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The Impact of the U.S. CHIPS And Science Act On Unemployment In Arizona, Tennessee and North Carolina

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ABSTRACT

The proposal reviews background information on the CHIPS and Science Act, enacted by President Biden in 2022, and selects Arizona as the treated state based on the extensive grants given to semiconductor producers located in it. Parallel trends analysis and the finding that no significant migration took place in or out of Arizona validate the election of Tennessee and North Carolina as the control states. The proposal suggests employing a Difference-In-Difference analysis in order to make a reliable estimate of the policy's impact on unemployment and recognizes the shortcomings of the research that has been conducted on the Act as of 2025.

Introduction

The semiconductor industry constitutes the basis of the latest technologies, with chips being integrated into devices ranging from MRI scanners to computers.[1] The production of semiconductors, which were invented in the United States, has now shifted to East Asian countries, with the White House[2] stating that they were responsible for the production of 75% of semiconductors in 2022, whereas the United States failed to produce the most advanced chips. The Biden-Harris Administration, aiming to boost domestic chip manufacturing and weaken America's dependence on chip imports, enacted the Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act on August 9th, 2022. The Act sets aside $39 billion for manufacturing incentives, $13.2 billion for R&D and workforce development, and other expenses, which sum up to $52.7 billion in total. Furthermore, the policy issues a 25% tax credit for capital expenses for manufacturing semiconductors and other analogous appliances.[3]

[1] Rinehart, William, and Aubrey Kirchhoff. "The Political Economy of the CHIPS and Science Act." *The Center for Growth and Opportunity*, 14 Nov. 2023.

[2] The White House . "FACT SHEET: CHIPS and Science Act Will Lower Costs, Create Jobs, Strengthen Supply Chains, and Counter China." 9 Aug. 2022.

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Although the act sets out to fund America's largest semiconductor companies, the bill places a number of restrictions upon its recipients. First and foremost, the bill prohibits recipients from expanding their manufacturing facilities to "countries of concern" such as China, over a 10-year period.[3] Moreover, in order to guarantee equitable economic growth, the bill requires recipients to provide proof of worker and community investments, such as opportunities for underprivileged communities. The act incorporates elements such as investments towards boosting regional technology hubs, joining forces with the Department of Commerce's Economic Development Administration (EDA) in order to guarantee the provision of stable jobs in distressed communities. In addition, the act invests in STEM education, starting from K-12, to ensure that individuals from all backgrounds can reap the benefits of STEM education and the array of opportunities fostered by it.[3]

Although the Act was signed in 2022, its implementation and the provision of funds have been rather slow. So slow, in fact, that companies started receiving funding as the Biden-Harris Administration was nearing its exit from the White House in 2024. This delay can be attributed to a number of factors, such as a high volume of applications and the inability of companies to meet specific milestones and criteria for obtaining a grant.[4] The latter can be observed in the case of Intel, one of America's largest semiconductor producers. The company was expected to receive direct funding worth $8.5 billion, along with an $11 billion low-interest rate loan. However, due to them not meeting milestones specified by the U.S. government, the granting of the funding was delayed to November 2024. The Biden-Harris Administration started issuing grants in September 2024, with Polar Semiconductor, a company situated in Minnesota, obtaining a grant worth $298 million on September 24th.[5] In the following months, the funding of major semiconductor manufacturing companies was finalized, including three that are based in Arizona. Intel, one of the largest semiconductor facilities located in Arizona, Oregon, Texas, and Ohio, received a grant worth $7.86 billion on November 26, 2024. $65 million of the grant was allocated to training workers in an attempt to build a qualified workforce. Additionally, $5 million has been put aside to expand childcare facilities near the company. Finally, $4 million has been dedicated to fostering the engagement of women and deprived individuals in Intel's workforce. In the framework of the grant, Intel is further planning to invest approximately $100 billion in capital investments, for which they are set to receive a 25% tax credit.[6] The Taiwan Semiconductor Manufacturing Company (TSMC), located in Arizona, also received a $6.6

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[3] Raza, Erum. "CHIPS and Science Act: What Is It? And Why Is It Important?" *Nyu.edu*, 2023.
[4] Lantek Corporation. "Pressure to Expedite CHIPs Act Funding." 2024.
[5] LaPedus, Mark . "Who Has Officially Obtained CHIPS Funding?" *Substack.com*, Semiecosystem , 2 Dec. 2024.
[6] Intel. "Intel, Biden-Harris Administration Finalize $7.86 Billion Funding Award under US CHIPS Act." *Newsroom*, 26 Nov. 2024.

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billion grant on November 15th. With it, the company aims to elevate production in its Arizona fabrication plants (fabs). In addition, the company aims to build two new fabs in the state. Finally, in December of 2024, Amkor, a semiconductor manufacturer based in Arizona, received direct funding worth $407 million.[6] In total, the state of Arizona has received funding that exceeds $13 billion. The changing political circumstances, however, and Trump's statement of wanting to "get rid of the CHIPS Act", puts the policy in jeopardy. Trump has specifically threatened to revoke grants given to chip manufacturers, proposed high tariffs on chips manufactured outside the country, and called for investments in new American industrial units.[7]

Methodology

A Difference-In-Difference analysis can be used to investigate the impact of the CHIPS and Science Act on employment. In order to determine the treated group, the sizes of the grants given by the Biden-Harris Administration can be observed. Considering the volume of the grants obtained by companies located in Arizona, Arizona was selected as the treated state. To work out the control groups, trends of unemployment rates between the years 2020 and 2024 were observed in all U.S. states.

1. Parallel Trends

The unemployment rate data was taken from the U.S. Bureau of Labor Statistics,[8] and December of each year was chosen. The data was then graphed on a line chart, with the y-axis displaying the unemployment rate, and the x-axis indicating the year.

To make out similar trends, all series except Arizona were removed. Afterward, each state was separately graphed and compared to the trend line of Arizona. It was found that Tennesse and North Carolina had similar trends to Arizona prior to Arizona receiving grants. In particular, the unemployment rate started off high, between 5-6% in all states around December 2021, then decreased to 3-4% near December 2022 and stayed relatively constant throughout 2023. In order to observe how Arizona's trend line will deviate in the future, unemployment rate data from 2025-2026 must be collected and displayed on the line graph. For now, observing that all three states had parallel trends prior to Arizona receiving the treatment provides the foundation to select Tennessee and North Carolina as the control states.

[7] Mickle, Tripp, et al. "Intel Agrees to Sell U.S. A 10% Stake in Its Business." *The New York Times*, 22 Aug. 2025.

[8] U.S. Bureau Of Labor Statistics. "State Unemployment Rates over the Last 10 Years, Seasonally Adjusted." *Bureau of Labor Statistics*, 2015.

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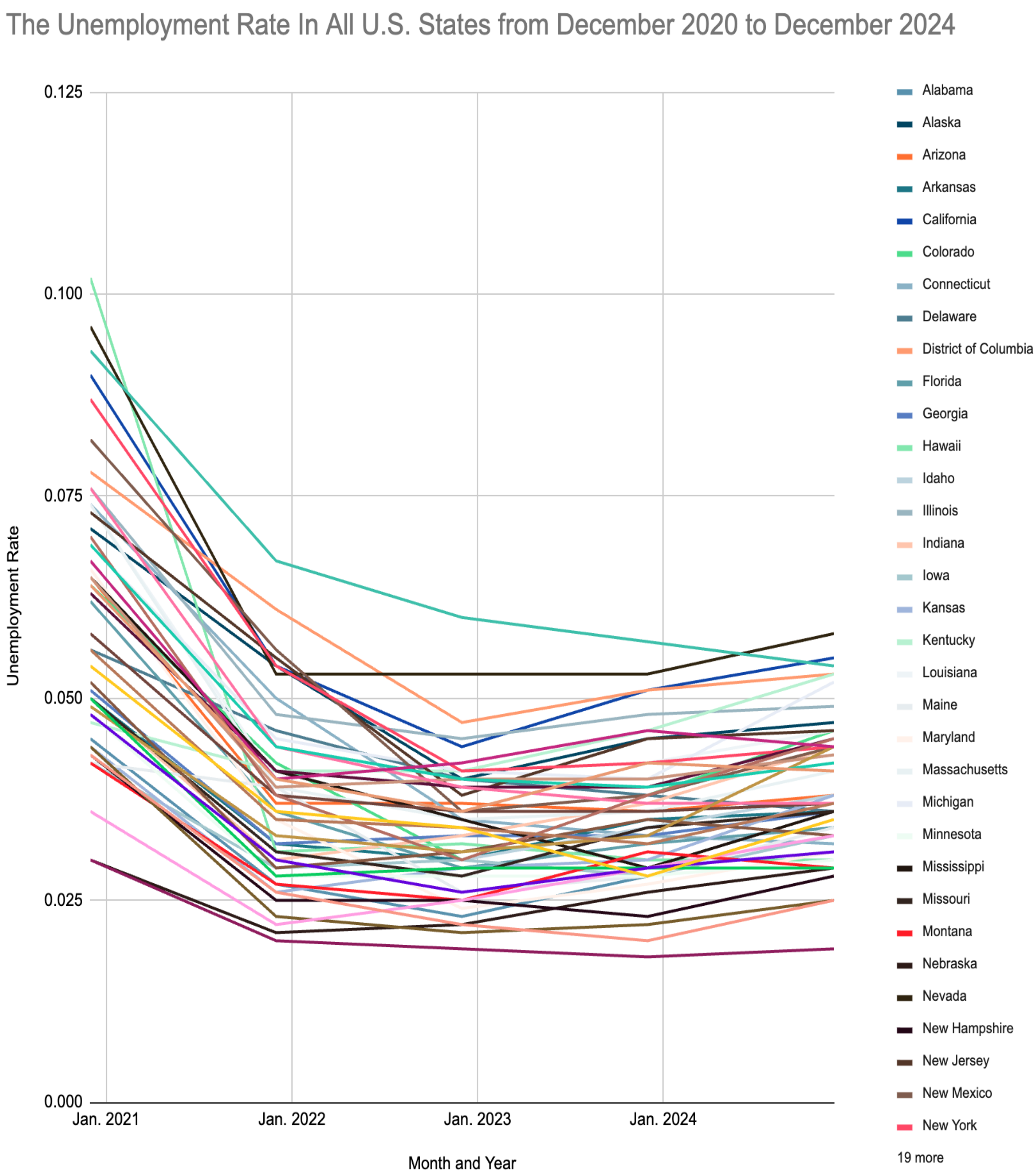
Graph: 1



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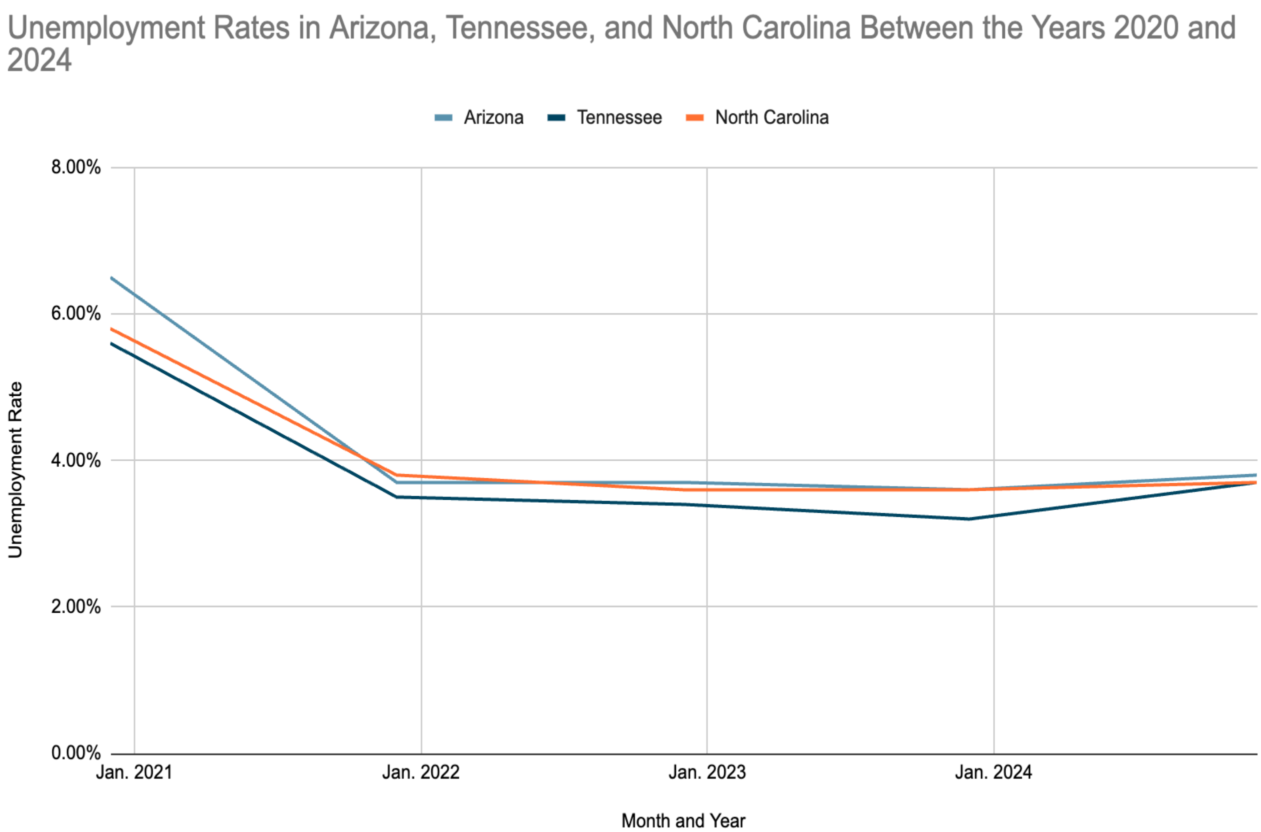
Graph: 2



2. No significant migration

To further ascertain the similarity between Arizona, North Carolina, and Pennsylvania, the following must be proved:

1. There was no significant migration out of Arizona once the policy was enacted (after September 2024).
2. There was no significant migration to Arizona from North Carolina and Pennsylvania after the implementation of the Act.

The U-Haul one-way customer transactions data reveal the states from which Phoenix, the capital of Arizona, and the site of Intel's semiconductor facility, received its domestic migrants. Through analyzing the origins of their trucks, trailers, and U-Box moving containers, U-Haul

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named the following states as locations from which individuals most frequently migrated to Phoenix, from January 2025 to July 2025:

1. California
2. Texas
3. Colorado
4. Nevada
5. Washington
6. Utah
7. New Mexico
8. Oregon
9. Illinois
10. Florida

Whereas Arizonians were seen moving into states such as Nevada, Arizona was not mentioned in the migrants' list of Tennessee and North Carolina.[9] In addition, the Net Migration values in Arizona were positive in both 2024 and 2025, being +50,000 and +55,000, respectively.[10] It can therefore be deduced that Arizona did not experience significant out-migration once the treatment was applied, and it furthermore did not experience large in-migration from North Carolina and Pennsylvania. Given that the existence of significant in or out migration confounds the impact of the treatment effect, the above data displays that any change in unemployment in the selected states can certainly be attributed to the Act.

3. Difference in Difference Analysis

After determining that the three states had parallel trends prior to Arizona receiving treatment and discovering that no significant in- or out-migration took place in Arizona, Arizona can assuredly be chosen as the treated group, whereas North Carolina and Tennessee can be considered as controls. The following Difference-In-Difference formula can then be used to estimate the causal effect of the CHIPS and Science Act on unemployment in the selected states:

$$Y_{it} = \boldsymbol{\alpha} + \beta D_i + \boldsymbol{\gamma} Post_t + \boldsymbol{\delta}(D_i \text{ x } Post_t) + \varepsilon_{it}$$

**The derivation of the formula is provided in Appendix A*

The current unemployment data is limited. Hence, collecting data from 2025 and 2026 will be optimal for making a credible estimate of the policy's effect.

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[9] U-Haul. "U-Haul 2025 Midyear Migration Trends | My U-Haul Story." Myuhaulstory.com, 2025.
[10] Heli Alaska. "Understanding the Population of Arizona: Trends and Insights for 2025 - Heli Alaska, Inc." Heli Alaska Inc, 31 May 2025.

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Literature Review

1. **"Economic Impacts of the CHIPS for America Act"(Mazewski, Flores)[11]**- The authors utilize the Data for Progress Jobs Model to conduct a theoretical analysis of the impact of the CHIPS and Science Act on various aspects of the U.S. economy. With it, they reach the conclusion that the act would help preserve and develop more than half a million jobs and contribute over $60 billion to GDP. Given that the paper was published in 2022, its deduction is limited by the fact that no grantings had taken place by the time the paper was published.
2. **"CHIPS Act Will Spur US Production but Not Foreclose China" (Hufbauer, Hogan) -** The paper, published in 2022, utilizes data sets such as global semiconductor production and global semiconductor trade from 2019-2021 to form the conclusion that although the act will stimulate job creation, it will not be able to surpass the Chinese production of semiconductors. The findings of the paper are limited by the conclusions being based on outdated data sets, with no grants being given at the time of the paper's publication.

Generally, although existing papers investigating the impact of the Act on elements such as economic growth or job creation are published, they are based on theoretical models and may not reflect the real impact of the policy. In order to ascertain a more reliable estimate of the Act's impact, unemployment data from 2025-2026 must be acquired, and a Difference-In-Difference analysis must be carried out.

Appendix A: The Difference-In-Difference Model

Substantiating that there was no significant in- or out-migration in Arizona once the act was passed, on top of demonstrating that the three states had parallel trend lines prior to Arizona receiving grants, gives the basis to deduce that Arizona, North Carolina, and Pennsylvania are suitable groups to conduct a Difference-In-Difference analysis on. In the beginning, the following list can be formed:

Treated Group: Arizona

Control Groups: North Carolina, Pennsylvania

"Pre Period": Before September 2024

"Post Period": After September 2024

[11] Mazewski, Matt, and Christian Flores. *Matt Mazewski and Christian Flores Economic Impacts of the CHIPS for America Act Introduction and Summary of Findings*. 2022.

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In order to make an estimate of the impact of the Act on unemployment in Arizona, the following equation can be used:

$$\bar{Y}_{T,\,post} - \bar{Y}_{T,\,pre}$$

However, the estimate cannot be used as a definitive measure of the Act's impact, as it includes the effects of factors outside the treatment. In order to cancel out the impacts of other factors, or, in other words, to obtain the *true difference*, we must make out the estimator ($\hat{\delta}$). The estimator removes the impact of the act on the control group (which is calculated by the formula $\bar{Y}_{C,\,post} - \bar{Y}_{c,\,pre}$) from the impact on the treated group:

$$\hat{\delta} = (\bar{Y}_{T,\,post} - \bar{Y}_{T,\,pre}) - (\bar{Y}_{C,\,post} - \bar{Y}_{c,\,pre})$$

After determining the estimator, new variables can be defined:

- *D_i - Dummy variable for treated or not*
- *$Post_t$ - Dummy variable for time (pre or post)*
- *$D_i * Post_t$ - The interaction term ($D_i * Post_t = 1$ only if the value is treated and is post)*

We can now consider the following values:

- $\boldsymbol{\mu}_{00} = E[Y \mid D=O, Post=0]$ (control-pre mean)
- $\boldsymbol{\mu}_{01} = E[\, Y \mid D=0, Post=0]$ (control-post mean)
- $\boldsymbol{\mu}_{10} = E[\, Y \mid D=1, Post=1]$ (treated-pre mean)
- $\boldsymbol{\mu}_{11} = E[\, Y \mid D=1, Post=1]$ (treated-post mean)

The outcomes can be compiled into a function of the above parameters and variables:

$$Y_{it} = \boldsymbol{\mu}_{00}(1-D_i)(1-Post_t) + \boldsymbol{\mu}_{01}(1-D_i)Post_t + \boldsymbol{\mu}_{10}D_i(1-Post_t) + \boldsymbol{\mu}_{11}D_i\,Post_t$$

Terms can then be expanded and grouped to form an expression in a usable form. We first start by grouping terms 1, D_i, $Post_t$, and D_i x $Post_t$:

$$Y_{it} = \boldsymbol{\mu}_{00}(1-D_i-Post_t+ D_i * Post_t) + \boldsymbol{\mu}_{01}(Post_t - D_i * Post_t) + \boldsymbol{\mu}_{10}(D_i-D_i * Post_t) + \boldsymbol{\mu}_{11}(D_i * Post_t)$$

The like terms can be grouped as shown below:

- Outcome measures that have no term around them: $\boldsymbol{\mu}_{00}$
- Terms that have just D_i : $(\boldsymbol{\mu}_{10}-\boldsymbol{\mu}_{00})$
- Terms that have just $Post_t$: $(\boldsymbol{\mu}_{01}-\boldsymbol{\mu}_{00})$
- Terms that contain the interaction term ($\boldsymbol{\mu}_{11} - \boldsymbol{\mu}_{10} - \boldsymbol{\mu}_{01} + \boldsymbol{\mu}_{00}$), which can be rewritten as

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$(\boldsymbol{\mu}_{11} - \boldsymbol{\mu}_{10} - (\boldsymbol{\mu}_{01} - \boldsymbol{\mu}_{00})$, as a Difference-In-Difference.

The above formula (Y_{it}), can now be rewritten using the grouped like-terms:

$$Y_{it} = \boldsymbol{\mu}_{00} + (\boldsymbol{\mu}_{10}-\boldsymbol{\mu}_{00})D_i + (\boldsymbol{\mu}_{01}-\boldsymbol{\mu}_{00})Post_t + (\boldsymbol{\mu}_{11} - \boldsymbol{\mu}_{10} - \boldsymbol{\mu}_{01} + \boldsymbol{\mu}_{00})D_iPost_t + \mathcal{E}_{it}$$

The coefficients can then be renamed as follows:

$\boldsymbol{\alpha} = \boldsymbol{\mu}_{00}$

$\beta = \boldsymbol{\mu}_{10}-\boldsymbol{\mu}_{00}$

$\boldsymbol{\gamma} = \boldsymbol{\mu}_{01}-\boldsymbol{\mu}_{00}$

$\boldsymbol{\delta} = \boldsymbol{\mu}_{11} - \boldsymbol{\mu}_{10} - \boldsymbol{\mu}_{01} + \boldsymbol{\mu}_{00}$

The Difference-In-Difference equation can hence be given its final form:

$$Y_{it} = \boldsymbol{\alpha} + \beta D_i + \boldsymbol{\gamma} Post_t + \boldsymbol{\delta}(D_i \, x \, Post_t) + \mathcal{E}_{it}$$

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