CARE REGIMES AND TIME ALLOCATION: AN EVENT STUDY ANALYSIS OF THE US PUBLIC EXPENDITURE

WORKING PAPER

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ABSTRACT

This paper provides new evidence that public investments in education, healthcare and public welfare significantly influence individual time allocation. We analyze the United States care regime from 2004 to 2021 where the latter is subject, as a public expenditure component, to positive and negative phases, or events. By distinguishing between expansionary and recessionary events, we study the individual time allocation as affected by alternative phases of the regime of care using a diff-in-diff event study design that exploits that extreme public spending investments occur in spikes. Using representative samples from the American Time Use Survey and the US State & Local Government Expenditure databases, we find that positive spikes in state and local expenditures cause increases in the waged working time for women and reduce the burden of domestic and care responsibilities. Conversely, period of fiscal austerity result in a gendered shift from paid to unpaid activities. These effects are large and highlight the role of institutional factors in shaping gender time inequalities and the need for gender budgeting at both recessionary and expansionary stages of the fiscal budget cycle.

1 Introduction

Interest in how individuals allocate their time is now gaining unprecedented momentum among economic scholars, particularly in understanding the balance between waged work, household tasks, and leisure activities, as well as how external conditions influence their substitutability. This topic, originally conceptualized by Margaret Reid and later popularized by Gary Becker and

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Jacob Mincer, has become increasingly important for both micro- and macroeconomic research, especially in studies adopting feminist or gender-aware perspectives on welfare state systems and household behavior. This is also due to the increasing availability of multinational time-use survey data (Gershuny and Harms, 2016), which facilitates applied research, alongside the estimates of historical time series that shed light on secular trends. Notable contributions in this area include works by Ngai et al. (2024), Gershuny and Harms (2016), Ramey and Francis (2009), Ramey (2009), stemming from earlier findings by Goldin (1990) and Vanek (1974).

Recently, time-use data has been integrated into macroeconomic models incorporating home production to study the evolution of time allocation over the business cycle (refer to Aguiar et al. (2013) for evidence during the Great Recession), or whether shifts in the productive structure and the marketization of household tasks explain long-term trends in time use (Ngai et al., 2024). Time reallocation has also been identified as a new channel for propagating macroeconomic shocks (Cacciatore et al., 2024), as a driver for fiscal multipliers (Gnocchi et al., 2016) and as a conditioning variable for estimating the effects of policy interventions, such as working time reductions and universal income schemes in the system dynamics Eurogreen model by Cieplinski et al. (2023).

Although scholars have long conceptualized the public provision of healthcare, childcare, education, and social assistance as public goods with significant indirect benefits for social cohesion and social capital (Arrow, 1996; Folbre, 1994; England, 2005), empirical research has only recently begun to robustly quantify their impacts on female labor market outcomes. Public investment in care infrastructure can reduce the burden of household labor and increase female employment (Olivetti and Petrongolo, 2017; De Henau and Himmelweit, 2020; Addabbo et al., 2012), while austerity measures have been shown to exacerbate the gender gap in time use (Sen, 2023). On the supply side, public early childcare services have been identified as having the most substantial impact on female labor force participation (Asai et al., 2023; Grigoli et al., 2018; Olivetti and Petrongolo, 2017). On the demand side, studies using input-output tables (De Henau et al., 2016; Ilkkaracan et al., 2021) and SVAR models (Onaran et al., 2022; Reljic and Zezza, 2024) highlight the positive effects of government spending on social infrastructure, particularly in terms of employment multipliers, which have a favorable impact on female employment through this type of fiscal policy.

A third remarkable and growing scholarship is the one that acknowledges time deficits as key for assessing poverty and life quality (Zacharias (2017); Antonopoulos et al. (2012)), as well as a source of instability/crisis tendency of the capitalist system of production, in a context of high rates

of women engaged in waged full-time jobs and responsible for social reproduction duties in a context of aging population (Fraser, 2016).

In this paper, we aim to contribute to these three bodies of literature by estimating the gendered effects on time use during both expansionary and recessionary periods of public spending in the U.S. care regime. By *care regime* we refer to general public expenditure on public welfare, healthcare, and education, encompassing funding for social programs, elder care and childcare facilities. The concept of care regime was systematically introduced in the 1990s and remains widely used as a framework for analyzing welfare states (Bettio and Plantenga (2004); Giordano (2022)). Care regimes typically include the set of policies, regulations, and arrangements each state uses to manage care responsibilities, resulting in specific partition between the state, the market, and the family. While scholars may offer different definitions based on their focus, common components of care regimes include childcare, long-term care, and elder care policies, as well as support for families in performing domestic and care activities (for instance, Simonazzi (2009) includes national employment models for paid caregivers). Also forms of social assistance aimed at reducing poverty and deprivation might be interpreted as contributions to care provision, as they affect human capabilities and the overall social climate (Folbre, 2024). Overall, our framework also acknowledges the recent systematisation of gender regime theory by Walby (2020), which builds upon Korpi (2000) and Lewis (2002) and emphasizes the role of welfare states in either enabling or hindering gender parity in both market and home production.

More specifically, we aim to estimate the effects of both extreme positive (right-tail investment spikes) and negative (left-tail investment spikes) events in the growth rate of public financing for the care regime in each state for the period 2004-2021, employing a difference-in-difference event study design using the estimator proposed by De Chaisemartin and d'Haultfoeuille (2024) that leverages the staggered timing of these events and their intensity. For this purpose, we combine the American Time Use Survey collecting information on hours spent in waged activities on the labour market and unpaid household activities with state and local expenditure data disaggregated by typology, as provided by the Urban Insitute. We also add state-level information on union coverage, minimum wage and income per capita to control for other phenomena that could have changed along with social spending. We identify public spending events by exploiting the nature of this variable to occur in spikes, accounting for their intensity and accommodating the possibility of multiple events. The suitability of our definition of investment spike is tested through the Callaway and Sant'Anna (2021) estimation method (CS) and our main result for the effect of these events on individual time use are computed relying on the normalized DiD estimator provided by De Chaisemartin

and d'Haultfoeuille (2024) (dCDH). The choice of these estimation techniques is due to the now well-documented challenges associated with two-way fixed effects estimators in staggered adoption settings with heterogeneous effects, which relies on "bad comparisons" between treated units and inappropriate controls, possibly resulting in estimates with the wrong sign (Goodman-Bacon, 2021; Borusyak and Jaravel, 2018). CS and dCDH estimators circumvent this problem by allowing only for good comparison between treated and control units (Baker et al., 2022), with the latter also accommodating continuous and non-absorbing treatments.

Using difference-in-difference event study framework to assess the impact of expenditures on education and healthcare across U.S. states on a variety of outcome variables has become a widely debated topic in applied microeconometrics research. For instance, Courtemanche et al. (2017) quantify the effects of the Affordable Care Act on healthcare access, risky health behaviors, and self-assessed health by leveraging state-level variations in the policy's implementation intensity. Similarly, Lafortune et al. (2018) investigate the impact of post-1990 school finance reforms on outcomes in low-income school districts by identifying structural shifts in state school financing, using the year of the largest financial change as the treatment point. Researchers also tend to provide their own definition of event to extend the methodology's applicability. For example, Gilpin et al. (2024) assess the effect of a discrete increase of at least $200 per student in public library capital spending on test scores. Likewise, Jackson and Mackevicius (2024) use a similar framework to evaluate the impact of a $1,000 increase in per-pupil spending in K-12 education on student outcomes. Finally, Sen (2023) applies the estimator from Sun and Abraham (2021) to assess the effect of austerity measures in school spending—defined as the first year of negative growth—on the gender gap in time use. As far as we know, this is among the few works using a diff-in-diff event study design for assessing the impact of public spending on time use aggregates, and we significantly expand her exercise by accounting for total spending in care regime–and not only the one for non-tertiary education–by analysis both positive and negative investment spikes–and not only austerity-related downturns–and by acknowledging also waged hours of work as outcome variable.

What we find is that positive investment events succeed in alleviating the unpaid care burden for women in the decade subsequent the occurrence of the spike, boosting their aggregate level of hours spent in the labour market. Women residents in treated states save one hour per day on household activities compared to their counterparts in non-shocked states, being this hours allocated to paid work activities. Negative investment events, on the contrary, significantly hamper female labour force participation, amounting to nearly two hours less per day as cumulative effect

over ten years. For females, the effects are stark and significant, while on the male side results remain inconclusive, pointing at the highly gendered effect of this type of public spending. We also address heterogeneous effects based on household's income class, confirming extant evidence on the importance of socioeconomic status differences in shaping home production in the United States (Moos and Gonalons-Pons, 2024).

In our study we shed light on the channel through which public spending in the care regime can stimulate employment by reducing unpaid household work, thereby encouraging the substitution of unpaid tasks with paid work. We provide confirmatory evidence of the gendered, class-based and positive effects of a well-financed public care provision, as well as for the necessity of gender budgeting at both up- and downturns of the fiscal budget cycle.

The remainder of the paper consists in Section 2 listing few relevant stylized facts for the topic at stake, which inform our analysis and justify methodological choices in the section of results. Section 3 provides some descriptive evidence of the U.S. care regime while Section 4 and Section 5 describe data used for the construction of our sample and the empirical strategy, respectively. Results are summarized in Section 6, along with an analysis based on income-class subsamples to assess heterogeneous effects and estimates with different specifications of treatment. Section 7 concludes.

2 Stylized Facts

In what follows we list some key stylized facts about time use, which provide a framework for our research strategy, helping us address the research question, understand its limitations, and interpret the results.

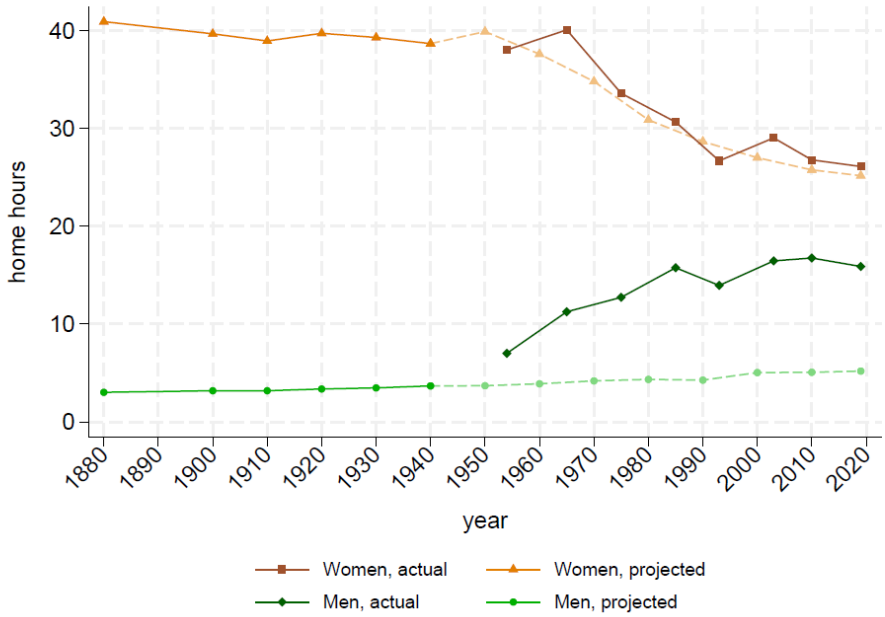
- *Paid market hours vary more than hours spent in home production.*
  Secular trends in the United States reveal that men's paid market hours have steadily declined, falling from 61 to 35 hours per week between 1880 and 2019. In contrast, women's market hours followed a U-shaped pattern, beginning at around 17 hours per week in 1880, dropping to 13 hours by 1940, and then increasing to about 27 hours over the next eight decades (see Figure 1). Scholars tend to attribute women's evolving participation in the workforce to a combination of household income effects in the 1960s, social norms that initially limited entry into manufacturing, and the later expansion of white-collar jobs in the service sector which raised the opportunity cost of homemaking (Ngai et al., 2024). The role of the establishment of national welfare systems is often overlooked in these analyses. Meanwhile,

total time spent on home production – mainly by women – remained stable at around 40 hours per week until 1960 before falling to 25 hours (Figure 1). Over the past 150 years, hours spent by women in home chores, childcare and other care as primary activity have decreased by 2 hours per day, while men's contributions have risen by 1.5 hours per day. Despite the rise of household appliances, high standards for cleanliness and nutrition contributed to what is known as the "paradox of stable hours" until the 1960s (Mokyr, 2000). According to the ILO, in a sample of 25 countries across seven continents, between 1998 and 2012, the weighted average of women's unpaid care work decreased by 10 minutes per day (from 4 hours 36 minutes to 4 hours 26 minutes), while men's unpaid care work increased by only 1 minute (from 1 hour 55 minutes to 128 minutes) (Charmes et al., 2019). In high-income countries, recent trends highlight the influence of changing gender norms and lower fertility rates, though the role of state care provision is often overlooked.

- *Unpaid care work is a significant barrier to women's labor force participation.*
  Unpaid care work remains a key reason why reproductive activities deserve greater attention from economists. Gender inequality in labor market participation is often attributed to the unequal distribution of housework and caregiving responsibilities (as initially conceptualized by Hochschild (1989)). According to the ILO and based on the latest available time use survey data, women in high-income countries are 8% less likely to participate in the labor force compared to women without children of the same age. Interestingly, men are now increasingly exiting the labor force for family reasons as well. For instance, the presence of older individuals in the household is linked to a 12.4 percentage point drop in the labor force participation rate among men in high-income countries (Addati et al., 2018).
- *Gender matters.*
  Gender is the most significant explanatory factor in time-use dynamics. Both historical data and recent surveys consistently show that women are more involved in unpaid care and housework and less engaged in formal labor market activities compared to men, regardless of income level. ILO estimates from 64 countries show that women contribute more than three-quarters of the 16.4 billion hours of unpaid care work performed daily. On average, men spend 83 minutes per day on unpaid care work, while women spend 265 minutes – over three times as much (Addati et al., 2018).
- *Class matters.*
  The aging population in Western countries, combined with the decline of the Keynesian consensus on welfare state models, particularly in Europe, has exacerbated class divides in accessing elder and childcare services. Households that can afford market-based care services are increasingly differentiated from those that rely on family members to provide

care (Vaittinen et al., 2018; Brennan et al., 2012; Small, 2023; Fields et al., 2024). As Nancy Fraser puts it, care and domestic work today is "dualized: commodified for those who can pay for it, privatized for those who cannot – all glossed by the even more modern ideal of the 'two-earner family'" (Fraser, 2016).

Figure 1: Weekly hours in home production in the United States. *Source:* Ngai et al. (2024)



In light of these stylized facts, our empirical strategy employs a gender- and income-class-sensitive approach to examine the effects of public care provision, presenting separate results for females and males and accounting for potential heterogeneous effects across different household income levels (Section 6.1). In discussing the results, we acknowledge that the outcome variables—namely, paid hours in waged employment and unpaid hours in housework and caregiving—respond differently to external factors, with unpaid work being generally more resistant to change.

The next section offers an overview of the key features and recent developments of what we define as the U.S. care regime, explaining the rationale behind our selection of expenditure categories to include in the empirical strategy.

3 A Glimpse of the United States Care Regime

In our analysis we define the care regime as the total public direct expenditure by state and local governments on K-12 education, healthcare, hospitals, and public welfare, as categorized by the Urban Institute under the Census classification. This approach captures the capacity of each of the 50 states to provide eldercare, childcare, and healthcare, along with educational programs for citizens under 18 – when they are still dependent on their households – and income support for households below the poverty line to help them achieve a minimum standard of living.

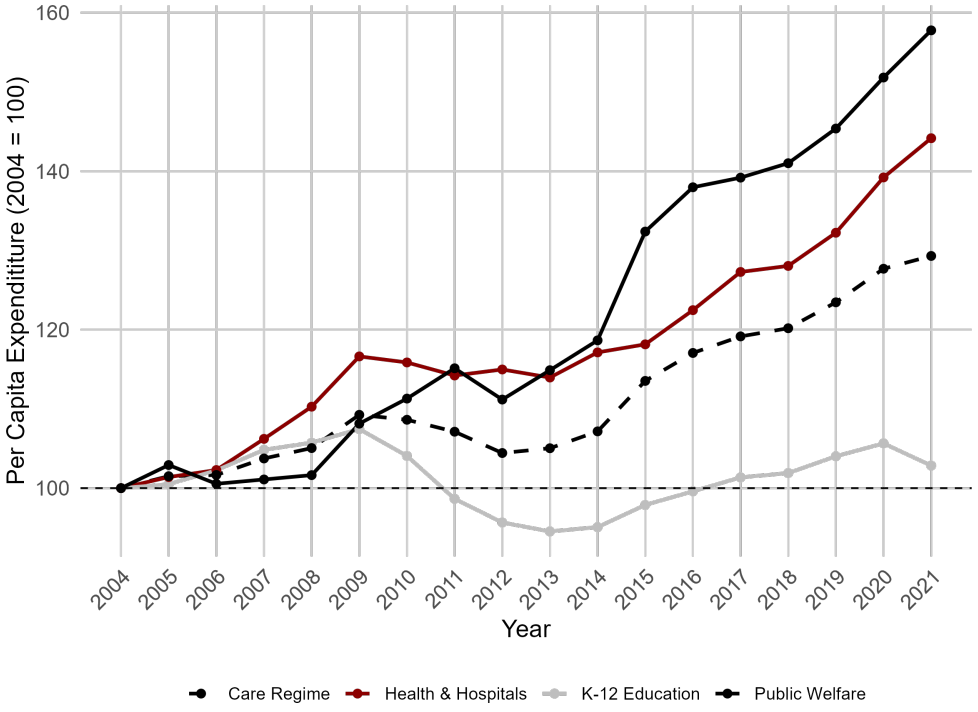
Specifically, K-12 education includes spending on pre-kindergarten programs, primary and secondary education, and covers the operation, construction, and maintenance of public schools and related facilities such as libraries, dining services, transportation, and vocational training. The early care and education landscape in the U.S. is highly fragmented, with various programs administered by the federal government, primarily through funding for state-run subsidy programs for low-income families. However, local administrations have significant autonomy. While state and federal funds largely finance these programs, direct spending on elementary and secondary education is primarily managed at the local level. For instance, the Child Care and Development Block Grant awards funds to states and territories for promoting their child care programs and policies for low-income working families. Similarly, the Preschool Development Grant Birth through Five program, a major competitive grant initiative administered by the federal government, supports state-level early childhood systems for children aged 0-5. It was first authorized in 2015 under the Every Student Succeeds Act (First Five Years Fund, 2024). Federal spending on public education was severely impacted by the austerity measures introduced after the Great Recession of 2007-2009, as seen in Panel A of Figure 3.

Spending on healthcare and hospitals, instead, includes the operation, maintenance, and construction of healthcare infrastructure, including medical schools, government-owned hospitals, community health programs, and payments to private hospitals for public services like Medicare and Medicaid. The federal government's contribution to state and local health and hospital expenditures is generally low but increased significantly in 2021 due to the CARES Act, which provided pandemic relief.

The U.S. healthcare system operates under a mixed private-public model, with the public sector offering health insurance primarily to specific groups, such as the elderly (via Medicare) and low-income individuals (via Medicaid). Additionally, the government provides health insurance for public employees and healthcare for veterans, while the rest of the population relies on employer-provided insurance, private market insurance, or remains uninsured. The Patient Protection and Affordable Care Act (ACA), enacted during the Obama presidency in 2010, aimed

to expand Medicaid and make affordable health insurance more widely available. However, this intervention has faced criticism for its lack of cost control mechanisms, which led to the diversion of public funds to for-profit insurance entities, driving up healthcare costs without fully addressing the issue of underinsurance (Waitzkin and Hellander, 2016). According to the White House, both eldercare and childcare costs have continued to rise significantly. Over the past decade, childcare costs have increased by 26%, and by more than 200% over the past 30 years, while long-term care costs for the elderly or disabled have risen by 40%. This growing financial burden has forced many Americans-—particularly women-—to leave the workforce to care for their families, slowing economic growth (The White House, 2024). A Boston Consulting Group brief forecasts that by 2030, the U.S. could lose $290 billion annually in GDP if affordable childcare solutions are not addressed (Kos et al., 2022).

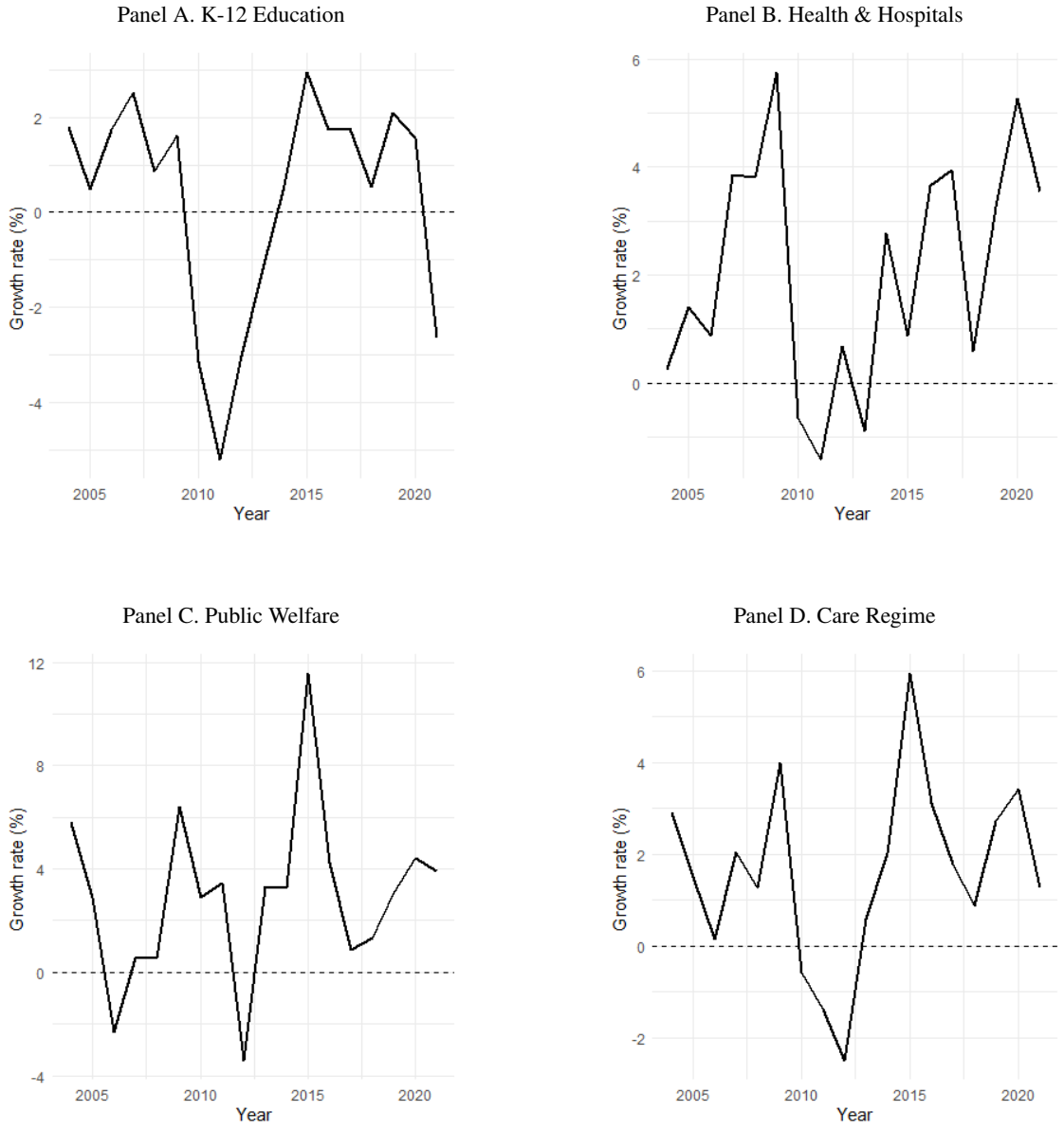
Figure 2: U.S. state and local direct general expenditures by type



As for public welfare expenditures, they primarily consists of Medicaid spending (such as payments to physicians and other service providers, excluding hospitals, which are categorized under hospital expenditures by the Census) and key means-tested social programs like Temporary Assistance for Needy Families (TANF), the Federal Low Income Home Energy Assistance Program, and Supplemental Security Income. In most states, Medicaid and TANF are federally funded but administered by state governments, which set income eligibility limits. Public welfare spending has

experienced the largest growth, driven mainly by higher Medicaid spending due to increased federal funding through the ACA, rising healthcare costs, and expanded coverage (see Figure 2). However, states were given the option to either expand Medicaid coverage with new federal funds or maintain pre-ACA eligibility levels. As of 2024, 40 states have accepted Medicaid expansion funds.

Figure 3: U.S. growth rates in state and local direct general expenditures by type



Although outside the scope of our analysis, it is worth mentioning the complex landscape of parental leave arrangements. The Family and Medical Leave Act of 1993 mandates up to three months of unpaid leave for both parents of newborn or newly adopted children, as well as for

caregivers of sick family members, for employees of companies with 50 or more workers. In addition to federal regulations, 13 states (California, Connecticut, Massachusetts, New Jersey, Rhode Island, Washington, Colorado, Delaware, Maine, Maryland, Minnesota, Oregon, and the District of Columbia) have enacted mandatory paid leave laws financed by pooled payroll taxes on employees and/or employers. New York requires employers to purchase private insurance plans for paid family and medical leave. Nine other states, including Florida, Texas, Alabama, Tennessee, Kentucky, Arkansas, Virginia, Vermont, and New Hampshire, provide voluntary private insurance (Bipartisan Policy Center, 2024). Since many states have only recently implemented paid parental leave programs, this expenditure component is excluded from our definition of the care regime, though it remains an important aspect of informal care provision for infants.

4 Data

4.1 Expenditure Data

We use expenditure data from the U.S. State & Local Finance Data provided by the Urban Institute for the period 2004-2021. This database compiles information from the U.S. Census Bureau's Annual Survey of State and Local Government Finances, the U.S. Bureau of Economic Analysis, and the U.S. Bureau of Labor Statistics. To enable meaningful comparisons across states, financial data are aggregated for all levels of state and local government (county, municipal, town, special district, and school district), as states vary in which level of government delivers services, and local governments often administer programs funded by the state. We use annual per capita real expenditure, adjusted to 2021 dollars, for K-12 education, health & hospitals, and public welfare. Our analysis is restricted to the 50 U.S. states, excluding the District of Columbia due to its outlier status in per capita spending.

4.2 Time Use Data

Annual data on time use and demographic characteristics, such as gender and income class, were obtained from the American Time Use Survey (ATUS), which is conducted annually by the U.S. Bureau of Labor Statistics. The ATUS draws respondents over the age of 15 from the existing sample of the Current Population Survey (CPS). In addition to employment and demographic information, respondents are asked to complete a daily diary detailing time spent on various activities, which ATUS officials categorize into over 400 detailed time-use categories.

We pooled 18 cross-sectional datasets (2004-2021), selecting individuals aged 16-64 who were employed during the survey week and reported at least 1 minute of paid work and 1 minute of unpaid work during the survey day. This selection aims to capture a realistic routine of working individuals.

Work activities include time spent on main and secondary jobs, excluding commuting. As for unpaid work, it encompasses housework, such as cleaning, cooking, shopping, and caregiving for both household and non-household children and adults. In principle, it can be defined as those activities that someone else could be paid to perform (Folbre, 2024), drawing from social reproduction theory in including both relational and non-relational reproductive activities as unpaid work, thus moving beyond the nurturant perspective (Duffy, 2005). We also include time spent supervising children while performing other activities, as child care often appears as a secondary activity, as noted by time-use researchers (Folbre, 2006). The final sample consists of 53,108 observations.

4.3 State Covariates

To account for factors that may influence changes in paid work hours following increases in care regime investments, we include data on time-varying state characteristics such as the minimum wage, union coverage, and per capita gross domestic product. State-level minimum wage data were sourced from the dataset provided by Vaghul and Zipperer (2021), which includes updated hourly minimum wage levels for states and sub-state areas through December 31, 2022.
Union membership data are drawn from the Current Population Survey. Indeed, since 1983, a subset of respondents in the Outgoing Rotation Group has been asked about union membership. This data is expressed as the percentage of employed individuals in each state, excluding incorporated self-employed individuals. Real GDP, measured in millions of chained 2012 dollars, is provided by the Bureau of Economic Analysis.

4.4 Sample Construction and Summary Statistics

Our final dataset consists of a cross-section of 53,108 individuals spanning the years 2004-2021. For each individual, we include information on state-level expenditure, minimum wage, and union membership for their state of residence in the corresponding year. Table 1 presents summary statistics for all variables used in the analysis.

Table 1: Summary statistics

Variable	Mean	SD	Median	P10	P90	Obs.
Unpaid work (Females) (minutes)	223.09	236.66	135.00	20.00	530.00	26,835
Unpaid Work (Males) (minutes)	167.21	196.56	95.00	10.00	400.00	26,273
Paid Work (Females)	434.33	165.99	468.00	180.00	600.00	26,835
Paid Work (Males)	473.75	173.68	490.00	220.00	660.00	26,273
Per Capita Spending in Care Regime (2021$)	5,150.88	1,153.59	4,928.00	4,022.00	6,891.00	53,108
Growth Rate (Spending in Care Regime)	1.77	3.80	1.65	-2.47	6.15	53,108
Minimum Wage ($/hour)	7.62	1.66	7.25	5.15	9.86	53,108
Membership Rate (percentage of employed)	11.25	5.77	11.60	4.40	17.80	53,108
Real GDP Per Capita (million 2012$)	52,773.92	8,728.38	52,563.35	41,941.68	65,000.98	53,108

Notes: This table shows summary statistics describing our pooled cross section dataset. Data cover the years 2004-2021 and come from (i) the American Time Use Survey, (ii) the Urban Institute U.S. State& Local Finance, iii) the Historical State and Sub-state Minimum Wages dataset (see Vaghul and Zipperer (2021) for more details), (iii) the Current Population Survey Outgoing Rotation Group data, iv) the Bureau of Economic Analysis database.

5 Empirical Strategy

This section presents our empirical strategy to identify the effect of public spending on time use. First, in Section 5.1, we describe the construction of our treatment variable, i.e. positive and negative spikes in public spending on care regime, and in Section 5.2 we outline our difference-in-difference event study design.

5.1 Defining Investment Spikes Events

We define our investment spike in public spending on the care regime as a growth rate exceeding the state mean by more than two standard deviations for positive events, and falling below the state mean by more than two standard deviations for negative events. This approach provides a binary indicator of whether the growth in public care regime spending is performing significantly better (positive event) or worse (negative event) than expected, based on the mean and variability from 2004 to 2021[2]. We test the suitability of our definition by estimating the effect of the event on levels of spending on care regime in our panel of 50 U.S. states. We expect that positive investment spikes will significantly increase such levels, while negative investment spikes will significantly decrease them. An hypothesis confirmed by the CS estimates plotted in Panel A and Panel B of Figure 5. Figure 4 visually represents the events we aim to capture, taking California as an example, while Figure 6 illustrates the incidence of exposure to both types of events.

[2]And admits the possibility for states to be not treated. This possibility is indeed ruled out by another more intuitive definition, such as setting the threshold for positive and negative events in the first and third quartiles or other quintiles.

As will be clarified in the following subsection, to capture the intensity of the spike, we then construct a continuous variable that represents the extent of the deviation from the mean. Specifically, the intensity of positive spikes measures how much the growth rate exceeds the threshold of the state mean plus two standard deviations. Conversely, for negative spikes, it measures how much the growth rate falls below the threshold of the state mean minus two standard deviations. In Section 6 we discuss the estimates from De Chaisemartin and d'Haultfoeuille (2024) for the effects on time use of exposure to this non binary treatment.

Figure 4: Density of growth rates in care regime spending for California 2004-2021

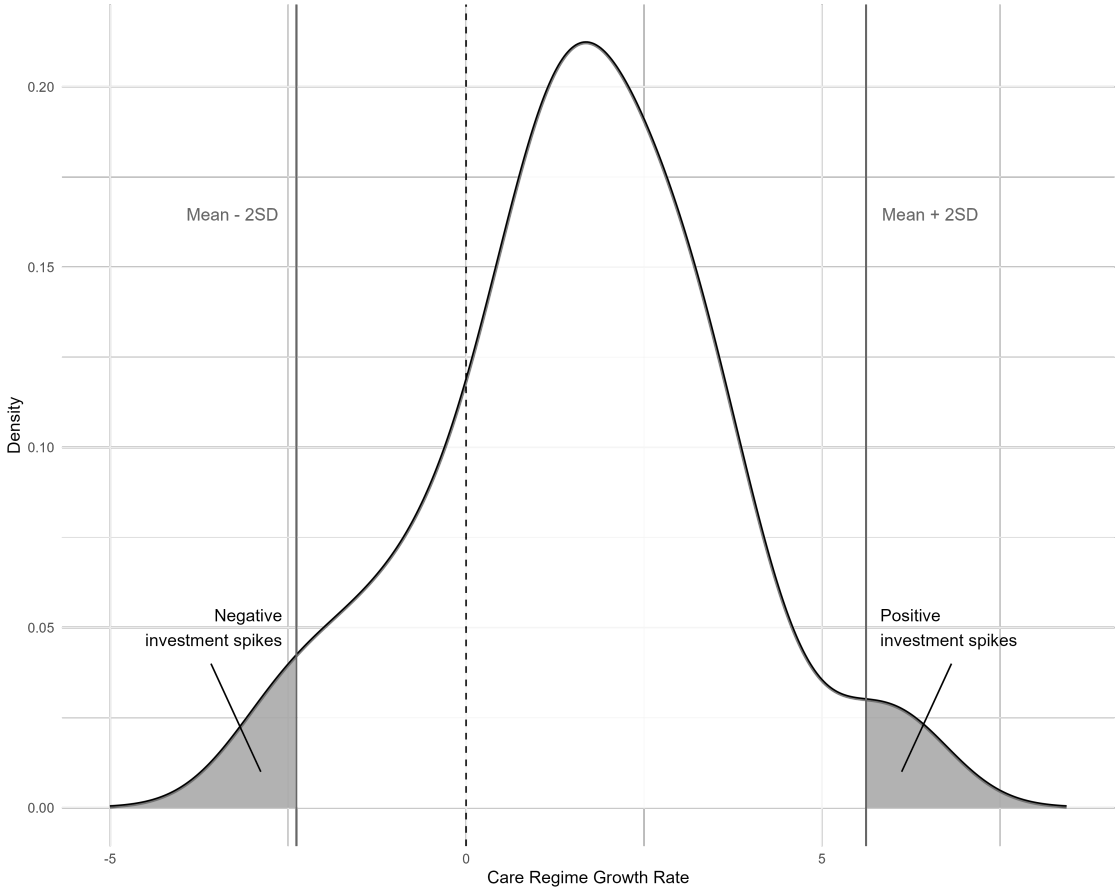
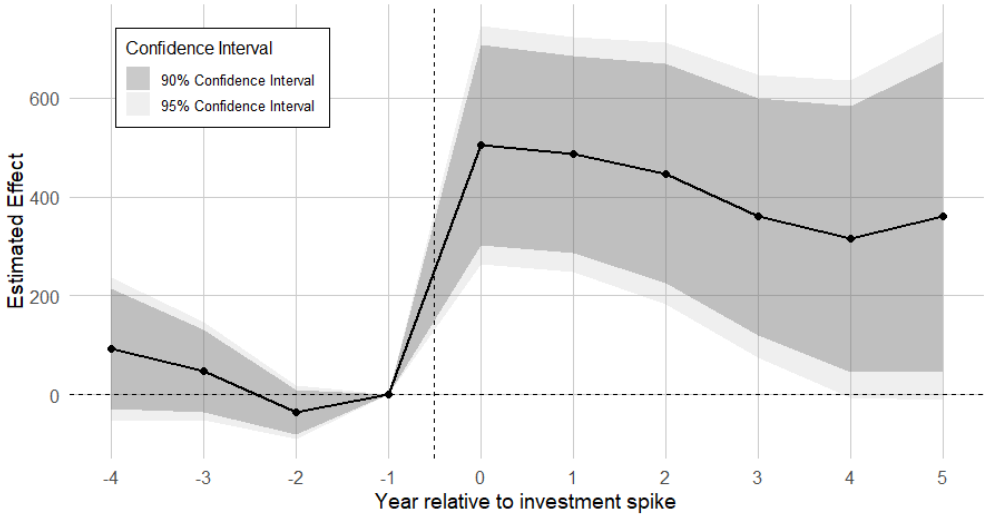
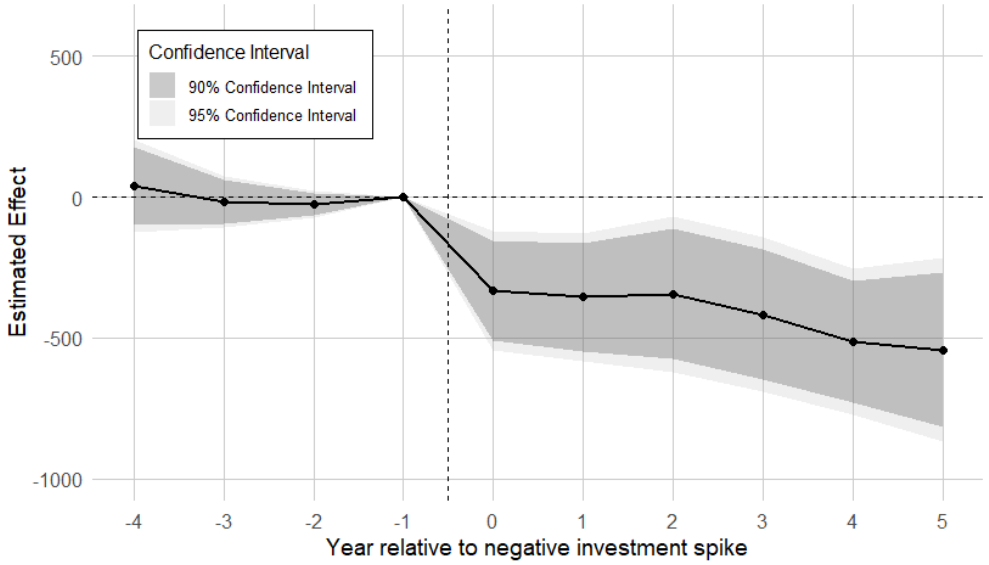


Figure 5: Impact of positive and negative investment spikes on public spending in care regime

Panel A. Levels of public spending in care regime (positive spike)



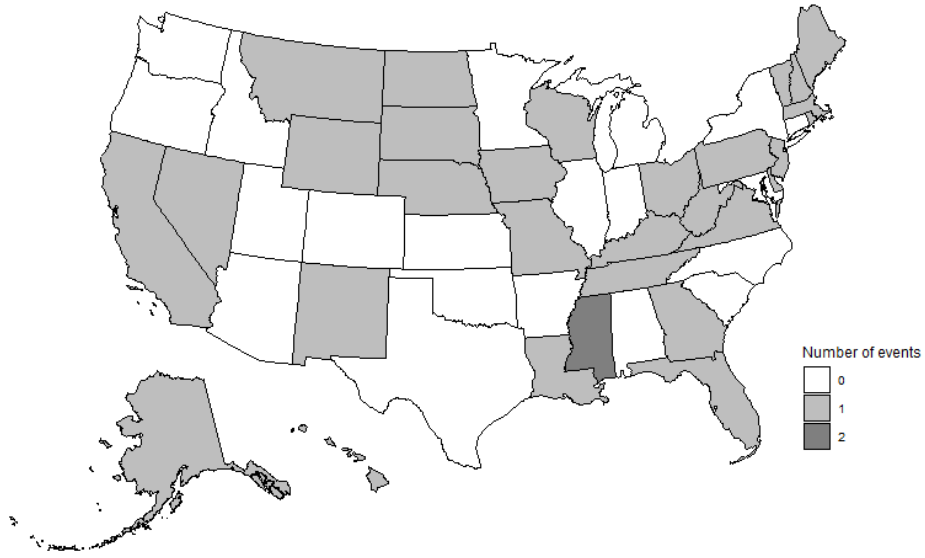
Panel B. Levels of public spending in care regime (negative spike)



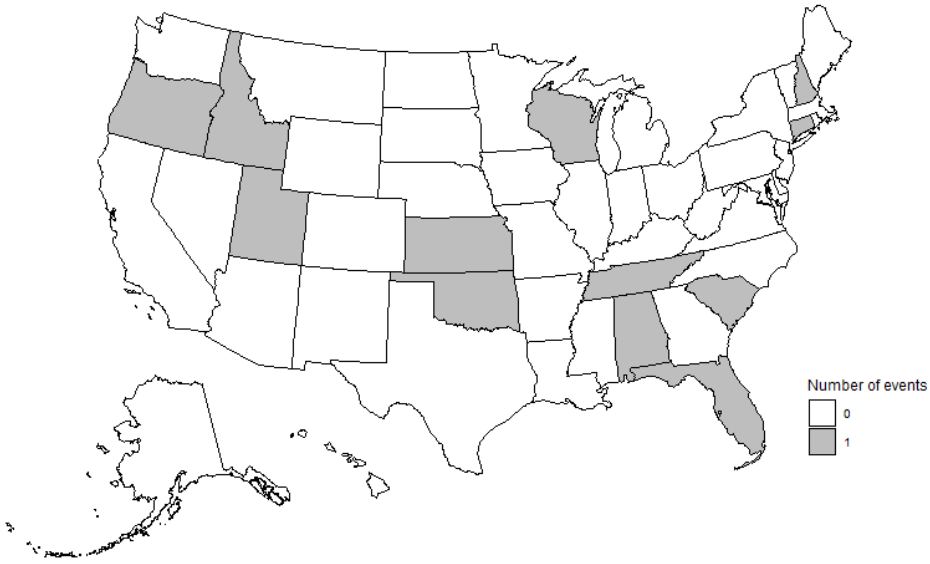
Notes: The figure provides event study estimates of the dynamic effects of experiencing a positive spike in investments (Panel A) and a negative spike in investments (Panel B) using the approach of Callaway and Sant'Anna (2021) for our state-year panel. The comparison group comprises never-treated states, with the analysis conducted under the assumption of parallel trends and no anticipation. The coefficient for the year prior to treatment is normalized to zero. Bootstrapped standard errors are clustered at the state level, with confidence intervals provided for both the 5% and 10% significance levels.

Figure 6: Incidence of the events

Panel A. Positive events



Panel B. Negative events



5.2 Event Study Framework

After testing the capacity of our binary and absorbing treatment to capture investment spikes, we create a new variable accommodating for both the intensity of the spikes a state might experience over the 2004-2021 period and the non absorbing nature of the treatment, meaning it can switch on and off over time. To estimate the effect on time use of states exposure to the treatment for

our cross-sectional dataset of individuals, we use the normalized DiD event-study estimators introduced by De Chaisemartin and d'Haultfoeuille (2024). We construct the group-level panel data by aggregating our repeated cross-sectional individual dataset at the (g, t) level, defining groups as individuals' state of residence. ATUS weights are always applied.

We regress the following model on our cross-sectional data of individuals i, being s their state of residence:

$$Y_{ist} = \alpha_s + \alpha_t + \sum_{\substack{e=-3 \\ e\neq -1}}^{10} \beta_e \cdot \mathbf{1}[t = g_s + e] \cdot \text{InvestmentSpikeIntensity}_{st} + X_{st}\gamma + \varepsilon_{ist} \qquad (1)$$

where Y_{ist} is the time use aggregate of interest, representing either the amount of daily minutes of unpaid work or paid work for individual i in state s at time t. α_s and α_t are state and time fixed effects, β_e are the coefficients of interest and $\mathbf{1}[t = g_s + e]$ is an indicator function that equals 1 when time t is e periods away from the treatment for state s, where g_s is the treatment time for state s. Finally, $\text{InvestmentSpikeIntensity}_{st}$ corresponds to the treatment intensity, which varies across states and over time, while X_{ist} is our vector of time-varying state control variables as defined in Section 4.

For all states that experience a change in their treatment over the period 2004-2021, the non-normalized event-study estimator DiD_l measures the average effect across all switchers of being exposed to a higher treatment dose for l periods. The normalized event-study estimator DiD_l as detailed in De Chaisemartin and d'Haultfoeuille (2024) computes a weighted average of the effects of the current treatment and its first $l - 1$ lags on the outcome.
This method computes the effect of incremental treatment doses by averaging the outcome evolution of switcher states relative to their period-one treatment, adjusting for the varying intensities and timings of the treatment across states. In the next section, Figures 7 and 8 display the normalized event-study estimates for positive and negative investment spikes. In Table 2 we display the estimated average total effect over the time span per unit of treatment as a synthetic indicator of the sign and magnitude of the effects on time use for individuals residing in states experiencing the event, along with three placebo estimators to test the parallel trends and no-anticipation assumptions.

6 Results

Figure 7 presents the estimated coefficients from equation (1), where the treatment is defined as a positive spike in care regime spending. The coefficients capture changes in daily minutes of unpaid and paid work for residents of states experiencing the treatment, relative to those in non-switcher states, during the three years before and ten years after the increase in aggregate public funding for K-12 education, healthcare, and public welfare. These changes are compared with the year immediately prior to the spending increase.

In the decade following the positive event, female residents in affected states spent approximately one hour less per day on household tasks compared to their counterparts in non-affected states (Panel A in Figure 7 and Table 2). At the same time, they gained over an hour per day in paid work (Panel B). For males, the estimates suggest an increase in unpaid household duties and no significant effect on paid work. However, the test for the nullity of pre-trends indicates potential bias in the results for men, preventing causal interpretation (Table 2). These findings highlight the gendered effects of public spending in key sectors such as education, healthcare, and social assistance. A substitution effect appears to be at play, with state-provided services replacing the informal care work performed by women and paving the way to their participation in the waged workforce.

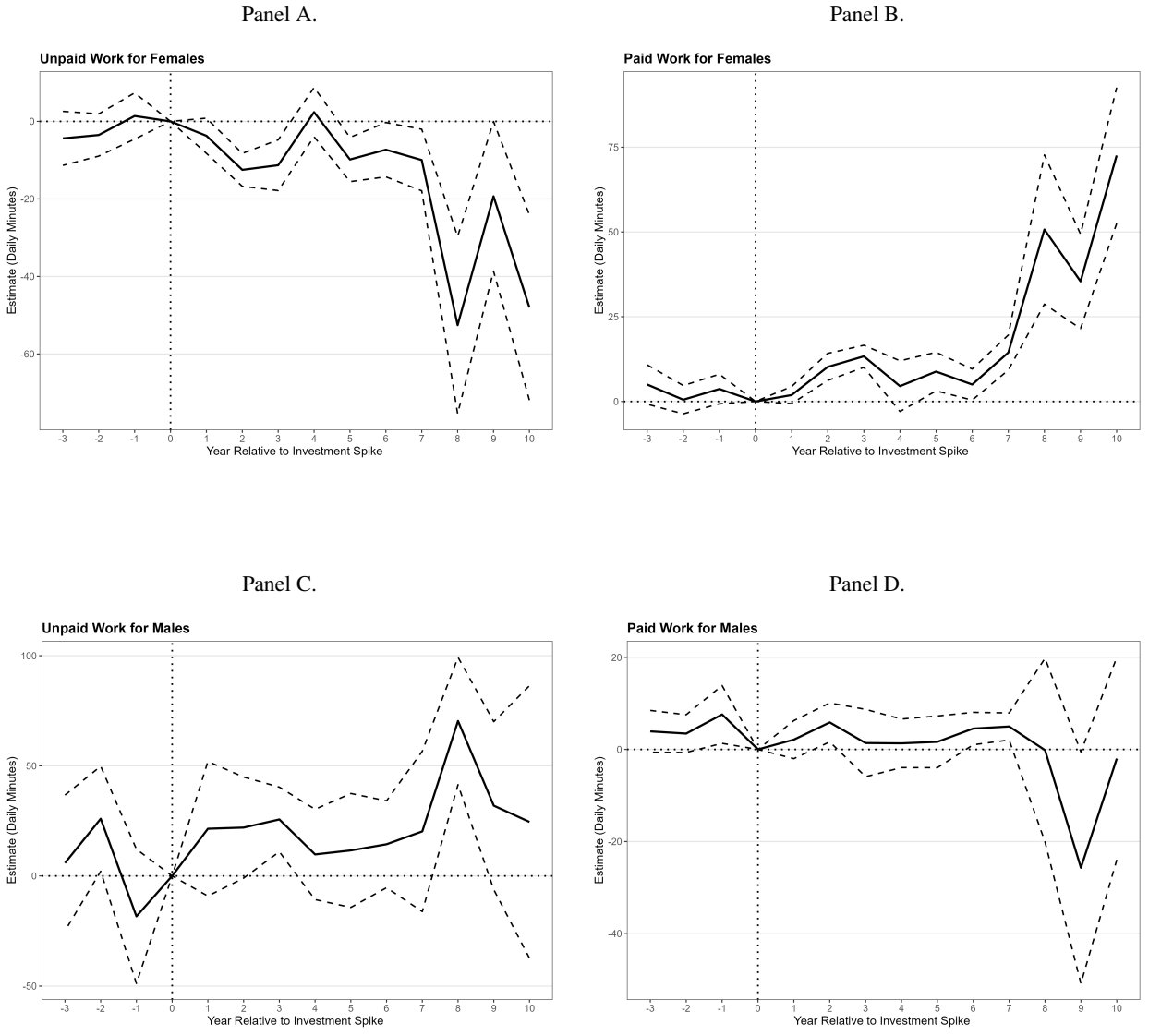
In contrast, negative shocks in care-related public spending result in a significant reduction in waged work hours for women, amounting to nearly two hours less per day as cumulative effect over ten years. For men, negative events seem to reduce unpaid duties, likely due to increased time spent in the labor market as a response to economic downturns. However, we cannot confidently exclude the presence of pre-trends, making coefficients in Panel D of Figure 8 less reliable for sound conclusions. This result may stem from the greater responsiveness of male labor supply to economic downturns compared to that of females. Negative events tend to reduce male participation in unwaged activities, likely due to increased time spent in the labor market—an anticipatory behavior that violates the pre-trends assumption.

We corroborate the existing literature on the positive relationship between public care provision and female labor force participation, while contributing new evidence on the substitutability between state-provided care and unpaid household care. Additionally, our findings on the contrasting effects of economic downturns for women and men – where women reduce paid labor market hours and men decrease their involvement in unpaid care work – complement Sen (2023),

who highlights the exacerbation of gender disparities in household childcare during austerity periods.

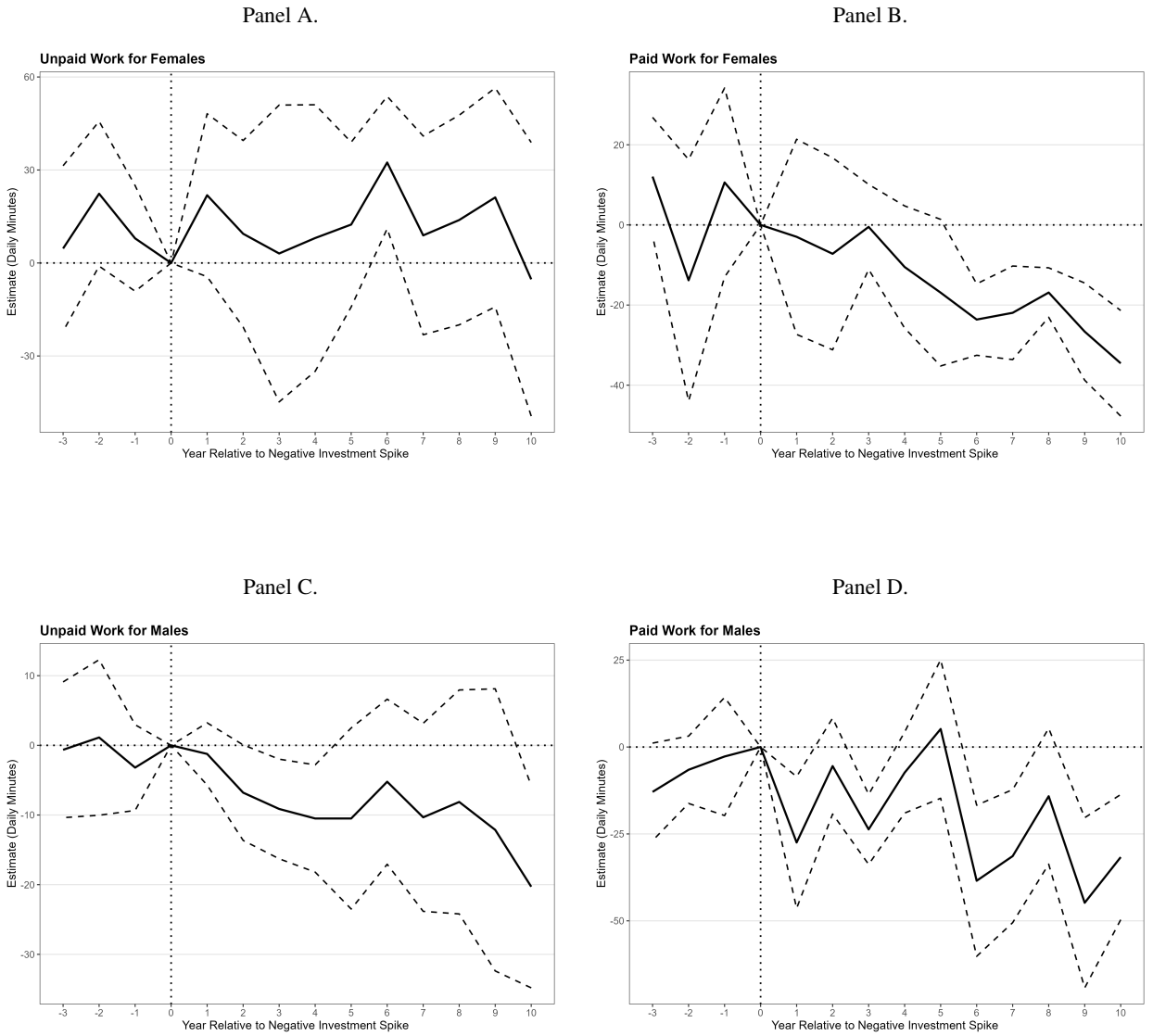
In the following subsections, we estimate heterogeneous effects based on household income levels and assess the robustness of our findings under alternative definitions of treatment.

Figure 7: Event study estimates for positive investment spikes



Notes: The figure provides event study estimates of dynamic effects of experiencing a positive spike in investments for female (Panel A and B) and male individuals (Panel C and D) for different time use aggregates, using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-section. Estimated coefficients are specified in equation (1) and expressed in daily minutes. The analysis is conducted with the coefficient for the year prior to treatment normalized to zero. Analytical standard errors are clustered at the state level, and confidence intervals are provided for the 5% significance level.

Figure 8: Event study estimates for negative investment spikes



Notes: The figure provides event study estimates of dynamic effects of experiencing a negative spike in investments for female (Panel A and B) and male individuals (Panel C and D) for different time use aggregates, using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-section. Estimated coefficients are specified in equation (1) and expressed in daily minutes. The analysis is conducted with the coefficient for the year prior to treatment normalized to zero. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance level.

Table 2: Average cumulative effect per treatment unit

	Outcome	*Sample*	*Average cumulative effect*	*Lower bound*	*Upper bound*	*P-value test for pre-trends*
Positive event						
	Unpaid work	Females	-62.21	-99.73	-24.70	0.17
	Paid work	Females	75.23	50.36	100.09	0.10
	Unpaid work	Males	159.37	18.72	300.01	0.08
	Paid work	Males	18.80	-1.41	39.02	0.09
Negative event						
	Unpaid work	Females	121.56	-137.59	380.71	0.09
	Paid work	Females	-117.57	-158.36	-76.78	0.26
	Unpaid work	Males	-97.52	-198.82	3.79	0.48
	Paid work	Males	-208.19	-359.54	-56.84	0.06

Notes: The table provides the average total effect accumulated over the decade following the event. Estimates expressed in daily minutes are derived from equation (1) and computed using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-sectional data. Command `summary.did_multiplegt_dyn` reports the average cumulative (total) effect per treatment unit, summarizing the dynamic effects. It also provides the p-value for the test of joint nullity for the placebos, or pre-trends test, where p-value lower than 0.10 points at possible violation of the parallel trends and no anticipation assumption. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance levels.

6.1 Heterogeneous effects

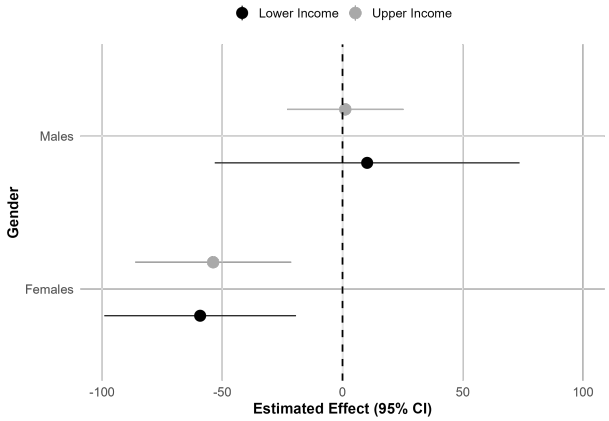
We now analyze subsamples based on income class to assess the presence of heterogeneous effects that could corroborate the "class matters" hypothesis described in Section 2. We estimate equation (1) for four distinct samples, disaggregated by gender and household income. Households with annual incomes above $50,000 are classified as upper-middle income, while those below this threshold are categorized as lower-middle income, in line with the most recent income dynamics outlined by Moos and Gonalons-Pons (2024).

Our results confirm significant substitution effects between informal household labor supplied by women and state-provided services, with negative cumulative effects observed across both income classes (Panel A in Figure 9). Notably, women from lower-income households benefit the most from increased public spending, experiencing a cumulative gain of 100 minutes per day in paid activities over the decade (Panel B). In years of economic contraction, men from poorer

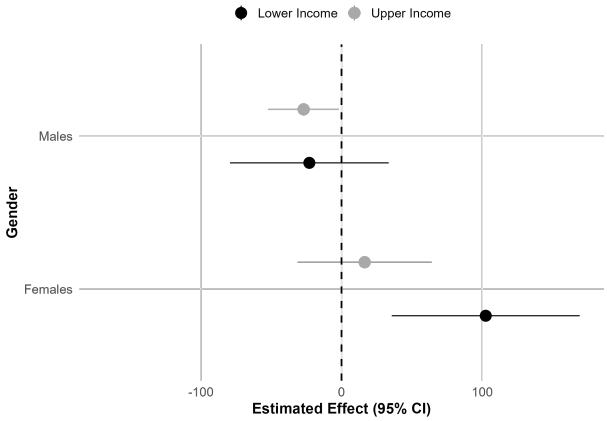
households reduce their involvement in housework and care tasks, while the impact on women varies significantly depending on their income class (Panel C). Austerity measures further reduce women's labor force participation and compel men from lower-income households to increase their paid work hours to maintain their standard of living (Panel D). Our findings seem to confirm the stylized fact emphasizing that "class matters" for time use analysis.

Figure 9: Forest plots with the estimated average total effects

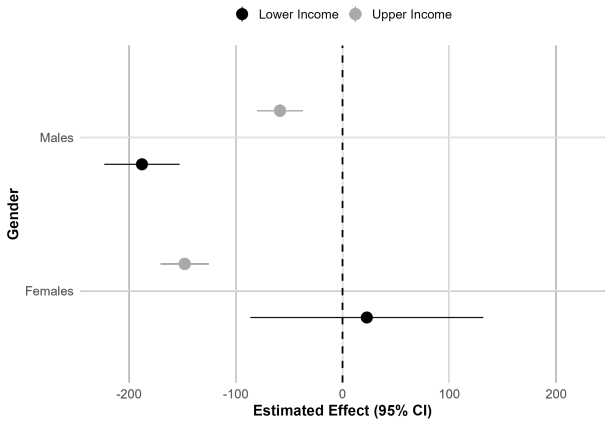
Panel A. Effect of positive spikes on minutes of unpaid work



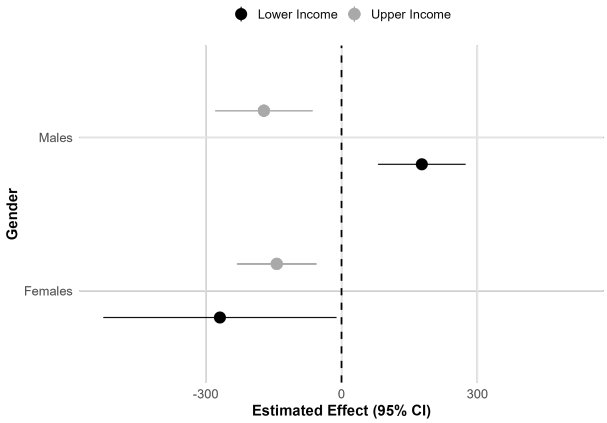
Panel B. Effect of positive spikes on minutes of paid work



Panel C. Effect of negative spikes on minutes of unpaid work



Panel D. Effect of negative spikes on minutes of paid work



Notes: The figure provides the average total effect on time use aggregates accumulated over the decade following the event for four different samples based on gender and income class. Estimates expressed in daily minutes are derived from equation (1) and computed using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-sectional data. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance levels.

6.2 Alternative spike definitions

We further examine our time use results by applying two alternative definitions of positive investment spike. Figure 10 shows the beta coefficients from equation (1) when intensity is defined as the extent to which the growth rate exceeds the state mean by 1.5 standard deviations, provided that the value in the current year is at least 0.5 times the value in the previous year. In contrast, Figure 11 uses a definition where intensity is based on the extent to which the state growth rate exceeds the state mean by one standard deviation and is no less than 0.75 times the value in the previous year.

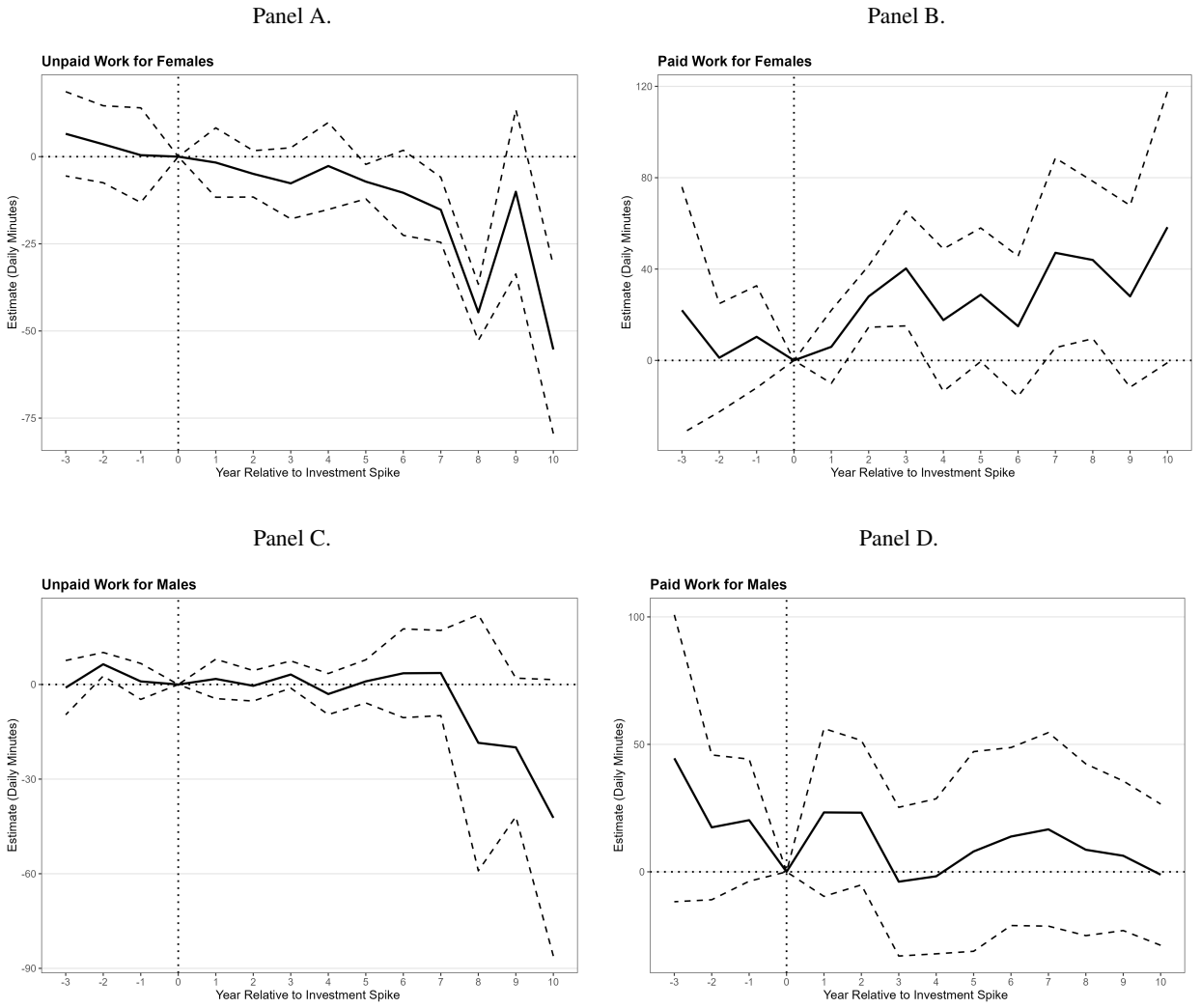
The cumulative effects over the decade following the treatment are reported in Table 3. These results confirm a large and positive effect on paid activities for women (at least in the first alternative definition) and a reduction in care duties robust to both specifications, while the effects for men remain inconclusive.

Table 3: Average cumulative effect per treatment unit

	Outcome	*Sample*	*Average cumulative effect*	*Lower bound*	*Upper bound*	*P-value test for pre-trends*
First definition						
	Unpaid work	Females	-78.82	-128.33	-29.32	0.53
	Paid work	Females	214.53	82.03	347.03	0.58
	Unpaid work	Males	-28.74	-181.10	123.62	0.13
	Paid work	Males	81.92	-112.54	276.38	0.30
Second definition						
	Unpaid work	Females	-30.07	-58.27	1.87	0.35
	Paid work	Females	64.32	-35.45	164.09	0.00
	Unpaid work	Males	-11.77	-53.63	30.09	0.00
	Paid work	Males	58.38	-21.71	138.47	0.20

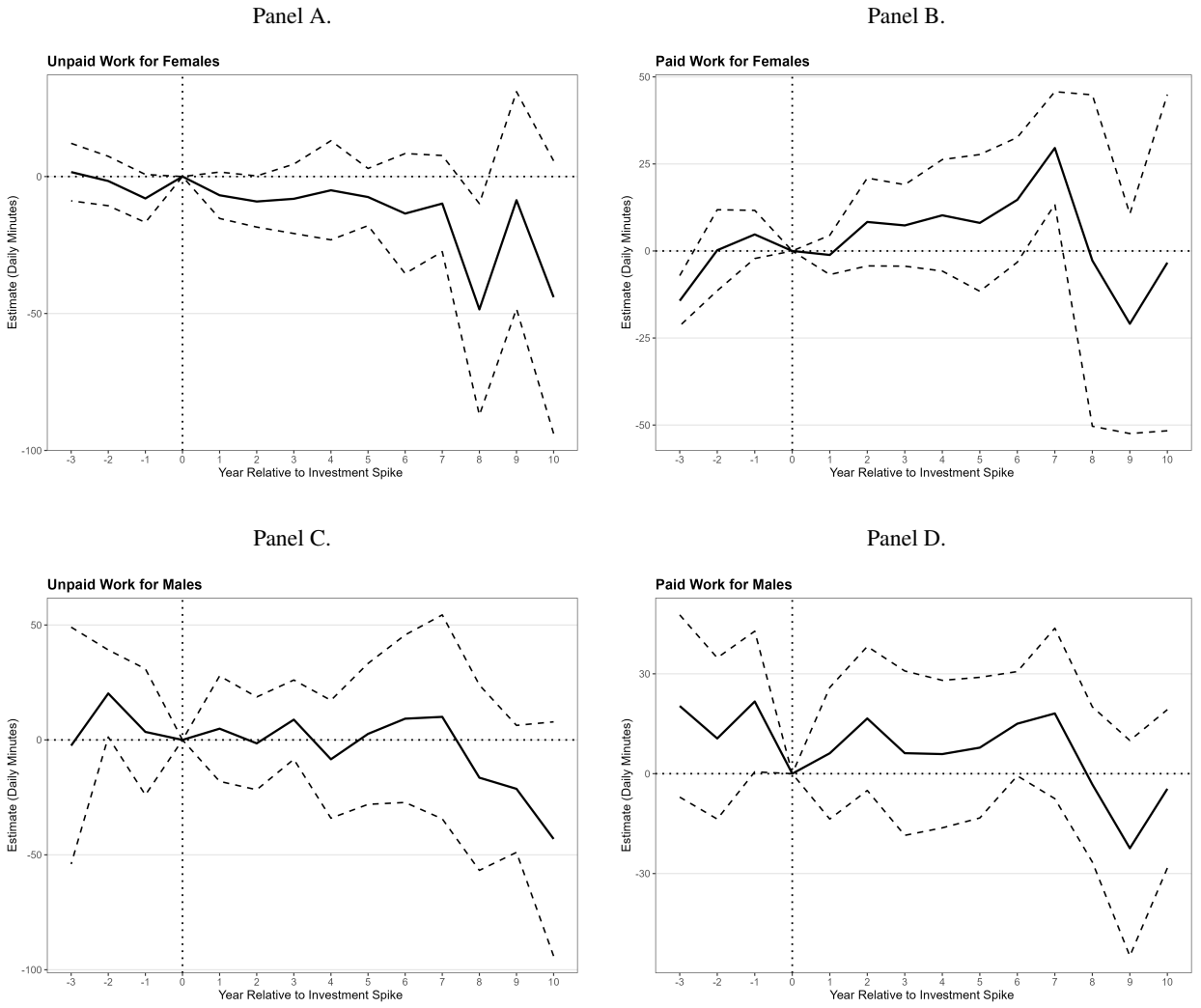
Notes: The table provides the average total effect accumulated over the decade following the event, when the event is defined as growth rate higher than 1.5sd the state mean and no lower than 0.5 the value in the previous year (first definition) and growth rate higher than 1sd the state mean and no lower than 0.75 the value in the previous year (second definition). Estimates expressed in daily minutes are derived from equation (1) and computed using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-sectional data. Command `summary.did_multiplegt_dyn` reports the average cumulative (total) effect per treatment unit, summarizing the dynamic effects. It also provides the p-value for the test of joint nullity for the placebos, or pre-trends test, where p-value lower than 0.10 points at possible violation of the parallel trends and no anticipation assumption. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance levels.

Figure 10: Event study estimates for positive investment spikes (first definition)



Notes: The figure provides event study estimates of dynamic effects of experiencing a positive spike in investments for female (Panel A and B) and male individuals (Panel C and D) for different time use aggregates using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-section. In this case, the event is defined as growth rate higher than 1.5sd the country mean and no lower than 0.5 the value in the previous year. Estimated coefficients are specified in equation (1) and expressed in daily minutes. The analysis is conducted with the coefficient for the year prior to treatment is normalized to zero. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance levels.

Figure 11: Event study estimates for positive investment spikes (second definition)



Notes: The figure provides event study estimates of dynamic effects of experiencing a negative spike in investments for female (Panel A and B) and male individuals (Panel C and D) for different time use aggregates using the approach of De Chaisemartin and d'Haultfoeuille (2024) for our individual-year cross-section. In this case, the event is defined as growth rate higher than 1sd the country mean and no lower than 0.75 the value in the previous year. Estimated coefficients are specified in equation (1) and expressed in daily minutes. The analysis is conducted with the coefficient for the year prior to treatment is normalized to zero. Analytical standard errors are clustered at the state level, with confidence intervals provided for the 5% significance levels.

7 Concluding remarks

Despite the relation between fiscal policy and female labour market outcomes is increasingly studied and empirically tested, little has been said on the aggregate of unwaged provision of care supplied within the household as a channel of propagation in both up and downturns in the budget cycle. Some studies find that household production can serve as a buffer to maintain living standards during recessions while drawing workers, particularly women, away from the market. Other research focuses on the virtuous effects of investing in care infrastructure, which can boost female

employment by increasing labour demand in sectors where female workforce is more concentrated and by enhancing the availability of better-funded care facilities. However, most evidence tends to account solely on the role of childcare services, overlooking the growing detrimental effect of eldercare in advanced capitalist economies characterised by declining fertility rates.

This paper studies how positive and negative investment spike in state spending on healthcare, education and social assistance affect time use in the United States. We use American Time Use Survey data combined with State & Local Finance Data and state-level economic and labor market indicators (such as income per capita, unionization rate and minimum wage) and we exploit growth spikes in care regime spending by estimating a staggered diff-in-diff model with non binary and non absorbing treatment. Our findings reveal that positive events reduce unpaid care duties by slightly over one hour and increase market labor hours by 75 minutes for women in treated states, with remarkable benefits for women in low-to-middle income households. Conversely, negative events decrease time in paid work by almost two hours. For men, negative spikes reduce household production especially among low-income households, where men appear to increase time spent in paid activities to mitigate the effects of economic downturns.

Our findings confirm the stylized facts in time use literature highlighting the stickiness of household reproductive activities compared to the more responsive aggregate of waged work, as well as the importance of gender and class lenses when evaluating the impact of fiscal policy on individual behaviors during both economic expansions and recessions. Policymakers should recognize that budgetary decisions can either add layers of constraints to an already highly uneven intra-household division of labour or provide essential support through public care provision, by leveraging the substitution effect now empirically supported even by the present paper.

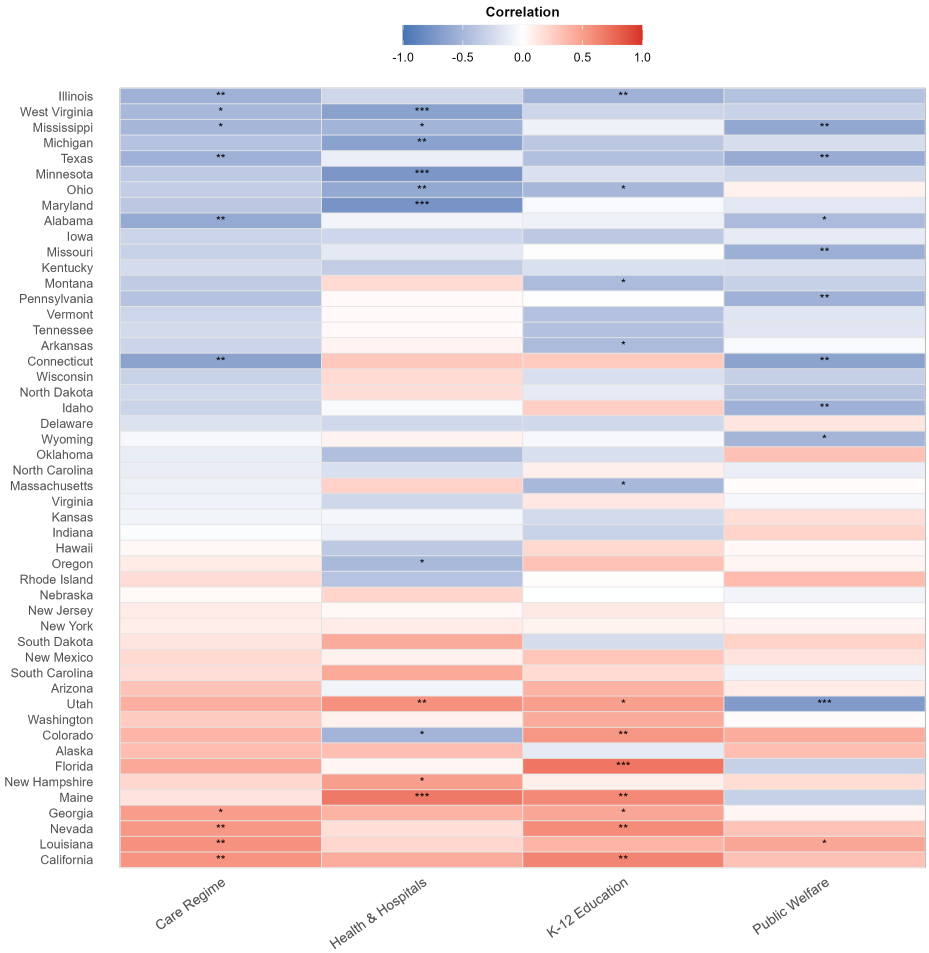
Appendix

Potential issue n.1: endogeneity of the treatment

To address the concern that care regime spending spikes might be a proxy for economic up and down swings, we study for each state the correlation between $log(GDP)$ and $log(careregime)$ cycles, testing overall co-movement, i.e., including all lags. Seven states show a systematic correlation between GDP per capita and care expenditure per capita at the 95% significance level, with only Nevada, Louisiana, and California having a concordant relation (Figure 12). Looking closer across lags and leads, we see a concomitant significant correlation for six states (Figure 13.A), with only three of them being part of the set of states treated by the positive event (Figure 6.A), and only

Alabama being in the set of states experiencing the negative event (Figure 6.B). We also see twelve states that over the 2004-2021 period display a public spending in the care sector significantly correlated with gdp per capita at time -1 (Panel B in Figure 13). To check whether this lagged correlation between growth rates reflects into high correlation between extreme spikes in both series, we plot the dynamics of growth rates for gdp and care regime for each state, and we see that the events affecting care spending we use in our event study framework do not mirror extreme events in the gdp series, providing evidence consistent with the assumption that these spikes are exogenous (Figure 14).

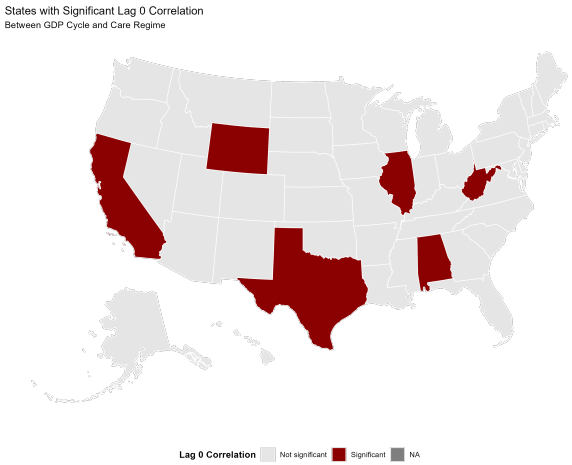
Figure 12: Cyclicality of public spending



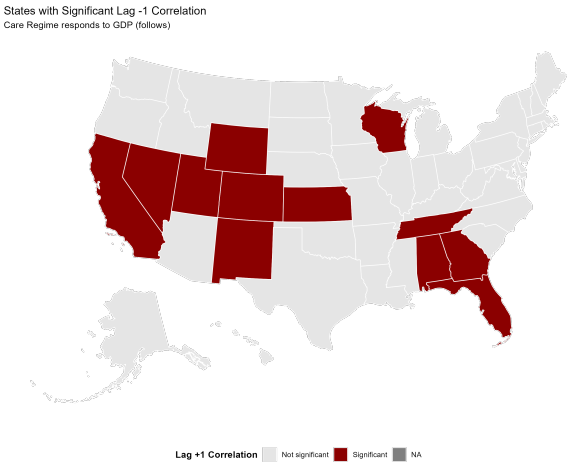
Notes: Correlation matrix for the cyclical component (Hodrick–Prescott filter) of (log) per capita gdp and per capita public expenditure for k-12 education, health and hospitals, public welfare, and the aggregate, i.e. care regime. Stars for p-value significant at the 1%, 5% and 10% significance level.

Figure 13: Cyclicality of care regime spending across leads and lags

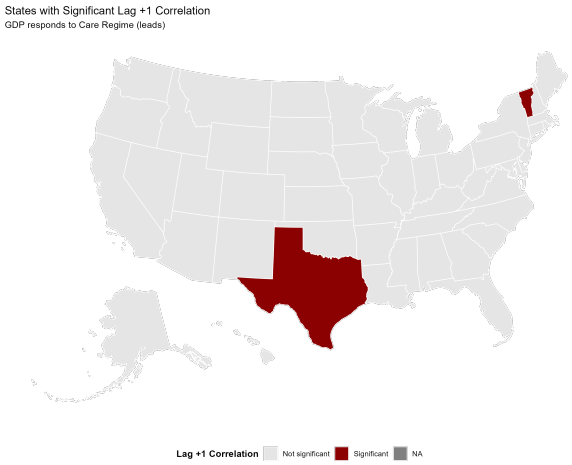
Panel A.



Panel B.



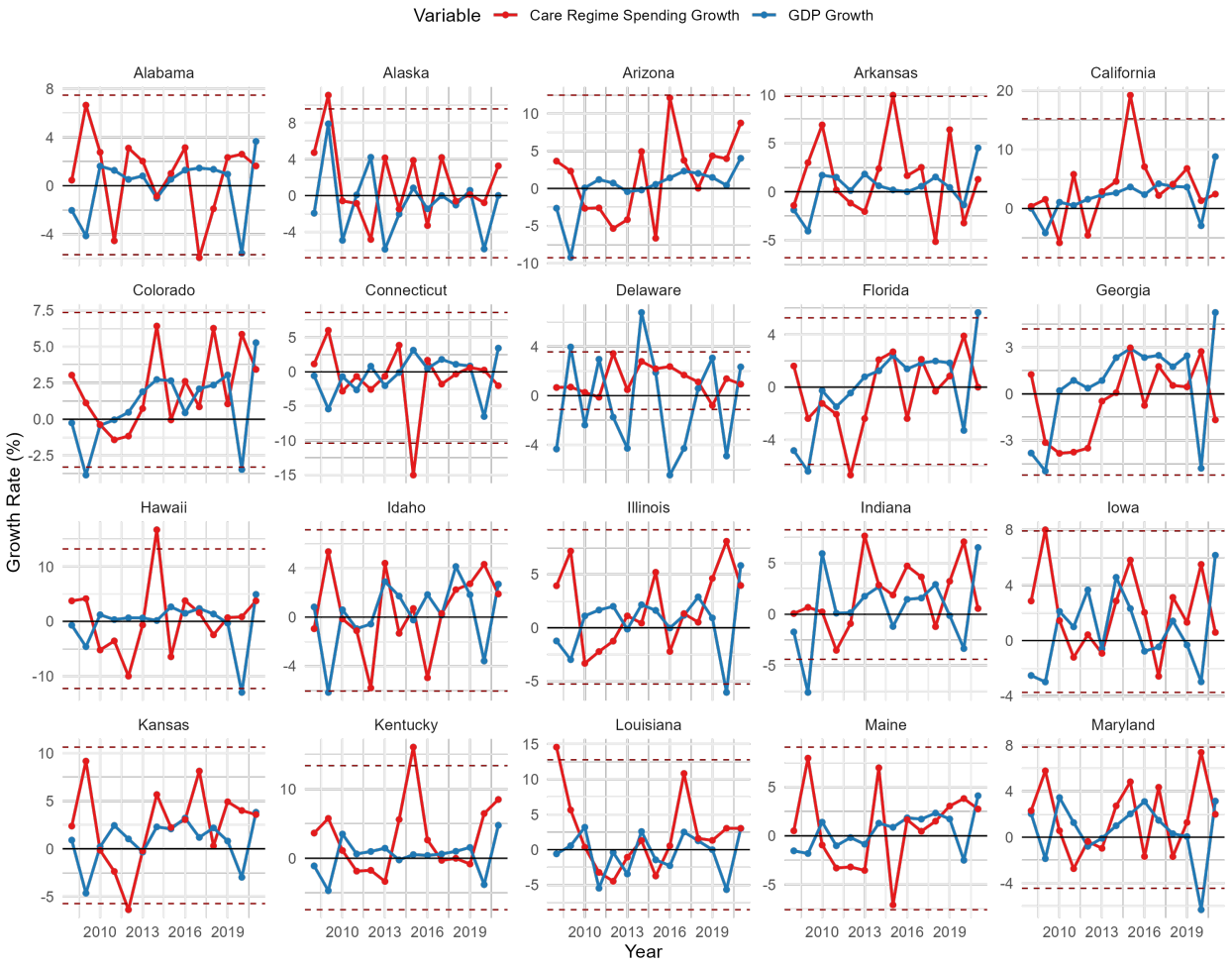
Panel C.



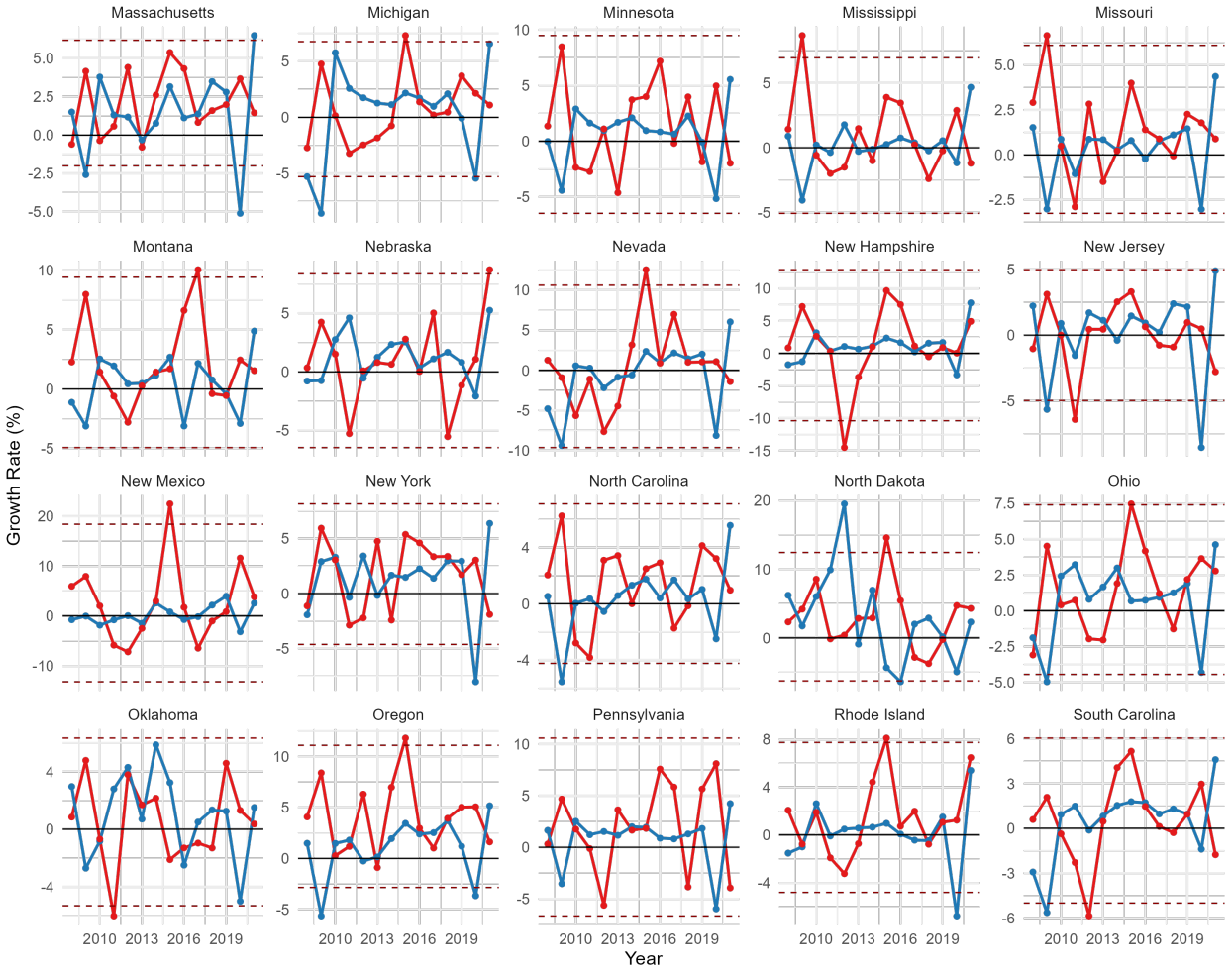
Notes: The figure highlights those states with significant lag 0, lag -1 and lag $+1$ correlation at the 1% significant level. The map results from cross-correlation analysis between the cyclical component of per capita GDP and per capita care regime spending. Lag -1 ($+1$) significance suggests that care regime (GDP) responds to GDP (care regime).

Figure 14: Growth rates of per capita GDP and care spending

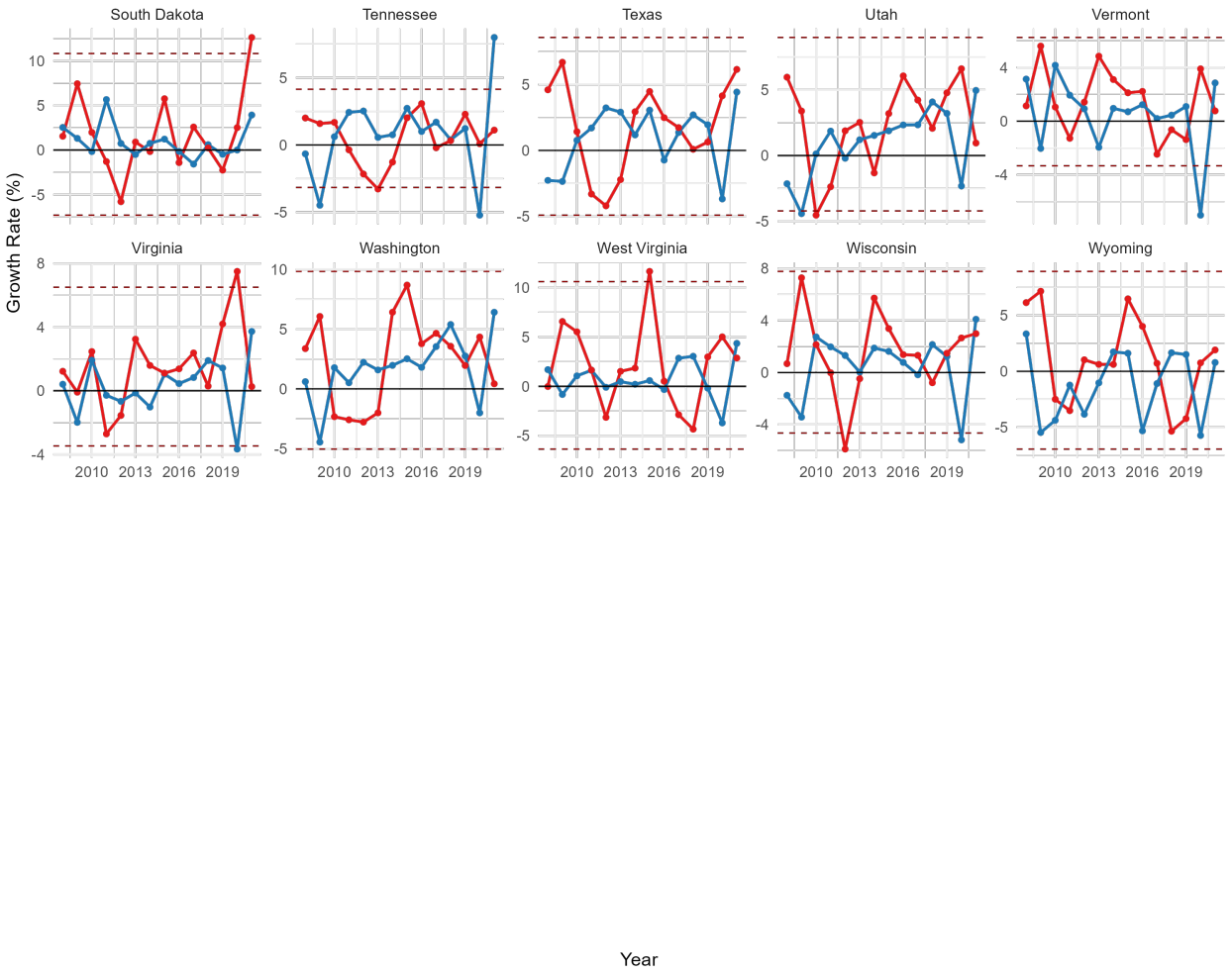
Panel A.



Panel B.


Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
Oklahoma
Oregon
Pennsylvania
Rhode Island
South Carolina
Growth Rate (%)
Year
2010 2013 2016 2019

Panel C.



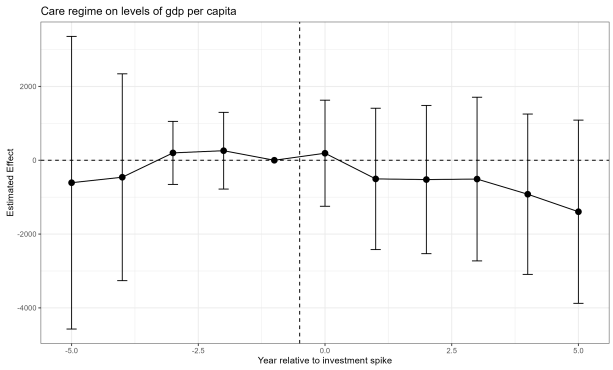
Notes: Growth rates through time. Dashed lines represent state-specific thresholds set at mean + 2sd and mean - 2sd.

Potential issue n.2: the treatment is affecting the control

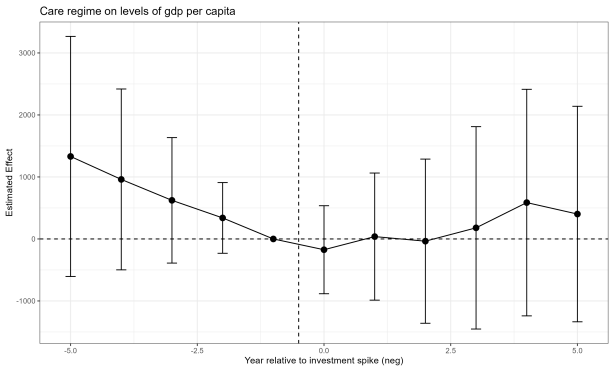
Now, to address the potential problem of control (concomitant levels of GDP) being affected by treatment, we check that only two states overall show a significant correlation at lag $+1$, capturing the degree to which GDP responds to care regime spending (Figure 13.C). In Figure 15, we double check this hypothesis by estimating the Callaway-Sant'Anna estimator using the standard treatment definitions (positive and negative investment spikes in public care spending) and GDP per capita as the response variable. We find no impact on GDP in either case. We replicate this analysis using GDP growth as the outcome variable and the findings remain unchanged (Figure 16).

Figure 15: Levels of GDP per capita as outcome variable

Panel A. Positive spike



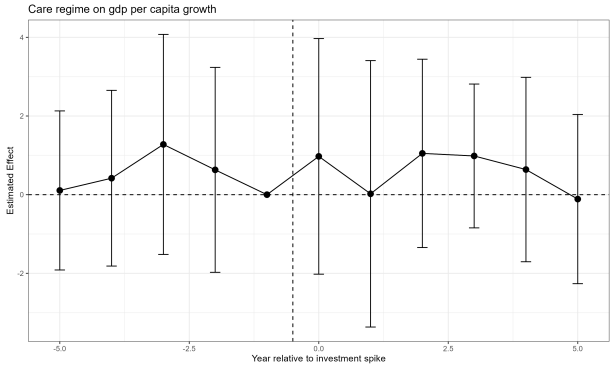
Panel B. Negative spike



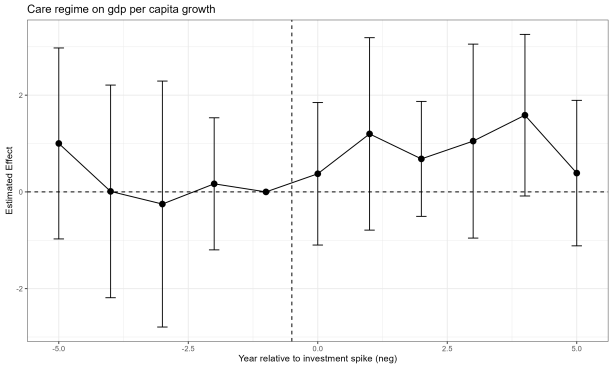
Notes: The figure provides event study estimates of the dynamic effects of experiencing a positive spike in investments (Panel A) and a negative spike in investments (Panel B) using the approach of Callaway and Sant'Anna (2021) for our state-year panel. The comparison group comprises never-treated states, with the analysis conducted under the assumption of parallel trends and no anticipation. The coefficient for the year prior to treatment is normalized to zero. Bootstrapped standard errors are clustered at the state level, with confidence intervals provided for both the 5% and 10% significance levels.

Figure 16: Growth of GDP per capita as outcome variable

Panel A. Positive spike



Panel B. Negative spike



Notes: The figure provides event study estimates of the dynamic effects of experiencing a positive spike in investments (Panel A) and a negative spike in investments (Panel B) using the approach of Callaway and Sant'Anna (2021) for our state-year panel. The comparison group comprises never-treated states, with the analysis conducted under the assumption of parallel trends and no anticipation. The coefficient for the year prior to treatment is normalized to zero. Bootstrapped standard errors are clustered at the state level, with confidence intervals provided for both the 5% and 10% significance levels.

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