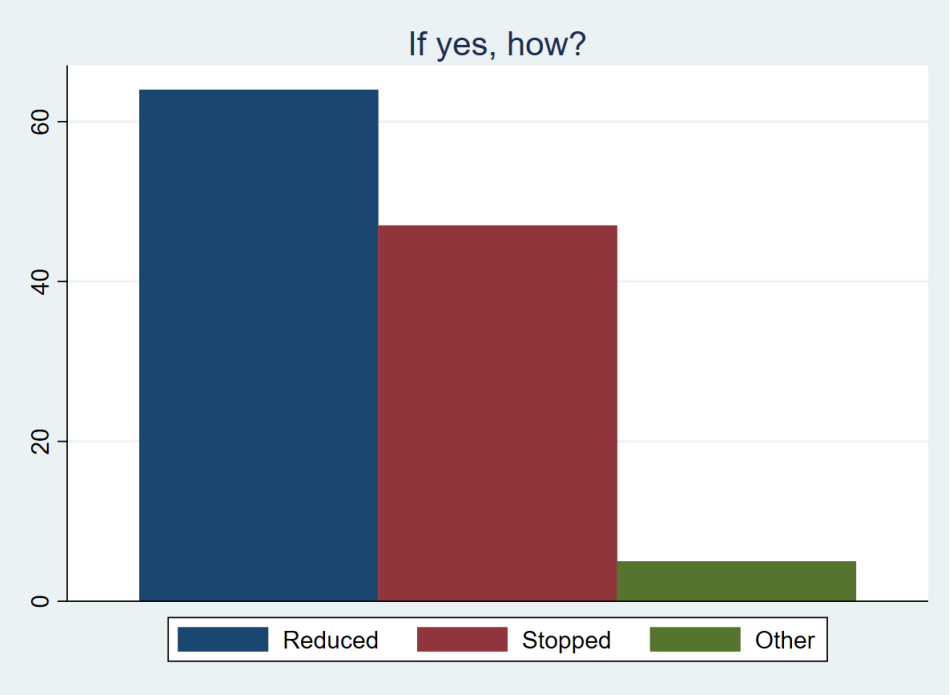

Figure 2: Stated change in dietary habits

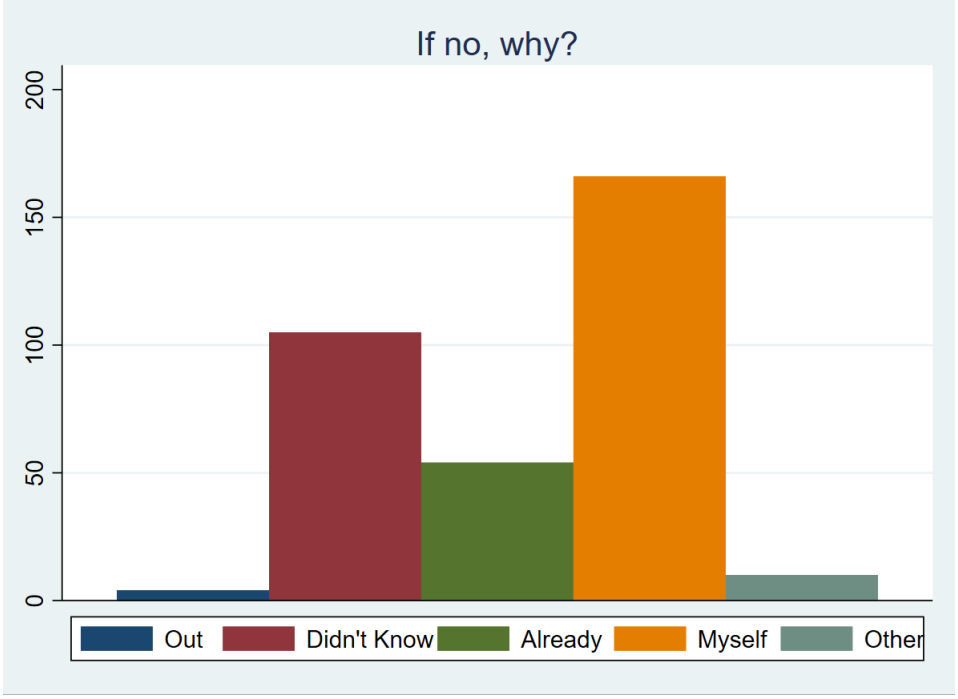

Figure 3: Reasons for not changing dietary habits

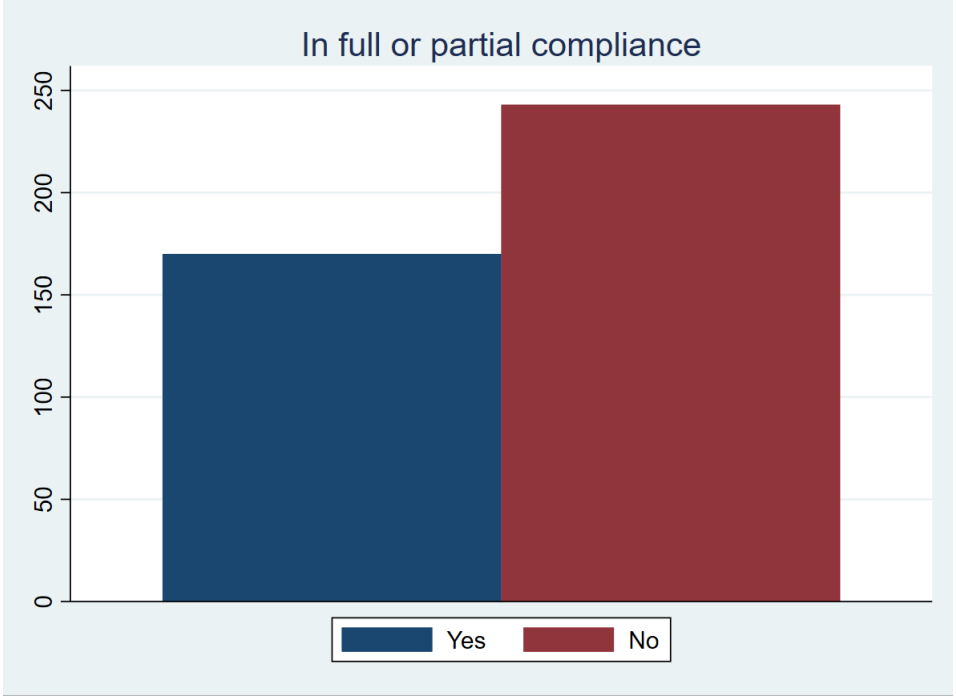

Figure 4: Compliance

4.3 NDNS Consumption Data

In addition to collecting ex-post survey data, we also use the National Diet and Nutrition Survey (NDNS) dataset in an effort to detect any consumption changes following the re-introduction of meatless Fridays for English and Welsh Catholics. The NDNS dataset is a yearly cross sectional survey designed to collect data on diet, nutrient intake and nutritional status of the UK population. It is administered by Public Health England. The first year of the survey was 2008-09 and each year a broadly representative sample of around 1000 (500 adults and 500 children) take part. The survey comprises of an interview, a 4-day estimated diet diary, and physical measurements and a blood and urine sample for a sub-sample of participants. We utilise the 4-day diet diary, that includes an estimate of dietary intake for each of the four days. Our dependent variables are grams of meat and fish eaten. As the obligation applies to people of 14 years and above, we exclude all children below this age from our analysis. The survey includes some demographic and economic control variables.[23] Unfortunately, the dataset does not contain any information on a respondent's religion. This limits our identification strategy, as we only have data on treatment and control *jurisdictions*, and Catholics are a minority in each of the constituent countries of the UK. Despite an extensive search for potential databases, we have concluded that the NDNS dataset provides the best opportunity available to us to measure any consumption changes following the reinstatement.

[23]Due to incomplete responses we are constrained in the controls that we can apply

4.4 NDNS Descriptive Statistics

Table 3a contains the descriptive statistics for the full NDNS dataset for the period from 2008 to 2015.[24] As can be seen, average meat consumption for the full sample is 101.6 grams per day, while average fish consumption is 19.92 grams.

Given that only some Catholics in the UK were subjected to the new obligation from September 2011 onwards and others were not, we define treatment and control jurisdictions based on the different bishops' conferences. The treatment jurisdiction is England and Wales and the control jurisdiction is Scotland and Northern Ireland.

It can also be seen that the treatment jurisdiction eats less meat and more fish on average than the control jurisdiction. In terms of average meat consumption, the treatment jurisdiction consumes 99.81 grams, while the control jurisdiction consumes 105.8 grams. In terms of average fish consumption, it is 21.07 grams for the treatment jurisdiction and 17.22 for the control jurisdiction.

[24]The list of variables is provided in the Appendix, Figure A2

Table 3: NDNS Descriptive Statistics

(a) NDNS Descriptive Statistics (Aggregate Sample)

	Total Sample				Treat				Control			
Variable	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**
Meat(g)	101.6	91.88	0	1000	99.81	92.38	0	1000	105.8	90.55	0	832
Fish (g)	19.92	46.91	0	600	21.07	48.34	0	600	17.22	43.21	0	445
Treat	0.703	0.457	0	1	1	0	1	1	0	0	0	0
Post	0.472	0.499	0	1	0.549	0.498	0	1	0.288	0.453	0	1
TreatXPost	0.386	0.487	0	1	0.549	0.498	0	1	0	0	0	0
Female	0.567	0.496	0	1	0.564	0.496	0	1	0.572	0.495	0	1
Age	41.83	20.31	14	96	42.32	20.31	14	96	40.66	20.25	14	93
Ethnicity: White	0.925	0.263	0	1	0.903	0.295	0	1	0.976	0.154	0	1
Ethnicity: Mixed	0.0117	0.108	0	1	0.0146	0.12	0	1	0.00503	0.0707	0	1
Ethnicity: Black	0.0192	0.137	0	1	0.0257	0.158	0	1	0.00402	0.0633	0	1
Ethnicity: Asian	0.0289	0.167	0	1	0.0379	0.191	0	1	0.00755	0.0865	0	1
Log Income	10.05	0.767	6.88	12.13	10.08	0.762	6.888	12.13	9.979	0.773	6.88	12.13
Observations	26743				18791				7952			

(b) NDNS Descriptive Statistics (Fridays)

	Total sample				Treat				Control			
Variable	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**
Meat(g, Fri)	94.77	87.86	0	713.2	93.29	88.42	0	713.2	98.23	86.04	0	597.5
Fish(g, Fri)	24.62	51.54	0	541	25.63	52.68	0	541	22.22	48.65	0	388.3
Treat	0.705	0.456	0	1	1	0	1	1	0	0	0	0
Post	0.459	0.498	0	1	0.542	0.498	0	1	0.263	0.440	0	1
TreatXPost	0.382	0.486	0	1	0.542	0.498	0	1	0	0	0	0
Female	0.565	0.496	0	1	0.563	0.496	0	1	0.571	0.495	0	1
Age	41.89	20.35	14	94	42.27	20.30	14	94	40.96	20.47	14	93
Ethnicity: White	0.920	0.272	0	1	0.899	0.301	0	1	0.970	0.172	0	1
Ethnicity:Mixed	0.0132	0.114	0	1	0.0155	0.124	0	1	0.00760	0.0869	0	1
Ethnicity:Black	0.0204	0.141	0	1	0.0272	0.163	0	1	0.00422	0.0649	0	1
Ethnicity:Asian	0.0314	0.174	0	1	0.0399	0.196	0	1	0.0110	0.104	0	1
Ethnic:Other	0.0152	0.122	0	1	0.0184	0.134	0	1	0.00760	0.0869	0	1
Log Income	10.04	0.759	6.880	12.13	10.08	0.743	7.209	12.13	9.946	0.787	6.880	12.13
Observations	4016				2832				1184			

Table 3b contains the descriptive statistics for average consumption for Fridays only.[25] As can be seen, average meat consumption is lower than the overall average at 94.77 grams while average fish consumption is higher at 24.62 grams. It can also be seen that the treatment jurisdiction (England and Wales) consume less meat than the control jurisdiction (Scotland and Northern Ireland) on Fridays, at 93.29 grams compared to 98.23 grams. The treatment jurisdiction consumes more fish than the control jurisdiction on Fridays. The treatment jurisdiction consumes 25.63 grams compared to the control jurisdiction with 22.22 grams. Indeed, based on consumption data cut for each day of the week (see Table A2) meat consumption is lowest on Fridays while fish consumption is highest, for both for the control and treatment jurisdictions, in part capturing the British tradition of eating fish (and chips) on Fridays. In relation to the control variables, it can be seen that the average age of the sample is approximately 42 years

[25]Due to the potential for substitution of consumption over days, we cut the dataset by day. The descriptive statistics are provided in Appendix, Table A1

(remembering children below 14 years are excluded from the sample) and that females make up approximately 57 percent of the sample. Those in the treatment jurisdiction are slightly older, more ethnically heterogeneous, and have higher income levels than those in the control jurisdiction (see the Balance Test in the Appendix).

Using full dataset with controls, we have a total of 26,743 observations, with 18,791 for the treatment jurisdiction and 7952 for the control jurisdiction. For the dataset cut for Fridays only, there are 4016 observations in total, with 2832 for the treatment jurisdiction and 1183 for the control jurisdiction.[26]

Next we present the consumption trends over the sample period for our two main variables of interest: average meat consumption on Friday and average fish consumption on Friday.[27] As can be seen, there is considerable variation from year to year, particularly for the control jurisdiction averages, which is likely, in part, to be due to their small sample sizes. As can be seen below, average meat consumption falls in the treatment jurisdiction in 2012 (following the Bishop's statement) while average fish consumption increases - however this does not seem to be a permanent shift. More generally, a visual inspection of the pre-trend data shows some consistent movement between the treatment and control jurisdictions before the reinstatement, but also some variation. There are also some sharp movements in the control jurisdiction for which there is no obvious explanation - other than year-to-year noise generated by small sample sizes, which is a particular issue given the control jurisdiction's smaller population. It must be remembered that Catholics make up approximately 10 percent of the UK's population, and that the sample size is only approximately 600 people in total (both treatment and control jurisdictions) per year.

Despite not being able to fully satisfy the parallel pre-trends assumption, we proceed with a difference-in-differences estimation. We do so on the basis that despite the potential for year-to-year noise generated by small sample sizes, it can provide us with an estimate for the post-period as a whole. Importantly a difference-in-differences estimation allows us to account for UK-wide consumption trends and shocks, such as the 2013 beef/horsemeat substitution scandal that led to consumption changes across the UK (and Europe).[28] In doing so, we concede that we are unable to make a causal claim from our NDNS econometric results, but rather proceed with

[26] As can be seen, post variable for the control jurisdiction is 0.288 and 0.262 compared to 0.549 and 0.524 for the treatment jurisdiction. These figures highlight a change in the sampling strategy of the NDNS survey in 2012. The sampling originally had boosters for Scotland, Wales and Northern Ireland. However from 2012, the sampling quota for these countries became more in line to their proportion of overall UK population.

[27] Due to variation in sampling rates over time for Scotland, Wales and Northern Ireland we weight the country average by its proportion to the treatment (England and Wales) and control (Scotland and Northern Ireland) population, using ONS Census data for 2011. Under this approach, the England average is weighted 0.95 and Wales is weighted 0.05 for 'treat' and the Northern Ireland average is weighted 0.25 and the Scotland average is weighted 0.75 for 'control'.

[28] See for example, https://www.ft.com/content/df08e7ee-7394-11e2-9e92-00144feabdc0

the aim of measuring consumption that would be either consistent, or inconsistent, with stated compliance given the available data.

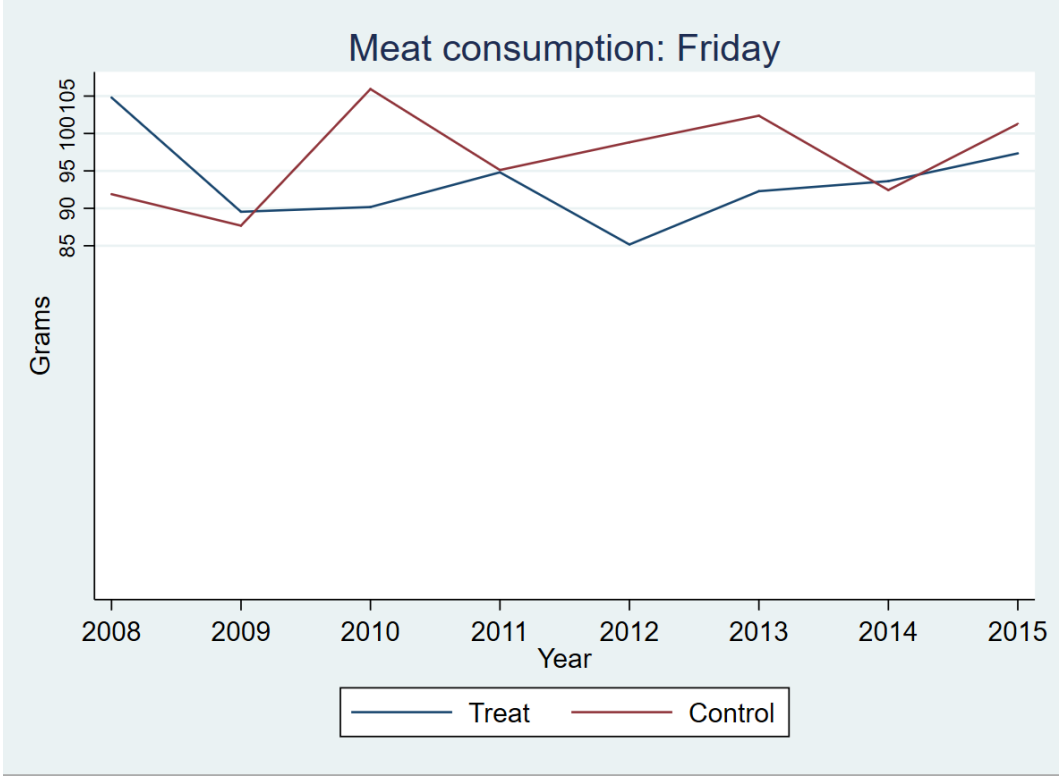

Figure 5: Average meat consumption on Friday

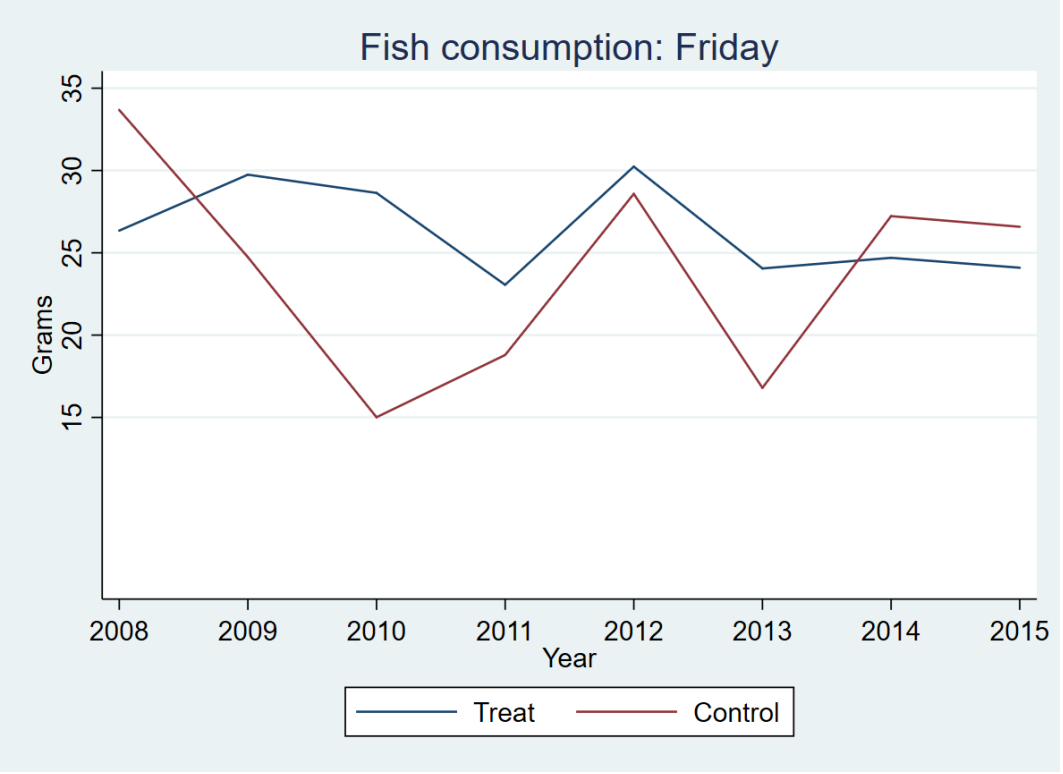

Figure 6: Average fish consumption on Friday

4.5 Estimation Method

To measure the change in consumption between our treatment and control jurisdictions following the reinstatement of meatless Fridays for English and Welsh Catholics, we estimate an OLS difference-in-differences regression:

$$c_{its} = \beta_0 + X'_{its}\Phi + \zeta d_{it}^{post} + \gamma d_{is}^{treat} + \delta(d_{it}^{post} \cdot d_{is}^{treat}) + \epsilon_{its} \tag{2}$$

Were c is meat or fish consumption for individual i, at time t, in jurisdiction s. β_0 represents the intercept term, X' is a vector of demographic attributes for individual i, d_{it}^{post} represents the post September 2011 dummy, d_{is}^{treat} represents the country dummy where Catholics were treated (whether the individual i is situated in England or Wales), and $(d_{it}^{post} \cdot d_{is}^{treat})$ is the difference-in-differences interaction term. ϵ represents the error terms. We adjust the standard errors for clustering at the UK NUTS Level 1 level (Abadie, Athey, Imbens and Wooldridge 2017).[29]. Due to the small number of clusters (12) we apply wild bootstrapped cluster adjusted

[29]This sees the following 12 clusters (Scotland, Wales, Northern Ireland, North East , North West, Yorkshire and the Humber, East Midlands , West Midlands, East of England, London, South East, South West). This is the level is the level at which treatment is applied and the NDNS dataset is stratified at the country and regional level

standard errors throughout (Cameron et al 2008). In addition, for robustness, and based on the work of Canay et al (2018), we only report the p-values for wild bootstrapped tests based on Rademacher weights.

4.6 NDNS Results

We present our results measuring any change in meat and fish consumption for the treatment group relative to the control jurisdiction in the post period in Table 4. The first two columns present the fish and meat results for the aggregate data while the second two columns present the results for Fridays only.

As can be seen below, the results for meat consumption are consistent with a change in behaviour (by a minority of individuals) in the treatment jurisdiction. There is a relative decrease in meat consumption both in aggregate and on Fridays. However, we do not find any statistically significant change in fish consumption. Table 4 below reports the summary estimates for each dependant variable when all available controls are included (full results tables for each variable with and without controls are included in the Appendix).

As can be seen from the first column in Table 4, the coefficient for the difference-in-differences coefficient for individual meat consumption is negative. With the inclusion of all the control variables (sex, age, ethnicity and log income), the coefficient is -2.95. This indicates that average daily individual meat consumption was approximately three grams lower in the treatment jurisdiction post implementation, relative to the control group (or approximately 21 grams over a week). The coefficient is significant at the 10 per cent level. While the R^2 grows with the inclusion of the control variables, it remains quite low at 0.053, a characteristic of all of the consumption estimations. Using the same dataset, previous research by Stewart et al (2021) has shown that in the *UK* average daily meat consumption has decreased by 17.4g over the period 2008-2019, primarily through a reduction in the consumption of red meat and processed meat. Our results suggest that part of this reduction came from the reintroduction of meatless Fridays for Catholics. The results from the second column of Table 2 shows that the coefficient for fish consumption is small (1.6 grams) and statistically insignificant.

In columns 3 and 4, provide the results for Equation 2 as above, but for data from Fridays only to better pin-point the impact. The coefficient meat consumption is negative and statistically significant at the one percent level, with a coefficient of -8.232. This indicates that average individual meat consumption fell by approximately 8 grams in the treatment jurisdiction following the introduction of obligation, relative to the control group. Column 4 reports the results for fish consumption and shows a coefficient of 2.057 grams with all available controls. However, as for the aggregate data, the coefficient is not statistically significant.

Table 4: Summary estimations for NDNS Consumption Data

	Meat(Agg)	Fish(Agg)	Meat(Fri)	Fish(Fri)
TreatXPost	-2.950*	1.604	-8.232***	2.057
	(1.662)	(1.163)	(2.859)	(2.454)
Treat	-4.049	2.234	-2.294	1.615
	(5.605)	(1.735)	(3.670)	(3.166)
Post	1.220***	-2.937***	6.505***	-3.245***
	(0.000)	(0.950)	(0.000)	(1.049)
Female	-38.61***	-3.219***	-32.65***	-7.302***
	(12.494)	(1.042)	(10.559)	(2.361)
Age	-0.338***	0.264***	-0.371***	0.413***
	(0.109)	(0.000)	(0.120)	(0.000)
White	4.189	-12.15***	-4.283	-1.932
	(5.085)	(3.930)	(13.552)	(6.550)
Mixed	1.953	-0.277	-11.67	5.855
	(8.583)	(0.053)	(20.330)	(8.803)
Black	9.429**	-2.827	-13.81	12.97
	(4.053)	(3.416)	(16.976)	(10.529)
Asian	-19.88***	-7.190*	-12.76	2.112
	(7.496)	(4.024)	(17.666)	(8.879)
Log Income	2.596	4.248***	4.406*	3.210***
	(1.670)	(0.000)	(2.360)	(0.000)
Constant	111.4***	-21.28***	91.04**	-19.84**
	(0.000)	(6.884)	(40.878)	(9.560)
Observations	26743	26743	4016	4016
R^2	0.053	0.023	0.045	0.037

Notes:Wild bootstrap clustered at UK NUTS Level 1 (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.7 Robustness of NDNS Results

We aim to provide some robustness analysis by estimating Equation 2 for each day of the week. This also enables to investigate whether any inter-week substitution may have occurred. Second, as an additional check for robustness, we also report the p-values for the wild bootstrap tests using Rademacher weights. These weights are recommended for use when there a small number of clusters (See Canay et al 2018).

As can be seen in Table 5 below, the only coefficient (using p-values generated from Rademacher weights) with a significance level at any recognised level is Friday meat consumption. Some of the day coefficients are negative (Monday, Tuesday, Friday and Saturday) and some are positive (Wednesday, Thursday and Sunday). The fish consumption coefficients are positive for all days (except Mondays) but all insignificant.

When looking at our consumption results in the whole, we cannot rule out other factors which

may coincide with the reintroduction of meatless Fridays that could have influenced our results (omitted variable bias). Due to missing data, we are only able to apply a limited number of control variables, and throughout the consumption equations the R^2 is relatively low. However, the difference-in-differences approach should remove the impact of any UK wide factors that influences the demand for meat; moreover, any time-varying omitted control variables would have to be systematically correlated with both the consumption of meat, and the treatment allocation. While this is certainly a possibility, for instance higher uptake rates of vegetarian or vegan diets by country, it would not easily explain our results showing a significant decrease in meat consumption on Fridays (Table 5).[30]

Table 5: Summary of boottest with Rademacher weight, NDNS

Fish Consumption	Mon	Tue	Wed	Thu	Fri	Sat	Sun
TreatXPost	-0.429	0.470	0.142	1.770	2.057	1.980	3.538
pvalue	0.838	0.868	0.950	0.737	0.439	0.667	0.290
Meat Consumption	Mon	Tue	Wed	Thu	Fri	Sat	Sun
TreatXPost	-2.065	-10.418	3.365	0.330	-8.23*	-8.896	5.932
p-value	0.465	0.163	0.669	0.964	0.088	0.430	0.272
Observations	3740	3561	3497	3733	4016	4061	4135

Notes: Wild bootstrap clustered at Country/Region level (Scotland, Wales,Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) with 1000 iterations. The estimations control TreatXPost, Treat, Post Age, Female, Ethnicity, and log of income. The brief descriptive statistics is provided in Table A1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.8 Comparing NDNS and survey results

Our survey results indicate that 28 percent of Catholics in England and Wales changed their dietary habits following the reinstatement. Of these, 41 percent stated that they stopped eating meat and 55 percent reduced their meat consumption. We also know that Catholics make up approximately 10 percent of the population and that average daily meat consumption in England and Wales is approximately 100 grams. If we assume that those who reduced their meat consumption (on average) halved it, this would amount to an approximate 2 gram reduction of meat consumption.[31] This figure is approximately a quarter of the 8 gram estimate from our econometric analysis.

[30]Interestingly, the coefficient for meat consumption for Tuesday is the highest for any day, and the p-value is relatively low at 0.16 using Rademacher weights. Taken with our other results, this does seem to suggest that other factors are also influencing consumption patterns in England and Wales relative to Scotland and Northern Ireland.

[31]100*0.1*0.28*(0.41 + 0.55*0.5)=1.92

While our two point estimates differ, when taken together, they both provide evidence that there was partial compliance with the reinstatement of meatless Fridays in England and Wales. Some divergence in estimates is to be expected, given the very different data sources and estimation methods. In addition to the various potential biases from both datasources and methods,[32] the differing estimates could also be driven by other systematic differences in consumption behaviour between the treatment and control groups in the post-period - such as a higher uptake of veganism and vegetarianism in England and Wales or changes in demographic factors that are known to be correlated with meat consumption (Stewart et al 2021), or the potential for inter-dependencies or spillover effects given that meals are often jointly consumed (for example, at the household, friendship, organisational level).[33]

5 Implications Climate Change Mitigation

In this section we estimate the carbon footprint implications for the return to meatless Fridays for Catholics in England and Wales. While focusing on the climate change mitigation impacts, we acknowledge that there are also likely to be other substantial human health and sustainably co-benefits from the reduced meat consumption, including increases human health and reduced morbidity; and reduced biodiversity loss, land use change, and use of water and pollutants (Willett et al 2019). While not a stated aim of the bishops, the sustainability implications were discussed and speculated at the time.[34] As stated in the Introduction, it is also noteworthy that Pope Francis has emphasised the importance of personal responsibility in changing the collective response to the threat of climate change and environmental degradation.[35]

We use our most conservative estimate of the decrease in weekly meat consumption. This equates to an average 2 gram decrease meat consumption per week per working-age person for England and Wales.[36]

[32]For instance, the recall method can suffer from measurement error due to imperfect recall or deliberate misstatement (see Sanchez de la Sierra 2020). The NDNS data is also not without its limitations, including a small sample size which is particularly challenging when aiming to measure a change in behaviour of a small subgroup, and the limited availability of control variables for the econometric estimation

[33]Also, presumably Catholic institutions (schools, universities, hostels, and hospitals) would have increased the provision of non-meat based meals on Fridays that would also be consumed by a proportion of non-Catholics; households eating non-meat alternatives on Fridays for main meals even if some (or most) members (or visitors) are non-Catholic; and the choice of venue for social activities on Fridays (for example, a group of mixed-faith friends deciding to eat in a vegetarian restaurant rather than a steakhouse on a Friday).

[34]For instance, see De Souza (2011) https://www.catholiceducation.org/en/controversy/common-misconceptions/catholics-are-once-again-embracing-meatless-fridays.html and Barbieri (2011).

[35]See for instance, the Pope's statement in the lead-up to COP26 https://www.bbc.co.uk/news/world-europe-59075041

[36]In doing so, we acknowledge that this entails a number of simplifying assumptions, including not accounting for intra-week substitution of non-meat meals across days or potential complement effects due to changes in tastes or habits from the reintroduction of the obligation.

Multiplying the 2 gram meat reduction by the working age population (40 million people) of England and Wales equates to a decrease in meat consumption of approximately 80 tonnes per week (or 4,160 tonnes per year). Working on the basis of an average (meal) portion of meat being 90 grams, this equates to approximately 875,000 less meat meals per week (or 46 million per year).

We next estimate the greenhouse gas implications. To do this, we present Table 6 below, listing the main protein rich foods, average daily consumption by non-meat eaters and meat eaters in our sample, and the equivalent mean greenhouse gas emissions (kg CO2eq) per kilo eaten (as calculated by Poore and Nemecek (2018)[37].

Table 6: Consumption and Emissions for Foods

Protein Rich Foods	**Daily Consumption: Non-Meat Eaters (g)**	**Daily Consumption: Meat Eaters (g)**	**Emissions per kg of food consumed (kg CO2 eq)**
Fish [a]	46	14	6.0
Cheese	23	17	11.0
Beans & Nuts	23	14	0.7
Beef [b]	0	23	50.0
Lamb	0	6	20.0
Pork [c]	0	25	7.6
Other/Processed red meat [d]	0	27	25.9
Chicken/bird	0	44	5.7
Total of Protein Rich Foods	92	170	
Total Food Consumed	462	519	

Notes: All estimates are derived from Poore and Nemecek's (2018) mean estimates (and where 1 kilo of food eaten equates to approximately 100 grams of protein). a) Includes shell fish; b) emissions estimate for beef herd; c) includes sausages; d) emissions based on weighted average of read meat; e) includes all bird (including game). emissions estimate based on poultry meat.

One kilo of high protein food that is typically eaten by non-meat eaters contains approximately 6 kilos of CO2.[38] This compares to a weighted average of meat eaten at 19.3 kilos of CO2 per

[37]We note that in doing so we a number of simplifying assumptions, including equivalent protein content per kilo eaten and the use of international averages

[38]This is based on a weighted average. As can be seen in Table 5, non-meat eaters eat much more non-meat sources of protein. The main sources of non-meat protein food eaten by non-meat eaters are fish (50 percent of protein rich foods eaten), beans and nuts (50 percent), and Cheese (25 percent). For meat eaters, these three foods together approximate 26 percent of protein rich foods eaten. The rest is made of meat. The main meats eaten are Chicken (26 percent of protein rich foods eaten), Other/Processed Red Meat (16 percent), Pork (14 percent), Beef (14 percent), and lamb (4 percent). We can also see that protein from meat, normally results in higher greenhouse gas emissions, with beef being the highest contributor with a mean of 50 (kg CO2 eq) for 1kg eaten, followed by lamb (20 kg CO2 eq), pork (7.6 kg CO2 eq) and chicken (5.7 kg CO2 eq). These compare to cheese (11 kg CO2 eq), Fish (6 kg CO2 eq) and beans and nuts (0.7 kg CO2 eq).

kilo eaten. That is, an average high protein non-meat diet contains approximately one third of greenhouse gas emissions per kilo compared to a weighted average of meat eaten.

If we assume that those who stopped eating meat on Friday adopted the average high protein element of a non-meat eater's diet,[39] the average 2 gram reduction (multiplied by the English and Welsh working age population of 40 million), produces a weekly saving of approximately 1,070 tonnes of CO2 per week (or 55,000 tonnes over a year).[40]

6 Religious Impacts

When announcing the reintroduction of meatless Fridays, the bishops noted that while Fridays had remained set aside for penance, individual discretion over its form has meant that many Catholics had forgotten to do any penance at all. They expressly hoped that in re-specifying the form of penance that it would encourage more prayer and charitable works. As discussed above, they also hoped that it would lead to a greater sense of identity, by uniting Catholics in a common tangible practice - that could be shared with fellow followers and visible to the wider community. In short, the bishops saw meatless Fridays as a complement, rather than a substitute to other forms of religiosity. As discussed above, this consistent with the analysis of Iannaccone (1992), who theorises that more stringent obligations may lead to increased religious satisfaction and commitment. [41] While measuring the religious impacts is important in its own right for those studying the economics of religion, it also enables us to measure the potential welfare costs or benefits from the reintroduced obligation. If the reintroduction led to an increase (or no change) in religious participation and satisfaction, we could conclude the environmental benefits were likely to be a costless by-product. However, if they led to a fall in participation and satisfaction we could conclude the environmental benefits would need to be weighed against the welfare costs.

6.1 Understanding Society Dataset

The Understanding Society dataset is generated from UK wide longitudinal survey of around 51,000 (Wave 1) individuals. The dataset is representative of the UK population for a range of

[39]While it would be theoretically possible to substitute meat for non-meat protein rich foods and increase carbon emissions (e.g wholly substituting chicken for cheese), based on current consumption patterns this seems unlikely.

[40]The greenhouse savings per gram of substituted protein are approximately 13 grams.

[41]He assumes that a person's religious satisfaction depends on both the inputs of the individual and those of others within the group. Therefore, the collective club good, is prone to suffer from free riding. Religious groups can penalise or prohibit alternative (secular) activities that compete for members' time and resources. This changes the relative price between religious and secular activities, inducing substitution toward religious activities. Due to the positive externalities from increased participation, this can lead to increased average utility within the group.

demographic and socioeconomic variables (sex, age, ethnicity, region, income, and car ownership). While some questions are asked in each wave, others are asked intermittently, including those related to religious observance and its importance in one's life. Specifically, we analyse the following two questions for those individuals who identify as Catholic in Wave 1. The first is, "How often, if at all, do you attend religious services or meetings?" With the potential responses being: 1. once a week or more; 2. less often but at least once a month; 3. less often but at least once a year; 4. never or practically never. The second question being "How much difference would you say religious beliefs make to your life?". Withe the potential responses being: 1. being a great difference; 2. some difference; 3. a little difference; 4. no difference. Note that for both questions, a lower value indicates a higher degree of self-reported religiosity. Usefully for our analysis, these two questions were asked in Wave 1 (data collected between Jan 2009-Jun 2011) and Wave 4 (data collected between Jan 2012-Jun 2014). The dates of these waves enable us to measure religious service attendance and importance of religion to one's life pre-and-post the reinstatement of the obligation (which occurred in September 2011). Of the 50,994 responses in Wave 1 for England, Wales, Scotland and Northern Ireland 4,770 (9.4 per cent) identified as Catholic. [42]

6.2 Descriptive Statistics

Table 7 below provides the descriptive statistics of our sample of 5328 observations (2664 individuals in total), with 4074 for the treatment group and 1254 for the control group for our individual fixed effects regressions. This sample includes all those who identified as Catholic in Wave 1 and who answered "attendance" and "difference" questions in both Waves 1 and 4.[43]

[42]The dataset contains responses to the following question 'Which religion do you regard yourself as belonging to?' There is attrition both in terms of the total number of survey respondents and those identifying as Catholic. In Wave 4, the total number of respondents is 47066 with 4212 Catholics (8.95 per cent). See https://www.understandingsociety.ac.uk/documentation/mainstage/dataset-documentation/index/religion

[43]While being a longitudinal survey, the attrition rate is non-negligible. Of those who identified as Catholic in Wave 1, 2229 remain in Wave 4. 42 percent dropped out of the survey altogether (non-responsiveness and ineligibility due to moving, institutionalisation or death). The remainder, approximately 10 percent, are made up of loss or religion or conversion to other religions. 282 (approximately 6 percent) of Catholics in Wave 1 reported 'no religion' in Wave 4 (6 percent in England and Wales and 5 percent in Scotland and Northern Ireland). A smaller number of 179 (approximately 4 percent) reported conversion to another faith (163 in England and Wales (4 percent) and 13 (1 percent) in Scotland and Northern Ireland). By including all those who reported to be Catholic in Wave 1, and who answered the religious questions in Wave 4 we are able to estimate the average treatment effect (of those treated) regardless if they remained Catholic or not.

Table 7: Understanding Society Descriptive Statistics: Catholics

	Total sample				Treat				Control			
Variable	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**
Attendance	2.581	1.262	1	4	2.695	1.238	1	4	2.211	1.270	1	4
Difference	2.243	1.080	1	4	2.250	1.089	1	4	2.220	1.049	1	4
TreatXPost	0.382	0.486	0	1	0.500	0.500	0	1	0	0	0	0
Treat	0.765	0.424	0	1	1	0	1	1	0	0	0	0
Post	0.500	0.500	0	1	0.500	0.500	0	1	0.500	0.500	0	1
Age	48.92	16.61	16	98	49.05	16.71	16	98	48.52	16.31	16	98
Female	0.630	0.483	0	1	0.636	0.481	0	1	0.611	0.488	0	1
H-EDU	0.392	0.488	0	1	0.406	0.491	0	1	0.344	0.475	0	1
M-EDU	0.346	0.476	0	1	0.352	0.478	0	1	0.325	0.468	0	1
L-EDU	0.263	0.440	0	1	0.242	0.428	0	1	0.331	0.471	0	1
NumbChild	0.609	0.995	0	8	0.613	0.998	0	8	0.596	0.984	0	6
Married	0.537	0.499	0	1	0.542	0.498	0	1	0.521	0.500	0	1
Observations	5328				4074				1254			

It can be seen, both attendance and meaningfulness is lower in England and Wales compared to the control group of Scotland and Northern Ireland, but that meaningfulness is quite similar between both groups (remembering that a lower mean value represents higher frequency attendance and a bigger difference to one's life).

In terms of the control variables, the average age is 49 years and there is a higher proportion of females identifying as Catholic at 63 percent. It can also be seen that the treatment and control groups are similar. In terms of other time varying variables there is a high degree of similarity between the treatment and control groups[44].

We next present the parallel trends graphs. While the first wave of the Understanding Society began in 2009, it was preceded by the smaller British Household Panel Survey (BHPS). The survey began in 1991 with 10,300 individuals in its first wave. For the graphs, we combine the BHPS mean values with the mean values of the Understanding Society dataset to examine the parallel trends before and after the reinstatement of the meatless Fridays obligation.[45]

As can be seen, attendance is consistently lower in the control group, remembering a higher value indicates lower frequency. The attendance means largely move in tandem, although there is some divergence between 1999 and 2004. The mean values for difference to one's life are very similar in both the treatment and control groups, both in terms of absolute value and variation.

[44]See Appendix for Balance Test that sees no difference for all variables except for one of the education variables

[45]The sample size for 1991 is 907, 1997 is 917, 1999 is 1309, 2004 is 1916, 2008 is 881, 2009 is 4064 and in 2012 is 3157. The 2012 mean value for the Understanding Society dataset are of those who identified as Catholic in Wave 1.

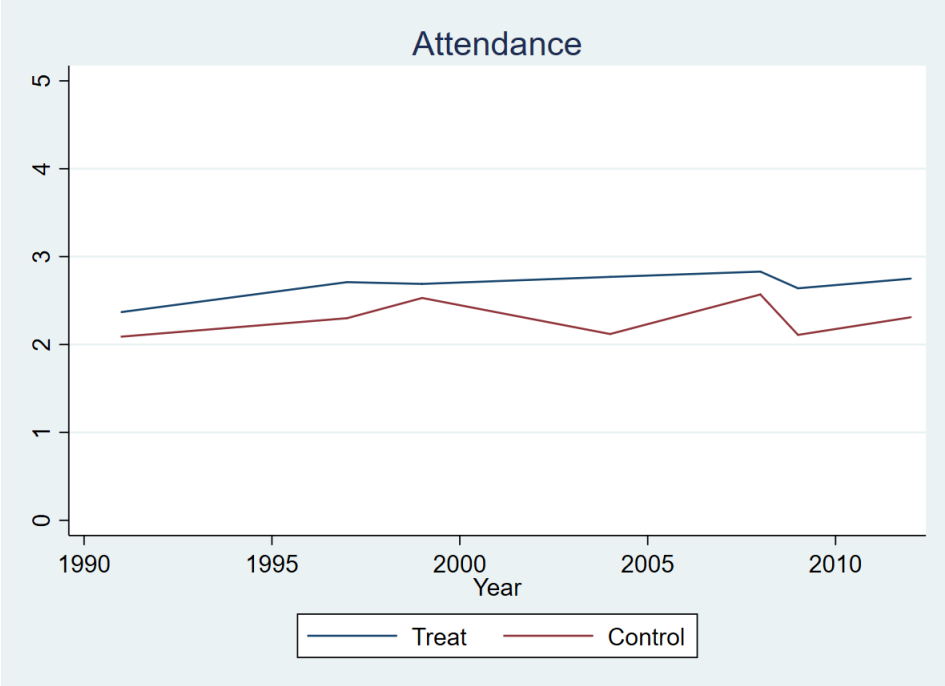

Figure 7: Mean of Attendance

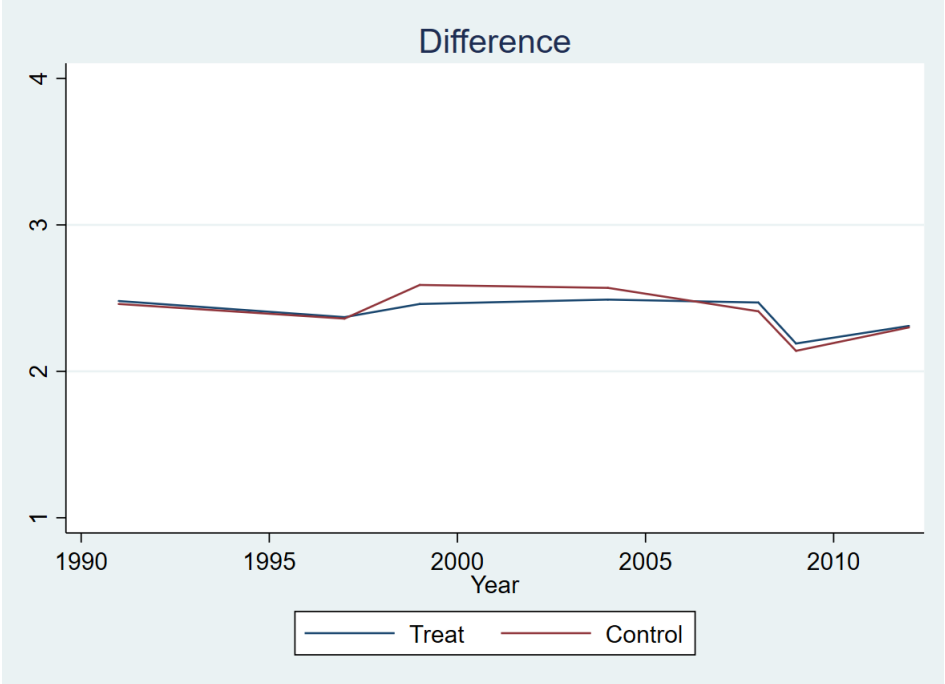

Figure 8: Mean of Difference to One's Life

6.3 Estimation Method

In addition to estimating Equation (2) for our measures of religiosity, we also estimate the following equation with individual fixed effects (given that the Understanding Society dataset is a longitudinal panel):

$$r_{its} = \alpha_i + X'_{its}\Phi + \delta_0 d_{it}^{post} + \delta_1 (d_{it}^{post} \cdot d_{is}^{treat}) + \epsilon_{its} \tag{3}$$

Where r is the religious outcome for individual i, at time t, in country s. α_i represents non-time varying individual fixed effects, X' is a vector of time varying individual characteristics, d_{it}^{post} represents the post September 2011 dummy, d_{is}^{treat} represents the treatment dummy (whether the individual i is situated in England or Wales), and $(d_{it}^{post} \cdot d_{is}^{treat})$ is the difference-in-differences interaction term. The use of individual fixed effects enables us to estimate the within individual effects over the time period. Given the categorical nature of our religious dependent variables, we estimate the equation using OLS (Ferrer-i-Carbonell and Frijters 2014). Our estimates can be interpreted as employing a linear probability model. ϵ represents the error term. We adjust the standard errors for clustering at the UK NUTS 1 level (Abadie, Athey, Imbens and Wooldridge 2017).[46]. Due to the small number of clusters (12) we apply wild bootstrapped cluster adjusted standard errors throughout and report the p-values for wild bootstrapped tests based on Rademacher weights (Canay, Santos and Shaikh 2018).

6.4 Religious Results

As can be seen in Tables 8, 9 and 10 below, both the "attendance" and "difference" difference in differences coefficients are negative, implying an increase in religiosity, but are statistically insignificant throughout. These results imply that the reintroduction of meatless Fridays had no discernible impact on religious attendance or the difference it makes to one's life.

Tables 8 and 9 contain our religious results without individual fixed effects (equation 2). As can be seen, the coefficients are consistently small (relative to their mean values), negative and insignificant.

[46]The country level is the level at which treatment is applied and the Understanding Society dataset is stratified at the country and regional level

Table 8: How often, if at all, do you attend religious services or meeting?

	1	2	3	4
TreatXPost	-0.0805	-0.0727	-0.0518	-0.0426
	(0.094)	(0.098)	(0.088)	(0.076)
Treat	0.515	0.517	0.539	0.535
	(0.531)	(0.535)	(0.601)	(0.467)
Post	0.156	0.192	0.213	0.222
	(0.231)	(0.283)	(0.320)	(0.299)
Age		-0.00928**	-0.0130***	-0.0140***
		(0.004)	(0.005)	(0.005)
Female		-0.187***	-0.185***	-0.183***
		(0.060)	(0.060)	(0.059)
Numb of Children				-0.141***
				(0.055)
Married				-0.192***
				(0.072)
M-EDU			0.348***	0.307***
			(0.000)	(0.000)
L-EDU			0.532***	0.457***
			(0.000)	(0.000)
Constant	2.153***	2.696***	2.572***	2.833***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	7440	7440	7438	7426
R^2	0.029	0.049	0.077	0.097

Notes:Wild bootstrap clustered at the UK NUTS 1 Level (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Definition of dependent variables 1 to 4 : 1. once a week or more, 2. less often but at least once a month, 3. less often but at least once a year, 4. never or practically never,
Samples are the Roman Catholics in Wave 1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: How much difference would you say religious beliefs make to your life?

	1	2	3	4
TreatXPost	-0.0377	-0.0277	-0.0108	-0.00694
	(0.044)	(0.049)	(0.049)	(0.040)
Treat	0.0406	0.0429	0.0625	0.0608
	(0.144)	(0.173)	(0.126)	(0.130)
Post	0.135	0.183**	0.200*	0.204***
	(0.199)	(0.091)	(0.106)	(0.066)
Age		-0.0126***	-0.0158***	-0.0160***
		(0.004)	(0.005)	(0.005)
Female		-0.208***	-0.208***	-0.207***
		(0.067)	(0.067)	(0.067)
Number of Children				-0.0401
				(0.037)
Married				-0.0647
				(0.042)
M-EDU			0.267***	0.255***
			(0.000)	(0.000)
L-EDU			0.446***	0.422***
			(0.000)	(0.000)
Constant	2.165***	2.873***	2.785***	2.863***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	7440	7440	7438	7426
R^2	0.002	0.050	0.075	0.078

Notes:Wild bootstrap clustered at the UK NUTS Level 1 (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Definition of dependent variables 1 to 4 : 1 a great difference, 2. some difference, 3. a little difference, 4. no difference
Samples are the Roman Catholics in Wave 1.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 contains our results employing individual fixed effects. Again, the difference in differences coefficients are consistently negative (implying an increase in religiosity in England and Wales) but insignificant. Our main results are presented under the "Full sample" heading, which includes all those who identified as Catholic in Wave 1 and who answered the religious questions on attendance and meaningfulness in Wave 4. The remaining results are aimed at providing some robustness analysis for our main results. "Up to 2012" presents the results using a sample of responses of up to 2012 in Wave 4. "E/W/S" provide results using a sample from England, Wales and Scotland only. "E/W/S Up to 2012" presents results using a sample from England, Wales and Scotland only up to 2012. These are aimed to account for any potential salience and other effects associated with the visit of Pope Benedict XVI (in England and Scotland *but not* Ireland) in September 2010 and the resignation of Cardinal Keith O'Brien after allegations of inappropriate sexual conduct in February 2013.[47] In summary, we conclude that

[47]Bassi and Raul (2017) has shown that a Papal visit can have significant salience effects on Catholics within

while we find no increase in religiosity using these variables, we find no religious costs imposed on those subject to the reintroduction of meatless Fridays.

Table 10: Summary of Religious Results with Individual Fixed Effects

Full Sample	Attendance	Difference
TreatXPost	-0.088	-0.042
p-value	(0.257)	(0.237)
R-squared	0.885	0.813
Observations	5328	5328
Up to 2012	Attendance	Difference
TreatXPost	-0.102	-0.018
p-value	(0.153)	(0.528)
R-squared	0.882	0.815
Observations	2932	2932
E/W/S	Attendance	Difference
TreatXPost	-0.012	-0.045
p-value	(0.527)	(0.422)
R-squared	0.884	0.818
Observations	4520	4520
E/W/S Up to 2012	Attendance	Difference
TreatXPost	-0.048	-0.018
p-value	(0.452)	(0.563)
R-squared	0.883	0.827
Observations	2124	2124

Notes: Wild bootstrap cluster adjusted standard errors using Rademacher Weights at the UK NUTS 1 Level (Scotland, Wales,Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) with 1000 iterations. Individual fixed effects applied throughout with the following time varying controls applied: Age, Female, Number of Children, Married, M-EDU, L-EDU. P-values reported. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7 Discussion

We have measured the consumption, climate change, and religiosity impacts of the reinstatement of meatless Fridays for English and Welsh Catholics. To do so, we have employed three different data sources.

the country visited influencing behaviour (in this case fertility decisions). Hungerman (2013) has found that sex scandals can lead to a loss of participation, charitable donations and membership.

To measure the consumption impacts we first presented the results from an ex-post recall method survey, where respondents were drawn from a nationally representative sample. The second was the use of the National Diet and Nutrition Survey (NDNS) food diary dataset. While both datasets are not without their weaknesses, analysis of both provides consistent evidence of partial compliance with the reinstated obligation.

The ex-post survey data found that approximately 28 percent of Catholics stated that they changed their dietary habits, with most either reducing (55 percent) or eliminating (41 percent) their meat consumption on Fridays. Based on this stated response, we estimated that it corresponds to an approximate 2 gram fall in per capita adult weekly meat consumption across England and Wales. For the majority of respondents, who did not change their diets, the main reasons indicated were a preference for making their own consumption decisions, not knowing of the change or that they already did not eat meat on Fridays. Given that a sizable portion of the Catholics surveyed did not know of the reinstatement, one seemingly low cost option to increase compliance would be to re-publicise it.

Taken together, our analysis provides evidence of partial compliance with the reinstated obligation. As discussed earlier, while being backed by Canon law, there was no externally imposed penalty attached for non-compliance. In doing so, it provides insight into the internalisation of an externally imposed obligation (see Kaplow and Shavell 2007,Etzioni 2000, Cooter 1998, McAdams 1997) and the magnitude of impact religious laws and obligations can have in a contemporary Western setting.

Our results also indicate that the reduced meat consumption on Fridays was not matched with a commensurate increase in fish consumption or that meat consumption increased on other days. As discussed earlier, when meatless Fridays for Catholics were lifted in the United States, the analysis of Bell (1968) showed that it led to a significant drop in fish demand - our results show that its reinstatement does not seem to have the reverse effect in the UK (either in terms of magnitude or significance). There are many more meat substitutes available to current consumers than in the past. As can be seen in Table 6 above, while non-meat eaters eat much more fish than meat eaters, they also consume much more bean and nut products, as well as more cheese and fruit. This highlights how norms of compliance in relation to the same rule can change over time, to better suit the circumstances of a given time and place (Bicchieri 2006 and McAdams 1997). Also numerous other factors affect, and are, related to food consumption. Some of these are evident from our results tables. For instance, it can be seen that females eat less meat and have more meat free days. It can also be seen that age is negatively related to meat consumption but positively related to fish consumption, while ethnicity is also associated with some consumption patterns. It can also be seen that the ''post" dummy is often significant, suggesting the importance of wider trends at play within the UK.

In terms of the resource and climate change impacts, our results highlight how a change in diet among a group of people, even if they are a minority in society, can have very large consumption and sustainability implications when aggregated. In this case, they also show how they can have positive environmental benefits, even if that is not their main intention. Indeed, as they are generated through a by-product of religious practice they are likely to be delivered at low (or no) cost in terms of consumer welfare. While we found no discernible increase in religiosity following the reinstatement, we also found no evidence of a backlash, in terms of service attendance or meaningfulness to one's life.

Using our most conservative estimate indicates a decrease in meat consumption of approximately 80 tonnes per week (4,160 tonnes per year) or 875,000 less meat meals per week (46 million per year). This would approximate to yearly savings in C02 equivalent of approximately 55,000 tones per year. This equates to 0.013 percent of UK annual C02 emissions.[48] To put this figure in perspective, we compare it to another well known source of greenhouse gas emissions - international air travel. According to the ICAO Carbon Emissions Calculator, an economy return trans-Atlantic flight (London Heathrow to New York Kennedy) produces 668.6 kilos of C02 equivalent per passenger.[49] This would approximate to yearly savings in C02 equivalent of approximately 1,600 less individual return trans-Atlantic trips per week (or 82,500 over a year). Importantly, if the behavioural change is permanent, so are the reductions, compared to one off-discretionary changes in behaviour.

In terms of religiosity, we do not find evidence that the obligation led to a significant change in religious service attendance or religion making difference to one's life. We can only speculate why this may be the case. Perhaps the obligation was too minor or too lightly enforced to lead to any significant effects. Perhaps the measures used are imperfect measures of religiosity or our estimation strategy is unable to adequately capture the effects.[50] Or perhaps the link between religious proscriptions and religiosity is less closely linked as hypothesised by Iannaccone (1992). We are not aware of any other studies that have attempted to directly measure the effect of a religious proscription on religiosity. Perhaps the closest to our own, but still very different in that they exploit changes in the availability of secular substitutes, is that of Gruber and Hungerman (2008) and Hungerman (2014) who found that as the cost of secular activities fall (e.g. relaxing Sunday trading laws, proximity to a casino and variations in in alcohol availability), people substituted away from religious activity (measured by spending and attendance).

Despite not finding a significant link between religious regulation and religiosity, our results

[48]Annual UK C02 equivalent emissions in 2020 were estimated at 419.1 million tonnes.https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972583/2020_Provisional_emissions_statistics_report.pdf

[49]See https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx

[50]For instance, if the impact was to make already religious people more deeply religious.

do highlight the link between religious regulation, consumer behaviour and environmental sustainability. In the UK's distant past, such a link would have been obvious. As noted above, in pre-Reformation England much of the general population did not eat meat on Wednesdays, Fridays and Saturdays; the whole of lent and the eves of other important feast days (Woolgar 2006). However, such were the resource use impacts of the Protestant Reformation, that meat free days were reintroduced under the rule of Edward VI and Elizabeth I, for the explicit purpose of supporting the fishing industry and navy, and conserving meat (Sgroi 2003). The UK has moved on from when most of the population refrained from eating meat on more than half of the days of the year for religious reasons. Nonetheless, our analysis highlights the existing role, and more importantly, the *potential role*, religious organisations, grass-roots movements and local groups can play in helping to achieve climate change mitigation and environmental sustainability more broadly. While much of the public debate around sustainable consumption, resource use and environmental protection focuses on the role of the state, our analysis highlights the potential role religious groups and non-state organisations could play. In terms of scaling up the environmental benefits from this case study, if the the Pope was to reinstate the obligation to all Catholics globally, or if the bishops in other countries were to follow the lead of English and Welsh bishops, the resource use implications would be many magnitudes higher. For instance, even if only the United States Catholic bishops were to follow suit, the benefits would likely be 20 times larger than in the UK.

8 Conclusion

We have measured the consumption, climate change mitigation and religiosity impacts of the reinstatement of meatless Fridays for English and Welsh Catholics. We have found evidence of partial compliance, with around one quarter of Catholics reducing or eliminating their meat consumption on Fridays. This approximates to 42 million fewer meat meals per year. This reduction is within a broader context of falling meat consumption in the UK. We found no evidence of an increase in fish consumption, or meat consumption on other days. In terms of greenhouse gas emissions, the change in diet generates savings of approximately 55,000 CO2 tonnes per year (or 82,500 less individual return trans-Atlantic trips per year). As these reductions are from the voluntary acceptance of the reinstated obligation (with no threat of external punishment) they are likely to be delivered at low (or no) cost. As such we identify a new source of low-cost greenhouse emissions reductions, especially if this practice was reinstated by the Catholic Church at a global scale. In terms of the impact on religiosity (service attendance and difference to one's life), we find coefficients consistent with a small increase, however they are not statistically significant throughout - and therefore we conclude that the reintroduction had no discernible impact.

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Appendices

A Appendix

Variable	Description
Age	A categorical variable of age groupings. A value of 1 indicates that a respondent is under 18 years old. A value of 2 indicates that a respondent is between 18-24 years old. A value of 3 indicates that a respondent is between 25-34 years old. A value of 4 indicates that a respondent is between 35-44 years old. A value of 5 indicates that a respondent is between 45-54. A value of 6 indicates that a respondent is between 55-64 years old. A value of 7 indicates a respondent is equal to or over 65 years old.
Income	A categorical variable of annual income. A value of 1 indicates an income of less than £15,000. A value of 2 indicates an income of between £15,000 to £20,000. A value of 3 indicates an income of between £20,001 to £30,000. A value of 4 indicates an income of between £30,0001 to £40,000. A value of 5 indicates an income of between £40,0001 to £50,000. A value of 6 indicates an income of between £50,001 to £60,000. A value of 7 indicates an income of between £60,001 to £70,000. A value of 8 indicates an income equal to or greater than £70,000.
Female	If individual respondent is female is equal to 1. Otherwise 0
Education	A categorical variable denoting respondents' highest level of education. A value of 1 indicates basic education. A value of 2 indicates secondary education. A value of 3 indicates undergraduate education. A value of 4 indicates a masters or equivalent. A value of 5 indicates doctoral level.

Figure A1: Survey Data Description

Variable	Description
Meat (g)	Individual consumption of meat in grams
Fish (g)	Individual consumption of fish in grams
Treat	Treat is equal to 1 if individual respondent is in England or Wales. Otherwise 0
Post	Post is equal to 1 if individual respondent is in England or Wales. Otherwise 0
Treat x Post	Interaction term of Post and Treat
Female	If individual respondent is female is equal to 1. Otherwise 0
Age	Age of respondent in years.
Ethnicity	Series of dummy variables for ethnicity. White British, Mixed, Black British, Asian British and Other (reference category)
Log Income	Log of annual income

Figure A2: NDNS Data Description

Variable	Description
Attendance	How often, if at all, do you attend religious services or meetings? "once a week or more" =1, "less often but at least once a month"=2, "less often but at least once a year" =3, "never or practically never, or only wedding, funerals etc"=4
Difference	How much difference would you say religious beliefs make to your life? "a great difference"=1, "some difference"=2, "a little difference"=3, " no difference"=4
Female	If individual respondent is female is equal to 1. Otherwise 0
Age	Age of respondent in years
Education	Binary variables for the level of education. High Education (H-EDU), Middle Education (M-EDU), and Low Education (reference category). Individual 's education higher than O-level or GCSE is classifed as high Education. Middle education is the education level between O-level and A-level.
Numb Child	Number of children of individual respondent.
Married	If individual respondent is married is equal to 1. Otherwise 0

Figure A3: Understanding Society Data Description

Table A1: NDNS Descriptive Statistics of Dependent Variable by Each Day

	Total sample				**Treat**				**Control**			
Variable	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**	**Mean**	**S.D**	**Min**	**Max**
Fish(g, Mon)	17.8	42.67	0	405	18.98	44.07	0	405	15.1	39.16	0	258.4
Meat(g, Mon)	99.69	90.68	0	1000	98.39	92.1	0	1000	102.7	87.27	0	505.9
Observations	3740				2608				1132			
Fish(g, Tue)	21.05	46.71	0	600	22.41	48.67	0	600	17.72	41.33	0	250
Meat(g, Tue)	95.13	87.38	0	1000	93.05	88.32	0	1000	100.2	84.84	0	642.8
Observations	3561				2532				1029			
Fish(g, Wed)	21.72	50.46	0	506	22.67	51.77	0	506	19.39	47.03	0	352.6
Meat(g, Wed)	95.12	89.86	0	1000	93.16	90.79	0	1000	99.96	87.36	0	490
Observations	3497				2488				1009			
Fish(g, Thu)	21.4	48.69	0	557.1	21.91	49.74	0	557.1	20.2	46.14	0	360
Meat(g, Thu)	95.94	87.79	0	754.6	94.59	88.22	0	754.6	99.11	86.71	0	501
Observations	3733				2620				1113			
Fish(g, Sat)	19.17	45.85	0	408.9	21.02	47.87	0	408.9	14.92	40.52	0	325.3
Meat(g, Sat)	107.2	98.77	0	874.4	105.2	97.8	0	874.4	111.9	100.8	0	832
Observations	4061				2829				1232			
Fish(g, Sun)	14.19	41.3	0	445	15.19	42.46	0	441	11.89	38.39	0	445
Meat(g, Sun)	120.7	95.86	0	1000	118.7	96.62	0	1000	125.2	93.97	0	613
Observations	4135				2882				1253			

Table A2: Balance Test for NDNS

	Mean(Control)	Mean(Treat)	Differences	t-test	Wilcoxon test
Female	0.57	0.56	0.01	0.623	0.623
Age	40.96	42.27	-1.31	0.063	0.043
White	0.97	0.9	0.07	0	0
Mixed	0.01	0.02	-0.01	0.045	0.045
Black	0	0.03	-0.02	0	0
Asian	0.01	0.04	-0.03	0	0
Log Income	9.95	10.08	-0.14	0	0

Table A3: Balance Test for Understanding Society

	Mean_Control	Mean_Treat	Differences	t-test	Wilcoxon test
Female	0.61	0.64	-0.02	0.109	0.109
Age	48.55	49.06	-0.51	0.342	0.718
H-EDU	0.34	0.41	-0.06	0	0
M-EDU	0.32	0.35	-0.03	0.071	0.071
Number of Children	0.59	0.61	-0.02	0.583	0.563
Married	0.52	0.54	-0.02	0.171	0.171

Table A4: Individual Meat Consumption with aggregate data (Grams)

	1	2	3	4
TreatXPost	-5.729**	-4.037**	-3.533*	-2.950*
	(2.331)	(1.965)	(1.833)	(1.662)
Treat	-3.893	-4.478	-3.904	-4.049
	(5.365)	(6.143)	(5.815)	(5.605)
Post	2.592***	1.976***	1.900***	1.220***
	(0.000)	(0.000)	(0.000)	(0.000)
Female		-38.10***	-38.23***	-38.61***
		(12.328)	(12.371)	(12.494)
Age		-0.309***	-0.328***	-0.338***
		(0.100)	(0.106)	(0.109)
White			4.449	4.189
			(6.270)	(5.085)
Mixed			3.997	1.953
			(12.140)	(8.583)
Black			9.438	9.429**
			(6.459)	(4.053)
Asian			-21.76***	-19.88***
			(7.560)	(7.496)
Log Income				2.596
				(1.670)
Constant	104.3***	139.3***	136.0***	111.4***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	31223	31223	31188	26743
R^2	0.001	0.049	0.052	0.053

Notes:Wild bootstrap clustered at Country/Region level (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Dependent variable is grams of meat consumption on Friday
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Individual Fish Consumption with aggregate data (Grams)

	1	2	3	4
TreatXPost	1.718*	1.859	1.703	1.604
	(1.045)	(1.221)	(1.212)	(1.163)
Treat	3.718	3.289	2.880	2.234
	(3.058)	(2.374)	(2.237)	(1.735)
Post	-2.830***	-3.072***	-3.045***	-2.937***
	(0.916)	(0.994)	(0.985)	(0.950)
Female		-3.320***	-3.336***	-3.219***
		(1.074)	(1.080)	(1.042)
Age		0.258***	0.269***	0.264***
		(0.000)	(0.000)	(0.000)
White			-10.92***	-12.15***
			(3.534)	(3.930)
Mixed			-2.050	-0.277
			(3.500)	(2.454)
Black			-4.131	-2.827
			(3.081)	(3.416)
Asian			-6.635	-7.190*
			(4.609)	(4.024)
Log Income				4.248***
				(0.000)
Constant	18.00***	9.284***	19.54***	-21.28***
	(0.000)	(0.000)	(0.000)	(6.884)
Observations	31223	31223	31188	26743
R^2	0.002	0.016	0.018	0.023

Notes:Wild bootstrap clustered at Country/Region level (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Dependent variable is grams of fish consumption on Friday
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Individual Meat Consumption on Friday (Grams)

	1	2	3	4
TreatXPost	-9.460***	-8.931***	-9.061***	-8.232***
	(3.565)	(3.366)	(2.931)	(2.859)
Treat	-1.018	-1.232	-0.851	-2.294
	(5.173)	(4.625)	(4.213)	(3.670)
Post	8.200***	8.150***	8.502***	6.505***
	(0.000)	(0.000)	(0.000)	(0.000)
Female		-33.76***	-33.86***	-32.65***
		(10.918)	(10.950)	(10.559)
Age		-0.359***	-0.368***	-0.371***
		(0.116)	(0.119)	(0.120)
White			-5.257	-4.283
			(12.255)	(13.552)
Mixed			-5.759	-11.67
			(17.634)	(20.330)
Black			-10.54	-13.81
			(15.557)	(16.976)
Asian			-17.25	-12.76
			(14.246)	(17.666)
Log Income				4.406*
				(2.360)
Constant	94.06***	128.6***	134.4***	91.04**
	(0.000)	(0.000)	(0.000)	(40.878)
Observations	4756	4756	4751	4016
R^2	0.001	0.045	0.046	0.045

Notes:Wild bootstrap clustered at Country/Region level (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Dependent variable is grams of meat consumption on Friday
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Individual Fish Consumption on Friday(Grams)

	1	2	3	4
TreatXPost	3.759	4.010	3.522	2.057
	(2.572)	(2.881)	(2.846)	(2.454)
Treat	2.919	2.346	1.815	1.615
	(4.763)	(3.718)	(3.178)	(3.166)
Post	-5.471***	-5.687***	-5.336***	-3.245***
	(1.769)	(1.839)	(1.726)	(1.049)
Female		-6.739***	-6.760***	-7.302***
		(2.180)	(2.186)	(2.361)
Age		0.387***	0.400***	0.413***
		(0.000)	(0.000)	(0.000)
White			-2.150	-1.932
			(7.556)	(6.550)
Mixed			4.372	5.855
			(9.076)	(8.803)
Black			9.609	12.97
			(9.005)	(10.529)
Asian			5.532	2.112
			(13.236)	(8.879)
Log Income				3.210***
				(0.000)
Constant	23.50***	11.22**	12.61	-19.84**
	(0.000)	(5.623)	(9.230)	(9.560)
Observations	4756	4756	4751	4016
R^2	0.002	0.031	0.033	0.037

Notes:Wild bootstrap clustered at Country/Region level (Scotland, Wales, Northern Ireland, North East , North West , Yorkshire and the Humber , East Midlands , West Midlands , East of England , London , South East , South West) standard errors in parentheses with 1000 iterations.
Dependent variable is grams of fish consumption on Friday
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$