Norwegian Care Plan

Norman Bannenberg

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1 Introduction

2 Literature and Institutional Background

2.1 Literature

2.2 Institutional Background

2.2.1 The health sector and the LTC sector

In Norway (5.2 million people in 2016), health care is mainly financed by taxation and provided by a National Health Service in a mixed centralized and decentralized system. The municipalities are the lowest level of government and responsible for primary care and long term care (LTC). For primary care, there is a mixed financing by the state, the municipalities and the patients in terms of co-payment. General practitioners (GPs) have individual lists of patients. Approximately 95% of the GPs are self-employed and have a contract with a municipality. The remaining PCPs are directly employed by municipalities and are salaried.

Also inhabitants who receive LTC services are listed with a GP. Nursing homes has own designated physicians, so nursing home residents are likely to receive services from the nursing home physicians rather than the GP the resident is listed with. LTC services are provided in terms of home-based services and services in nursing homes. Home based services will typically be practical assistance with cleaning, doing shopping etc. and home nursing. Home based services can be provided in a recipients own home or in sheltered housing built particularly for individuals with care needs. Sheltered housing comes in several varieties up to 24 hours in-house services almost like a nursing home. It is even then an important distinction from nursing homes with regard to organization and financing of services. Sheltered housing implies that the inhabitant pays rent, makes use of his or her designated GP and is under the similar health care system as the population in general. Mrk et al. (2017) show that over time there has been a relative increase in sheltered housing compared with nursing homes. In addition to the various types of formal care, informal care to the elderly is provided by family, relatives and volunteers.

Specialized health care is the responsibility of the state. Most of the care is provided by state owned hospitals organized in four regional health authorities (RHA). The RHAs are responsible for the hospitals in their regions. Hospitals receive revenue as a mix of risk adjusted capitation based on the population in their catchments areas and activity based financing according to weights Diagnostic Related Groups (DRGs). There is a patient co-payment for outpatient consultations, but not for inpatient stays. Patients may also receive specialized outpatient consultations at private specialists. Most private specialists contract with RHAs. The contract gives a private specialist an annual practice allowance from an RHA and fee-for-service reimbursements from the NIS. Private specialists are mainly located in urban areas. Approximately one third of all outpatient consultations are given by private specialists. Patients have access to specialized health care irrespective of their status as LTC recipient.

2.2.2 Care Plan 1998 and Care Plan 2015

The Norwegian parliament (Stortinget) approved in 1997 a plan to expand the capacity and quality of LTC services by temporary state subsidies (Borge and Haraldsvik, 2006). The subsidies were partly related to increasing the provision of home based services and partly related to investing in new places in nursing homes and sheltered housing. The investment subsidies were partly in terms of grants and subsidies of interest payment and installments. Subsidies according to the plan were given during the period 1998 - 2003. Borge and Haraldsvik (2006) find that a total of 28 000 places were financed with a majority of sheltered housing.

The Care Plan 1998 was followed by the Care Plan 2015 which was in effect during the period 2008 2015. Hagen and Tingvold (2017) describe some major characteristics of the plan. Again, the priorities were to expand the quantity and quality of LTC services by increasing the number of personnel with upgraded skills and by subsidizing 12,000 places in institutions and sheltered housing. The subsidies were mainly awarded in terms of investment grants. Due to fewer institutions and decentralization the municipalities are responsible for an increasing number of young individuals with care needs. Applications for investment grants were for housing to individuals with care needs irrespective of age. In this paper, however, we focus on housing and services to the elderly.

2.2.3 Other recent reforms

There have been several other health care reforms during the time period considered in this paper. In 2001, the regular GP system was introduced. All inhabitants got then the right to be individually listed with a GP. More than 95 percent of the population makes use of the opportunity. In 2002, the hospital reform transferred the ownership of all public hospitals from the county governments to the state. The state then took the actual responsibility for both hospital financing and provision of hospital services for the entire country. The coordination reform was introduced from 2012. The purpose was both to coordinate services from primary care, LTC and specialized care and to encourage disease prevention. In line with this, the government introduced, in the state budget for 2012, a 20 percent municipal co-financing of hospital inpatient stays for somatic patients with medical (non-surgical) diagnoses. The intention was to create a financial incentive for municipalities to pay greater attention to disease preventive measures so that the need for hospital admissions would be less. The scheme met much criticism and ended January 1, 2015. The state also introduced a fee from municipalities to hospitals for patients declared ready to be discharged. The motivation was to encourage the municipalities to expand capacity in LTC. There has also been greater attention towards disease prevention in the municipalities than before.

3 Datasets

In this section, the datasets used in the analysis are presented and an overview of the relevant variables is given. First, the grants dataset containing information on the two Care Plans starting in 1998 and 2007, respectively, is introduced. Then, descriptive statistics for all dependent variables and covariates are provided.

3.1 Grants Dataset

Our grants dataset contains information on all projects of the two Care Plan programmes from 1998 to 2015. We focus on those projects that were funded to improve the nursing home infrastructure.

In Norway, there is a total number of 428 municipalities out of which 339 municipalities applied for grants during the first Care Plan programme. Until 2015, 123 municipalities completed projects funded by the second programme. Most of the municipalities that took part in the second programme received grants in the previous programme. Figure 1 provides a graphical overview of the Care Plan participation pattern.

We define our potential treatment group as those municipalities that started projects in at least one of the Care Plan programmes. The year of treatment is the year after the project started. This appears to be plausible as the simple application for grants does not increase for example the number of nursing home rooms and the first results should should appear in the following year. We consider two types of treatment variables: a binary treatment indicating whether the first project started one year ago or before, and a continuous treatment that equals the aggregate amount of grants (in 10,000,000 NOK) per 10,000 inhabitants (or 100 inhabitants aged 80 and above for variables at the 80+ level) applied for until the previous year. Figure 2 shows how many municipalities applied for grants for the first time in a certain year

3.2 Municipality-Level Nursing Home Dataset

In this study, we intend to estimate the causal effect of the two Care Plan programmes on nursing homes considering three aspects: quantity, quality, and users. For quantity, we use two indicators, the total number of nursing home rooms ($\text{Rooms}^{\text{Total}}$) and the total number of nursing home spaces ($\text{Spaces}^{\text{NH}}$) in a municipality. The number of single

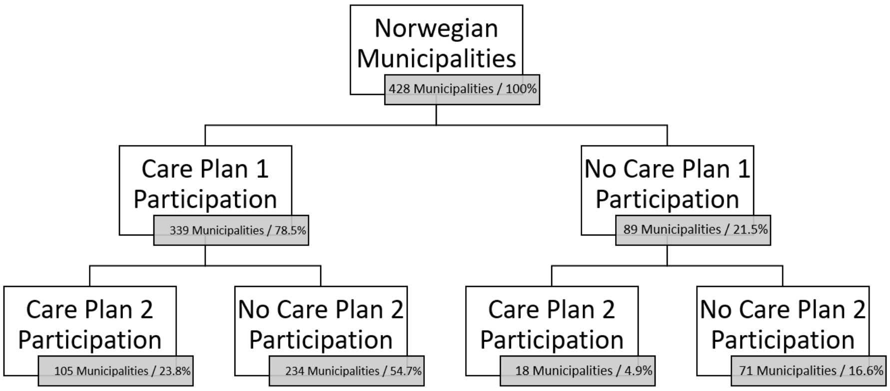


Figure 1: Care Plan Participation Pattern

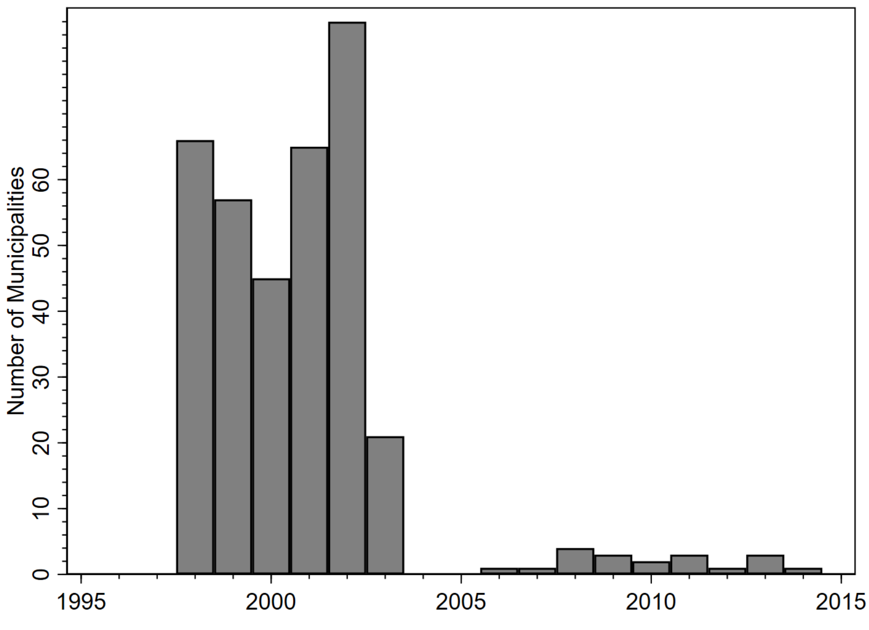


Figure 2: Year of First Application for Grants

rooms ($\text{Rooms}^{\text{Single}}$) and rooms with bath ($\text{Rooms}^{\text{Bath}}$) are expected represent the nursing home quality in a municipality. Finally, we investigate whether the programmes affect the number of nursing home users aged 80 and above (Users^{80+}). All variables are expressed as per 10,000 inhabitants (100 inhabitants aged 80+ for Users^{80+}).

The Care Plan programmes are expected to positively affect both quantity and quantity of nursing home spaces. This might make entering a nursing home possible or more attractive for elderly people and thus increases the number of nursing home users.

$\text{Rooms}^{\text{Total}}$, $\text{Rooms}^{\text{Single}}$, and $\text{Rooms}^{\text{Bath}}$ are observed from 1998 to 2015; the observation period of $\text{Spaces}^{\text{NH}}$ starts in 2001. Users^{80+} is not observed before 2007. The treatment group consists of all municipalities that applied for grants for nursing homes and for which at least one year before and one year after the treatment year is available. Control group municipalities did not apply for any grants in both programmes. One exception is Users^{80+}. As we only observe a short time period for Users^{80+}, we just consider the second programme as treatment and municipalities that applied for grants from the second Care Plan programme are considered as treated whereas all others belong to the control group.

Six covariates are included in the analysis; four indicate the level of education in a municipality (share of people who have a basic school level (EDU^{basic}), upper secondary education (EDU^{sec}), short tertiary education (EDU_S^{ter}), and long tertiary education (EDU_L^{ter})), one is the net internal migration as share of total population ($NetIM$), and the last one is the share of women in the municipality ($Share^f$). Municipalities are excluded from the analysis if information on the dependent variables or covariates is incomplete. Table 1 contains descriptive statistics separately for all lengths of datasets.

Comparing the mean outcome variables by group for the last year when all treatment group municipalities are treated and the first year after all those municipalities received the treatment can give a first hint whether a causal effect of our treatment can be expected and which sign and size it might have. The corresponding results are presented in Table 2.

The results show that there are actually changes in the differences of the dependent variables between treatment and control group municipalities. Most results confirm our expectation that the Care Plan programmes positively affect our quantity, quality, and users indicators.

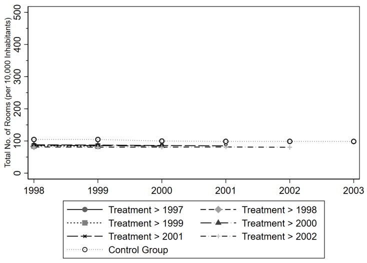
An essential requirement for identifying a causal effect is that the dependent variable

Table 1: Descriptive Statistics

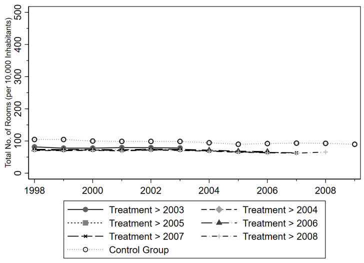
	Obs.	Mean	Std. Dev.	Min.	Max.
1998-2015					
$\text{Rooms}^{\text{Total}}$	5652	115.164	56.879	0	467.836
$\text{Rooms}^{\text{Single}}$	5652	108.925	57.432	0	467.836
$\text{Rooms}^{\text{Bath}}$	5652	84.054	62.991	0	467.836
NetIM	5652	−.003	.011	−.103	.075
EDU^{basic}	5652	29.071	13.369	0	58.2
EDU^{sec}	5652	39.869	16.997	0	58.7
EDU_S^{ter}	5652	13.422	6.732	0	30.8
EDU_S^{ter}	5652	2.777	2.322	0	19.3
Share^f	5652	.496	.01	.432	.536
Population	5652	12536.567	37523.361	206	647676
2001-2015					
$\text{Spaces}^{\text{NH}}$	3750	125.661	59.366	0	463.768
NetIM	3750	0	0	0	0
EDU^{basic}	3750	27.985	13.42	0	55.9
EDU^{sec}	3750	39.346	17.58	0	58.7
EDU_S^{ter}	3750	13.679	7.037	0	31.3
EDU_S^{ter}	3750	2.936	2.616	0	19.9
Share^f	3750	.494	.011	.432	.522
Population	3750	6713.258	10241.218	206	120685
2007-2015					
Users^{80+}	3564	15.564	5.833	1.498	72.727
NetIM	3564	0	0	0	0
EDU^{basic}	3564	26.586	12.63	0	51.4
EDU^{sec}	3564	39.276	17.633	0	58.3
EDU_S^{ter}	3564	14.674	7.304	0	31.3
EDU_S^{ter}	3564	3.217	2.585	0	19.9
Share^f	3564	.495	.01	.432	.524
Population	3564	528.02	1414.625	11	24173

Table 2: Pre- and Post-Treatment Group Means

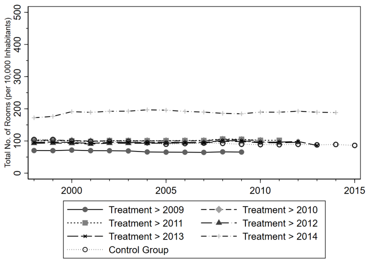
	Treatment			Control			
	Pre	Post	Diff.	Pre	Post	Diff.	Diff.-in-Diff.
$\text{Rooms}^{\text{Total}}$	83.5089	77.7278	−5.7811	104.7059	86.2201	−18.4858	12.7047
$\text{Spaces}^{\text{NH}}$	97.5934	80.161	−17.4324	113.4266	87.6201	−25.8065	8.3741
$\text{Rooms}^{\text{Single}}$	69.6752	75.7325	6.0573	90.7685	83.8369	−6.9316	12.9889
$\text{Rooms}^{\text{Bath}}$	33.2411	64.8901	31.649	49.5421	66.3069	16.7648	14.8842
Users^{80+}	13.7532	13.6657	−.0875	15.0418	13.6483	−1.3935	1.3060



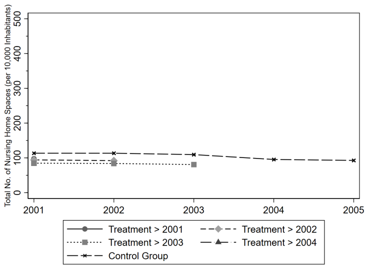
(a) $\text{Rooms}^{\text{Total}}$ (1998-2003)



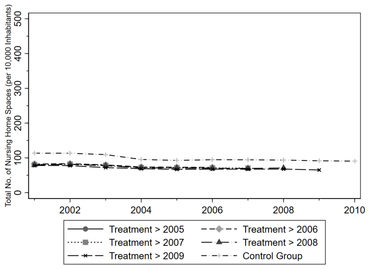
(b) $\text{Rooms}^{\text{Total}}$ (2004-2009)



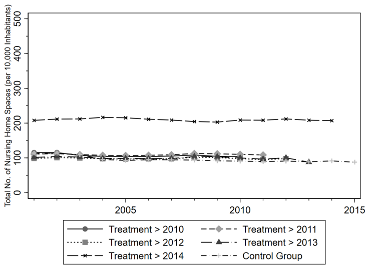
(c) $\text{Rooms}^{\text{Total}}$ (2010-2015)



(d) $\text{Spaces}^{\text{NH}}$ (2001-2005)



(e) $\text{Spaces}^{\text{NH}}$ (2006-2010)



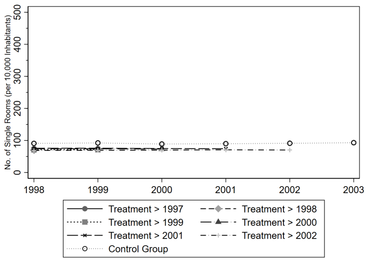
(f) $\text{Spaces}^{\text{NH}}$ (2011-2015)

Figure 3: Time Trends (Quantity)

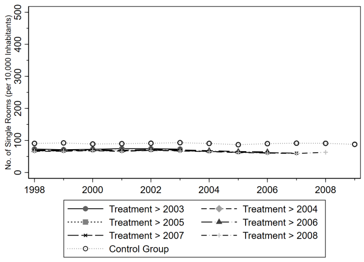
means of the untreated treatment group and the control group are parallel over time. A visual presentation of our outcome variables is helpful to evaluate whether this condition can be expected to be fulfilled. Figures 3 to 5 compare the control group means in each year to the corresponding treatment group means. Each line represents a group of treatment group municipalities prior to treatment that receive the treatment after a certain year. So the shortest lines consist of most treatment group municipalities whereas the longest ones only contain those municipalities that received their initial grants last.

Basically all trends appear relatively smooth over time, only in case of $\text{Rooms}^{\text{Bath}}$ a slightly higher volatility can be observed. However, this volatility is also present in the control group so the graphical analysis is not able to reject our parallel trend assumption.

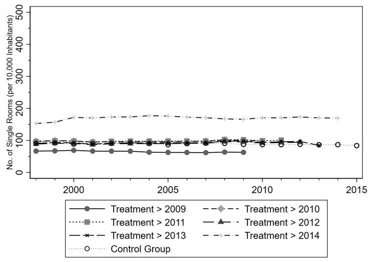
For identifying a causal effect we assume that our treatment variable is independent of our set of covariates. To check whether this assumption is plausible, we conduct a number of balancing tests using observations from 1998 to 2015 on all available municipalities with complete information on the covariates. Models with both binary and continuous



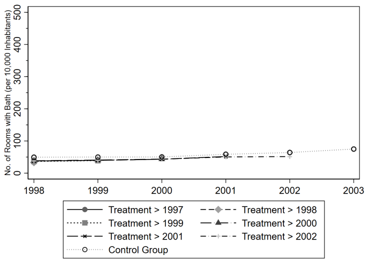
(a) $\text{Rooms}^{\text{Single}}$ (1998-2003)



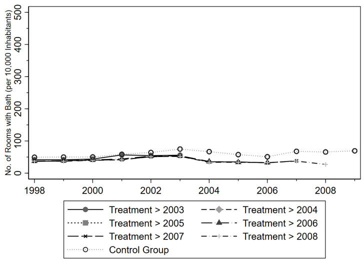
(b) $\text{Rooms}^{\text{Single}}$ (2004-2009)



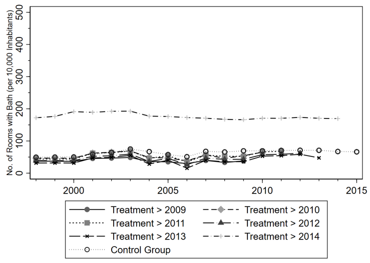
(c) $\text{Rooms}^{\text{Single}}$ (2010-2015)



(d) $\text{Rooms}^{\text{Bath}}$ (1998-2003)

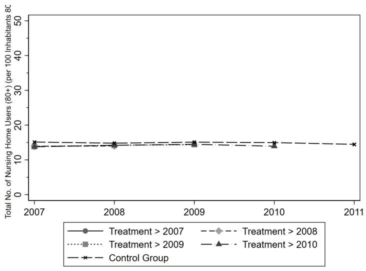


(e) $\text{Rooms}^{\text{Bath}}$ (2004-2009)

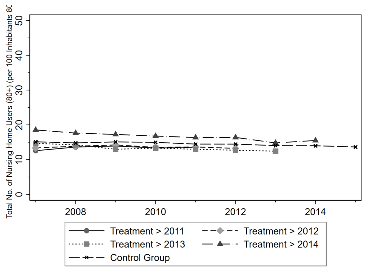


(f) $\text{Rooms}^{\text{Bath}}$ (2010-2015)

Figure 4: Time Trends (Quality)



(a) Users^{80+} (2007-2010)



(b) Users^{80+} (2011-2015)

Figure 5: Time Trends (Users)

Table 3: Balancing Tests

	$NetIM$		EDU^{basic}		EDU^{sec}		EDU_S^{ter}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Treat.	-0.0001	-1.67×10^{-12}	0.2227	1.50×10^{-10}	0.5595	-8.26×10^{-9}	0.2961^{+}	-4.27×10^{-9}
	(0.0006)	(3.34×10^{-12})	(0.3469)	(3.92×10^{-9})	(0.4450)	(6.86×10^{-9})	(0.1588)	(2.92×10^{-9})
Cont. Treat.		✓		✓		✓		✓
N	416		416		416		416	
NT	7488		7488		7488		7488	

	EDU_L^{ter}		$Share^f$		Population	
	(9)	(10)	(11)	(12)	(13)	(14)
Post-Treat.	0.1028^{+}	-6.99×10^{-10}	0.0007	$-1.34 \times 10^{-11***}$	$-2.9 \times 10^{+2}$	$8.46 \times 10^{-5***}$
	(0.0554)	(6.46×10^{-10})	(0.0004)	(2.72×10^{-12})	(258.4648)	(1.80×10^{-5})
Cont. Treat.		✓		✓		✓
N	416		416		416	
NT	7488		7488		7488	

Municipality-level clustered standard errors in parentheses; $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

N: Number of municipalities; NT: Number of observations

treatments are estimated using the following equations:

$$Y_{mt} = \lambda_t + \mu_m + \beta_1 \left(\text{CP}_m \times \text{Post}_{mt}\right) + \varepsilon_{mt} \tag{1}$$

$$Y_{mt} = \lambda_t + \mu_m + \beta_1 \text{grants}_{mt} + \varepsilon_{mt} \tag{2}$$

with Y_{mt} as outcome for municipality m in year t, λ_t is a set of year dummies, μ_m is a set of municipality dummies, CP_m is a dummy variable that equals 1 if m belongs to the treatment group, the dummy Post_{mt} equals 1 for each post-treatment year t of m, grants_{mt} is the aggregate amount of grants applied for up to year $t-1$, ε_{mt} is the error term, and β_1 and γ are the coefficients. The results can be found in Table 3.

Our causal variable is not significant at the 10%-level in most cases but weakly significant for EDU_S^{ter}. Highly significant results are obtained in case of a continuous treatment for $Share^f$ and Population but as the effects are small and not robust if a binary treatment specification is considered, this is not expected to cause major problems in the following analysis.

4 Methods

In this section, the econometric models for identifying the effect of the two Care Plan programmes on the quantity, quality, and users indicators are presented.

As we can observe both a treatment and a control group over a relatively long time period but do not have randomly assigned treatment, a difference-in-differences approach seems to be suitable for identifying a causal effect. For identifying the average treatment effect on the treated (ATET), five assumptions need to hold: he stable unit treatment value assumption (SUTVA), the exogeneity assumption (EXOG), the no effect on the pre-treatment population assumption (NEPT), the common trend assumption (CT), and the common support assumption (CS) (Lechner, 2011).

SUTVA is most likely not violated as the receiving of grants of one municipality cannot be expected to affect quantity or quality of nursing homes in another municipality. So there actually exists a control group unaffected by the treatment. The balancing tests conducted in the previous section confirm that EXOG holds as well. As the application for grants cannot increase the number of nursing home spaces or rooms with bath, there is no evidence that NEPT might be violated. Figures 3 to 5 indicate that treatment and control group follow a parallel trend in the untreated state which justifies CT. Treatment group municipalities tend to be a bit larger than control group municipalities but the covariates do not tend to be too different between groups so there is no reason for assuming that CS is not fulfilled.

Our basic specifications for the binary treatment variable are

$$Y_{mt} = \lambda_t + \beta_1 \mathrm{CP}_m + \beta_2 \left(\mathrm{CP}_m \times \mathrm{Post}_{mt}\right) + \mathrm{X}_{mt}\gamma + \varepsilon_{mt} \tag{3}$$

$$Y_{mt} = \lambda_t + \mu_m + \beta_2 \left(\mathrm{CP}_m \times \mathrm{Post}_{mt}\right) + \mathrm{X}_{mt}\gamma + \varepsilon_{mt} \tag{4}$$

where X_{mt} is a vector of covariates with γ as coefficient vector, μ_m is a set of municipality-level fixed effects, β_2 indicates our ATET estimate, and all other parameters are defined as above.

Using our continuous treatment variable, the equations to be estimated are specified as

$$Y_{mt} = \lambda_t + \beta_1 \mathrm{CP}_m + \beta_2 \mathrm{grants}_{mt} + \mathrm{X}_{mt}\gamma + \varepsilon_{mt} \tag{5}$$

$$Y_{mt} = \lambda_t + \mu_m + \beta_2 \mathrm{grants}_{mt} + \mathrm{X}_{mt}\gamma + \varepsilon_{mt} \tag{6}$$

with grants_{mt} as the aggregate amount of grants (in 10,000,000 NOK) per 10,000 inhabitants (Users^{80+}: per 100 inhabitants aged 80+) of municipality m applied for up to year $t-1$, and all other variables as defined before. All regressions are weighted by the corresponding population size.

5 Results

The results of our estimations are presented in this section. All results can be found in Table 4 where the upper part contains the coefficients of Equations 3 and 4, and the other part shows the causal estimates for for the models using the continuous treatment presented in Equations 5 and 6.

The binary results indicate that there are negative but insignificant pre-treatment differences between the two groups. The causal effects estimated by the difference-in-differences models have the expected signs but are only significant for $\text{Spaces}^{\text{NH}}$ and $\text{Rooms}^{\text{Bath}}$. According to the results, the application for grants has on average increased both the total number of nursing home rooms (6.09) and the number of nursing home spaces (14.41) per 10,000 inhabitants but the latter to a greater extend. The increases in single rooms (5.39) is about half of the increase in rooms with bath (11.22). After the application for grants, the number of nursing home users aged 80 and above per 100 inhabitants aged 80+ rose by 0.40 on average.

However, after the inclusion of municipality-fixed effects all causal parameters become significant. The sizes of the estimates decline in most cases but the effects are still positive. As before, the $\text{Spaces}^{\text{NH}}$ coefficient exceeds that of $\text{Rooms}^{\text{Total}}$ but the difference between the quality indicators becomes absolutely smaller.

Considering a continuous treatment comes to slightly different results regarding the pre-treatment differences as most of them are significant, and all of them are larger in absolute terms than in the binary models. All difference-in-differences estimates except for Users^{80+} are highly significant with a p-value below 0.001 and are close to their binary counterparts. Unlike the binary cases, the continuous treatments are insignificant for the quantity indicator $\text{Spaces}^{\text{NH}}$ if fixed effects are included. The effect on all outcome variables is – as expected – positive. Different from the binary results, the increase in the total number of rooms is larger than the increase in spaces but the rise in rooms with bath is still about twice that of single rooms. Further, an increase in aggregate grants of 10,000,000 NOK per 100 inhabitants aged 80 and above is associated with an average increase in almost one nursing home user aged 80 and above per 100 inhabitants aged 80+.

Table 4: Results

	Quantity				**Quality**				**Users**	
	$\text{Rooms}^{\text{Total}}$		$\text{Spaces}^{\text{NH}}$		$\text{Rooms}^{\text{Single}}$		$\text{Rooms}^{\text{Bath}}$		Users^{80+}	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Binary										
Treat. Grp.	−12.3725		−11.2277		−12.8100		−10.6862		0.0285	
	(8.1663)		(9.7718)		(7.9188)		(7.2233)		(0.3924)	
ATET	6.0883	2.6456^{+}	14.4065^{+}	5.7206^{*}	5.3931	3.6777^{*}	11.2224^{***}	6.7702^{**}	0.3987	0.5578^{**}
	(4.0260)	(1.4261)	(7.7484)	(2.2548)	(3.6715)	(1.5935)	(3.0523)	(2.1920)	(0.3359)	(0.1755)
Continuous										
Treat. Grp.	-22.4588^{**}		-14.9188^{+}		-23.4539^{**}		-18.9814^{**}		0.2132	
	(7.6092)		(7.7872)		(7.4828)		(6.9611)		(0.4054)	
ATET	9.5667^{***}	2.4757^{***}	8.4222^{***}	0.2446	9.5629^{***}	4.2646^{***}	11.0764^{***}	7.9651^{***}	0.4474	0.9410^{*}
	(1.1137)	(0.5642)	(1.4057)	(0.6080)	(1.0844)	(0.7534)	(0.9719)	(1.0944)	(0.5087)	(0.4727)
Fixed Effects		✓		✓		✓		✓		✓
Covariates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
N	314		250		314		314		396	
NT	5652		3750		5652		5652		3564	

Municipality-level clustered standard errors in parentheses; $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
N: Number of municipalities; NT: Number of observations

6 Robustness Checks

In this section, we present the results of several robustness checks to prove the reliability of our results. First, we apply random placebo tests; i.e., we randomly assign the treatment status to municipalities. Re-estimating our models allows us to obtain a distribution of the t-statistics of our causal parameters which helps us to evaluate whether results of the given significance are frequent or if the assumption that we actually measure causality is justified. Then, we present event study graphs for our binary and continuous treatment specifications which, on the one hand, show whether the parallel trend assumptions is likely to hold, and on the other hand, provides information on the timing and persistence of effects.

6.1 Random Placebo Tests

A random placebo test allows us to evaluate whether we measure a causal effect and not just a random noise by comparing out t-statistics to an empirical instead of a theoretical distribution. For this test, we take the original distribution of group membership, treatment status, and aggregate amount of grants, randomly assign them to the municipalities, estimate the causal effects according to the equations presented in Section 4, and calculate the corresponding t-statistics. These steps are repeated 1,000 times so that we obtain a distribution of t-statistics to which our original values can be compared. In case a t-statistic of the original size or larger in absolute terms is rarely obtained, we can conclude that there is a high probability that our results show actual causality. The distributions and p-values for our binary treatment fixed effects specifications are depicted in Figure 6, the continuous treatment fixed effects distributions can be found in Figure 7.

As expected, all binary t-statistics distributions are centred around a mean of zero. All p-values are below 0.1 so it is likely that our binary specifications are able to find a causal effect of the Care Plan programmes on our quality and users indicators.

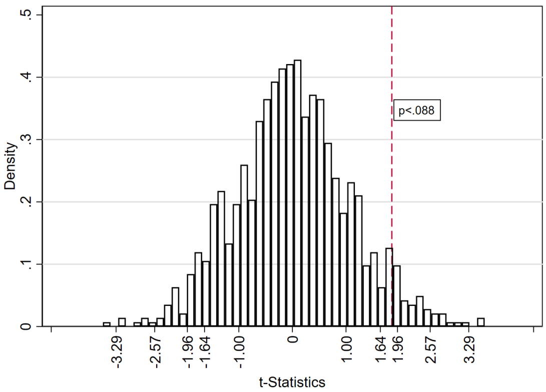
The results for the continuous treatment variable specifications indicate that the grants causally affect all quality indicators and the total number of rooms as we do not observe p-values higher than 0.01. The p-value of Users^{80+} is only slightly above the 10%-level but in almost 70% of the random regressions a larger t-statistic than the original of $\text{Spaces}^{\text{NH}}$ is obtained.

6.2 Event Study Graphs

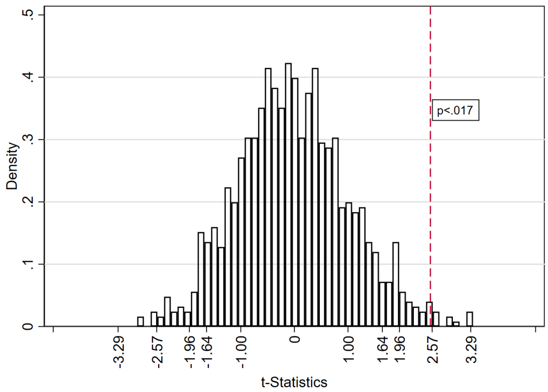
Event study graphs are produced by inserting dummy variables for each pre- and post-treatment year. If all pre-treatment dummies are insignificantly different from zero, we can conclude that the parallel trends assumption holds. Further, the post-treatment dummies provide information on the persistence of the treatment. The binary results are presented in Figure 8 and the continuous ones – where the post-treatment dummies are interacted with the aggregate amount of grants applied for until the previous year – are shown in Figure 9.

The binary results are positive as the common trend assumption does not seem to be violated in any case and almost all post-treatment dummies are significant at the 5%-level. In case of $\text{Rooms}^{\text{Total}}$, $\text{Rooms}^{\text{Single}}$, and Users^{80+} the post-treatment dummies are increasing over time. In the other two cases, the effect appears to be constant or even slightly decreasing after a few years.

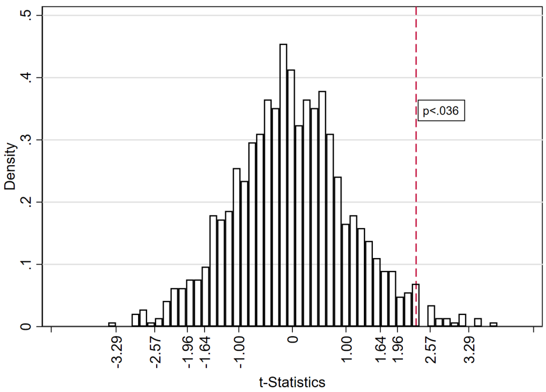
In the continuous treatment variable case, all pre-treatment periods are not significantly different from zero (the one exception for $\text{Rooms}^{\text{Single}}$ is only weakly significant and can be the results of a random noise). Most post-treatment periods of the quality indicators and $\text{Rooms}^{\text{Total}}$ are significant at the 5%-level and rather constant over time. The post-treatment effect of Users^{80+} is positive in all cases and increasing but insignificant. Only for the nursing home spaces there is neither any significant effect nor a clear trend observed. So we can conclude that the aggregate amount of grants applied for has



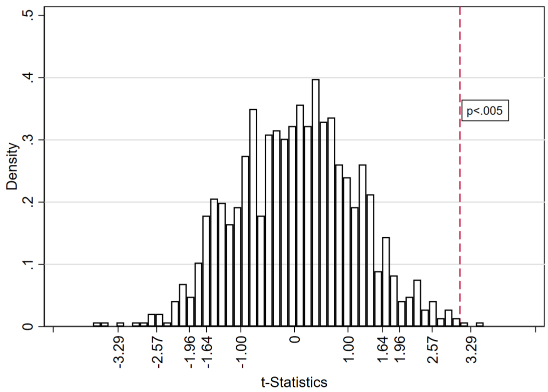
(a) $\text{Rooms}^{\text{Total}}$



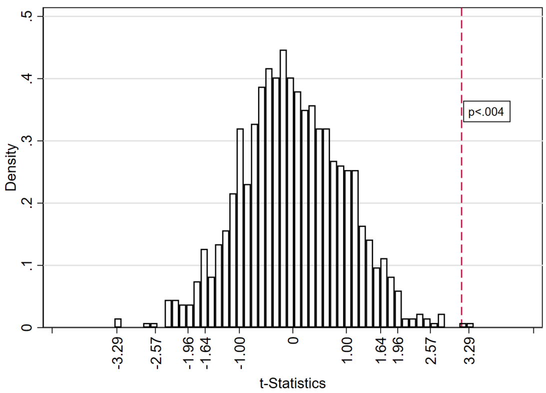
(b) $\text{Spaces}^{\text{NH}}$



(c) $\text{Rooms}^{\text{Single}}$

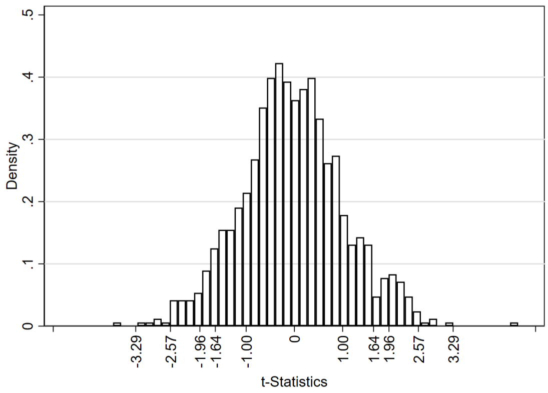


(d) $\text{Rooms}^{\text{Bath}}$

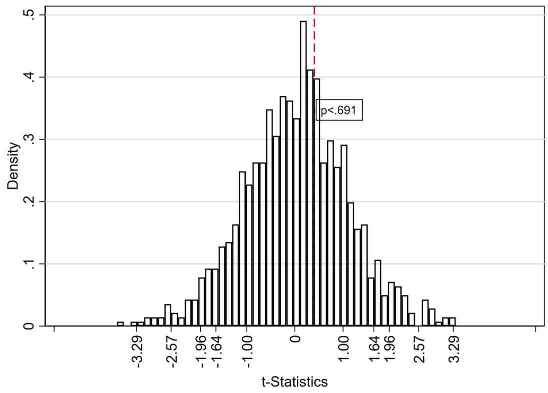


(e) Users^{80+}

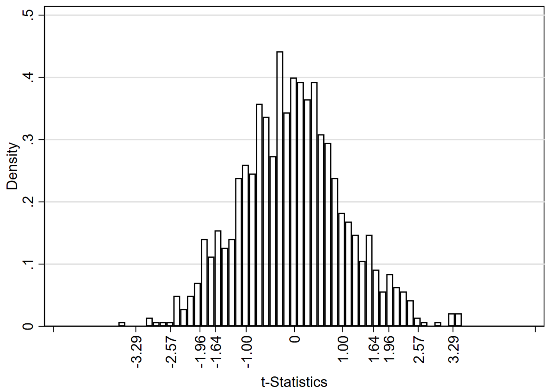
Figure 6: Random Placebo Tests (Binary Treatment)



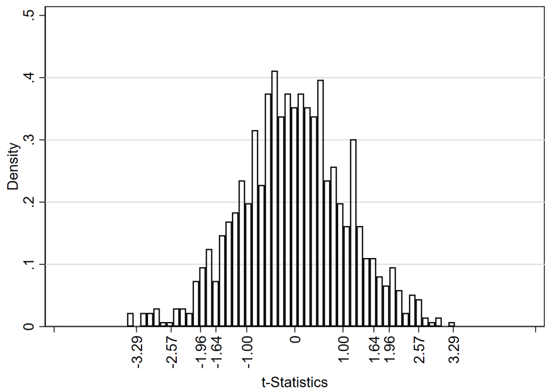
(a) $\text{Rooms}^{\text{Total}}$



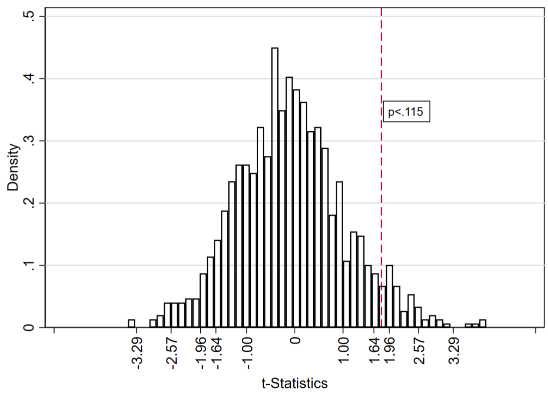
(b) $\text{Spaces}^{\text{NH}}$



(c) $\text{Rooms}^{\text{Single}}$

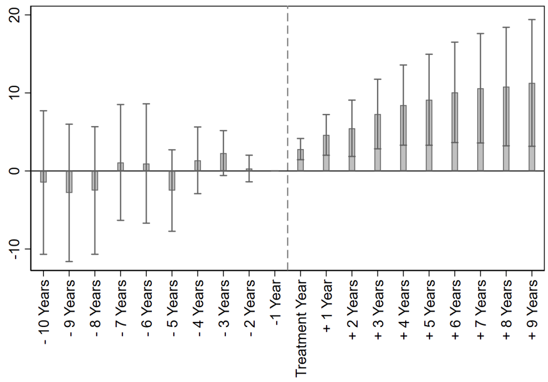


(d) $\text{Rooms}^{\text{Bath}}$

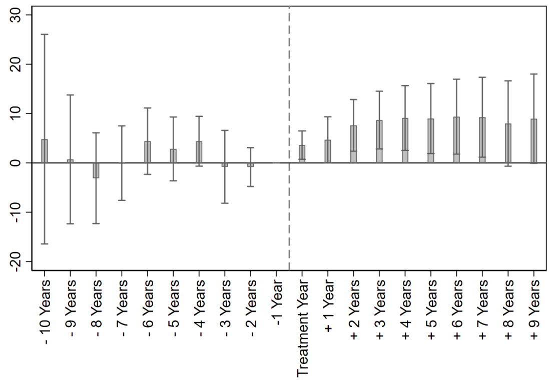


(e) Users^{80+}

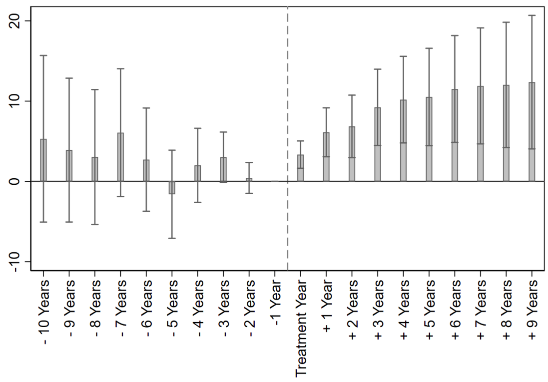
Figure 7: Random Placebo Tests (Continuous Treatment)



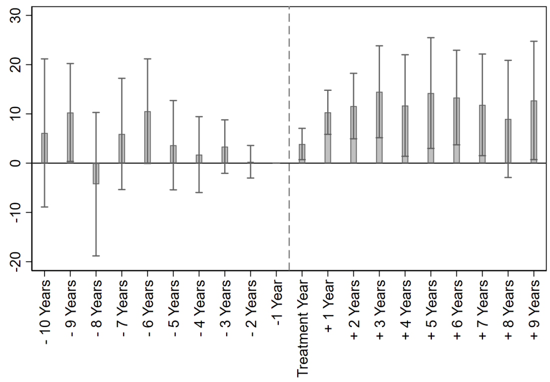
(a) $\text{Rooms}^{\text{Total}}$



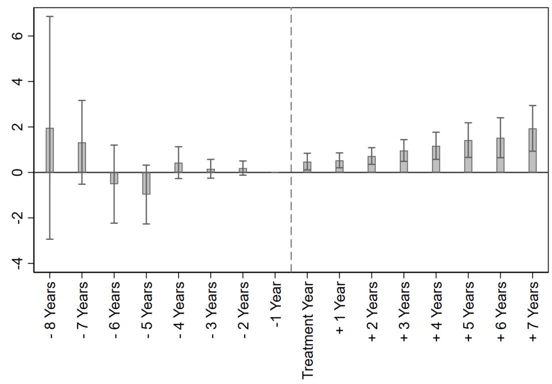
(b) $\text{Spaces}^{\text{NH}}$



(c) $\text{Rooms}^{\text{Single}}$

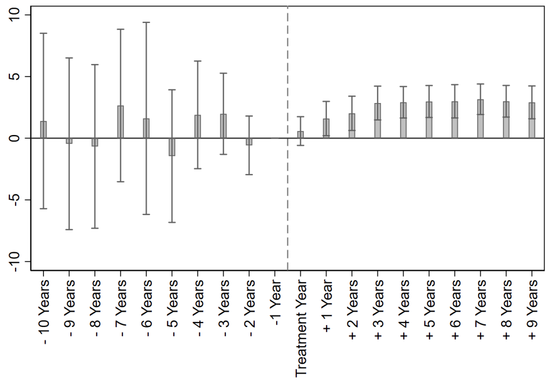


(d) $\text{Rooms}^{\text{Bath}}$

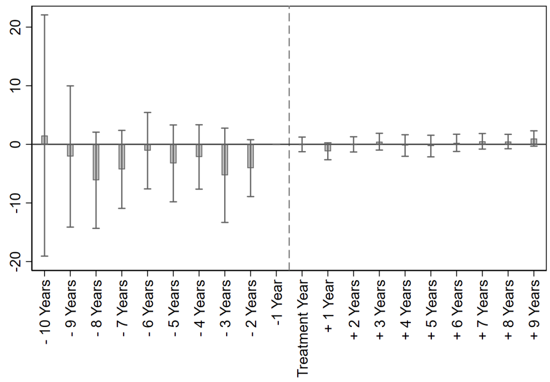


(e) Users^{80+}

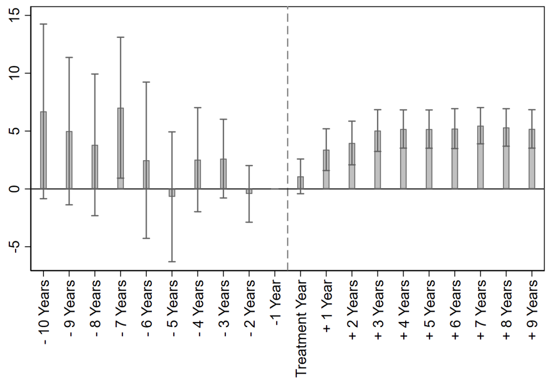
Figure 8: Event Study Graphs (Binary Treatment)



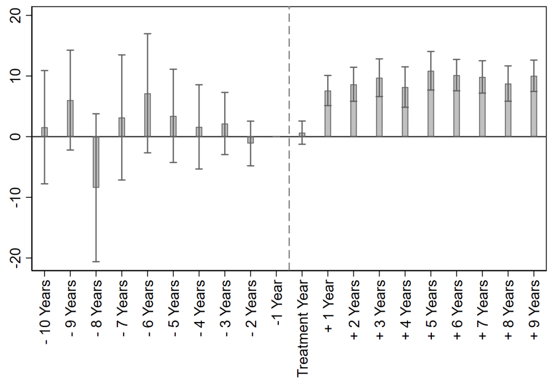
(a) $\text{Rooms}^{\text{Total}}$



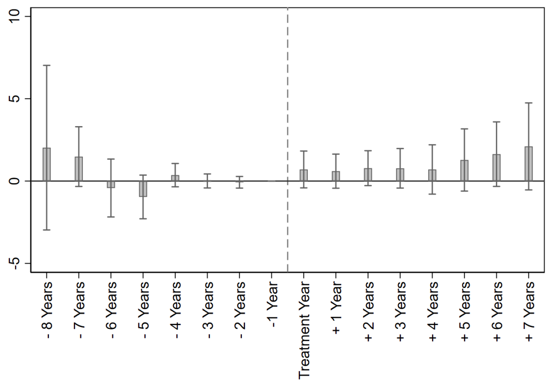
(b) $\text{Spaces}^{\text{NH}}$



(c) $\text{Rooms}^{\text{Single}}$



(d) $\text{Rooms}^{\text{Bath}}$



(e) Users^{80+}

Figure 9: Event Study Graphs (Continuous Treatment)

a positive and constant causal effect on the total number of rooms, the number of single rooms, and rooms with bath, and perhaps an increasing effect on the number of nursing home users aged 80 and above. An effect on the number of nursing home spaces is not clear but the parallel trend assumption does not seem to be violated in any case.

7 Conclusion

In this study, we evaluated whether the two Care Plan programmes in Norway had a causal effect on quantity, quality, and users indicators for nursing homes. We observed municipality-level variables of a maximum period of 18 years from 1998 to 2015 and applied difference-in-differences approaches to two types of treatment variables, one binary indicating the first year after the first application for grants, and one continuous representing the aggregate amount of grants applied for up to a specific year.

Our results indicate that the Care Plan programmes had a huge influence on the quality of nursing homes as on average the number of single rooms and rooms with baths increased by up to 4.26 and up to 7.97, respectively, for an increase in aggregate grants of 10,000,000 NOK per 10,000 inhabitants according to our fixed effects models. The evidence for an increase in the total number of rooms is slightly weaker but our continuous treatment variable specification is still able to find a highly significant positive effect of on average 2.48 if fixed effects are included. Further, the number of nursing home users aged 80 and above is effected as well as additional 10,000,000 NOK per 100 inhabitants aged 80+ leads to an average increase in one person per 100 inhabitants aged 80 and above. The effect on nursing home spaces is hardly significant.

By this, we conclude that the care plan mainly affected the quality of nursing homes and especially the number of single rooms and number of rooms with bath which also led to an increase in the total number of rooms. This increase in quality possibly made entering a nursing home more attractive which led to a higher number of elderly nursing home users. The weak effect on the number of spaces is perhaps caused by a nearly sufficient supply.

Random placebo tests and event study graphs further confirm our previous findings and show that the parallel trend assumption is likely to hold.